UNCLASSIFIED

TECHNICAL MANUAL

for

CONTINUOUS RF TUNER MODEL HFR-1

(TN-376/UR)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, CANADA

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IN-3001A Issue Date: 15 April 1963

NOTICE

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.

2. That the defect is not the result of damage incurred in shipment from or to the factory.

3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.

4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

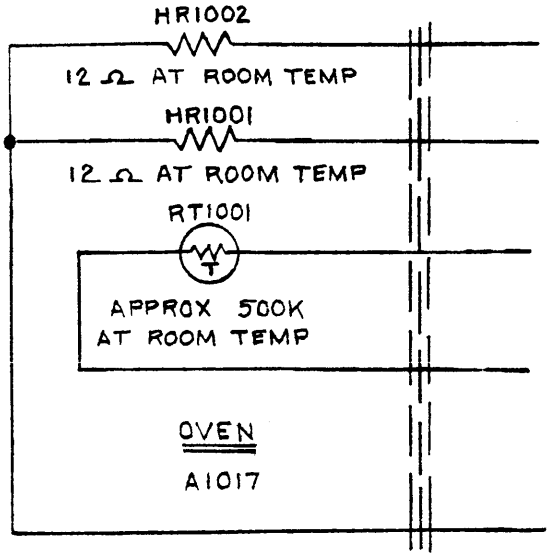
CHANGE NO. 1 HFR-1

INSTRUCTION BOOK CHANGE NOTICE

Date 6/6/63

Manual affected: Continuous RF Tuner HFR-1 IN -3001

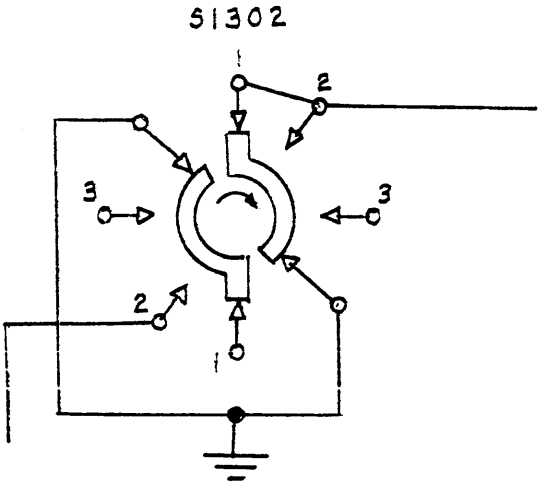
Page 8-3/8-4, Figure 8-1(Sheet 1 of 2)
Add the term "A1017" as indicated below



Page 8-5/8-6, Figure 8-1(Sheet 2 of 2)

a. Change proportional oven control symbol from "A1017" to "A1301".

b. Change terminal numbers of switch S1302 to appear as follows:



SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director f Eng. Services.

CHANGE NO. 2

INSTRUCTION BOOK CHANGE NOTICE

Date September 20, 1963

Manual affected: Continuous RF Tuner Model HFR-1 IN -3001A

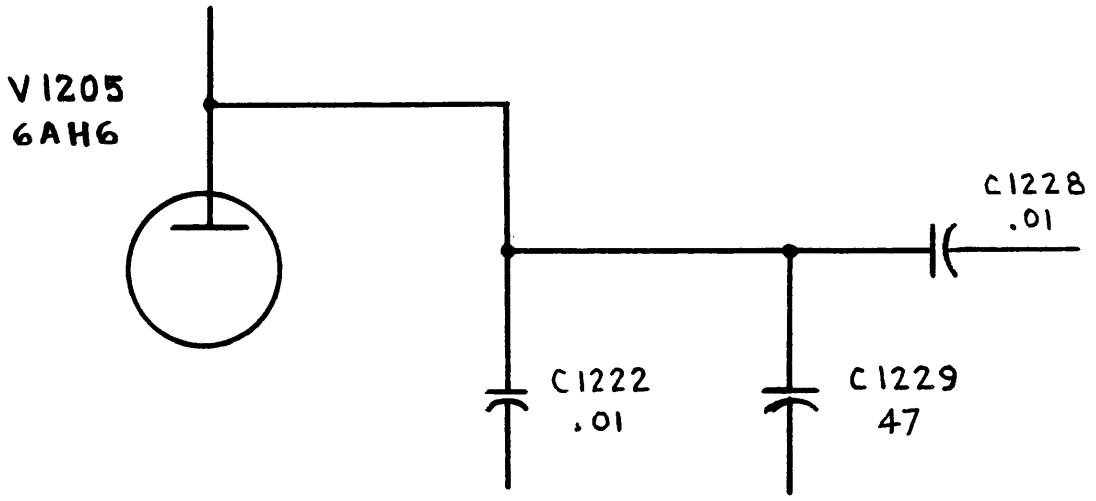
Page 4-3/4-4 Figure 4-2 and Page 8-3/8-4 Sheet 1 of 1

Connect wire from junction of C1026 and R1022 (grid circuit of V1004) to AGC bus from Terminal 2, P1004.

Page 8-5/8-6 Figure 8-1 Sheet 2 of 2

Delete connection between junction of capacitors C1228 and C1229 and junction of resistor R1229 and potentiometer R1230

Correct schematic as indicated below:



SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director of Eng. Services.

CHANGE NO. 3 HFR-1

INSTRUCTION BOOK CHANGE NOTICE

Date 4-14-64

Manual affected: Continuous RF Tuner Model HFR-1 IN -3001A

Page 1-3. Table 1-2

Change V1006 type from 6S4A to 6AH6.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenim re Road, Mamar neck, New York

Attn.: Director of Eng. Services.

CHANGE NO. 4 HFR-1

INSTRUCTION BOOK CHANGE NOTICE

Date June 1, 1964

Manual affected: Continuous RF Tuner, Model HFR-1 IN -3001A

1. Page 6-10. Paragraph 6-3c(6).

REMOVAL OF OVEN HEATER ELEMENT

Delete note stating that oven heater element and proportional oven control must be replaced as a matched pair. Changes in design have made it possible to replace either part as an individual component.

2. Page 7-4. Parts List.

In description for A1301, delete sentence stating that A1301 must be replaced as a matched set with RR-131 heater.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director f Eng. Services.

CHANGE NO. KIT-184 5-HFR-1 (Sheet 1 of 3)

INSTRUCTION BOOK CHANGE NOTICE

Date 6/30/64

Manual affected: Continuous RF Tuner Model HFR-1 IN -3001A

Upon modifying the Model HFR-1 per KIT-184 make the following additions to the technical manual.

Add the following to the parts list.

SYM	DESCRIPTION	TMC PART NO.
C1342	CAPACITOR, FIXED, MICA DIELECTRIC: .1 ufd; +80 -20%, 100 wvdc.	CC-100-28
DS1006	LAMP, INCANDESCENT: 28.0 v AC/DC, .04 amps; T 1-3/4 single contact, midget flange.	BI-110-7 GE-327
R1338	RESISTOR, FIXED, COMPOSITION: 220 ohms, ±10%, 2 watts.	RC42GF221K
R1339	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%, 1 watt.	RC32GF101K
S1003	SWITCH, THERMOSTATIC: SPST; contact normally closed; operating temperature 74 - 85°C.	SS-108
XDS1006	LIGHT, INDICATOR: With transparent red lens; sub-miniature bayonet base.	TS-153-1

CHANGE NO. KIT-184-5-HFR-1 (Sheet 2 of 3)

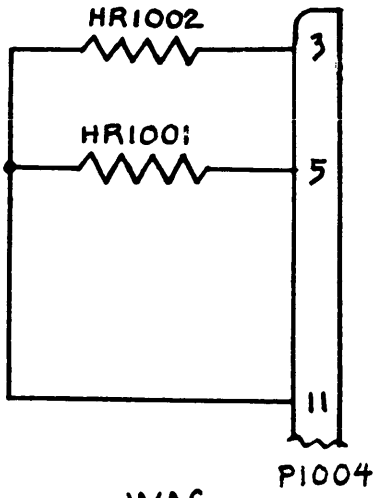
INSTRUCTION BOOK CHANGE NOTICE

Date 6/30/64

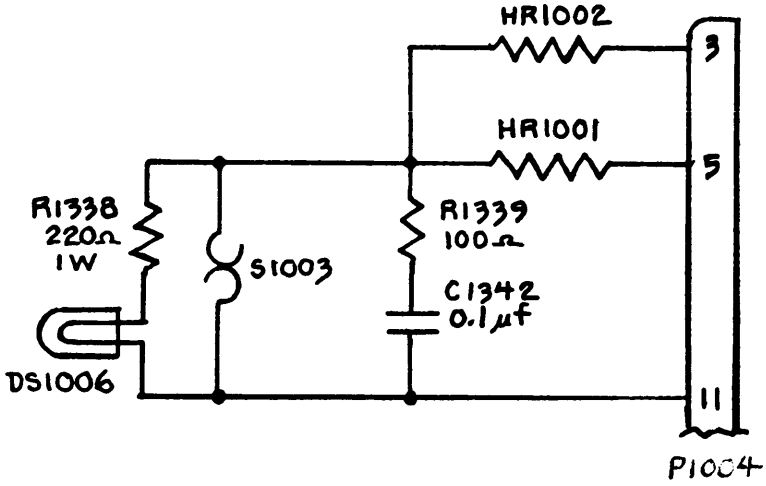
Manual affected: Continuous RF Tuner Model HFR-1 IN -3001A

Page 4-3/4-4 Figure 4-2, Page 8-3/8-4 Figure 8-1

Make the following change to the schematic diagram.



WAS



NOW

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenim re R ad, Mamar neck, New Y rk

Attn.: Director of Eng. Services.

CHANGE NO. KIT-184-5-HFR-1 (Sheet 3 of 3)

INSTRUCTION BOOK CHANGE NOTICE

Date 4/21/64

Manual affected: Continuous RF Tuner Model HFR-1 IN -3001A

Insert this notice in SECTION 3 OPERATOR'S SECTION.

IMPORTANT NOTICE

In the event of an over temperature condition within the HFO oven the over temperature thermostat S-1003 will open at 85 degrees centigrade (the normal oven temperature is 70 degrees centigrade) and the "OSC OVERHEAT" indicator will light. The oven will commence cycling, as will be evidenced by periodic flashing of the "OSC OVERHEAT" indicator, and will continue to cycle in the vicinity of 85 degrees centigrade. No damage to the HFO oven will result at this temperature. However, all power should be removed from the unit immediately pending repair or replacement of defective components.

CHANGE NO. 6 (Two pages attached 8-3/8-4 and 8-5/8-6)

INSTRUCTION BOOK CHANGE NOTICE

Date 8-19-64

Manual affected: Continuous RF Tuner Model HFR-1 IN -3001A

Make the following changes:

1. Remove and destroy figure 8-1 (sheets 1 and 2), pp.8-3/8-4 and 8-5/8-6, for the manual.

2. Appropriately insert attached pages (8-3/8-4 and 8-5/8-6), figure 8-1, in the manual.

3. Make necessary pen and ink changes on all other related diagrams to comply with new schematic diagram (figure 8-1).

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamar neck, New Y rk

Attn.: Director of Eng. Services.

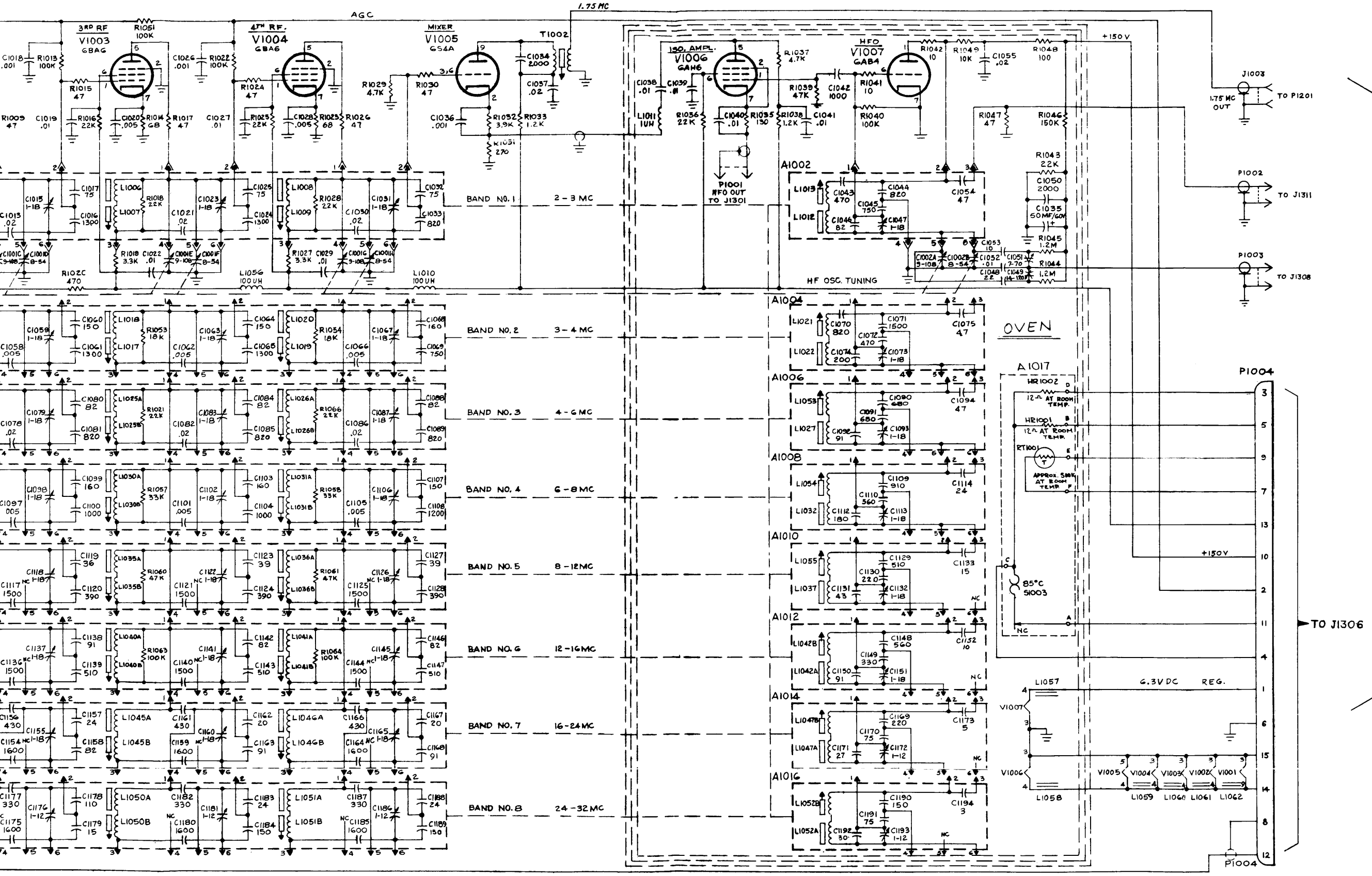
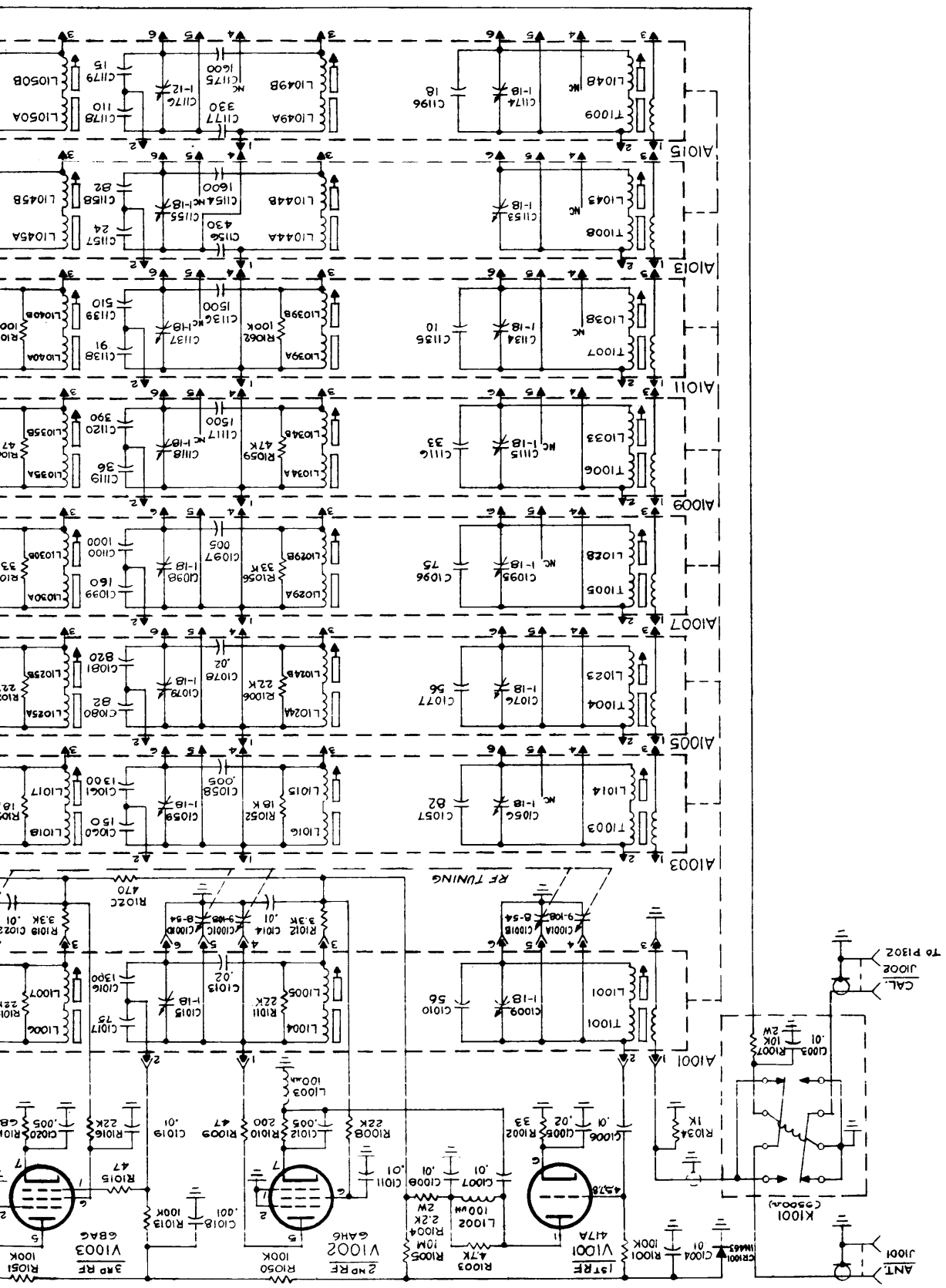
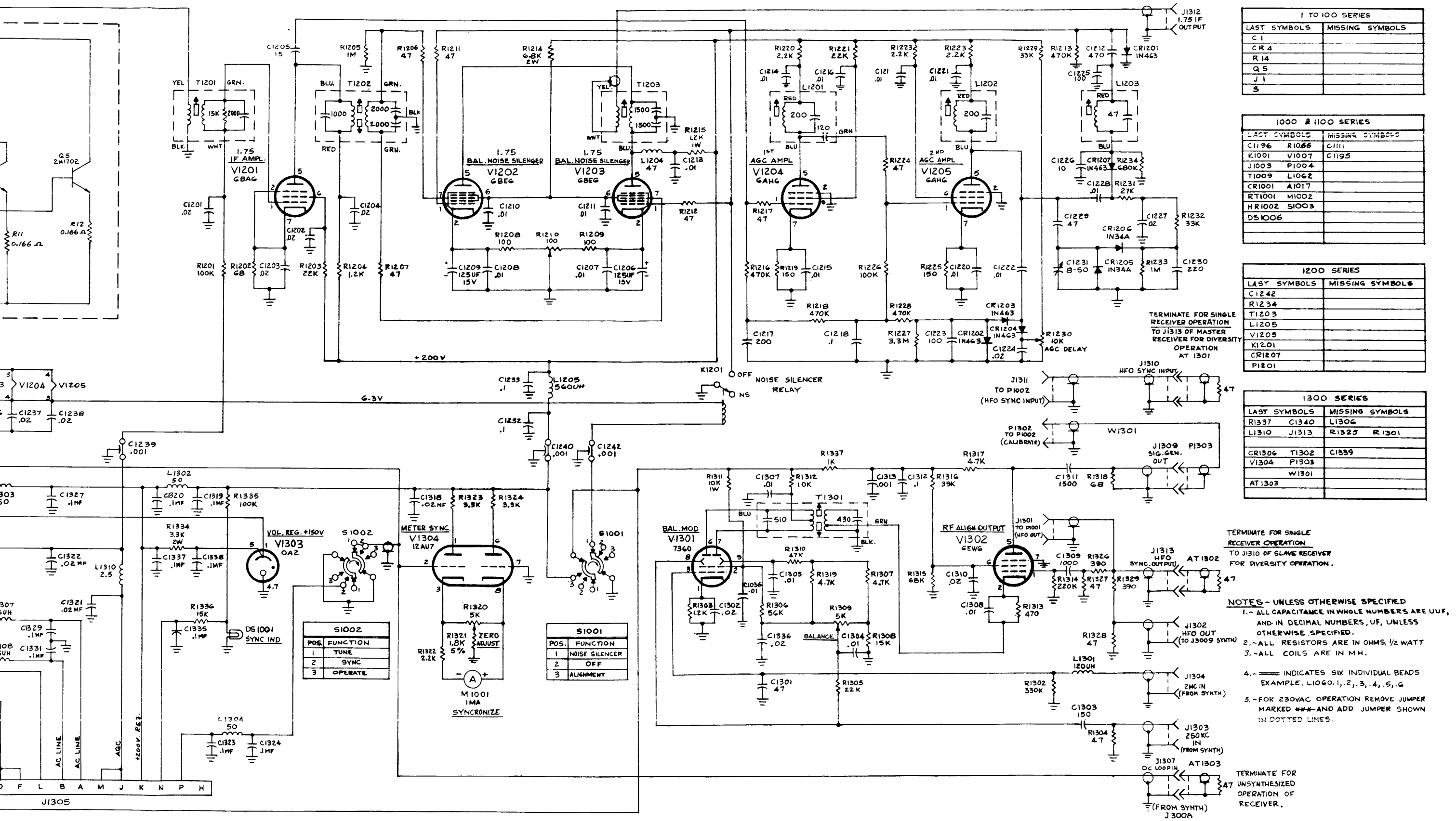


Figure 8-1. HFR-1, Schematic Diagram (Sheet 1 of 2)

CK-729

1086430O1A





S1002	
POS.	FUNCTION
1	TUNE
2	SYNC
3	OPERATE

S1001	
POS.	FUNCTION
1	NOISE SILENCER
2	OFF
3	ALIGNMENT

1 TO 100 SERIES	
LAST SYMBOLS	MISSING SYMBOLS
C 1	
CR 4	
R 14	
Q 5	
J 1	
S	

1000 & 1100 SERIES		
LAST SYMBOLS		MISSING SYMBOLS
C1196	R1066	C1111
K1001	V1007	C1195
J1003	P1004	
T1009	L1062	
CR1001	A1017	
RT1001	M1002	
HR1002	S1003	
DS1006		

1200 SERIES	
LAST SYMBOLS	MISSING SYMBOLS
C1242	
R1234	
T1203	
L1205	
V1205	
K1201	
CR1207	
P1201	

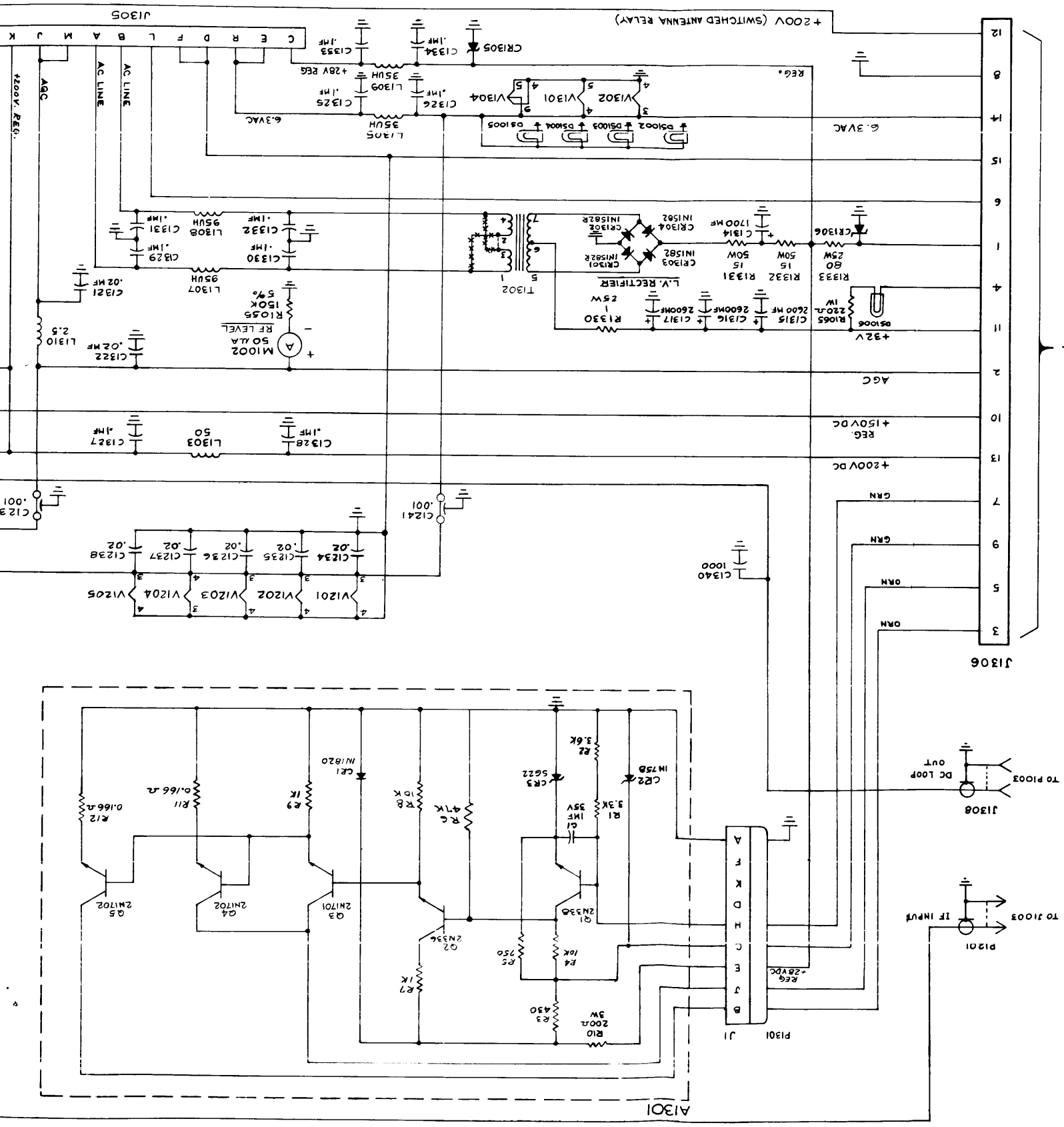
1300 SERIES		
LAST SYMBOLS		MISSING SYMBOLS
R1337	C1340	L1306
L1310	J1313	R1325 R1301
CR1306	T1302	C1339
V1304	P1303	
	W1301	
AT1303		

NOTES - UNLESS OTHERWISE SPECIFIED

1. - ALL CAPACITANCE IN WHOLE NUMBERS ARE UUF, AND IN DECIMAL NUMBERS, UF, UNLESS OTHERWISE SPECIFIED.
2. - ALL RESISTORS ARE IN OHMS, 1/2 WATT
3. - ALL COILS ARE IN MH.
4. - ═══ INDICATES SIX INDIVIDUAL BEADS EXAMPLE. L1060.1,.2,.3,.4,.5,.6
5. - FOR 230VAC OPERATION REMOVE JUMPER MARKED ### AND ADD JUMPER SHOWN ::: DOTTED LINES.

Figure 8-1. HFR-1, Schematic Diagram (Sheet 2 of 2)

CK-729


A1301
J1306
J1308
P1201
J1003
TO P1004
TO J1003
TO P1003
+200V (SWITCHED ANTENNA RELAY)
+32V
AGC
+150V DC
REG
+200V DC
GRN
ORN
6.3VAC
+28V REG
AC LINE
J1305
M1002
50 uA
RF LEVEL
R1055
150K
5%
T1302
L.V. RECTIFIER
R1330
1
25W
R1331
50W
R1332
50W
R1333
50W
R1065
220 Ω
1W
C1315
2600 MF
C1316
2600MF
C1317
2600MF
C1314
1700 MF
CR1306
CR1303
CR1304
CR1305
CR1302
1N1582
1N1582R
L1307
95UH
L1308
95UH
L1309
35UH
L1305
35UH
C1321
.02 MF
C1322
.02 MF
C1329
.1MF
C1330
.1MF
C1331
.1MF
C1332
.1MF
C1324
.1MF
C1325
.1MF
C1326
.1MF
C1333
.1MF
C1334
.1MF
CR1305
C1340
1000
C1241
.001
C1237
.02
C1238
.02
C1234
.02
C1235
.02
C1236
.02
V1201
V1202
V1203
V1204
V1205
V1301
V1302
V1303
V1304
DS1002
DS1003
DS1004
DS1005
C1310
2.5
C1327
.1MF
C1328
.1MF
L1303
50
P1301
J1
R10
200Ω
3W
R3
430
R4
10K
R5
750
R6
-28VDC
Q1
2N336
Q2
2N336
R7
1K
Q3
2N1701
Q4
2N1702
Q5
2N1702
R12
0.166Ω
R11
0.166Ω
R9
1K
CR1
IN1820
R8
10K
R C
47K
C1
1MF
35V
R1
3.3K
CR3
S622
R2
3.6K
CR2
IN758
DC LOOP OUT
IF INPUT

CHANGE NO. 7 HFR-1

INSTRUCTION BOOK CHANGE NOTICE

Date 1/19/65

Manual affected: CONTINUOUS RF TUNER, MODEL HFR-1 IN 3001A

Change all references to "HFR-1" to read "HFR-1A".

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director of Eng. Services.

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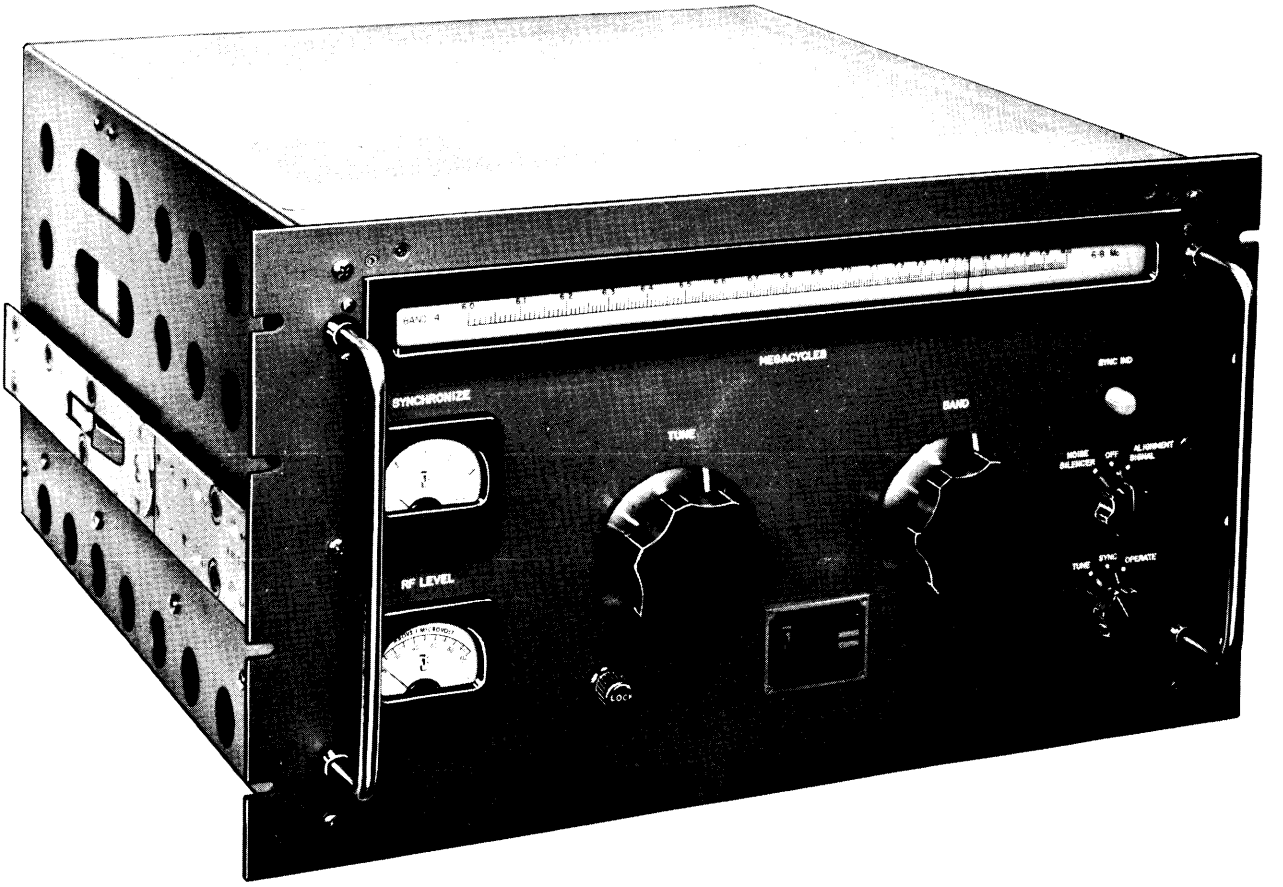


Figure 1-1. Continuous RF Tuner, Model HFR-1

SECTION 1

GENERAL DESCRIPTION

1-1. PHYSICAL DESCRIPTION

The HFR-1 (figure 1-1) is designed for rack mounting on tilt-slide mechanisms; the unit weighs 55 lbs., and requires a mounting area 10-1/2 inches high, 19 inches wide, and 19-3/4 inches deep. All controls, meters, and indicators necessary for operation of the HFR-1 are mounted on the front panel. Plug-in jacks located at the rear of the HFR-1 permit installation for single receiver on diversity operation. The tilt-slide mechanisms provided with the HFR-1 facilitate in-service troubleshooting and maintenance procedures; the receiver does not have to be disconnected from its associated equipment. Dzus fasteners are provided on top and bottom dust covers; components are therefore made readily accessible.

1-2. FUNCTIONAL DESCRIPTION

a. GENERAL. The HFR-1 is an RF tuner and first IF capable of receiving RF signals in the frequency range of 2 to 32 mc; incoming signal strength is indicated on the RF LEVEL meter. Received signals may be SSB, ISB, DSB with carrier suppressed, AM, FSK, CW, MCW, PULSE or PHASE. The HFR-1 comprises three major sections: HFR-1/T (front end, and high frequency oscillator); HFR-1/N (1.75 mc IF output amplifier, and noise silencer); HFR-1/C (alignment signal generator, SYNCHRONIZE meter amplifier, and low voltage power supply.

b. HFR-1/T. Turret tuning employed in the front end of the HFR-1 places the tuned circuit elements directly adjacent to their respective sections of the tuning capacitor and their respective tubes, thus providing greater sensitivity and a high signal to noise ratio. One RF tuner strip and one oscillator tuner strip containing the tuned circuit elements for each of eight RF receiver bands are mounted on a revolving turret. Turret contacts engage fixed contacts on the main chassis to engage the required elements. The 2 to 32 mc frequency range covered by the HFR-1 is divided into eight RF bands as listed below; selection of the desired frequency is accomplished by means of the BAND and TUNE control knobs. Input signals are fed through four stages of RF amplification and combined with the high frequency oscillator output signal to produce a 1.75 mc IF.

BAND 1	2-3 mc
BAND 2	3-4 mc
BAND 3	4-6 mc
BAND 4	6-8 mc
BAND 5	8-12 mc
BAND 6	12-16 mc
BAND 7	16-24 mc
BAND 8	24-32 mc

The HFR-1 incorporates a highly stable high frequency oscillator (HFO). Maximum stability of the HFO is achieved through the use of a proportional oven control to control the oscillator's temperature. The proportional oven control regulates oven temperature of 75°C ±1/2°C for an ambient temperature of 0°C to 50°C. In synthesized DDR-5 operation, the HFO VARICAP circuits receive a DC correction voltage from the Model HFS-1 synthesizer unit; the amplitude and polarity of the correction voltage is such that the HFO is maintained at the exact frequency required. In non-synthesized operation (continuous coverage), the correction voltage is disabled and the HFO circuits are free running. Synthesized or non-synthesized operation of the HFO circuits is determined by the setting of the TUNE/SYNC/OPERATE control knob.

c. HFR-1/N. Incorporated in the HFR-1 is an IF output amplifier that provides two stages of amplification to 1.75 mc information signals from the mixer stage. The output of the IF amplifier circuit is extended to a second converter and IF amplifier (HFI-1 in DDR-5 operation).

