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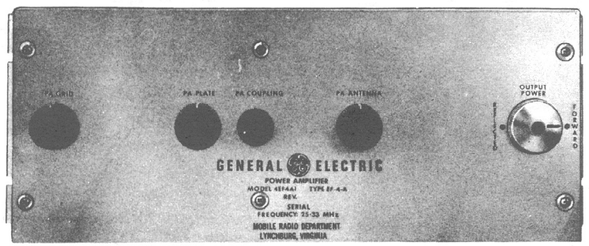
Mobile Communications



MASTR® II
POWER AMPLIFIER
MODELS 4EF4A1,2,3

Maintenance Manual

ERICSSON

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LBI-4938

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SPECIFICATIONS*

MODEL NUMBER	4EF4A1,2,3		
USED WITH	Driver Type KT-56-A and Power Supply 19D402530G1, G2 to provide a 150-300 Watt (KT-39-A) Transmitter		
FREQUENCY RANGE	4EF4A1: 25-30 MHz 4EF4A2: 30-42 MHz 4EF4A3: 42-50 MHz		
POWER INPUT	117 VAC, 50/60 Hz Standby: 2 amps Transmit: 9 amps (maximum)		
POWER OUTPUT	150 to 300 Watts		
TUBE COMPLEMENT	(1) 4CX250B or 7203/4CX250B		
AM HUM AND NOISE LEVEL	Down 34 dB		
MAXIMUM FREQUENCY SPREAD:			
(2 or more channels)	Full Specifications	1 dBDegradation	
25-30 MHz	0.12 MHz	0.24 MHz	
30-36 MHz	0.12 MHz	0.24 MHz	
36-42 MHz	0.16 MHz	0.32 MHz	
42-50 MHz	0.18 MHz	0.36 MHz	
DUTY CYCLE	Continuous --Blower recommended for cabinet ventilation under conditions of high ambient temperatures or continuous duty operation.		
AMBIENT TEMPERATURE RANGE	-30°C to +60°C (-22°F to +144°F)		
DIMENSIONS (HxWxD)	7" x 19" x 11"		
WEIGHT	18 pounds		

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS!

DESCRIPTION

General Electric Power Amplifier Models 4EF4A1, 2 and 3 operate in the 25-54 megahertz band. They are used with an external driver and power supply to provide a power output between 150 and 300 watts. The amplifier employs a 4CX250B as a power amplifier tube, with forced-air cooling providedby a blower mounted on the power supply. Standard RETMA rack-mounting dimensions are used. The tuning controls most frequently used are located on the front of the unit.

All the power connections, except the high voltage connection, are made with a 6-pin plug from the front of the unit. High voltage is brought to the plate at the rear of the plate compartment.

Antenna relay keying voltage connections are made behind the output Power Indicator, using screw connections. The RF drive connection is made by an RG-58/U cable plugged into the driver from the front of the unit.

CIRCUIT ANALYSIS

Excitation of the Power Amplifier at P482 is fed to coupling loop L482 and coupled to coil L484, which, with C481, forms the grid tank of the amplifier. By adjusting the PA GRID control (C481), the grid tank may be tuned to the operating frequency. Coil L481 isolates RF from the power cable.

In order to obtain optimum tube life the filament voltage on the Power Amplifier tube V481 is set at the factory for 6 Volts with R4 on the High Power Power Supply. The filament voltage can be set for a higher value but with a corresponding decrease in tube life. C482, C483, and C484 are RF by-pass capacitors and R481 is used as a screen RF decoupling resistor. Built into the tube socket, XV481, is a ring-type capacitor which is used as a screen grid by-pass.

All input voltage connections to the Power Amplifier, except the B-plus voltage connection, are made at P481 on the front side of the panel. The 2000-volt B-plus lead is connected at terminal P0-2 located in the rear on the plate cavity cover. C485 provides bypassing for the B-plus and L485 is an RF choke. The plate tank is composed of C488 and L494. The plate tank is tuned to the operating frequency by adjusting the PA PLATE control C488.

Adjusting the PA COUPLING control varies the coupling from the plate to the output by controlling the amount of magnetic flux linking the plate coupling loop to the outputloop. The filter consists of L490, L491, L492, L493, C492, C493, L494 and C495.

Antenna coupling is adjusted by the PA ANTENNA control C489. The signal is fed from the filter to J481. The signal from J481 is connected to the antenna through P1 and P2 on the Reflectometer and through the contacts on the antenna relay K482.

POWER REFLECTOMETER

The Power Reflectometer gives a relative voltage which indicates forward and reflected RF power output.

The Reflectometer samples the magnetic field caused by current in the transmission line and the electrical field from the voltage on the line. on a properly matched line, these two voltages are equal and cancel each other when reading REFLECTED power ("0" reflected power). When the probe is rotated 180, these two voltages add to indicate FORWARD power.

When the load is not matched, these two voltages become unequal and provide a ratio of incident (forward) to reflected power. Any significant change in this ratio (if other than 1:1) after initial installation and check out, should be cause for examination of the antenna and feed line. Actual V.S.W.R. as measured on a calibrated bridge, should remain below 1.5:1 at all times.

ANTENNA RELAY

K482, the antenna relay, switches the antenna from the receiver to the transmitter when the transmitter is keyed.

