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Midland 13-888 Service Manual

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MANUAL NO. 13 • 220147  
DATE: FEB. 11, 1976  
MANUAL PRICE \$2.00



**SPECIFICATIONS**

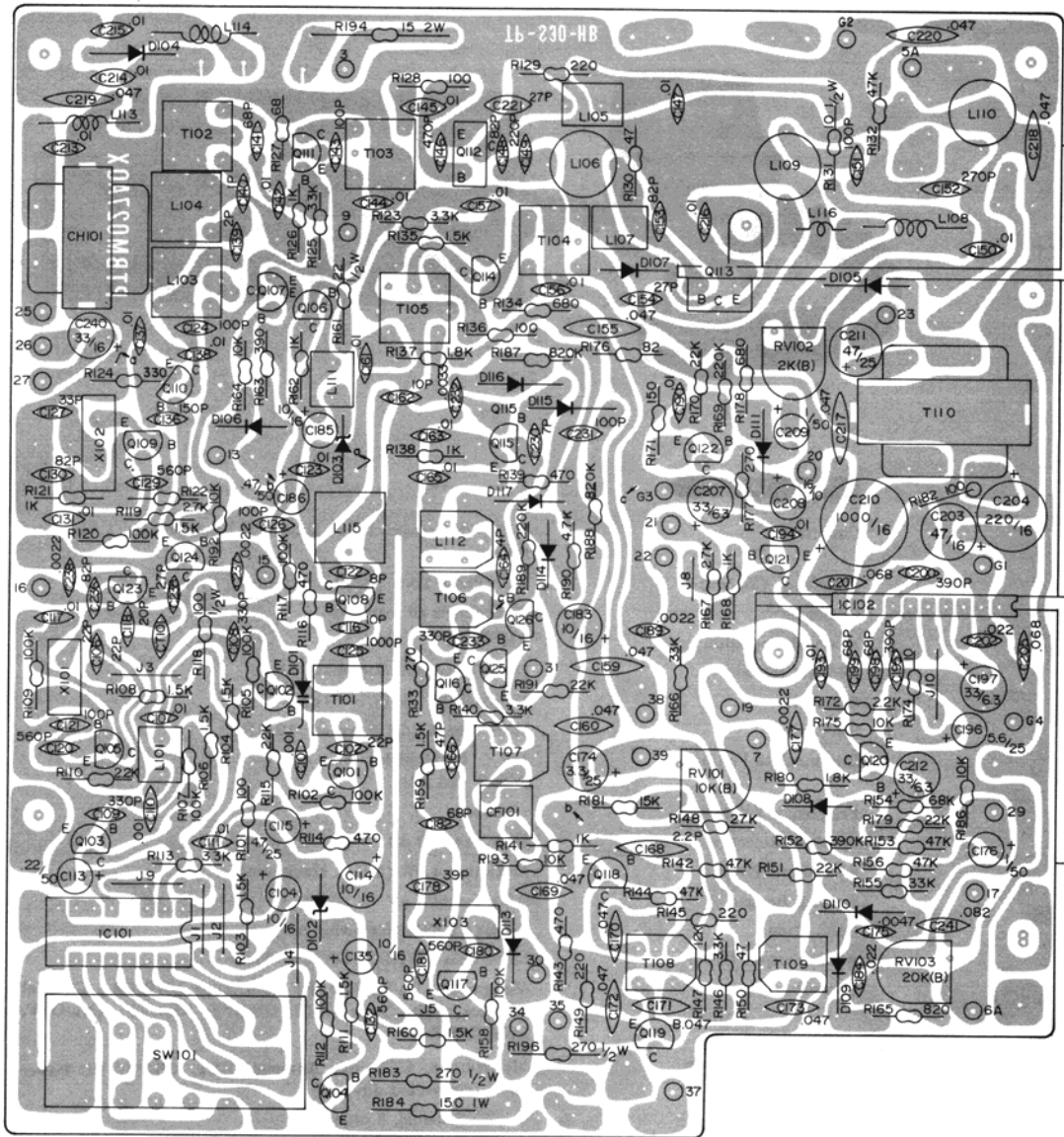
Circuitry:	2 ICs, 28 Transistors, 14 Diodes, 2 Zener Diodes, 1 Vari-Cap Diode
Frequency Control:	PLL (Phase Lock Loop) Synthesizing System
Channels:	23 channels all installed
Mode of Operation:	AM
Receiver System:	Dual Conversion Superheterodyne
Sensitivity:	Nominal 0.7 $\mu$ V (S/N 10 dB)
Selectivity:	More than 45 dB down at $\pm$ 10 KHz
Intermediate Frequency:	1st: 5.945 MHz 2nd: 455 KHz
Frequency Tolerance:	$\pm$ 0.005%
Spurious Rejection:	More than 50 dB
RF Output Power:	Maximum 4.0W (F.C.C. Maximum)
Squelch Range:	0.5 $\mu$ V — 500 $\mu$ V
Delta Tune:	About $\pm$ 1 KHz (Receiving only)
Audio Output Power:	More than 3W (EXT. SP at 8 ohms)
Controls:	Volume/PA, PA-Squelch, RF Gain, Tone, SWR/CAL, Channel Selector, Delta Tune, EXT. CB-OFF, NB-OFF, ANL-OFF, SWR-CAL-S/RF
Jacks and Connectors:	Microphone, EXT. SP, Antenna, EXT. CB/PA, DC Power cable (connected directly)
Speaker:	3-1/2" dynamic, 8 ohms
Microphone:	Dynamic CB Mike
Power Source:	DC 13.8V
Size:	7 (W) x 8-1/4 (D) x 2-5/16 (H) inches
Weight:	3.3 lbs