A modified "lamb" noise silencer used in conjunction with the IF output amplifier nullifies the effects at impulse noise contained in the 1.75 mc information signal. In synthesized DDR-5 operation, the noise figure and sensitivity is 6 db or better over the band; with a 1 μV signal and a 7.5 kc bandwidth, the output signal to noise ratio is 15 db or better. The noise silencer can be circumvented by means of the NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knob.

d. HFR-1/C. An alignment signal generator, comprising a balanced modulator circuit and a mixer circuit, permits calibration and sensitivity checks when the HFR-1 is installed for DDR-5 operation. Alignment signal strength is indicated on the RF LEVEL meter. Use of the alignment signal generator is governed by the setting of the NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knob.

A SYNCHRONIZE meter and SYNC IND lamp indicate system synchronization when the HFR-1 is used in synthesized operation. When the system is

synchronized, the SYNC IND lamp lights; the polarity and amount of DC correction voltage required to keep the system synchronized are indicated on the SYNCHRONIZE meter. When the system is out of synchronization, the SYNC IND lamp goes out and the SYNCHRONIZE meter reads zero center scale.

A, B+, C-, and primary AC voltages required by the HFR-1 are furnished by an external power supply. A special low voltage power supply in the HFR-1 furnishes power for the proportional oven control and heater circuits, and for the frequency standard in the Model HFS-1 synthesizer unit in DDR-5 operation.

1-3. MILITARY NOMENCLATURE

Commercial and military nomenclature for the HFR-1 is as follows:

Commercial	Military
Continuous RF Tuner, Model HFR-1	Tuner, Radio Frequency, TN-376/UR

1-4. REFERENCE DATA

The crated dimensions of the HFR-1 are 25-1/4 by 16-1/8 by 29 inches; gross crated weight is 135 lbs. Tables 1-1 and 1-2 contain additional reference data.

TABLE 1-1. TECHNICAL SPECIFICATIONS, HFR-1

ITEM	CHARACTERISTICS
Frequency range.	2 to 32 mc, synthesized, in 100 cycle steps.
	2 to 32 mc, continuous coverage, non-sythesized.
Type of reception.	SSB, ISB, DSB with carrier suppressed, AM, FS, CW, PULSE, and PHASE.
Stability	Synthesized stability of 1 part in 10^8 for 24 hours for a change in ambient temperature of 15°C within the limits of 0° to 50°C.
	Unsynthesized stability of 20 to 50 parts in 10^6 without AFC.
Input impedance	50 ohms nominal, unbalanced.
Noise figure and sensitivity.	6 db or better over the band; with a 1 μV signal and a 7.5 kc bandwidth the output signal to noise ratio is 15 db or better.
Image ratio.	80 db referenced to 1 μV input signal.
Spurious response, as defined by CCIR.	Better than 120 db referenced to 1 μV. For synthesized operation, all spurious will be no greater than .01 μV when referred to the antenna.
Input power.	115/230 volts AC, 48 to 62 cps, single phase.

TABLE 1-2. ELECTRON TUBE AND DIODE COMPLEMENT

REFERENCE DESIGNATION SYMBOL	TYPE	FUNCTION
V1001	417A	First RF Amplifier
V1002	6AH6	Second RF Amplifier
V1003	6BA6	Third RF Amplifier
V1004	6BA6	Fourth RF Amplifier
V1005	6S4A	Mixer

TABLE 1-2. ELECTRON TUBE AND DIODE COMPLEMENT (Cont'd)

REFERENCE DESIGNATION SYMBOL	TYPE	FUNCTION
V1006	6S4A	Isolation Amplifier
V1007	6AB4	HF Oscillator
V1201	6BA6	Amplifier
V1202	6BE6	Amplifier
V1203	6BE6	Amplifier
V1204	6AH6	Amplifier
V1205	6AH6	Amplifier
V1301	7360	Converter
V1302	6EW6	Buffer Amplifier
V1303	0A2	Voltage Regulator
V1304	12AU7	DC Amplifier
CR1001	1N463	AGC Delay
CR1201	1N463	DC Clamp
CR1202	1N463	DC Clamp
CR1203	1N463	AVC Rectifier
CR1204	1N463	AVC Rectifier
CR1205	1N34A	AVC Rectifier
CR1206	1N34A	AVC Rectifier
CR1207	1N34A	AVC Rectifier
CR1301	1N1582R	Rectifier
CR1302	1N1582R	Rectifier
CR1303	1N1582	Rectifier
CR1304	1N1582	Rectifier
CR1305	1N3323B	Voltage Regulator
CR1306	DZ20426	Voltage Regulator

SECTION 2

INSTALLATION

2-1. INITIAL INSPECTION

Each HFR-1 has been calibrated and tested at the factory before shipment. Inspect the packing case and its contents for possible damage when it arrives at the operating site; unpack the equipment carefully. Inspect all packing material for parts that may have been shipped as "loose items". With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

The equipment is shipped with all tubes and other plug-in components installed. Check that all such components are properly seated in their sockets.

2-2. 115- VS. 230-VOLT LINE SUPPLY

The low voltage power supply of the HFR-1 is designed for 115- or 230-volt, 50- or 60-cps, single phase power; it is factory wired for 115 volts. If 230-volt operation is required, a minor wiring change must be made at the primary winding of transformer T1302 as shown in figure 2-1.

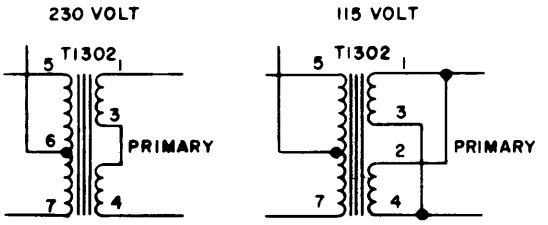


Figure 2-1. Transformer Wiring, 115-VS 230-Volt Line Supply

2-3. INSTALLATION

a. MECHANICAL INSTALLATION. The HFR-1 is equipped with a standard front panel (19 inches wide), but due to its extra depth it will not fit into a standard rack cabinet. Approximately 20 inches of clearance from the back of the panel to the rear of the rack is required. Refer to the dimensional outline drawing (figure 2-2) and install the HFR-1 in equipment rack as follows:

(1) Set HFR-1 chassis slide mechanisms in tracks as shown in figure 2-3.

(2) Slide HFR-1 on tracks until rearward release finger engages holes in track.

(3) Make the necessary cable and electrical connections as described in b.

CAUTION

Cables and electrical wiring should be carefully positioned to prevent snagging or catching as units slide in and out of equipment rack.

(4) Press forward release finger and push HFR-1 into equipment rack.

(5) Secure front panel to rack with screws.

b. ELECTRICAL INSTALLATION. Figures 2-4 and 2-5 illustrate the interconnections for the HFR-1 as used in synthesized DDR-5 operation. For non-synthesized operation, the cable connection between jack J3017 of the synthesizer and jack J1307 of HFR-1 is removed, and J1307 is terminated with the 47 ohm AT1303 termination. If the HFR-1 is used with another system, a synthesizer unit, an IF amplifier, and a power supply capable of furnishing the voltages and frequencies indicated in schematic diagram 8-1 are required.

2-4. INITIAL ADJUSTMENT

Before the HFR-1 is shipped, it is aligned and thoroughly checked against the manufacturer's specifications; no initial adjustments are required before installation and operation. Alignment procedures necessary for preventive maintenance and troubleshooting are given in section 6.

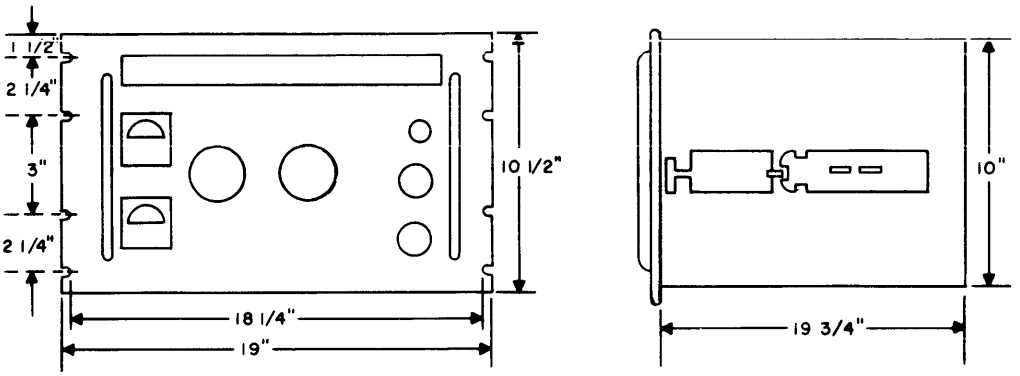


Figure 2-2. HFR-1, Dimensional Outline Drawing

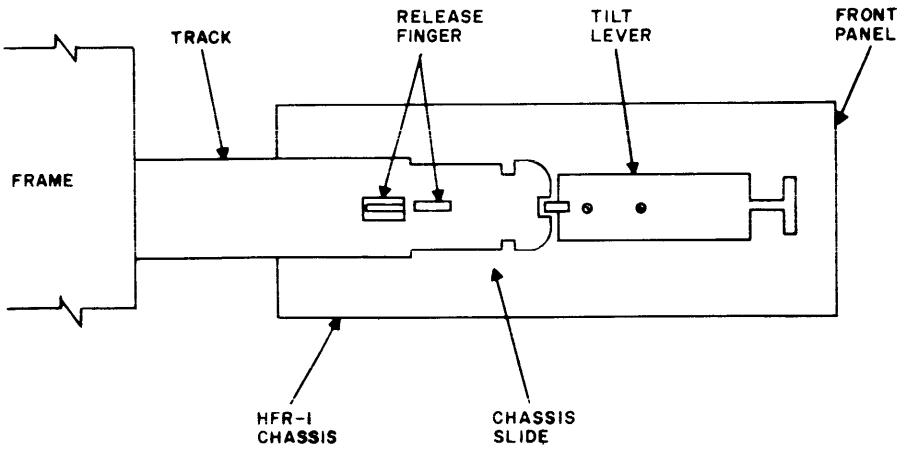
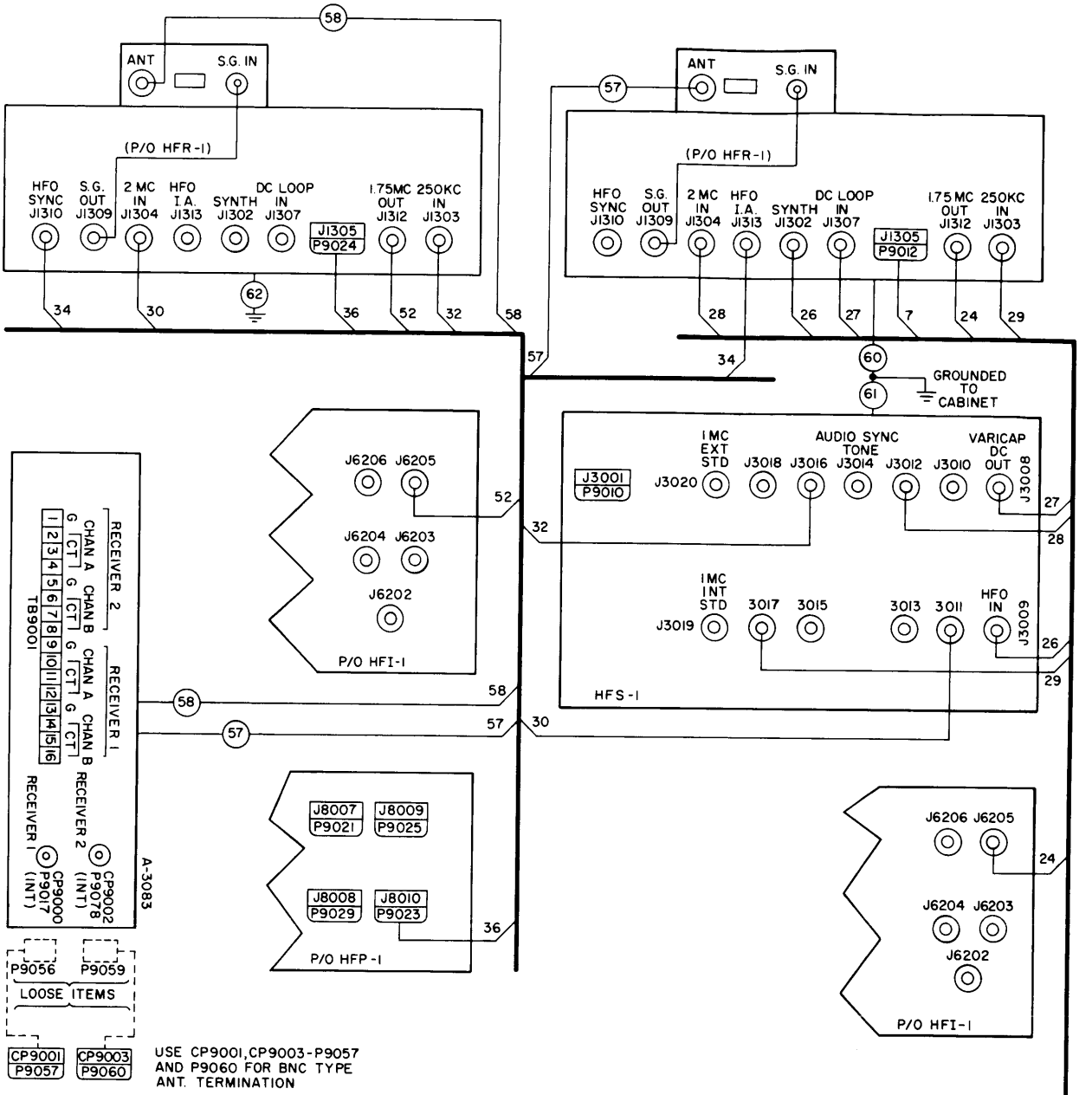
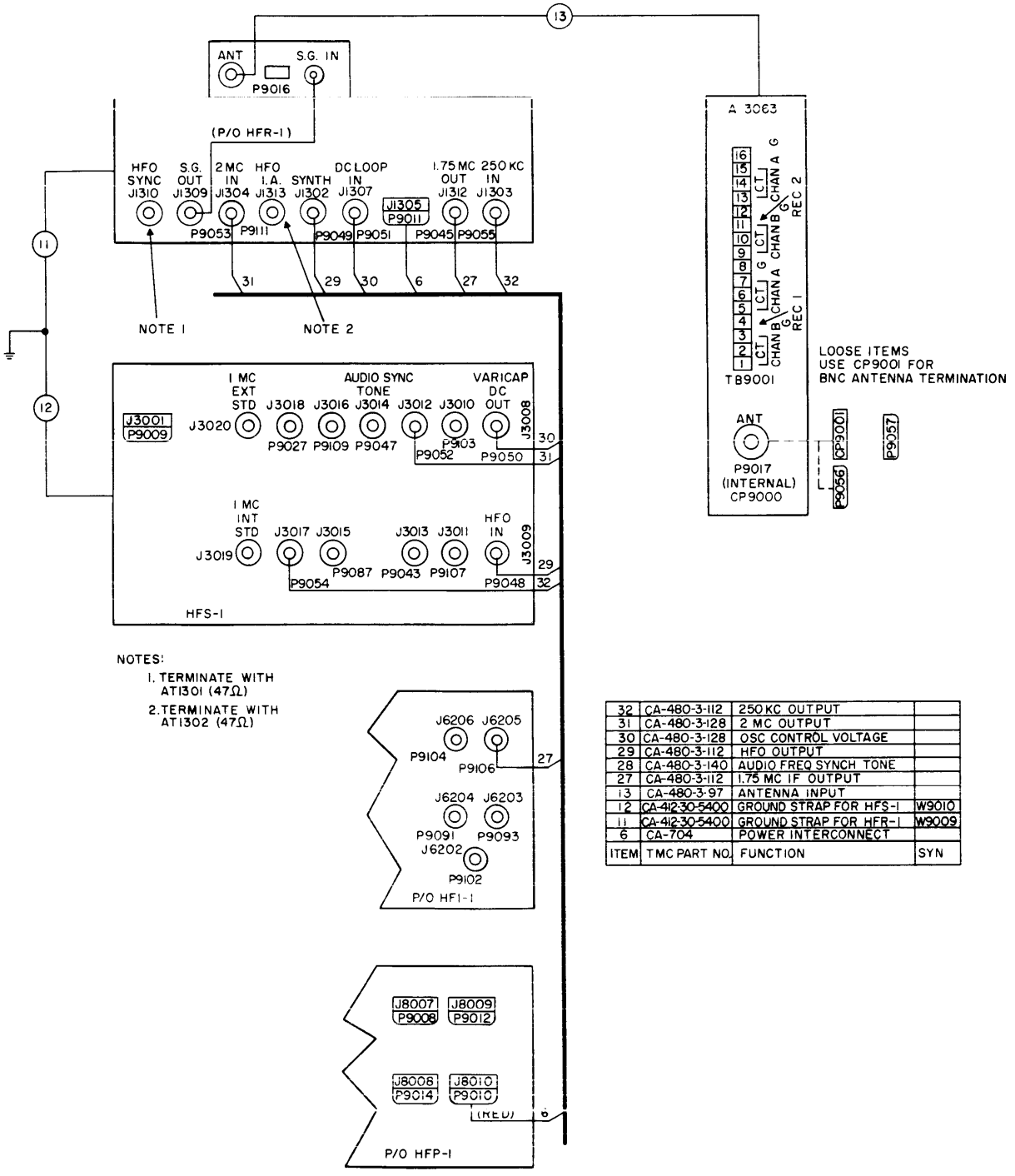


Figure 2-3. Slide-Mounting Details



ITEM	TMC PART NO.	FUNCTION	SYN
62	CA-412-34-54	GROUND STRAP HFR-1	W9039
61	CA-412-34-54	GROUND STRAP HFS-1	W9010
60	CA-412-34-54	GROUND STRAP HFR-1	W9009
58	CA-480-3-112	ANTENNA INPUT	W9041
57	CA-480-3-160	ANTENNA INPUT	W9011
52	CA-480-3-112	1.75 MC I.F OUTPUT	W9055
36	CA-704	POWER INTERCONNECT CABLE	W9036
34	CA-480-3-150	OUTPUT ISOLATION AMPLIFIER	W9058
32	CA-480-3-140	250 KC OUTPUT	W9057
30	CA-480-3-140	2 MC OUTPUT	W9056
29	CA-480-3-112	250 KC OUTPUT	W9030
28	CA-480-3-128	2 MC OUTPUT	W9029
27	CA-480-3-128	OSCILLATOR CONTROL VOLTAGE	W9028
26	CA-480-3-112	HFO OUTPUT	W9027
24	CA-480-3-112	1.75 MC I.F. OUTPUT	W9025
7	CA-704	POWER INTERCONNECT CABLE	W9004

Figure 2-4. HFR-1 Cabling Interconnections, DDR-5A Operation



32	CA-480-3-112	250 KC OUTPUT	
31	CA-480-3-128	2 MC OUTPUT	
30	CA-480-3-128	OSC CONTROL VOLTAGE	
29	CA-480-3-112	HFO OUTPUT	
28	CA-480-3-140	AUDIO FREQ SYNCH TONE	
27	CA-480-3-112	1.75 MC IF OUTPUT	
13	CA-480-3-97	ANTENNA INPUT	
12	CA-412-30-5400	GROUND STRAP FOR HFS-1	W9010
11	CA-412-30-5400	GROUND STRAP FOR HFR-1	W9009
6	CA-704	POWER INTERCONNECT	
ITEM	TMC PART NO.	FUNCTION	SYN

Figure 2-5. HFR-1 Cabling Interconnections, DDR-5B1 Operation

SECTION 3

OPERATOR'S SECTION

3-1. OPERATION OF UNIT

a. CONTROL FUNCTIONS. Front panel controls and instruments (figure 3-1) of the HFR-1 are arranged to permit: ease of tuning through any of eight RF bands to the desired frequency within the range of 2 to 32 mc, non-synthesized continuous coverage operation or synthesized operation in 100 cycle steps, and alignment and sensitivity checks of the HFR-1. All operating controls are easily identified by front panel markings. Table 3-1 lists the controls and instruments and the functions of each.

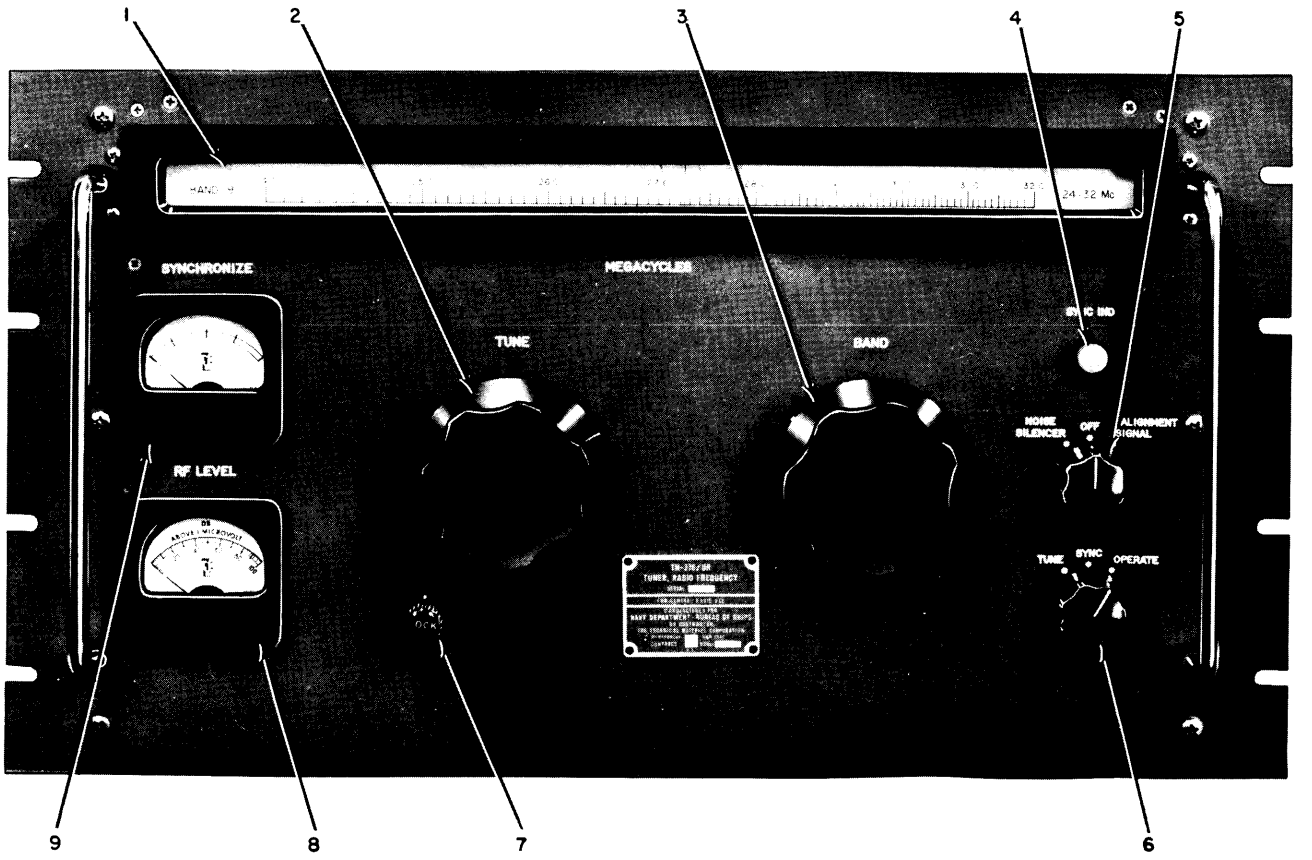


Figure 3-1. Panel Controls, HFR-1

TABLE 3-1. CONTROL FUNCTIONS, HFR-1

SERIAL DESIGNATION (Figure 3-1)	PANEL DESIGNATION (Figure 3-1)	FUNCTION
1	MEGACYCLES	Displays RF band selected by operation of BAND control knob; refer to serial designation 3.
2	TUNE	Moves slide rule pointer along dial of selected band to the appropriate frequency. This control is fitted with a lock; refer to serial designation 7.
3	BAND	Rotates illuminated MEGACYCLE dial to the desired RF band. RF bands are arranged as follows: BAND 1 2-3 mc BAND 2 3-4 mc BAND 3 4-6 mc BAND 4 6-8 mc BAND 5 8-12 mc BAND 6 12-16 mc BAND 7 16-24 mc BAND 8 24-32 mc
4	SYNC IND	Lights to indicate that the system is synchronized. This indicator functions only when HFR-1 is operating synthesized.
5	NOISE SILENCER/ OFF/ALIGNMENT SIGNAL	NOISE SILENCER position activates noise silencer circuits; disables alignment signal generator, and connects ANT input jack to first RF amplifier circuit. OFF position disables output of noise silencer, disables alignment signal generator, and connects ANT input jack to first RF amplifier circuit. ALIGNMENT SIGNAL position activates alignment signal generator, disables output of noise silencer, and connects CAL input jack to first RF amplifier circuit.

TABLE 3-1. CONTROL FUNCTIONS, HFR-1 (Cont'd)

SERIAL DESIGNATION (Figure 3-1)	PANEL DESIGNATION (Figure 3-1)	FUNCTION
6	TUNE/SYNC/ OPERATE	TUNE position grounds DC correction voltage from synthesizer causing HFO circuit to free run, and de-energizes AUDIO SYNC TONE relay of HFA-1 in DDR-5 operation to remove audio sync tone from channel A audio amplifier. In this position, SYNCHRONIZE meter should read zero center scale. SYNC position grounds DC correction voltage from synthesizer causing HFO circuits to free run, and energizes AUDIO SYNC TONE relay of HFA-1 in DDR-5 operation to inject audio sync tone in channel A audio amplifier. OPERATE position causes synthesizer circuits to control HFO circuits for synthesized operation in 100 cycle steps, and de-energizes AUDIO SYNC TONE relay of HFA-1 in DDR-5 operation to remove audio sync tone from channel A audio amplifier.
7	LOCK	Locks TUNE control in position.
8	RF LEVEL	Meter indicates strength of antenna input signal or alignment signal in db above 1 μV.
9	SYNCHRONIZE	Meter indicates amount and polarity of DC voltage required to keep the system synchronized. When system is out of synchronization, meter reads zero center scale. This meter functions only when HFR-1 is operating synthesized.

b. OPERATING PROCEDURE. Operation of the HFR-1 consists primarily of tuning to the desired frequency by means of the BAND and TUNE control knobs as indicated in table 3-1. Procedures for synchronizing the HFR-1 with the other receiver units for synthesized and non-synthesized DDR-5 operation are included in the technical manual decribing the DDR-5 system. If the HFR-1 is required to function with any other system, the synchronization procedures will be similar to those given in the DDR-5 manual.

3-2. OPERATOR'S MAINTENANCE

The operator should observe whether the front panel indicator lamp, dial light, meters and controls are in good condition and functioning properly. The operator should also check the general condition of electron tubes; tubes that appear to be defective should be checked on a reliable tube tester and replaced as required.

SECTION 4

PRINCIPLES OF OPERATION

4-1. BLOCK DIAGRAM ANALYSIS

Block diagram figure 4-1 illustrates the three sections (HFR-1/T, HFR-1/N, and HFR-1/C) of the HFR-1 and the major components of each section.

Signals within the range of 2 mc to 32 mc that are applied to the RF amplifier chain undergo four stages of amplification and are mixed with an HFO frequency of 3.75 mc to 33.75 mc to produce a 1.75 mc IF at the output of mixer V1005. A front panel RF LEVEL meter, associated with the AGC circuit, indicates incoming signal strength. Isolation amplifier V1006 isolates the HFO from mixer V1005 and from the alignment signal generator stage to prevent HFO frequency modulation.

The 1.75 mc IF signal from V1005 is amplified by V1201, and applied simultaneously to IF amplifiers V1202 and V1203 and to the noise silencer stage comprising gate amplifiers V1204 and V1205. Negative pulses corresponding to the impulse noise contained in the IF signal are generated in the noise silencer stage and fed back to V1202 and V1203. These negative pulses cut off V1202 and V1203 so that noise does not appear in the amplified output. When the NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knob is set at OFF, relay K1201 grounds the negative pulse output of the noise silencer stage thereby making the noise silencer ineffective.

The alignment signal generator, comprising balanced modulator V1301 and mixer V1302, combines the HFO output signal with a 2 mc and a 250 kc signal from the synthesizer (HFS-1 in DDR-5 operation) to produce an alignment signal for calibration and sensitivity checks. The exact frequency of the alignment signal coincides with the setting of the BAND and TUNE controls.

DC correction voltage required to maintain system synchronization is extended to SYNCHRONIZE meter amplifier V1304 from the synthesizer unit (HFS-1 in DDR-5 operation). V1304 amplifies the DC correction voltage and applies it to the SYNCHRONIZE meter which in turn displays the amount and polarity of the DC correction voltage. When the TUNE/SYNC/OPERATE control knob is set at TUNE or SYNC, switch S1302 grounds the DC correction voltage from the synthesizer unit thereby making the SYNCHRONIZE meter amplifier circuit ineffective.

Voltage regulator V1303 furnishes a constant 150 VDC for the HFO plate circuit, and the low voltage power supply incorporated in the HFR-1 furnishes:

a. Plus 28 VDC for the proportional oven control unit and for the frequency standard unit in the synthesizer.

b. Plus 32 VDC for the HFO oven heater circuits.

c. Regulated 6.3 VDC for the HFO (V1007) filament.

4-2. DETAILED CIRCUIT ANALYSIS, HFR-1/T

a. INPUT CIRCUIT AND RF AMPLIFIER CHAIN. See figure 4-2. The input circuits and RF amplifier chain comprise ANT-CAL relay K1001; RF tuner strips A1001 through A1015 (corresponding to the eight receiver bands); RF amplifiers V1001, V1002, V1003, and V1004; and tuning capacitor C1001. Depending upon the position of relay K1001, alignment or antenna input signals within the range of 2 mc to 32 mc are extended through one of eight tuned RF circuits (A1001 through A1015), amplified by V1001, V1002, V1003, and V1004, and applied to mixer V1005. Turret contacts engage fixed chassis contacts to connect the required elements of amplifiers V1001 through V1004, RF tuner strips A1001 through A1015, and tuning capacitor C1001. Simplified schematic diagram figure 4-3 shows the circuit components between V1002 and V1003 in the BAND 1 position (RF tuner A1001 engaged); circuit configurations for RF tuner strips A1003 through A1015 and other sections of tuning capacitor C1001 are similar. C1016 and C1017 form a capacitive voltage divider that determines the drive and impedance presented to the following stage. C1001C and C1001D are the main tuning capacitors for this stage. R1012 and C1014 form a decoupling network. Swamping resistor R1011 adjusts the circuit Q for the required bandpass. R1009 and R1015 are parasitic suppressors. C1015 is the trimmer for this stage, and is adjusted at the high end of the tuning range. Bypass capacitor C1013 places the "bottom" of the tank at RF ground. L1004 is a fixed toroid coil. L1005 is a slug tuned coil adjusted at the low end of the tuning range.

V1003 and V1004 are conventional tuned RF stages. V1001, a low noise triode, is cascade connected to the cathode circuit of grounded grid amplifier V1002 low noise rather than gain is the primary consideration of these stages. AGC from the IF unit (HFI-1 in DDR-5 operation) is applied to V1001, V1003, and V1004 through a delay circuit as shown in figure 4-4; maximum delay is given to low gain amplifier V1001. CR1001 clamps the junction of R1001 and R1005 at a very slight positive potential which is developed across the voltage divider formed by CR1001 and C1001. Weak AGC voltages have little or no effect on V1001; with normal AGC voltages, CR1001 is cut off and V1001 receives a delayed AGC that

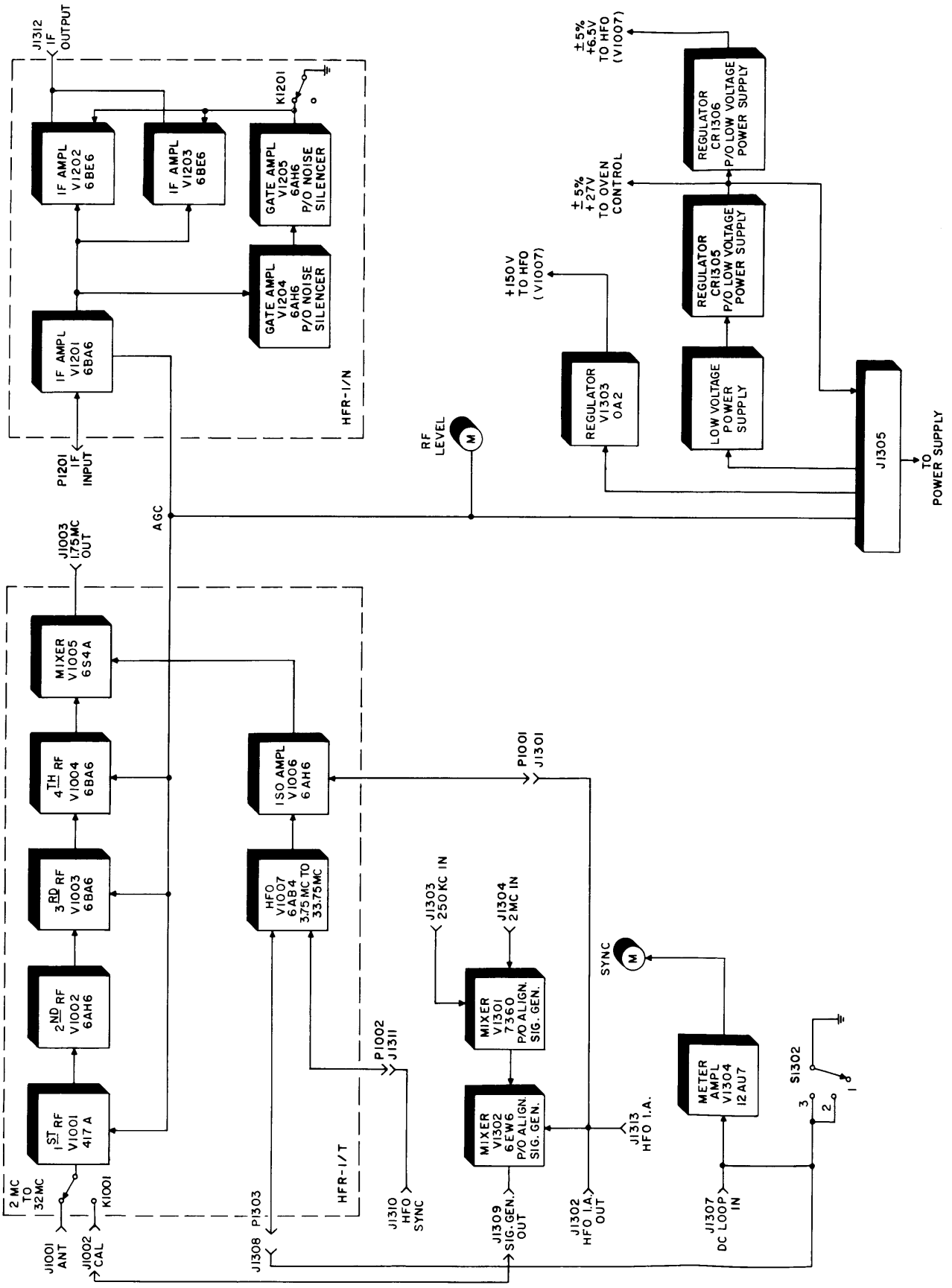


Figure 4-1. Block Diagram, HFR-1

1.75 MC

ISO. AMPL. V1006 6AH6

HFO V1007 6AB4

+150V

J1003 1.75 MC OUT

P1201 IF INPUT

A1017

+ 28V DC REG

TO FIGURE 4-8

P1002 HFO. SYNC. INPUT TO J1311 (HFO. SYNC. INPUT)

P1003

P1001 HFO OUT TO J1301

HF OSC TUNING

A1002

A1004

A1006

A1008

A1010

A1012

A1014

A1016

HR1002 12Ω AT ROOM TEMP.