MAINTENANCE

PREVENTIVE MAINTENANCE

To obtain optimum performance from the equipment, a program of regular preventive maintenance should be followed. This preventive maintenance should include the following:

1. A check of the operating frequency as required by the Federal Communications Commission.

2. A check of the PA PLATE current, Power Amplifier GRID current and PA PLATE voltage meter readings.

3. A check of the PA PLATE tuning and reflected power (if any) and realignment if improper operation is indicated.

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4. A check for loose nuts, screws, cables and parts.

5. An inspection of the high- and low- voltage connections.

POWER AMPLIFIER TUBE REPLACEMENT

To remove the Power Amplifier tube, proceed as follows:

1. Remove the high-voltage lead from P0-2, located on the rear of the Power Amplifier.

2. Loosen the winged screws holding the rear cover plate to the assembly.

3. Slide off the rear cover plate.

4. Insert the prongs of the tube extractor (included with the station equipment) between the cooling fins of the PA tube plate.

5. Pull the tube straight out from the socket.

To reinsert the Power Amplifier tube, proceed as follows:

1. Insert the prongs of the tube extractor between the cooling fins of the PA tube plate.

2. Push the PA tube all the way into the socket while observing the key on the tube and socket. The tube extractor may be left on the tube cooling fins.

3. Replace the rear cover plate of the Power Amplifier.

4. Tighten the winged screws on the rear cover plate.

5. Replace the high-voltage lead to P0-2 on the rear of the Power Amplifier.

BLOWER

The blower motor bearings are to be lubricated every 2000 hours of operation. A small oil can for this purpose is mounted on the power supply chassis, at the right of the blower motor. Use the oil recommended in the Parts List. (See Parts List on back of Schematic Diagram.)

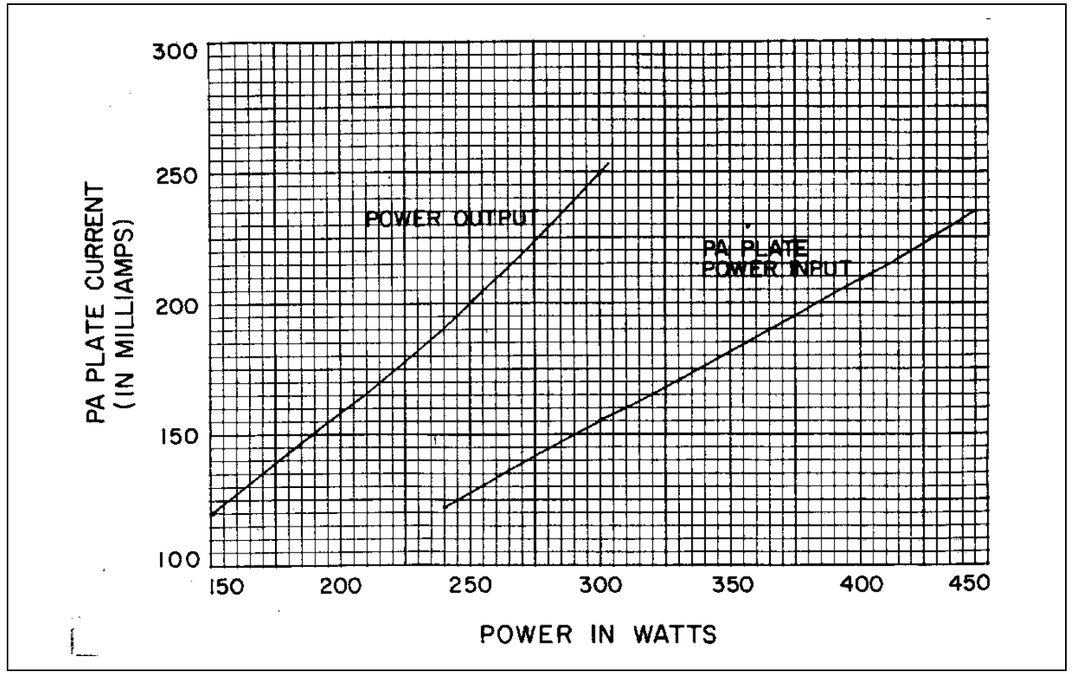


Figure 1 - Power and PA Plate Current Levels

MULTI-FREQUENCY OPERATION

1. Tune the PA on the LF (lowest frequency).

2. Select the HF (highest frequency) and re-peak the grid tuning.

3. Select LF and adjust the PA plate tuning CW (clockwise) to let the plate current rise 5 - 10 mA.

4. Then re-adjust the screen control for rated plate current level.

5. Select HF to compare the plate currents.

6. If there is greater than 10 mA difference then repeat the step at the lowest frequency (LF) by adjusting the plate tuning control CW for another 5 - 10 mA increase.

7. Re-set the screen control for rated plate current and compare the highest frequency current again.

8. Continue this process until there is less than 10 mA difference at the two frequencies.

ALIGNMENT PROCEDURE

This Alignment Procedure is provided for completely realigning and loading Power Amplifier Models 4EF4A1, 2, 3 (using KT-56-A as a Driver Unit) in a KT-39-A transmitter.

Before tuning the Power Amplifier, the Driver (KT-56-A, C) must be aligned according to the Driver ALIGNMENT PROCEDURE.

