

TM11-5830-221-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE MANUAL

INTERCOMMUNICATION STATIONS LS-147A/FI, LS-147B/FI, LS-147C/FI, AND LS-147D/FI

*HEADQUARTERS, DEPARTMENT OF THE ARMY
20 JULY 1961*

WARNING

HIGH VOLTAGE

is used in
this equipment.

DEATH ON CONTACT

may result if safety precautions
are not observed.

Be careful not to contact high-voltage connections or any power connections when using this equipment. Turn off the power, remove the power cord plug from the ac outlet, and discharge filter capacitor C5 with an insulated screwdriver before doing any work inside the LS-147(*)/FI unit. Before connecting the LS-147(*)/FI to a 115-volt ac source, make sure that the chassis is connected to the same ground as the ac source. Be extremely careful when working on or near the power transformer.

EXTREMELY DANGEROUS VOLTAGES

EXIST IN THE FOLLOWING PLACES:

Power transformer T3 (LS-147A/FI and LS-147B/FI)	495-volt ac circuit.
Power transformer T3 (LS-147C/FI)	460-volt ac circuit.
Power transformer T2 (LS-147D/FI)	495-volt ac circuit.
Ac line connections (LS-147(*)/FI)	115-volt 60 cps.

DON'T TAKE CHANCES!

Technical Manual
No. 11-5830-221-35



HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 20 July 1961

**INTERCOMMUNICATION STATIONS LS-147A/FI, LS-147B/FI,
LS-147C/FI, AND LS-147D/FI**

			Paragraph	Page
CHAPTER	1.	INTRODUCTION		2
		Scope	1	2
		Differences in models	2	2
CHAPTER	2.	THEORY		3
		General	3	3
		Transmitting circuits	4	3
		Receiving circuits	5	3
		Power supply circuits	6	3
		Circuit differences	7	3
CHAPTER	3.	THIRD ECHELON MAINTENANCE		9
Section	I.	General maintenance information		9
		Scope of third echelon maintenance	8	9
		Tools and test equipment required	9	9
Section	II.	Troubleshooting		9
		Visual inspection	10	9
		Troubleshooting chart	11	9
		Additional troubleshooting data	12	10
CHAPTER	4.	FOURTH ECHELON TESTING PROCEDURES		18
		General	13	18
		Test equipment, tools, end materials	14	18
		Calibration of test equipment	15	18
		Distortion and gain test	16	21
CHAPTER	5.	FIFTH ECHELON MAINTENANCE		22
		Scope of fifth echelon maintenance	17	22
		Maintenance procedures	18	22
APPENDIX		REFERENCES		23

* This manual supersedes TM 11-5880-221-35, 25 January 1960.

CHAPTER 1

INTRODUCTION

1. Scope

a. This manual covers field and depot maintenance for Intercommunication Station LS-147(*)/FI. It includes instructions appropriate to third, fourth, and fifth echelon for troubleshooting, testing, and repairing the equipment, and replacing maintenance parts. It also lists tools, materials, and test equipment for third, fourth, and fifth echelon maintenance. Schematic analysis of the equipment is covered in paragraphs 3 through 7.

b. The complete technical manual for the LS-147(*)/FI includes three other publications: TM 11-5830-221-12, TM 11-5830-221-20P, and TM 11-5830-221-35P.

c. Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA2d, Fort Monmouth, N.J.

Note. For applicable forms and records, see paragraph 2, TM 11-5830-221-12.

2. Differences in Models

a. All models of the LS-147(*)/FI are similar; however, the reference designations assigned to parts in the LS-147C/FI (fig. 2) differ from the reference designations assigned to parts in the LS-147A/FI and LS-147B/FI (fig. 1), and LS-147D/FI (fig. 3). In addition to the differences in reference designations, some of the parts have difference values.

b. Refer to paragraph 7 for detailed coverage of the circuit differences that exist in the various models.

c. For differences concerning operator's and organizational maintenance, refer to TM 11-5830-221-12.

CHAPTER 2

THEORY

3. General

(fig. 1, 2, and 3)

The LS-147(*)/FI consists of speaker-microphone LS1, which is used as a loud-speaker or a microphone; voltage amplifier V1; power amplifier V2; and rectifier V3. The rectifier circuit supplies power to the amplifier circuits which amplify audio signals for transmission to distant stations. Audio signals received from distant stations are not amplified. A PRESS TO TALK switch determines whether the LS-147(*)/FI is used for transmission or reception.

4. Transmitting Circuits

a. Voltage Amplifier V1. Audio signals generated in microphone-speaker LS1 are applied to the primary of input transformer T1 through the contacts of PRESS TO TALK switch S1 (fig. 1) or S2 (fig. 2 and 3). Input transformer T1 matches the low impedance of microphone-speaker LS1 to the high input impedance of voltage amplifier V1. Audio signals from the secondary of input transformer T1 are applied through bias network R1 and C2 (fig. 1 and 3), or R1 and C1 (fig. 2), to the control grid (pin 1 of voltage amplifier V1). The amplified voltage signals from the plate (pin 5) of voltage amplifier V1 are applied to the input circuit of power amplifier V2. Resistor R3 is the screen grid voltage dropping resistor. Capacitor C1 (fig. 1 and 3) or C2 (fig. 2) is a screen grid bypass capacitor.

b. Power Amplifier V2. The amplified signals from voltage amplifier V1 are applied through coupling capacitor C3 (fig. 1 and 3), or C2 (fig. 2) and VOLUME control R8 (fig. 1), or SEND control R4 (fig. 2) or R8 (fig. 3) to the control grid (pin 7) of power amplifier V2. The output signals from the plate (pin 5) of power amplifier V2 are applied to the primary of output transformer T2 (fig. 2) or T3 (fig. 1 and 3). Output transformer T2 or T3 matches

the high output impedance of power amplifier V2 to the low impedance of the line. The signals from the secondary of output transformer T2 or T3 are applied through the contacts of PRESS TO TALK switch S1 (fig. 1) or S2 (fig. 2 and 3) to binding posts E1 and E2.

5. Receiving Circuits

The audio signals from a distant LS-147(*)/FI station are applied to binding posts E1 and E2 and speaker-microphone LS1 through the contacts of PRESS TO TALK switch S1 (fig. 1) or S2 (fig. 2 and 3). No amplification is required for the received audio signals.

6. Power Supply Circuits

The 115-volt 60-cycle-per-second (cps) line voltage is applied to primary winding 1 and 2 of power transformer T2 (fig. 1 and 3) or T3 (fig. 2) through power plug P1 and OFF switch S1 (fig. 2 and 3) or S2 (fig. 1). The alternating current (ac) voltage output from secondary winding 3, 4, and 5 of power transformer T2 or T3 is applied to the plates (pins 1 and 6) of rectifier V3. The pulsating direct current (dc) voltage from the cathode (pin 7) of rectifier V3 is applied to series voltage dropping resistors R5 and R6 (fig. 1 and 3) or R7 (fig. 2). The pulsating dc voltage output is applied to filter capacitor C5A and C5B and series voltage dropping resistor R7 (fig. 1 and 3) or R5 (fig. 2). The filtered dc voltage is applied to the plates and screen grids of voltage amplifier V1 and power amplifier V2. Secondary windings 6, 7, and 8 of power transformer T2 or T3 supplies 6.3 volts ac for the filaments of V1, V2, and V3.

7. Circuit Differences

a. Transmitting Circuits.

- (1) A bypass capacitor in the LS-147C/F1 (C7, fig. 2) and LS-147D/FI (C8, fig. 3) maintains a constant bias

voltage on the cathode of power amplifier V2.

- (2) A neutralization capacitor in the LS-147C/FI (C4, fig. 2) and the LS-147D/FI (C7, fig. 3) supplies degenerative feedback for power amplifier V2.
- 3) The W segment of the PRESS TO TALK switch in the LS-147A/FI and LS-147B/FI (S2B, fig. 1) and the LS-147D/FI (S2B, fig. 3) increases the plate voltage of power amplifier V2 during transmission.

b. Receiving Circuits. A RECEIVE control and voltage dropping resistor in the LS-147C/FI (R9 and R10, fig. 2) and LS-147D/FI (R10 and R9, fig. 3) controls the level of the received signal.

c. Ac Power Input.

- (1) Only one side of the ac line is bypassed in the LS-147A/FI and LS-147B/FI (C4, fig. 1).
- (2) Both sides of the ac line are bypassed in the LS-147C/FI (C6, and C8, fig. 2) and the LS-147D/FI (C4 and C6, fig. 3).

d. Pilot Lamp.

- (1) The pilot lamp for the LS-147A/FI and LS-147B/FI (DS1, fig. 1) is connected across the filament winding of power transformer T2.
- (2) The pilot lamp, in series with a dropping resistor for the LS-147C/FI (DS1 and R8, fig. 2) and LS-147D/FI (DS1 and R11, fig. 3), is connected across the output circuit of rectifier V3.

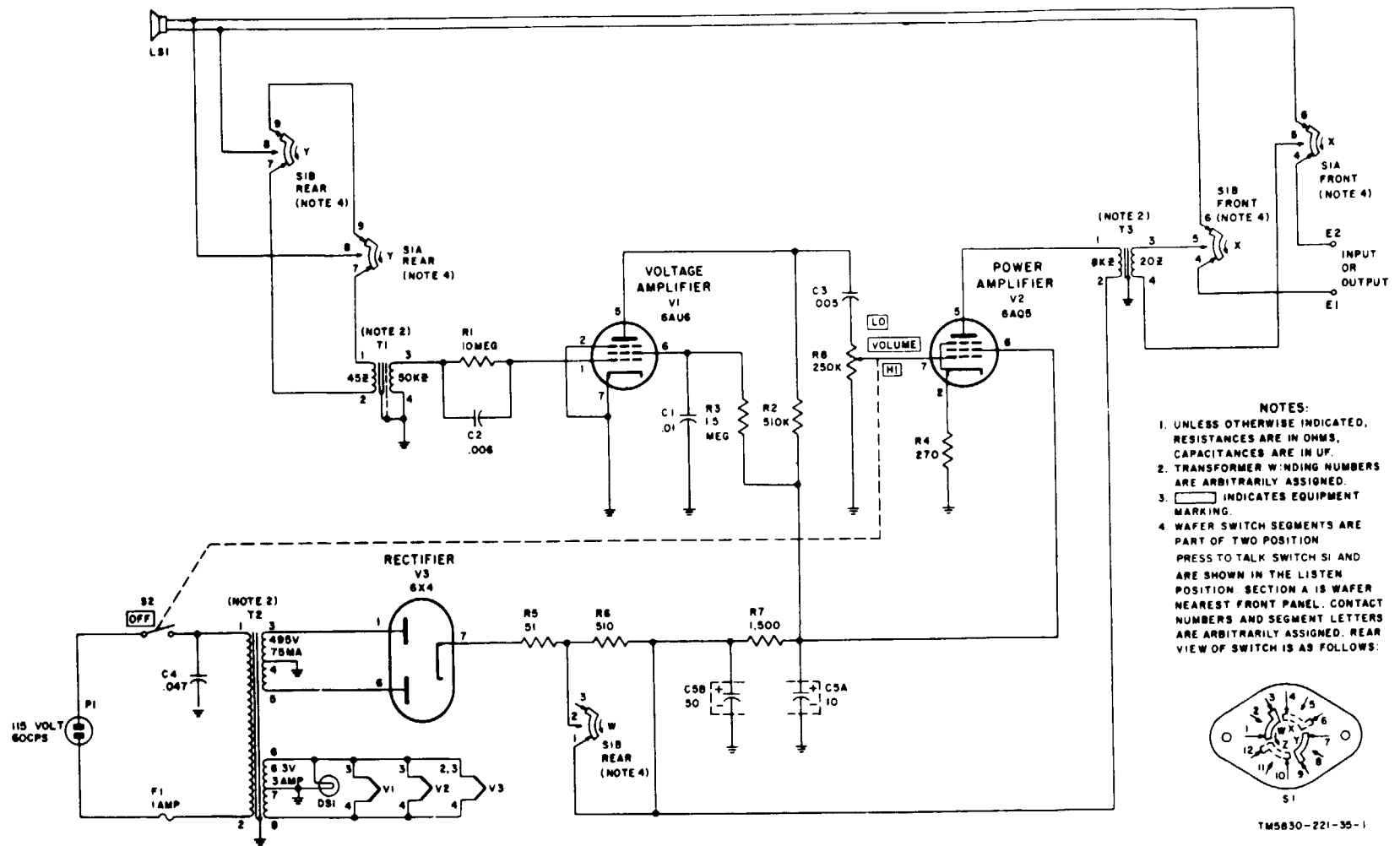


Figure 1. Intercommunication Station LS-147A/FI or LS-147B/FI, schematic diagram.