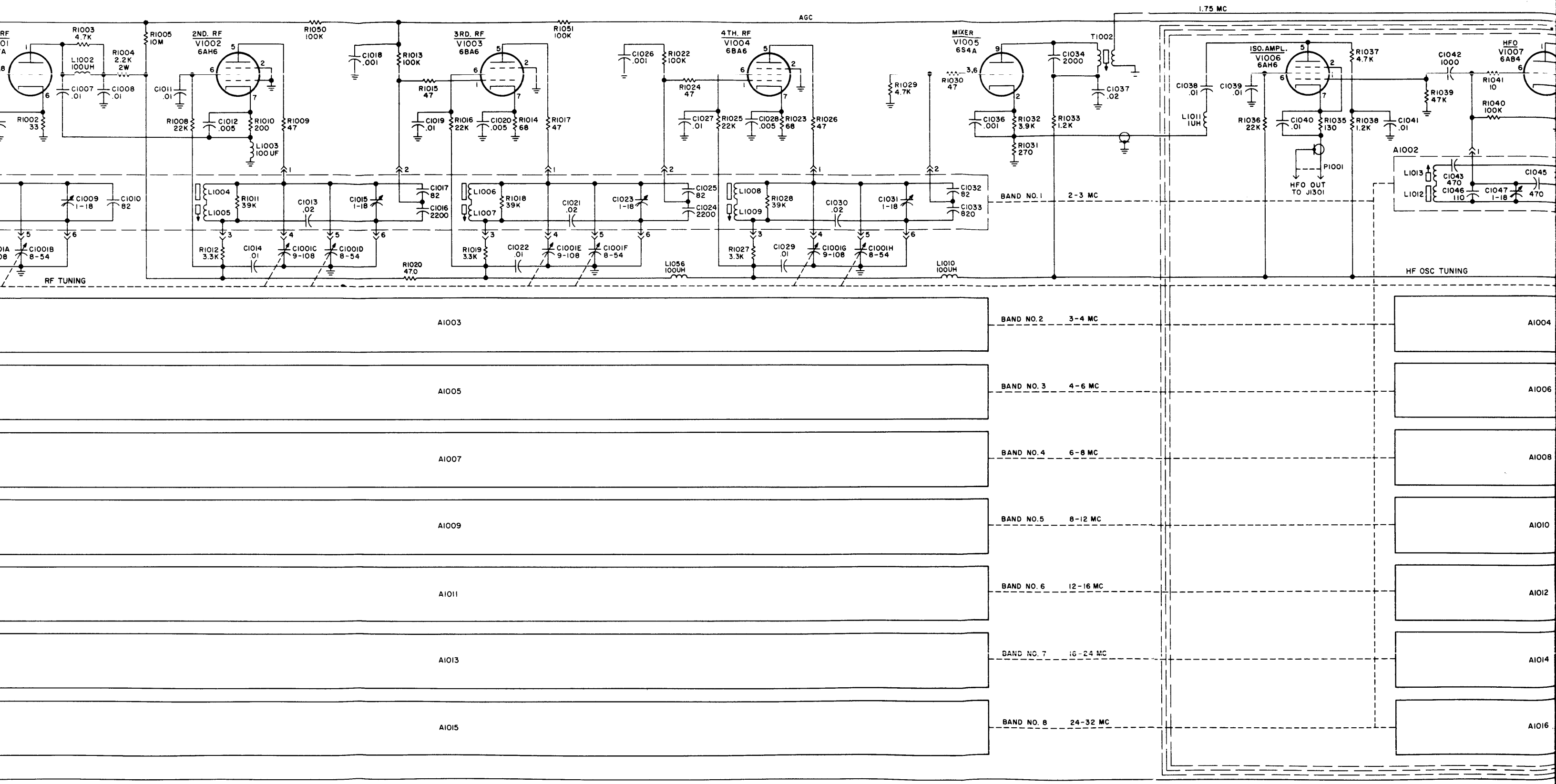
HR1001 12Ω AT ROOM TEMP.

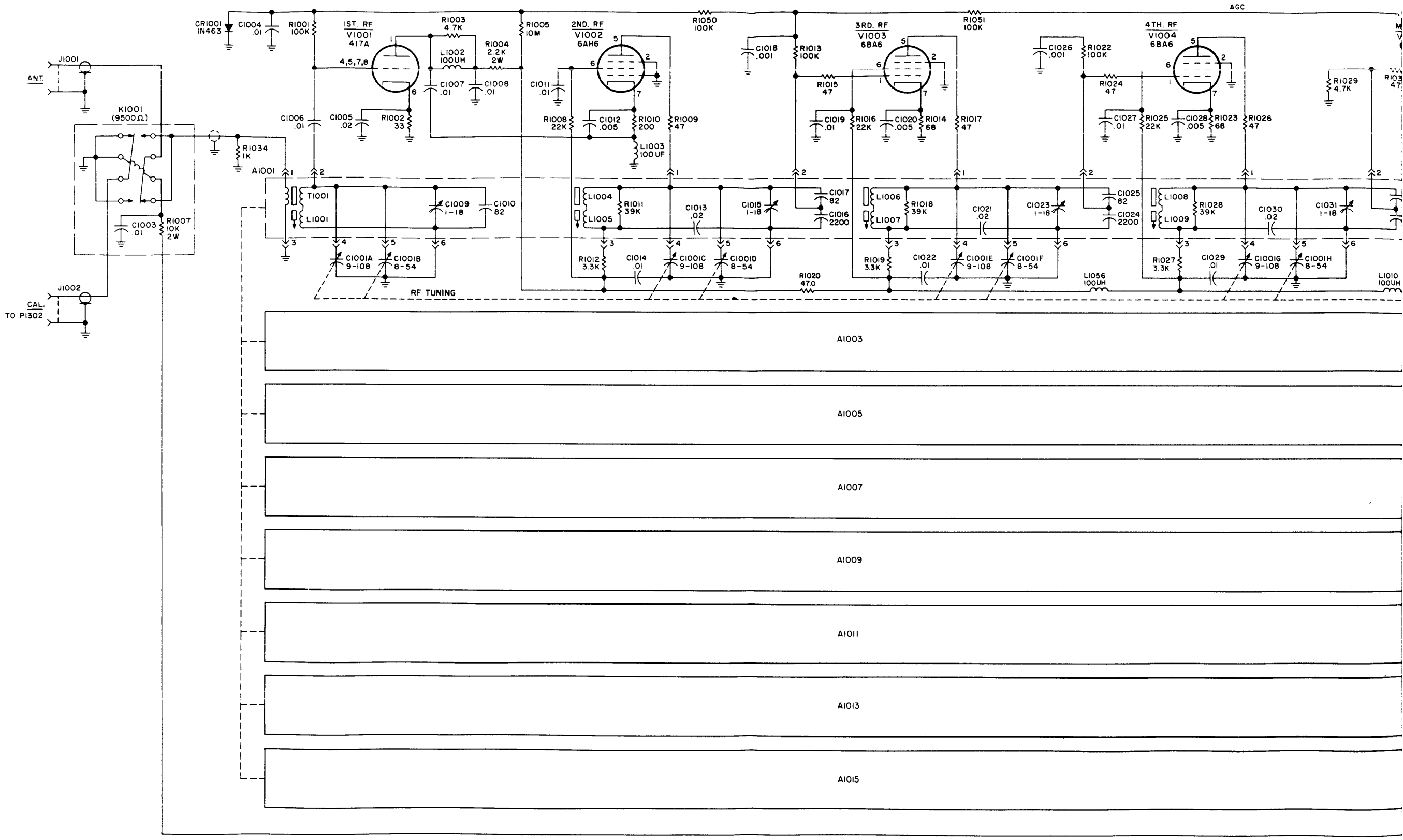
RT1001 APPROX. 500K AT ROOM TEMP.

OVEN

P1004 J1306

6.3V DC REG.


AGC
1.75 MC
R1003 4.7K
R1004 2.2K 2W
R1005 10M
L1002 100UH
C1007 .01
C1008 .01
R1002 33
2ND. RF V1002 6AH6
R1050 100K
C1011 .01
R1008 22K
C1012 .005
R1010 200
R1009 47
L1003 100 UF
C1018 .001
R1013 100K
R1015 47
3RD. RF V1003 6BA6
R1051 100K
C1019 .01
R1016 22K
C1020 .005
R1014 68
R1017 47
C1026 .001
R1022 100K
R1024 47
4TH. RF V1004 6BA6
C1027 .01
R1025 22K
C1028 .005
R1023 68
R1026 47
R1029 4.7K
MIXER V1005 6S4A
R1030 47
C1036 .001
R1032 3.9K
R1031 270
C1034 2000
T1002
C1037 .02
R1033 1.2K
ISO. AMPL. V1006 6AH6
C1038 .01
L1011 1UH
C1039 .01
R1036 22K
C1040 .01
R1035 130
R1037 4.7K
R1039 47K
R1038 1.2K
C1041 .01
P1001
HFO OUT TO J1301
HFO V1007 6AB4
C1042 1000
R1041 10
R1040 100K
A1002
L1013
C1043 470
C1046 110
L1012
C1047 1-18
C1045 470
C1009 1-18
C1010 82
C1001A 8-54
L1004
L1005
R1011 39K
C1013 .02
C1015 1-18
C1017 82
C1016 2200
R1012 3.3K
C1014 .01
C1001C 9-108
C1001D 8-54
L1006
L1007
R1018 39K
C1021 .02
C1023 1-18
C1025 82
C1024 2200
R1019 3.3K
C1022 .01
C1001E 9-108
C1001F 8-54
L1008
L1009
R1028 39K
C1030 .02
C1031 1-18
C1032 82
C1033 820
R1027 3.3K
C1029 .01
C1001G 9-108
C1001H 8-54
R1020 47.0
L1056 100UH
L1010 100UH
BAND NO. 1 2-3 MC
RF TUNING
HF OSC TUNING
A1003
BAND NO. 2 3-4 MC
A1004
A1005
BAND NO. 3 4-6 MC
A1006
A1007
BAND NO. 4 6-8 MC
A1008
A1009
BAND NO. 5 8-12 MC
A1010
A1011
BAND NO. 6 12-16 MC
A1012
A1013
BAND NO. 7 16-24 MC
A1014
A1015
BAND NO. 8 24-32 MC
A1016


J1001
ANT.
K1001
(9500Ω)
J1002
CAL.
TO P1302
CR1001
1N463
C1004
.01
R1001
100K
1ST. RF
V1001
417A
4,5,7,8
R1003
4.7K
L1002
100UH
R1004
2.2K
2W
C1007
.01
C1008
.01
C1006
.01
C1005
.02
R1002
33
R1005
10M
2ND. RF
V1002
6AH6
C1011
.01
R1008
22K
C1012
.005
R1010
200
R1009
47
L1003
100 UF
R1050
100K
C1018
.001
R1013
100K
3RD. RF
V1003
6BA6
R1015
47
C1019
.01
R1016
22K
C1020
.005
R1014
68
R1017
47
R1051
100K
C1026
.001
R1022
100K
4TH. RF
V1004
6BA6
R1024
47
C1027
.01
R1025
22K
C1028
.005
R1023
68
R1026
47
R1029
4.7K
AGC
R1034
1K
A1001
T1001
L1001
C1009
1-18
C1010
82
C1001A
9-108
C1001B
8-54
L1004
L1005
R1011
39K
C1013
.02
C1015
1-18
C1017
82
C1016
2200
R1012
3.3K
C1014
.01
C1001C
9-108
C1001D
8-54
L1006
L1007
R1018
39K
C1021
.02
C1023
1-18
C1025
82
C1024
2200
R1019
3.3K
C1022
.01
C1001E
9-108
C1001F
8-54
L1008
L1009
R1028
39K
C1030
.02
C1031
1-18
R1027
3.3K
C1029
.01
C1001G
9-108
C1001H
8-54
C1003
.01
R1007
10K
2W
R1020
470
L1056
100UH
L1010
100UH
RF TUNING
A1003
A1005
A1007
A1009
A1011
A1013
A1015

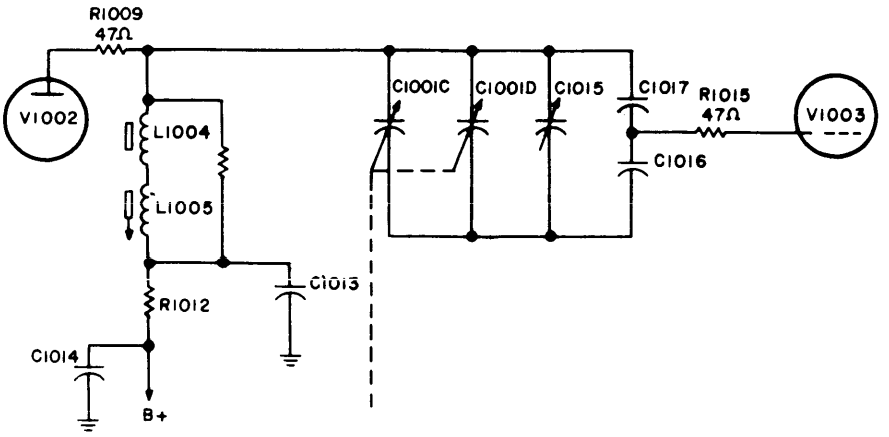


Figure 4-3. V1002 and V1003 Stages, A1001 Tuner Strip

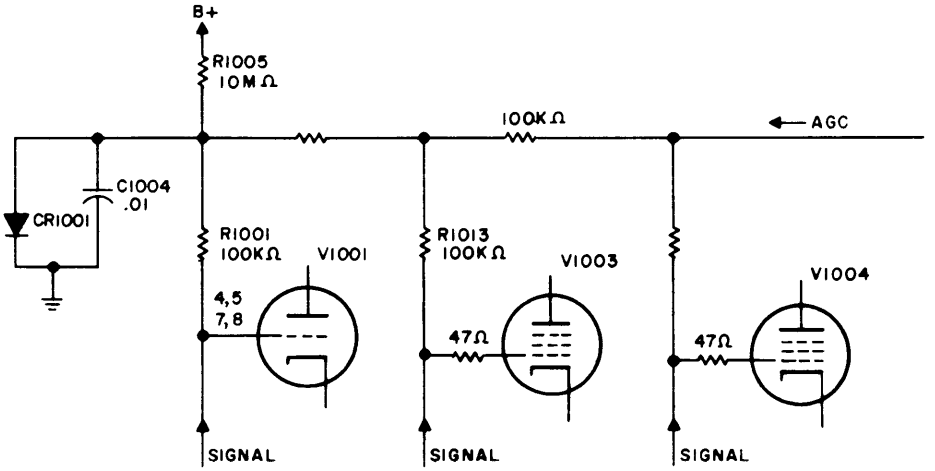


Figure 4-4. AGC, Simplified Schematic Diagram

is developed across resistors R1050 and R1051. AGC is felt with decreasing effect by V1004, V1003, and V1001.

b. FIRST MIXER CIRCUIT. See figure 4-2. The first mixer circuit comprises triode V1005 and transformer T1002. The amplified output signal from V1004 and the HFO output signal from the plate of V1006 are applied to the V1005 control grid and cathode circuits respectively.

Transformer T1002, resonant at 1.75 mc and designed to allow the full bandpass of more than 15 kc, couples the V1005 output signal to jack J1003. Cathode bias places the control grid of V1005 at about -11 volts negative with respect to the cathode, and both input signals are held below 1 volt RMS; this combination reduces intermodulation products in the converted output signal about 60 db below the desired output signal.

c. HFO AND ISOLATION AMPLIFIER. See figure 4-2. The HFO and isolation amplifier circuit comprises high frequency oscillator V1007; isolation amplifier V1006; tuning capacitor C1002; oven heaters HR1001 and HR1002; thermistor RT1001; proportional oven control A1017; a VARICAP circuit consisting of C1048, C1049, C1051, C1052, C1053, R1044, and R1045; and oscillator tuner strips A1002 through A1016. Turret contacts engage fixed chassis contacts to connect V1007 and HFO SYNC INPUT jack J1311 to the required elements of oscillator tuner strips A1001 through A1016, tuning capacitor C1002, and the VARICAP circuit.

The HFO is a modified colpitts (Vacker) circuit enclosed in a carefully designed oven regulated by proportional oven control A1017. Oven temperature is maintained at 75°C ±1/2 degree in the following manner:

(1) Changes in oven temperature cause corresponding changes in the resistance of thermistor RT1001.

(2) A1017 responds to resistance changes of RT1001 and changes the conduction through oven

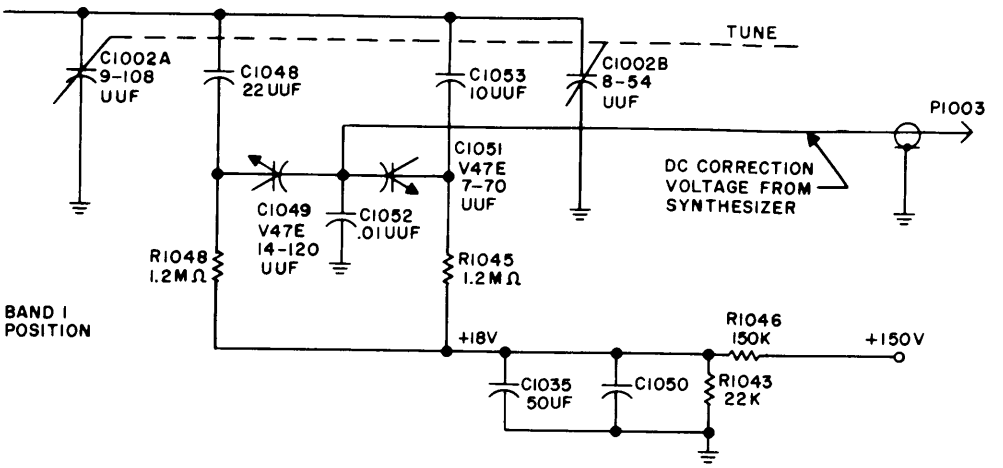


Figure 4-5. VARICAP, Simplified Schematic Diagram

heaters HR1001 and HR1002 accordingly to maintain a constant oven temperature.

In synthesized operation, HFO frequency is controlled by the VARICAP circuit shown in simplified schematic figure 4-5. A DC correction voltage from the synthesizer unit changes the difference of potential across C1049 and C1051 thereby changing the capacity shunting C1002A and C1002B. Figure 4-5 shows the VARICAP and tuning capacitors connected to oscillator tuner strip A1002 (BAND 1 position); circuit configurations for oscillator tuner strips A1004 through A1016 are similar. Both sections of C1002 are not utilized with all tuner strips; regardless of the tuner strip engaged, at least one VARICAP control is inserted to "pull" the frequency as required.

Isolation amplifier V1006 presents a constant load to the grid of V1007 and thus prevents HFO frequency modulation.

4-3. DETAILED CIRCUIT ANALYSIS, HFR-1/N

a. 1.75 MC IF OUTPUT AMPLIFIER. See figure 4-6. The IF output amplifier comprises amplifiers V1201, V1202, and V1203; and transformers T1201, T1202, and T1203. 1.75 mc first IF (with full bandpass) from mixer V1005 is coupled to V1201 grid by transformer T1201. A 15K ohm swamping resistor in the secondary of T1201 assures that full bandpass is preserved. The amplified output signal from V1201 is coupled to the grids of push-pull amplifiers V1202 and V1203 by transformer T1202, is amplified, and is coupled to 50 ohm output jack J1312 by transformer T1203. Control grids 1 of V1202 and V1203 are configured to cut off these stages when negative spikes are received from the noise silencer (refer to paragraph 4-3,b). These control grids do not affect the operation of V1202 or V1203 except in the presence of impulse noise.

b. NOISE SILENCER. See figure 4-6. The noise silencer comprises high gain cascade connected amplifiers V1204 and V1205; a self contained AGC system containing diodes CR1202, CR1203,and CR1204; and a pulse detector and spike generator circuit containing diodes CR1205, CR1206, and CR1207. V1204 and V1205 stages contain their own AGC loop to improve stability. The output of IF amplifier V1201 is coupled to the grid of V1204 by capacitor C1205, amplified by V1204 and V1205, and applied to the AGC loop and to the pulse detector and spike generator circuit. Figure 4-7 is a simplified schematic diagram of the pulse detector and spike generator.

The amplified 1.75 mc IF output signal from V1205 is coupled to the cathode of CR1207 and to the plate of CR1206 by C1228 and C1229 respectively. On negative excursions of the input signal, C1227 discharges through CR1205. On positive excursions however, a positive voltage is developed at the cathode of CR1206. Filtering and voltage reduction takes place in the network composed of R1238, C1230, R1232, C1227, and R1231; trimmer C1231 adjusts the voltage output of this rectifier filter network. The positive voltage output of this network is applied as back bias on diode CR1207. When impulse noise is present in the input signal, the positive impulses drive CR1207 deeper into cutoff. If the impulse noise is of sufficient amplitude, the negative impulses cause CR1207 to conduct and sharp negative spikes are developed across C1226 and R1234. These negative spikes are applied to control grids 1 of IF amplifiers V1202 and V1203 by means of L1203 and the coupling network comprising R1213 and C1201. L1203 traps out the 1.75 mc carrier to prevent feedback; CR1201 clamps the negative spikes below zero reference. V1202 and V1203 are cut off for the duration of the negative spikes thus preventing noise from appearing in the IF output. When the NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knob is set at OFF, relay K1201 grounds the negative spikes and the noise silencer has no effect on V1202 and V1203 stages.

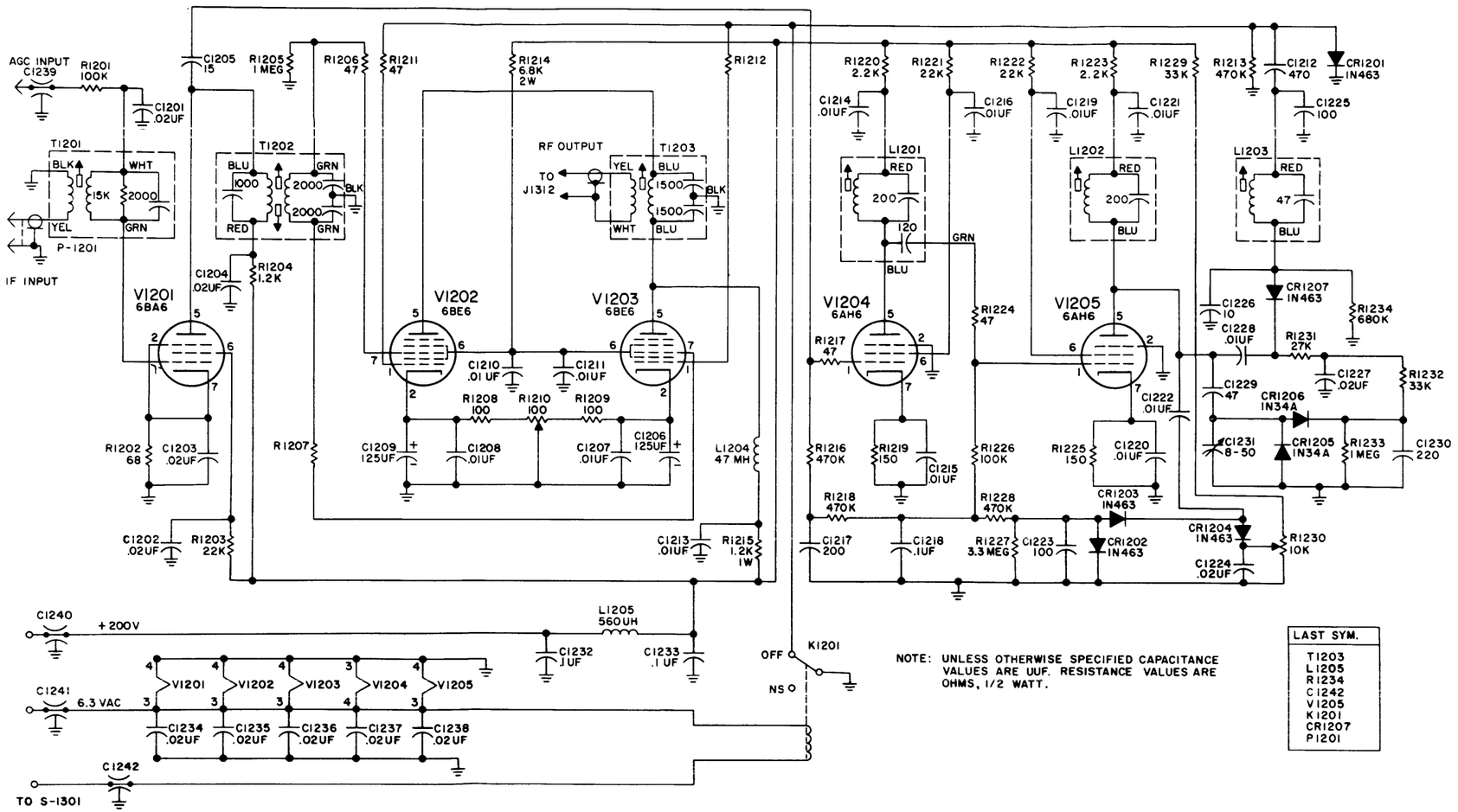


Figure 4-6. HFR-1/N, Schematic Diagram

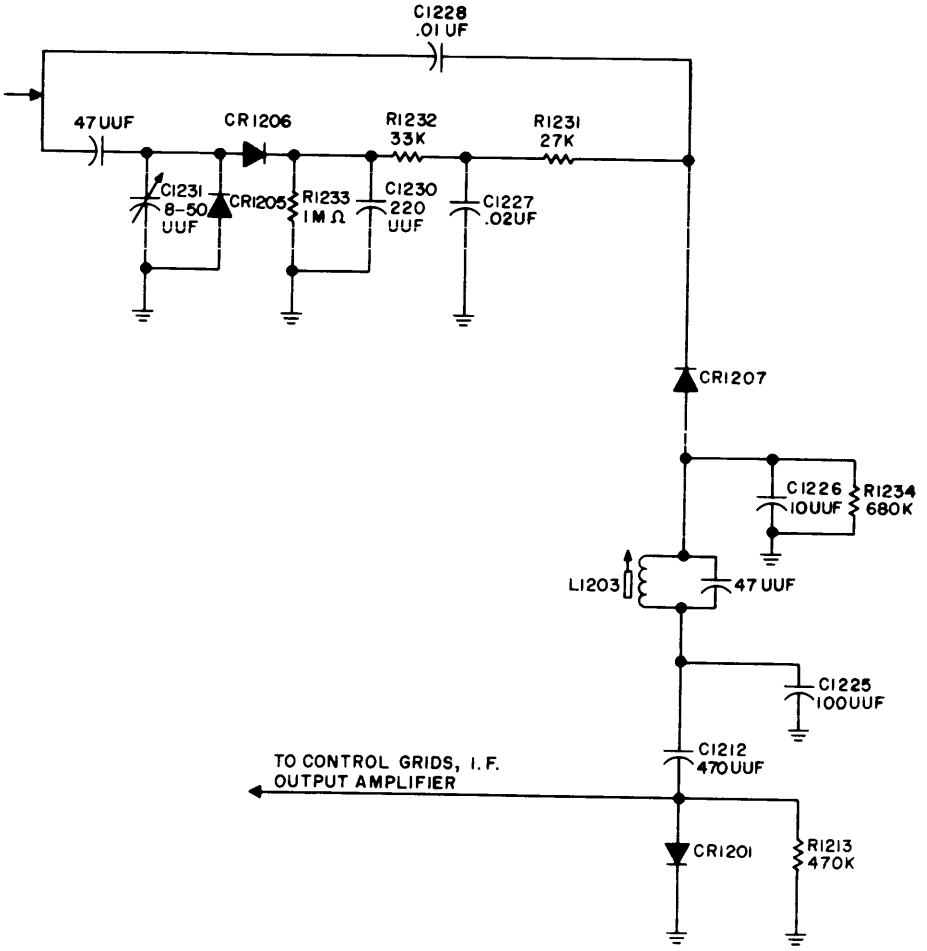


Figure 4-7. Pulse Detector and Spike Generator, Simplified Schematic Diagram

4-4. DETAILED CIRCUIT ANALYSIS, HFR-1/C

a. ALIGNMENT SIGNAL GENERATOR. See figure 4-9. The alignment signal generator comprises balanced modulator V1301 and mixer V1302. V1301 is a beam deflection tube arranged as shown in figure 4-8 below. Total beam current is determined by the voltages on G_1 (pin 3) and G_2 (pin 2). However, the amount of current collected by plate 6 or 7 is determined by the difference of potential between deflection electrodes 8 and 9. If there is no difference in potential on the deflection electrodes, there is no plate current.

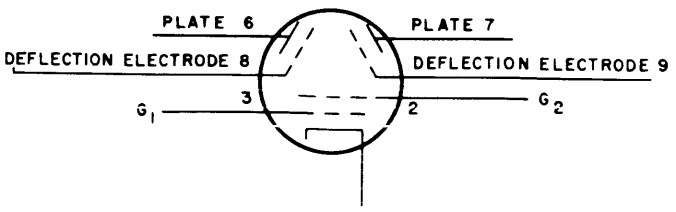


Figure 4-8. Electrode Arrangement, V1301

A 2 mc and a 250 kc signal from the synthesizer unit (HFS-1 in DDR-5 operation) are applied to the control grid (pin 3) and to deflection electrode 8 respectively of V1301. Unbalance of deflection electrodes 8 and 9, due to application of the 250 kc signal, results in V1301 mixer action. Transformer T1301 couples the difference frequency output signal (1.75 mc) to the cathode circuit of mixer V1302. V1302 mixes this 1.75 mc signal with the V1006 output signal (HFO frequency) which is applied to the control grid of V1302 by means of jack J1301. The V1302 output signal is coupled to SIG GEN OUT jack J1309.

Voltage divider networks comprising R1307 through R1310 and R1319 fix the deflection electrodes of V1301 at equal DC potential, with no 250 kc signal on deflection electrode 8, there is no output signal. Plate voltage for V1301 and V1302 is controlled by the setting of the NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knob; in the OFF or NOISE SILENCER position, the alignment signal generator is circumvented.

b. SYNCHRONIZE METER AMPLIFIER. See figure 4-9. The SYNCHRONIZE meter amplifier circuit comprises dual triode V1304, SYNCHRONIZE

meter MI1301, and variable resistor R1320. Dual triode V1304 is configured as a balanced bridge in which one half (pins 1, 2, and 3) of V1304 acts as the variable element. Resistor R1320 is adjusted so that meter MI1301 reads zero center scale when the control grid (pin 2) of V1304 is grounded. DC correction voltage from the synthesizer, applied to J1307 and extended to pin 2 of V1304, creates an unbalanced condition, and current flows through MI1301. The offcenter reading of MI1301 is an indication of the amount and the polarity of DC correction voltage required to maintain the HFO at the correct frequency.

c. SYNC IND LAMP. See figure 4-9. The SYNC IND lamp, mounted on the front panel, is controlled from the synthesizer unit. When the system is synchronized, pin N of jack J1305 is ungrounded, and the B+ applied to the high side of SYNC IND lamp BI1301 causes the lamp to light. When the system is not synchronized, a ground applied to pin N of J1305 reduces the voltage on the high side of BI1301, and the lamp does not light.

d. LOW VOLTAGE POWER SUPPLY. See figure 4-5. The low voltage power supply consists of transformer T1302 and a full wave bridge rectifier comprising diodes CR1301, CR1302, CR1303, and CR1304. Line voltage (115- or 230-VAC) applied to the primary of transformer T1302 is stepped down to 61 VAC in the secondary, rectified by the full wave bridge, and dropped and regulated at 28 VDC ±5% by resistors R1331 and R1332 and diode CR1305. Plus 28 VDC is extended through jack J1 to the proportional oven control and through jack J1305 to the frequency standard unit of the synthesizer (HFS-1 in DDR-5 operation). Plus 28 VDC is further dropped by resistor R1333 and regulated at 6.3 VDC by diode CR1306; 6.3 VDC is extended through jack J1306 to the HFO (V1007) filament.

In addition to their normal function in the full wave bridge rectifier, diodes CR1301 and CR1302 act as a full wave rectifier to supply 32 VDC for the HFO oven heater circuits. Current flow is from ground, through diode CR1302 or diode CR1301, through the center tap of transformer T1302, through resistor R1330 and jack J1306, to the HFO oven heater circuits.

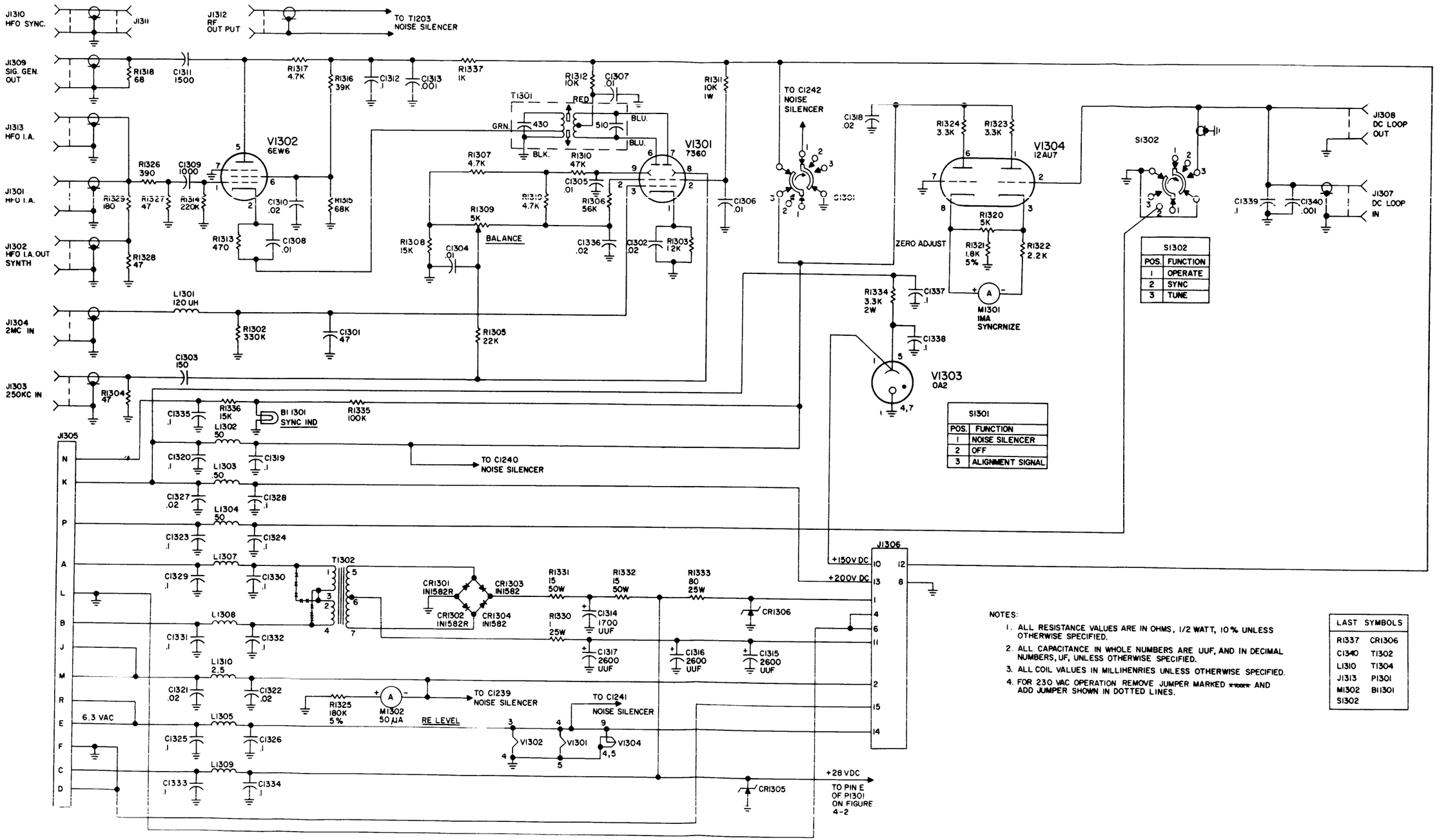


Figure 4-9. HFR-1/C, Schematic Diagram

SECTION 5
TROUBLESHOOTING

5-1. GENERAL

Troubleshooting is the art of locating and diagnosing equipment troubles and maladjustments; the information necessary to remedy the equipment troubles and maladjustments is reserved for Section 6 of this manual under the heading "Maintenance". Refer to the information given in Section 4 the schematic diagram given in Section 8 as additional aids when troubleshooting the HFR-1. Figures 5-1, 5-2, and 5-3 show the locations of the major components of the HFR-1 and should be used to facilitate the location of components during troubleshooting procedures.

5-2. TROUBLESHOOTING SHORT-CUTS

When the HFR-1 has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. In these cases, it is unnecessary to follow a lengthy and orderly course of troubleshooting in order to localize and isolate the faulty part.

A second short-cut in troubleshooting is to ascertain that all tubes are in proper working order, and that the HFR-1 is receiving proper supply voltages. Many times, this simple procedure eliminates further investigation.

A third short-cut is to examine the HFR-1, section by section, for burned out components, charring, corrosion, arcing, excessive heat, dirt, dampness, etc.

It is important to recognize that components may have become defective due to their own weaknesses or to some contributing cause beyond their control.

5-3. VOLTAGE AND RESISTANCE MEASUREMENTS

Nominal tube socket, proportional oven control, and J1 connector voltage measurements are provided in tables 5-1 and 5-2 respectively; tube socket resistance measurements are provided in table 5-3. Large deviations from the nominal values should be carefully investigated. Refer to figures 5-1, 5-2, and 5-3, and to schematic diagram figure 8-1 as aids in locating components and determining the reason for voltage or resistance deviations. Proportional oven control components are accessible only through unit disassembly, and therefore should be tested only as a last resort. The oven and proportional oven control are matched units; if the oven heater element or any component part of the proportional oven control is faulty, both units must be replaced as a matched set. No attempt should be made to replace individual components of either unit.

5-4. TROUBLESHOOTING PROCEDURES

a. LOCALIZING TROUBLES. Table 5-4 outlines a systematic approach for localizing troubles to a functional unit of the HFR-1. Procedures given in table 5-4 assume that there is an input signal, but no output signal for all eight RF bands. If, however, a no-output signal condition is confined to one RF band, table 5-4 should be ignored, and troubleshooting should start with paragraph 5-4, b. In the case of weak or distorted output signals, only the procedures given in paragraphs 5-4, b through 5-4, d and the alignment procedures given in Section 6 need to be used.