1. Connect the antenna or some other suitable 50-ohm load to the top jack on the Power Amplifier antenna relay.

2. Turn the PLATE switch OFF on the PA Power Supply.

3. Tune the SCREEN adjust on the PA Power Supply fully counterclockwise.

NOTE

Make sure the PLATE switch on the PA POWER SUPPLY is in the OFF position.

4. Place the power switches located on the Power Panel and Driver Power Supply to the ON position. Turn the PA Power Supply Control switch to the ON position. Allow 15-minutes for warmup.

5. Connect a microphone to the MIKE jack (J1215) on the back of the station control shelf mother board.

6. Loosen the locking ring on the PA COUPLING control and push the control in and turn fully counterclockwise. Rotate the meter switch on the POWER PANEL to TX Driver and meter switch on Receiver/Exciter door to position 10.

7. Key the driver and adjust the Power Control potentiometer on the driver PA for approximately 2 amperes of driver PA collector current (0.6 V on 3 V scale of tune-up meter) Rotate meter switch on power panel to PA GRID. Tune the PA GRID for maximum voltage on the tuning meter and then readjust the power control potentiometer for the following voltage on that meter:

4EF4A1-2	0.75 VDC
4EF4A3	2.0 VDC Min. (2.5 VDC Msx:)

8. Turn the PLATE switch on the PA Power Supply to the ON position.

9. While keying the Driver, adjust the PA Plate control for a minimum reading at the PA PLATE current meter. Do not exceed 275 mA of plate current. Retune the GRID per STEP 7.

NOTE

The current readings on the meter includes approximately 25 mA of screen current.

10. Rotate the meter switch on the Power Panel to Forward/Reverse position. Rotate the Reflectometer to the Forward position.

11. While keying the Driver, adjust the PA FILTER control for maximum meter reading.

12. While keying the Driver adjust the SCREEN control for 250 mA on the plate current meter.

ALIGNMENT PROCEDURE
25-50 MHz, 300-WATT
MASTR II POWER AMPLIFIER
MODELS 4EF4A1, 2 & 3

13. Tighten the PA COUPLING control locking nut, just enough to support the control.

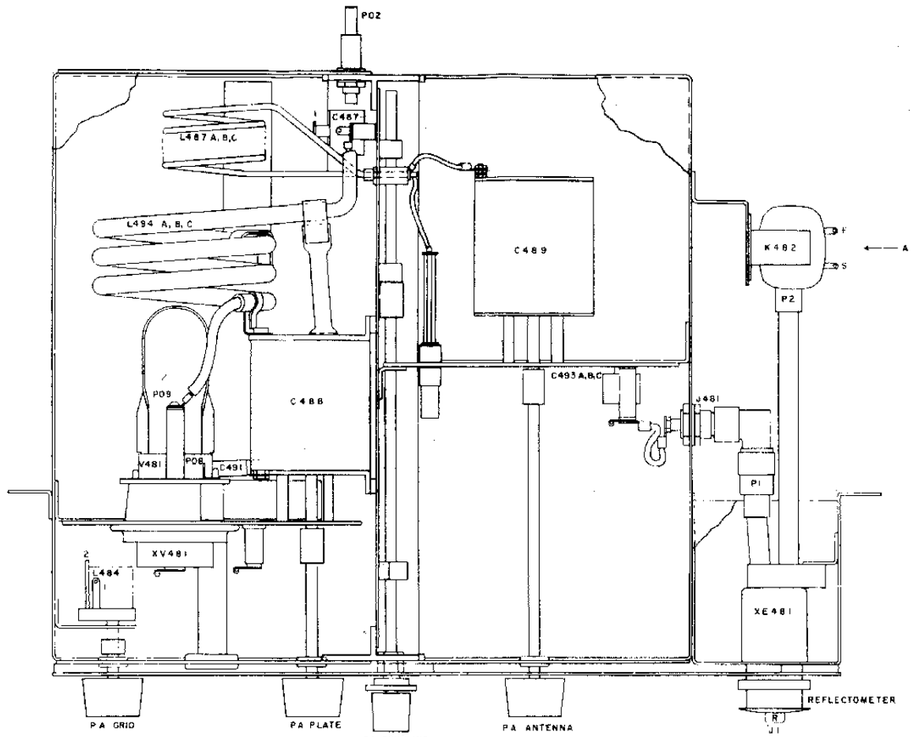
14. While the Driver is being keyed, rotate the PA COUPLING to a maximum of 275 mA at the PA PLATE current meter. For fine adjustment of coupling, the PA COUPLING control may be pushed or pulled.

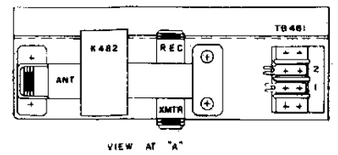
15. While keying the Driver, readjust the PA PLATE control for minimum reading at the PA PLATE current meter.