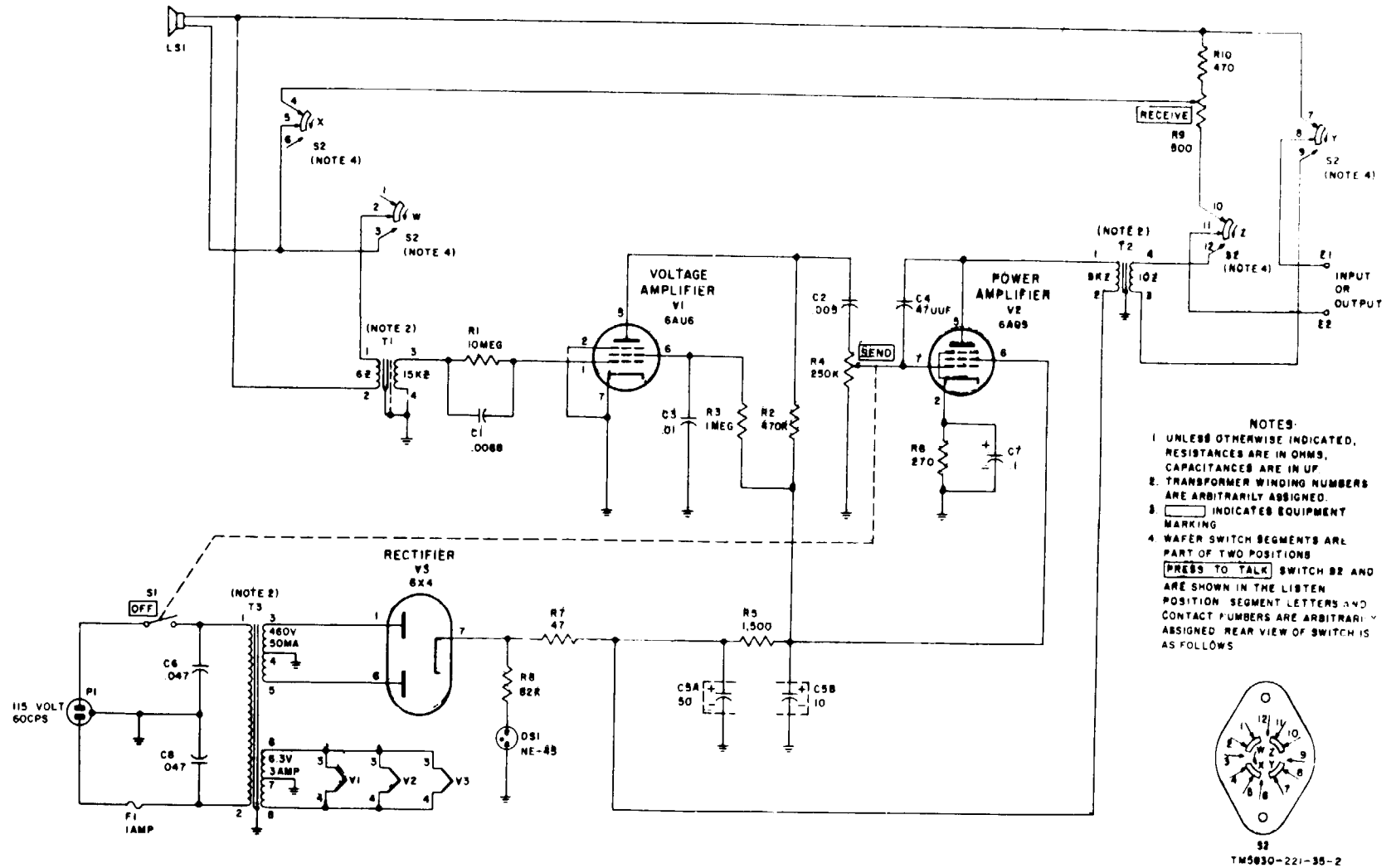


Figure 2. Intercommunication Station LS-147C/F1, schematic diagram.



32
TM5830-221-35-2

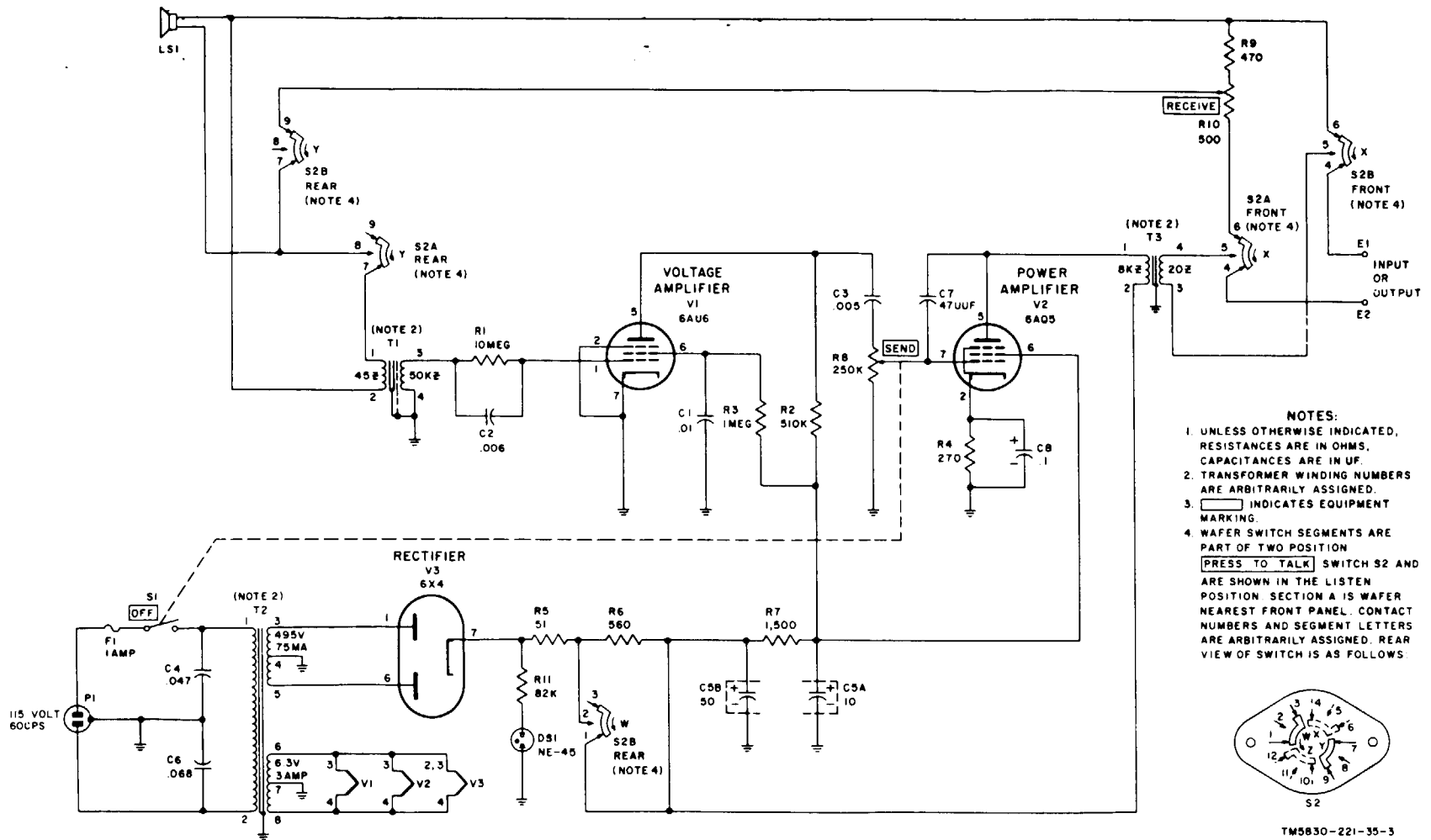


Figure 3. Intercommunication Station LS-147D/F1, schematic diagram.

CHAPTER 3

THIRD ECHELON MAINTENANCE

Section I. GENERAL MAINTENANCE INFORMATION

8. Scope of Third Echelon Maintenance

Troubleshooting at third echelon includes all the techniques outlined for organizational maintenance and any special or additional procedures required to isolate a defective part. These procedures are not complete in themselves, but supplement the procedures described in organizational maintenance (TM 11-5830-221-12). The systematic troubleshooting procedure, which begins with the operational and sectionalization checks performed at an organizational level, must be completed by further isolating procedures. Localization means tracing the fault to the

circuit responsible for abnormal operation. Isolation means tracing the fault to a defective part. Some faults may be isolated by sight, touch, smell, or hearing. The majority of faults, however, must be isolated by electrical checks. Detailed troubleshooting procedures are covered in paragraphs 10 and 11.

9. Tools and Test Equipment Required

- a. Tool Equipment TE-113.
- b. Multimeter AN/URM-105.
- c. Test Set, Electron Tube TV-7/U.
- d. Voltmeter, Meter ME-30A/U.

Section II. TROUBLESHOOTING

10. Visual Inspection

Inspect the LS-147(*)/FI for obvious defects as follows:

- a. Turn the on-off switch on OFF.
- b. Remove the power cord plug from the ac outlet.
- c. Remove the chassis from the cabinet (TM 11-5830-221-12).
- d. Inspect the PRESS TO TALK switch for loose, open, or burnt contacts.
- e. Inspect transformers T1, T2, and T3 for bulging, leaking, or other evidence of overheating.
- f. Inspect the fuseholder for cracked insulation or loose connections.
- g. Inspect binding posts E1 and E2 for cracked, broken, or worn insulation.
- h. Inspect the line cord and line cord plug P1 for cracks, frays, or loose connections.
- i. Inspect resistors for cracks or charring.
- j. Inspect capacitors for evidence of breakdown or leakage.
- k. Inspect speaker-microphone LS1 for

a cracked, torn, or loose cone, or loose connections from the voice coil to the cone.