**MIDLAND**  
INTERNATIONAL®  
Communications Division

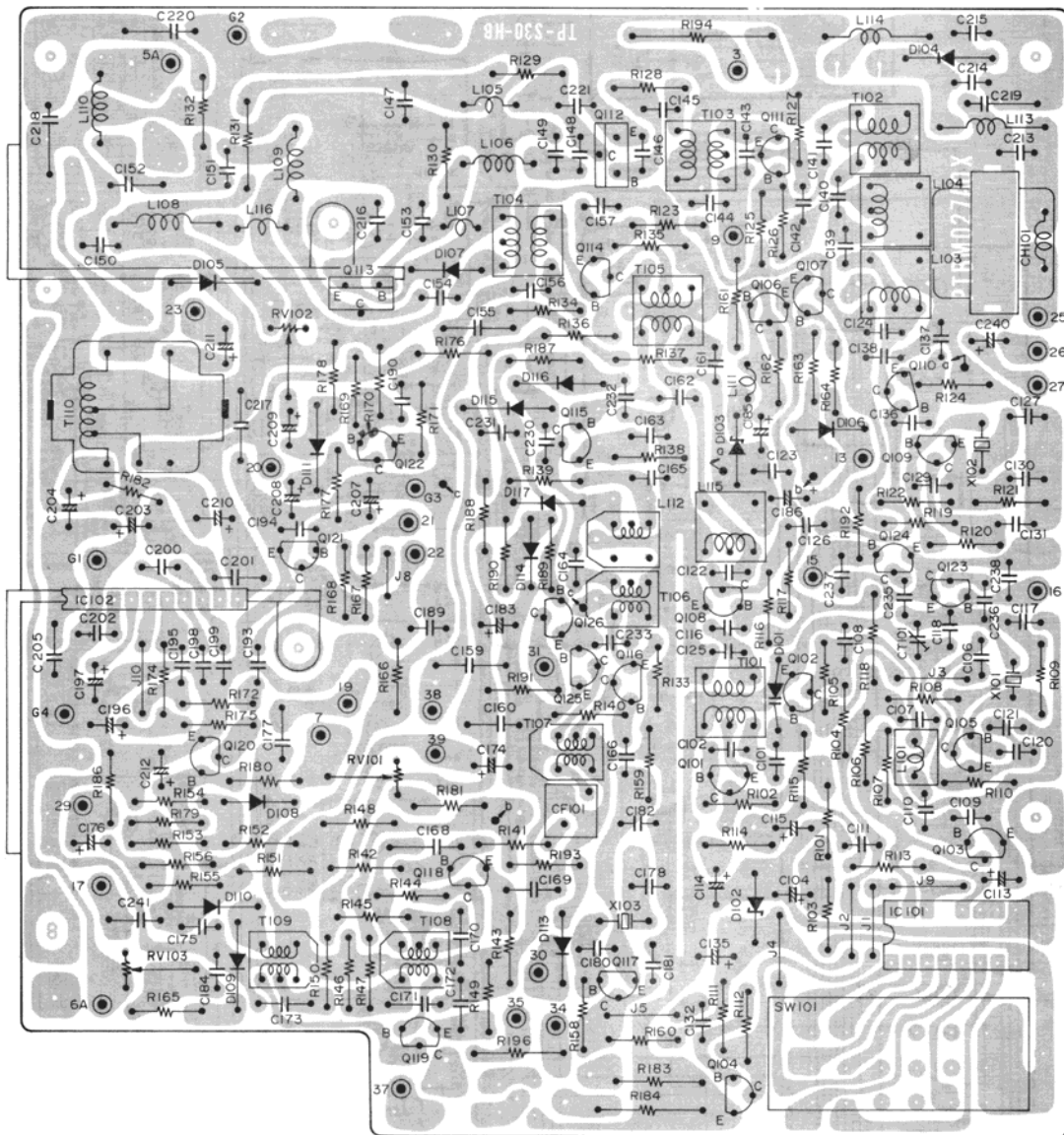
P.O. Box 19032 • Kansas City, Missouri 64141  
Phone 816-474-5080 • Cable: MIDELEC  
Telex: 42-6344