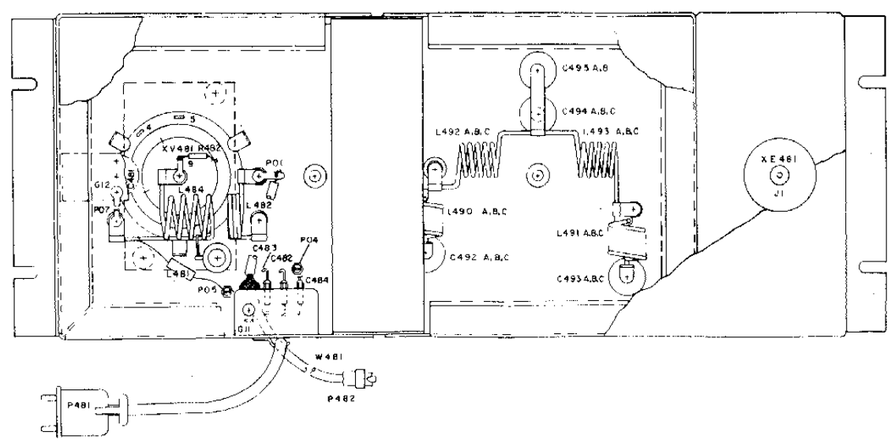
16. Repeat steps 11, 14 and 15 being sure not to exceed 275 mA at the PA PLATE current meter.

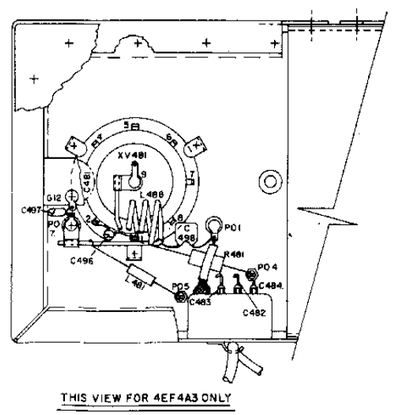
17. Finger tighten the PA COUPLING control locking nut.

18. Turn the SCREEN adjust (R461) on the PA power supply counterclockwise to obtain the licensed power output or PA Plate Power input. Power levels with typical PA plate current values are shown in Fig. 1. (The current shown in Fig. 1 does not include screen current. See note following step 9.









(E-5499156, Rev. 3)

