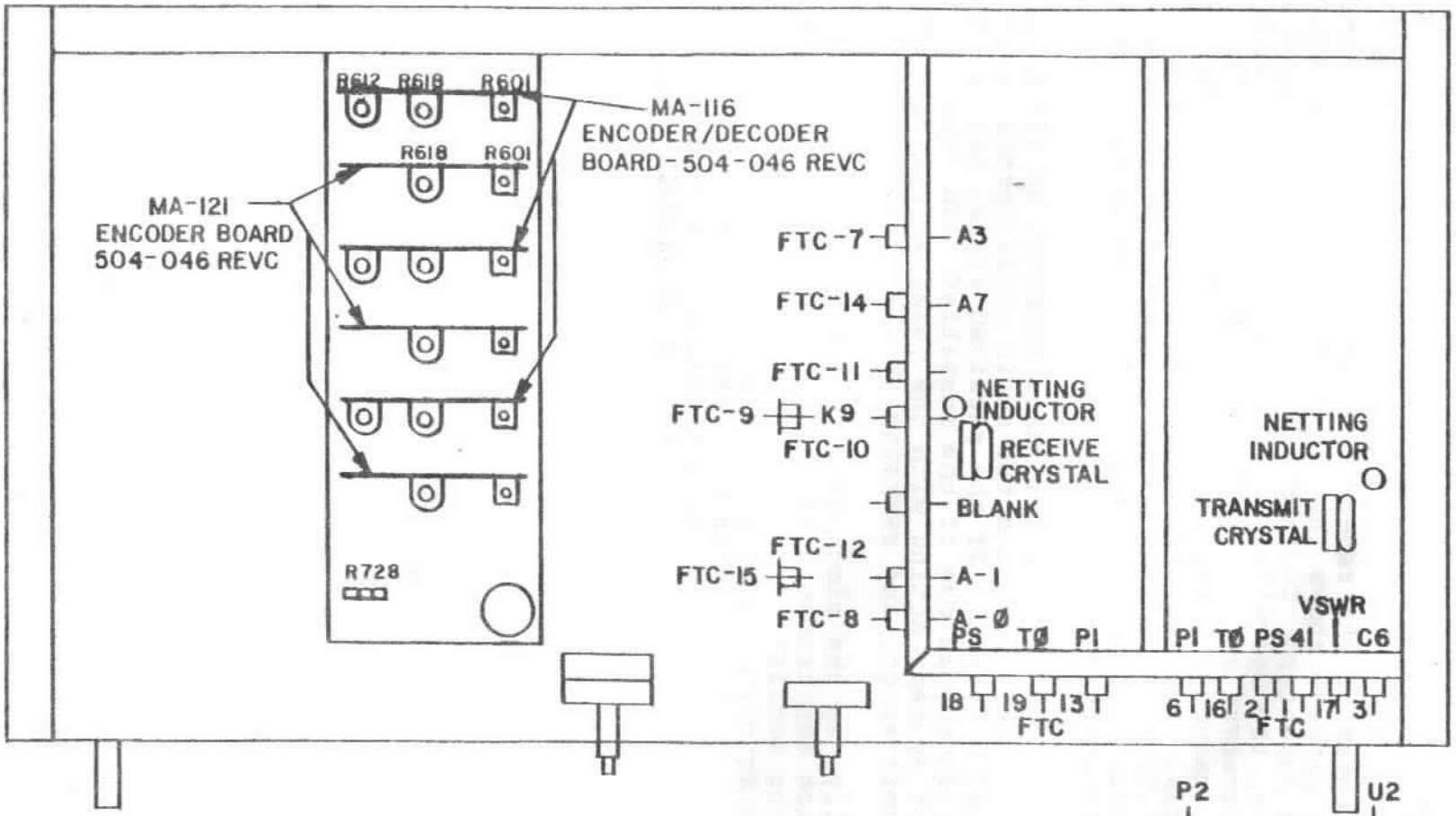


CRYSTAL LOCATION
MA-116 & MA-121 SET UP
ADJUSTMENT LOCATION

1-8
5-12
7-8

SECTION 3 RECEIVER

3-1 RECEIVER CIRCUIT DESCRIPTION

The antenna is connected to a 2 Section RF Helical Filter, L205 and L206, which acts as a preselector for incoming signals.

Q203 is a grounded gate, low noise, J-FET amplifier. Its output is fed through an additional 2 Section Helical Filter, L212 and L213 and delivered to the gate of Q206, a J-FET mixer.

L.O. (Local Oscillator) injection for the J-FET mixer Q206 is a frequency of 10.7 MHz lower than the incoming signal frequency. It is obtained from a crystal oscillator-multiplier chain, consisting of Q201, Q202 and Q205. Q201 is a crystal oscillator, using a third overtone crystal in the 48.8 to 55.7 MHz range. The output circuit of Q201 oscillator is tuned to the third harmonic of the crystal frequency, and this harmonic is amplified by a buffer-amplifier consisting of Q202. Q202 drives Q205, which operates as a frequency tripler, providing the wanted local oscillator injection frequency. This wanted injection frequency is separated from various harmonics and subharmonics by the L215 and L216 section of the helical filter and delivered to the source of the mixer, Q206.

The output of Q206 consists of a 10.7 MHz IF signal which is fed to a six-pole monolithic crystal filter, consisting of XF201, XF202 and XF203. This filter provides most of the adjacent channel selectivity of the receiver. The signal is then amplified by Q207. The amplified 10.7 MHz IF signal is then coupled to IC201 (terminal 18) which contains the second mixer circuitry and the second L.O. circuitry operating at 10.245 MHz.

The 455 KHz output of IC201 (terminal 3) is coupled through a tuned circuit to the input of the ceramic filter, CF201. CF201 is a narrow-band filter centered at 455 KHz, and it provides additional adjacent channel rejection. The output of CF201 goes back to IC201 (terminal 5) where it is amplified approximately 60dB. Also included in IC103 is the limiting circuitry and a quadrature detector circuit. L220, connected between terminals 4 and 8 of IC201, is the adjustable quadrature coil.

The audio output from IC201 Pin 10 leaves the shielded receive compartment at Pin AØ to the repeater control board where it is deemphasized. Then the audio returns to the shielded receiver at Pin A3 where it is coupled to the audio amplifier circuit. Also, from Pin AØ, the squelch noise is applied to the squelch control. From the squelch control the noise returns to the input of the noise operated squelch circuit at Pin A1.

From Pin A1, the noise is filtered and then amplified by the internal squelch amplifier in IC201. The amplified noise is rectified by CR204 and CR207 and the DC voltage is applied to Pin 14 of IC201. From Pin 14 the voltage is applied to an internal squelch switch which pulls Pin 16 high with a receive signal. This high is applied to the base of Q204 and will cause it to conduct.

From Pin A3 the audio signal is coupled to the base of Q204. Q204 is an audio switch and emitter follower. The audio output from the emitter at Pin A4 leaves the shielded receiver to the volume control and control board. From the arm of the volume control it returns to the shielded receiver at Pin A6. From Pin A6 the audio is amplified by IC202 to loudspeaker level.

3-2 RECEIVER VOLTAGES

Voltage on active component MCCU01R

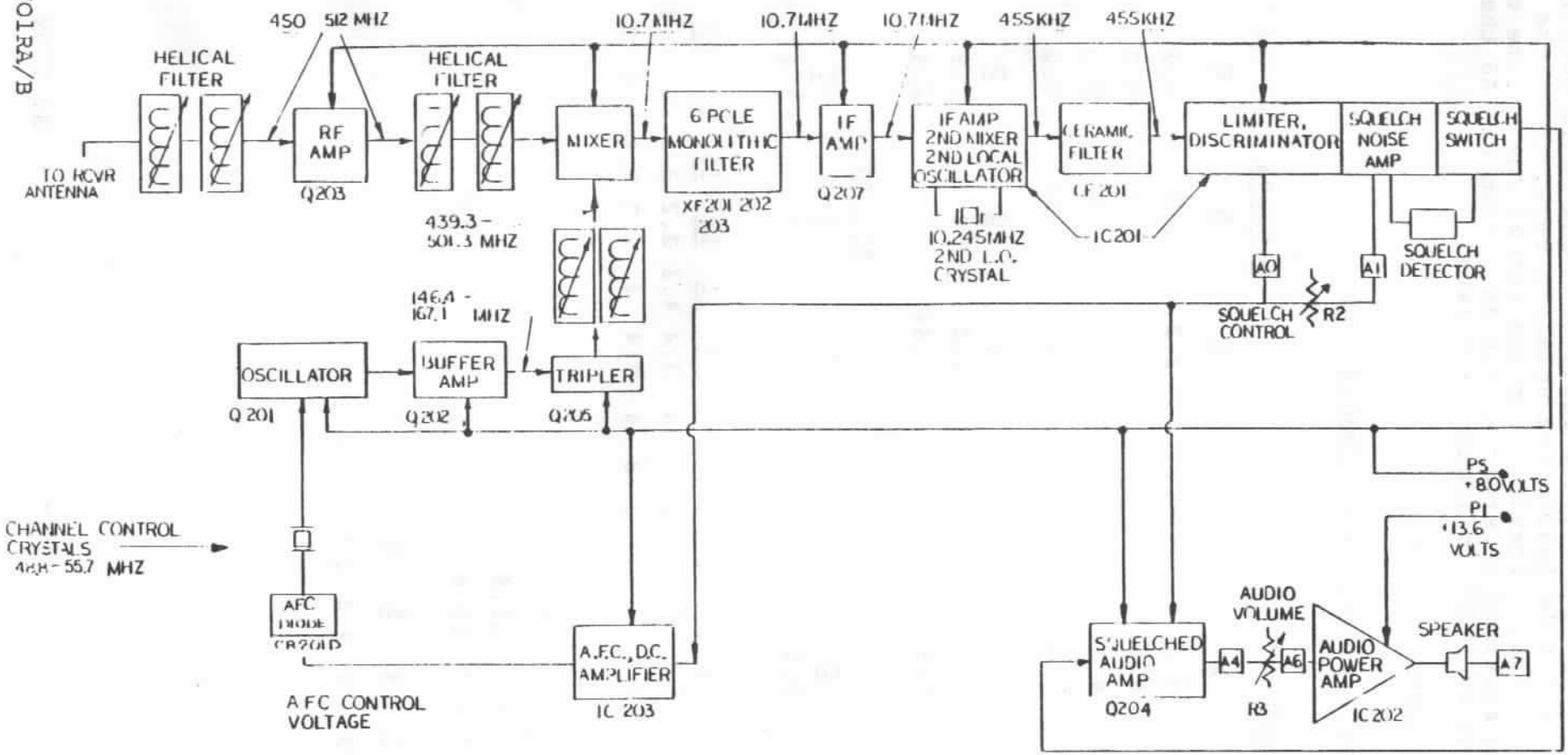
	With Drive			No Drive		
	E	B	C	E	B	C
Q201	2.2v	2.7v	8.2	2.2	2.9	8.2
Q202	3.2	3.7	8.2	3.3	4.2	8.2
Q205	.7	.54	8.2	0	.6	8.2
Q207	.2	.85	5.2	.2	.85	5.2
	S	G	D	S	G	D
Q203	1.2	0	7.8	1.2	0	7.8
Q206	.71	0	6.8	.64	0	6.8
				sq. on		
	E	B	C	E	B	C
Q204	2.4	3	8.2	.9	0	8.2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
IC201	8.0	7.6	7.7	8.2	1	1	1	8	4	3.4	4.1	2.2	2.2	0	7.6	7.5	0	2
sq. on	8	7.6	7.7	8.0	1	1	1	8	4	3.4	4	2.2	2.2	.6	0	0	0	2

	1	2	3	4	5
IC202	.7	.6	0	6.7	13.6
Sq.	.7	.6	0	6.7	13.6

	1	2	3	4	5	6	7	8
IC203	7	5.5	5	0	3.4	4.0	2.8	8.2

K11 3.5



3-3 RECEIVER BLOCK DIAGRAM

SECTION 4 TRANSMITTER

4-1 TRANSMITTER CIRCUIT DESCRIPTION

AUDIO SECTION

Integrated Circuit IC301 (Sections A and B) constitutes the audio circuitry of the transmitter. IC301A provides a high impedance input for the ceramic microphone and supplies pre-emphasis and amplification prior to the modulation limiting circuit which consists of Q307 and Q308. IC301B provides additional amplification, and acts as an active filter to provide the post-limited filter action. The output of IC301B is fed to a control potentiometer which controls the audio voltage sent to the modulator section and, therefore, is used to set the peak modulation deviation of the transmitter.

IC301B also provides an amplified input to feed tones for continuous tone squelch systems, or other tone systems, into the transmitter modulation circuits.

CRYSTAL OSCILLATOR

Y301A serves as the crystal oscillator, using a crystal at 1/36 of the channel frequency. The crystal is a fundamental cut, in the frequency range 12.5 to 14.3 MHz.

Direct frequency modulation of the crystal is obtained by applying the modulation signals from the audio section to varactor modulator diode, CR301A.

FREQUENCY MULTIPLIER SYSTEM

The output of the crystal oscillator, Q301, is tuned to three times the crystal frequency, and this signal is amplified by buffer-amplifier Q302, then delivered to the tripler circuit, Q303, then delivered to the doubler circuit Q304. Q304 drives another doubler, Q305, to obtain a combined frequency multiplication of 36 to reach the channel frequencies from 450-512 MHz. The doubler Q305 develops about 800 milliwatts of power to drive the helical preselector.

PA CIRCUIT DESCRIPTION

The MCCU15R Range A and Range B 15 Watt amplifier is the same as used on the 15 watt mobiles except for a change in the input circuitry to Q103 and the parts for the antenna switch deleted. All other operation and circuitry remains the same.

Input power from the main exciter board at 500-1000 milliwatts is amplified to 3 watts by Q103. This is amplified by Q104, then filtered, for a final output of 15-18 watts.

VSWR SYSTEM

The VSWR system is a part of the 15 watt power amplifier and controls the voltage to the collector of Q305.