Before connecting the power cable to J1305 as indicated in table 5-4, a resistance check should be made in order to prevent unnecessary damage to equipment caused by shorted B+ and AC lines, reduce shock hazard, and circuit failures.

Using Simpson #260 ohmmeter or equivalent, the following resistance to ground measurements should result:

(1) RF Power Plug P1004 disconnected.
Pin "K" = 20K ohms, S1301 on "Alignment Signal"
= 32K ohms, S1301 on "Off"

(2) RF Power Plug P1004 connected.
Pin "K" = 10K ohms, S1301 on "Alignment Signal"
= 27K ohms, S1301 on "Off" and
= 27K ohms, Band switch on band 1, Tune RF tuning from stop-to-stop.

(3) Pin "A" = Infinite (open)

(4) Pin "B" = Infinite (open)

(5) Pin "L" = 0 (short)

(6) Pins "D" & "F" = 0 (short)

(7) Pins "E" & "R" = 0 (short)

(8) Pin "C" = 85 ohms (ohmmeter must be polarized positive).

(9) Pin "N" = 125K ohms, S1301 on "Alignment"
= 145K ohms, S1301 on "Off"

(10) Pin "P" = Infinite, S1302 on "Tune" and "Operate"
= 125 ohms, S1302 on "Sync"

(11) Pins "M" & "J" = 200K ohms (ohmmeter must be polarized negative).

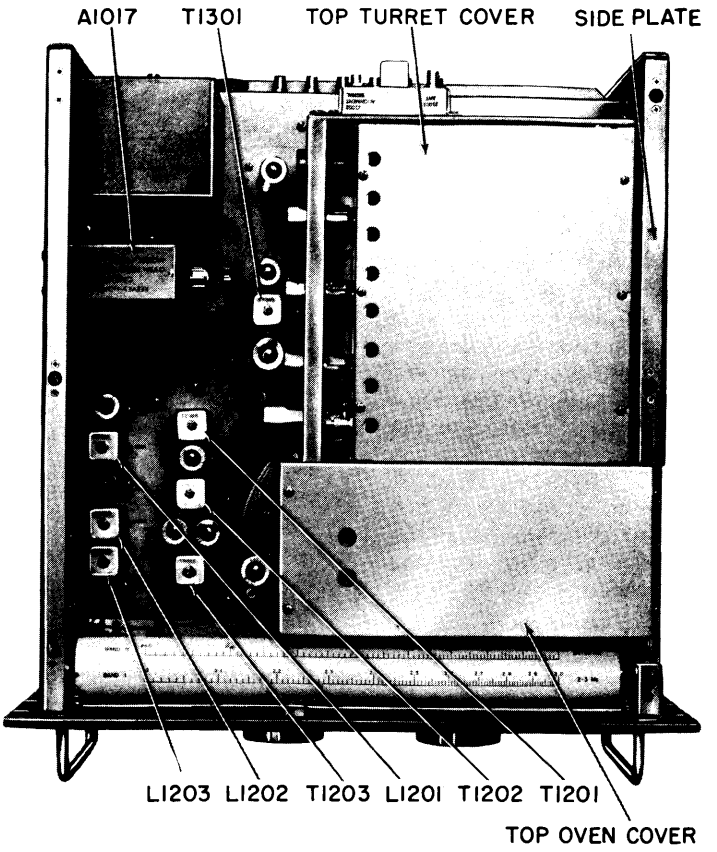


Figure 5-1. HFR-1, Location of Components, Top View

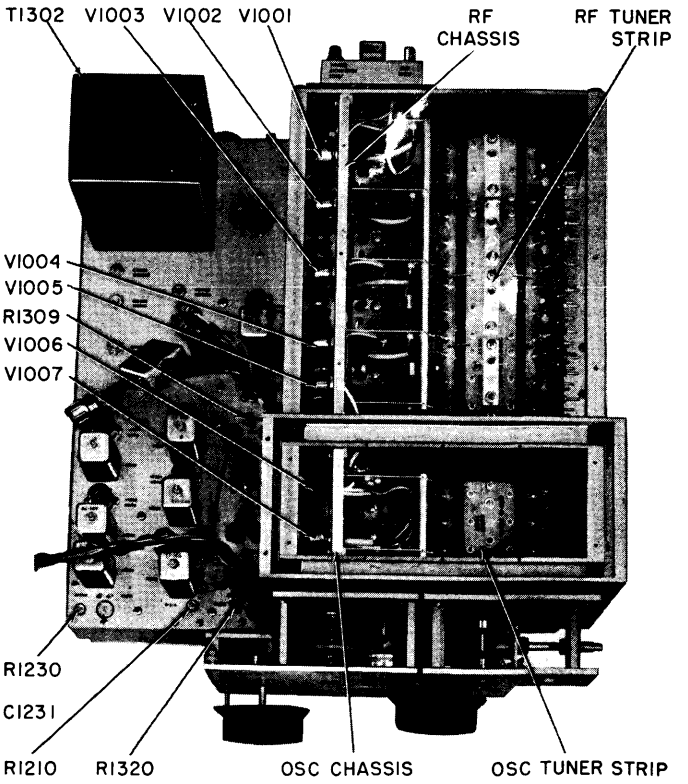


Figure 5-2. HFR-1, Location of Components, Top View W/Turret Cover and Oven Cover Removed

TABLE 5-1. HFR-1, TUBE SOCKET VOLTAGE MEASUREMENTS

TUBE SYMBOL	FUNCTION	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1001 417A	1st RF Amplifier	+118	-	0	+0.43	+0.43	+0.91	+0.43	+0.43	6.3 A-C
V1002 6AH6	2nd RF Amplifier	0	0	0	6.3 A-C	+154	+154	+1.7	-	-
V1003 6BA6	3rd RF Amplifier	+0.3	0	0	6.3 A-C	+159	+97	+0.95	-	-
V1004 6BA6	4th RF Amplifier	+0.2	0	0	6.3 A-C	+155	+107	+0.92	-	-
V1005 6S4A	1st Mixer	-	+10.5	0	6.3 A-C	0	0	-	-	+187
V1006 6AH6	Isolation Amplifier	0	+1.72 (I)	0	6.3 A-C	+140	+140	+1.72 (I)	-	-
V1007 6AB4	HF Oscillator	+112	-	0	+6.3	-1.5 to -2.5 (II)	-1.5 to -2.5 (II)	0	-	-
V1201 6BA6	1.75 MC IF Amplifier	0 (III)	+1.1	6.3 A-C	0	+177	+103	+1.1	-	-
V1202 6BE6	1.75 MC Push-Pull IF	0	+1.45 (IV)	6.3 A-C	0	+180	+83	0	-	-
V1203 6BE6	1.75 MC Push-Pull IF	0	+1.45 (IV)	6.3 A-C	0	+180	+83	0	-	-
V1204 6AH6	1st Noise Silencer Amp.	0	0	0	6.3 A-C	+170	+142	+1.6	-	-
V1205 6AH6	2nd Noise Silencer Amp.	0	0	6.3 A-C	0	+170	+143	+1.6	-	-
V1301 7360	Balanced Modulator	+3.5	+160	0	6.3 A-C	0	+165	+165	+38 (V)	+38 (V)
V1302 6EW6	RF Align. Output	0	+3	6.3 A-C	0	+186 (V)	+120 (V)	0	-	-
V1303 OA2	+150V Voltage Regulator	+150	-	-	0	+150	-	0	-	-
V1304 12AU7	Meter Sync.	+183	0 (VI)	+9.1 (VII)	0	0	-183	0	+9.1 (VII)	6.3 A-C

(I) J1313 terminated 47Ω. (II) After Alignment, Band 1 to 8. (III) At Zero signal. (IV) R1210 Adjusted for balance. (V) R1309 Adjusted for balance, S1301 on Align. Signal. (VI) S1302 on Tune. (VII) R1320 adjusted for balance. 6.3V A-C voltages are ±10%.

TABLE 5-2. HFR-1, PROPORTIONAL OVEN CONTROL VOLTAGE MEASUREMENTS

SYMBOL & TYPE	FUNCTION	EMITTER		BASE		COLLECTOR		DIODES	
		ROOM TEMP.	OVEN TEMP.	ROOM TEMP.	OVEN TEMP.	ROOM TEMP.	OVEN TEMP.	CATHODE	ANODE
Q1 2N338	1st D-C Amplifier	+0.75	+0.75	+0.15	+1.3	+6.9	+3.6		
Q2 2N336	2nd D-C Amplifier	+6.0	+3.6	+6.9	+3.6	+6.8	+15.0		
Q3 2N1701	Driver	+5.3	+3.0	+6.0	+3.6	+5.4	+19.0		
Q4 2N1702	Output	+0.32	+0.17	+5.3	+3.0	+5.4	+19.0		
Q5 2N1702	Output	+0.32	+0.17	+5.3	+3.0	+9.2	+24.0		
CR-1 1N1820	Voltage Regulator							+18.0	0
CR-2 1N758	Voltage Regulator							+9.3	0
CR-3 SG22	Emitter Bias							0	0.75
J1	Connector	Pin A	Pin H	Pin C	Pin E	Pin J	Pin B		
		0	+0.15 to +1.3	+9.3	+28.0	+5.4 to +19.0	+9.2 to +24.0		

Room Temperature = 25°C approx. Voltages taken within the first 2 min. after energizing unit.
Oven Temperature = 72°C to 78°C. Initial setting stabilized to ±1/2°C. Voltages then taken.
All voltages are ±10% and referred to ground.

TABLE 5-3. HFR-1, RESISTANCE MEASUREMENTS

TUBE SYMBOL	TYPE	FUNCTION	SOCKET PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V1001	417A	RF AMP	38K#		0#	440K#	440K#	33#	440K#	440K#	0#
V1002	6AH6	RF AMP	0#	0#	0#	0#	38K#	60K#	200#		
V1003	6BA6	RF AMP	330K#	0#	0#	0#	38K#	60K#	68#		
V1004	6BA6	RF AMP	250K#	0#	0#	0#	38K#	60K#	68#		
V1005	6SA4	MIXER		4.17K#	4.7K#	0#	0#	4.7K#			38K#
V1006	6SA4	ISO. AMP.	47K#	0#	0#	0#	39K#	54K#	180#		
V1007	6AB4	HF. OSC.	47K#	0#	0#	0#	100K#	100K#	0#		
V1201	6BA6	IF AMP	120K	68	FIL	0	6K	25K	68		
V1202	6BE6	IF GATE	47	***	FIL	0	6K	10K	1M		
V1203	6BE6	IF GATE	47	***	FIL	0	6K	10K	1M		
V1204	6AH6	GATE AMP	1.5M	0	0	FIL	6K	25K	150		
V1205	6AH6	GATE AMP	580K	0	FIL	0	7K	25K	150		
V1301	7360	1ST MIXER	1.2K	16K	50	FIL	0	20K	20K	40K	65K
V1302	6EW6	2ND MIXER	220K	470	FIL	0	16K	28K	0		
V1303	OA2	VOLTAGE REGULATOR	13K			0	13K		0		
V1304	12AU7	METER AMP	10K	*	**	0	0	10K	0	**	FIL

CONDITIONS:
1. All Resistances to ground.
2. All power turned off.
3. Measurements taken with Hewlett Packard Model 410 or equivalent.

\# S1301 set at OFF, and S1302 set at TUNE.

* Depends on setting of S1302. Either 0 or 600K.

** Depends on setting of R1320. Between 1.8K and 7K.

*** Depends on setting of R1210. Between 100 and 200 ohms.

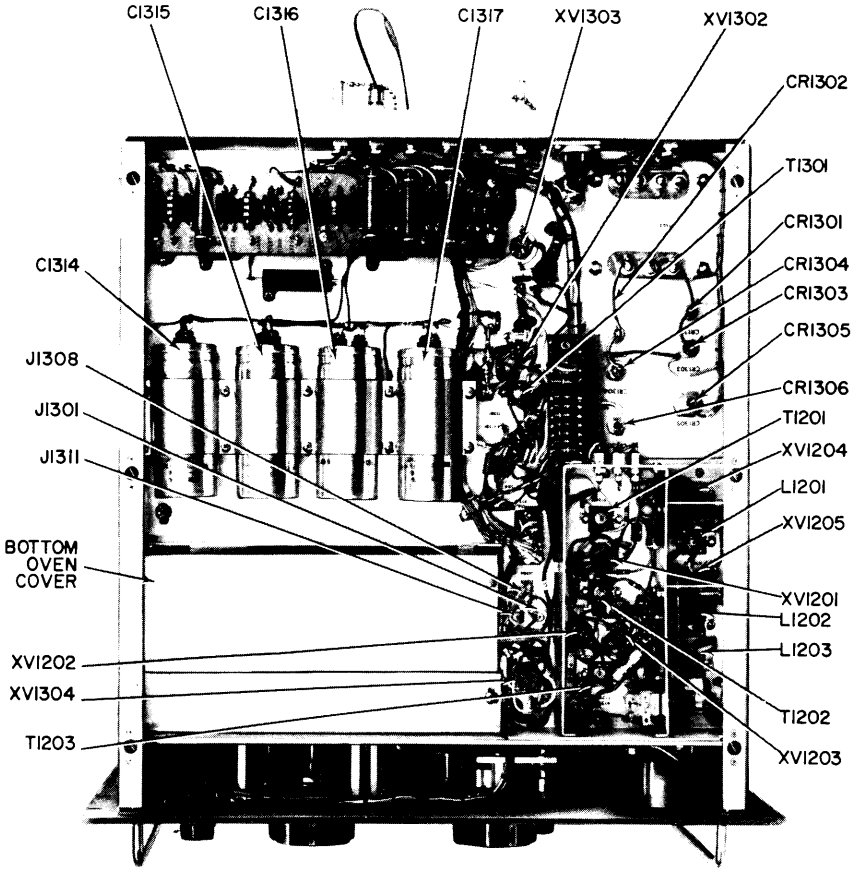


Figure 5-3. HFR-1, Location of Components, Bottom View

TABLE 5-4. SYSTEM TROUBLESHOOTING

STEP	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1	Connect power supply to J1305 of HFR-1.	All tubes should light.	If indication is normal, proceed to step 2. If indication is abnormal, check filament voltage (table 5-1). If filament voltage is incorrect, perform point-to-point voltage and resistance measurements; locate and repair or replace faulty component as required. Replace faulty tubes as required. Remove test equipment and restore HFR-1 to service.
2	Using Signal Generator, Measurements 82 or equivalent, inject a 2 mc unmodulated signal at J1001. Adjust signal generator for 1 MV input signal. Ground AGC of HFR-1, and tune HFR-1 to 2 mc.	Voltmeter reading should be 14.5 MV.	If indication is normal, refer to paragraph 5-4, d. If indication is abnormal, proceed to step 3.

TABLE 5-4. SYSTEM TROUBLESHOOTING (Cont'd)

STEP	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
2 (Cont.)	Using AC voltmeter, Ballantine 314 or equivalent, measure signal voltage across primary of T1201.		
3	With signal generator connected as in step 2, HFR-1 tuned to 2 mc and AGC grounded, measure signal voltage across R1029 with AC voltmeter, Ballantine 314 or equivalent.	Voltmeter reading should be 1.0 V.	If indication is normal, proceed to step 4. If indication is abnormal, proceed to paragraph 5-4, b.
4	With signal generator connected as in step 2, HFR-1 tuned to 2 mc and AGC grounded, measure signal voltage at pin 2 of V1005 with AC voltmeter, Ballantine 314 or equivalent.	Voltmeter reading should be 1.3 V.	If indication is normal (and indication for step 3 is normal), mixer stage is defective. Perform point-to-point voltage and resistance measurements of V1005 circuitry; locate and repair or replace faulty component as required. Remove test equipment and restore HFR-1 to service. If indication is abnormal, refer to paragraph 5-4, c.

b. TESTING RF CHAIN. Proceed as follows:

(1) Connect HFR-1 to power supply (HFP-1) as shown in connection diagram figure 5-4.

(2) Set TUNE/SYNC/OPERATE and NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knobs of HFR-1 to TUNE and OFF respectively.

(3) Connect signal generator and VTVM as shown in connection diagram figure 5-4.

NOTE

When performing step 4, HFR-1 must be tuned very carefully to obtain maximum output.

(4) Tune signal generator and HFR-1 to test frequencies of each RF band as listed in table 5-5. Simultaneously attenuate signal generator for VTVM reading of 1.0 V; input signal voltages should agree with those given in table 5-5.

(5) Use stage-by-stage gain chart figure 5-5 in conjunction with table 5-5 as an aid in locating troubles.

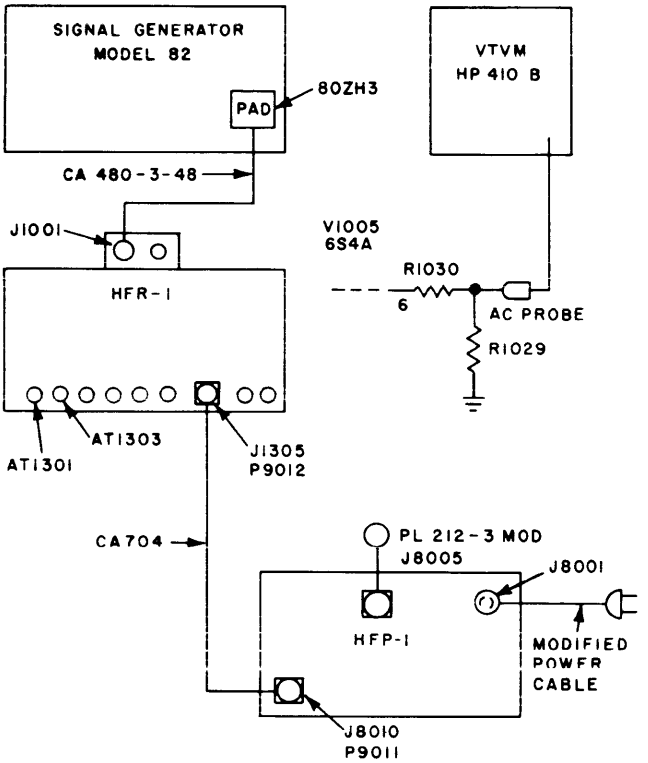


Figure 5-4. Connection Diagram Testing RF Chain

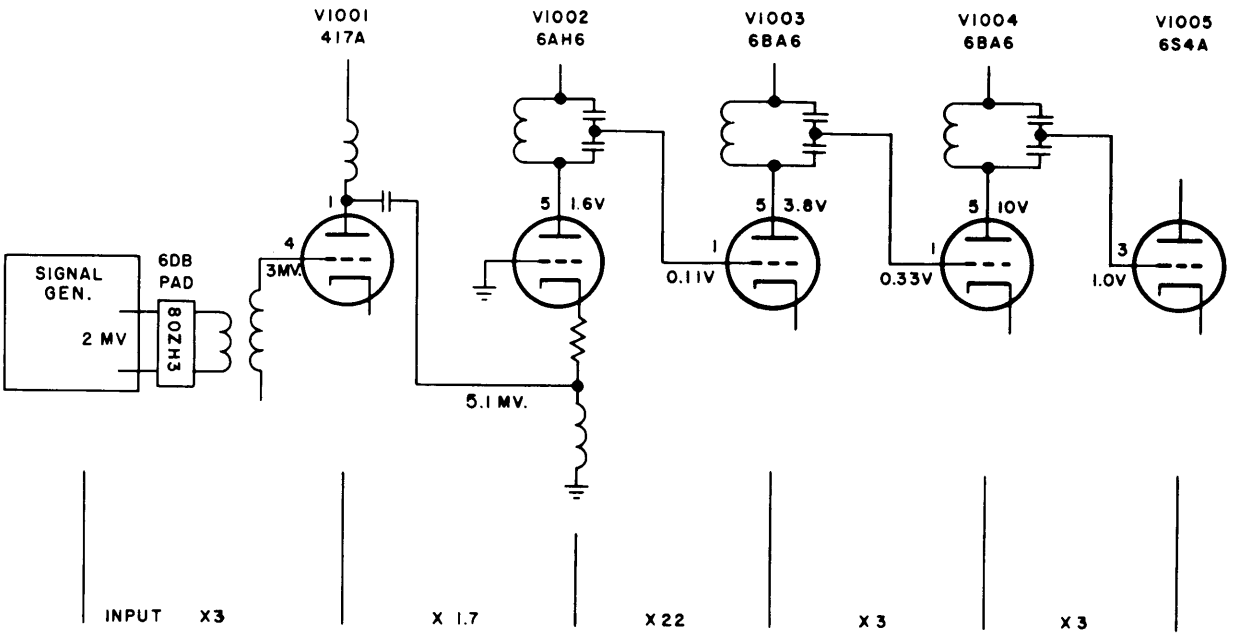


Figure 5-5. Gain of RF Stages

TABLE 5-5. GAIN, RF STAGES

Output shall be 1.0 V (grid 6S4A mixer V1005). Input shall be 1000 μV or less (read pad calibration mark). The gain shall be 1000 or more, exceptions are as shown on table.

BAND	FREQ. MC	μV INPUT LIMITS (FOR 1.0 V OUTPUT)	μV INPUT TYPICAL	TYP. GAINS (FOR REF.)
1	2 3	500 to 1000 450 to 1000	800 500	1250 2000
2	3 4	800 to 1600 500 to 1200	1600 1000	625 1000
3	4 6	500 to 1100 330 to 1000	800 330	1250 3000
4	6 8	500 to 1100 450 to 1000	1090 500	920 2000
5	8 12	500 to 1000 330 to 1000	600 330	1675 3000
6	12 16	500 to 1000 330 to 1000	600 400	1675 2500
7	16 24	500 to 1100 450 to 1000	800 500	1250 2000
8	24 32	450 to 1000 500 to 1300	500 1200	2000 835

c. TESTING OSCILLATOR OUTPUT. Proceed as follows:

(1) Connect power supply to J1305 of HFR-1.

(2) Ensure that input to ANT jack J1001 is zero, or that J1001 is disconnected.

(3) Set TUNE/SYNC/OPERATE and NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knobs at TUNE and OFF respectively.

(4) Tune HFR-1 to frequencies shown in table 5-6, and measure output across R1031, J1313, J1302, and J1310 with VTVM; readings should agree with those given in table.

TABLE 5-6. OSCILLATOR OUTPUT VOLTAGES

Output across R1031 shall be at least 0.75 V and not more than 1.3 V. Output across J1313 shall be at least 0.2 V and not more than 0.5 V. Output across J1302 shall be at least 40 MV and not more than 100 MV. Output across J1310 shall be at least 20 MV and not more than 110 MV.

BAND	DIAL FREQ.	OUTPUT ACROSS					
		R1031 VOLTS	J1313 VOLTS	(AT1302 INSERTED)	J1302 μV	J1310 μV	(AT1301 INSERTED)
1	2	1.25	0.46		92	77	
	2.5	1.25	0.49		96	61	
	3	1.25	0.49		99	50	
2	3	1.0	0.24		48	31	
	3.5	1.1	0.26		51	29	
	4	1.1	0.25		50	24	
3	4	0.9	0.23		44	110	
	5	0.9	0.23		45	84	
	6	0.85	0.21		41	63	
4	6	0.9	0.25		49	45	
	7	0.95	0.24		47	35	
	8	0.9	0.22		43	28	
5	8	0.85	0.30		60	26	
	10	0.85	0.28		56	38	
	12	0.75	0.22		44	54	
6	12	1.0	0.31		62	38	
	14	1.05	0.29		58	29	
	16	1.0	0.25		50	20	
7	16	1.0	0.41		83	86	
	20	1.0	0.43		87	62	
	24	0.95	0.36		74	36	
8	24	0.95	0.39		80	69	
	28	0.95	0.35		73	47	
	32	1.15	0.27		36	30	

d. TESTING IF OUTPUT AMPLIFIER. Proceed as follows:

(1) Connect signal generator to P1201.

(2) Tune signal generator for 1.75 mc unmodulated signal; adjust signal generator for 14.5 MV input signal.

(3) Using AC voltmeter, Ballantine Model 314 or equivalent, check gain of each stage as shown in figure 5-6.

e. TESTING OVEN TEMPERATURE AND STABILITY. Proceed as follows:

CAUTION

BAND control knob must not be turned, during this operation.

(1) Connect power supply to HFR-1, and allow HFR-1 to warm up for 1-1/2 hours. Approximate time required for oven temperature to stabilize is 1-1/2 hours.

(2) Insert thermometer into oven through hole marked "C". Lower thermometer gently until it comes to rest.

(3) Allow sufficient time for thermometer to register oven temperature, and note temperature reading. Oven temperature should be between 72°C and 78°C.

(4) Repeat steps 2 and 3 several times.

(5) Compute average of readings taken in steps 3 and 4; difference between lowest reading and computed average is the oven stability.

(6) Oven stability should be ±0.5°C.

f. CALIBRATION MEGACYCLE DIAL. Proceed as follows:

(1) Connect Electronic Counter, Hewlett Packard Model 524C or equivalent, and power supply (HFP-1) to HFR-1 as shown in connection diagram figure 5-7.

(2) Ensure that input to ANT jack J1001 is zero, or that J1001 is disconnected.

(3) Set TUNE/SYNC/OPERATE and NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knobs of HFR-1 at TUNE and OFF respectively.

(4) Tune HFR-1 to low and high frequencies of each RF band, and note counter indications. MEGACYCLE dial calibration should be as follows:

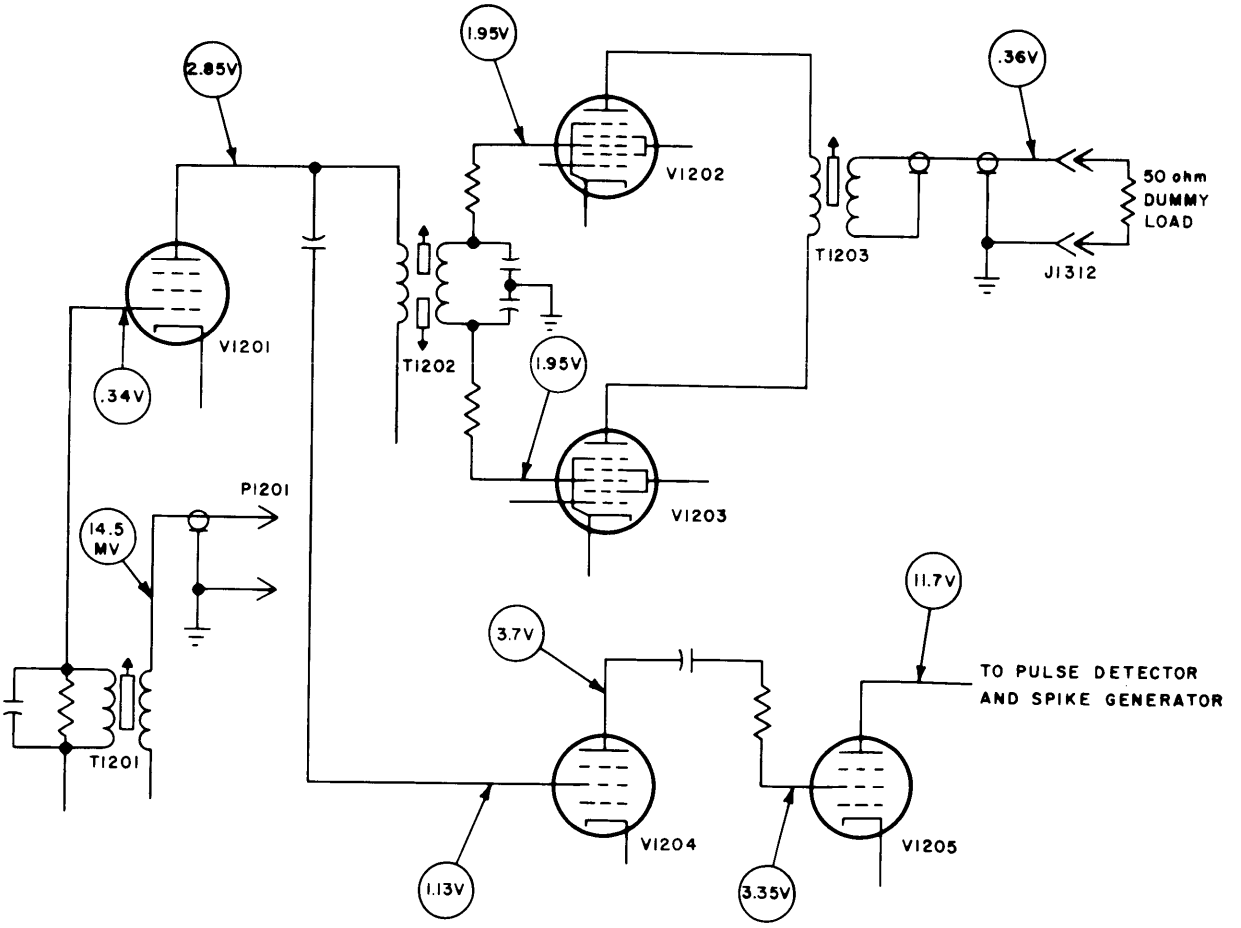


Figure 5-6. Gain of IF Stages

BAND	± TOLERANCE IN Kc/s	± DIAL DIVISION	±% OF △ F
1	10	1	1
2	10	1	1
3	20	2	1
4	20	2	1
5	40	2	1
6	40	2	1
7	80	.8	1
8	80	.8	1

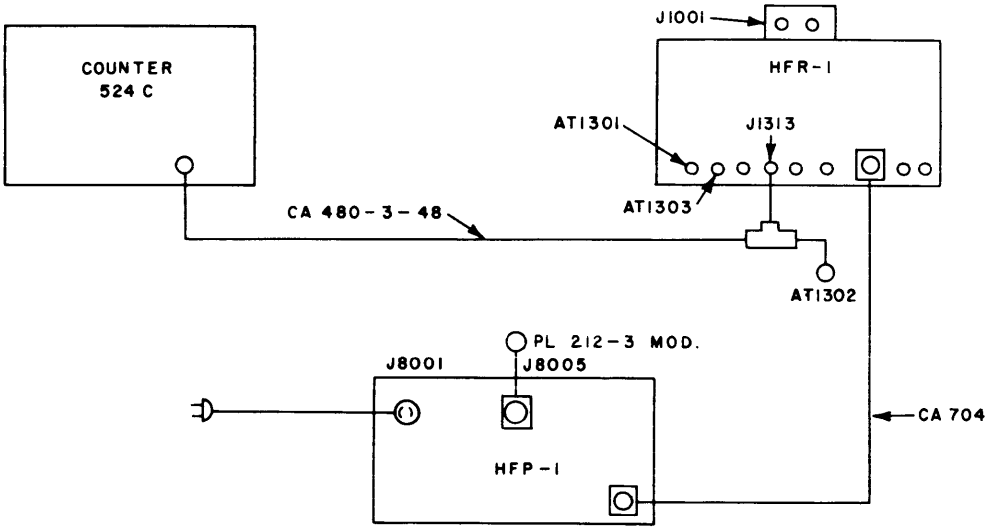


Figure 5-7. Connection Diagram Calibrating MEGACYCLE Dial

SECTION 6
MAINTENANCE

6-1. GENERAL

Maintenance is divided into three categories: operator's maintenance, preventive maintenance and corrective maintenance. Operator's maintenance for the HFR-1 is described in Section 3; preventive and corrective maintenance are included in Section 6. Corrective maintenance consists of information useful in locating and diagnosing equipment troubles and maladjustments, existing or pending, and information necessary to remedy the equipment troubles and maladjustments. Remedial information for corrective maintenance is given in Section 6 whereas the diagnosis of trouble is presented in Section 5.

The HFR-1 has been designed to provide long term trouble-free operation under continuous duty conditions. It is recommended that any necessary maintenance be performed by a competent maintenance technician familiar with radio techniques. Otherwise, advantage may be taken of the required specialized test equipment and personnel trained in its use in the test department of Technical Material Corporation. If trouble develops that cannot be corrected by the procedures outlined in the following paragraphs, it is recommended that the instrument be returned to Technical Material Corporation for servicing. To expedite the return of the serviced equipment to you, it is recommended that the equipment be shipped to us by Air Freight and that we be authorized to return it the same way.

6-2. PREVENTIVE MAINTENANCE

a. GENERAL. In order to prevent failure of the equipment due to corrosion, tube failure, dust, or other destructive elements, it is suggested that a schedule of preventive maintenance be established and adhered to.

b. AT PERIODIC INTERVALS. At periodic intervals (at least every six months), the equipment should be removed from the rack for cleaning and inspection. All accessible covers should be removed and the wiring and all components inspected for dirt, corrosion, charring, discoloring, or grease; in particular, the tube sockets should be inspected for deterioration. Dust may be removed with a soft brush or a vacuum cleaner, if one is available. Remove dirt or grease from electrical parts with trichloroethylene or ethylenedichloride. Remove dirt or grease from other parts with any good dry cleaning fluid.

WARNING

When using trichloroethylene, or carbon tetrachloride, ensure that adequate ventilation exists. These are toxic substances. Avoid prolonged contact with skin.

c. TUBE CHECK. While the HFR-1 is out of the rack with chassis covers removed, it is advisable to check the tubes. All tubes are accessible from the top of the chassis; the oscillator and isolation amplifier tubes are accessible when the oven side button covers are removed.

d. GEARS. Examine the BAND and TUNE gear assemblies contained in the region between the front panel and oven (see figures 6-1 and 6-2). If any of the gears show signs of becoming dry, coat them heavily with a molybdenum disulphide compound such as Molykote-Type G made by the Alpha Corporation of Greenwich, Conn. Recommended time interval is every two years.

e. LOOSE PARTS. Carefully inspect for loose solder connections or screws, especially those on solder lugs. Recommended time interval is every six to twelve months, depending upon the amount of vibration encountered in service.

6-3. CORRECTIVE MAINTENANCE

a. GENERAL. Replacement and alignment procedures are included under the category of corrective maintenance. Replacement is confined to those procedures that are not obvious upon inspection.

b. ALIGNMENT. The procedures presented below are essentially Technical Material Corporation's factory alignment procedures modified for use in the field. Table 6-1 lists the test equipment and special or modified tools required for alignment. Tables 6-2 through 6-7 outline the alignment procedures for each section of the HFR-1. Figure 6-3 locates the alignment controls and adjustments.