11. Troubleshooting Chart

a. General. In the chart (c below), procedures are outlined for localizing and isolating troubles. Part locations are indicated in figures 6 through 11. Schematic diagrams are shown in figures 1, 2, and 3, and wiring diagrams are shown in figures 15, 16, and 17. Resistance measurements of transformers are given in paragraph 12. The nature of the operational symptoms will determine the procedure to be used.

b. Use of Chart. The symptom in the chart (c below) are obtained while performing the procedures outlined in the equipment performance checklist (TM 11-5830-221-12). If previous operational checks result in reference to a particular item in the chart, go directly to the referenced item. If no operational symptoms are known, begin with item 1 of the equipment performance checklist (TM 11-5830-221-12) and proceed as directed. After a

trouble has been localized, make voltage and resistance measurements (fig. 4 and 5) to isolate the defective parts.

c. Chart.

Item	Symptom	Probable trouble	Correction
1	Pilot lamp does not light when VOLUME control (LS-147A/FI, LS-147B/FI) or OFF-SEND control (LS-147C/FI, LS-147D/FI) is turned	<ul style="list-style-type: none"> a. Defective power cord or plug P1. b. Defective fuseholder XF1 c. Defective pilot lamp socket XDS1. d. Defective on-off switch S2 (LS-147A/FI, LS-147B/FI) or S1 (LS-147C/FI, LS-147D/FI). e. Defective power transformer T2 (LS-147A/FI, LS-147B/FI, LS-147D/FI) or T3 (LS-147C/FI). f. Defective resistor R8 (LS-147C/FI) or R11 (LS-147D/FI). 	<ul style="list-style-type: none"> a. Replace or repair (fig. 6,7, or 8). b. Replace. c. Replace. d. Check continuity of switch. Replace switch if defective. e. Check voltages and resistances of transformer (para 12). f. Replace (fig. 10 or 11).
2	Incoming signal cannot be received.	<ul style="list-style-type: none"> a. Defective PRESS TO TALK switch S1 (LS-147A/FI, LS-147B/FI) or S2 (LS-147C/FI, LS-147D/FI). 	<ul style="list-style-type: none"> a. Check continuity of PRESS TO TALK switch contacts. Replace switch if defective (fig. 6, 7, or 8).
3	No transmission to distant station.	<ul style="list-style-type: none"> a. Defective tube socket XV1, XV2, or XV3. b. Defective input or output transformer T1 or T3 (LS-147A/FI, LS-147B/FI, and LS-147D/FI), T1 or T2 (LS-147C/FI). c. Defective VOLUME control potentiometer (LS-147A/FI, LS-147B/FI), OFF-SEND control (LS-147C/FI, LS-147D/FI). 	<ul style="list-style-type: none"> a. Replace defective socket. b. Check resistances of transformers (para 12). Replace transformer if defective. c. Check potentiometer. Replace potentiometer if defective.
4	No transmission or reception.	Defective speaker-microphone LS1.	Check continuity across voice coil of speaker-microphone LS1 and replace if defective.
5	Excessive hum in transmission to distant station.	Defective filter capacitor C5A or C5B.	Check filter capacitor C5A and C5B. Replace capacitor if defective.
6	Low signal transmission level	Defective component in amplifier stage.	Make voltage and resistance measurement (fig. 4 and 5) and replace defective component (fig. 9, 10, or 11).

12. Additional Troubleshooting Data

The following charts (a, b, and c below) indicate the dc resistance of the transformers.

a. LS-147A/FI and LS-147B/FI.

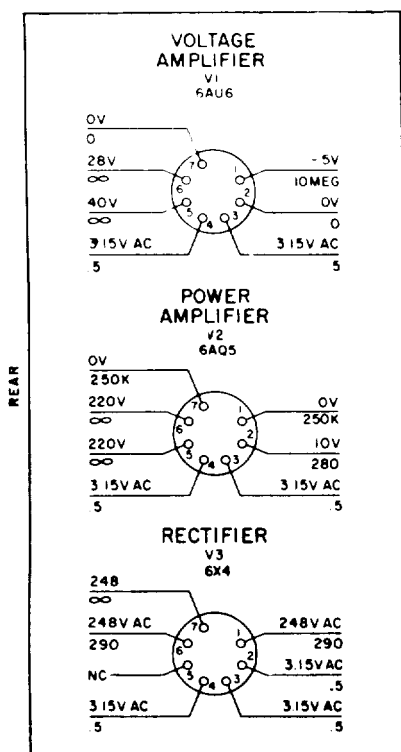
b. LS-147C/FI.

Transformer	Winding	Resistance (ohms)
T1	1-2	150
	3-4	1,300
T2	1-2	13
	3-4	350
	5-6	350
	6-7	0.5
	7-6	0.5
T3	1-2	190
	3-4	3

Transformer	Winding	Resistance (ohms)
T1	1-2	0.5
	3-4	470
T2	1-2	130
	3-4	1
T3	1-2	13
	3-4	265
	4-5	280
	6-7	0.5
	7-8	0.5

c. LS-147D/FI.

Transformer	Winding	Resistance (ohms)
T1	1-2	1
	3-4	1,150
T2	1-2	13
	3-4	290
	4-5	290
	6-7	0.5
	7-8	0.5
T3	1-2	170
	3-4	3.5

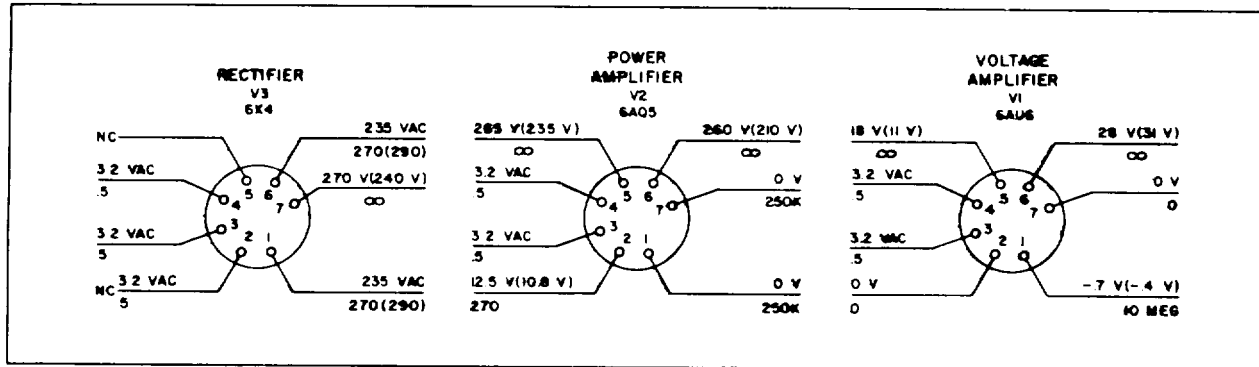


- NOTES:**
1. VOLTAGE READINGS ABOVE THE LINE, RESISTANCE READINGS BELOW THE LINE.
 2. 115 VAC INPUT.
 3. PRESS TO TALK SWITCH SET IN LISTEN (NON DEPRESSED) POSITION.
 4. **VOLUME** CONTROL RB MAXIMUM CLOCKWISE POSITION.
 5. DC VOLTAGE MEASUREMENTS MADE WITH A 20,000 OHMS-PER-VOLT METER.
 6. VOLTAGE AND RESISTANCE MEASURED TO CHASSIS.
 7. NC INDICATES NO CONNECTION.
 8. RESISTANCES ARE IN OHMS.

TM5830-221-35-5

Figure 4. LS-147A/FI or LS-147B/FI, voltage and resistance chart.

FRONT (LS-147C/FI)
REAR (LS-147D/FI)

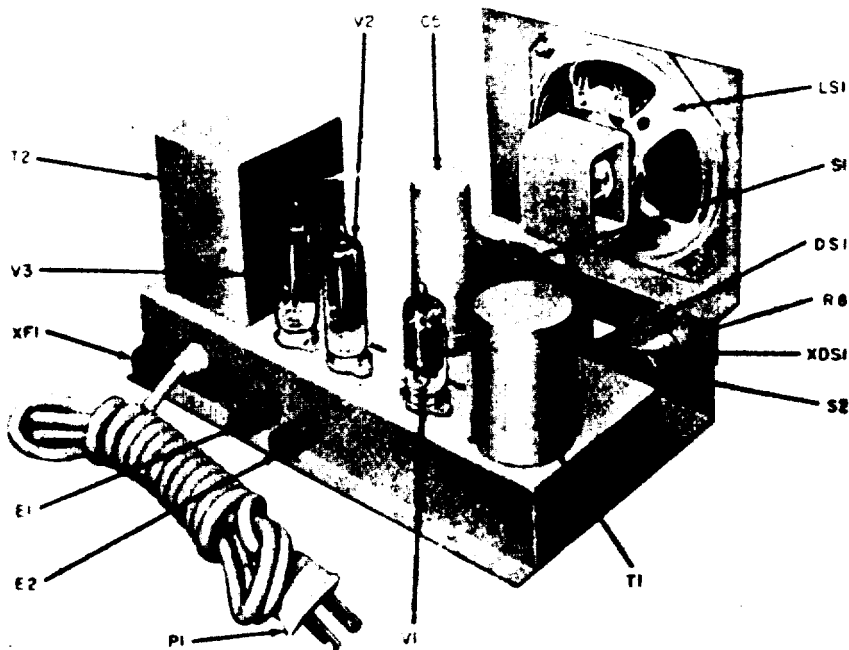


NOTES:

- VOLTAGE READINGS ABOVE THE LINE, RESISTANCE READINGS BELOW THE LINE
- VOLTAGES AND RESISTANCES IN PARENTHESES APPLY ONLY TO THE LS-147D/FI
- 115 VAC INPUT
- [PRESS TO TALK] SWITCH S2 IN LISTEN (NON DEPRESSED) POSITION
- [OFF-SEND] CONTROL R4(LS-147C/FI) MAXIMUM COUNTER-CLOCKWISE POSITION, R8(LS-147D/FI) MAXIMUM CLOCKWISE POSITION
- [RECEIVE] CONTROL MAXIMUM CLOCKWISE POSITION
- DC VOLTAGE MEASUREMENTS MADE WITH A 20,000 OHMS-PER-VOLT METER
- VOLTAGE AND RESISTANCE MEASURED TO CHASSIS
- NC INDICATES NO CONNECTION
- RESISTANCES ARE IN OHMS

TM5830-221-35-4

Figure 5. LS-147C/FI or LS-147D/FI, voltage and resistance chart.



TM5830-221-35-6

Figure 6. LS-147A/FI or LS-147B/FI, less cabinet, top rear oblique view, location of parts.