# PARTS LAYOUT

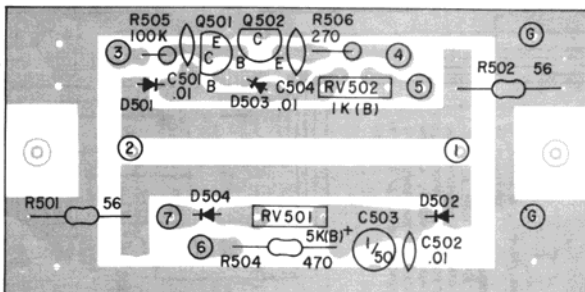
## FRONT VIEW



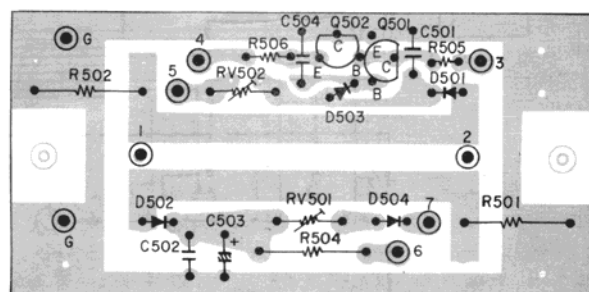
# PARTS LAYOUT



FRONT VIEW

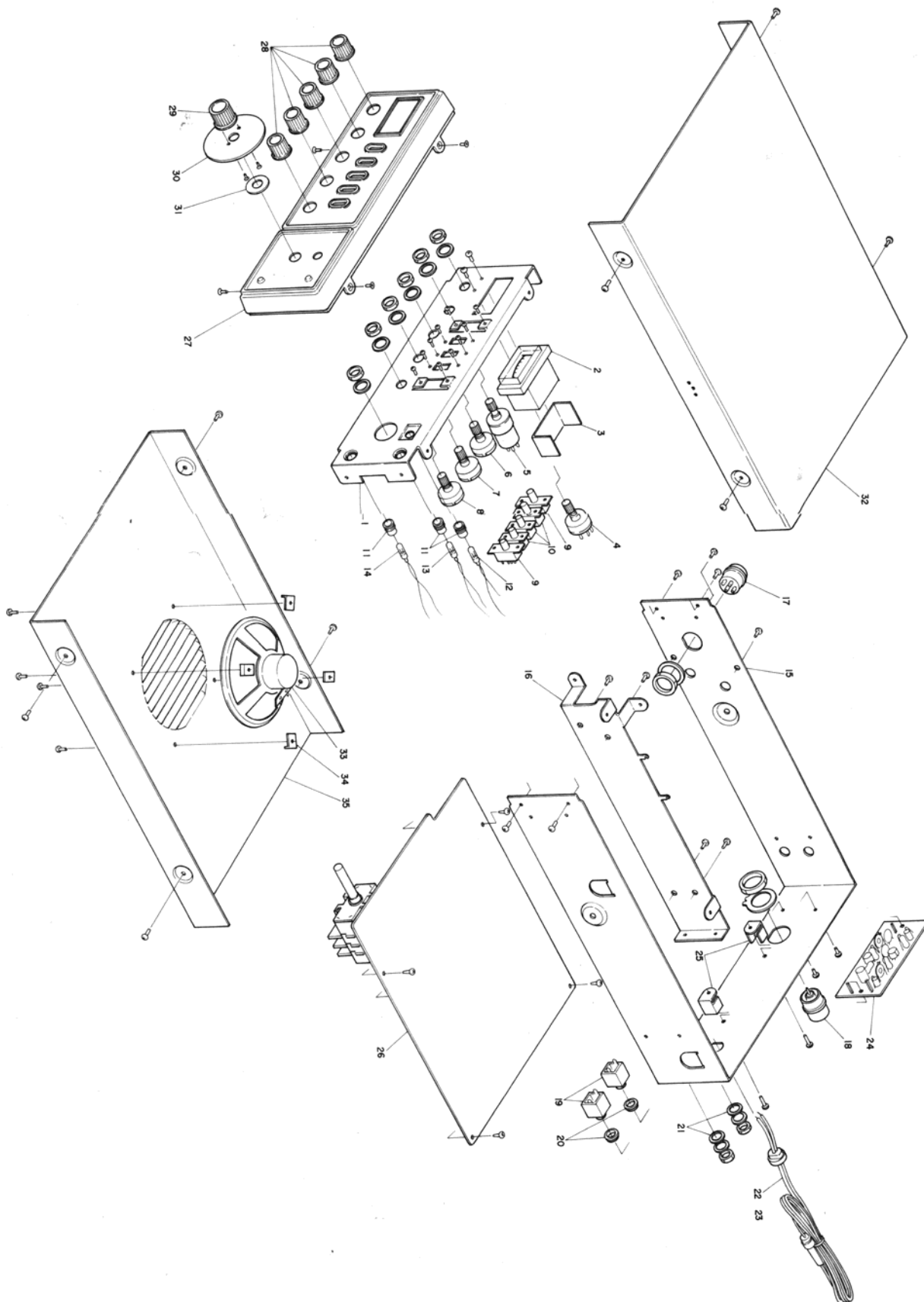


BACK VIEW





# EXPLODED VIEW



ALIGNMENT PROCEDURES FOR MODEL 13-888

1. Test Voltage

DC 13.8V  $\pm$  5 %, unless otherwise specified.

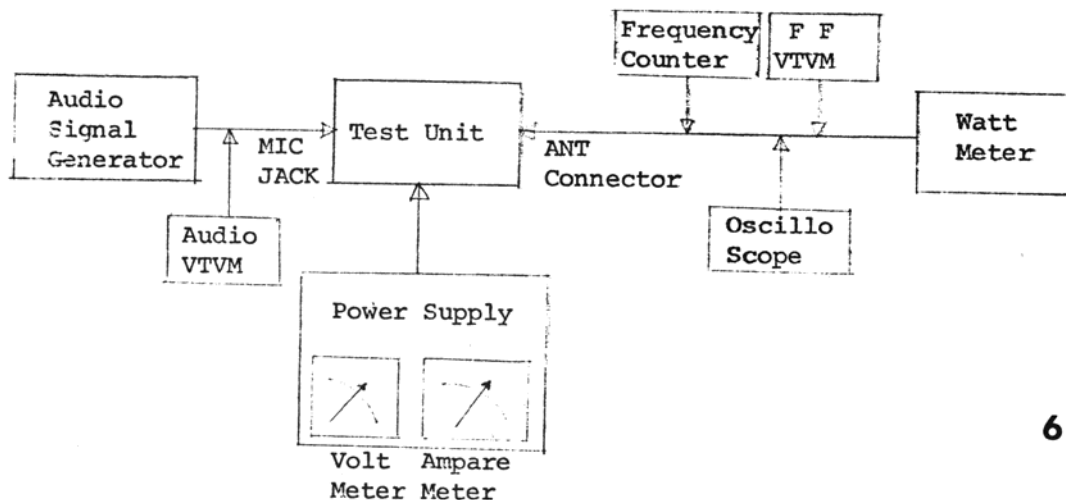
2. Test Equipment

All test equipment should be properly calibrated.

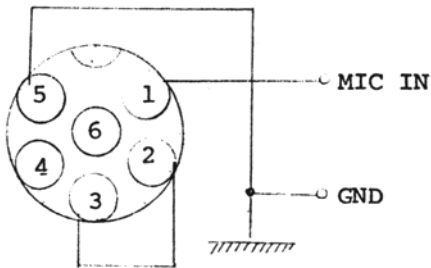
1. Audio Signal Generator, 10 Hz - 20 KHz
  2. VTVM, 1 mV measurable
  3. DC Ampere Meter, 2A
  4. Regulated Power Supply, DC 0 - 20V, 2A or higher
  5. Frequency Counter, 0 - 40 MHz, High Input Impedance Type .
  6. RF VTVM, Probe Type
  7. Oscilloscope, 30 MHz, high input impedance
  8. RF Watt Meter, thermo-couple type, 50 ohm, 5W
  9. Standard Signal Generator, 100 KHz - 50 MHz, -10 - 100 dB, 5- ohm unbalanced
  10. Speaker Dummy Resistor, 8 ohm, 5W
  11. Circuit Tester, DC V/20K ohm or higher
3. Alignment of Transceiver Circuitry

3.1 Test Set-Up

Connect all test equipment as shown below:



- 3.2 To set the transceiver into transmit mode without the microphone, insert the microphone plug wired as shown below into the MIC jack on the transceiver. When applying the audio modulation signal to the microphone input circuit, also use the same plug.