4-2 TRANSMITTER VOLTAGES

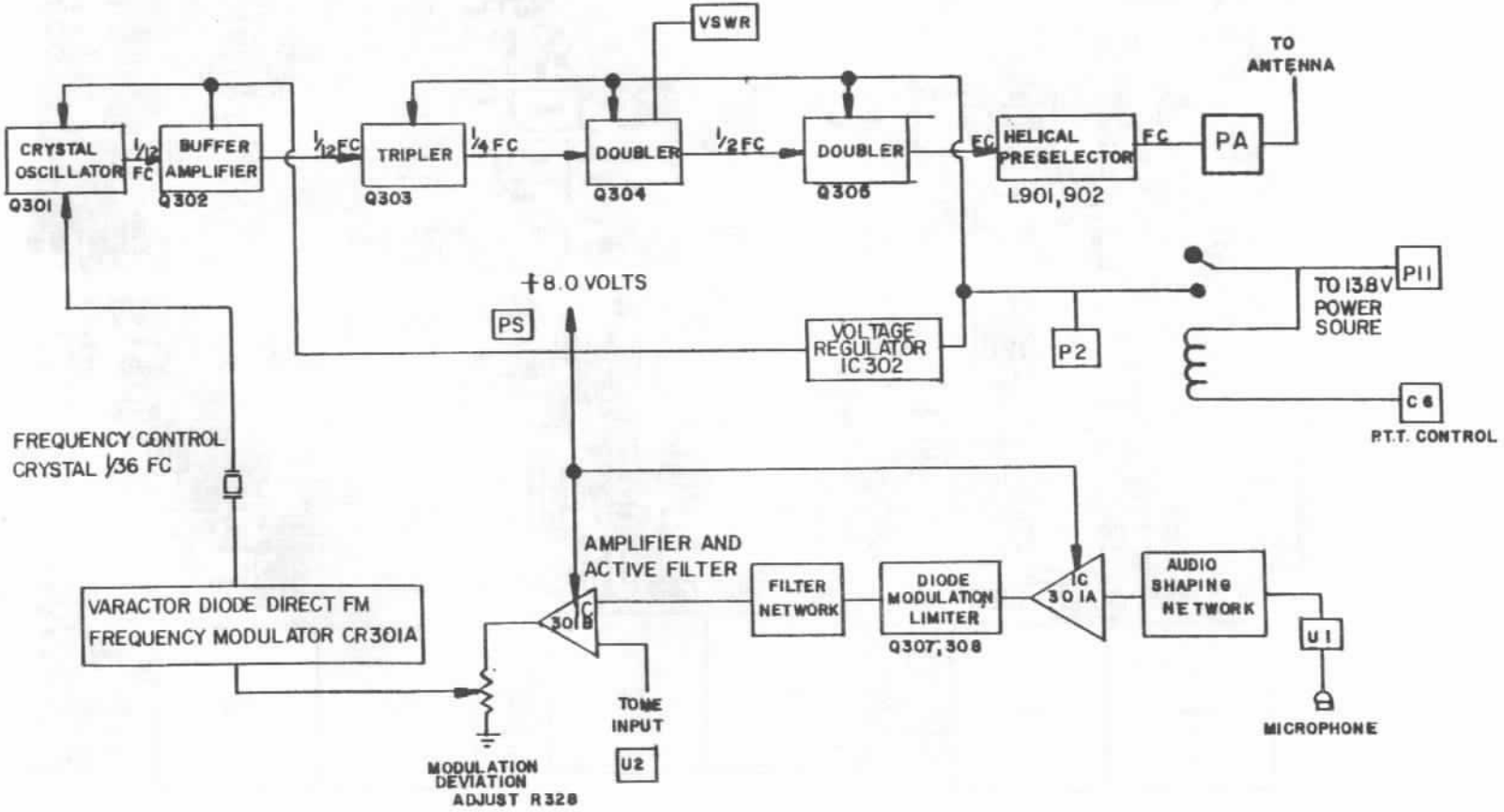
Voltage on active components

	With Drive			No Drive		
	E	B	C	E	B	C
Q301	1.8	2.2	8	1.7	2.3	8.2
Q302	1.4	1.8	3.1	1.4	2.2	3.6
Q303	0	-1.5	10.5	0	0	13.6
Q304	0	- .75	9.5	0	0	13.6
Q305	0	0	11.5	0	0	13.6
Q306	.2	.9	13.6			
Q307	4	3.9	3.9			
Q308	3.9	4	4			

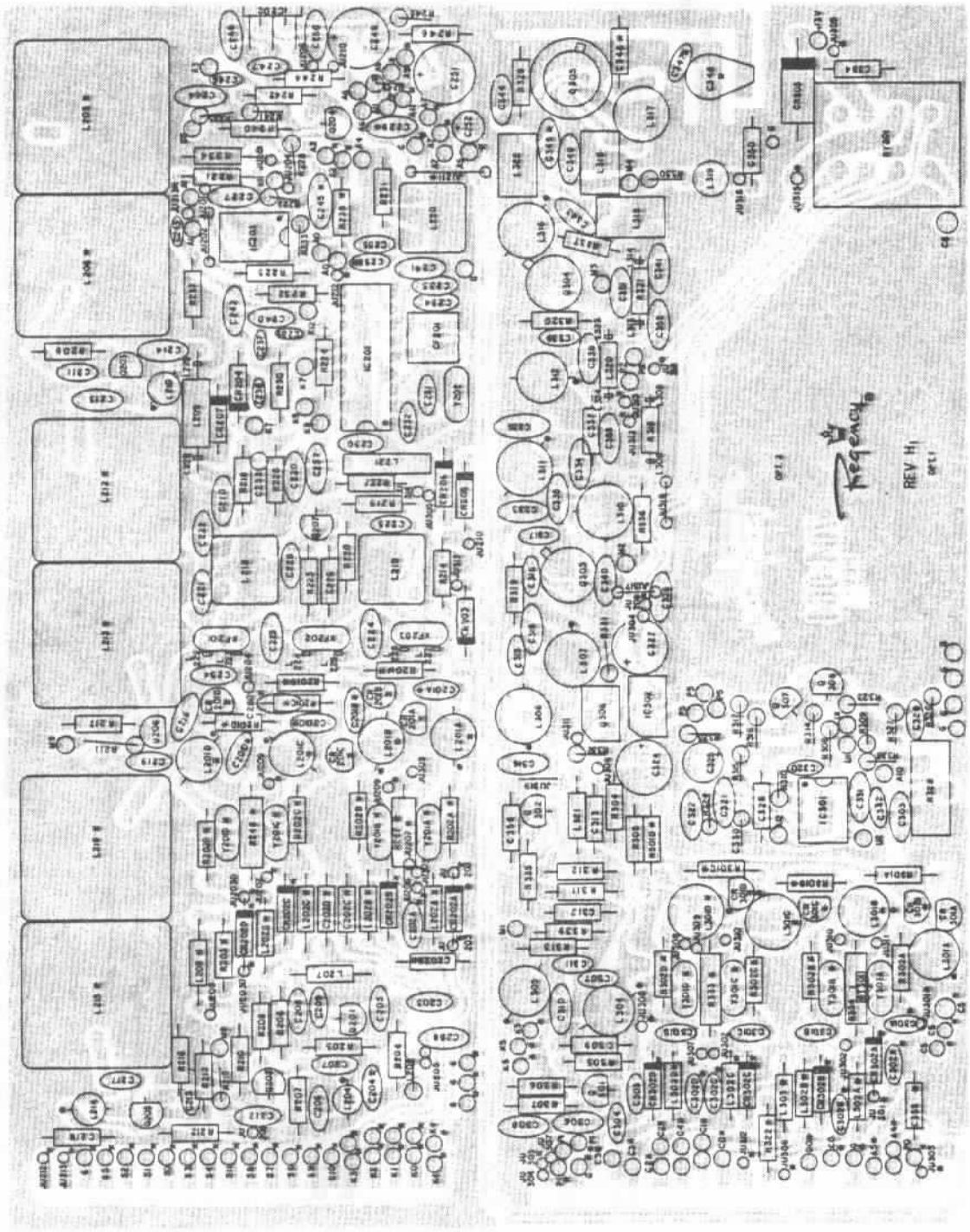
	1	2	3	4	5	6	7	8
IC301	3.8	3.8	3.8	0	3.8	3.8	3.8	8

	1	2	3
IC302	8.2	0	13.6

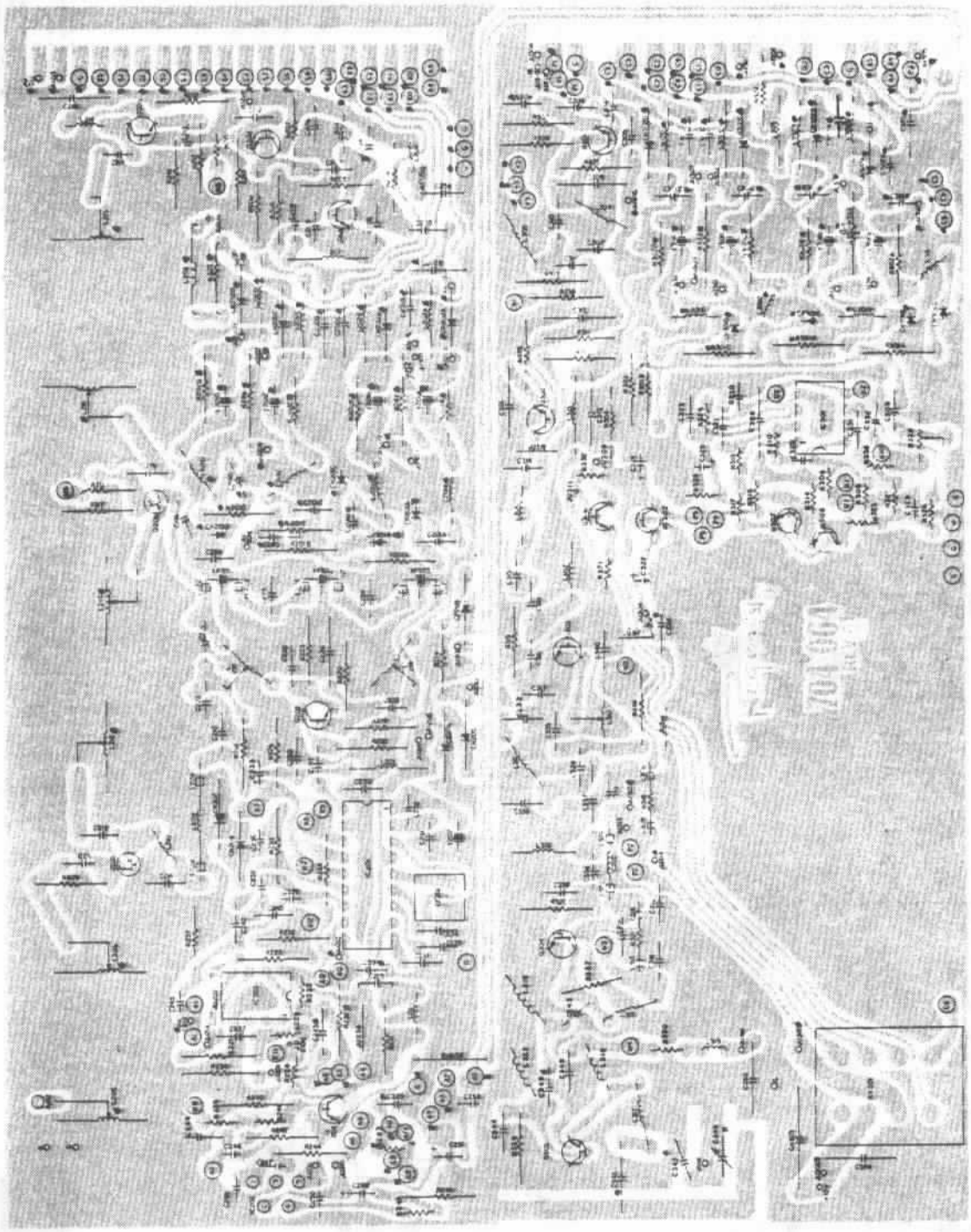
	M1	M2	M3	M4
Tuned	1.5	10.2	9	12
No Drive	2.1	13.6	13.6	13.6