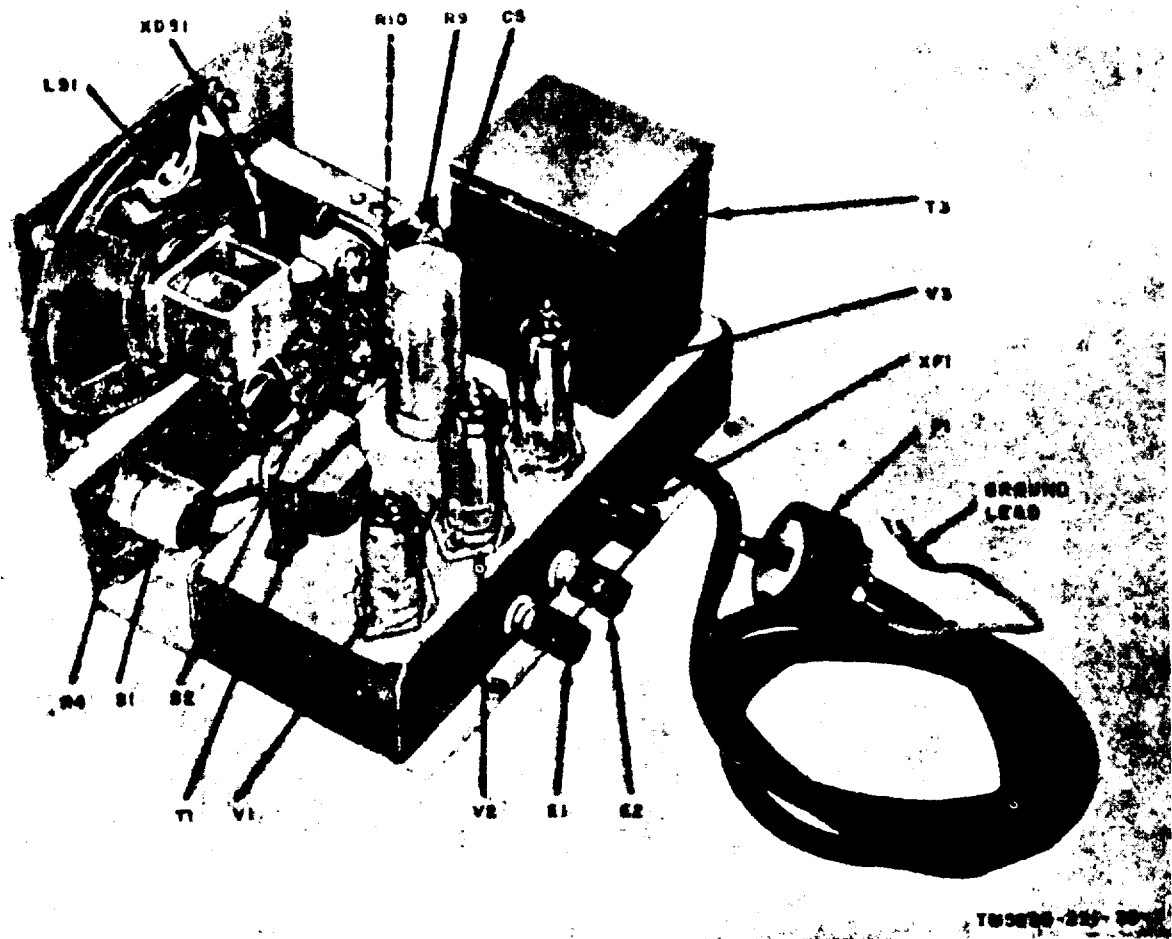
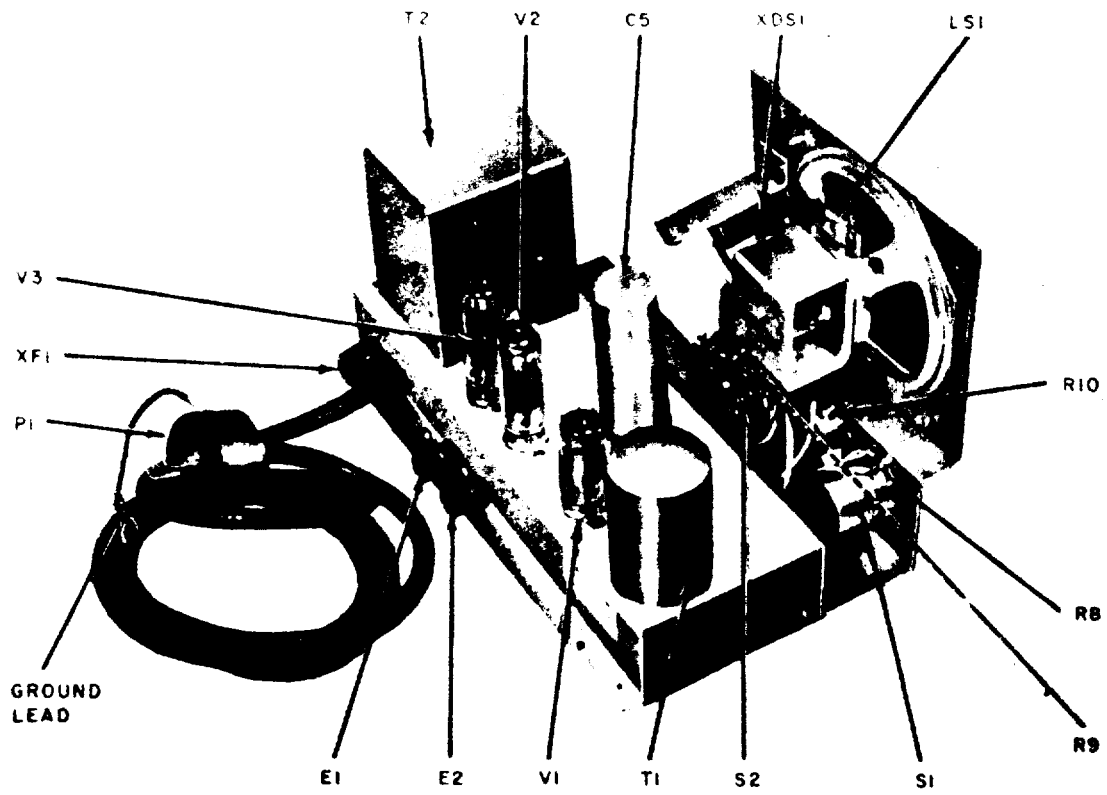


Figure 7. LS-147C/FI less cabinet, top rear oblique view, location of parts.



TM5830-221-35-8

Figure 8. LS-147D/FI, less cabinet, top rear oblique view, location of parts.