OUTLINE DIAGRAM
25-50 MHz, 300-WATT MASTR II
POWER AMPLIFIER MODELS 4EF4A1, 2 & 3

PARTS LIST

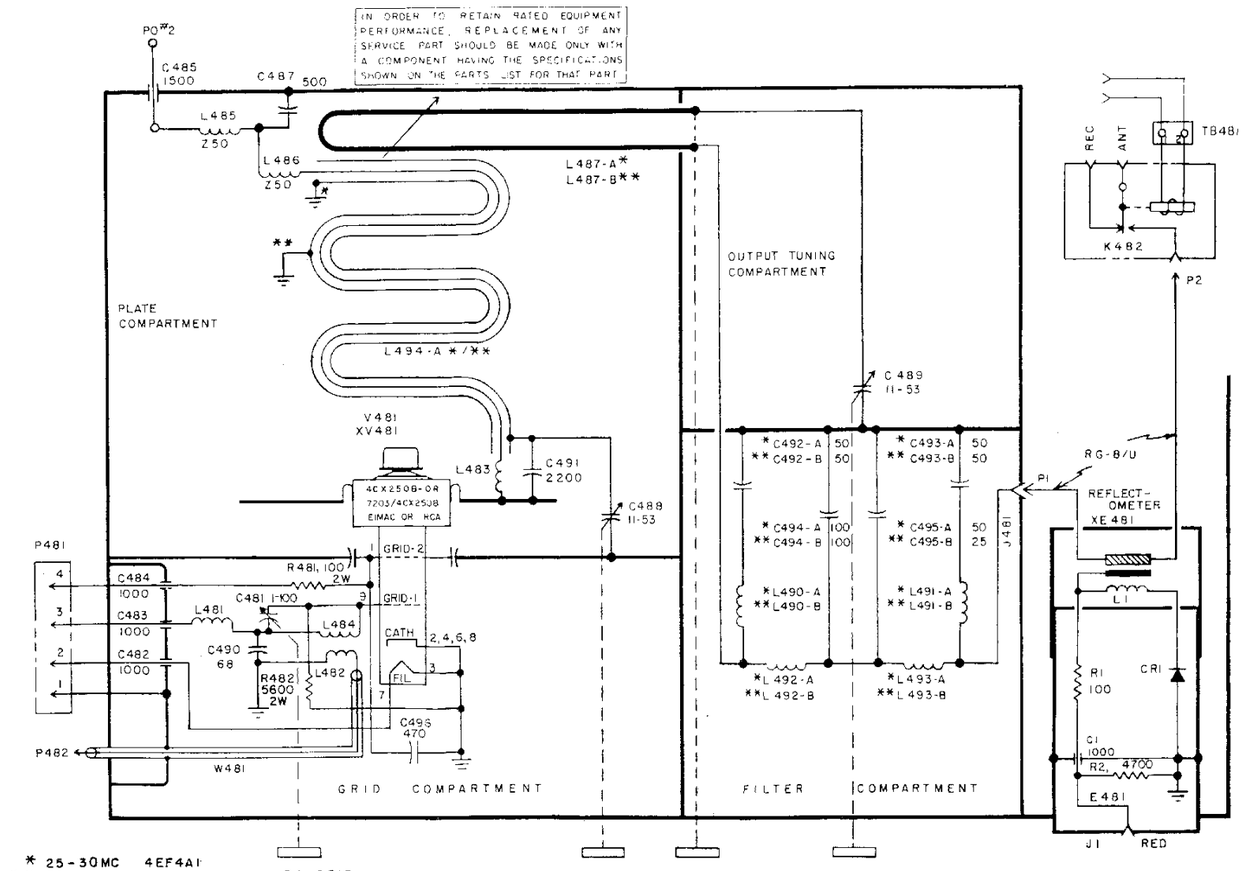
RB41737G

POWER AMPLIFIER
MODEL 4EF4A1 25-30 MHz
MODEL 4EF4A2 30-42 MHz
MODEL 4EF4A3 40-54 MHz

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C481	3B47P12	Variable, air: 0.1 to 100 pf; sim to Hammarlund APC-100-B.
C482 thru C484	7485978P19	Ceramic, feed-thru: 1000 pf ±20%, 500 VDCW; sim to Erie Style 327.
C485	5490846P1	Ceramic, feed-thru: 1500 pf +20%, 3000 VDCW; sim to Erie 320-02.
C487	5490906P2	Ceramic: 500 pf +80% -20%, 20,000 VDCW; sim to Sprague Type 70HC50.
C488 and C489	7770519P12	Variable, air: approx 11-53 pf, 4500 v peak; sim to JF Johnson Type 154.
C490*	7480162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15. Deleted by REV E in 4EF4A3.
C491	3B31961	Mica: 2200 pf ±10%, 2500 VDCW; sim to EIA Style RCM50B222K.
C492A and C492B	7488281P2	Ceramic: 50 pf ±10%, 7500 VDCW, temp coef 0 PPM.
C492C	7488281P1	Ceramic: 25 pf ±10%, 7500 VDCW, temp coef 0 PPM.
C493A and C493B	7488281P2	Ceramic: 50 pf ±10%, 7500 VDCW, temp coef 0 PPM.
C493C	7488281P1	Ceramic: 25 pf ±10%, 7500 VDCW, temp coef 0 PPM.
C494A and C494B	7488281P6	Ceramic: 300 pf ±10%, 5000 VDCW, temp coef -750 PPM.
C494C	7488281P5	Ceramic: 75 pf ±10%, 7500 VDCW, temp coef -750 PPM.
C495A	7488281P2	Ceramic: 50 pf ±10%, 7500 VDCW, temp coef 0 PPM.
C495B	7488281P1	Ceramic: 25 pf ±10%, 7500 VDCW, temp coef 0 PPM.
C496*	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Deleted in 4EF4A2 by REV A. Added in 4EF4A3 by REV B.
C497* and C498*	7489162P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15. Added by REV E in 4EF4A3.
K481		REFLECTOMETER PROBE 402962G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	7160807P1	Ceramic, feed thru: 1000 pf +100%-0%, 500 VDCW.
		- - - - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	7777146P22	Germanium.
		- - - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	7150763P2	Jack, tip, stake-in: red nylon body; sim to Alden Products 1108C).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	403113G1	Coil.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2	3R77P472J	Composition: 4.7K ohms ±5%, 1/2 w.
R3	3R77P151J	Composition: 150 ohms ±5%, 1/2 w.
		- - - - - - - - - - JACKS AND RECEPTALES - - - - - -
J481	2R22P4	Adapter, junction: coaxial. Signal Corps WL-258 or sim to Amphenol 83-1J.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RELAYS - - - - - - - - - -
K482 *	19B234872G1	Armature, coaxial: 13.8 Vdc (Includes hardware).
	747968802	Armature, coaxial: 7000 ohms ±10% coil res, 140 Vdc, 1 form C coaxial contact: sim to Aspheno1 700-11294. (Used before Rev D in 4EF4A1,2 and before Rev F in 4EF4A3).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L481	7488079M47	Choke, RF: 22 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4422-8K.
L482*	4029993P1	Coil. Deleted by REV E in 4EF4A3.
L483*	7772834P8	Choke, RF: 7.0 µh ±10%, 0.36 ohms DC res, freq range 35-110 MHz.
		In 4EF4A1, A2 or REV G and earlier: In 4EF4A3 of REV C and earlier:
	7772834P4	Choke, RF: 7.0 µh, 1000 ma; sim to Ohmite Z-50.
L484*	4031026P1	Coil. Deleted by REV E in 4EF4A3.
L485* and L486*	7772834P8	Choke, RF: 7.0 µh ±10%, 0.36 ohms DC res, freq range 35-110 MHz.
		In 4EF4A1, A2 of REV H and earlier: In 4EF4A3 of REV C and earlier:
	7772834P4	Choke, RF: 7.0 µh, 1000 ma; sim to Ohmite Z-50.
L487A	4031036P1	Coil.
L487B	4031035P1	Coil.
L487C	4031034P1	Coil.
L488*	4031026P2	Coil. Added by REV E in 4EF4A3
L489A	7143797P1	Coil.
L489B	7143798P1	Coil.
L489C	7143799P1	Coil.
L491A	7143797P1	Coil.
L491B	7143798P1	Coil.
L491C	7143799P1	Coil.
L492A	4031027P1	Coil.
L492B	4029951P2	Coil.
L492C	4029952P2	Coil.
L493A	4029950P1	Coil.
L493B	4029951P1	Coil.
L493C	4029952P1	Coil.
L494A	5490530G1	Coil.
L494B	5490529G1	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P481	7473192P25	Plug: 6 main contacts, cable clamp 12 cap; sim to HH Jones 263-31-06-000.
P482		(Part of W481).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R481	3B79P101K	Composition: 100 ohms ±10%, 2 w.
R482*	3B79P562K	Composition: 5.6K ohms ±10%, 2 w. Added in 4EF4A1 and 4EF4A2 by REV B. Added in 4EF4A3 by REV D. Deleted by REV F in 4EF4A3.
		- - - - - - - - - - TERMINAL BOARDS - - - - - - - - - -
TB481	19C301088P9	Phen: 2 terminals; sim to GE CR151D.
		- - - - - - - - - - TUBES - - - - - - - - - -
V481	4039317P1	Type EIMAC Ceramic 7203/4CX250B.
		- - - - - - - - - - CABLES - - - - - - - - - -
W481	5491689P54	Cable, RF: coaxial, approx 32.75 inches long with phono plug molded on one end.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK481	5490188G3	Reflectometer housing. Includes:
P1 and P2	2R22P1	Plug, coaxial: Signal Corps PL-259 or sim to Amphenol 83-1SP.
XV481	5490373P2	Tube: octal; sim to Eitel McCullough SK-610.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SCHEMATIC DIAGRAM
25-42 MHz, 150-300-WATT MASTR II
POWER AMPLIFIER MODELS 4EF4A1 & 2