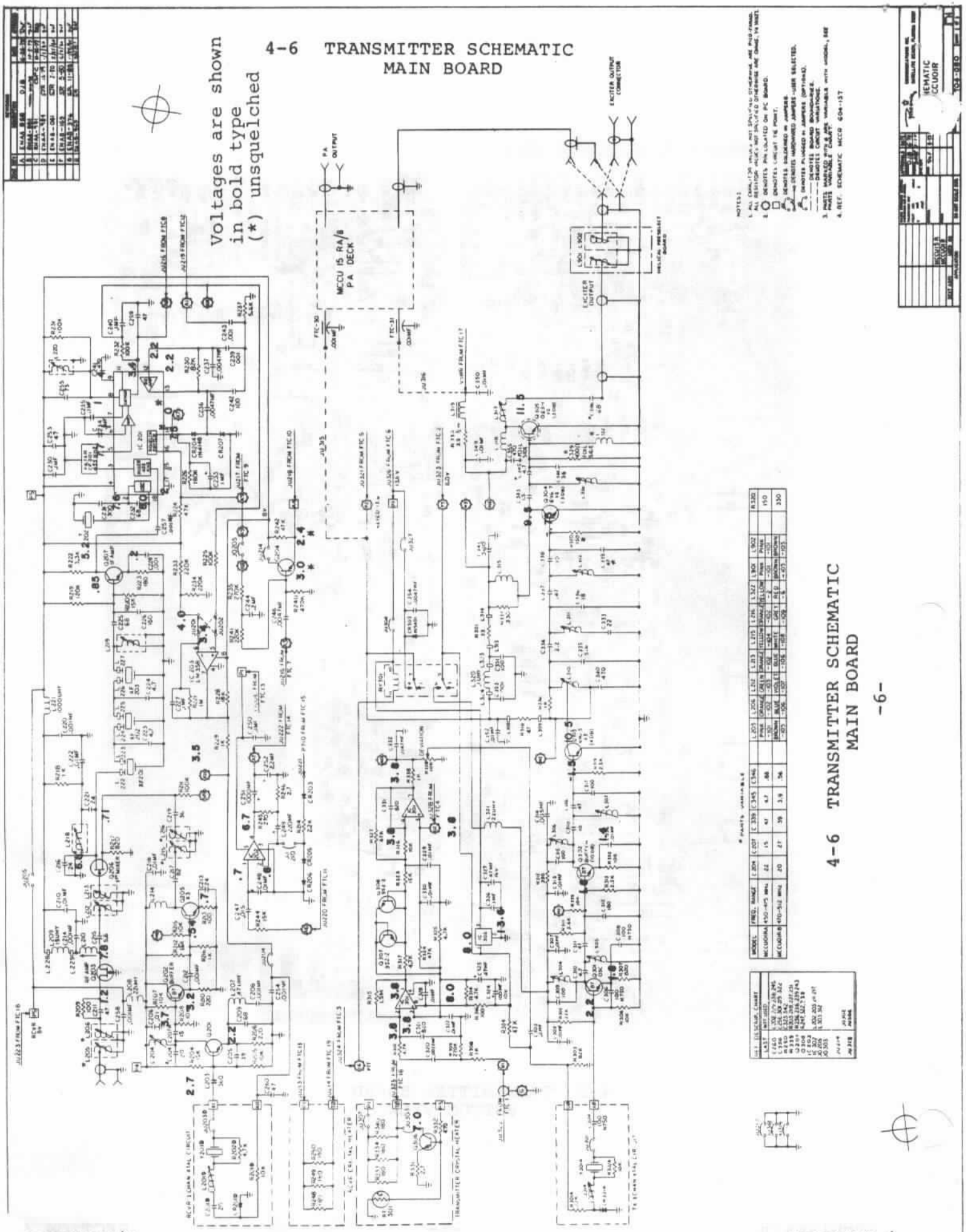
4-3 TRANSMITTER BLOCK DIAGRAM



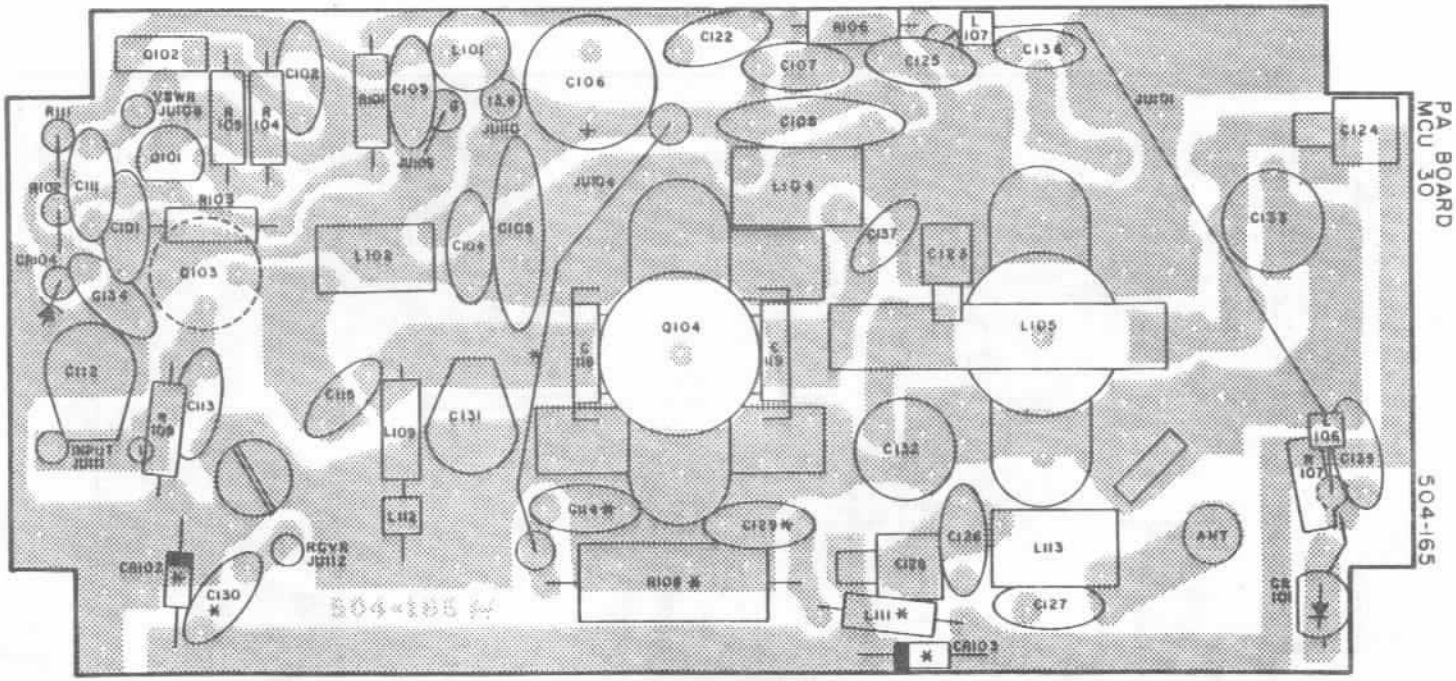
4-4 TRANSMITTER BOARD
TOP VIEW



4-5 TRANSMITTER BOARD
BOTTOM VIEW


4-6 TRANSMITTER SCHEMATIC
MAIN BOARD
Voltages are shown
in bold type
(*) unsquelched
MCCU 15 RA/B
PA DECK
PA OUTPUT
EXCITER OUTPUT CONNECTOR
4-6 TRANSMITTER SCHEMATIC
MAIN BOARD
-6-

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	D	REDRAWN EN AB-320 10-380	11-5-80	DCD
	E	EN AB-780 SJR 5-81	5-26-81	DCD
	F	EN AC-029 SJR 11-81	11/81	DCD



NOTES

1 * INDICATES NOT USED IN MCCU15R.

			APPROVALS	DATE
	MCCU15R MCU-15		DCD	10 80
NEXT ASSY	USED ON			
APPLICATION		DO NOT SCALE DWG		

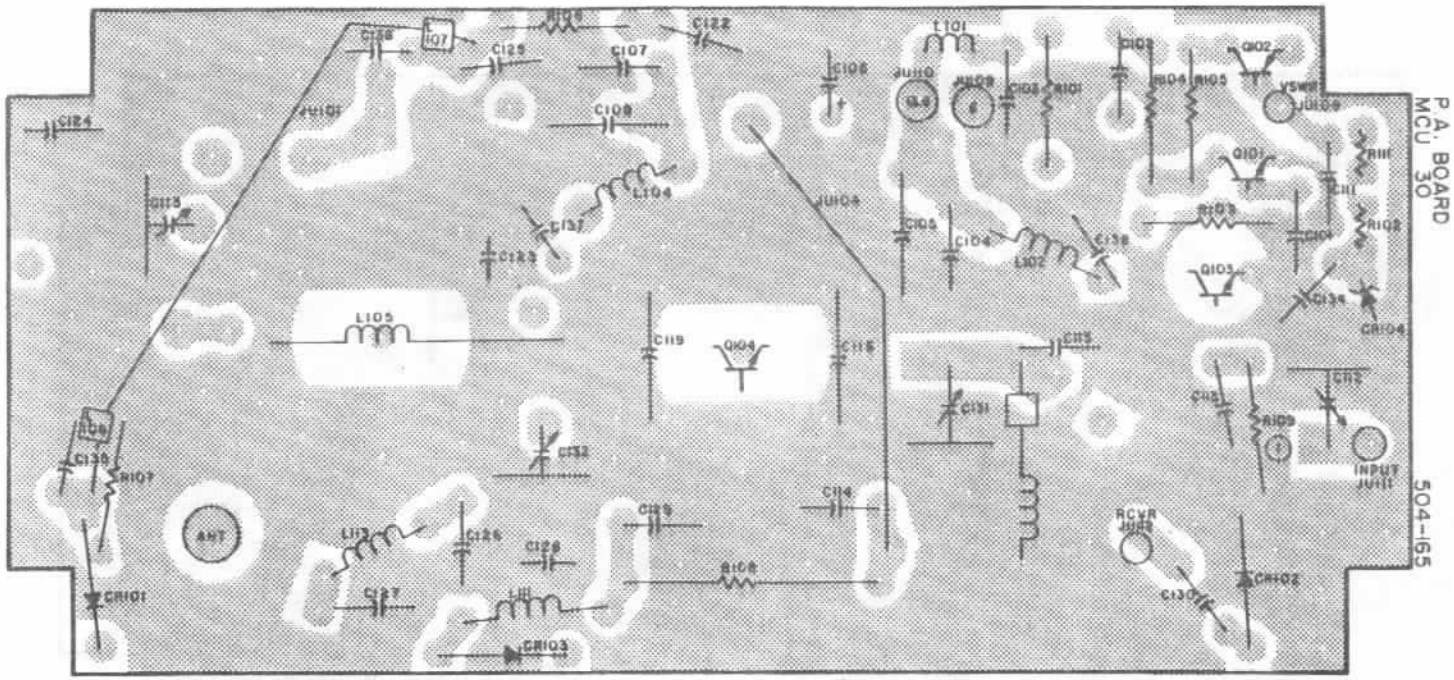
COMMUNICATIONS INC
SATELLITE BEACH, FLORIDA 32937

PARTS PLACEMENT
PA BOARD

SIZE C | PART NUMBER 504-223 | REV F

SCALE 4/1 | SHEET 1 OF 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	D	REDRAWN EN AB-320 DCD	10-8-80	
	E	EN AB-780 SJR 5-81	5-26-81	
	F	EN AC-029 SJR 11-81	11/6/81	



			APPROVALS	DATE
	MCCU15R MCU-15		DCD	1080
NEXT ASSY	USED ON			
APPLICATION		DO NOT SCALE DWG		

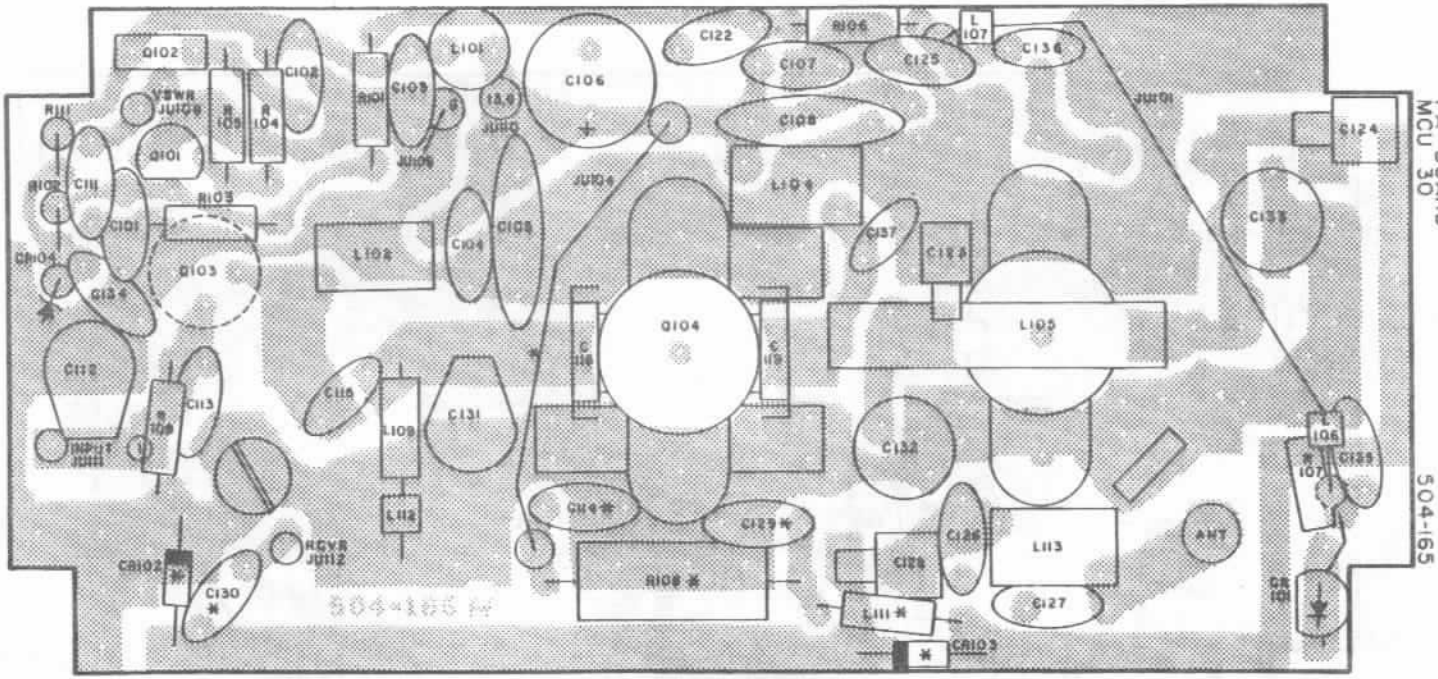
COMMUNICATIONS INC
SATELLITE BEACH, FLORIDA 32937

PARTS OVERLAY
PA BOARD

C | 504-224 | F

SCALE 4/1 | SHEET 1 OF 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	D	REDRAWN EN AB-320 10-380	11-3-80	DCD
	E	EN AB-780 SJR 5-81	5-26-81	
	F	EN AC-029 SJR 11-81	11/1/81	



NOTES

1 * INDICATES NOT USED IN MCCU15R.

			APPROVALS	DATE
	MCCU15R MCU-15		DCD	10 80
NEXT ASSY	USED ON			
APPLICATION		DO NOT SCALE DWG		

COMMUNICATIONS INC
SATELLITE BEACH, FLORIDA 32937

PARTS PLACEMENT
PA BOARD

SIZE C | PART NUMBER 504-223 | REV F

SCALE 4/1 | SHEET 1 OF 1

APPLICATION	
NEXT ASSY	USED ON
	MCCU15R

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	R281	8/80	DLF

REV A | SH 1 | TP 14-293 | DWG. NO.

TEST PROCEDURE

MCCU15R 19" RACK MOUNT UHF REPEATER

I. Test Set-Up (Refer to Figure 1)

1. MCCU15R Repeater
2. DC Power Supply 13.6VDC @ 5A
3. Audio and subaudible Signal Generator
4. R.F. Signal Generator
5. 450 MHz Thruline Wattmeter, 25W element
6. 40dB Power Pad
7. Frequency Counter*
8. Deviation Meter*
9. Spectrum Analyzer
10. UHF Notch Filter
11. HP410 DC VTVM
12. Sinadder or Distortion Meter with 1 KHz notch filter
13. AC VTVM
14. Audio Oscilloscope
15. PTT Switch
16. DC Voltmeter
17. 10.7 MHz Oscillator
18. AC VTVM
19. Microphone Matching Network
20. Audio Generator
21. MCCU01R Short Protector (Figure 3)
22. Temperature Indicator
23. 110 VAC Power Cord

*May be replaced with Cushman or similar equipment.