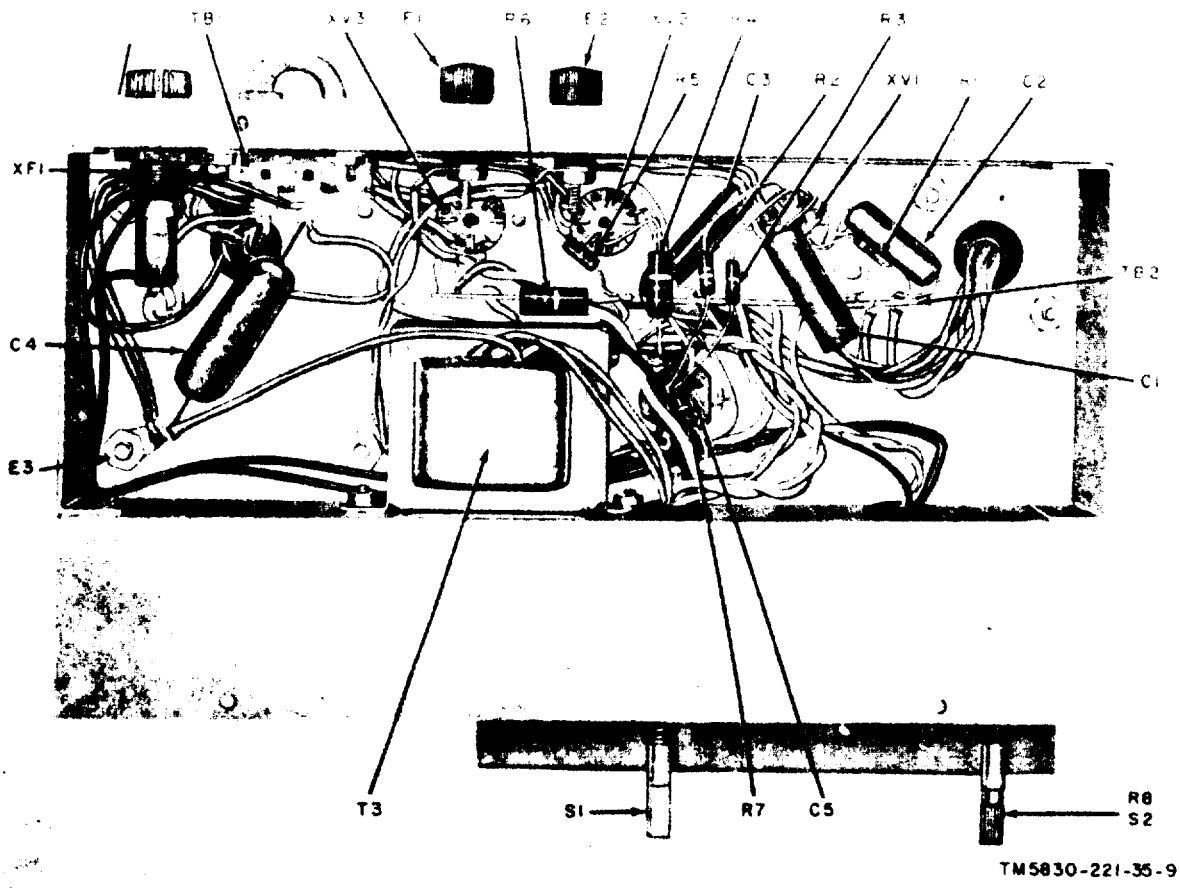
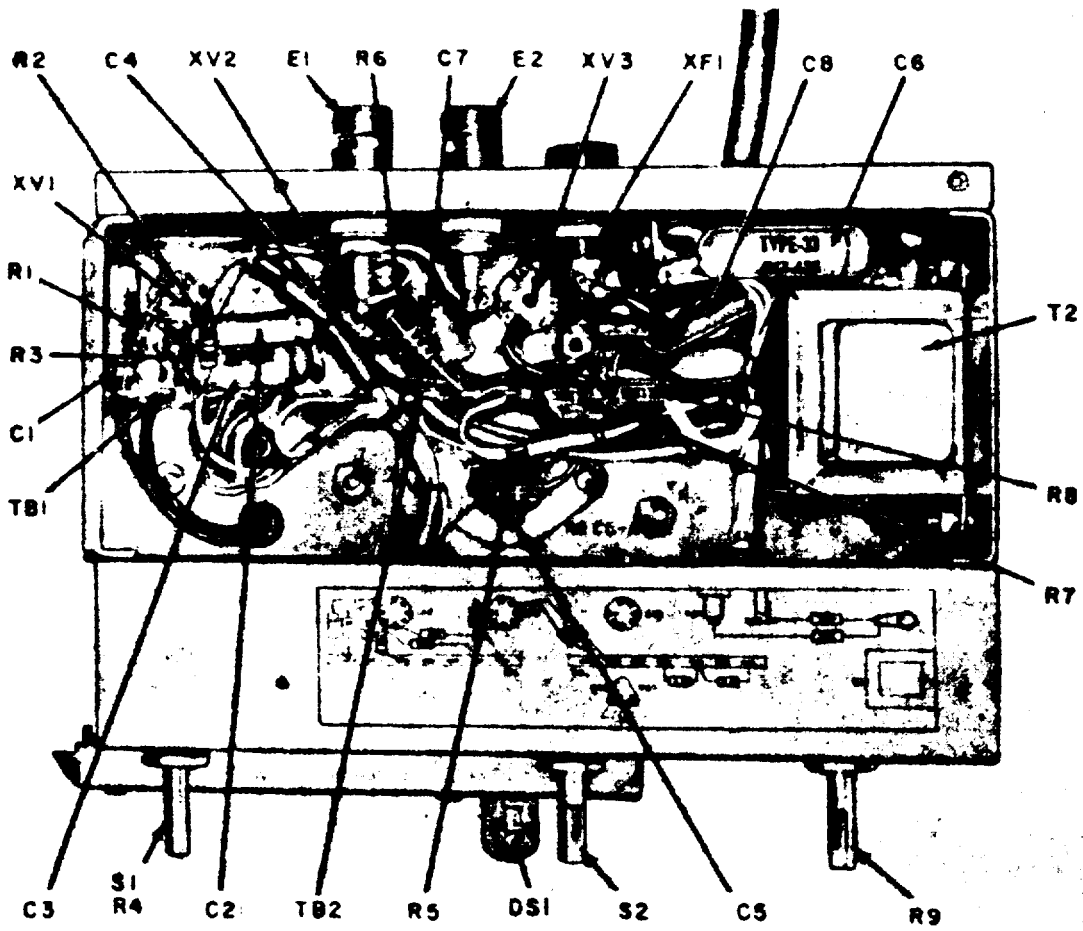
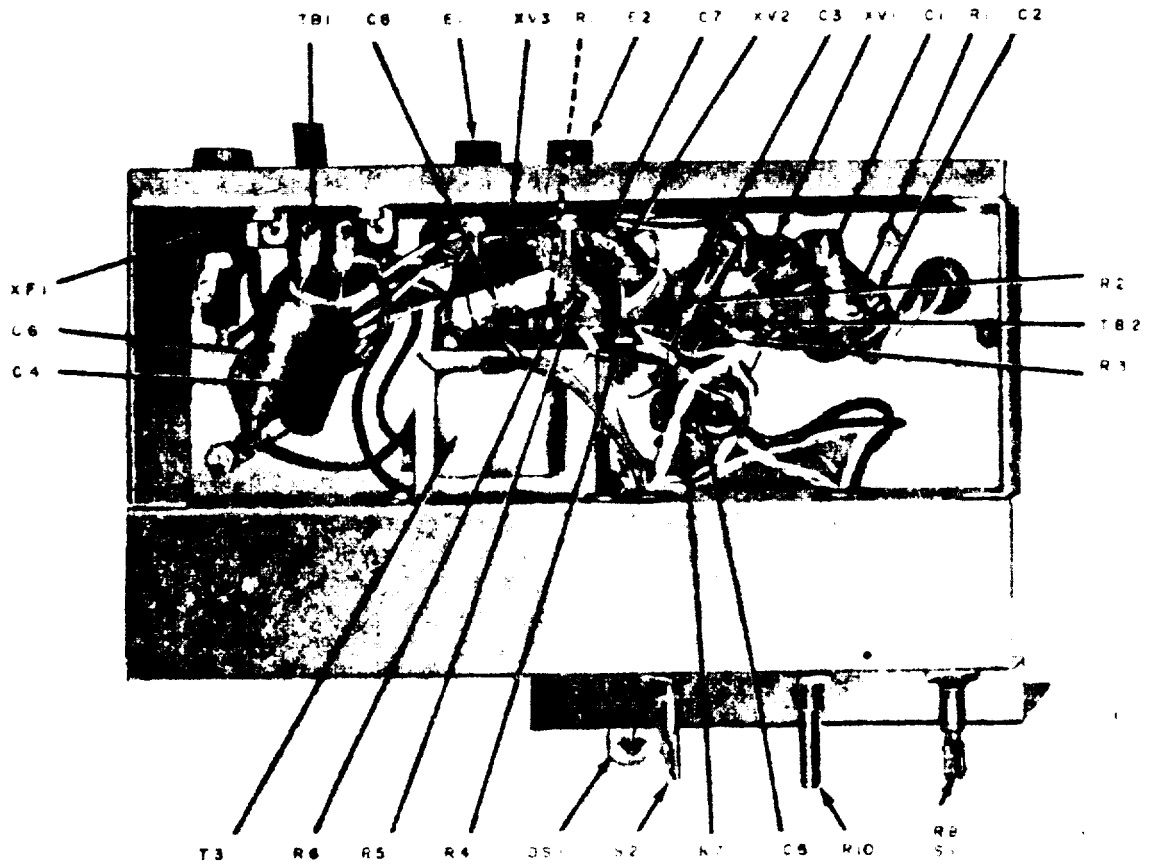


Figure 9. LS-147A/FI or LS-147B/FI, less cabinet, bottom view of chassis, location of parts.



TM5830-221-35-10

Figure 10. LS-147C/FI, less cabinet, bottom view of chassis, location of parts.



TM5830-221-35 11

Figure 11. LS-147D/FI, less cabinet, bottom view of chassis, location of parts.

CHAPTER 4

FOURTH ECHELON TESTING PROCEDURES

13. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance of signal equipment to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment must meet before it is returned to the using organization. The testing procedures may also be used as a guide to test the LS-147(*)/FI repaired at third echelon if the proper tools and test equipment are available. These testing procedures are also used for fifth echelon final testing of an LS-147(*)/FI.

b. Comply with the instructions pre-

ceding the body of each chart before proceeding to the chart. Perform each test in sequence. Do not vary the sequence. For each step, perform all the actions required in the *Test equipment control setting* and *Equipment under test control setting* columns; then perform each specific test procedure and v e r i f y it against its performance standard.

14. Test Equipment, Tools, and Materials

All test equipment, tools, and materials, and other equipment required to perform the testing procedures given in this section are listed in the following charts and are authorized under TA 11-17 and TA 11-100 (11-17).

a. Test Equipment.

Nomenclature	Federal stock No.	Technical manual
Analyzer, Spectrum TS-723/U	6615-668-9418	TM 11-5097
Audio Oscillator TS-382A/U	6625-192-5094	TM 11-2684A
Multimeter AN/URM-105	6625-581-2036	TM 11-6625-203-12
Test Set, Election Tube TV-2/U	6625-669-0263	TM 11-2661
Test Set, Election Tube TV-7/U	6625-376-4939	TM 11-6625-274-12
Volmeter, Meter ME-30A/U.	6625-669-742	TM 11-6625-320-12

b. Tools. Tool Equipments TE-113.

c. Materials.

Materials	Federal stock No.	Quantity (ea)
Resistor, 150-ohm, 2-watt $\pm 10\%$	5905-101-8800	2
Test Lead Set CX-1331A/U	6625-395-9313	2
Hookup wire, stranded, #18 AWG	6145-160-5317	10 ft
Clip, Electrical (blk) ^a	5940-233-3495	1
Clip, Electrical (red) ^a	5940-220-9756	1

^aAlligator clips.

15. Calibration of Test Equipment

The following test equipments must be calibrated before performing fourth eche-

lon testing procedures. After calibration of the test equipments, follow the procedures given in paragraph 16 for distortion and gain testing.

a. *Audio Oscillator TS-382A/U.*

- (1) Plug Cord CX-237A/U into the power receptacle.
- (2) Attach Cord CG-409A/U to OUTPUT plug J102.
- (3) Turn the HEATER ON-OFF switch to OFF.
- (4) Turn the OSC. ON-OFF switch to OFF.
- (5) Plug the power cable into a 115-volt 60-cps source.
- (6) Turn the OSC. ON-OFF switch to ON; the OSC. pilot lamp should light.
- (7) Allow the oscillator to warmup for 15 minutes.

- (8) At low temperatures, proceed as follows :
- (a) Turn the HEATER ON-OFF switch to ON.
 - (b) Turn the THERMOSTAT control fully clockwise; the HEATER pilot lamp should light.
 - (c) When the case of the oscillator feels warm to the touch, turn the THERMOSTAT control counter-clockwise until the HEATER pilot lamp extinguishes; leave the control in this position.
- (9) Check to see that the oscillator is operating properly, follow the procedure below:
- (a) Set the main tuning dial at 60.
 - (b) Set the RANGE switch at X1 (lowest frequency range) .
 - (c) Turn the FREQ. METER switch to ON.
 - (d) Move the main tuning dial back and forth slightly until the FREQ. METER reed marked 60 CYCLES PER SECOND vibrates with maximum amplitude. The setting

of the main tuning dial at this point should be within 1 division of 60.

- (e) Make the same check at 400 cps. The main tuning dial should be within 1-1/2 divisions of 40 (with the range switch set at X10) when the FREQ. METER reed marked 400 CYCLES PER SECOND vibrates with maximum amplitude.
- (f) Turn the FREQ. METER switch to OFF.

b. Voltmeter, Meter ME-30A/U. Before applying power, if the meter needle does not point to zero, adjust the zero adjust screw until it does.

Note. After the voltmeter is turned on, there may be a meter indication of as much as two scale divisions. This effect is normal and does not affect the accuracy of the instrument.

c. Spectrum Analyzer TS-723A/U.

- (1) Turn the ON-OFF switch to OFF.
- (2) Turn the signal INPUT control to MIN.
- (3) Set the RMS VOLTS DB switch to +50 DB (maximum attenuation).