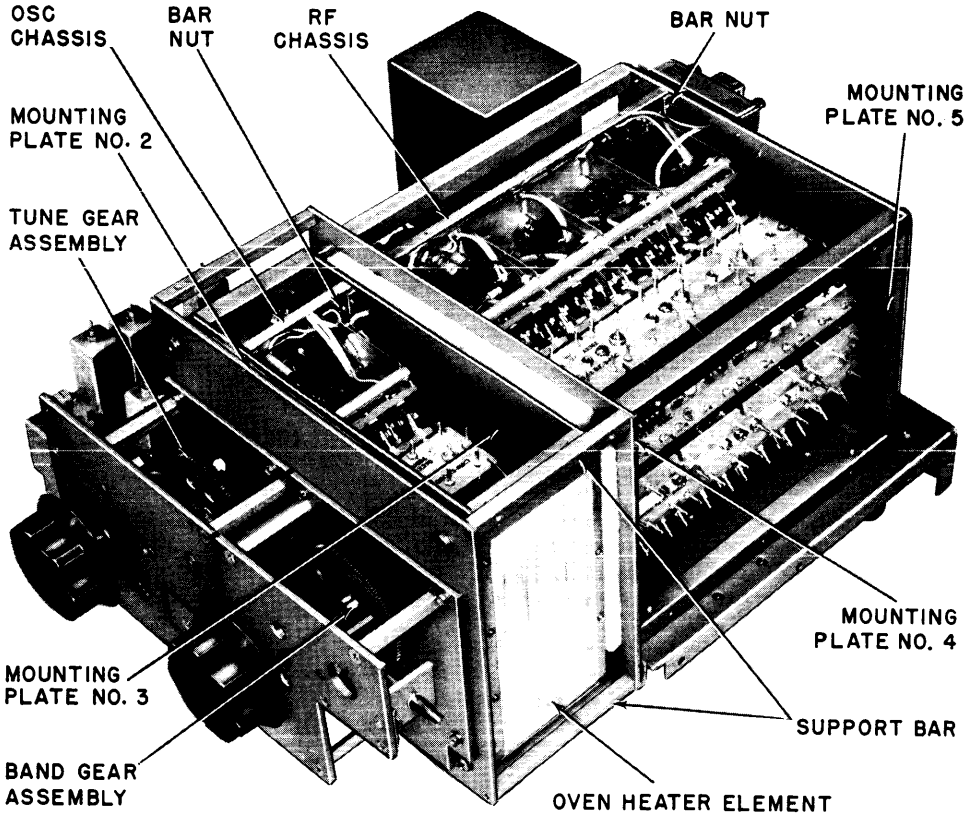


Figure 6-1. HFR-1 Assembly, Front Oblique View

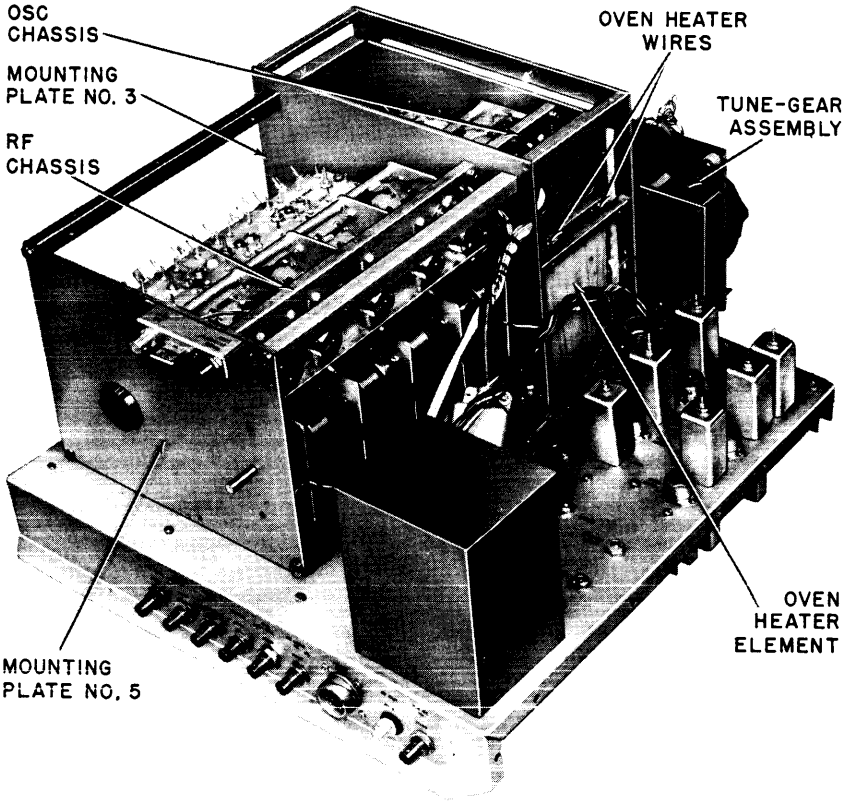
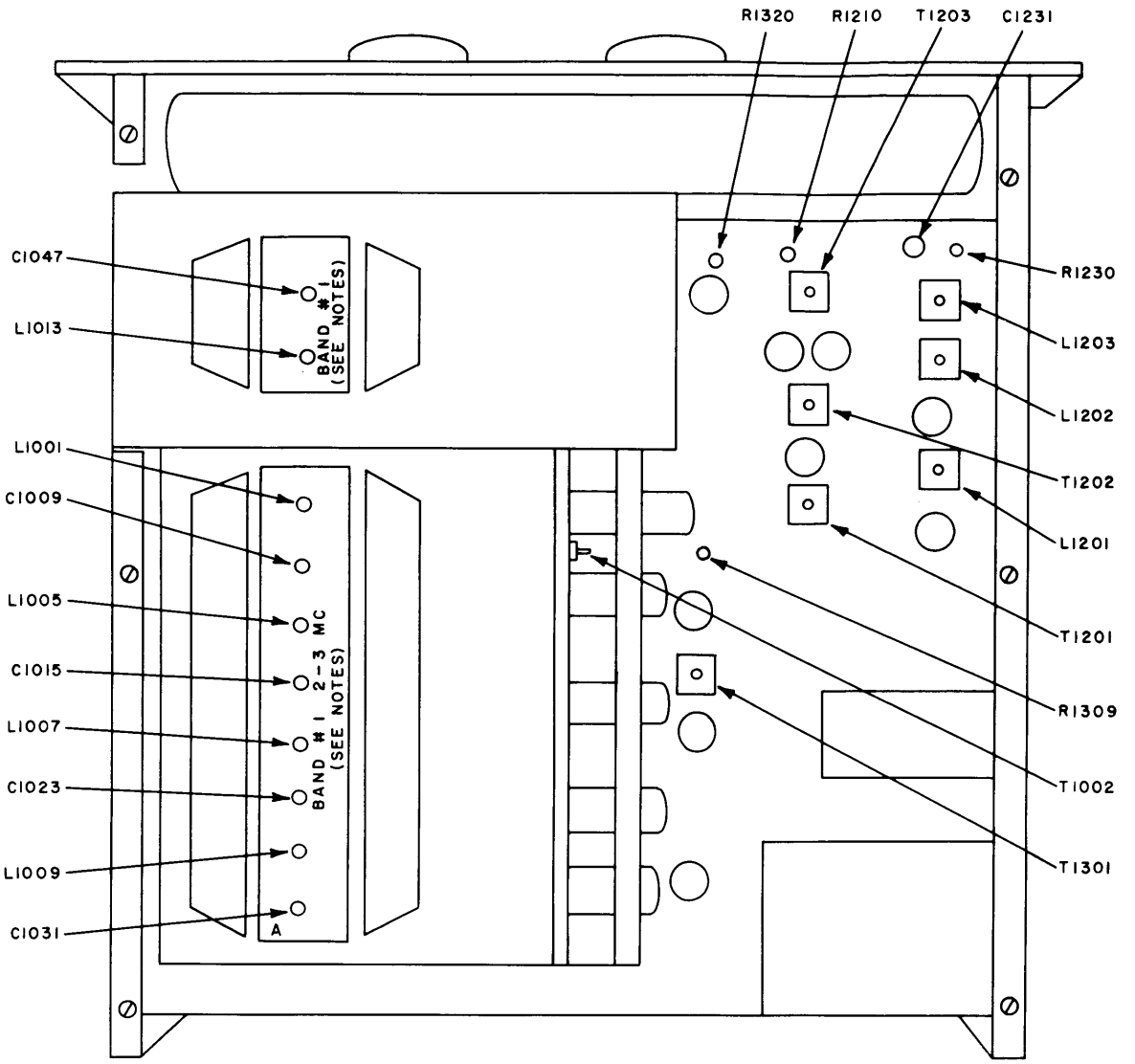


Figure 6-2. HFR-1 Assembly, Rear Oblique View



NOTES

INDUCTORS AND CAPACITORS FOR RF AND OSC. TUNER STRIPS

BAND	#1	#2	#3	#4	#5	#6	#7	#8
RF TUNER STRIP	L1001 C1009 L1005 C1015 L1007 C1023 L1009 C1031	L1014 C1056 L1015 C1059 L1017 C1063 L1019 C1067	L1023 C1076 L1024B C1079 L1025B C1083 L1026B C1087	L1028 C1095 L1029B C1098 L1030B C1102 L1031B C1106	L1033 C1115 L1034B C1118 L1035B C1122 L1036B C1126	L1038 C1134 L1039B C1137 L1040B C1141 L1041B C1145	L1043 C1153 L1044B C1155 L1045B C1160 L1046B C1165	L1048 C1174 L1049B C1176 L1050B C1181 L1051B C1186
OSC TUNER STRIP	L1013 C1047	L1021 C1073	L1053 C1093	L1054 C1113	L1055 C1132	L1042B C1151	L1047B C1172	L1052B C1193

Figure 6-3. Alignment Controls and Adjustments

TABLE 6-1. TEST EQUIPMENT AND SPECIAL OR MODIFIED TOOLS FOR ALIGNMENT

ITEM	MANUFACTURER
A, TEST EQUIPMENT	
Signal generator	Measurements Model 82 or equivalent.
Vacuum Tube Voltmeter with RF probe	Hewlett Packard Model 410B or equivalent.
Multimeter	Simpson Model 260 or equivalent.
Electronic Counter	Hewlett Packard Model 524C for equivalent.
Power Supply (tested)	TMC, Model HFP-1.
Thermometer	Rascher & Betzold #14-4470.
High Sensitivity Oscilloscope	
Pad (for use with signal generator)	Measurements Model 80-2H3
Cable (for use with signal generator)	TMC CA-480-3-48.
Cable (for use with electronic counter)	TMC CA-480-3-48.
Cable (for use with power supply)	TMC CA-704.
Connector Plug (for use with power supply)	TMC PL212-3 modified (strap terminals U and P)
Line cord for AC power (for use with power supply)	CA-696 modified.
47 ohm 1/2 watt resistor	
B, TOOLS	
Alignment tool	TMC TP114
Alignment tool	TMC TP115
3/16" Spintite	Xcelite #HS-6 modified (3/16" hole drilled through plastic handle).
1/4" Spintite	Xcelite #HS-8 modified (3/16" hole drilled through plastic handle).
5/15" Spintite	Xcelite #HS-10 modified (3/16" hole drilled through plastic handle).
1/8" Blade screw driver, 8" long.	Xcelite R188 modified (hollow ground to .013").
Miniature tube puller (7 pin)	Kellems #1116
Noval tube puller (9 pin)	Kellems #1316

TABLE 6-2. ALIGNMENT, RF CIRCUITS

STEP	OPERATION
1.	Connect signal generator and VTVM as shown in figure 6-4.
2.	Tune HFR-1 to 2 mc; set TUNE SYNC OPERATE control knob of HFR-1 to TUNE.
3.	Set signal generator for 2 mc unmodulated signal. Attenuate signal generator for 1V output. **NOTE** When performing step 4, a clear and distinct indication of tuning should result on each stage except the automatic stage (L1001) where the circuit is so broadly tuned that it will appear sluggish. Observe VTVM carefully as the peaking will appear to be very small in amplitude.
4.	Using tool TP115 (figure 6-5, A), tune inductors, L1001, L1005, L1007, and L1009 for maximum output on VTVM, simultaneously reducing signal generator output as needed to maintain approximately 0.5V on VTVM (this keeps circuits from overloading and produces a good indication of peaking).
5.	Tune HFR-1 to 3 mc; set signal generator to 3 mc, and attenuate as required.
6.	Using tool TP114 (figure 6-5, B), tune capacitors C1009, C1015, C1023, C1031 for maximum output; the same conditions as in step 4 will prevail.
7.	Repeat steps 3 through 6 until no further improvement is discernible on VTVM.
8.	Tune HFR-1 and signal generator to low and high frequencies (in that order) of each band, and align each band in accordance with instructions given in steps 3 through 7.

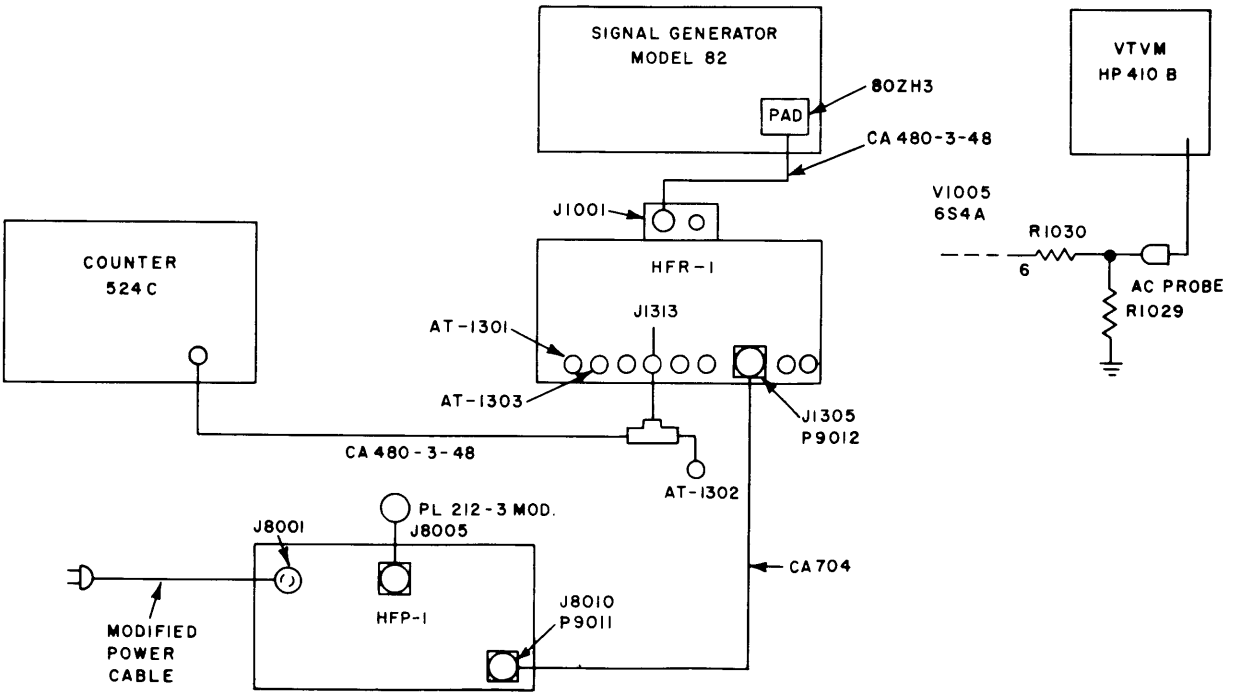
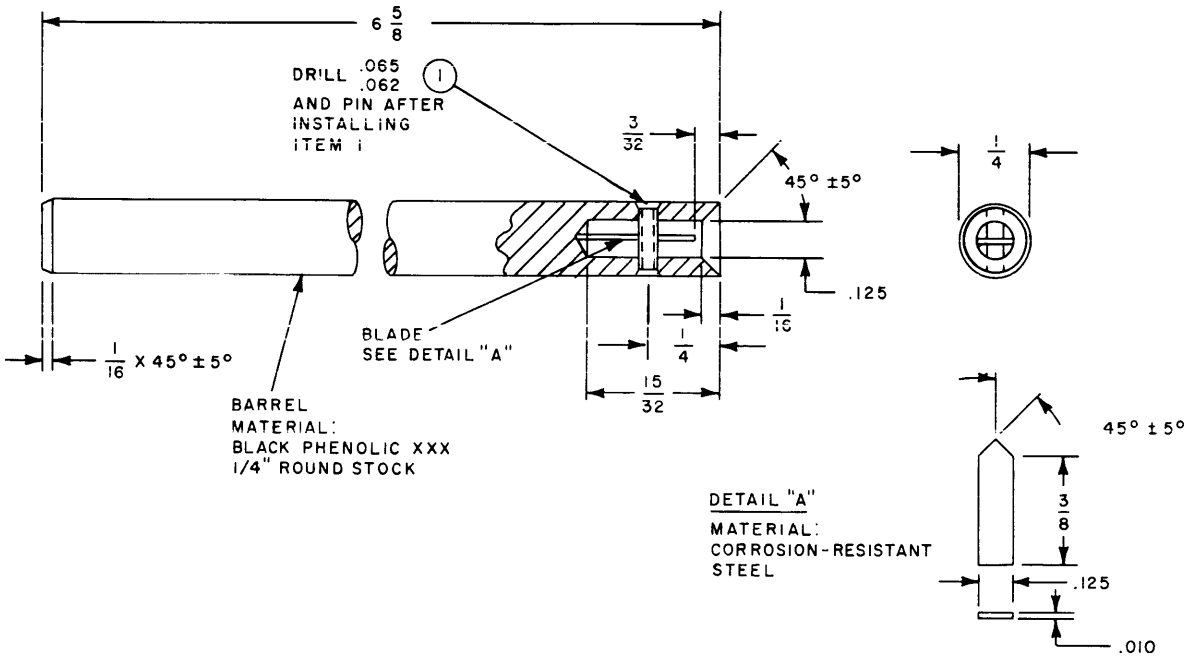
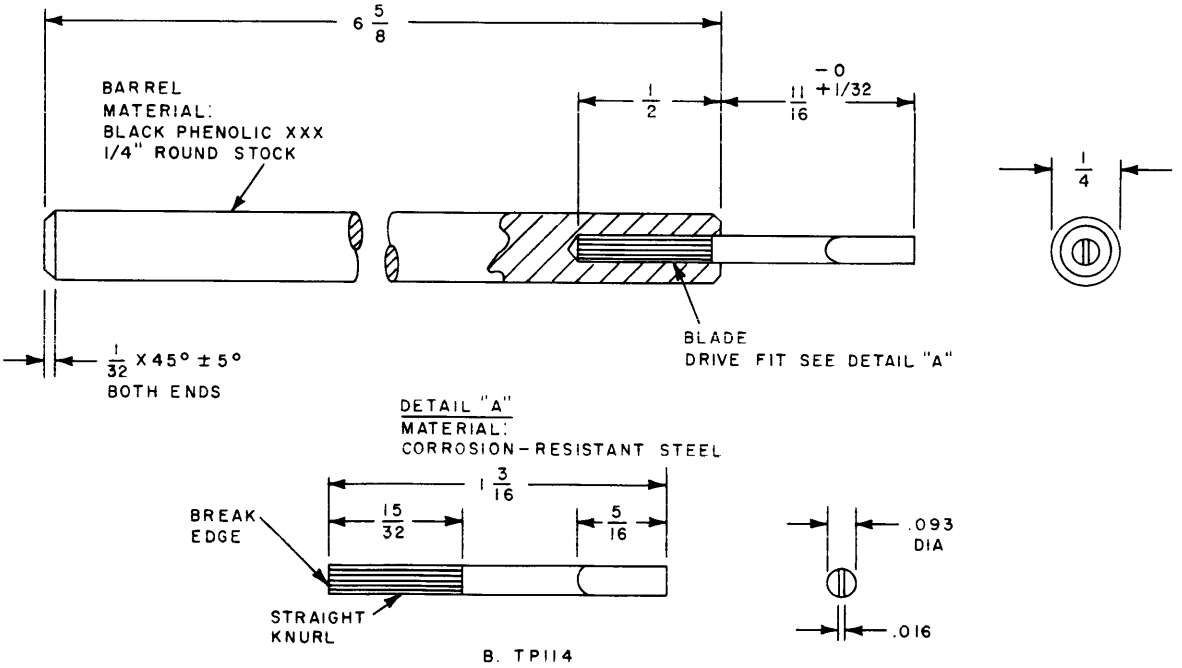


Figure 6-4. Connection Diagram, Aligning RF Chain and HFO



A. TP115



B. TP114

Figure 6-5. Alignment Tools TP114 and TP115

TABLE 6-3. ALIGNMENT, HFO CIRCUITS

<table>
<tr><th>STEP</th><th>OPERATION</th></tr>
<tr><td></td><td>NOTE

If alignment is to be performed as part of troubleshooting procedures, the top oven cover, insulating pad, and inner cover should be removed to afford access to HFO circuitry. P1301 should also be disconnected. Connect power supply to HFR-1 and align the HFO circuits in accordance with steps 2 through 7 of this procedure. When the trouble is cleared, replace the inner cover, insulating pad, and top oven cover, and realign the HFO in accordance with steps 1 through 7. Normal frequency drift is approximately -1.2% of the indicated frequency.</td></tr>
<tr><td>1.</td><td>Connect power supply to HFR-1, and allow HFR-1 to warm up for 1-1/2 hours. Oven temperature should be between 72°C and 78°C and stability must be within 0.5°C. When oven stability is attained, proceed to step 2.</td></tr>
<tr><td>2.</td><td>Connect counter as shown in figure 6-4; signal generator and VTVM should not be connected, and there should be no input to ANT jack J1001.</td></tr>
<tr><td>3.</td><td>Set TUNE/SYNC/OPERATE control knob of HFR-1 at TUNE.</td></tr>
<tr><td>4.</td><td>Tune HFR-1 to 2 mc, and adjust inductor L1013 for indication of 3.7500 mc on counter.</td></tr>
<tr><td>5.</td><td>Tune HFR-1 to 3 mc, and adjust capacitor C1047 for indication of 4.7500 mc on counter.</td></tr>
<tr><td>6.</td><td>Repeat steps 4 and 5 until further adjustment becomes unnecessary.</td></tr>
<tr><td>7.</td><td>Using procedures set fourth in steps 4, 5, and 6, align all bands as indicated below.
<table>
<tr><th>BAND</th><th>ALIGNMENT FREQUENCY</th><th>COUNTER INDICATION</th><th>ADJUSTMENT</th></tr>
<tr><td>1</td><td>2 mc
3 mc</td><td>3.7500
4.7500</td><td>L1013
C1047</td></tr>
<tr><td>2</td><td>3 mc
4 mc</td><td>4.7500
5.7500</td><td>L1021
C1073</td></tr>
<tr><td>3</td><td>4 mc
6 mc</td><td>5.7500
7.7500</td><td>L1053
C1093</td></tr>
<tr><td>4</td><td>6 mc
8 mc</td><td>7.7500
9.7500</td><td>L1054
C1113</td></tr>
<tr><td>5</td><td>8 mc
12 mc</td><td>9.7500
13.7500</td><td>L1055
C1132</td></tr>
<tr><td>6</td><td>12 mc
16 mc</td><td>13.7500
17.7500</td><td>L1042B
C1151</td></tr>
<tr><td>7</td><td>16 mc
24 mc</td><td>17.7500
25.7500</td><td>L1147B
C1172</td></tr>
<tr><td>8</td><td>24 mc
32 mc</td><td>25.7500
33.7500</td><td>L1052B
C1193</td></tr>
</table></td></tr>
</table>

TABLE 6-4. ALIGNMENT, 1.75 MC IF

STEP	OPERATION
1.	Connect signal generator and RF VTVM to pins 3 and 9 respectively of V1005.
2.	Place short jumper between green and white lugs of T1201.
3.	Set signal generator for 1.75 mc unmodulated signal; maintain signal generator output at minimum required for adequate indication of tuning.
4.	Adjust T1002 for maximum indication on meter.
5.	Remove jumper from T1201.
6.	Adjust T1201 for minimum indication on meter. Tighten locknut.
7.	Disconnect RF VTVM from V1005, and connect it to pin 5 of V1201; adjust signal generator output for reading of 1 volt on meter.
8.	Connect short jumper across green lugs of T1202.
9.	Adjust bottom slug of T1202 for maximum indication on meter. Tighten locknut.
10.	Remove jumper and adjust top slug of T1202 for minimum indication on meter. Tighten locknut.
11.	Place 50 ohm dummy load on J1312.
12.	Disconnect RF VTVM from V1201; connect VTVM across dummy load.
13.	Adjust T1203 for maximum indication on meter. Tighten locknut.
14.	Connect DC VTVM to pin 2 of V1202, then V1203; DC voltages should be equal (approximately 1.45 volts). Adjust R1210 until voltages are equal.
15.	Check 3 db bandwidth; it should be approximately ±10 kc at 1.75 mc.
16.	After all other circuits of the HFR-1 have been aligned, repeat T1201, T1202, using the output of the RF turret from J1003, and using the RF LEVEL meter as an indicator.
17.	Remove all test equipment, and restore HFR-1 to service.

TABLE 6-5. ALIGNMENT, NOISE SILENCER

STEP	OPERATION
1.	Connect signal generator and RF VTVM to P1201 and pin 5 of V1201 respectively; adjust signal generator output to provide 1.75 mc signal at 1.0V RMS or 2.8V peak-to-peak VTVM reading. Note signal generator output.
2.	Set NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knob of HFR-1 at NOISE SILENCER.
3.	Arrange VTVM to measure -DC volts and connect it to pin 1 of V1205. Adjust R1230 for mechanical center. Check that signal generator output level is same as that noted in step 1.

TABLE 6-5. ALIGNMENT, NOISE SILENCER (C nt.)

STEP	OPERATION
4.	Adjust L1201 then L1202 for maximum negative voltage and tighten locknuts. Adjustment of L1202 will be broad.
5.	Connect VTVM to pin 5 of V1205; switch to AC range. Adjust R1230 for indication of 10 volts RMS, and tighten locknut.
6.	Connect sensitive VTVM or scope to red lug of L1203; adjust L1203 for minimum indication at 1.75 mc.
7.	Adjust signal generator output for 1.75 mc, 50% to 80% modulated with 1 kc; adjust output level to that noted in step 1.
8.	Connect sensitive scope across 50 ohm dummy load at J1312; carefully adjust C1231 for a notch at crest of modulated signal as shown in figure 6-6, A.
9.	Adjust C1231 until notch just disappears as shown in figure 6-6, B.
10.	Remove test equipment and dummy load; reconnect P1201, and the plug to J1312. Restore HFR-1 to service.

TABLE 6-6. ALIGNMENT, ALIGNMENT SIGNAL GENERATOR

STEP	OPERATION
1.	Remove 2.0 mc input and 250 kc input to J1304 and J1303 respectively.
2.	Connect signal generator and AC voltmeter to J1303 and pin 2 of V1302 respectively.
3.	Set NOISE SILENCER/OFF/ALIGNMENT SIGNAL control knob at ALIGNMENT SIGNAL.
4.	Tune signal generator for 1.75 mc unmodulated signal; use sufficient output for AC voltmeter indication.
5.	Detune T1301 by turning slugs to maximum counterclockwise position.
6.	Adjust top and bottom slugs of T1301 for maximum indication on AC voltmeter; tighten locknuts.
7.	Disconnect signal generator and AC voltmeter from J1303 and V1302; connect signal generator and AC voltmeter to J1304 and pin 3 of V1301 respectively.
8.	Tune signal generator for 2 mc unmodulated signal; use sufficient output so that AC voltmeter indicates approximately 3.0V.
9.	Remove AC voltmeter from V1301, and connect it to unmarked terminal between green and black lugs of T1301.
10.	Adjust R1309 for minimum AC voltmeter indication, decreasing scale of AC voltmeter as required. Tighten locknut.
11.	Remove test equipment, and restore HFR-1 to service.

TABLE 6-7. ALIGNMENT, SYNCHRONIZE METER AMPLIFIER AND LOW VOLTAGE POWER SUPPLY

STEP	OPERATION
	A. SYNCHRONIZE METER AMPLIFIER
1.	Turn S1302 to the "Tune" position.
2.	Adjust R1320 for zero center; tighten locknut.
	B. LOW VOLTAGE POWER SUPPLY
1.	Using VTVM, measure the voltage at CR1305; voltage should be 27 VDC ±1.6V.
2.	Measure the voltage at CR1306; voltage should be 6.5 VDC +0.33V.
3.	Disconnect all test equipment.

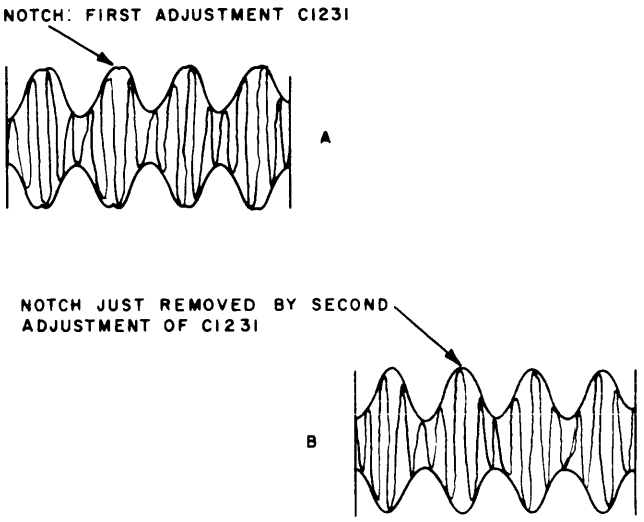


Figure 6-6. Scope Picture, Noise Silencer Alignment

c. REPLACEMENT OF COMPONENTS.

(1) GENERAL. After defective components have been localized and isolated, by the troubleshooting procedures given in Section 5, replacement generally presents no major problems, particularly in the case of non complex electrical and mechanical components. When circuit components of the RF tuner strips or oscillator tuner strips fail, necessary time consuming realignment procedures involved with replacement of singular components makes replacement of the entire tuner strip more practical. When replacing diodes, a long-nosed pliers or similar tool must be used to hold the wire being soldered in order to transfer heat away from the diode junction.

Replacement encompasses removal and installation procedures. However, because installation is accomplished in the reverse order of removal, only the removal procedures are given in this manual.

(2) REMOVAL OF RF CHASSIS. The RF chassis is secured to bar nuts on mounting plates #4 and #5 (see figures 6-1 and 6-7) with four screws, one at each corner of the RF chassis. Proceed as follows:

(a) Remove top turret cover (see figure 5-3) to afford access to RF chassis wiring.

(b) Remove plug P1201 from J1003.

(c) Ensure that all capacitor leads, ground leads, and leads to or from other parts of the main chassis are disconnected and properly tagged or noted.

(d) Remove screws securing RF chassis to bar nuts, and remove RF chassis.

(3) REMOVAL OF OSCILLATOR CHASSIS. The oscillator chassis is secured to bar nuts on mounting plates #2 and #3 (see figures 6-1 and 6-7) with four screws, one at each corner of the oscillator chassis. Proceed as follows:

(a) Remove top oven cover (see figure 5-3), insulating pad, and inner oven cover to afford access to oscillator chassis wiring, mounting screws, and tubes.

(b) Remove oscillator tube V1007 and isolation amplifier tube V1006 from their sockets.

(c) Ensure that capacitor leads, ground leads, and all leads to or from other parts of the main chassis are disconnected and properly tagged or noted.

(d) Remove screws securing oscillator chassis to bar nuts, and remove oscillator chassis by lifting slightly outward and then upward.

(4) REMOVAL OF RF TUNER STRIPS AND OSCILLATOR TUNER STRIPS. RF tuner strips and oscillator tuner strips are mounted on the revolving turret with mounting screws as shown in figure 6-8. Removal is obvious and does not require any special procedure.

(5) REMOVAL OF RF TUNING CAPACITOR AND OSCILLATOR TUNING CAPACITOR. Remove RF and oscillator tuning capacitors as shown in figure 6-7.

(6) REMOVAL OF OVEN HEATER ELEMENT. Refer to figures 6-1 and 6-2, and proceed as follows:

NOTE

The oven heater element and proportional oven control must be replaced as a matched pair.

(a) Remove top oven cover, insulating pad, and inner oven cover.

(b) Remove brace, bottom oven cover, and insulating pad; remove side insulating pads.

(c) Remove side plate (see figure 5-1) to afford access to heater element mounting screws.

(d) Disconnect oven heater wires.

(e) Remove screws securing heater element to mounting plates #2 and #3.

(f) Rotate lower support bars slightly to facilitate removal of heater element.

(g) Slide heater element off mounting plates #2 and #3 from underside of main chassis.

(7) REMOVAL OF BAND AND TUNE GEAR ASSEMBLIES. Figure 6-9 illustrates the mounting of the BAND and TUNE gear assemblies to mounting plate #1. Figures 6-10 and 6-11 illustrate the composition of the BAND and TUNE gear assemblies respectively. Removal of either gear assembly or any component part is accomplished in the reverse order of the assembly procedures given in figures 6-9, 6-10, and 6-11.

(8) REPLACEMENT OF TUNER CABLE. Figure 6-12 provides tuner cable detail. Replacement is accomplished by recabling in accordance with figure 6-12.

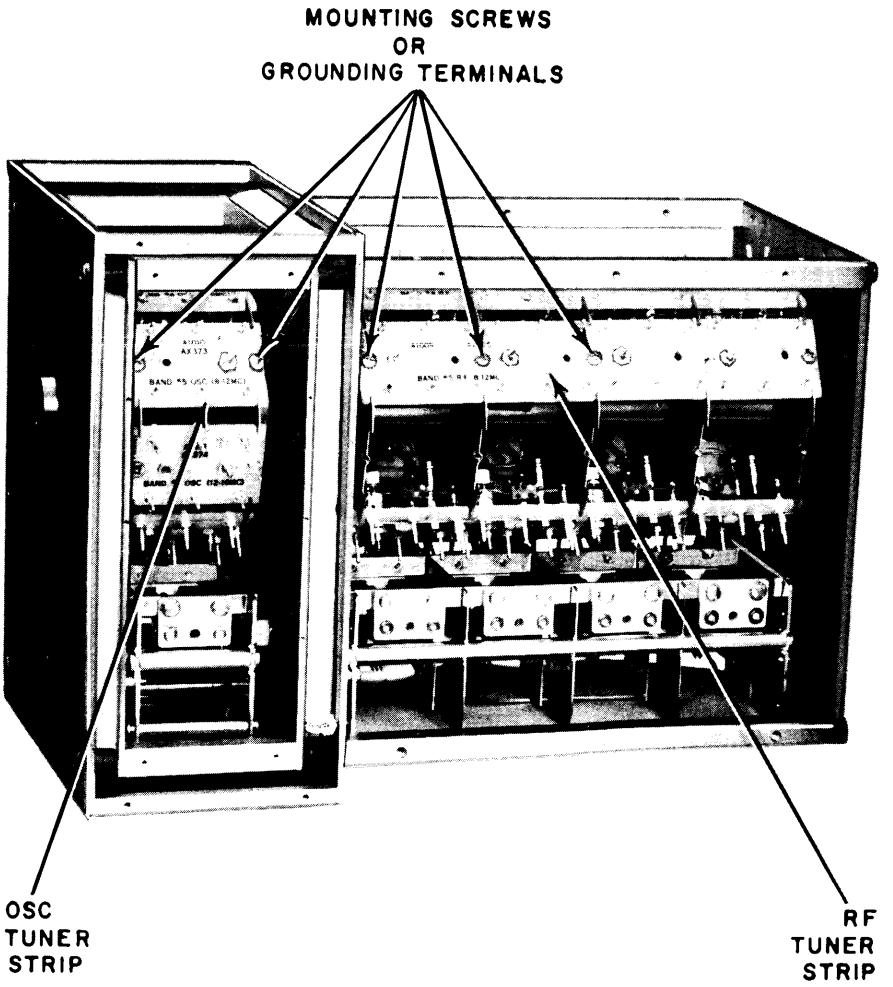
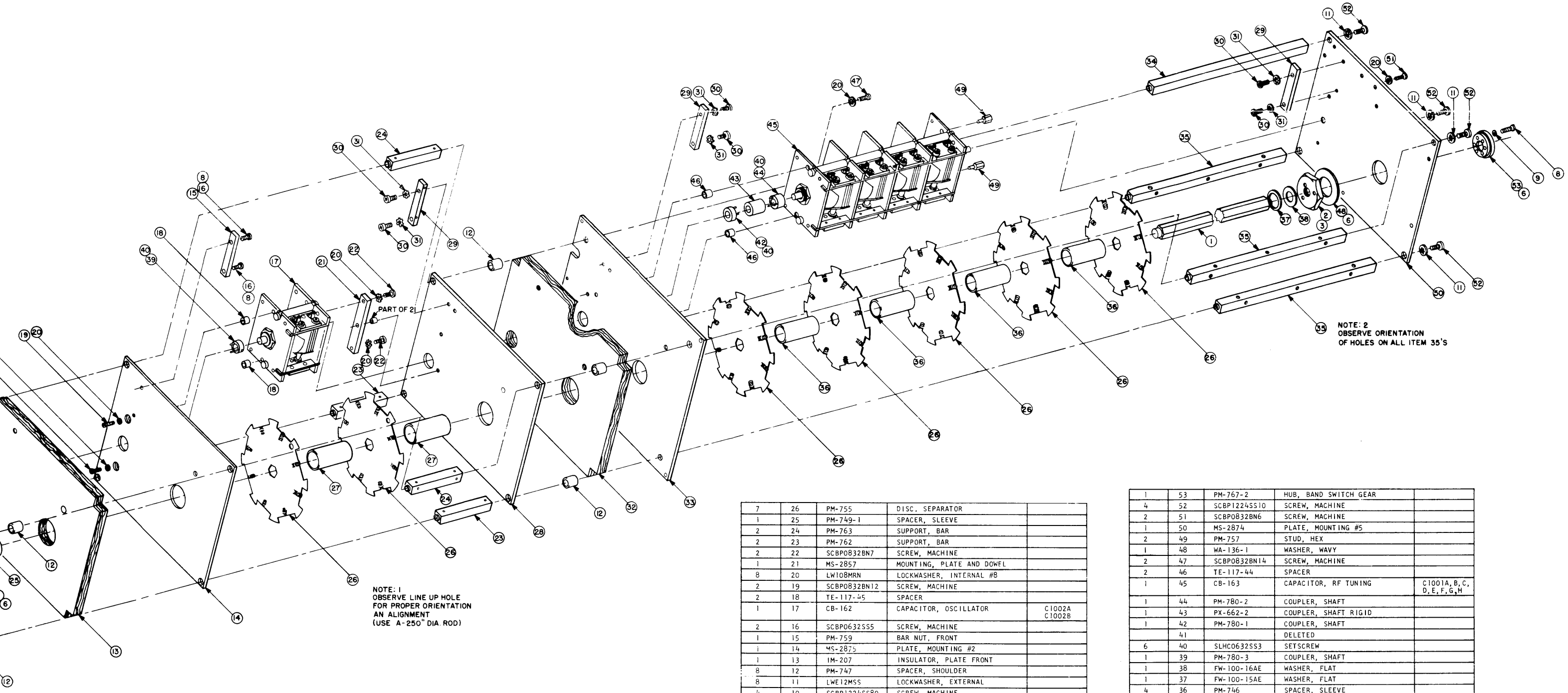