SYMBOL	GE PART NO.	DESCRIPTION
		MECHANICAL PARTS (SEE MC370b)
1	4031070P1	Stop.
2	N81P13005C6	Machine screw, phillips head: No. 8-32 x 5/16.
3	N414P13C6	Lockwasher, internal tooth: No. 6.
4	N207P13C6	Nut, hex: No. 6-32.
5	4031039P1	Support.
6	N81P13006C6	Machine screw, phillips head: No. 6-32 x 3/8.
7	4031090P1	Clip loop.
8	7135118P1	Solderless terminal.
9	19A209288P112	Solderless terminal: sim to AMP 41052.
10	787845bP2	Solderless terminal.
11	N81P13004C6	Machine screw, phillips head: No. 6-32 x 1/4.
12	N414P18C8	Lockwasher, internal tooth: No. 8.
13	4037857P2	Knob, screw on.
14	7115135P2	Hex nut: No. 15/32-32.
15	7115130P11	Lockwasher, internal tooth: sim to Shakeproof 1222-1.
16	N207P15C6	Nut, hex: No. 8-32.
17	7135118P1	Solderless terminal.
18	4036888P1	Insulator, standoff: sim to Centralab 3RX1M65C.
19	4031037P1	Stop.
20	7491823P6	Solderless terminal.
21	5491541P212	Threaded spacer.
22	7479752P13	Bushing.
23	4035306P2	Washer, fiber.
24	7479752P1	Bushing.
25	5490897P1	Support.
26	7145188P2	Thumbscrew.
27	4031130G1	Plate.
28	N81P13010C6	Machine screw, phillips head: No. 6-32 x 5/8.
29	4031040P1	Support.
30	N81P15004C6	Machine screw, phillips head: No. 8-32 x 1/4.
31	4029953P1	Clip.
32	4036889P4	Stop.
33	4031089P1	Hex nut: 5/8-24.
34	2B22P2	Adaptor: sim to Amphenol 83-1AP.
35	N401P37C6	Flatwasher: No. 6.
36	5490194G2	Housing.
37	7160508P2	Nut, sheet spring: sim to Tinnerman C1356-632-24.
38	7147248P2	Marker.
39	4031104P1	Plunger, detent.
40	787845bP2	Solderless terminal.
41	N81P13014C6	Machine screw, phillips head: No. 6-32 x 7/8.
42	N170P13003C6	Cap screw: No. 6-32 x 3/16.
43	4029990P2	Block.
44	N81P13016C6	Machine screw, phillips head: No. 6-32 x 1.
45	4031033P1	Block.
46	4031088P1	Spring pin.
47	4031042P2	Shaft.
48	4029990P1	Block.
49	4029810P2	Coupling.
50	4031043P1	Block.
51	4029954P3	Shaft.
52	N81P13008C6	Machine screw, phillips head: No. 6-32 x 1/2.
53	19A115139P26	Spacer.
54	2B51P16	Rubber grommet.
55	7119771P1	Strap.
56	4033714P18	Terminal, Solderless.
57	4029710G1	Can.
58	7763541P5	Retainer strap.
59	N81P15006C6	Machine screw, phillips head: No. 8-32 x 3/8.
60	7142182P51	Spacer.
61	7143208P4	Stud terminal.
62	N330P1903C13	Metallic eyelet.
63	19A122963P1	Rubber grommet.
64	4036889P3	Stop, insulated.
65	7878455P2	Solderless terminal.
66	5491541P205	Threaded spacer.
67	4029902P1	Block.
68	N70P1h03C13	Set screw: No. 8-32 x 3/16.
69	4034552P1	Solderless terminal.
70	7143805P1	Strap.
71	N81P13003C6	Machine screw, phillips head: No. 6-32 x 3/16.
72	7117805P1	Plug, tip.
73	4035306P26	Fiber washer.
74	4031042P3	Shaft.
75	7487773Pb	Knob.
76	4031038P1	Spacer.
77	N81P14032C6	Machine screw, phillips head: No. 6-32 x 2.
78	7147315P1	Bushing.
79	7487773Pb	Knob.
80	4031042P1	Shaft.
81	4035306P20	Fiber washer.
82	8529P11C	Plug button.
83	8529P10C	Plug button.
84	5490407P4	Rubber grommet.
85	N81P15010C6	Machine screw, phillips: No. 8-32 x 5/8.
86	N402P8MC13	Flatwasher: No. 8.
87	5490532G1	Faceplate. (25-30 MHz)
88	5490532G2	Faceplate. (30-42 MHz)
89	5490532G3	Faceplate. (40-54 MHz)
90	4029618P2	Shaft.
91	N70P1302C	Set screw: No. 6-32 x 1/8.
92	N81P3003C6	Machine screw: No. 4-40 x 3/16.
93	N414P11C6	Lockwasher, internal tooth: No. 4.
94	4031024P1	Support.
95	4031014P1	Support.
96	5490373P3	Socket.
97	4035306P19	Fiber Washer.
98	4036899P9	Stop, insulated.
99	4035306P25	Fiber Washer.
100	7135118P2	Solderless terminal.
101	4036899P6	Stop, insulated.
102	N81P13003C6	Machine screw, phillips head: No. 6-32 x 3/16.
103	19A115139P18	Spacer.
104	4032060P1	Nut, self locking. No. 3/8-32; sim to James Millen K1U062-T.
105	5491541P203	Spacer, hex. (Used in 4KF4A3 only).
106	4029882P1	Tube extractor.