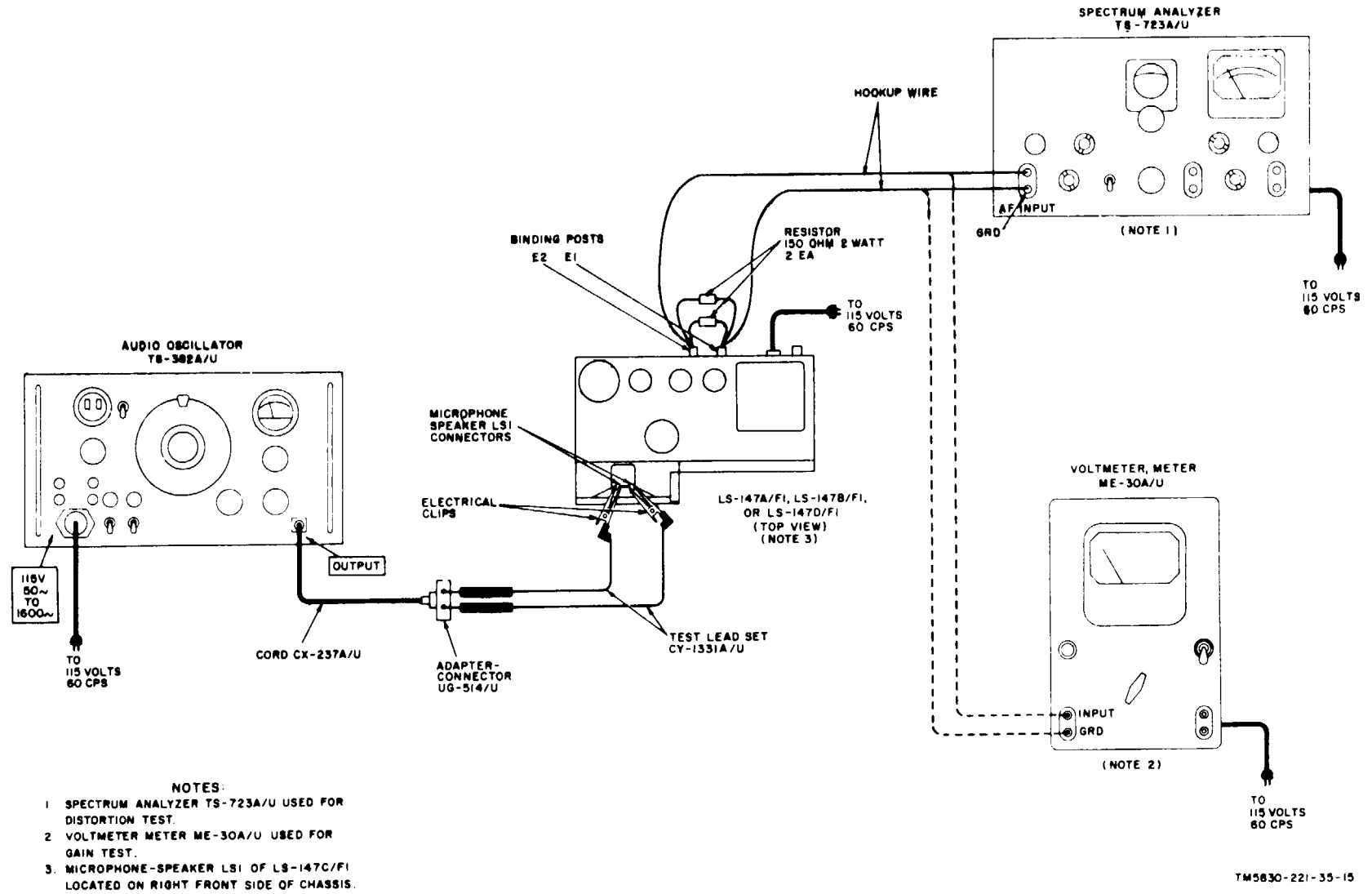


Figure 12. Distortion and gain test setup.

16. Distortion and Gain
(fig. 12)

a. Test Equipment and Material.

- (1) Audio Oscillator TS-382A/U.
- (2) Analyzer, Spectrum TS-723A/U.
- (3) Voltmeter, Meter ME-30A/U.
- (4) Resistor, 150-ohm, 2-watt, $\pm 10\%$ (2 ea).
- (5) Test Lead Set CX-1331A/U (1 2a).
- (6) Alligator clips (2 ea).
- (7) Hookup wire, stranded, #18 AWG (10 ft).

b. Test Connections and Conditions. Connect the equipments as shown in figure 12. For distortion test, use Spectrum Analyzer TS-723A/U; for gain test, use Voltmeter, Meter ME-30A/U. Connect the ac power cord plugs to the ac power source. Allow 15 minutes for the equipment to warm up before conducting the test.

c. Procedure.

Step No.	Test equipment control setting	Equipment under test control setting	Test procedure	Performance standard
1	<p><i>TS-382A/U:</i></p> <p>RANGE switch: X10 Main tuning dial: 100 ATTENUATOR: .01 OUTPUT LEVEL control: Adjust until output level meter reads .35 volt rms.</p> <p><i>ME-30A/U:</i></p> <p>Range selector switch: 300 VOLTS or 100 VOLTS.</p>	<p>VOLUME control (LS-147A/FI and LS-147B/FI): Maximum volume (fully clockwise).</p> <p>OFF-SEND control (LS-147A/FI or LS-147B/FI): Maximum volume (fully clockwise).</p> <p>PRESS TO TALK switch: Depressed position.</p>	<p>Note the indication on the ME-30A/U. Read top scale with range selector switch on 100 VOLTS; read second scale from top with selector switch on 300 VOLTS.</p>	<p>ME-30A/U should indicate not less than 10 volts.</p>
2	<p><i>TS-382A/U:</i></p> <p>RANGE switch: X10 Main tuning dial: 100 Attenuator: .01 OUTPUT LEVEL control: Adjust until output level meter reads .35 volt rms.</p> <p><i>TS-723A/U:</i></p> <p>AF-RF switch: AF Meter range switch: 100% Function switch: SET LEVEL Signal INPUT control: Turn clockwise until RMS VOLTS meter pointer reads full-scale deflection of 1.0. Frequency RANGE switch: X10 Function switch: DISTORTION Coarse FREQUENCY tuning control: Rotate control until RMS VOLTS needle dips sharply. Fine FREQUENCY Control: Rotate control for minimum reading on RMS VOLTS meter. BALANCE control: Rotate control for minimum RMS VOLTS meter reading. (Tuning became sharper as meter reading decreases.)</p>	<p>Same as step No. 1</p>	<p>Note the indication on the TS-723A/U RMS VOLTS meter. Read the top scale. Full scale represents 100% distortion, with meter range switch on 100%.</p>	<p>TS-723A/U RMS VOLTS meter distortion reading should not exceed 8%.</p>

CHAPTER 5

FIFTH ECHELON MAINTENANCE

17. Scope of Fifth Echelon Maintenance

Fifth echelon maintenance consists of rebuilding the LS-147(*)/FI. Final tests for a rebuilt LS-147(*)/FI can be performed by use of fourth echelon testing procedures (para 13 through 16). The tools required for fifth echelon maintenance are listed in TM 11-5830-221-12.

18. Maintenance Procedures

Restore the LS-147(*)/FI to its original performance, appearance, and life expect-

ancy comparable to that of a new LS-147(*)/FI by performing the following procedures:

- a. Disassemble the LS-147(*)/FI as required.
- b. Inspect all parts.
- c. Repair or replace all unserviceable parts with standard replacement parts that conform to the original specifications.
- d. Reassemble the LS-147(*)/FI.
- e. Perform the fourth echelon testing procedures (para 13 through 16).

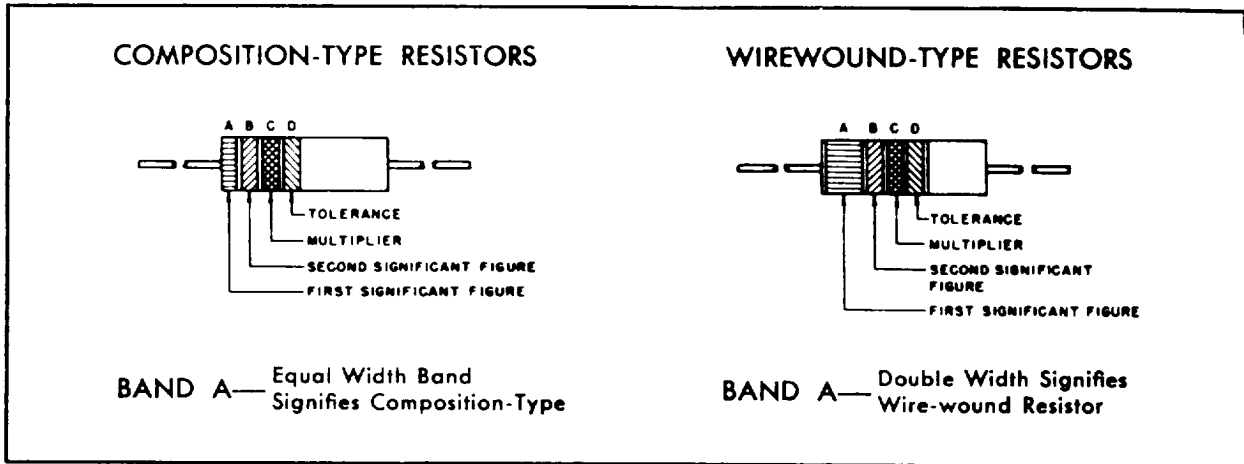
APPENDIX

REFERENCES

Following is a list of references applicable and available to the field and depot maintenance repairmen of Intercommunication Station LS-147(*)/FI.

TA 11-17	Signal Field Maintenance Shops.
TA 11-100 (11-17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TM 11-2661	Electron Tube Test Sets TV-2/U, TV-2A/U, and TV-2B/U.
TM 11-2684A	Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, and TS-382E/U.
TM 11-5097	Spectrum Analyzers TS-723A/U and TS-723/U.
TM 11-5830-221-12	operator's and Organizational Maintenance Manual: Intercommunication Station LS-147B/FI.
TM 11-5830-221-20P	Organizational Maintenance Repair Parts and Special Tools Lists, Intercommunication Stations LS-147A/FI, LS-147B/FI, LS-147C/FI, and LS-147D/FI.
TM 11-5830-221-35P	Field and Depot Maintenance Repair Parts and Special Tools List, Intercommunication Stations LS-147A/FI, and LS-147B/FI.
TM 11-6625-203-12	Operation and Organizational Maintenance Manual, Multimeter AN/URM-105, Including Multimeter ME-77/U.
TM 11-6625-274-12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U.
TM 11-6625-320-12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U.

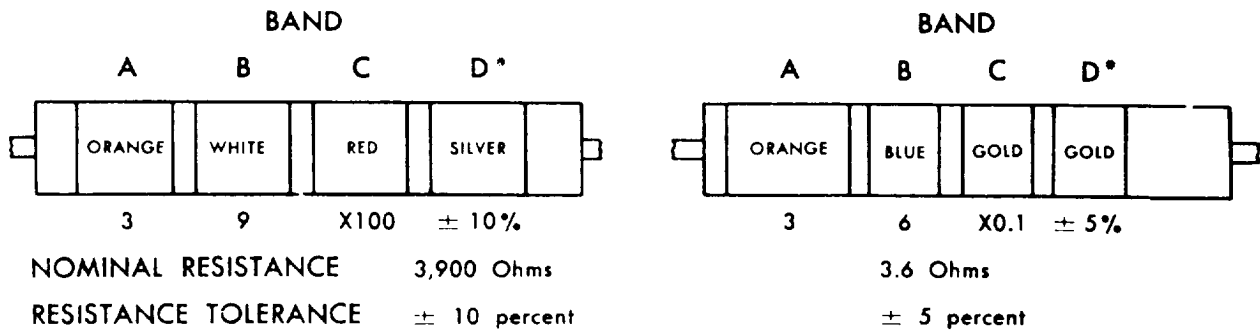
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS



COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING



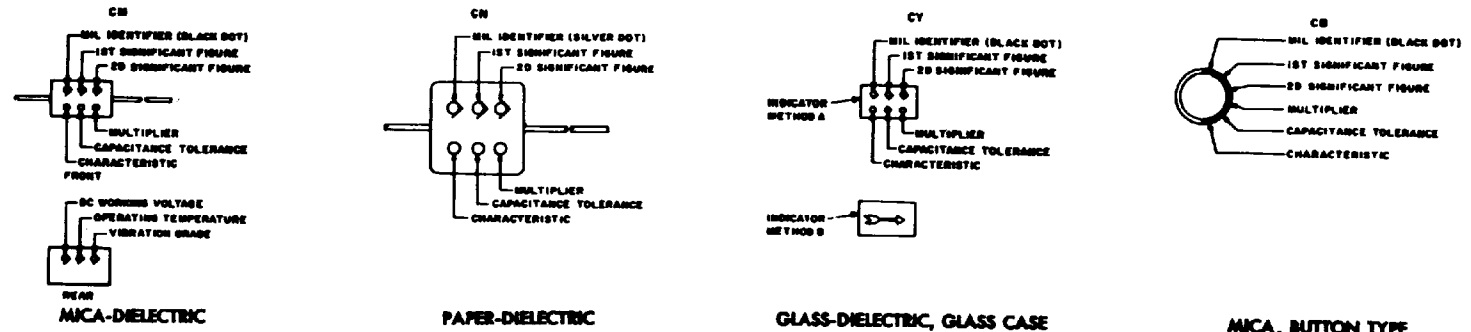
*If Band D is omitted, the resistor tolerance is ± 20%, and the resistor is not Mil-Std.