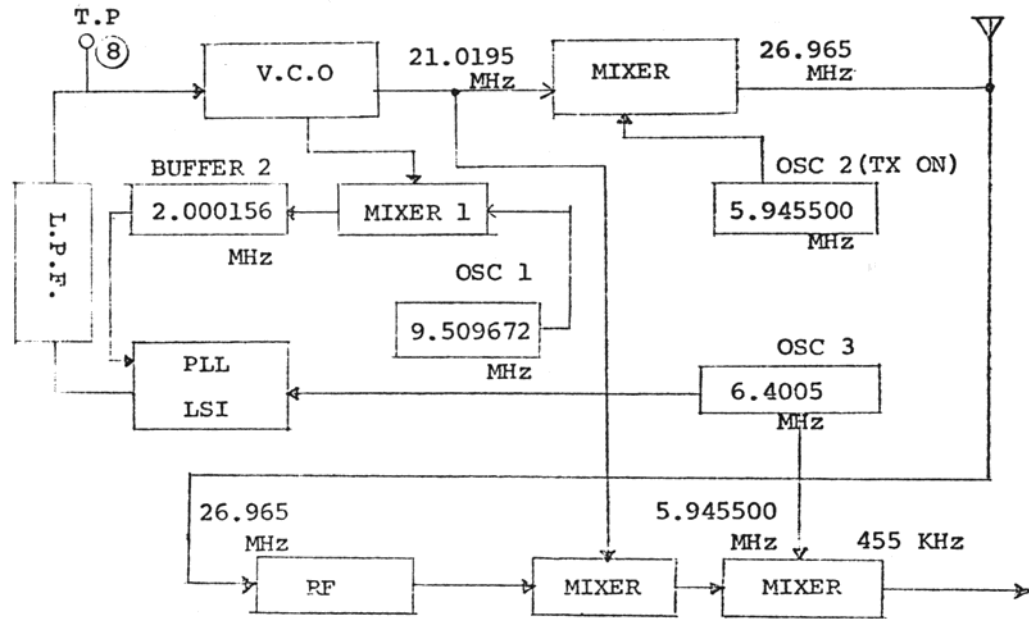
### 3.3 PLL Circuit Alignment

Before processing alignment, make sure operating frequencies at the points which follow, using the frequency counter (through a 1000 pF coupling capacitor connected in series with counter input probe).

- a. 6.4 MHz Buffer 1 (Q 104) collector frequency should be  
 $6400.500 \pm 0.13 \text{ KHz}$
- b. VCO, Q 108 base frequency should be  
 $21.0195 \pm 0.38 \text{ KHz}$  at CH 1 position
- c. 5.945 MHz OSC 2 (Q 109) emitter frequency should be  
 $5945.300 \pm 0.12 \text{ KHz}$
- d.  $\Delta$ TUNE Check

Place the  $\Delta$ TUNE switch in "+" position. Connect the frequency counter to the base of Q 108 base, the counter should read 21.020700 MHz with channel selector switch placed in CH 1 position. If not, adjust CT101 to obtain the correct reading. The standard frequency at each section with the channel selector switch placed in CH 1 position will be given below.





e. VCO Alignment

1. Place the channel selector in CH 1 position.
2. Connect the circuit tester (DC 3V range) between the ground and R114 (TP -8 side).
3. Adjust T101 core clockwise to obtain  $1.5V \pm 0.1V$  on the tester (the tester should be calibrated and has an input impedance of  $V/20K$  ohm or higher).
4. Place the channel selector in open channel position, the voltage reading of 5.1 - 5.4V will be obtained. Next, place the channel selector in 23 CH position, and read the value on the tester, it should be  $2.7 \pm 0.6V$ .

3.4 Alignment Stages before RF Power Amplifier

1. Place the channel selector in CH 13 position
2. Adjust Power Supply Voltage to 8.0V.
3. Connect oscilloscope to the base side of T102 (C141) and ground.
4. Adjust L103, L104 and T102 for maximum amplitude on the scopedisplay (27.115 MHz).
5. Next, connect the oscilloscope to the base of Q112 and adjust T102 and T103 for maximum amplitude.

### 3.5 Alignment of RF Power Amplifier

1. Channel Selector Switch in 13 CH position, Power Supply voltage 13.8V.
2. Adjust L106 for maximum reading on the RF Watt Meter.
3. Adjust L109 for maximum RF Power Output.
4. Adjust L110 for maximum RF Power Output.
5. Adjust L109 for maximum RF Power Output again.
6. Turn L106 core clockwise so that RF Watt Meter should indicate 4.4W.
7. Turn L110 core counter clockwise until the power reading of 3.8W is obtained.

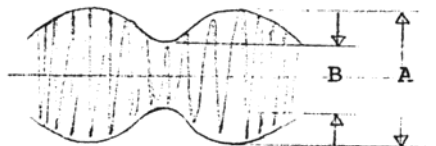
After completion of above alignment, read the total DC current flowing into the power cord, using ampere meter built-in the power supply unit or ampere meter connected series in the power cord. The reading should be 935 mA or less.

### 3.6 Transmit Frequency Check

1. Set the transceiver into transmit mode, no modulation.
2. Connect the frequency counter to the ANT connector and read the frequency at each channel. The frequency should be within  $\pm 800$  Hz from each center channel frequency as tabulated in the Frequency Table attached.