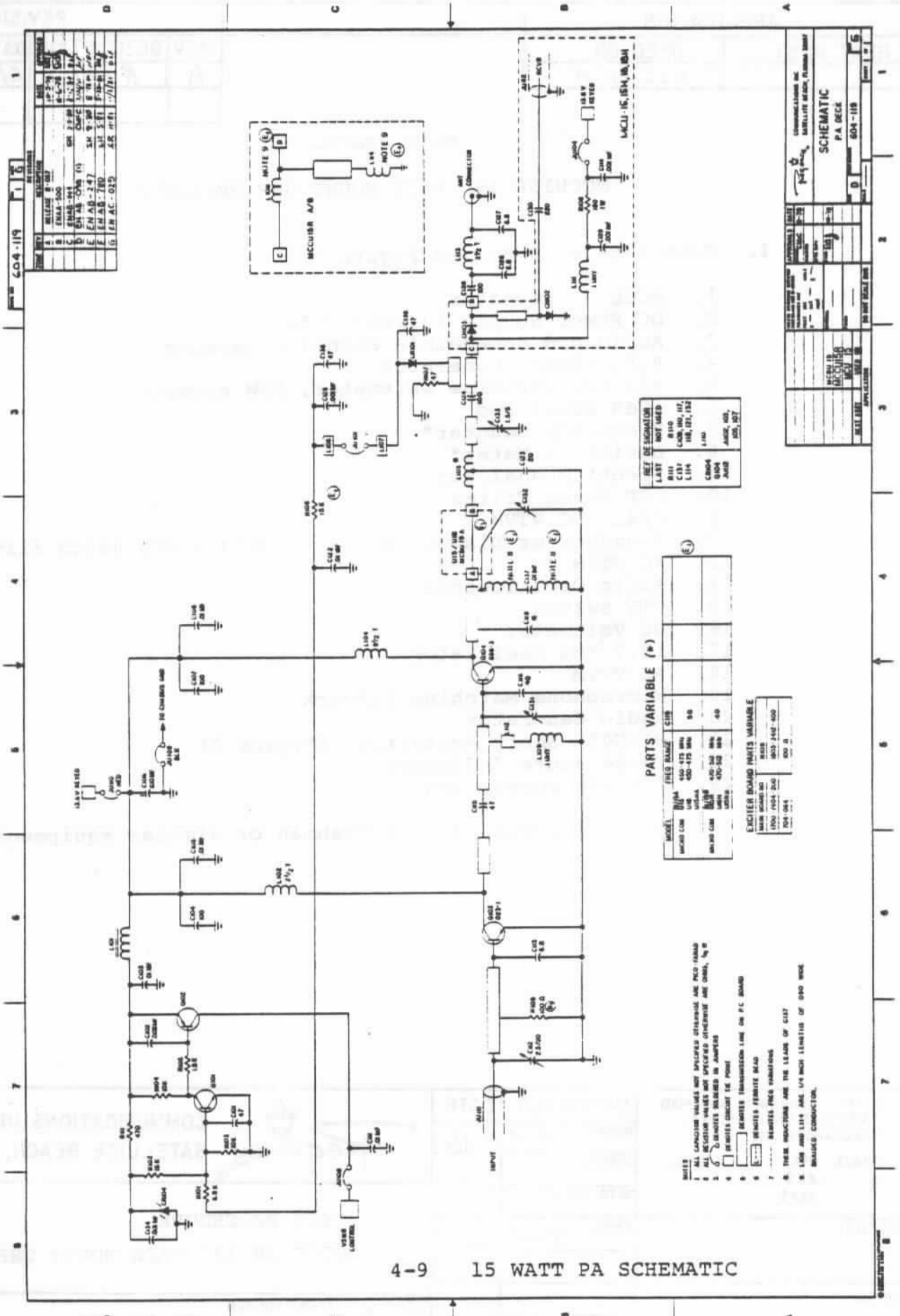
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE	APPROVALS	DATE
FRACT. ± DEC .XX± .XXX± ANG. ±	DRAWN GM	4/8/80
	CHECKED	
	DFTG. SUPV.	
MATERIAL	ENGR. DLF	6/17/80
FINISH		
DO NOT SCALE DRWG.		

Regency® COMMUNICATIONS INC.
SATELLITE BEACH, FLORIDA 32937

TEST PROCEDURE
MCCU15R 19" RACK MOUNT UHF REPEATE

SIZE	PART NUMBER	REV.
A	TP 14-293	8

SCALE | SHEET 1 OF 11



4-9 15 WATT PA SCHEMATIC

II. Set-Up Instructions

A. Set-Up Control Board
1. Add JO jumper between A1 and A3 on P706.
2. Connect tone select lead JU703 (black) to ground Pin G.
3. Connect JU718 (yellow) to squelch Pin P708.
4. Disconnect JU702 (white) from P709.

B. DC Input Short to Ground Test
1. Set S1 to Position A. Connect external DC power to P1.
2. If D2 (red) is on, B+ is shorted to ground in receiver.
3. If B+ is not shorted to ground, continue to step 4.
4. Key transmitter; if D2 is on, B+ shorted in transmitter.

C. Preliminary Preparations for Transmitter Testing
1. Insert tune-up crystal; set S1 to Position B.
2. Connect transmitter output to load.
3. Insert PTT keying switch.
4. Preset L901 and L902 tuning screws down into the can until the screws are even with the top of the nut.

D. Preliminary Preparations for Receiver Testing
1. Insert tune-up crystal. Both transmit and receive tune-up crystals are selected as follows:

Freq Range	450-476 MHz	470-512 MHz
Frequency	462 MHz	492 MHz

2. Set UHF-FM signal generator (2) to tune-up crystal frequency as measured on frequency counter (9).
a. Set squelch control clockwise.

3. Preset L210 as follows: above 465 MHz, screw the slug all the way into the coil; below 465 MHz screw the slug out to the top of the coil.

III. Transmitter Tune-Up

A. VTVM metering - Metering point M1 must be referenced to ground, but metering points M2 through M4 may be referenced to ground or to 13.6 V. Key transmitter with external PTT and key only when measuring or tuning.

1. Monitor M1. Tune L304 and L305 for minimum positive voltage. A reading of 2.1V indicates oscillator, Q301, is not oscillating.

The following metering points will be described referenced to 13.6 VDC. The VTVM is set in the -DCV position and all test points are peaked. To reference to ground, set the VTVM in the +DCV position and dip all test points. Either way the voltage difference between tuned and not tuned will be identical.

2. Monitor M2. Alternately tune L306 and L307 for maximum negative voltage. Tune L310 for a minimum. Voltage should be -2.5V to -3.0V. A reading of 0V indicates Q303 stage has no output.

3. Monitor M3. First tune L312 for maximum negative voltage, then tune L311. Tune L316 for a minimum. Voltage should read -3.5V to -5.0V when tuned. A reading of 0V indicates Q304 stage has no output.

4. Monitor M4. Tune L316 for maximum negative voltage, then tune L317 for maximum negative voltage. Voltage should read -1.5 VDC. A reading of 0V indicates Q305 stage has no output.

5. Tune L901 and L902 for maximum power out by alternating 2 turns on each of the screws. Tune L316 and L317 and set the tuning screws on L901 and L902 as far as possible into the can for maximum power output.

   For following see Figure 4.

6. Tune C112, *C131 and C133 in RF Power Amplifier Deck for maximum power output.

7. Repeat Steps 5 and 6. Power output should be in excess of 15 watts.

B. Connect counter (7) to the output of the 40 dB attenuator (6) and set the F1 warp control, L301A to the nominal crystal frequency ±100 Hz.

C. Conducted spurious emissions measurement. Tune band reject filter (10) so that the carrier is not notched and set the spectrum analyzer (9) carrier indication to the 0dB reference line. Tune the band reject filter to attenuate the carrier at least 30dB. In the MCCU15R all harmonics should be 60dB or more lower than the reference.

D. Deviation adjustment

1. Connect audio generator (20) to microphone input. Set the generator for 1 KHz at 1 VAC. Connect the deviation meter (8) to the attenuator (6) output.

2. Key the transmitter and adjust R328 for ±5 KHz deviation as measured on the meter.

E. Check the modulation sensitivity by reducing the audio generator output until the deviation is ±3 KHz. The measured generator output on the AC VTVM (18) should be less than 20mv rms.

F. The crystal heater circuit can be checked in two ways. The check must be made at 25°C (76°F) after the DC voltage to the MCCU15R has been turned on for at least 3 minutes. In the preferred test, the sensor of the temperature indicator (22) is positioned between the crystal clip and the crystal in both the transmitter and receiver. The reading must be within 49°C to 59°C on the transmitter and within 45°C to 59°C on the receiver. Alternately the voltage at the collector of Q306 must be within 6.0 to 8.0 VDC.

IV. Table of Performance Limits for Transmitter

PARAMETER	MIN	TYP	MAX	UNITS
M1	+2	+1.8	+1.6	VDC
M2	0	-2.5	-3.5	VDC
M3	0	-3.5	-5	VDC
M4	0	-1.5	-2	VDC
Deviation	-	-	+5.0	KHz
Mic Mod Sens	-	10	20	mVac
Xtal Temp at 25°C	49	54	59	°C
Collector Q306 at 25°C	6.0	7.0	8.0	VDC
MICRO-COM U15R				
Tx Power Output	15	17.5	20	W
DC current	4.2	4.5	4.8	A

V. Receiver Alignment Procedure

A. Connect AC VTVM (13) across the speaker load (P2 Pin 12) and adjust the ON-OFF Volume Control for a readable VTVM reading on the 1 VAC scale.
B. Monitor K11 with DC VTVM (11). Inject strong 10.700 MHz signal into the vicinity of L319 and Q207. Set K11 to 3.5 VDC by adjusting L220.
C. Monitor M8 with the DC VTVM (11). Adjust L204 for minimum voltage at M8. A voltage dip of 0.05V from the oscillator off to the oscillator on should be observed. A reading of 0.6 VDC indicates no drive to Q205.
D. Modulate signal generator (3) with a 1 KHz tone at ±3 KHz deviation. Increase generator output for 6dB SINAD on sinadder (12).
E. Adjust L205, L206, L212 and L213 for best 12dB SINAD by constantl reducing the signal generator output for 12dB SINAD.
F. Adjust L215 and L216 for best 12dB SINAD.
G. Monitor K11 with DC VTVM. Adjust L201D to 3.5V.
H. Increase deviation to ±6 KHz. Adjust L218 and L219 for best 12dB SINAD.
I. Set the signal generator (3) for a 1 KHz tone at ±3 KHz deviation Adjust the generator output for 12dB SINAD. The generator should read no more than .35uv.
J. Increase the signal generator output to 100uv and turn the volume control R3 to full volume. The AC VTVM (13) should exceed 4.0 VAC.
K. Set the signal generator to -130dBm and remove the modulation.

Set AC VTVM (13) to the 1V scale and use the volume control to set voltage to 1.0 VAC. Increase the signal generator output until the AC VTVM reads 0.1 VAC. This is 20dB quieting and the generator should read less than 0.5uv.

L. Set the signal generator (3) output to -130dBm. Set the squelch control R2 to threshold, just quieting the receiver noise. Increase the signal generator output until noise appears. This is threshold squelch and the generator should read less than .25uv.

M. Turn the squelch control fully counterclockwise. Increase the signal generator output until the squelch opens. This is tight squelch and the generator should read less than 0.7uv.

N. Monitor K11 with DC VTVM (11) set on 10V scale. Set signal generator (3) for 100uv and offset the frequency ±3.0 KHz from the crystal frequency. Voltage at K11 should increase from 3.5 VDC on frequency to at lease 4.5 VDC with +3.0 KHz offset.

O. The receiver desensitization test must be made with all shields, covers, (except top cover) and screws firmly in place. The signal generator (4) is modulated with 1000 Hz at 3 KHz deviation with the RF output corresponding to 12dB SINAD. The transmitter is keyed, by shorting feed-thru capacitor FTC-3 to ground, into a 50 ohm load (6). The signal generator output is increased for 12dB SINAD. The maximum acceptable signal generator increase is 1.0dB.

VI. Table of Performance Limits

PARAMETER	MIN	TYP	MAX	UNITS
M8	-	.5	.55	VDC
12dB SINAD	-	.3	.35	uv
20dBQ	-	.4	.5	uv
Threshold Squelch	-	.2	.25	uv
Tight Squelch	-	.55	.7	uv
Audio Output 1 KHz Tone	-			
3 KHz Dev	4.0	4.2	-	VAC
Noise Output	4.0	4.2	-	VAC
K11 +3 KHz offset	4.5	6.0	-	VDC
Desens	-	-	1.0	dB

VII. Tone/Control Board Checkout Procedure

A. Timer Test

1. Connect JU702 (white) to P709 (transmit).
2. Turn up volume control so you can hear the receiver in the local loudspeaker.
3. Open squelch control. Transmitter should now be activated.
4. Closing squelch control should turn off transmitter after two second delay.
5. Open squelch control again. Transmitter should be activated. Monitor transmit audio on modulation meter. After a period of three minutes the time-out warning oscillator should be audible. Then the time-out timer should automatically turr off the transmitter.

B. Transfer Audio Level Setting

1. Modulate the generator with a 1000 Hz tone at ±3 KHz peak modulation deviation.
2. Then monitor the transmitter modulation deviation and adjust R728 (on tone/control board) to obtain a reading of ±3 KHz peak modulation deviation.

C. Tone Squelch Test

1. Connect JU718 (yellow) to NC.
2. Clip R762 (33K) "pull-up" resistor. LD701 should light and transmitter should be activated.
3. Install Test Encoder (MA-121) into P701.
   Install Test Decoder (MA-116) into P702.
   Modulate FM signal generator with test subaudible frequency at 500 Hz deviation. LD701 should light and transmitter should be now modulated by the test encoder.
4. This test should be repeated to the remaining tone positions, P703, P704, P705 and P706, each time clipping the associated "pull-up" resistor(33K) and replacing this resistor in the unused position(s).

D. Local Tone Squelch Test

1. Test Decoder should be in P706. Install tone select lead JU703 (black) to S13. Unsquelch radio and then apply ground to Pin 5 of the microphone jack (microphone in grounded hang-up clip). Audio from speaker should be muted until test decoder is activated.

E. Tone Plus Carrier Test

1. Install JU718 (yellow) to P707.
2. Remove signal generator from receiver antenna port.
3. Remove test decoder from P706. LD703 should light, but the transmitter should not be keyed.
4. Squelch control should now operate transmitter.
t. Replace the clipped resistor R764.