STD-R.

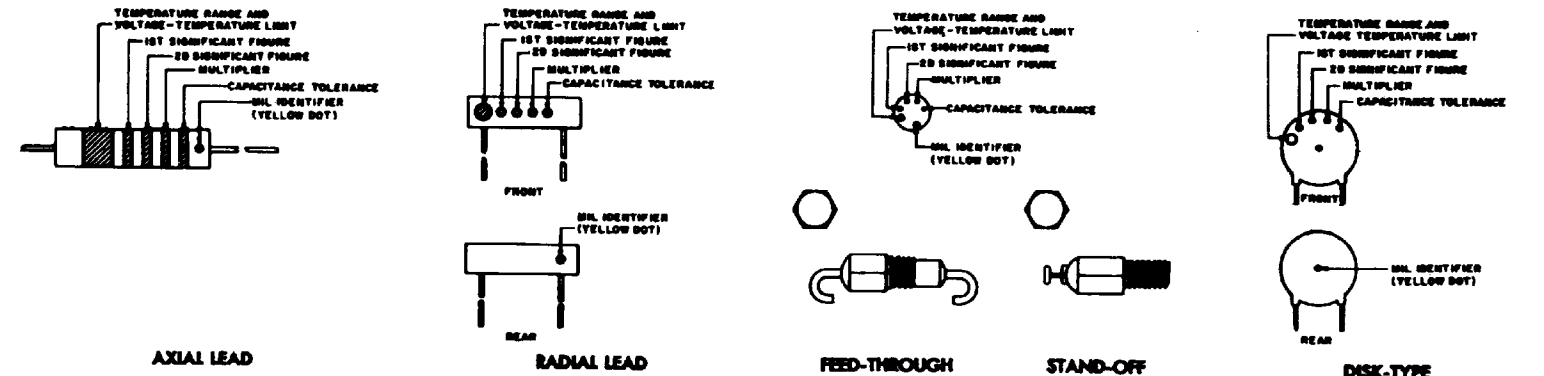
Figure 13. MIL-STD resistor color code marking.

COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

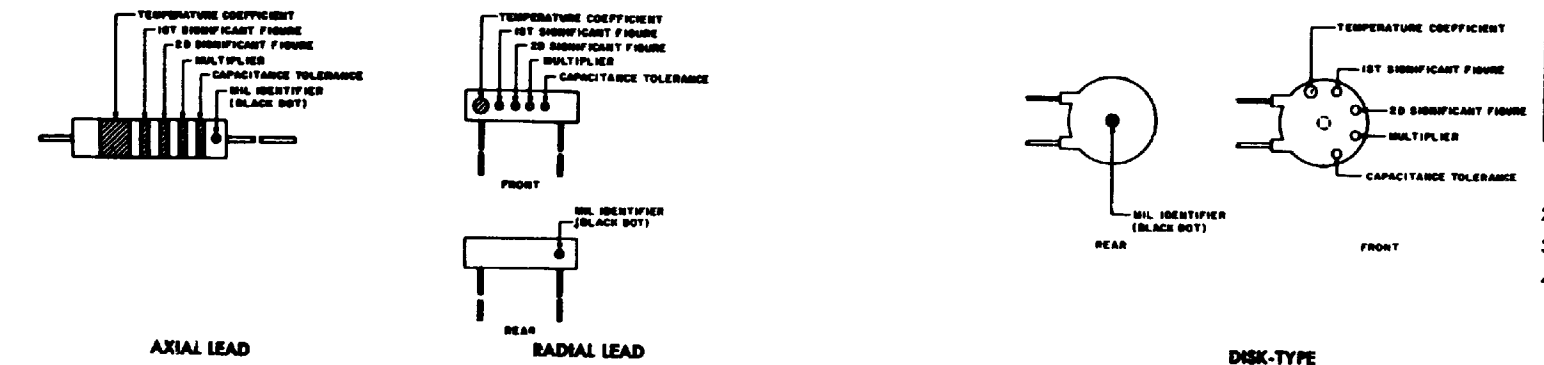
GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



GROUP III Capacitors, Fixed, Ceramic-Dielectric (Temperature Compensating) Style CC



COLOR CODE TABLES

TABLE I - For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER ¹	CAPACITANCE TOLERANCE				CHARACTERISTIC ²				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY, CB	0	0	1						A				-55° to +70°C	10-88 gpc
BROWN		1	1	10					B	E					
RED		2	2	100	± 2%		± 2%	± 2%	C		C			-55° to +85°C	
ORANGE		3	3	1,000		± 30%			D		D	300			
YELLOW		4	4	10,000					E			300		-55° to +125°C	10-2,000 gpc
GREEN		5	5		± 5%				F						
BLUE		6	6											-55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1				± 5%	± 5%						
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

TABLE II - For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE - TEMP. LIMITS ³	1st SIG FIG	2nd SIG FIG	MULTIPLIER ¹	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AZ	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BY	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III - For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT ⁴	1st SIG FIG	2nd SIG FIG	MULTIPLIER ¹	CAPACITANCE TOLERANCE		MIL ID
					Capacitance over 10µuf	Capacitance 10µuf or less	
BLACK	0	0	0	1		± 2.0µuf	CC
BROWN	-30	1	1	10	± 1%		
RED	-60	2	2	100	± 2%	± 0.25µuf	
ORANGE	-150	3	3	1,000			
YELLOW	-220	4	4				
GREEN	-330	5	5		± 5%	± 0.5µuf	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0µuf	
SILVER							

- The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in µuf.
- Letters indicate the Characteristics designated in applicable specifications: MIL-C-5, MIL-C-91, MIL-C-11272, and MIL-C-10950 respectively.
- Letters indicate the temperature range and voltage-temperature limits designated in MIL-C-11015.
- Temperature coefficient in parts per million per degree centigrade.

Figure 14. MIL-STD capacitor color code marking.

- NOTES:
- 1 TRANSFORMER MOUNTED ON TOP OF CHASSIS. TRANSFORMER LEADS CONNECTED DIRECTLY TO COMPONENTS
 - 2 TRANSFORMER WINDING NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES
 - 3 WAFER SWITCH (S1) SEGMENT LETTERS, AND CONTACT NUMBERS ARE ARBITRARILY ASSIGNED. SECTION A IS WAFER BEHIND THE FRONT PANEL. SEGMENTS SHOWN IN DASHED LINES ARE ON FRONT OF WAFER
 - 4 PT DENOTES METAL LEAD