### 3.7 Modulation Sensitivity Alignment

1. Set the unit into transmit mode and apply 20 mV, 1 KHz signal to the MIC input circuit.
2. RV-102 should be adjusted to obtain 90 % modulation at this condition.



$$\text{Modulation Ratio} = \frac{A - B}{A + B} \times 100 (\%)$$

3. Next, decrease signal input to 6 mV and observe that the modulation ratio is still keeping the value higher than 80 %.

### 3.8 RF Meter Alignment

Adjust RV-501 on pc board PTSR002BOX so that the meter pointer should indicate the center of red zone on the scale at the power output of 3.8W. Refer to step 3.5 to set the reference power level (3.8W) on the watt meter.

### 3.9 SWR Meter Circuit Adjustment

1. Connect a non-inductive resistor of  $100\Omega$  to the antenna connector on rear of the transceiver.
2. Set the transceiver into transmit mode and place the SWR CAL Switch in the "CAL" position. Adjust CAL control (VR4) to move the meter pointer on the exact "SET" mark on the meter scale.
3. Next, place the SWR CAL in the "SWR" position and adjust RV502 on pc board (PTSR002BOX) so that the meter pointer indicates "2" on the SWR scale.

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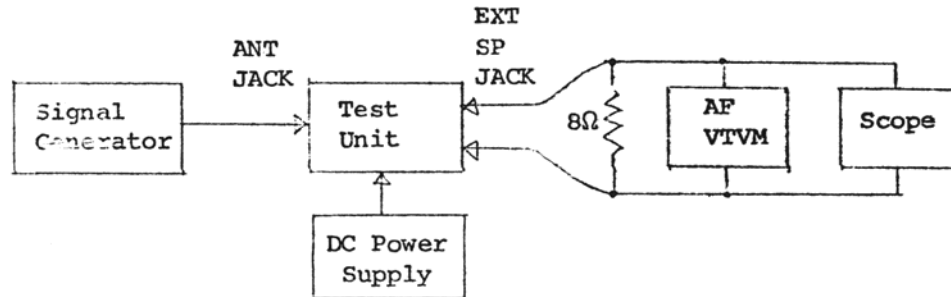
CHANNEL NO.	CHANNEL.FREQ.	"N" CORD	VCO.FREQ. (±380 Hz)	IC PIN NO.					
				16 (A)	15 (B)	14 (C)	13 (D)	12 (A)	11 (B)
CH- 1	26.965 MHz	200	21.0195 MHz	0	0	0	0	0	0
2	26.975	201	21.0295	1	0	0	0	0	0
3	26.985	202	21.0395	0	1	0	0	0	0
4	27.005	204	21.0595	0	0	1	0	0	0
5	27.015	205	21.0695	1	0	1	0	0	0
6	27.025	206	21.0795	0	1	1	0	0	0
7	27.035	207	21.0895	1	1	1	0	0	0
8	27.055	209	21.1095	1	0	0	1	0	0
9	27.065	210	21.1195	0	0	0	0	1	0
10	27.075	211	21.1295	1	0	0	0	1	0
11	27.085	212	21.1395	0	1	0	0	1	0
12	27.105	214	21.1595	0	0	1	0	1	0
13	27.115	215	21.1695	1	0	1	0	1	0
14	27.125	216	21.1795	0	1	1	0	1	0
15	27.135	217	21.1895	1	1	1	0	1	0
16	27.155	219	21.2095	1	0	0	1	1	0
17	27.165	220	21.2195	0	0	0	0	0	1
18	27.175	221	21.2295	1	0	0	0	0	1
19	27.185	222	21.2395	0	1	0	0	0	1
20	27.205	224	21.2595	0	0	1	0	0	1
21	27.215	225	21.2695	1	0	1	0	0	1
22	27.225	226	21.2795	0	1	1	0	0	1
23	27.255	229	21.3095	1	0	0	1	0	1

1: H Level (5.1V - 5.5V Circuit Tester DC V/20K ohm)  
0: L Level (0.05V - 0.4V " " " " " )

Frequency Table

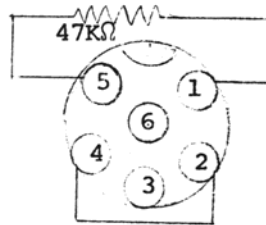
#### 4. Alignment of Transceiver Circuitry

##### 4.1 Test Set-Up



Unless otherwise noted, place the  $\Delta$  TUNE switch in "0" position and ANL switch in the "ON" position.

- 4.2 To make the transceiver into receiver mode, insert the 6-P plug wired as shown below into the MIC jack on the front panel.