VIII. MCCUR 5 Amp Power Supply Checkout Procedure

A. Voltage Charts

1. Turn front panel Volume Control On/Off switch to off positio
2. Insert 110 VAC Power Cord(23).
3. Relay RY501 should immediately pull in and 25 VDC should be measured at positive side of C502/C503.
4. Measure voltage at hot side of Volume Control On/Off switch. This should be 13.8 ± 0.5 VDC. Leave voltmeter attached to this point for next steps.

5. Turn Volume Control On/Off switch to on. On indicator should light. Voltage at On/Off switch should not change.

6. Key transmitter. Voltage should not drop more than 0.5 VDC.

B. Emergency Standby Power Transfer Checkout Procedure

1. With repeater operating normally on internal AC power supply, connect test DC power supply (2) to P1. LED CR501 located on 5 amp power supply board should light This indicates that an external DC supply is connected.

2. Unplug AC power cord. Relay RY501 should drop out, LED CR501 should be turned off and power for the repeater will be derived from the external source.

DRAWN		DATE 4/8/30	SIZE A	PART NUMBER TP 14-293	REV. B
APPROVED	DLF	DATE 6/16/30			
DO NOT SCALE DWG.		SCALE			SHEET 7

DO NOT SCALE DWG.

DRAWN

APPROVED DLF

DATE 6/16/80

SCALE

SIZE A

PART NUMBER TP 14-293

SHEET 8

REV. B

TEST INTERCONNECTION DIAGRAM FOR MCCU15R

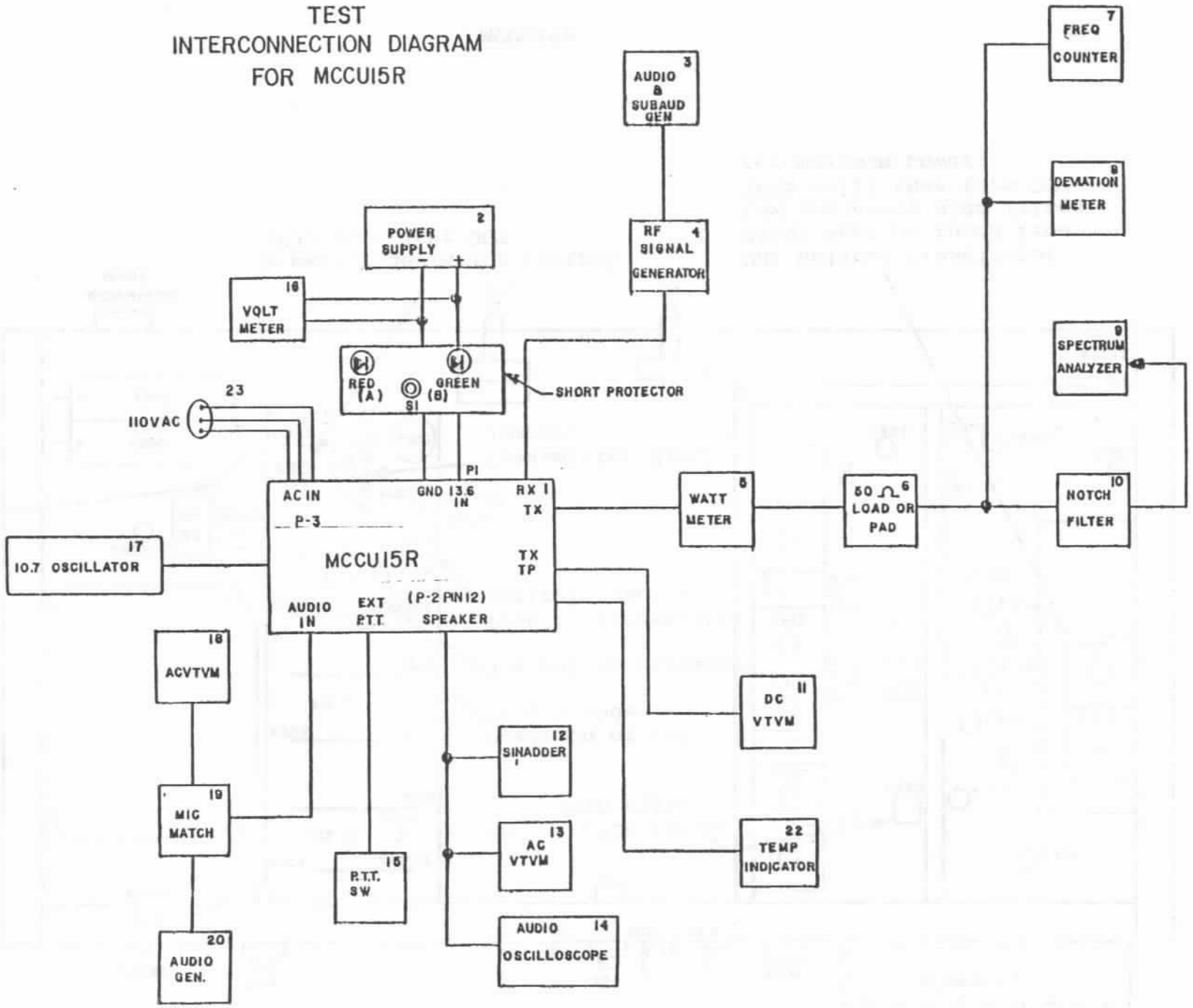
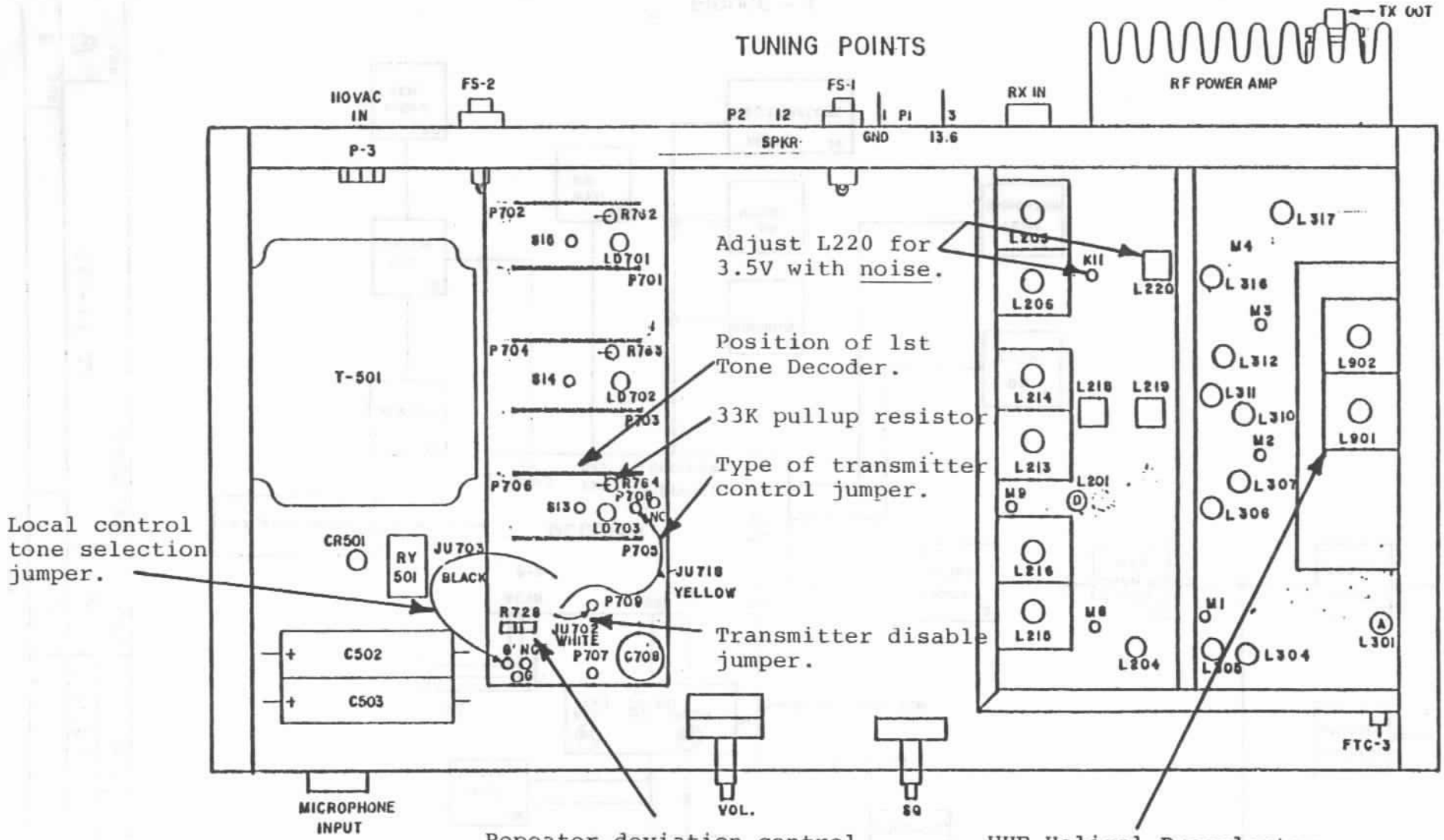


FIGURE - 1

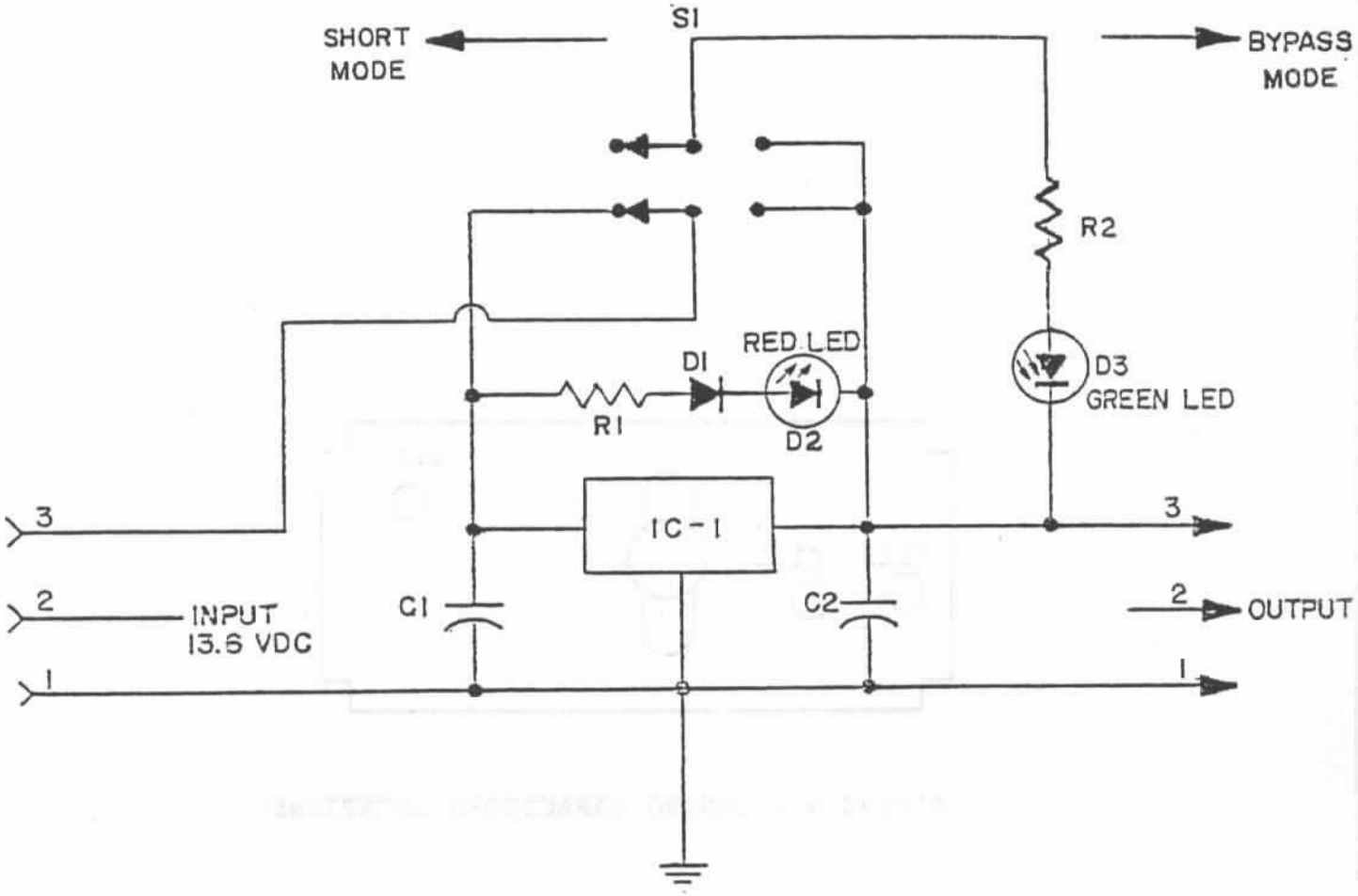
TUNING POINTS



MCCU15R

TP 14-293 REV E
SHT 9

SCHEMATIC FOR SHORT PROTECTOR



R1, R2 = 390 Ω 1/2 WATT
C1, C2 = 1MF TANT
D1 = IN4148
D2 = RED LED
D3 = GREEN LED
IC-1 = 7812 REGULATOR
S1 = D.P.D.T. SWITCH

FIGURE 3

DRAWN	M Tin	DATE 11/8/22	SIZE A	PART NUMBER TP 14-293	REV. B
APPROVED	DLF	DATE 5/16/80			
DO NOT SCALE DWG.			SCALE		SHEET 10

MCCU15RA/B

RF POWER AMPLIFIER

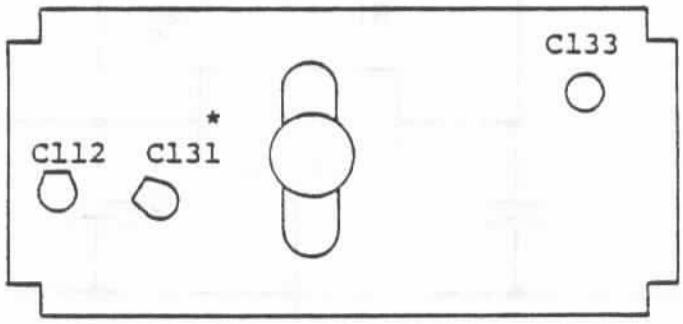


FIGURE 4 - TUNING CAPACITORS LOCATIONS

* NOTE C131 USED IN MCCU15RB ONLY

DRAWN	DATE	SIZE	PART NUMBER	REV.
APPROVED DLF	DATE 6/16/86	A	TP 14-293	B
DO NOT SCALE DWG.		SCALE		SHEET 11

SECTION 5 - MCCUR 5 AMP POWER SUPPLY (504-374)

5-1 DESCRIPTION

The power supply transformer T501 transforms the 117 VAC line voltage to 38 VAC, center tapped, at the secondary. Rectifiers D501, D502 and filter capacitors C502 and C503, rectify and filter this secondary voltage to produce approximately 23 VDC. This is applied to Pin 1 of voltage regulator IC. IC1 is a fixed 12 volt device and its output is boosted to 13.8 volts by D504, D505 and D506 in series with the case of IC1 to ground.