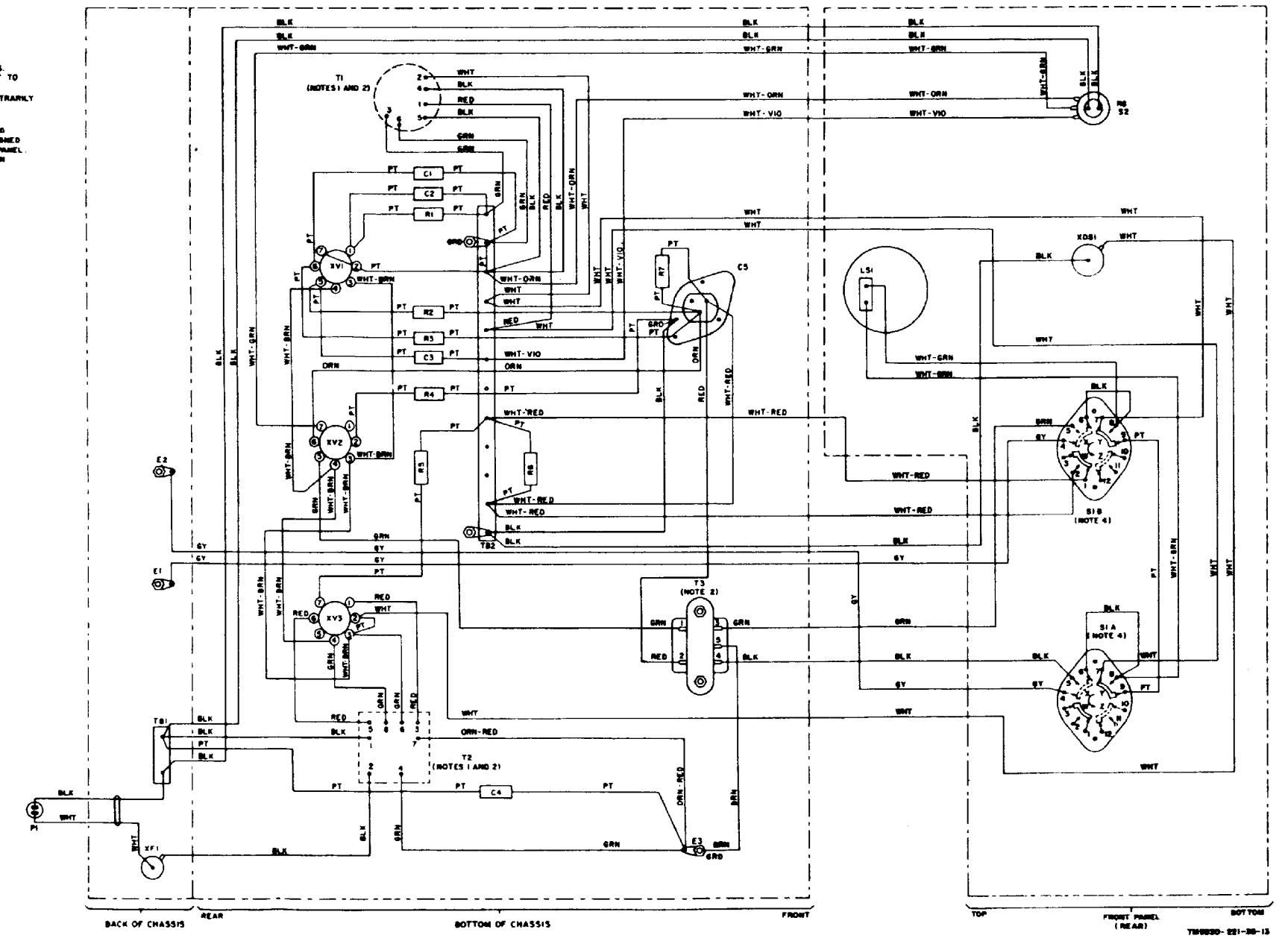
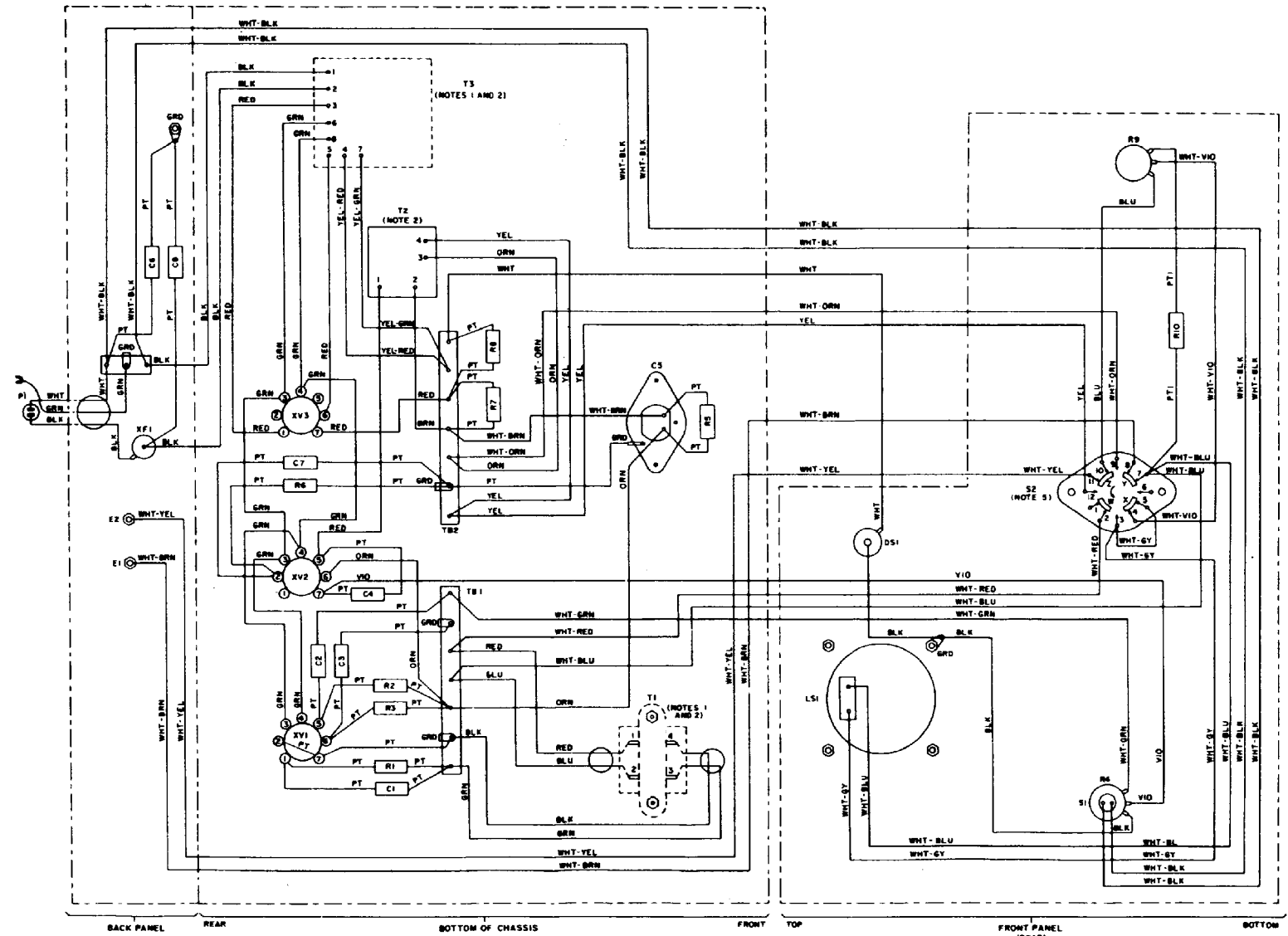


Figure 16. LS-147A/F1 or LS-147B/F1, wiring diagram.

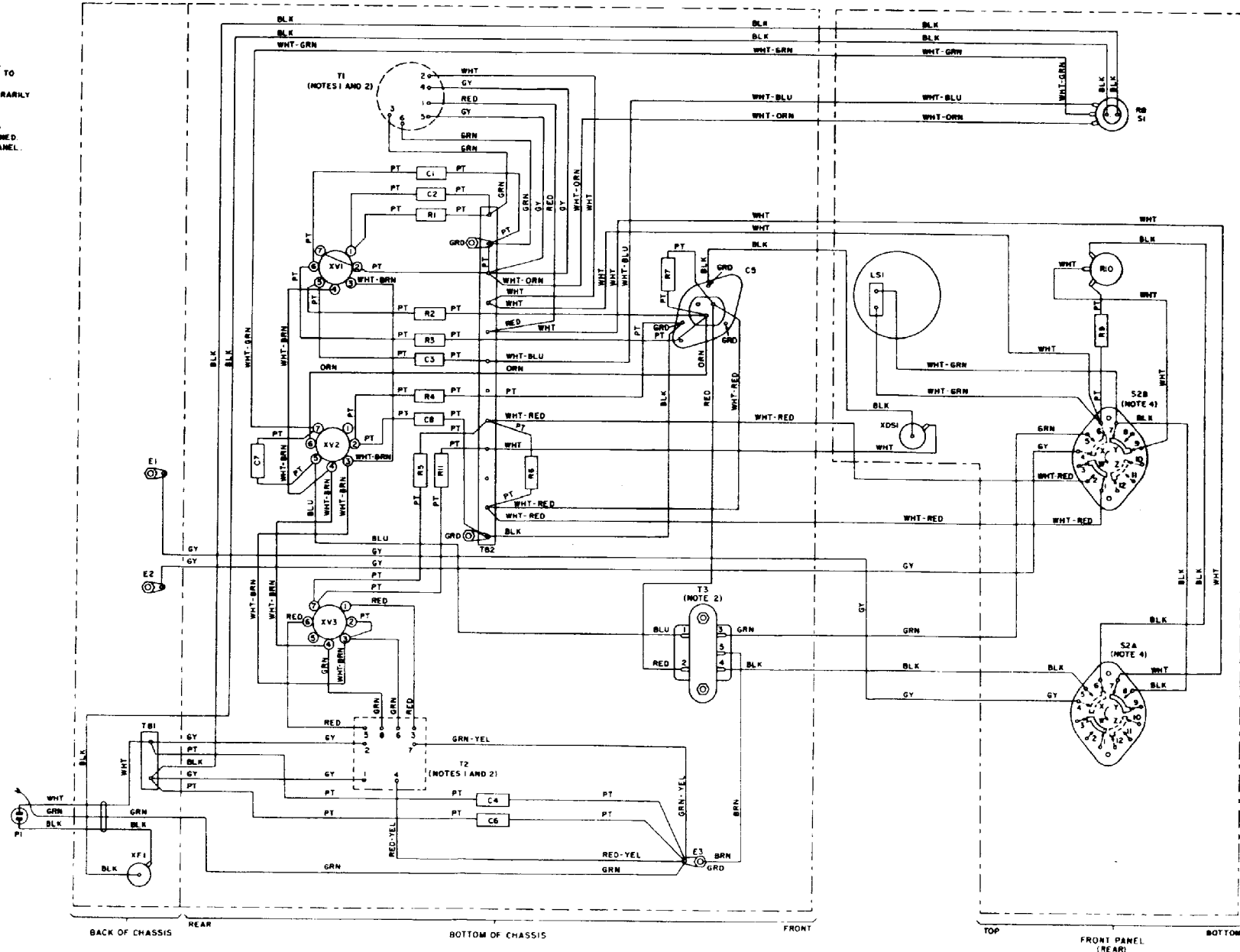


- NOTES
- 1 TRANSFORMER MOUNTED ON TOP OF CHASSIS. TRANSFORMER LEADS CONNECTED DIRECTLY TO COMPONENTS.
 - 2 TRANSFORMER WINDING NUMBERS ARE ARBITRARILY ASSIGNED.
 - 3 PT DENOTES PH-TAIL LEAD.
 - 4 PT1 DENOTES PH-TAIL LEAD INSULATED.
 - 5 WAFER SWITCH (S2) SEGMENT LETTERS AND CONTACT NUMBERS ARE ARBITRARILY ASSIGNED.

TW5930-121-35-12

Figure 16. LS-147C/FI, wiring diagram.

- NOTES:
1. TRANSFORMER MOUNTED ON TOP OF CHASSIS. TRANSFORMER LEADS CONNECTED DIRECTLY TO COMPONENTS.
 2. TRANSFORMER WINDING NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES.
 3. PT DENOTES PIGTAIL LEAD.
 4. WAFER SWITCH (S2) SEGMENT LETTERS, AND CONTACT NUMBERS ARE ARBITRARILY ASSIGNED. SECTION A IS WAFER NEAREST THE FRONT PANEL. SEGMENTS SHOWN IN DASHED LINES ARE ON FRONT OF WAFER.



*M5630-221-35-14

Figure 17. LS-147D/F1, wiring diagram.

By Order of Secretary of the Army

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DASA (5)	AFIP (1)
USASA (2)	WRAMC (1)
CNGB (1)	Yuma Test Sta (2)
Tech Stf, DA (1) except	USAEPG (2)
CSigO (18)	EMC (1)
Tech Stf Bd (1)	USACA (3)
USCONARC (5)	USASEA (1)
USAARTYBD (1)	USA Caribbean Sig Agcy (1)
USAARMD (2)	USA Sig Msl Spt Agcy (13)
USAIB (1)	USASSA (20)
USARADB (2)	USASSAMRO (1)
USAABELCTBD (1)	Army Pictorial Cen (2)
USAAVNBD (1)	USAOMC (3)
USAATBD (1)	USA Trans Tml Comd (1)
ARADCOM (2)	Army Tml (1)
ARADCOM Rgn (2)	POE (OS) (1)
OS Maj Cored (3)	OSA (1)
OS Base Cored (2)	AMS (1)
LOGCOMD (2)	Sig Fld Maint Shops (3)
MDW (1)	JBUSMC (2)
Armies (2)	Units org under fol TOE:
corps (5)	(2 each UNOINDC)
USATC (2)	11-7
Ft Monmouth (63)	11-16
Svc Colleges (2)	11-57
Br Svc Sch (2)	11-96
GENDEP (2) except	11-117
Atlanta GENDEP (none)	11-155
Sig See, GENDEP (5)	11-500 AA-AE (4)
Sig Dep (12)	11-557
	11-587
	11-592
	11-597

NG: State AG (3) Units same as Active Army except allowance is one copy to each unit.

USA R: None.

For explanation of abbreviations used, see AR 320-50.

TM 11-5830-221-35 INTERCOMMUNICATION STATIONS LS-147A/FI, LS-147B/FI, LS-147C/FI, AND LS-147D/FI-1961

PIN: 018955-000