##### 4.3 Receiver Sensitivity Alignment

1. Set the Signal Generator, 27.115 MHz, 1 KHz 30% modulation. Also set the transceiver into 13 CH position.
2. Tune the generator to the receiver, 13 CH.
3. Adjust L115, T104, T105, L112, T106, T107, T108 and T109 for maximum audio output between the 8 ohm dummy resistor.

This alignment should be performed with very small signal input from the signal generator to avoid inaccurate alignment due to agc action.

#### 4.4 Squelch Circuit Alignment

1. Set the signal generator to provide RF input signal of 54 dB (1 KHz, 30% mod.)
2. Rotate the Squelch Control volume in full clockwise direction.
3. Temporarily adjust the RV-101 for maximum audio output, and note the audio output level. Then, adjust RV-101 so that the audio output level decreases by 6 dB.

#### 4.5 S-meter Adjustment

1. Set the signal generator to provide 40 dB signal output.
2. Adjust RV-103 so that the S-meter pointer should read "9" on the meter provided on the front panel.

#### HOW AND WHERE TO ORDER REPLACEMENT PARTS

NOTE: To eliminate error and speed delivery of replacement parts, always include following information on your order:

1. Complete identification of merchandise for which the part is wanted.
  - A. Name Item
  - B. Model Number
  - C. Serial Number
2. Best possible identification of the part itself.
  - A. Part Number
  - B. Part Name
  - C. Quantity
  - D. If necessary, return old part as sample.
3. Customer should use address listed below when ordering replacement parts.



Communications Division

P.O. Box 19032 • Kansas City, Missouri 64141

PARTS/PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

PARTS LIST

MODEL NO. 13-888

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<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
<u>CASE PARTS</u>			
SEE EXPLODED VIEW.			
32	Case, Top	13-010316	\$ 3.78
35	Case, Lower	13-013143	4.00
1	Panel, Front	13-010317	1.90
27	Escutcheon Ass'y	13-011028	6.30
28	Knob, Volume/Squelch Gain/SWR	13-110203	.74
29	Knob, Channel Ass'y	13-115141	1.44
30	Plate, Channel	13-115142	1.44
31	Buffer, Channel Plate	13-115143	.46
3	Bracket, Meter Mounting	13-158503	.74
11	Holder, Lamp	13-158504	.46
16	Bracket, PCB Mounting	13-158505	.96
20	Washer, Jack	13-151487	.46
21	Washer, Insulating	13-157248	.46
25	Bracket, Ant. PCB Mounting	13-158506	.46
34	Bracket, Speaker Mounting	13-158507	.46
	Plate, Serial No.	13-020708	.46
	Spacer, Crystal	13-156151	.46
	Spacer, Crystal	13-156170	.46
	Heatsink	13-089150	.74
	Heatsink	13-089151	.46
	Heatsink	13-089136	.96
	Sheet, Mylar	13-157249	.46
	Bracket, Mobile Mounting	13-158508	.96
	Holder, Microphone	13-158509	.46
	Screw, Thumb	13-151488	.74
	Terminal	13-155047	.74
	Terminal	13-155052	.46
<u>MISCELLANEOUS</u>			
2	Meter	13-200077	7.48
12	Lamp	13-201076	.96
13	Lamp	13-201077	.96
14	Lamp	13-201078	.96
22	Cord, DC Ass'y	13-034095	.46
23	Bushing, Cord	13-157250	.46
	Cord, Speaker Ass'y	13-034096	.46
33	Speaker	13-060117	3.54
	Microphone	13-038099	21.76
CF101	Filter, Ceramic	13-179059	4.00
CT1	Capacitor, Trimmer 20PF	13-123069	.96

## PARTS LIST

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<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
<u>JACKS</u>			
J1 (18)	Antenna	13-159212	\$ 1.90
J2 (17)	Microphone	13-159233	2.30
J3,4 (19)	Earphone	13-153168	.74
<u>CRYSTALS</u>			
X101	9.509960 MHz	13-128379	6.86
X102	5.945000 MHz	13-128380	6.86
X103	6.400300 MHz	13-128381	6.86
<u>SWITCHES</u>			
S2,6 (9)	Delta Tune/SWR-CAL	13-183234	1.66
S3,5,7 (10)	ANL/NB/Ext. CB	13-183235	.96
S101	Channel	13-180115	8.04
<u>CONTROLS</u>			
VR1/S1(4)	Volume W/Switch 50K	13-160138	3.54
VR2/S4 (5)	Squelch/PA 10K	13-166068	3.54
VR3 (7)	Tone 50K	13-165041	.96
VR4 (8)	SWR 10K	13-165042	.96
VR5 (6)	RF Gain 50K	13-165043	.96
RV101	Sensitivity 10K	13-164132	.46
RV102	Sensitivity 2K	13-164133	.74
RV103	Sensitivity 20K	13-164134	.46
RV501	Sensitivity 5K	13-164114	.74
RV502	Sensitivity 1K	13-164153	.74
<u>COILS &amp; TRANSFORMERS</u>			
L101	Coil, RF Choke 22 uH	13-178227	.46
L103	Coil, RF 27MHz	13-176562	.96
L104	Coil, RF	13-176563	.96
L105	Coil, RF 2.2 uH	13-176564	.46
L106	Coil, RF	13-176508	.74
L107,111	Coil, RF Choke 68 uH	13-178210	.46
L108	Coil, RF	13-176565	.46
L109	Coil, RF	13-176509	.74
L110	Coil, RF 68 uH	13-176510	.74
L112	Coil, RF	13-176513	.96
L113,114	Coil, RF Choke	13-178209	.46
L115	Coil, RF	13-176566	.96