5-2 EMERGENCY STANDBY POWER FEATURE

Relay RY501 senses the rectified DC voltage from the power supply. If 110 VAC is removed, relay RY501 drops out, connecting Pin 3 of the external power socket to the repeater. Therefore, repeater operation remains the same except that power is derived from the standby source.

Provisions have also been included to float charge the standby battery. This is made by proper selection of R502 (not included). The value is selected by following battery manufacturer's suggested float charge current and the following formula:

Formula

$$R = \frac{(24.6V - E)}{I}$$

E = Battery Voltage
I = Float Charge Current

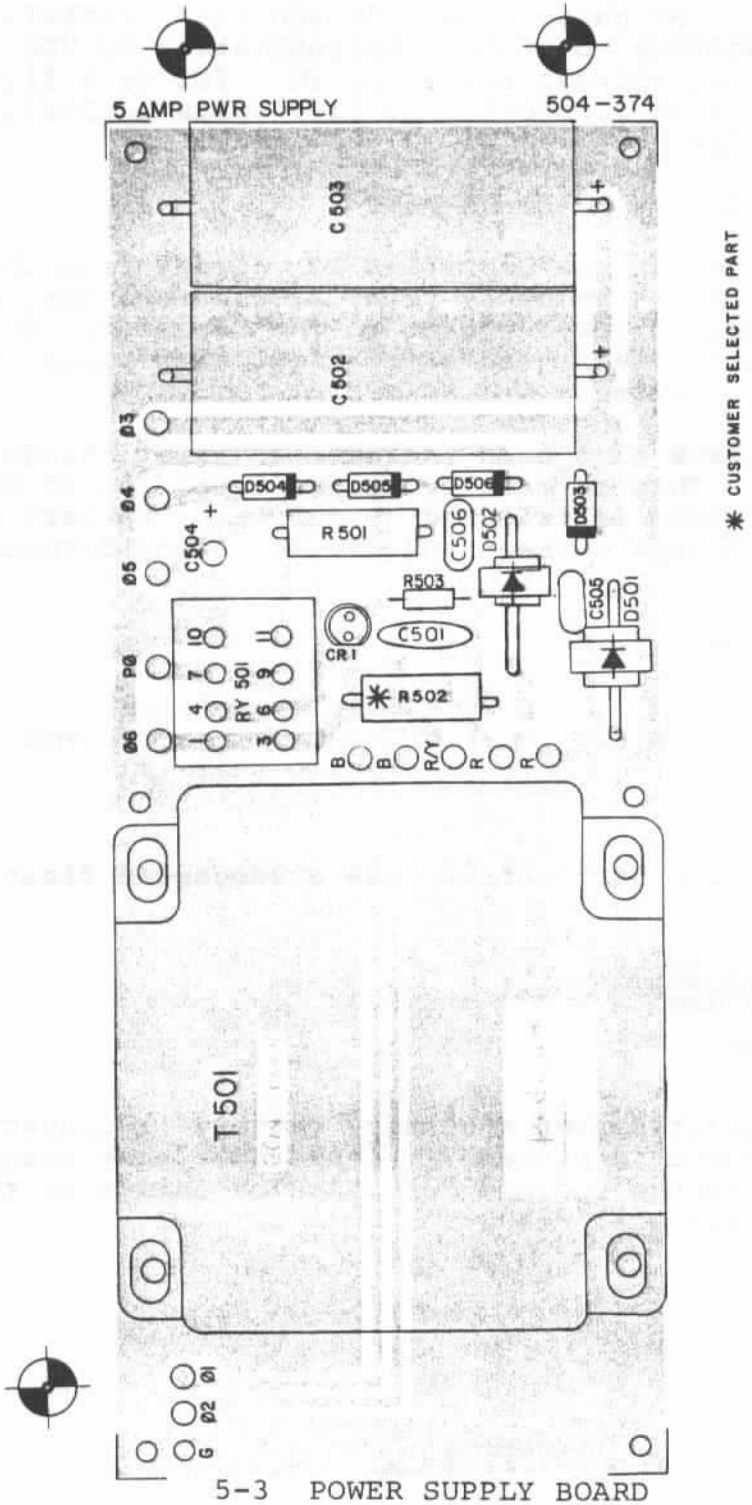
Example

A 5 amp/hr 12.6 volt battery has a suggested float charge of .05 Amp

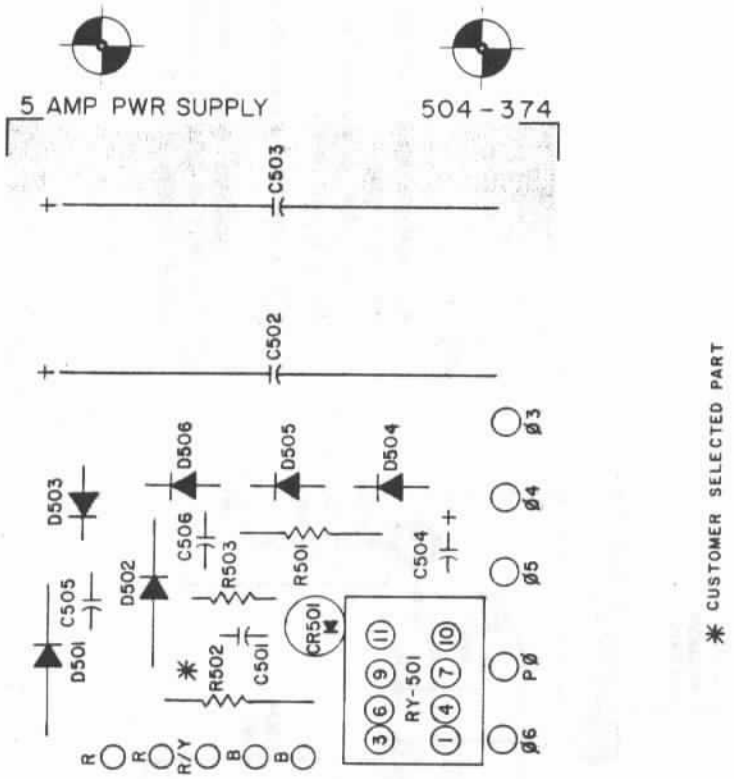
$$R = \frac{(24.6V - 12.6V)}{.05\ Amp}$$

$$R = 240\ ohms$$

LED CR1 indicates that a standby battery is connected and that float charge current is present. Please note that charge current must be limited to the recommended value or damage to the battery and/or power supply will result.



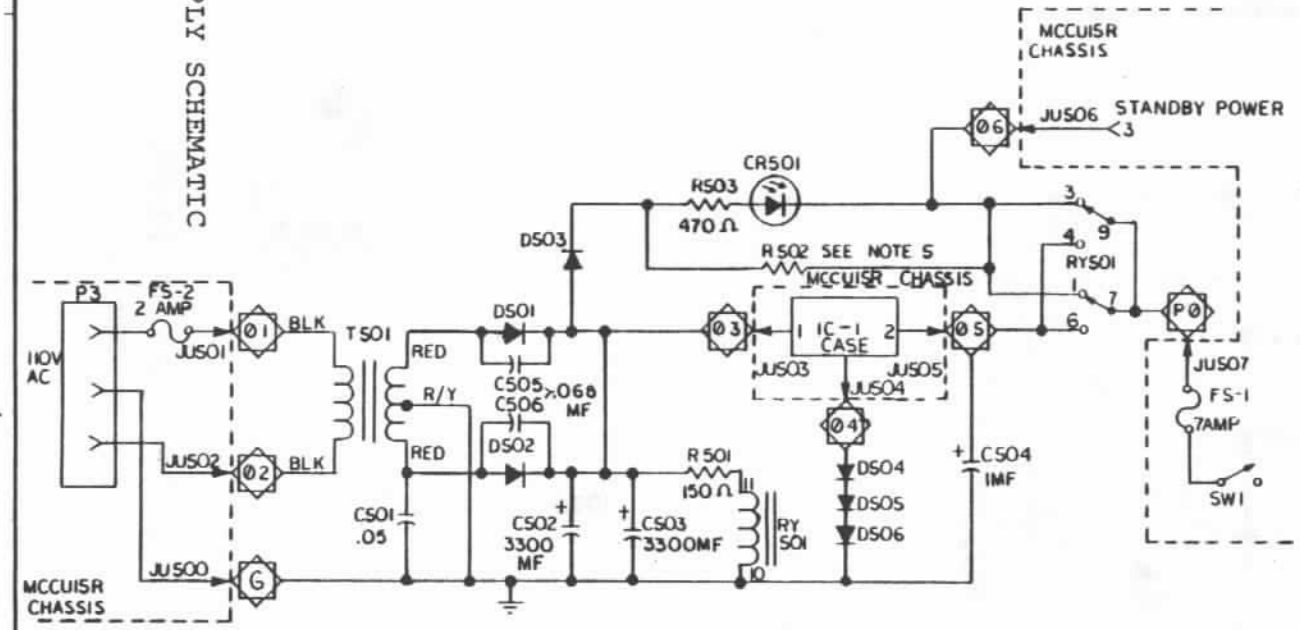
5-3 POWER SUPPLY BOARD
TOP VIEW



5-4 POWER SUPPLY BOARD
BOTTOM VIEW

5-5 POWER SUPPLY SCHEMATIC

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	R-279	5-21-80	D.F



NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO-FARAD.
2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, 1/4 WATT.
3. ○ DENOTES PIN LOCATED ON P.C. BOARD.
4. - - - - INDICATES OPTION VARIATIONS.
5. THIS VALUE IS SELECTED FOR PROPER FLOAT CHARGE ON STANDBY BATTERY.

			APPROVALS	DATE
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACT. DEC. ANGLE ± .xx± ± .xxx±	DRAWN SJR.	3-80
			CHECKED	3-80
			QUAL. SUPV.	
		MATERIAL	ENGR. DLF	5-80
	MCCUR	FINISH		
NEXT ASSY	USED ON			
APPLICATION		DO NOT SCALE DWG.		

Regency COMMUNICATIONS INC. SATELLITE BEACH, FLORIDA 32937

SCHEMATIC
5 AMP POWER SUPPLY
MCCUR

SIZE C | PART NUMBER 504-379 | REV A

SCALE NONE | SHEET 1 OF 1

SECTION 6 MA-116 TONE ENCODER-DECODER, AND MA-121 TONE ENCODER

6-1 GENERAL INFORMATION

The model MA-116 Tone Squelch Encoder-Decoder is used as a tone decoder for CTCSS (tone squelch) operation of the Regency repeater. Since the MA-116 can serve as either an encoder or a decoder, it can be used in either the encoder or decoder sockets of the repeater.

The model MA-121 Tone Squelch Encoder is a simplified version of the MA-116 encoder-decoder, in which only those components needed for the encoding function are installed.

Normally, for each tone frequency accommodated by the repeater, one MA-116 is installed in a decoder position and one MA-121 is installed in an encoder position.

6-2 MA-116 ENCODER-DECODER CIRCUIT DESCRIPTION (Tone Receiving Condition)

Audio from the receiver discriminator is fed into the tone squelch board at terminal A1, and passes through the High Pass Filter IC601A, and back to the receiver's audio amplifier circuits at terminal A3. The high pass filter removes the CTCSS tones, which are below the normally utilized speech frequencies, so they will not be heard on the receiver loudspeaker.

Audio from the receiver discriminator (At A2) is also fed into an active filter, consisting of IC601B, IC602A and IC602B. This filter is a high Q, bandpass filter, that can be tuned for operation on any of the CTCSS tone frequencies. The components of the filter which determine the operating tone are precision resistors and condensers; R601, R602, R603, R604, R605, R606, R607, C601 and C602.

If the received tone is the proper one, as determined by the bandpass filter, it will be present in the output of IC602 and will be amplified by IC603, and then rectified to a D.C. signal by the tone rectifier CR602. This D.C. signal is then amplified further by the D.C. amplifier, IC603A. The output of IC603 is normally high, and goes to a low voltage upon receipt of proper tone. This output appears at terminal K-7 which connects to the corresponding terminal K-7 on the tone/control board and is used to disable the receiver audio section when no tone is being detected.

6-3 MA-121 ENCODER CIRCUIT DESCRIPTION

A block diagram of the encode only circuit board is shown on Figure 6-9, and a circuit diagram is shown in Figure 6-10.

The operating frequency of the tone system is controlled by an active filter, consisting of IC601B, IC602A and IC602B. This filter is a high Q, bandpass filter, that can be tuned for operation on any of the CTCSS tone frequencies. The components of the filter which determine the operating tone are precision resistors and condensers; R601, R602, R603, R604, R605, R606, R607, C601 and C602.

IC603A is an integrated circuit operational amplifier, used as a limiting amplifier. It is connected between one of the inputs and one of the outputs of the active filter described above. This limiting amplifier thus serves as a feedback path which causes the total circuit to oscillate at a frequency determined by the active filter. The limiting action of IC603 serves to keep the level of oscillation from overloading the active filter, thus keeping the output from the active filter sinusoidal.

6-4 TONE SETTING INSTRUCTIONS (MA-116 and MA-121)

The tone frequency is determined by (a) the insertion of jumpers to determine which of three bands of operation is desired and (b) the adjustment of a precision potentiometer to determine the specific tone frequency.

For purposes of installing the jumpers, the total CTCSS frequency is divided into three bands, the low band being 67.0 Hz to 110.9 Hz; the middle band 114.8 Hz to 192.4 Hz, and the high band 203.5 Hz to 253.0 Hz.

INSTALL JUMPERS FOR THE PROPER BAND

Figure 6-11 shows the jumper locations. Determine which band includes the desired frequency, and insert (or remove) jumpers according to the following chart:

67.0 Hz to 110.9 Hz	Low Band	JU601,JU602,JU603,JU604 are all removed.
114.8 Hz to 192.4 Hz	Middle Band	JU601,JU603 in place. JU602, JU604 removed.
203.5 Hz to 253.0 Hz	High Band	JU602, JU604 in place. JU601, JU603 removed.