Figure 6-8. RF Tuner Strip and Oscillator Tuner Strip, Installation



REQ'D	ITEM	PART NUMBER	DESCRIPTION	SYMBOL
			LIST OF MATERIAL	
7	26	PM-755	DISC, SEPARATOR	
1	25	PM-749-1	SPACER, SLEEVE	
2	24	PM-763	SUPPORT, BAR	
2	23	PM-762	SUPPORT, BAR	
2	22	SCBP0832BN7	SCREW, MACHINE	
1	21	MS-2857	MOUNTING, PLATE AND DOWEL	
8	20	LW108MRN	LOCKWASHER, INTERNAL #8	
2	19	SCBP0832BN12	SCREW, MACHINE	
2	18	TE-117-45	SPACER	
1	17	CB-162	CAPACITOR, OSCILLATOR	C1002A C1002B
2	16	SCBP0632SS5	SCREW, MACHINE	
1	15	PM-759	BAR NUT, FRONT	
1	14	MS-2875	PLATE, MOUNTING #2	
1	13	IM-207	INSULATOR, PLATE FRONT	
8	12	PM-747	SPACER, SHOULDER	
8	11	LWE12MSS	LOCKWASHER, EXTERNAL	
4	10	SCBP1224SS80	SCREW, MACHINE	
8	9	LWS06MRN	LOCKWASHER, SPRING	
6	8	SCBP0632SS10	SCREW, MACHINE	
1	7	PM-767-1	HUB, BAND SWITCH GEAR	
X	6	GL-114	COMPOUND, SILICONE LUBRICANT	
1	5	WA-136-2	WASHER, WAVY	
1	4	MS-2877	PLATE, MOUNTING #1	
2	3	SLHC832SS6	SETSCREW	
2	2	PM-758	NUT, BEARING	
1	1	PM-753	SHAFT, ROTOR	

REQ'D	ITEM	PART NUMBER	DESCRIPTION	SYMBOL
			LIST OF MATERIAL	
1	53	PM-767-2	HUB, BAND SWITCH GEAR	
4	52	SCBP1224SS10	SCREW, MACHINE	
2	51	SCBP0832BN6	SCREW, MACHINE	
1	50	MS-2874	PLATE, MOUNTING #5	
2	49	PM-757	STUD, HEX	
1	48	WA-136-1	WASHER, WAVY	
2	47	SCBP0832BN14	SCREW, MACHINE	
2	46	TE-117-44	SPACER	
1	45	CB-163	CAPACITOR, RF TUNING	C1001A, B, C, D, E, F, G, H
1	44	PM-780-2	COUPLER, SHAFT	
1	43	PX-662-2	COUPLER, SHAFT RIGID	
1	42	PM-780-1	COUPLER, SHAFT	
	41		DELETED	
6	40	SLHC0632SS3	SETSCREW	
1	39	PM-780-3	COUPLER, SHAFT	
1	38	FW-100-16AE	WASHER, FLAT	
1	37	FW-100-15AE	WASHER, FLAT	
4	36	PM-746	SPACER, SLEEVE	
3	35	PM-750	SUPPORT BAR, PLATE	
1	34	PM-751	SUPPORT BAR, PLATE (TOP LEFT)	
1	33	MS-2872	PLATE, MOUNTING #4	
1	32	IM-208	INSULATOR, PLATE REAR	
6	31	LWE06MRN	LOCKWASHER, EXTERNAL	
6	30	SCBP0632SS7	SCREW, MACHINE	
3	29	PM-761	BAR NUT	
1	28	MS-2876	PLATE, MOUNTING #3	
2	27	PM-749-2	SPACER, SLEEVE	

Figure 6-7. Tuner Frame Assembly, Exploded View

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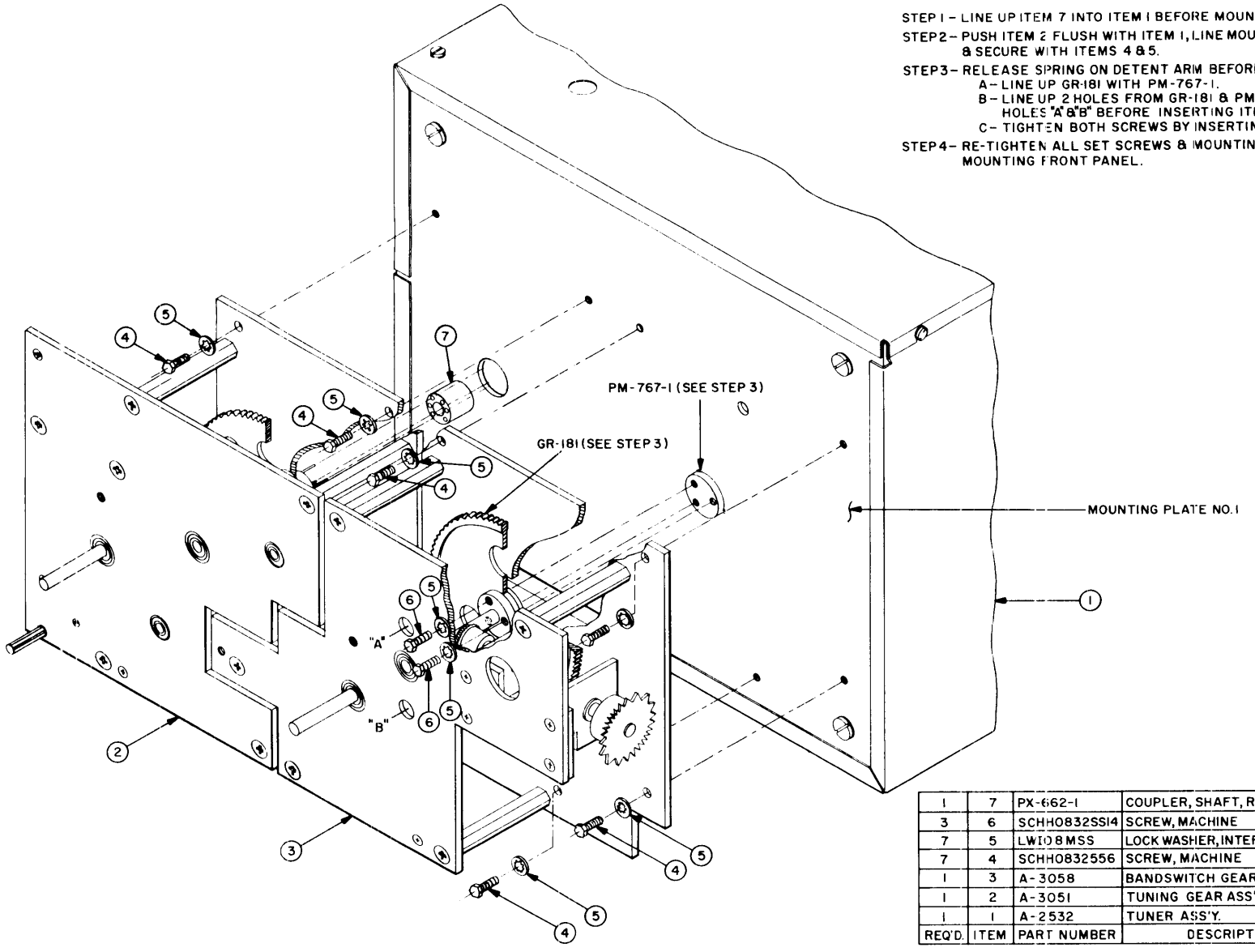
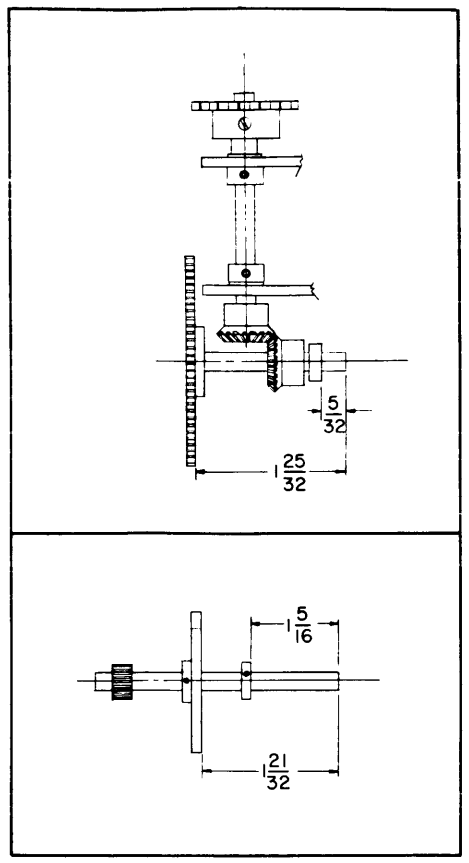


REQ'D.	ITEM	PART NUMBER	DESCRIPTION	SYM.
1	7	PX-662-1	COUPLER, SHAFT, RIGID	
3	6	SCHH0832SS14	SCREW, MACHINE	
7	5	LWI08MSS	LOCK WASHER, INTERNAL TOOTH	
7	4	SCHH0832556	SCREW, MACHINE	
1	3	A-3058	BANDSWITCH GEAR ASS'Y.	
1	2	A-3051	TUNING GEAR ASS'Y.	
1	1	A-2532	TUNER ASS'Y.	

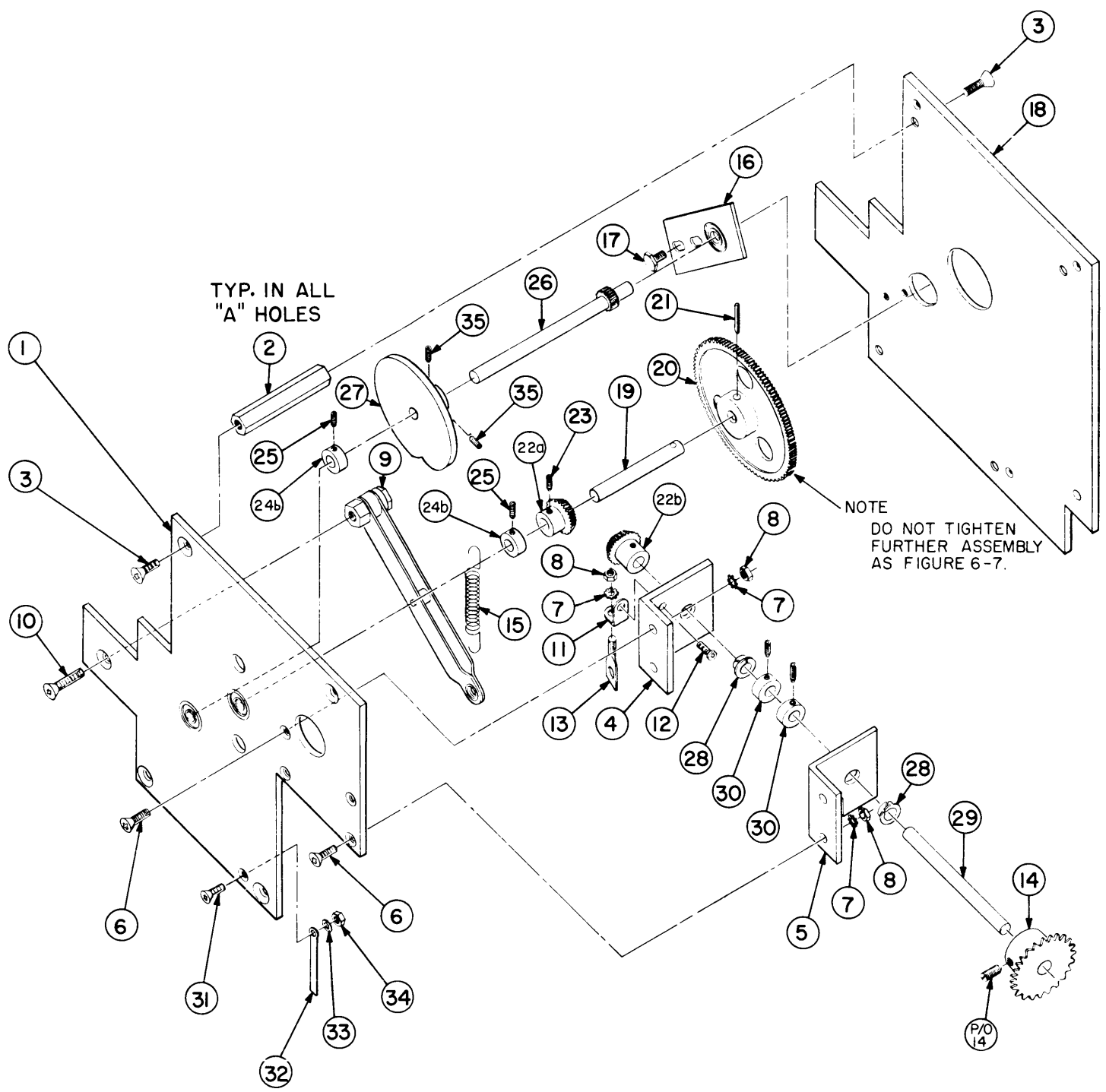
Figure 6-9. BAND and TUNE Gear Assembly Mounting, Exploded View



ASSEMBLY PROCEDURE

GENERAL NOTE - DO NOT TIGHTEN SETSCREWS ON GEARS, CAM AND COLLAR UNTIL INSTRUCTED TO DO SO IN THIS PROCEDURE.

1 - ASSEMBLE ITEM 16 TO ITEM 18.
2 - ASSEMBLE ITEM 2 TO ITEM 1.
3 - ASSEMBLE ITEM 9 TO ITEM 1.
4 - ASSEMBLE ITEM 11 AND 13 TO ITEM 4.
5 - INSERT ITEMS 28 IN ITEM 4 AND ITEM 5.
6 - MOUNT ITEMS 4 AND 5 TO ITEM 1.
7 - ASSEMBLE ITEMS 26, 27 AND $24^{(b)}$ MOUNT ASSEMBLY TO ITEM 1.
8 - ASSEMBLE ITEMS 19, 20 AND 21.
9 - MOUNT ITEMS $24^{(a)}$ $22^{(a)}$ ON 19. MOUNT ASS'Y. TO ITEM 1.
10 - ASSEMBLE ITEMS 29, 30, $22^{(b)}$ AND 14 AS SHOWN.
11 - ASSEMBLE ITEM 18.
12 - ADJUST ITEM 27, FOR PROPER ALIGNMENT WITH ITEM 3, AND SECURE.
13 - SECURE ITEM $24^{(b)}$ FLUSH AGAINST BEARING.
14 - ADJUST ITEM $24^{(a)}$ SO THAT GEARS 20 AND 26 MESH.
15 - SECURE ITEM 16.
16 - MESH GEARS ITEMS $22^{(a)}$ AND $22^{(b)}$ AND SECURE TO RESPECTIVE SHAFTS.
17 - SECURE ITEMS 30 AND 14.
18 - CONNECT ITEM 15 BETWEEN ITEMS 9 AND 13.
19 - ASSEMBLE ITEMS 31 THRU 34.



REQ'D	ITEM	PART NUMBER	DESCRIPTION	SYMBOL
2	35	SLHV0632SS3	SETSCREW (632 THDS)	
1	34	NTH0440SS8	NUT, HEX.	
1	33	LW104MRN	LOCKWASHER, EXT.	
1	32	TE-116-1	LUG	
1	31	SCFP0440SS6	SCREW, MACHINE	
2	30	PM-786-3	COLLAR, SHAFT, MOUNTING	
1	29	PM-792	SHAFT, STRAIGHT	
2	28	BB-117-6	BUSHING, NYLON	
1	27	PM-787	CAM, CONTROL, DETENT	
1	26	GR-186	GEAR, SHAFT PINION	
2	25	SLHV0440SS6	SETSCREW (440 THDS)	
2	24 a & b	PM-785	COLLAR, SHAFT MOUNTING	
4	23	SLHV0632SS4	SETSCREW (632 THDS)	
1 SET	22 a & b	GR-183	GEAR, BEVEL	
1	21	PN-114-2	GROOVE PIN	
1	20	GR-181	GEAR, SPUR	
1	19	PM-774	SHAFT, GEAR MTG.	
1	18	PM-802	PLATE, REAR #1	
2	17	SCHH0832SS3	SCREW, MACHINE	
1	16	MS-2993	PLATE, SHAFT SUPPORT	
1	15	SP-124	EXTENSION SPRING	
1	14	GR-187	SPROCKET, WHEEL	
1	13	SC-106-1	BOLT, SPADE, REGULAR TYPE	
1	12	SCBP0632SS6	SCREW, MACHINE	
1	11	TE-167	LUG, ANGLE, THREADED	
1	10	SCFP0832SS16	SCREW, MACHINE	
1	9	AX-360	DETENT ARM, ASSEMBLY	
5	8	NTH0632SS8	NUT, HEX	
5	7	LWE06MRN	LOCKWASHER	
4	6	SCFP0632SS6	SCREW, MACHINE	
1	5	MS-2992	BRACKET, BEVEL SUPPORT	
1	4	MS-2991	BRACKET, BEVEL SUPPORT	
8	3	SCFP1032SS6	SCREW, MACHINE	
4	2	TE1032AE60H	SPACER, THREADED	
1	1	PM-797	PLATE, FRONT	

LIST OF MATERIAL

Figure 6-10. **BAND Gear Assembly, Exploded View**

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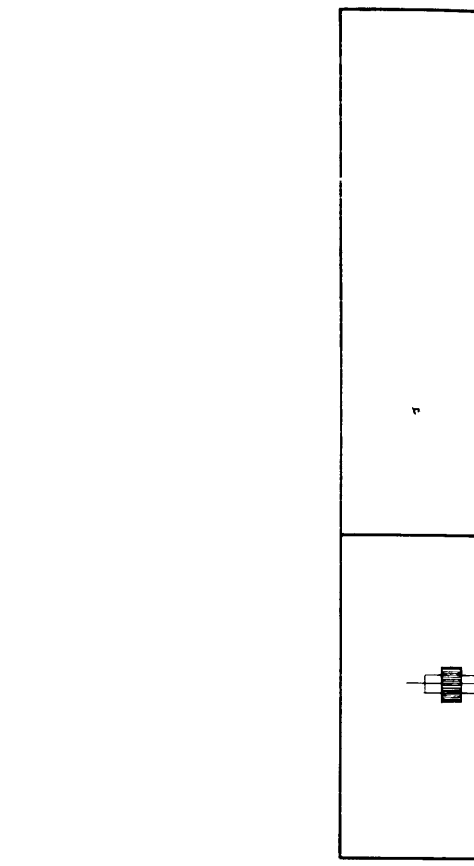
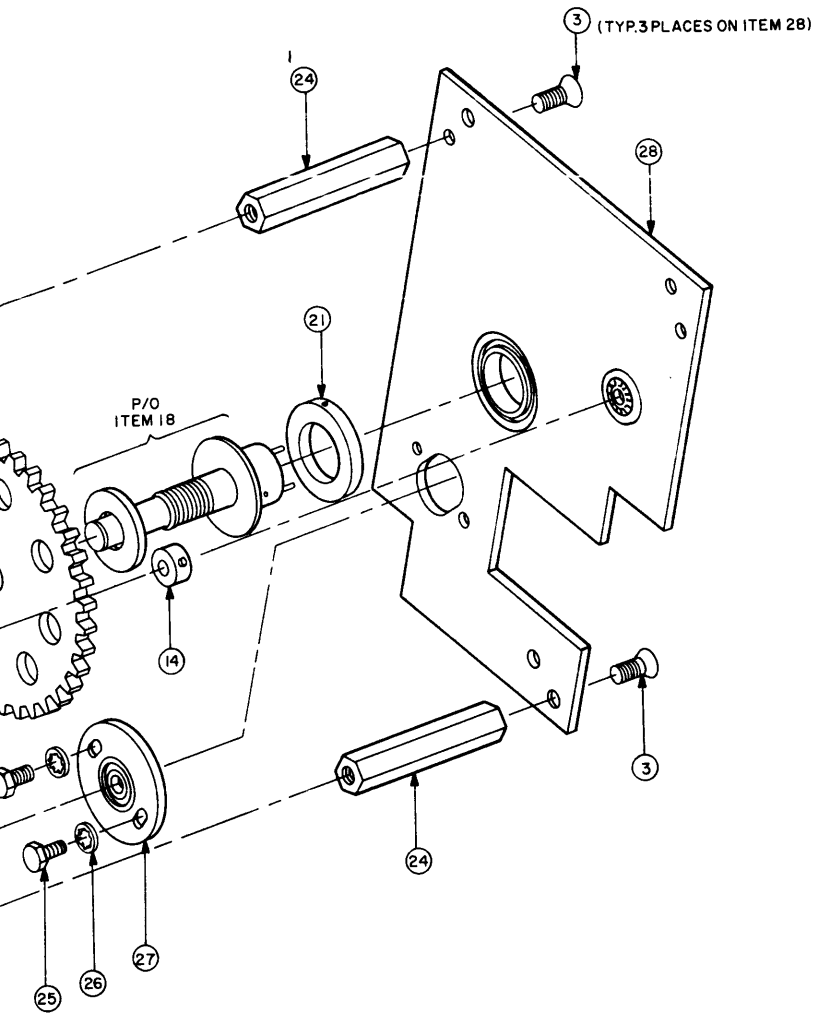
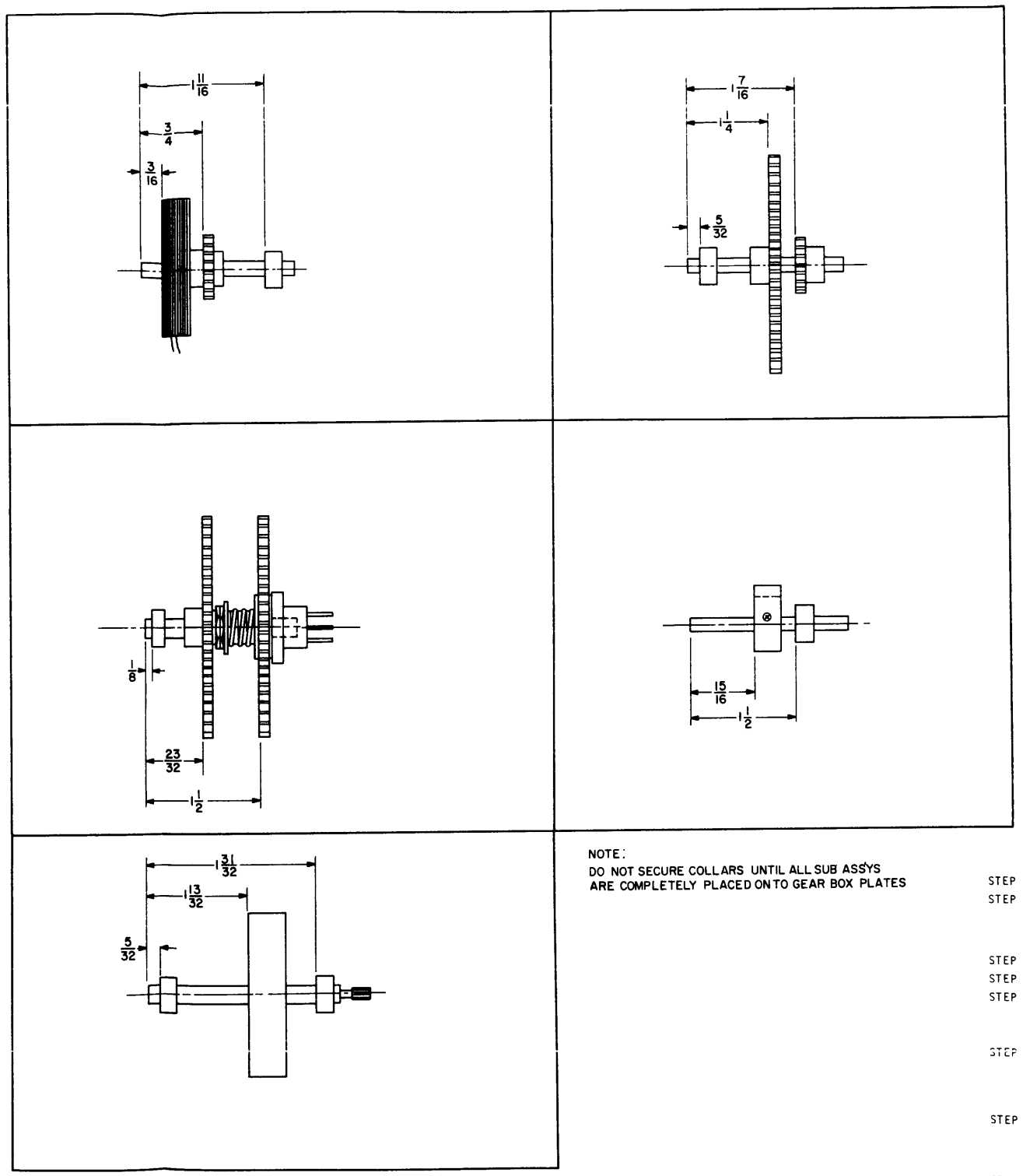


ASSE

GENERAL NOTE - DO NOT TIGHTEN
UNTIL INSTRUCTE

STEP 1 - ASSEMBLE ITEM 16 TO
STEP 2 - ASSEMBLE ITEM 2 TO
STEP 3 - ASSEMBLE ITEM 9 TO
STEP 4 - ASSEMBLE ITEM 11 AN
STEP 5 - INSERT ITEMS 28 IN
STEP 6 - MOUNT ITEMS 4 AND 5
STEP 7 - ASSEMBLE ITEMS 26, 2
STEP 8 - ASSEMBLE ITEMS 19, 2
STEP 9 - MOUNT ITEMS 24(a) 22
STEP 10 - ASSEMBLE ITEMS 29, 3
STEP 11 - ASSEMBLE ITEM 18.
STEP 12 - ADJUST ITEM 27, FOR
AND SECURE.
STEP 13 - SECURE ITEM 24(b) FL
STEP 14 - ADJUST ITEM 24(a) SC
STEP 15 - SECURE ITEM 16.
STEP 16 - MESH GEARS ITEMS 22(
SHAFTS.
STEP 17 - SECURE ITEMS 30 AND
STEP 18 - CONNECT ITEM 15 BETW
STEP 19 - ASSEMBLE ITEMS 31 TH





NOTE:
DO NOT SECURE COLLARS UNTIL ALL SUB ASSYS ARE COMPLETELY PLACED ON TO GEAR BOX PLATES

REQ'D	ITEM	PART NUMBER	DESCRIPTION	SYMBOL
3	37	FW04HSS	FLATWASHER	
1	36	PN-79-.062-12	PIN, ROLL	
1	35	TE-116-1	SOLER, LUG	
2	34	WL-105-50"	WIRE, DIAL INDICATOR	
2	33	NTH0440SS6	NUT, HEX.	
2	32	LWE04MRN	LOCKWASHER, EXT.	
2	31	PX-665	RING, SLIP-ON	
2	30	BB-126-3	BEARING, RACE	
2	29	SCFP0440SS12	SCREW, MACHINE	
1	28	PM-803	PLATE, REAR #2.	
1	27	PM-793	PLATE, SHAFT SUPPORT # 2	
2	26	LW108MRN	LOCKWASHER, INTERNAL	
2	25	SCHH0832SS4	SCREW, MACHINE	
3	24	TE1032AE60H	SPACER, THREADED	
	23		DELETED	
1	22	PO-238	PULLEY, W/HUB	
1	21	PM-791	COLLAR, SLIP, MOUNTING	
1	20	GR-176	GEAR, SPUR W/HUB	
1	19	GR-177	GEAR, SPUR HUBBLES	
1	18	A-3135	CLUTCH, SLIP, ASS'Y	
	17		DELETED	
2	16	GR-178	GEAR, ANTI-BACKLASH	
1	15	GR-179	GEAR, ANTI-BACKLASH	
3	14	PM-786-2	COLLAR, SHAFT	
2	13	PM-804-2	SHAFT, STRAIGHT	
1	12	PM-773	PLATE, FLY WHEEL, SUPPORT	
1	11	AX-377	ADJUSTABLE, LOCK ASS'Y	
2	10	SCFP0256SS6	SCREW, MACHINE	
1	9	RY-148-1	PAD, SLIDE MOUNTING	
1	8	PM-799	SLIDE, WHEEL LOCKING	
1	7	PM-807	HOUSING, WHEEL LOCKING	
3	6	PM-786-3	COLLAR, SHAFT, MOUNTING	
1	5	PM-794	WHEEL, INERTIA	
1	4	GR-185	GEAR, SHAFT, PINION	
12	3	SCFP1032SS6	SCREW, MACHINE	
3	2	TE1032AE61H	SPACER, THREADED	
1	1	PM-798	PLATE, FRONT #2	

LIST OF MATERIAL

ASSEMBLY PROCEDURE

INERTIA WHEEL AND LOCKING ASS'Y

STEP 1 - ASSEMBLE ITEMS 2 AND 24 TO ITEM 1.
STEP 2 - ASSEMBLE ITEM 7 THRU 11 TO ITEM 1.
NOTE: ASSEMBLE PIN OF ITEM 11 AFTER ASSEMBLING TO ITEM 12.
STEP 3 - ASSEMBLE ITEMS 4, 5, AND 6 TO ITEM 1.
STEP 4 - ASSEMBLE ITEM 12.
STEP 4A - ASSEMBLE ITEM 36 TO ITEM 12.

ANTI BACKLASH GEARS

STEP 5 - ASSEMBLE ITEMS 13 THRU 16 TO ITEM 1.
NOTE: SPRING LOAD ITEMS 15 AND 16.

SLIP CLUTCH ASS'Y

STEP 6 - ASSEMBLE ITEM 18 AND 19.
NOTE: ASSEMBLE ITEM 19 BETWEEN (2) TWO CORKWASHERS OF ITEM 18.
STEP 7 - ASSEMBLE ITEMS 17, 6 AND 20 TO ITEMS 18 AND 19.
STEP 8 - ASSEMBLE ITEM 21 TO 18.
STEP 9 - ASSEMBLE STEPS 6, 7 AND 8 TO ITEM 1.

PULLEY

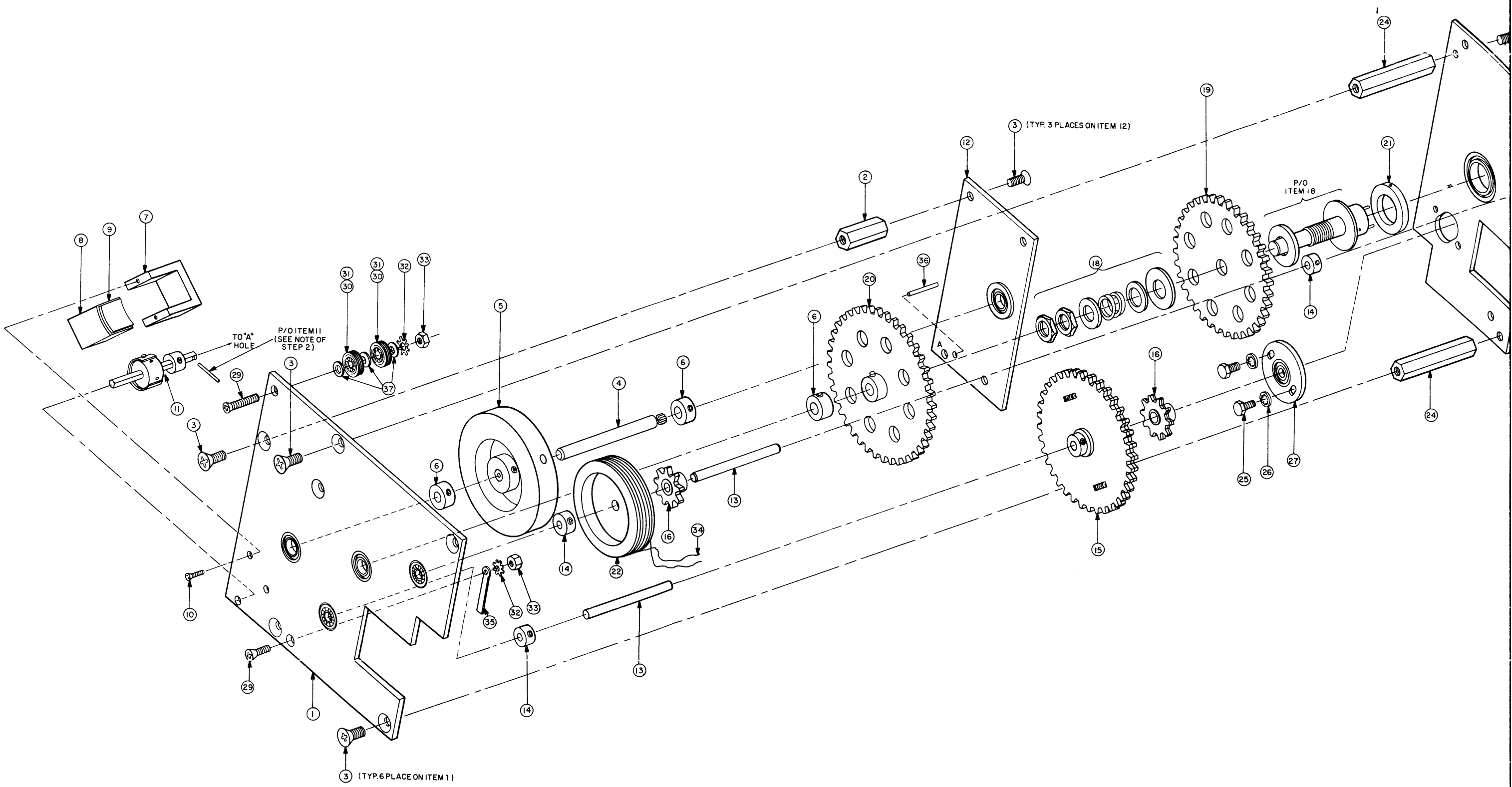
STEP 10 - ASSEMBLE ITEMS 13, 14, 16, 22, AND 34 TO ITEM 1.
NOTE: 1 - SPRING LOAD ITEM 16.
2 - WIND ITEM 34 TO ITEM 22 BEFORE MOUNTING TO ITEM 1.
STEP 11 - ASSEMBLE ITEMS 25, 26 AND 27 TO ITEM 28.
STEP 12 - ASSEMBLE ITEM 28.

CABLE PULLEY

STEP 13 - ASSEMBLE ITEMS 29, THRU 33 AND 37 TO ITEM 1.
STEP 14 - ASSEMBLE ITEMS 23, 32, 33, 35 TO ITEM 1

Figure 6-11. TUNE Gear Assembly Exploded View

004633001A


TO "A" HOLE
P/O ITEM 11 (SEE NOTE OF STEP 2)
3 (TYP. 3 PLACES ON ITEM 12)
P/O ITEM 18
3 (TYP. 6 PLACE ON ITEM 1)

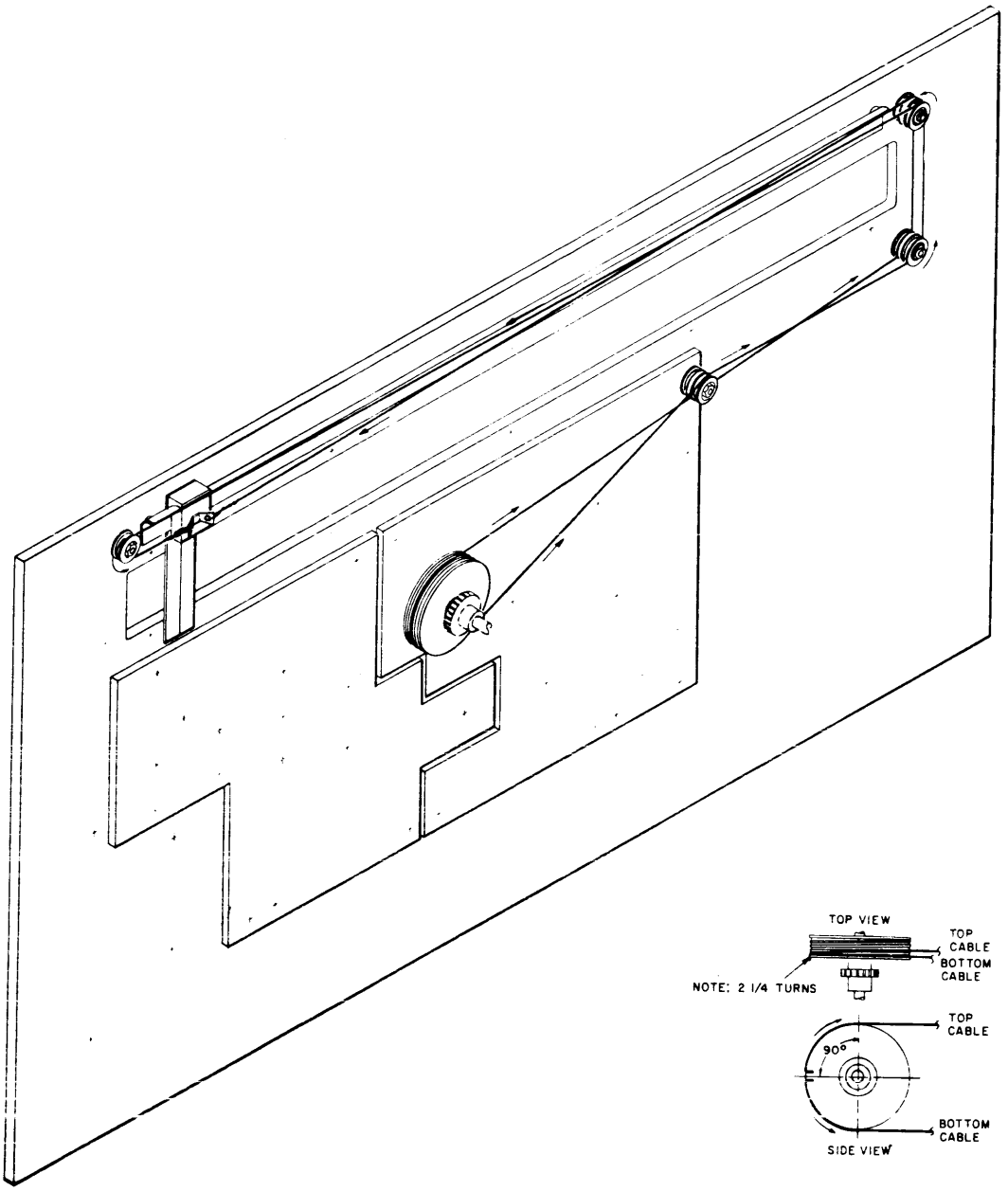


Figure 6-12. Tuner Cable Detail

SECTION 7
PARTS LIST

INTRODUCTION. Reference designations have been assigned to identify all maintenance parts of the equipment. These designations appear on wiring schematics and are marked on the equipment adjacent to the part. The following table lists all maintenance parts and their corresponding designations. The TMC part number is the number by which the part may be ordered.