## PARTS LIST

MODEL NO. 13-888

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<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
<u>COILS &amp; TRANSFORMERS, (Cont.)</u>			
L116	Coil, RF	13-176567	\$ .74
CH101	Coil, Choke (Power)	13-178208	1.44
T101	Transformer, RF 27 MHz	13-094231	.96
T102	Transformer, RF 27 MHz	13-094232	.96
T103	Transformer, RF 27 MHz	13-094233	.96
T104	Transformer, Antenna	13-094234	.96
T105	Transformer, RF 27 MHz	13-094235	.96
T106	Transformer, RF 5.9MHz	13-094236	.96
T107	IFT 455 KHz	13-090371	.74
T108	IFT 455 KHz	13-090375	.74
T109	IFT 455 KHz	13-090372	.74
T110	Transformer, Output	13-096200	1.66
<u>TRANSISTORS</u>			
Q101,105,109, 110,117	2 SC 710		2.40
Q102-104,116, 118,119	2 SC 829		1.70
Q106	2 SC 1318		.96
Q107	2 SA 719		2.10
Q108,115	2 SC 1359		1.70
Q111	2 SC 1687		2.10
Q112	2 SC 1760		1.66
Q113	2 SC 1306		4.80
Q114	2 SC 1047		1.70
Q120	2 SC 372		2.10
Q121,122	2 SC 828		2.10
Q123,124	2 SC 839		1.70
Q125,126	2 SC 900		2.40
Q501	2 SC 945		1.70
Q502	2 SA 733		1.70
<u>DIODES</u>			
D101	1TT410		1.20
D102	MZ205 5.0 - 5.5V (Zener)		.90
D103	RD9.1E (Zener)		.74
D104	1S1885		.74
D105	VO6C		.98
D106-108,113, 114,117,503	1S1555		.46
D109,111,115, 116,501,502,504	1N60		.60

## PARTS LIST

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<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
	<u>INTEGRATED CIRCUITS</u>		
IC101	PLL01A		\$ 27.40
IC102	BA-521		6.06

RESISTORS

ALL RESISTORS NOT SHOWN ON THIS PARTS LIST ARE CARBON, 1/4W. SEE SCHEMATIC FOR SPECIFIC VALUES.

SOLID

R506	270 OHM 1/2W		.30
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METAL OXIDE FILM

R118	100 OHM 1/2W		.80
R131	10 OHM 1/2W		.80
R161	22 OHM 1/2W		.80
R183,196	270 OHM 1/2W		.80
R184	150 OHM 1W		.88
R194	15 OHM 2W		1.08

CAPACITORS

ALL CAPACITORS NOT SHOWN ON THIS PARTS LIST ARE CERAMIC, 50V. SEE SCHEMATIC FOR SPECIFIC VALUES.

CERAMIC, 500V

C168	2.2 PF		.38
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MYLAR, 50V

C110,125	0.001 uF		.38
C111,117,193	0.01 uF		.38
C132	560 PF		.38
C160,169-173	0.047 uF		.38
C175	0.0047 uF		.38
C177,237,238	0.0022 uF		.38
C184,202	0.022 uF		.38
C201,205	0.068 uF		.38
C232	0.0033 uF		.38
C241	0.082 uF		.38

PARTS LIST

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<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>LIST PRICE</u>
	<u>MICA, 500V</u>		
C124,151	100 PF		\$ .78
C152	270 PF		.78
	<u>TANTALUM</u>		
C196	5.6 uF 25V		1.20
	<u>ELECTROLYTIC</u>		
C104,114,135, 183,185,208	10 uF 16V		.96
C113	0.22 uF 50V		.96
C115	4.7 uF 25V		1.20
C176,209,227 503	1 uF 50V		.96
C186	0.47 uF 50V		.96
C197,207,212	33 uF 6.3V		.74
C203	47 uF 16V		.96
C204	220 uF 16V		.96
C210	1000 uF 16V		1.90
C211	47 uF 25V		1.20
C240	33 uF 16V		.96
C174	3.3 uF 25V		1.20