After soldering or unsoldering jumpers, at least five minutes should elapse before making any final frequency adjustment. This is necessary to permit the precision resistors and capacitors in the vicinity of the soldering points to stabilize in temperature.

TONE SETTING PRECAUTIONS

Accurate frequency setting is necessary on CTCSS (tone squelch) systems. When making the above frequency adjustments, be sure that you set the tone as precisely as possible. If the tone board is to

operate in a system using reed type tone boards, be sure that your frequency setting is within .1 or .2 Hz if possible. Especially on reed tone systems, it is advisable to measure the tone frequency of several of the existing units; it is not safe to assume that the system is really operating on exactly the frequency stamped on the nameplate.

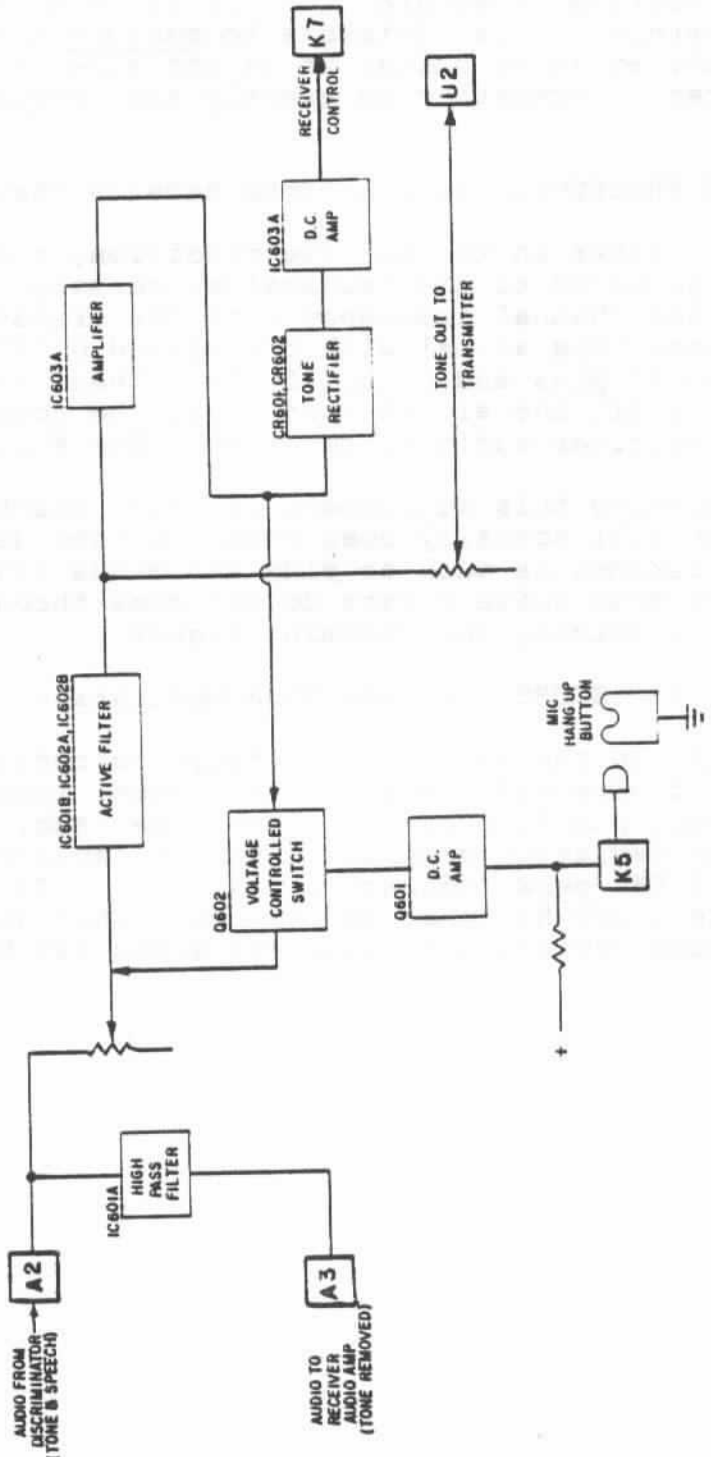
6-5 ADJUSTMENT PROCEDURE (Setting Tone Receive Threshold on MA-116)

With the receiver in the receive condition, and the microphone hang up button grounded to the transceiver chassis, inject a signal of the appropriate channel frequency into the transceiver antenna jack, and modulate this signal with the wanted CTCSS tone frequency, with a deviation of plus and minus 250 Hz. Then, adjust R612 (on the tone board) until the signal just opens the tone squelch system, and allows the receiver audio to function, (See Fig. 6-11).

After performing this adjustment of R612, check to be sure that the tone squelch will actually open when the tone deviation of the receive signal becomes as much as plus and minus 250 Hz. Further, check to be sure that noise bursts do not come through when the receiver is not receiving any incoming signal.

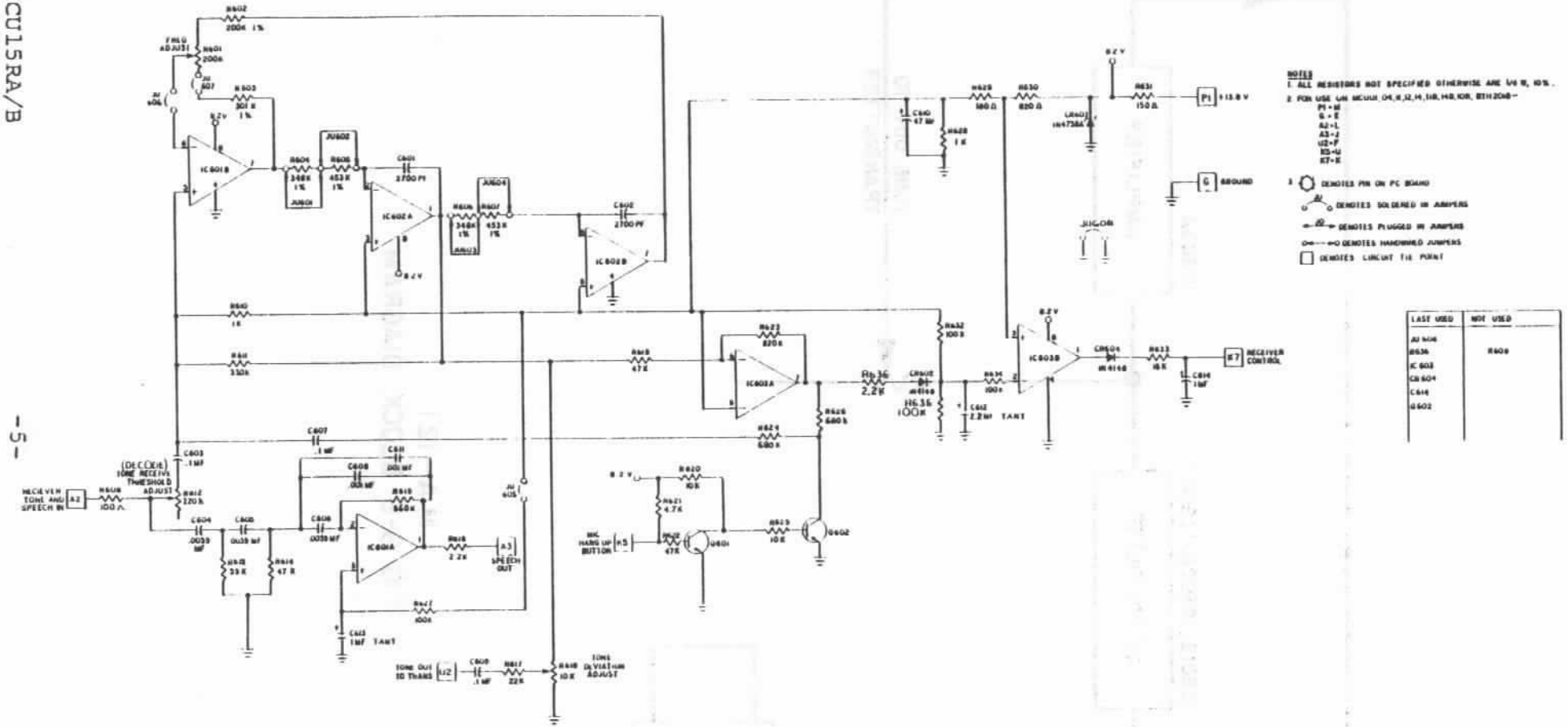
6-6 ADJUSTMENT PROCEDURE (Setting Tone Modulation Deviation on MA-121)

Adjust R618, on the tone squelch board to obtain a tone modulation deviation of plus and minus 500 Hz. Then, insert a 100 millivolt, 1,000 Hz tone into pin four of the microphone jack, and adjust R240, (the transmitter deviation control on the transceiver) to obtain plus and minus 5 KHz peak modulation deviation. If R240 was changed much, remove the 1,000 Hz tone, and readjust R618 to obtain a tone squelch modulation deviation of plus and minus 500 Hz.