Revised as of June 1964.

PARTS LIST

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
A1001	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #1: consists of one insulated board, 14 capacitors, symbol no's., C1009, C1010, C1013, C1015, C1016, C1017, C1021, C1023, C1024, C1025, C1030, C1031, C1032, C1033; 3 resistors, symbol no's., R1011, R1018, R1028; 7 coils, symbol no's., L1001, L1004, L1005, L1006, L1007, L1008, L1009; 1 transformer, symbol no., T1001, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-490
A1002	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #1: consists of, one insulated board, 6 capacitors, symbol no's., C1043, C1044, C1045, C1046, C1047, C1054; 2 coils, symbol no's., L1012, L1013; and misc. hardware, wire and sleeving.	Oscillator Tuner Strip	AX-482
A1003	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #2: consists of, one insulated board, 14 capacitors, symbol no's., C1056, C1057, C1058, C1059, C1060, C1061, C1062, C1063, C1064, C1065, C1066, C1067, C1068, C1069; 3 resistors, symbol no's., R1052, R1053, R1054; 7 coils, symbol no's., L1014, L1015, L1016, L1017, L1018, L1019, L1020; 1 transformer, symbol no. T1003, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-491
A1004	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #2: consists of, one insulated board, 6 capacitors, symbol no's., C1070, C1071, C1072, C1073, C1074, C1075; 2 coils, symbol no's., L1021, L1022; and misc. hardware, wire and sleeving.	Oscillator Tuner Strip	AX-483
A1005	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #3: consists of, one insulated board, 14 capacitors, symbol no's., C1076, C1077, C1078, C1079, C1080, C1081, C1082, C1083, C1084, C1085, C1086, C1087, C1088, C1089; 4 coils, symbol no's., L1023, L1024A, B, L1025A, B, L1026A, B, 3 resistors symbol no's R1006, R1021, R1066, 1 transformer, symbol no., T1004, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-492

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
A1006	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #3: consists of, one insulated board, 5 capacitors, symbol no's., C1090, C1091, C1092, C1093, C1094; 2 coils, symbol no's., L1027, L1053; and misc. hardware, wire and sleeving.	Oscillator Tuner Strip	AX-484
A1007	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #4: consists of, one insulated board, 14 capacitors, symbol no's., C1095 thru C1108; 4 coils, symbol no's., L1028, L1029A,B, L1030A,B, L1031A,B; 3 resistors, symbol no's R1056, R1057, R1058; 1 transformer, symbol no. T1005, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-493
A1008	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #4: consists of, one insulated board, 5 capacitors, symbol no's., C1109, C1110, C1112, C1113, C1114, 2 coils, symbol no's., L1032, L1054; and misc. hardware, wire and sleeving.	Oscillator Tuner	AX-485
A1009	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #5: consists of, one insulated board, 14 capacitors, symbol no's., C1115 thru C1128, 4 coils, symbol no's., L1033, L1034A,B, L1035A, B, L1036A, B, 3 resistors, symbol no's.,R1059, R1060, R1061, 1 transformer, symbol no., T1006, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-494
A1010	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #5: consists of, one insulated board, 5 capacitors, symbol no's., C1129, C1130, C1131, C1132, C1133, 2 coils, symbol no's., L1037, L1055; and misc. hardware, wire and sleeving.	Oscillator Tuner Strip	AX-486
A1011	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #6: consists of, one insulated board, 14 capacitors, symbol no's.. C1134. thru C1147; 4 coils, symbol no's. L1038, L1039A,B, L1040A,B, L1041A,B, 3 resistors, symbol no's. R1062, R1063, R1064, 1 transformer, symbol no., T1007, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-496

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
A1012	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #6: consists of, one insulated board, 5 capacitors, symbol no's., C1148, C1149, C1150, C1151, C1152; 1 coil, symbol no., L1042A, B, and misc. hardware, wire and sleeving.	Oscillator Tuner Strip	AX-487
A1013	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #7: consists of, one insulated board, 16 capacitors, symbol no's., C1153, C1154, C1155, C1156, C1157, C1158, C1159, C1160, C1161, C1162, C1163, C1164, C1165, C1166, C1167, C1168, 4 coils, symbol no's., L1043, L1044A, B, L1046A, B, 1 transformer, symbol no., T1008, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-497
A1014	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #7: consists of, one insulated board, 5 capacitors, symbol no's., C1169, C1170, C1171, C1172, C1173; 1 coil, symbol no., L1047A, B, and misc. hardware, wire and sleeving.	Oscillator Tuner Strip	AX-488
A1015	TERMINAL BOARD SUB-ASSEMBLY, RADIO FREQUENCY, BAND #8: consists of, one insulated board, 17 capacitors, symbol no's., C1174, C1175, C1176, C1177, C1178, C1179, C1180, C1181, C1182, C1183, C1184, C1185, C1186, C1187, C1188, C1189, C1196; 4 coils, symbol no's., L1048, L1049A, B, L1050A, B, L1051A, B, 1 transformer, symbol no., T1009, and misc. hardware, wire and sleeving.	RF Tuner Strip	AX-498
A1016	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #8: consists of, one insulated board, 5 capacitors, symbol no's., C1190, C1191, C1192, C1193, C1194; 1 coil, symbol no., L1052A, B, and misc. hardware, wire and sleeving.	Oscillator Tuner Strip	AX-489
A1017	HEATING ELEMENT, ELECTRICAL: operating voltage 10 v to 25 v per leg, 8.4 to 52 watts per leg, .084 amps to 2.08 amps per leg; 6 solder lug type terminals; o/a dim. 7-7/32" x 33/8" x 9.130.	Oscillator heater	RR-131

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
A1301	OVEN, PROPORTIONAL CONTROL: power source, +32v unregulated. +28v regulated, 4 amperes; temperature requirements, 0 to 50 ambient, 72 initial setting, ±1/2 C stability; This item must be purchased as a matched set with RR-131 heater (see HFR-1/T Spare Parts List)	Oven Temperature Control	PO-240
C1001 A, B, C, D, E, F, G, H	CAPACITOR, RADIO FREQUENCY, TUNING: Sect. 1A, 8.5 uuf to 60.62 uuf; sect. 1B, 11.5 uuf to 115.70 uuf; sect. 2A, 3A, 4A, 8.5 uuf to 60.62 uuf; sect. 2B, 3B, 4B, 11.5 uuf to 115.70 uuf; ±1 uuf ±1%; 500 VDCW.	RF Tuning	CB-163
C1002 A, B	CAPACITOR, OSCILLATOR, TUNING: sect. 1A, 8.5 uuf to 60.62 uuf; sect. 1B, 11.5 uuf to 115.70 uuf; ±1 uuf ±1%; 500 VDCW.	HF Oscillator Tuning	CB-162
C1003	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV: 500 VDCW.	Bypass	CC-100-16
C1004	Same as C1003.	RF Bypass	
C1005	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +60% -40%; 150 VDCW.	Cathode Bypass	CC-100-35
C1006	Same as C1003.	Grid Coupling	
C1007	Same as C1003.	Coupling	
C1008	Same as C1003.	Bypass	
C1009	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	
C1010	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Fixed Tuning	
C1011	Same as C1003.	Screen Bypass	
C1012	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 uuf, GMV: 500 VDCW.	Cathode Bypass	CC-100-15
C1013	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Bypass	
C1014	Same as C1003.	Bypass	
C1015	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	
C1016	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Grid Tap	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1017	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Grid Tap	
C1018	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100 uuf, GMV; 500 VDCW.	Bypass	CC-100-29
C1019	Same as C1003.	Screen Bypass	
C1020	Same as C1012	Cathode Bypass	
C1021	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Bypass	
C1022	Same as C1003.	Bypass	
C1023	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	
C1024	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Grid Tap	
C1025	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Grid Tap	
C1026	Same as C1018.	Bypass	
C1027	Same as C1003.	Screen Bypass	
C1028	Same as C1012.	Cathode Bypass	
C1029	Same as C1003.	Bypass	
C1030	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Bypass	
C1031	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	
C1032	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Grid Tap	
C1033	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Grid Tap	
C1034	CAPACITOR, FIXED, MICA DIELECTRIC: 2000 uuf, ±2%; 500 VDCW.	Fixed IF Tuning	CM112F202G5S
C1035	CAPACITOR, FIXED, ELECTROLYTIC: tantalum; 50 uf, +50% -15%; 60 VDCW. polarized, tubular case.	Bypass	CE-107-1
C1036	Same as C1018.	Cathode Bypass	
C1037	Same as C1005.	Bypass	
C1038	Same as C1003.	Mixer Coupling	
C1039	Same as C1003.	Screen Bypass	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1040	Same as C1003.	Cathode Bypass	
C1041	Same as C1003.	Bypass	
C1042	CAPACITOR, FIXED, MICA DIELECTRIC: 1000 uuf, ±2%; 500 VDCW.	HFO Coupling	CM112F102G5S
C1043	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	Osc. Tracking	
C1044	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	Osc. Feedback Tap	
C1045	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	Osc. Feedback Tap	
C1046	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	Osc. Grid Tap	
C1047	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	HFO Trimmer	
C1048	CAPACITOR, FIXED, MICA DIELECTRIC: 22 uuf, ±5%; 500 VDCW.	Varicap Limiter	CM15C220J
C1049	CAPACITOR, VOLTAGE VARIABLE, SILICON: 14-120 uuf range; hermetically sealed glass to metal; 50 VDCW.	Varicap	CX-106-12
C1050	Same as C1034.	Bypass	
C1051	CAPACITOR, VOLTAGE VARIABLE, SILICON: 7-70 uuf range; hermetically sealed glass to metal; 65 VDCW.	Varicap	CX-106-11
C1052	Same as C1003.	Varicap Bypass	
C1053	CAPACITOR, FIXED, MICA DIELECTRIC: 10 uuf, ±10%; 500 VDCW.	Varicap Limiter	CM15B100K
C1054	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	HFO Coupling	
C1055	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +80% -20%, 500 VDCW.	Bypass	CC-100-24
C1056	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	
C1057	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Fixed RF Tuning	
C1058	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Bypass	
C1059	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1060	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Grid Tap	
C1061	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Grid Tap	
C1062	Non-replaceable Item, Part of Symbol A1003, Part No AX-491.	Bypass	
C1063	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	
C1064	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Grid Tap	
C1065	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Grid Tap	
C1066	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Bypass	
C1067	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	
C1068	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Grid Tap	
C1069	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Grid Tap	
C1070	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	Osc. Tracking	
C1071	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	Osc. Feedback Tap	
C1072	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	Osc. Feedback Tap	
C1073	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	HFO Trimmer	
C1074	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	Osc. Grid Tap	
C1075	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	HFO Coupling	
C1076	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Trimmer	
C1077	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Fixed RF Tuning	
C1078	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Bypass	
C1079	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Trimmer	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1080	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Grid Tap	
C1081	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Grid Tap	
C1082	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Bypass	
C1083	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Trimmer	
C1084	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Grid Tap	
C1085	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Grid Tap	
C1086	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Bypass	
C1087	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Trimmer	
C1088	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Grid Tap	
C1089	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Grid Tap	
C1090	Non-replaceable Item, Part of Symbol A1006, Part No. AX-484.	Osc. Feedback Tap	
C1091	Non-replaceable Item, Part of Symbol A1006, Part No. AX-484.	Osc. Feedback Tap	
C1092	Non-replaceable Item, Part of Symbol A1006, Part No. AX-484.	Osc. Grid Tap	
C1093	Non-replaceable Item, Part of Symbol A1006, Part No. AX-484.	HFO Trimmer	
C1094	Non-replaceable Item, Part of Symbol A1006, Part No. AX-484.	HFO Coupling	
C1095	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Trimmer	
C1096	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Fixed RF Tuning	
C1097	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Bypass	
C1098	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Trimmer	
C1099	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Grid Tap	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1100	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Grid Tap	
C1101	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Bypass	
C1102	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Trimmer	
C1103	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Grid Tap	
C1104	Non-replaceable Item. Part of Symbol A1007, Part No. AX-493.	Grid Tap	
C1105	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Bypass	
C1106	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Trimmer	
C1107	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Grid Tap	
C1108	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Grid Tap	
C1109	Non-replaceable Item. Part of Symbol A1008, Part No. AX-485.	Osc. Feedback Tap	
C1110	Non-replaceable Item, Part of Symbol A1008, Part No. AX-485.	Osc. Feedback Tap	
C1111	NOT USED		
C1112	Non-replaceable Item, Part of Symbol A1008, Part No. AX-485	Osc. Grid Tap	
C1113	Non-replaceable Item, Part of Symbol A1008, Part No. AX-485.	HFO Trimmer	
C1114	Non-replaceable Item, Part of Symbol A1008, Part No. AX-485.	HFO Coupling	
C1115	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Trimmer	
C1116	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Fixed RF Tuning	
C1117	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Bypass	
C1118	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Trimmer	
C1119	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Grid Tap	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1120	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Grid Tap	
C1121	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Bypass	
C1122	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Trimmer	
C1123	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Grid Tap	
C1124	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Grid Tap	
C1125	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Bypass	
C1126	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Trimmer	
C1127	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Grid Tap	
C1128	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Grid Tap	
C1129	Non-replaceable Item, Part of Symbol A1010, Part No. AX-486.	Osc. Feedback Tap	
C1130	Non-replaceable Item, Part of Symbol A1010, Part No. AX-486.	Osc. Feedback Tap	
C1131	Non-replaceable Item, Part of Symbol A1010, Part No. AX-486.	Osc. Grid Tap	
C1132	Non-replaceable Item, Part of Symbol A1010, Part No. AX-486.	HFO Trimmer	
C1133	Non-replaceable Item, Part of Symbol A1010, Part No. AX-486.	HFO Coupling	
C1134	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Trimmer	
C1135	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Fixed RF Tuning	
C1136	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Bypass	
C1137	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Trimmer	
C1138	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Grid Tap	
C1139	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Grid Tap	

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1140	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Bypass	
C1141	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Trimmer	
C1142	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496	Grid Tap	
C1143	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Grid Tap	
C1144	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Bypass	
C1145	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Trimmer	
C1146	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Grid Tap	
C1147	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Grid Tap	
C1148	Non-replaceable Item, Part of Symbol A1012, Part No. AX-487.	Osc. Feedback Tap	
C1149	Non-replaceable Item, Part of Symbol A1012, Part No. AX-487.	Osc. Feedback Tap	
C1150	Non-replaceable Item, Part of Symbol A1012, Part No. AX-487.	Osc. Grid Tap	
C1151	Non-replaceable Item, Part of Symbol A1012, Part No. AX-487.	HFO Trimmer	
C1152	Non-replaceable Item, Part of Symbol A1012, Part No. AX-487.	HFO Coupling	
C1153	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Trimmer	
C1154	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Bypass	
C1155	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Trimmer	
C1156	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Tracking	
C1157	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Grid Tap	
C1158	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Grid Tap	
C1159	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Bypass	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1160	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Trimmer	
C1161	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Tracking	
C1162	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Grid Tap	
C1163	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Grid Tap	
C1164	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Bypass	
C1165	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Trimmer	
C1166	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Tracking	
C1167	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Grid Tap	
C1168	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Grid Tap	
C1169	Non-replaceable Item, Part of Symbol A1014, Part No. AX-488.	Osc. Feedback Tap	
C1170	Non-replaceable Item, Part of Symbol A1014, Part No. AX-488.	Osc. Feedback Tap	
C1171	Non-replaceable Item, Part of Symbol A1014, Part No. AX-488.	Osc. Grid Tap	
C1172	Non-replaceable Item, Part of Symbol A1014, Part No. AX-488.	HFO Trimmer	
C1173	Non-replaceable Item, Part of Symbol A1014, Part No. AX-488.	HFO Coupling	
C1174	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Trimmer	
C1175	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Bypass	
C1176	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Trimmer	
C1177	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Tracking	
C1178	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Grid Tap	
C1179	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Grid Tap	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1180	Non-replaceable Item. Part of Symbol A1015, Part No. AX-498.	Bypass	
C1181	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Trimmer	
C1182	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Tracking	
C1183	Non-replaceable Item. Part of Symbol A1015, Part No. AX-498.	Grid Tap	
C1184	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Grid Tap	
C1185	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Bypass	
C1186	Non-replaceable Item. Part of Symbol A1015, Part No. AX-498.	RF Trimmer	
C1187	Non-replaceable Item. Part of Symbol A1015, Part No. AX-498.	RF Tracking	
C1188	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Grid Tap	
C1189	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Grid Tap	
C1190	Non-replaceable Item, Part of Symbol A1016, Part No. AX-489.	Osc. Feedback Tap	
C1191	Non-replaceable Item, Part of Symbol A1016, Part No. AX-489.	Osc. Feedback Tap	
C1192	Non-replaceable Item, Part of Symbol A1016, Part No. AX-489.	Osc. Grid Tap	
C1193	Non-replaceable Item, Part of Symbol A1016, Part No. AX-489.	HFO Trimmer	
C1194	Non-replaceable Item, Part of Symbol A1016, Part No. AX-489.	HFO Coupling	
C1196	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Fixed RF Tuning	
C1201	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +60%-40%, 150 VDCW.	Decoupling	CC-100-35
C1202	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +80%-20%, 500 VDCW.	Screen Bypass	CC-100-24
C1203	Same as C1201	Cathode Bypass	
C1204	Same as C1202	Decoupling	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1205	CAPACITOR, FIXED, MICA DIELECTRIC: 15 uuf, ±10%; 500 VDCW.	Coupling	CM15B150K
C1206	CAPACITOR, FIXED, ELECTROLYTIC: 125 uuf; 15 VDCW; polarized; insulated tubular case.	Cathode Bypass	CE-105-125-15
C1207	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, ±10%; 500 VDCW.	Cathode Bypass	CC-100-16
C1208	Same as C1207	Cathode Bypass	
C1209	Same as C1206	Cathode Bypass	
C1210	Same as C1207	Decoupling	
C1211	Same as C1207	Decoupling	
C1212	CAPACITOR, FIXED, MICA DIELECTRIC: 470 uuf, ±5%, 500 VDCW.	Voltage Divider	CM15C471J
C1213	Same as C1207	Decoupling	
C1214	Same as C1207	Decoupling	
C1215	Same as C1207	Cathode Bypass	
C1216	Same as C1207	Decoupling	
C1217	CAPACITOR, FIXED, MICA DIELECTRIC: 200 uuf, ±5%; 500 VDCW.	Filter	CM15C201J
C1218	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80%-20%; 500 VDCW.	Filter	CC-100-32
C1219	Same as C1207	Decoupling	
C1220	Same as C1207	Cathode Bypass	
C1221	Same as C1207	Decoupling	
C1222	Same as C1207	Coupling	
C1223	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf, ±10%; 500 VDCW.	AGC Network	CM15B101K
C1224	Same as C1202	AGC Network	
C1225	Same as C1223	Voltage Divider	
C1226	CAPACITOR, FIXED, MICA DIELECTRIC: 10 uuf, ±10%; 500 VDCW.	Phase Shift	CM15B100K
C1227	Same as C1201	Filter	
C1228	Same as C1207	Filter	

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1229	CAPACITOR, FIXED, MICA DIELECTRIC: 47 uuf, ±10%; 500 VDCW.	AGC Network	CM15B470K
C1230	CAPACITOR, FIXED, MICA DIELECTRIC: 220 uuf, ±10%; 500 VDCW.	AGC Network	CM15B221K
C1231	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 8 to 50 uuf, 350 VDCW.	AGC Network	CV-109-6
C1232	Same as C1218	Power Filter	
C1233	Same as C1218	Power Filter	
C1234	Same as C1201	Filiment Filter	
C1235	Same as C1201	Filiment Filter	
C1236	Same as C1201	Filiment Filter	
C1237	Same as C1201	Filiment Filter	
C1238	Same as C1201	Filiment Filter	
C1239	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf; ±20%; 500 VDCW; feed thru type.	Feed Thru	CK70AW102M
C1240	Same as C1239	Feed Thru	
C1241	Same as C1239	Feed Thru	
C1242	Same as C1239	Feed Thru	
C1301	CAPACITOR, FIXED, MICA DIELECTRIC: 47 uuf, ±5%, 500 VDCW.	Filter Network	CC21SL470J
C1302	Same as C1201	Cathode Bypass	
C1303	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 150 uuf, ±10%; 500 VDCW.	Coupling	CM15B151K
C1304	Same as C1207	Decoupling	
C1305	Same as C1207	RF Bypass	
C1306	Same as C1207	RF Bypass	
C1307	Same as C1207	B + Decoupling	
C1308	Same as C1207	Coupling RF	
C1309	CAPACITOR, FIXED, MICA DIELECTRIC: 1000 uuf, ±3%, 100 VDCW.	Coupling RF	CM-111D102H1S
C1310	Same as C1202	Screen Bypass	
C1311	CAPACITOR, FIXED, MICA DIELECTRIC: 1500 uuf, ±10%, 500 VDCW.	Coupling RF	CM20B152K

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1312	Same as C1218	B + Decoupling	
C1313	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf, GMV; 500 VDCW.	B + Decoupling	CC-100-29
C1314	CAPACITOR, FIXED, ELECTROLYTIC; 1700 uf; 75 VDCW; polarized; tubular case.	A + Filter	CE-112-2
C1315	CAPACITOR, FIXED, ELECTROLYTIC: 2600 uf; 50 VDCW; polarized; tubular case.	A + Filter	CE-112-3
C1316	Same as C1315	A + Filter	
C1317	Same as C1315	A + Filter	
C1318	Same as C1202	B + Decoupling	
C1319	Same as C1218	B + Decoupling	
C1320	Same as C1218	B + Decoupling	
C1321	Same as C1202	Bypass	
C1322	Same as C1202	AVC Bypass	
C1323	Same as C1218	Bypass	
C1324	Same as C1218	Relay bypass	
C1325	Same as C1218	Filiment Bypass	
C1326	Same as C1218	Filiment Bypass	
C1327	Same as C1202	Bypass	
C1328	Same as C1218	B + Filter	
C1329	Same as C1218	AC Bypass	
C1330	Same as C1218	AC Filter	
C1331	Same as C1218	AC Bypass	
C1332	Same as C1218	AC Filter	
C1333	Same as C1218	Bypass	
C1334	Same as C1218	Filter	
C1335	Same as C1218	Bypass	
C1336	Same as C1201	Decoupling	
C1337	Same as C1218	B + Bypass	
C1338	Same as C1218	VR Filter	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1339	CAPACITOR, FIXED, PLASTIC DIELECTRIC: mylar,metalized .10 uf; ±20%; 200 VDCW.	Filter	CN-114-R10-2M
C1340	Same as C1313	Filter	
CR1001	SEMICONDUCTOR DEVICE, DIODE: silicon; 175V max peak inverse voltage; 30 ma at 25°C and 15 ma at 150°C; two axial wire lead type terminals; hermetically sealed glass case.	AGC Delay	1N463
CR1201	SEMICONDUCTOR DEVICE, DIODE: silicon; 175V max peak inverse voltage; 30 ma at 25°C and 15 ma at 150°C; two axial wire lead type terminals; hermetically sealed glass case.	DC Clamp	1N463
CR1202	Same as CR1201	DC Clamp	
CR1203	Same as CR1201	AVC Rectifier	
CR1204	Same as CR1201	AVC Rectifier	
CR1205	SEMICONDUCTOR DEVICE, DIODE: germanium: max peak inverse volts 60 volts; continuous average forward current 50 ma; max peak forward current 150 ma; max surge current 500 ma; max inverse current 500 ua; at 50 volts or 30 ua at 10 volts.	AVC Rectifier	1N34A
CR1206	Same as CR1205	AVC Rectifier	
CR1207	Same as CR1201	AVC Rectifier	
CR1301	SEMICONDUCTOR DEVICE, DIODE: silicon; 100 volts max peak inverse voltage; 300 ma max continuous forward current at 150°C; one solder stud, one 10-32 thd stud type terminals; hermetically sealed and glass case.	Rectifier	1N1582R
CR1302	Same as CR1301	Rectifier	
CR1303	SEMICONDUCTOR DEVICE, DIODE: silicon; 100 volts max peak inverse voltage; 300 ma max continuous forward current at 150°C; one solder stud, one 10-32 thd stud type terminals; hermetically sealed and glass case.	Rectifier	1N1582
CR1304	Same as CR1303	Rectifier	

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
CR1305	SEMICONDUCTOR DEVICE, DIODE: silicon, zener type; 27 volts nominal zener type voltage ±5%; 1500 ma max dc zener current at 75°C; one solder stud, one 10-32 thd stud type terminals, hermetically sealed metal and glass case.	Voltage Regulator	1N3323B
CR1306	SEMICONDUCTOR DEVICE, DIODE: silicon, zener type; 6.5 volts nominal zener voltage; ±20%; 1350 ma max dc zener current at 75°C; one solder stud, one 10-32 stud type terminals; hermetically sealed glass case.	Voltage Regulator	VR101-6.5S5
DS1001	LAMP, GLOW: 110/125v, 1/15 watt; midget flange base; T-2 bulb.	Front Panel Illumination	BI-111-1
DS1002	LAMP, INCANDESCENT: 6-8 volts, 0.25 amps; bayonet base: T-3 1/4 bulb.	Illumination for P/N PX 660	BI-101-44
DS1003 thru DS1005	Same as DS1002	Illumination for P/N PX 660	
DS1006	LAMP, INCANDESCENT: 28 VAC or VDC; .04 amp; T-1 3/4 single contact, midget flange.	Oven Overheat Indicator	BI-110-7
J1001	CONNECTOR, RECEPTACLE, ELECTRICAL: RF type; 1 round female contact; straight type; series BNC to BNC.	Antenna Input	UG-625/U
J1002	CONNECTOR, RECEPTACLE, ELECTRICAL: RF type; 1 round male contact; straight type; series BNC to BNC.	Calibration Input	JJ-211
J1003	Same as J1002.	1.75 mc Output	
J1301	CONNECTOR, RECEPTACLE, ELECTRICAL: RF type; 1 round male contact; straight type; series BNC to BNC.	HFO Input	UG-625/U
J1302	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact; straight; straight type; series BNC to BNC.	Sync Output	JJ-172
J1303	Same as J1302	250KC Input	
J1304	Same as J1302	Isol Amp Output	
J1305	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 #16 male contacts rated at 17.0 amperes.	Input Power	JJ-200-2

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
J1306	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 #16; 12 #20 female contacts, #16 contacts rated at 20 amps; #20 contacts rated at 7.5 amps.	Output Power	JJ-256-2S
J1307	Same as J1302	DC Loop Input	
J1308	Same as J1301	DC Loop Output	
J1309	Same as J1302	Sig. Gen. Output	
J1310	Same as J1302	HFO Sync Output	
J1311	Same as J1301	HFO Sync Output	
J1312	Same as J1301	1.75 MC RC Output	
J1313	Same as J1301	HFO 1 A Output	
K1001	RELAY, ARMATURE: coil operating voltage, 110 vdc; coil resistance 9100 ohms dc; contact rating 26.5 vdc; 3 amps, non-inductive; double pole, double throw.	Antenna Relay	RL-143-1
K1201	RELAY, ARMATURE: coil operating voltage 6 volts; contact rating 26 volts, 3 amps, non-inductive; single pole; double throw.	Noise Silencer ON-OFF	RL-145
L1001	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	
L1002	COIL, RADIO FREQUENCY: fixed; 100 uf, ±5%, 2.6 ohms dc resistance, 345 ma current rating; molded case.	Plate Loading	CL-275-101
L1003	Same as L1002	Cathode Load	
L1004	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Tuner	
L1005	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	
L1006	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Tuner	
L1007	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	
L1008	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Tuner	
L1009	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Trimmer	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L1010	Same as L1002	Filter	
L1011	COIL, RADIO FREQUENCY: fixed; 1.0 uh, ±5%; 0.062 ohms dc resistance; 2300 ma current rating; molded case.	Peaking	CL-275-1R0
L1012	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	Oscillator Tuning	
L1013	Non-replaceable Item, Part of Symbol A1002, Part No. AX-482.	Oscillator Trimmer	
L1014	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	
L1015	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	
L1016	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Tuner	
L1017	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	
L1018	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Tuner	
L1019	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Trimmer	
L1020	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Tuner	
L1021	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	Oscillator Trimmer	
L1022	Non-replaceable Item, Part of Symbol A1004, Part No. AX-483.	Oscillator Tuner	
L1023	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Trimmer	
L1024 A, B	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Tuner	
L1025 A, B	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Tuner, Trimmer	
L1026 A, B	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Tuner, Trimmer	
L1027	Non-replaceable Item, Part of Symbol A1006, Part No. AX-484.	Oscillator Tuner	
L1028	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Trimmer	
L1029 A, B	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Tuner, Trimmer	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L1030 A, B	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Tuner, Trimmer	
L1031 A, B	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Tuner, Trimmer	
L1032	Non-replaceable Item, Part of Symbol A1008, Part No. AX-485.	Oscillator Tuner	
L1033	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Trimmer	
L1034 A, B	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Tuner, Trimmer	
L1035 A, B	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Tuner, Trimmer	
L1036 A, B	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Tuner, Trimmer	
L1037	Non-replaceable Item, Part of Symbol A1010, Part No. AX-486.	Oscillator Tuner	
L1038	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Trimmer	
L1039 A, B	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Tuner, Trimmer	
L1040 A, B	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Tuner, Trimmer	
L1041 A, B	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Tuner, Trimmer	
L1042 A, B	Non-replaceable Item, Part of Symbol A1012, Part No. AX-487.	Oscillator Tuner, Trimmer	
L1043	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Trimmer	
L1044 A, B	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Tuner, Trimmer	
L1045 A, B	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Tuner, Trimmer	
L1046 A, B	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	RF Tuner, Trimmer	
L1047 A, B	Non-replaceable Item, Part of Symbol A1014, Part No. AX-488.	Oscillator Tuner, Trimmer	
L1048	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Trimmer	
L1049 A, B	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Tuner, Trimmer	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L1050 A, B	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Tuner, Trimmer	
L1051 A, B	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	RF Tuner, Trimmer	
L1052 A, B	Non-replaceable Item, Part of Symbol A1016, Part No. AX-489.	Osc. Tuner, Trimmer	
L1053	Non-replaceable Item, Part of Symbol A1006, Part No. AX-484.	Osc. Trimmer	
L1054	Non-replaceable Item, Part of Symbol A1008, Part No. AX-485.	Osc. Trimmer	
L1055	Non-replaceable Item, Part of Symbol A1010, Part No. AX-486.	Osc. Trimmer	
L1056	Same as L1002	Filter	
L1057 .1,.2, .3,.4, .5,.6,	CORE, TOROID: bead type; powered iron.	Filiment RF Choke	CI-120-1
L1058 .1,.2, .3,.4, .5,.6,	Same as L1057	Filiment RF Choke	
L1059 .1,.2, .3,.4, .5,.6,	Same as L1057	Filiment RF Choke	
L1060 .1,.2, .3,.4, .5,.6,	Same as L1057	Filiment RF Choke	
L1061 .1,.2, .3,.4, .5,.6,	Same as L1057	Filiment RF Choke	
L1062 .1,.2, .3,.4, .5,.6,	Same as L1057	Filiment RF Choke	
L1201	COIL, RF: tuned; 1.75 mc operating frequency: consists of, one 200 uuf capacitor.	Plate Load	AC-147
L1202	COIL, RF: tuned, 1.75 mc operating frequency: consists of, one 200 uuf capacitor.	Plate Load	AC-146

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L1203	COIL, RF: tuned; 1.75 mc operating frequency; consists of, one 47 uuf capacitor.	Tank Circuit	AC-145
L1204	COIL, RF: fixed; 47,000 uh, ±5%; 452 ohms dc resistance, 27 ma current rating; molded case.	RF Choke	CL-275-473
L1205	COIL, RF: fixed; 560 uh, ±10%; 7.9 ohms dc resistance, 100 ma current rating; molded case.	Power Filter	CL-140-5
L1301	COIL, RF: fixed; 120.0 uh, ±10%; 3.2 ohms dc resistance; molded case.	Filter	CL-240-120
L1302	COIL, RF: fixed; 50.0 uh, ±5%; 110 ohms dc resistance; 75 ma current rating; molded case.	Filter	CL-226-5
L1303	Same as L1302	Filter	
L1304	Same as L1302	Filter	
L1305	COIL, RF: fixed; 35 uh, ±5%; 1 ohm dc resistance.	Filter	CL-292
L1306	NOT USED		
L1307	COIL, RF: fixed; 95 uh, ±5%; .1 ohm dc resistance.	Filter	CL-291
L1308	Same as L1307	Filter	
L1309	Same as L1305	Filter	
L1310	COIL, RF: fixed; 2.5 uh, ±10%; 26 ohms dc resistance 100 ma current rating; molded case.	Filter	CL-140-1
M1001	METER, ARBITARY SCALE: movement 0-1 milliamp; approx. resistance. 2000 ohms; black scale on white background rectangular case.	Field Strength	MR-160
M1002	METER, AUDIO LEVEL: 0-100 db above ± microvolt scale; 0-50 ua movement, linear scale, approx. resistance, 2000 ohms; standard 2-3/16" rectangular case.	Phase Comparator	MR-161
P1001	CONNECTOR, PLUG, ELECTRICAL: RF; 1 round female coaxial contact; straight type; series miniature bayonet lock.	HFO Output	PL-204
P1002	Same as P1001	HF Sync Input	
P1003	Same as P1001	Varicap Input	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
P1004	CONNECTOR, PLUG, ELECTRICAL: 3 #16, 12 #20 male contacts; #16 contacts rated 23 amp; #20 contacts rated 7.5 amps.	Power Input	PL-228-2P
P1201	CONNECTOR, PLUG, ELECTRICAL: RF; 1 round female coaxial contact; straight type, series miniature bayonet lock.	RF Input	PL-204
P1301	CONNECTOR, PLUG, ELECTRICAL: miniature type; 9 female contacts; straight type; w/cable clamp.	Oven Control	PL-189-95
P1302	Same as P1201		
P1303	CONNECTOR, PLUG, ELECTRICAL: miniature type; 9 female contacts; straight type; w/cable clamp.	Sig. Gen.	PL-169
R1001	RESISTOR, FIXED, COMPOSITION: 100,000 ohms; ±10%; 1/2 watt.	Grid Loading	RC20GF104K
R1002	RESISTOR, FIXED, COMPOSITION: 33 ohms; ±10%; 1/2 watt.	Cathode Res.	RC20GF330K
R1003	RESISTOR, FIXED, COMPOSITION: 4700 ohms; ±10%; 1/2 watt.	Plate Load	RC20GF472K
R1004	RESISTOR, FIXED, COMPOSITION: 2200 ohms; ±10%; 2 watts.	Plate Filter	RC42GF222K
R1005	RESISTOR, FIXED, COMPOSITION: 10.2 megohms; ±10%; 1/2 watt.	Divider	RC20GF106K
R1006	Non-replaceable Item, Part of symbol A1005, Part No. AX-492.	RF Loading	
R1007	RESISTOR, FIXED, COMPOSITION: 10,000 ohms; ±10%; 2 watts.	Voltage Drop.	RC42GF103K
R1008	RESISTOR, FIXED, COMPOSITION: 22,000 ohms; ±10%; 1/2 watt.	Screen Loading	RC20GF223K
R1009	RESISTOR, FIXED, COMPOSITION: 47 ohms; ±10%; 1/2 watt.	Parasitic Supp.	RC20GF470K
R1010	RESISTOR, FIXED, COMPOSITION: 200 ohms; ±10%; 1/2 watt.	Cathode Res.	RC20GF201K
R1011	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Loading	
R1012	RESISTOR, FIXED, COMPOSITION: 33,000 ohms; ±10%; 1/2 watt.	Plate Filter	RC20GF332K
R1013	Same as R1001	Grid Loading	
R1014	RESISTOR, FIXED, COMPOSITION: 68 ohms; ±10%; 1/2 watt	Cathode Res.	RC20GF680K