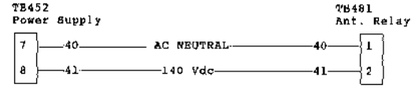
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on this unit includes all previous revisions. Refer to the Parts List for the descriptions of parts affected by these revision.

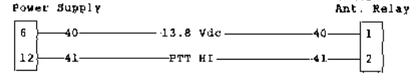
REV. C - POWER AMPLIFIER MODEL 4EF4A1 & 2
REV. E - POWER AMPLIFIER MODEL 4EF4A3
Incorporated into initial shipment.

REV. D - POWER AMPLIFIER MODEL 4EF4A1 & 2
REV. F - POWER AMPLIFIER MODEL 4EF4A3
To improve operation, changed K482 from a 140 Vdc coil relay (7479680P2) to a 13.8 Vdc coil relay (19B234872G1). Also wired new relay as described below.

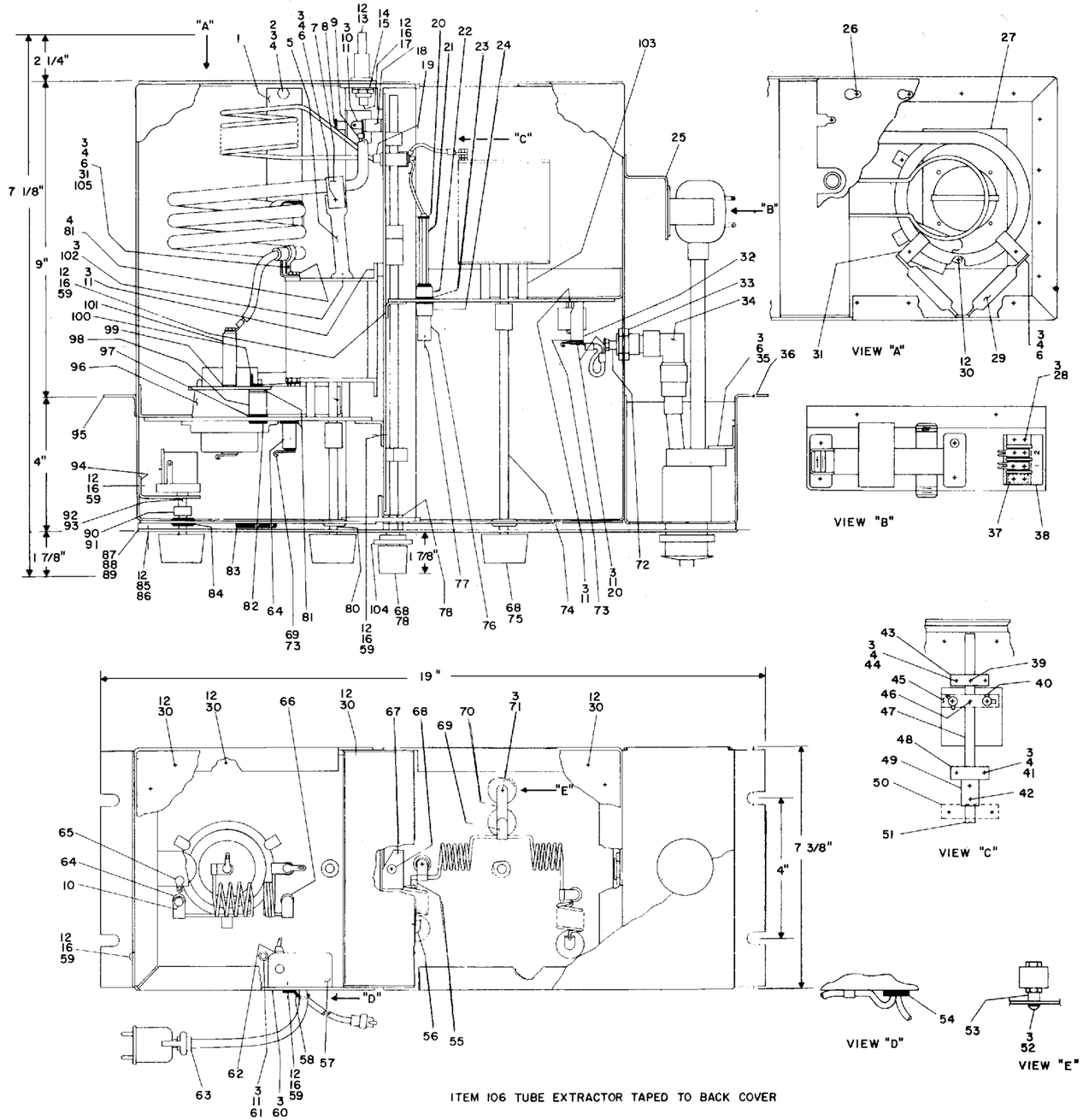
From:

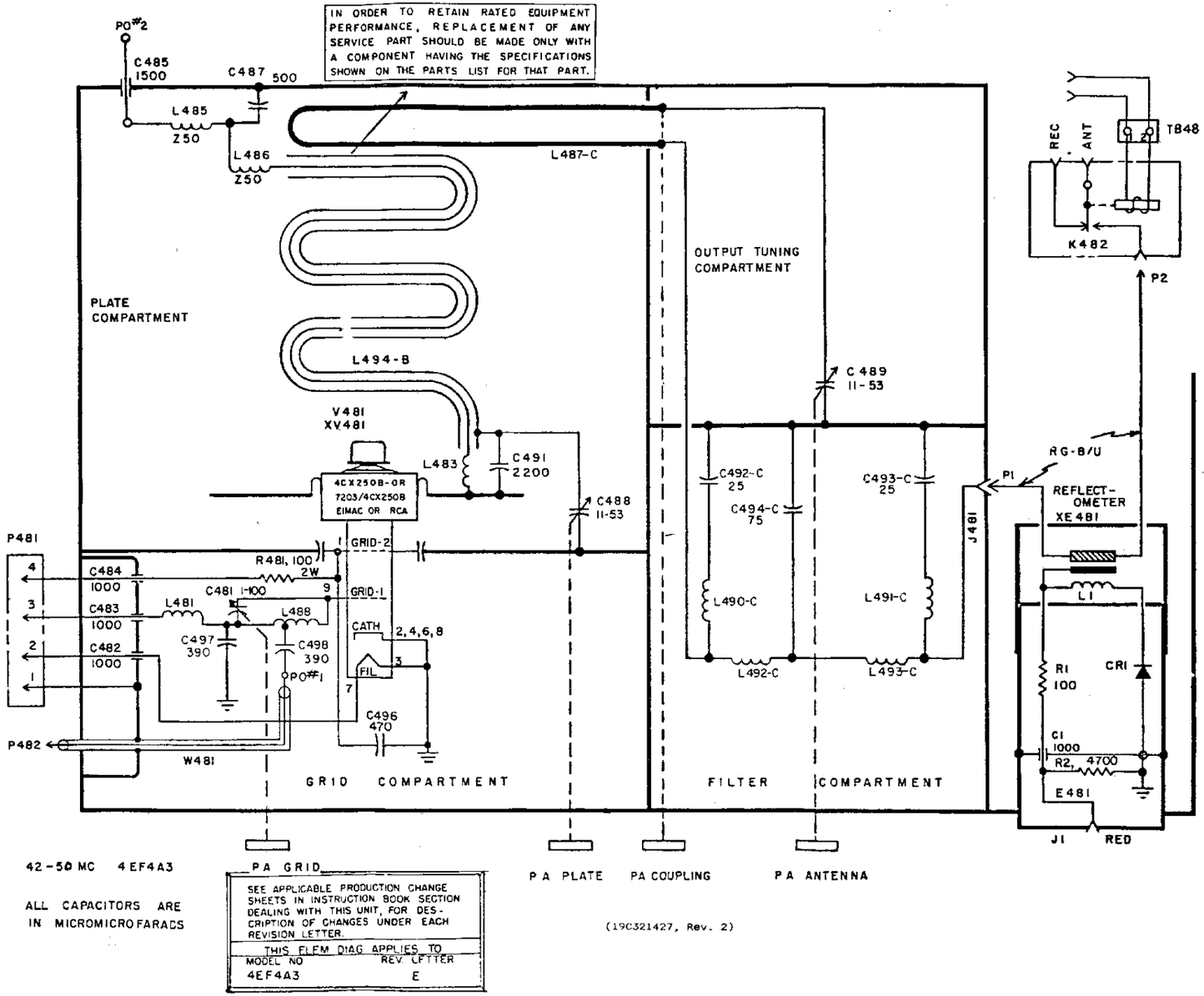


To:



LBI-4938


"A"
2 1/4"
7 1/8"
9"
4"
1 7/8"
"B"
"C"
"D"
"E"
VIEW "A"
VIEW "B"
VIEW "C"
VIEW "D"
VIEW "E"
19"
7 3/8"
4"
1 7/8"
ITEM 106 TUBE EXTRACTOR TAPED TO BACK COVER
RC-3705



SCHEMATIC DIAGRAM
42-50 MHz, 150-300-WATT MASTR II
POWER AMPLIFIER MODEL 4EF4A3