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R1015	Same as R1009	Parasitic Supp.	
R1016	Same as R1008	Screen Loading	
R1017	Same as R1009	Parasitic Supp.	
R1018	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Loading	
R1019	Same as R1012	Plate Filter	
R1020	RESISTOR, FIXED, COMPOSITION: 470 ohms; ±10%; 1/2 watt.	Filter	RC20GF471K
R1021	Non-replaceable Item, Part of symbol A1005, Part No. AX-492.	RF Loading	
R1022	Same as R1001	Grid Loading	
R1023	Same as R1014	Cathode Res.	
R1024	Same as R1009	Parasitic Supp.	
R1025	Same as R1008	Screen Loading	
R1026	Same as R1009	Parasitic Supp.	
R1027	Same as R1012	Plate Filter	
R1028	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	RF Loading	
R1029	Same as R1003	Grid Loading	
R1030	Same as R1009	Parasitic Supp.	
R1031	RESISTOR, FIXED, COMPOSITION: 270 ohms; ±10%; 1/2 watt.	HFO Injection Loading	RC20GF271K
R1032	RESISTOR, FIXED, COMPOSITION: 3900 ohms; ±10%; 1/2 watt.	Cathode Res.	RC20GF392K
R1033	RESISTOR, FIXED, COMPOSITION: 1200 ohms; ±10%; 1/2 watt.	Plate Filter	RC20GF122K
R1034	RESISTOR, FIXED, COMPOSITION: 1000 ohms; ±10%; 1/2 watt.	Antenna Loading	RC20GF102K
R1035	RESISTOR, FIXED, COMPOSITION: 130 ohms; ±5%; 1/2 watt.	Cathode Res.	RC20GF131J
R1036	RESISTOR, FIXED, COMPOSITION: 22,000 ohms; ±5%; 1/2 watt.	Screen Loading	RC20GF223J
R1037	Same as R1003	Plate Loading	
R1038	Same as R1033	Plate Filter	
R1039	RESISTOR, FIXED, COMPOSITION: 47,000 ohms; ±10%; 1/2 watt.	Grid Loading	RC20GF473K

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R1040	Same as R1001	Grid Loading	
R1041	RESISTOR, FIXED, COMPOSITION: 10 ohm; ±10%; 1/2 watt.	Parasitic Supp.	RC20GF100K
R1042	Same as R1041	Parasitic Supp.	
R1043	Same as R1036	Divider	
R1044	RESISTOR, FIXED, COMPOSITION: 1.2 megohms; ±5%; 1/2 watt.	Divider	RC20GF125J
R1045	Same as R1044	Divider	
R1046	RESISTOR, FIXED, COMPOSITION: 150,000 ohms; ±10%; 1/2 watt.	Divider	RC20GF154K
R1047	Same as R1009	Loading	
R1048	RESISTOR, FIXED, COMPOSITION: 100 ohms; ±10%; 1/2 watt.	Plate Filter	RC20GF101K
R1049	RESISTOR, FIXED, COMPOSITION: 10,000 ohms; ±10%; 1/2 watt.	Plate Loading	RC20GF103K
R1050	Same as R1001	AGC Filter	
R1051	Same as R1001	AGC Filter	
R1052	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Loading	
R1053	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Loading	
R1054	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	RF Loading	
R1055	RESISTOR, FIXED, COMPOSITION: 150,000 ohms; ±5%; 1/2 watt.	AVC Load	RC20GF154J
R1056	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Loading	
R1057	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Loading	
R1058	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	RF Loading	

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R1059	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Loading	
R1060	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Loading	
R1061	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	RF Loading	
R1062	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Loading	
R1063	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Loading	
R1064	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	RF Loading	
R1065	RESISTOR, FIXED, COMPOSITION: 220 ohms; ±10%; 1 watt.	Voltage Dropping	RC32GF221K
R1066	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	RF Loading	
R1201	RESISTOR, FIXED, COMPOSITION: 100,000 ohms; ±10%; 1/2 watt.	AGC Network	RC20GF104K
R1202	RESISTOR, FIXED, COMPOSITION: 68 ohms; ±10%; 1/2 watt.	Cathode Bias	RC20GF680K
R1203	RESISTOR, FIXED, COMPOSITION: 22,000 ohms; ±10%; 1/2 watt.	Screen Drop	RC20GF223K
R1204	RESISTOR, FIXED, COMPOSITION: 1200 ohms; ±10%; 1/2 watt.	Plate Drop	RC20GF122K
R1205	RESISTOR, FIXED, COMPOSITION: 1 megohm; ±10%; 1/2 watt.	Grid Leak	RC20GF105K
R1206	RESISTOR, FIXED, COMPOSITION: 47 ohms; ±10%; 1/2 watt.	Suppressor	RC20GF470K
R1027	Same as R1206.	Suppressor	

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R1208	RESISTOR, FIXED, COMPOSITION: 100 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF101K
R1209	Same as R1208	Voltage Divider	
R1210	RESISTOR, VARIABLE, COMPOSITION: 100 ohms; ±10%; 1/2 watt.	Balance Adjust	RV106UX10B101A
R1211	Same as R1206	Suppressor	
R1212	Same as R1206	Suppressor	
R1213	RESISTOR, FIXED, COMPOSITION: 470,000 ohms; ±10%; 1/2 watt.	Grid Leak	RC20GF474K
R1214	RESISTOR, FIXED, COMPOSITION: 68,000 ohms; ±10%; 2 watts.	Screen Drop	RC42GF682K
R1215	RESISTOR, FIXED, COMPOSITION: 1200 ohms; ±10%; 1 watt.	Plate Drop	RC32GF122K
R1216	Same as R1213	Grid Leak	
R1217	Same as R1206	Suppressor	
R1218	Same as R1213	Filter Network	
R1219	RESISTOR, FIXED, COMPOSITION: 150 ohms; ±10%; 1/2 watt.	Cathode Bias	RC20GF151K
R1220	RESISTOR, FIXED, COMPOSITION: 2200 ohms; ±10%; 1/2 watt.	Plate Drop	RC20GF222K
R1221	Same as R1203	Screen Drop	
R1222	Same as R1203	Screen Drop	
R1223	Same as R1220	Plate Drop	
R1224	Same as R1206	Suppressor	
R1225	Same as R1219	Cathode Bias	
R1226	Same as R1201	Grid Leak	
R1227	RESISTOR, FIXED, COMPOSITION: 3.3 megohms; ±10%; 1/2 watt.	AGC Network	RC20GF335K
R1228	Same as R1213	AGC Network	
R1229	RESISTOR, FIXED, COMPOSITION: 33,000 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF333K
R1230	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms; ±10%; 1/2 watt.	AGC Delay Adjust	RV106UX10B103A
R1231	RESISTOR, FIXED, COMPOSITION: 27,000 ohms; ±10%; 1/2 watt.	Filter	RC20GF273K
R1232	Same as R1229	AGC Network	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R1233	Same as R1205	AGC Network	
R1234	RESISTOR, FIXED, COMPOSITION: 680,000 ohms; ±10%; 1/2 watt.	DC Return	RC20GF684K
R1301	NOT USED		
R1302	RESISTOR, FIXED, COMPOSITION: 330,000 ohms; ±10%; 1/2 watt.	Filter Network	RC20GF334K
R1303	Same as R1204	Cathode Bias	
R1304	Same as R1206	Impedance Match	
R1305	Same as R1203	Balance Network	
R1306	RESISTOR, FIXED, COMPOSITION: 56,000 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF563K
R1307	RESISTOR, FIXED, COMPOSITION: 4700 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF472K
R1308	RESISTOR, FIXED, COMPOSITION: 15,000 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF153K
R1309	RESISTOR, VARIABLE, COMPOSITION: 5000 ohms; ±10%; 1/2 watt.	Balance Adjust	RV106UX10 B50A
R1310	RESISTOR, FIXED, COMPOSITION: 47,000 ohms; ±10%; 1/2 watt.	Grid Leak	RC20GF473K
R1311	RESISTOR, FIXED, COMPOSITION: 10,000 ohms; ±10%; 1 watt.	Screen Drop	RC32GF103K
R1312	RESISTOR, FIXED, COMPOSITION: 10,000 ohms; ±10%; 1/2 watt.	Plate Drop	RC20GF103K
R1313	RESISTOR, FIXED, COMPOSITION: 470 ohms; ±10%; 1/2 watt.	Cathode Bias	RC20GF471K
R1314	RESISTOR, FIXED, COMPOSITION: 220,000 ohms; ±10%; 1/2 watt.	Grid Leak	RC20GF224K
R1315	RESISTOR, FIXED, COMPOSITION: 68,000 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF683K
R1316	RESISTOR, FIXED, COMPOSITION: 39,000 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF393K
R1317	Same as R1307	Plate Load	
R1318	Same as R1202	Impedance Match	
R1319	Same as R1307	Voltage Divider	
R1320	Same as R1309	Balance Adjust	
R1321	RESISTOR, FIXED, COMPOSITION: 1800 ohms; ±5%; 1/2 watt.	Voltage Divider	RC20GF182J

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R1322	Same as R1220	Voltage Divider	
R1323	RESISTOR, FIXED, COMPOSITION: 3300 ohms; ±10%; 1/2 watt.	Plate Drop	RC20GF332K
R1324	Same as R1323	Plate Drop	
R1325	NOT USED		
R1326	RESISTOR, FIXED, COMPOSITION: 390 ohms; ±10%; 1/2 watt.	Impedance Match	RC20GF391K
R1327	Same as R1206	Filter Network	
R1328	Same as R1206	Impedance Match	
R1329	RESISTOR, FIXED, COMPOSITION: 390 ohms; ±10%; 1/2 watt.	Voltage Divider	RC20GF391K
R1330	RESISTOR, FIXED, WIREWOUND: 1.0 ohms; ±10%; 15 watts.	Filter Network	RE70G1R00
R1331	RESISTOR, FIXED, WIREWOUND: 15 ohms; ±1%; 20 watts.	Filter Network	RE75G15R0
R1332	Same as R1331	Filter Network	
R1333	RESISTOR, FIXED, WIREWOUND: 80 ohms; ±10%; 15 watts.	Filter Network	RE70G80R0
R1334	RESISTOR, FIXED, COMPOSITION: 3300 ohms; ±10%; 2 watts.	Plate Drop	RC42GF332K
R1335	Same as R1201	Voltage Divider	
R1336	Same as R1308	Voltage Divider	
R1337	RESISTOR, FIXED, COMPOSITION: 1000 ohms; ±10%; 1/2 watt.	Plate Drop	RC20GF102K
S1001	SWITCH, ROTARY: 1 section; 3 position; contacts rated at 1 amp, 28 volts dc or 5 amps at 110 volts ac.	Noise Silencer Alignment Signal	SW-112
S1002	Same as S1001	Tune, Sync, Operate	
T1001	Non-replaceable Item, Part of Symbol A1001, Part No. AX-490.	Antenna Xfmr	
T1002	TRANSFORMER, RADIO FREQUENCY: tuned; 1.75 mc operating frequency; 2.45 uh, ±.04 uh to 4.15 uf.	Output Xfmr	TT-194
T1003	Non-replaceable Item, Part of Symbol A1003, Part No. AX-491.	Antenna Xfmr	
T1004	Non-replaceable Item, Part of Symbol A1005, Part No. AX-492.	Antenna Xfmr	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
T1005	Non-replaceable Item, Part of Symbol A1007, Part No. AX-493.	Antenna Xfmr	
T1006	Non-replaceable Item, Part of Symbol A1009, Part No. AX-494.	Antenna Xfmr	
T1007	Non-replaceable Item, Part of Symbol A1011, Part No. AX-496.	Antenna Xfmr	
T1008	Non-replaceable Item, Part of Symbol A1013, Part No. AX-497.	Antenna Xfmr	
T1009	Non-replaceable Item, Part of Symbol A1015, Part No. AX-498.	Antenna Xfmr	
T1201	TRANSFORMER, RF: tuned; 1.75 mc operating frequency; consists of, one 2000 uuf capacitor; one 15000 ohms resistor.	Grid Coupling	TT-166
T1202	TRANSFORMER, RF: tuned; 1.75 mc operating frequency; consists of, one 2000 uuf and one 1000 uuf capacitor.	Plate Load and Coupling	TT-164
T1203	TRANSFORMER, RF: tuned; 1.75 mc operating frequency; consists of two 1500 uuf capacitors.	Plate Load and Coupling	TT-165
T1301	TRANSFORMER, RF: tuned; 1.75 mc operating frequency; inductance 8.7-9.5 uh in primary; 11-12 uh in secondary; c/o; one 430 uuf and one 510 uuf capacitor.	Plate Load and Coupling	TT-174
T1302	TRANSFORMER, POWER, STEP DOWN: primary, 230/115 volts; 50/400 cps, single phase; secondary, 61 volts center tap at 4 amps; hermetically sealed in retangular steel case.	Power	TF-244
V1001	TUBE, ELECTRON: single triode; 9 pin miniature.	First RF Ampl	417A
V1002	TUBE, ELECTRON: sharp-cutoff pentode; 7 pin miniature.	Second RF Ampl	6AH6
V1003	TUBE, ELECTRON: remote-cutoff pentode; 7 pin miniature.	Third RF Ampl	6BA6
V1004	Same as V1003	Fourth RF Ampl	
V1005	TUBE, ELECTRON: medium-triode; 9 pin miniature.	Mixer	6S4A
V1006	Same as V1002	Isolation Ampl	
V1007	TUBE, ELECTRON: high-mu triode; 7 pin miniature.	HF Oscillator	6AB4

PARTS LIST (Cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
V1201	TUBE, ELECTRON: remote cutoff pentode; 7 pin miniature.	Amplifier	6BA6
V1202	TUBE, ELECTRON: pentagrid converter; 7 pin miniature.	Amplifier	6BE6
V1203	Same as V1202	Amplifier	
V1204	TUBE, ELECTRON: sharp-cutoff pentode; 7 pin miniature.	Amplifier	6AH6
V1205	Same as V1204	Amplifier	
V1301	TUBE, ELECTRON: beam deflection; 9 pin miniature.	Converter	7360
V1302	TUBE, ELECTRON: sharp-cutoff pentode; 7 pin miniature.	Buffer Amplifier	6EW6
V1303	TUBE, ELECTRON: voltage regulator; 7 pin miniature.	Voltage Regulator	OA2
V1304	TUBE, ELECTRON: medium-mu twin-triodes; 9 pin miniature.	DC Amplifier	12AU7
W1301	CABLE ASSEMBLY, RADIO FREQUENCY: consists of 13 in. of RF cable RG 174/U and 2 connectors symbol no's., P1302, P1303.	Sig. Gen. to Calibrate	CA-480-84-13
W1302	CABLE ASSEMBLY, POWER, ELECTRICAL: consists of, various colors and lengths of MIL type MWC cable; various lengths of RF cable RG 174/U and one connector symbol no., J1305.	Power and Signal Harness	CA-702
XV1001	SOCKET, ELECTRON TUBE: 9 pin miniature.	Socket for V1001	TS-103-P01
XV1002	SOCKET, ELECTRON TUBE: 7 pin miniature.	Socket for V1002	TS-102-P01
XV1003	Same as XV1002	Socket for V1003	
XV1004	Same as XV1002	Socket for V1004	
XV1005	Same as XV1001	Socket for V1005	
XV1006	Same as XV1002	Socket for V1006	
XV1007	Same as XV1002	Socket for V1007	

PARTS LIST (C nt'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
XV1201	SOCKET, ELECTRON: 7 pin miniature.	Socket for V1201	TS-102-P01
XV1202	Same as XV1201	Socket for V1202	
XV1203	Same as XV1201	Socket for V1203	
XV1204	SOCKET, ELECTRON: 7 pin miniature.	Socket for V1204	TS-155-P01
XV1205	Same as XV1204	Socket for V1205	
XV1301	SOCKET, ELECTRON: 9 pin miniature.	Socket for V1301	TS-103-P01
XV1302	Same as XV1201	Socket for V1302	
XV1303	Same as XV1201	Socket for V1303	
XV1304	Same as XV1301	Socket for V1304	
XDS1001	LIGHT, INDICATOR: with white lens; accepts T-3 1/4 single contact, midget flange lamp.	Socket for DS1001	TS-154-5
XDS1002	LAMPHOLDER: accepts T-3 1/4 bayonet base lamp; no mounting bracket.	Socket for DS1002	TS-107-3
XDS1003	LAMPHOLDER: accepts T-3 1/4 bayonet base lamp; 1 terminal, no mounting bracket/case ground.	Socket for DS1003	TS-107-4
XDS1004	Same as XDS1002	Socket for DS1004	
XDS1005	Same as XDS1003	Socket for DS1005	
XDS1006	Same as XDS1001	Socket for DS1006	

SECTION 8
SCHEMATIC DIAGRAMS

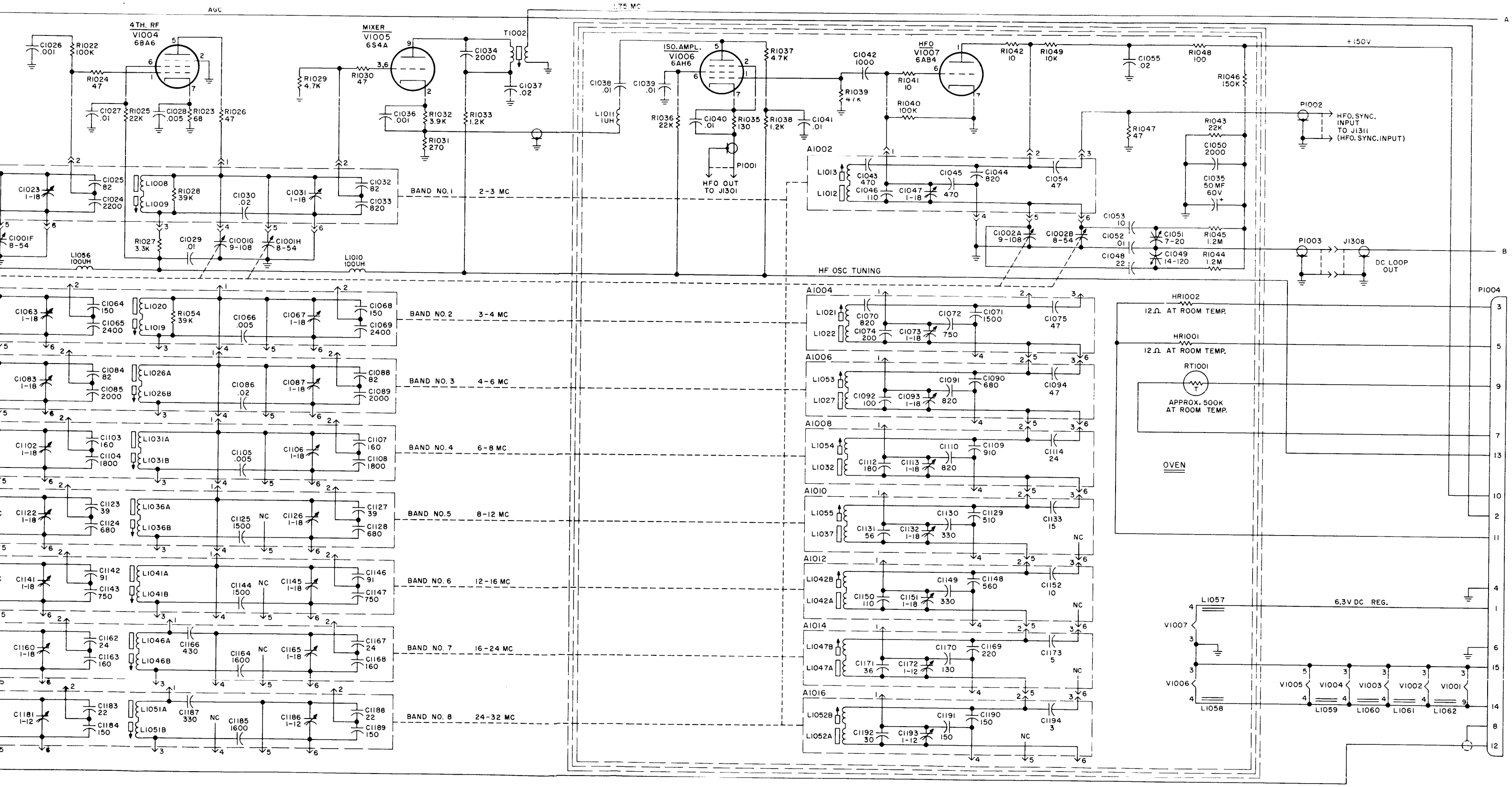
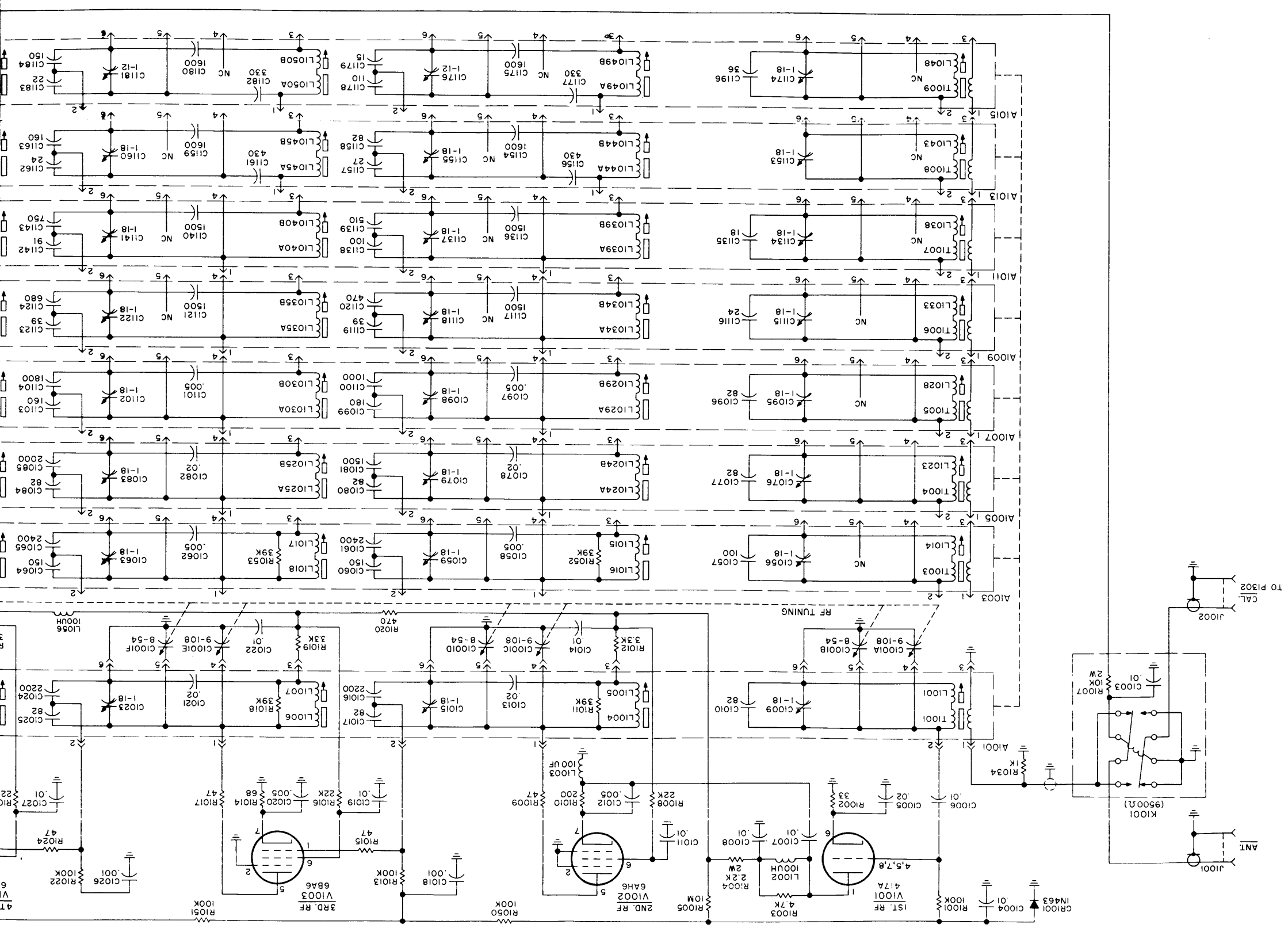


Figure 8-1. HFR-1, Schematic Diagram
(Sheet 1 of 2)


ANT.
J1001
K1001 (9500Ω)
C1003 .01
R1007 10K 2W
CAL. TO P1302
J1002
R1034 1K
CR1001 IN463
C1004 .01
R1001 100K
1ST. RF V1001 417A
4,5,7,8
R1003 4.7K
L1002 100UH
C1007 .01
R1004 2.2K 2W
C1008 .01
C1006 .01
C1005 .02
R1002 33
R1005 10M
2ND. RF V1002 6AH6
C1011 .01
R1008 22K
C1012 .005
R1010 200
L1003 100UF
R1009 47
R1050 100K
C1018 .001
R1013 100K
R1015 47
3RD. RF V1003 6BA6
C1019 .01
R1016 22K
C1020 .005
R1014 68
R1017 47
R1051 100K
C1026 .001
R1022 100K
R1024 47
C1027 .01
A1001
T1001
L1001
C1009 1-18
C1010 82
C1001A 9-108
C1001B 8-54
RF TUNING
L1004
L1005
R1011 39K
C1013 .02
C1015 1-18
C1017 82
C1016 2200
R1012 3.3K
C1014 .01
C1001C 9-108
C1001D 8-54
R1020 470
L1006
L1007
R1018 39K
C1021 .02
C1023 1-18
C1025 82
C1024 2200
R1019 3.3K
C1022 .01
C1001E 9-108
C1001F 8-54
L1056 100UH
A1003
T1003
L1014
NC
C1056 1-18
C1057 100
L1016
L1015
R1052 39K
C1058 .005
C1059 1-18
C1060 150
C1061 2400
L1018
L1017
R1053 39K
C1062 .005
C1063 1-18
C1064 150
C1065 2400
A1005
T1004
L1023
C1076 1-18
C1077 82
L1024A
L1024B
C1078 .02
C1079 1-18
C1080 82
C1081 1500
L1025A
L1025B
C1082 .02
C1083 1-18
C1084 82
C1085 2000
A1007
T1005
L1028
C1095 1-18
C1096 82
L1029A
L1029B
C1097 .005
C1098 1-18
C1099 180
C1100 1000
L1030A
L1030B
C1101 .005
C1102 1-18
C1103 160
C1104 1800
A1009
T1006
L1033
C1115 1-18
C1116 24
L1034A
L1034B
C1117 1500
C1118 1-18
C1119 39
C1120 470
L1035A
L1035B
C1121 1500
C1122 1-18
C1123 39
C1124 680
A1011
T1007
L1038
C1134 1-18
C1135 18
L1039A
L1039B
C1136 1500
C1137 1-18
C1138 100
C1139 510
L1040A
L1040B
C1140 1500
C1141 1-18
C1142 91
C1143 750
A1013
T1008
L1043
C1153 1-18
L1044A
L1044B
C1156 430
C1154 1600
C1155 1-18
C1157 27
C1158 82
L1045A
L1045B
C1161 430
C1159 1600
C1160 1-18
C1162 24
C1163 160
A1015
T1009
L1048
C1174 1-18
C1196 36
L1049A
L1049B
C1177 330
C1175 1600
C1176 1-12
C1178 110
C1179 15
L1050A
L1050B
C1182 330
C1180 1600
C1181 1-12
C1183 22
C1184 150

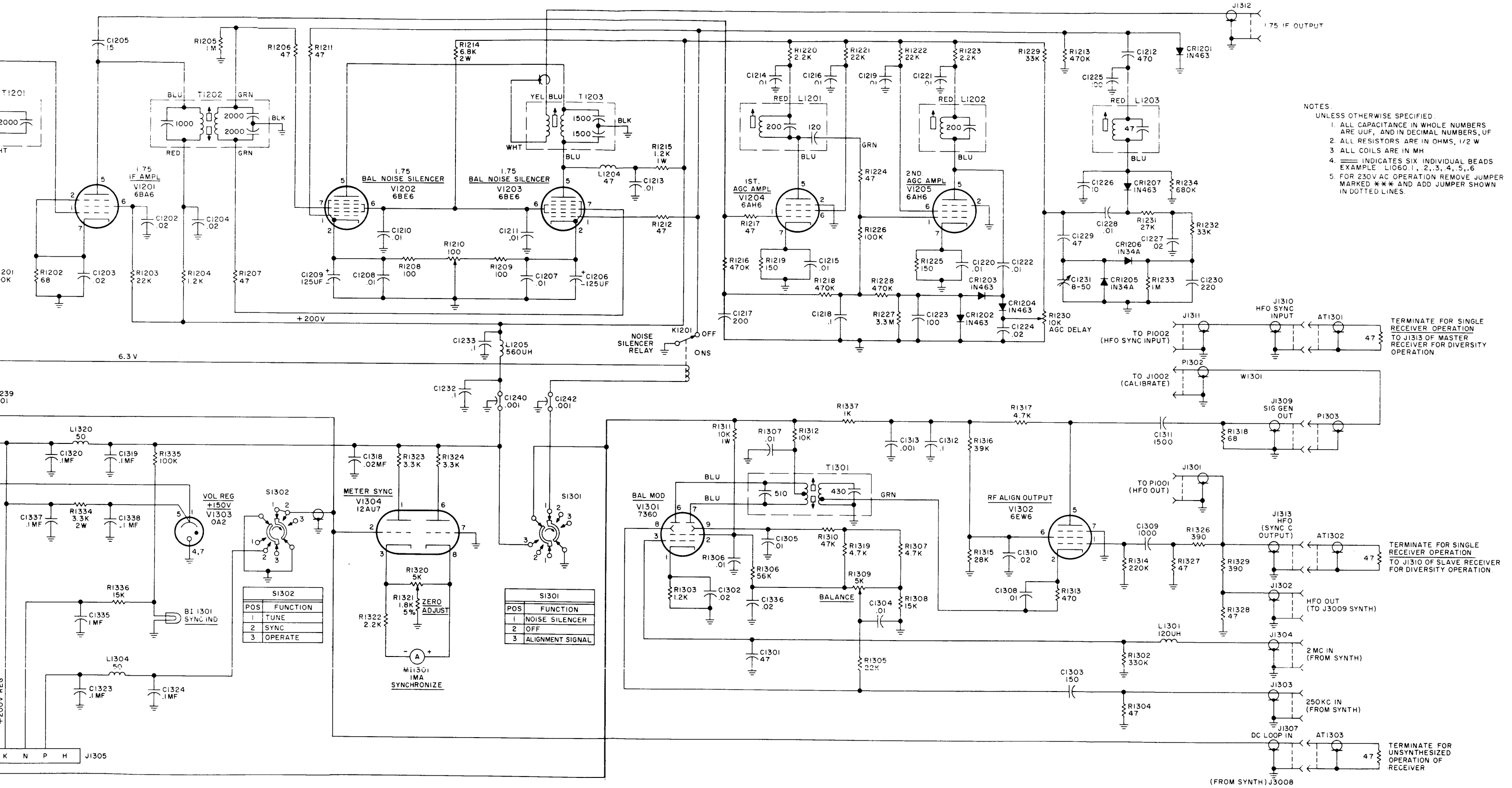
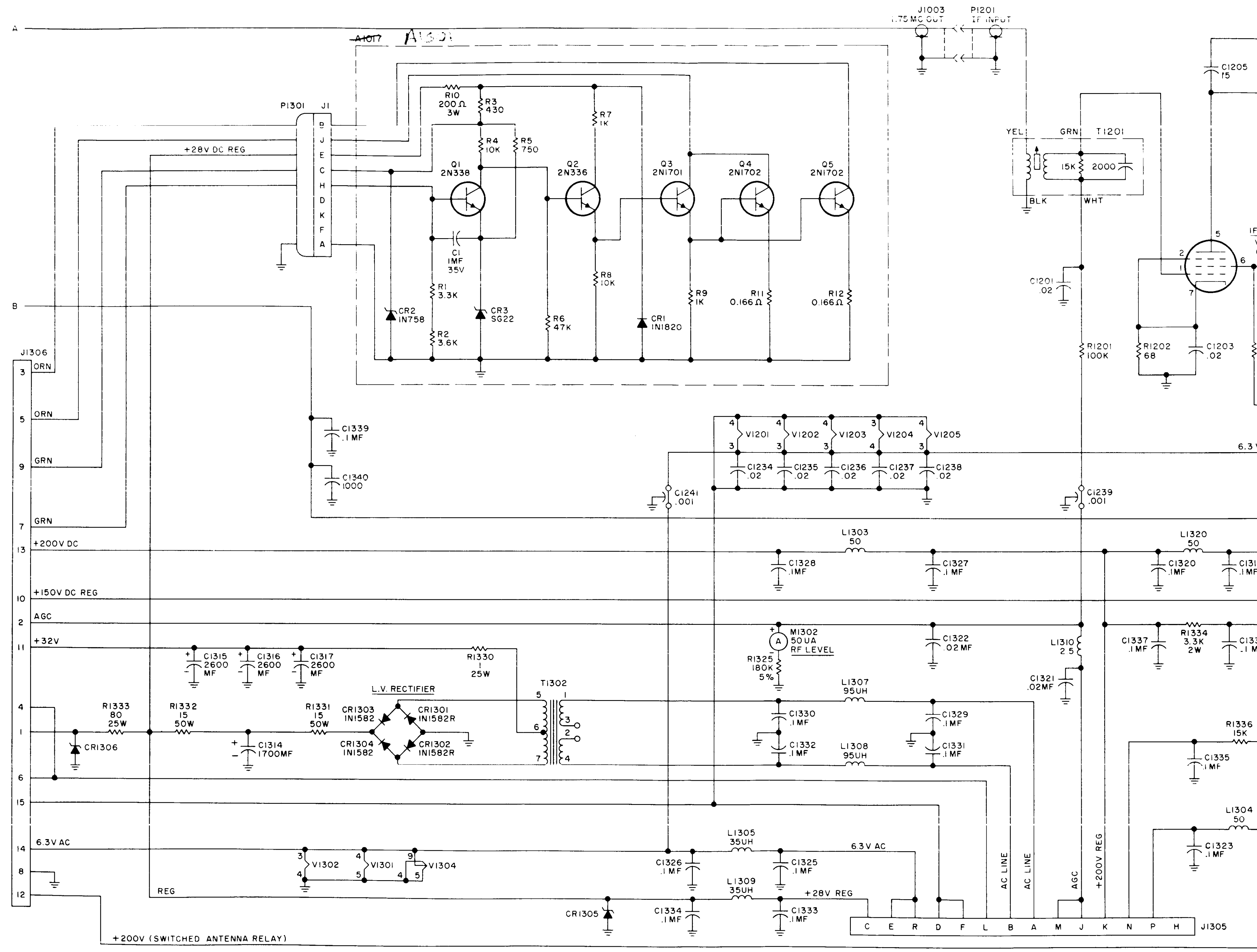


Figure 8-1. HFR-1, Schematic Diagram (Sheet 2 of 2)



A1017
J1003
1.75 MC OUT
P1201
IF INPUT
P1301
J1
+28V DC REG
R10 200Ω 3W
R3 430
R4 10K
R5 750
R7 1K
R8 10K
R9 1K
R11 0.166Ω
R12 0.166Ω
R1 3.3K
R2 3.6K
R6 47K
Q1 2N338
Q2 2N336
Q3 2N1701
Q4 2N1702
Q5 2N1702
C1 1MF 35V
CR1 1N1820
CR2 1N758
CR3 SG22
C1339 .1MF
C1340 1000
J1306
ORN
GRN
+200V DC
+150V DC REG
AGC
+32V
6.3V AC
REG
+200V (SWITCHED ANTENNA RELAY)
R1333 80 25W
R1332 15 50W
R1331 15 50W
R1330 1 25W
CR1306
C1315 2600 MF
C1316 2600 MF
C1317 2600 MF
C1314 1700MF
L.V. RECTIFIER
CR1301 1N1582R
CR1302 1N1582R
CR1303 1N1582
CR1304 1N1582
T1302
V1302
V1301
V1304
V1201
V1202
V1203
V1204
V1205
C1234 .02
C1235 .02
C1236 .02
C1237 .02
C1238 .02
C1241 .001
C1239 .001
L1303 50
C1328 .1MF
C1327 .1MF
M1302 50UA RF LEVEL
R1325 180K 5%
C1322 .02MF
L1307 95UH
L1308 95UH
C1330 .1MF
C1332 .1MF
C1329 .1MF
C1331 .1MF
L1305 35UH
L1309 35UH
C1326 .1MF
C1325 .1MF
C1334 .1MF
C1333 .1MF
CR1305
+28V REG
AC LINE
+200V REG
J1305
T1201
YEL
GRN
BLK
WHT
15K
2000
C1205 15
C1201 .02
R1201 100K
R1202 68
C1203 .02
L1320 50
C1320 .1MF
L1310 2.5
C1321 .02MF
C1337 .1MF
R1334 3.3K 2W
R1336 15K
C1335 .1MF
L1304 50
C1323 .1MF