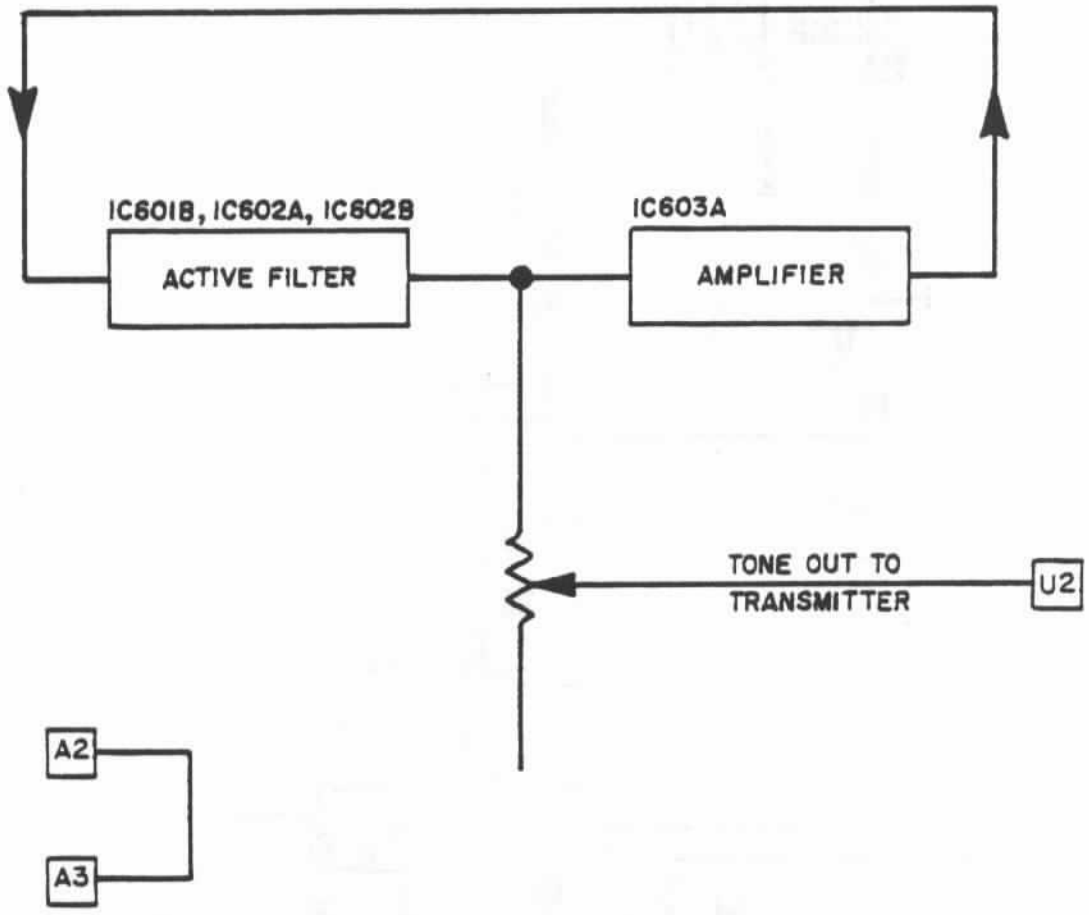


MA-116 BLOCK DIAGRAM

FIG. 6-7



6-8 SCHEMATIC MA-116



MA-121
FIG. 6-9 BLOCK DIAGRAM

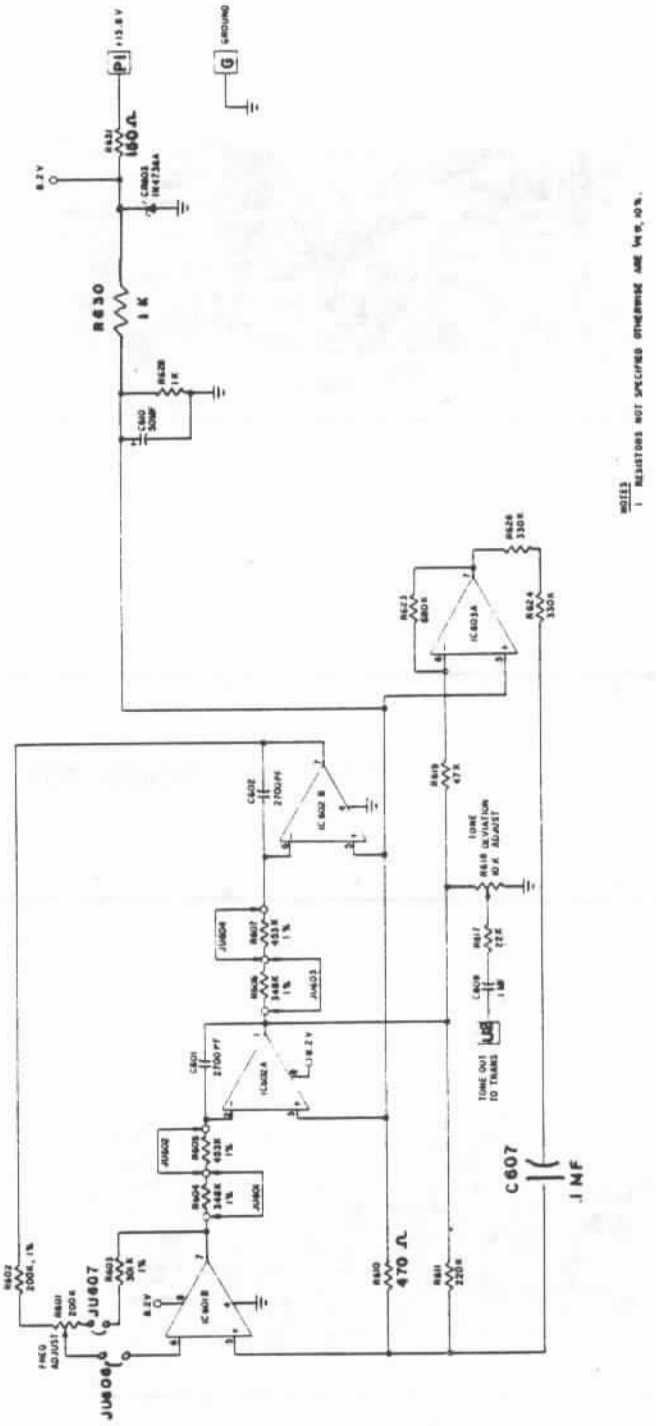
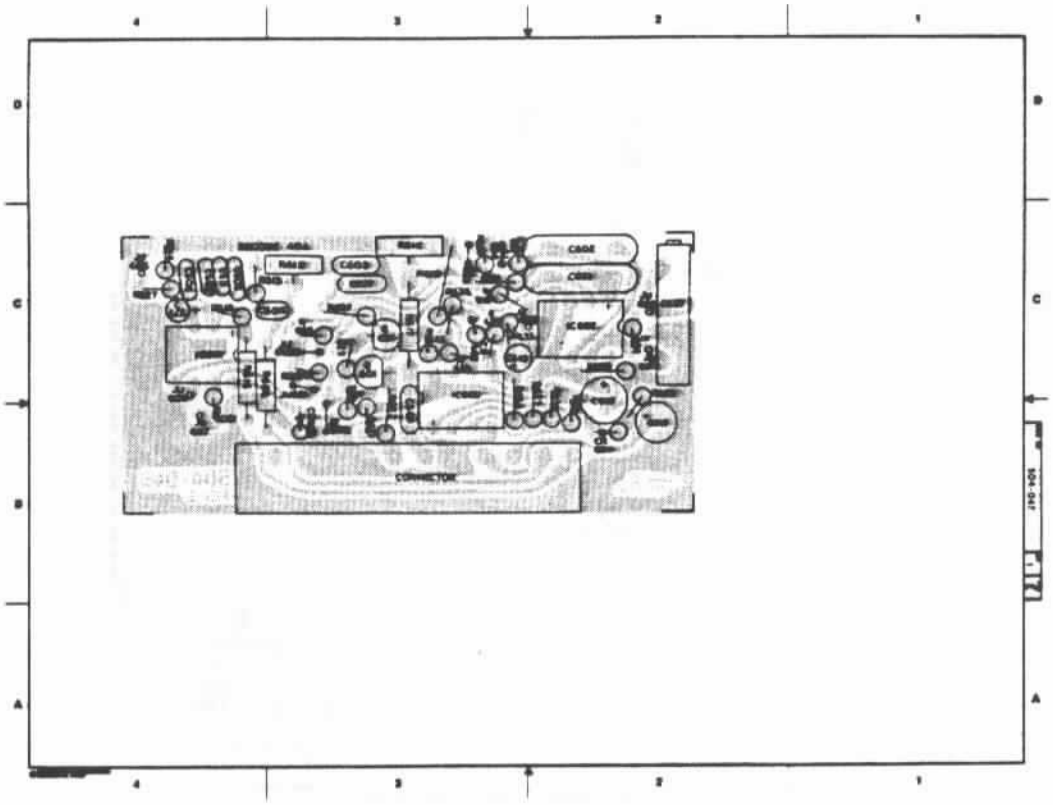
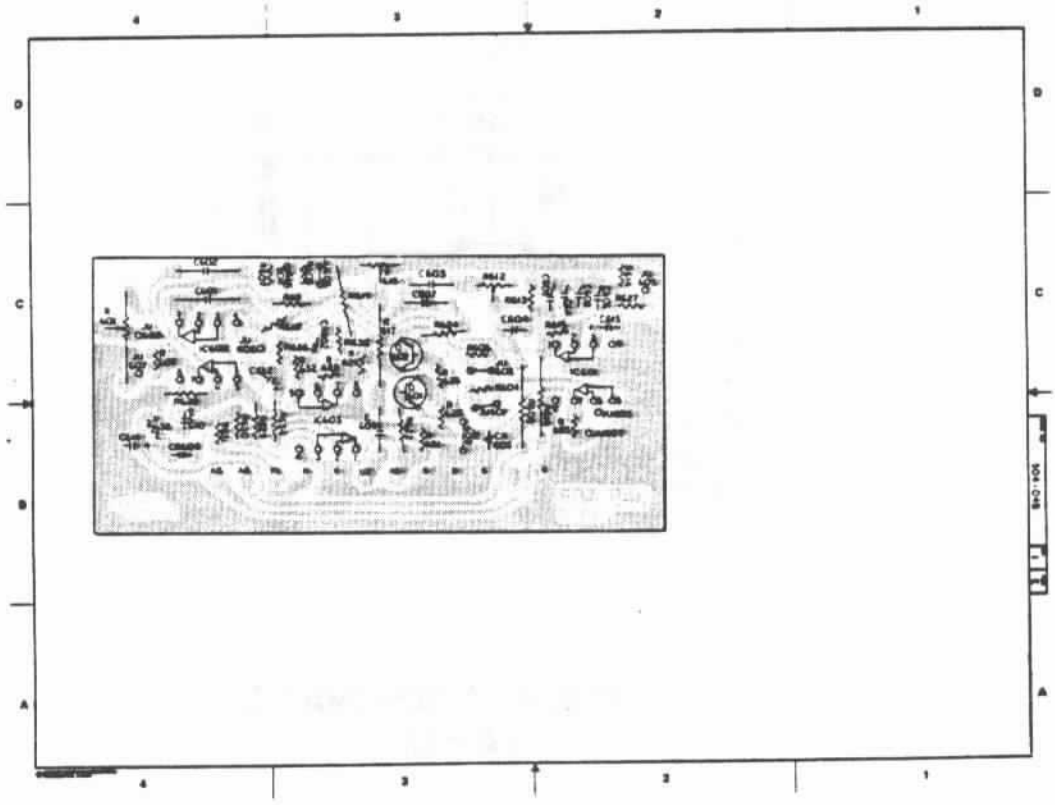


FIG. 6-10 SCHEMATIC
MA-121



6-11 CTCSS TONE BOARD TOP VIEW



6-11 CTCSS TONE BOARD BOTTOM VIEW

SECTION 7 REPEATER CONTROL SYSTEM

7-1 REPEATER CONTROL BOARD

An interconnection schematic of the repeater is shown in Figure 7-10. The repeater control functions are performed by the repeater control board, which is shown in detail on the interconnection schematic. The control board components carry 700 series numbers. Follow Figure 7-10 while reading the following.

The control board is arranged to permit operation of the repeater by noise squelch, CTCSS (Continuous Tone Controlled Squelch, often abbreviated as "tone squelch") tones or by CTCSS plus noise squelch.

The MCCU15R repeater is equipped to hold three different tone decoders and four additional on the accessory tone squelch board. Any number up to seven may be installed, but the first one should be installed in P706, located on the repeater control board. Similarly, the repeater is equipped to hold three different tone encoders, and four additional on each accessory tone squelch board. Any number up to seven may be installed, but the tone generator corresponding to the first tone encoder should be installed in P705.

7-2 AUDIO PATHS

Audio from the receiver is fed to Pin A2 of the tone receiver in the P706 receptacle. This audio contains both the speech and the CTCSS tone portions of the received signal. An active high pass filter removes those frequencies below about 400 Hz, which includes the CTCSS tones and feeds the remaining signal (now speech only) back to the receiver at Pin A3. (In units not equipped with tone squelch, a jumper is placed between Pins A1 and A3 to provide an audio path. This speech-only signal is then passed through the emitter follower audio switch in the receiver and fed to the front panel volume control R3. Audio from the arm of R3 is fed back to the receiver audio power amplifier and raised to loudspeaker levels to operate the local loudspeaker. Thus, R3 controls the volume heard by the local operator and has no effect on re-transmitted audio.

Receive audio, for retransmission, is taken from the high side of R3, passed through the repeater modulation input control, R728, and sent to the transmitter modulation circuits. Since this audio has passed through the high pass filter in the tone squelch board, it contains only speech components, and does not contain any CTCSS tone. If CTCSS tone is used, the CTCSS tone for the re-transmitted signal comes from the appropriate encoder board, as will be explained later.

7-3 TRANSMITTER ACTIVATION BY NOISE SQUELCH (Carrier)

When JU718 is connected to the "Squelch" contact pin, P708, the transmitter will be activated by any signal that is accepted by the receiver's noise squelch system. When a signal is received and the receiver's noise squelch system causes the receiver to become unsquelched, audio amplifier Q204 in the receiver draws current through R3, the front panel volume control. This current creates a high across R727 that causes Q708 to conduct. Q708 causes Q707 to conduct, which places an effective ground on the cathode of CR712, which causes Q709 to conduct, which then causes Q716 to conduct. Q716 places an effective ground on the PTT terminals of the transmitter, and therefore activates the transmitter.

7-4 TRANSMITTER ACTIVATION BY TONE PLUS NOISE SQUELCH (CTCSS + Carrier)

When JU718 is connected to the "tone" contact pin, P707, the receiver noise squelch is no longer in control of the activation of the transmitter, but used to control Q720 as a clamp across Q714, preventing repeater from being keyed up without carrier present. In this condition, tone decoders, tuned to specific subaudible tones plus noise squelch activate the transmitter when the appropriate tone is detected on a received signal.

To follow the operation under tone squelch (CTCSS) control, assume that a tone decoder board for 127.3 Hz had been installed in the P706 connector of the repeater control board, and that a tone encoder for the same frequency has been installed in the corresponding P705 connector, also on the repeater control board.

Unsquelched audio from the receiver is connected to Pin A2 of all of the CTCSS tone receivers. When no tone is being received, Pin K7 of all tone receivers will have a positive voltage causing Q702, Q704, Q706, Q802, Q804, Q806 to be conducting and Q701, Q703, Q705, Q801, Q803 to be non-conducting. When a signal with 127.3 Hz tone is received, the 127.3 Hz tone receiver in P706 will sense the presense of the tone, and the positive voltage will disappear from its K7 terminal, causing Q706 to be non-conducting, thereby causing Q705 to be conducting. Current pulled by the collector of Q706 pulls current through LD703 and CR712, causing LD703 to light, and causing Q709 to conduct. The conduction of Q709 eventually causes the transmitter to be activated in the same manner as it would be in the noise squelch operation mode described earlier.

When no CTCSS tones are received, the cathodes of CR709 and CR710 are held at a positive voltage by R719. CR709 and CR710 constitute a diode switch. In this condition, the switch is open, preventing the output of the tone encoder (Pin U2, P705) from reaching the transmitter tone input terminal U2. Similar diode switches prevent the output of other tone encoders from reaching the transmitter tone input. When a 127.3 Hz tone is received, the action of Q706 and Q705 cause the voltage on the cathodes of switch diodes CR709 and CR710 to disappear. The diodes are then forward biased by current through R715 and R716, and therefore will conduct the tone from the P705 tone generator to reach the tone input to the transmitter.

7-5 OPERATION BY LOCAL MICROPHONE, PTT FUNCTION

The local microphone may be used for dispatching from the repeater location, or for testing the repeater station during maintenance procedures. This is a ceramic type microphone with a switch section that disconnects the microphone element when the PTT switch is released.

One pole of the microphone PTT switch is connected to Pin 3 of the microphone connector S1. Inside the transmitter, Pin 3 goes to the coil of the PTT relay. Since the other side of this relay is connected to plus 13 volts, approximately 13 volts appears at Pin 3 of the microphone jack. This voltage is blocked by diode CR721, but when the PTT switch is closed the voltage at Pin 3 drops to zero, causing K9 to go low, which causes Q204 (receiver audio switch) not to conduct, and thereby preventing the retransmission of any received audio during the time the local microphone is depressed.

If the repeater is equipped with tone, the tone select test lead JU703 is normally connected to contact S13. When the microphone button is depressed, S13 is pulled almost to ground, causing CR709 and CR710 to conduct, thereby permitting the tone generated by the tone encoder in P705 to be delivered to the transmitter tone input. Thus, the 127.3 Hz tone assumed above will be transmitted when the local microphone switch is operated.

If it is desired to actuate other tones for test purposes, the Tone Select lead JU703 may be connected to the appropriate tone selection contact for the desired tone, i.e., S13, S14 and S15. When the microphone PTT switch is activated, the CTCSS tone associated with the selected contact will be transmitted. After the test, be sure to return JU703 to S13 for normal operation.

7-6 TONE MONITORING PROVISIONS

Assuming that the tone select test lead is connected to S13 and that a 127.3 Hz tone decoder is plugged into P706, the positive voltage of Pin K7 of P760 (under the no-tone received condition), acting through R750 at Pin P710 to block the receiver audio power amplifier, (IC212), thereby muting the local loudspeaker.

When a tone of 127.3 Hz is received, S13 is no longer positive, and the blocking voltage is removed from Pin P712, thereby permitting the receiver audio amplifier to operate normally.

The above has described the operation when the microphone is in its grounded hanger. When the microphone is in its hanger, only signals bearing the specific tone installed in P706 will be heard in the loudspeaker. The microphone hang-up button is connected through the microphone cable to Pin 5 of the microphone connector J1, placing a ground on the base of Q717, which causes Q717 to be non-conductive. Under this condition, only the signals bearing the 127.3 Hz tone assumed above will be heard in the local loudspeaker, as described above.

When the microphone is lifted from its hanger, the base of Q717 is pulled positive by R749, causing Q717 to conduct, forcing Pin P710 low, removing blocking voltage from CI202, regardless of the voltage coming from S13. Under this condition, referred to as the "MONITOR" condition, all audio signals that pass through the receiver noise squelch system will be passed on to the receiver audio amplifier and the local loudspeaker. This "MONITOR" condition permits the operator to listen on the channel before transmitting, and thus avoid breaking up an ongoing communication on the channel.

Summarizing the action of the microphone hang-up button, and its monitoring actions:

When the microphone is in its hanger, all received signals with appropriate tone squelch frequencies (those for which a tone decoder has been installed) will be retransmitted by the repeater, but only those signals bearing one specific tone (selected by the placement of the tone-select test lead, JU703) will be heard in the local loudspeaker. This enables the local operator to avoid being bothered by transmissions over the repeater which do not concern him.

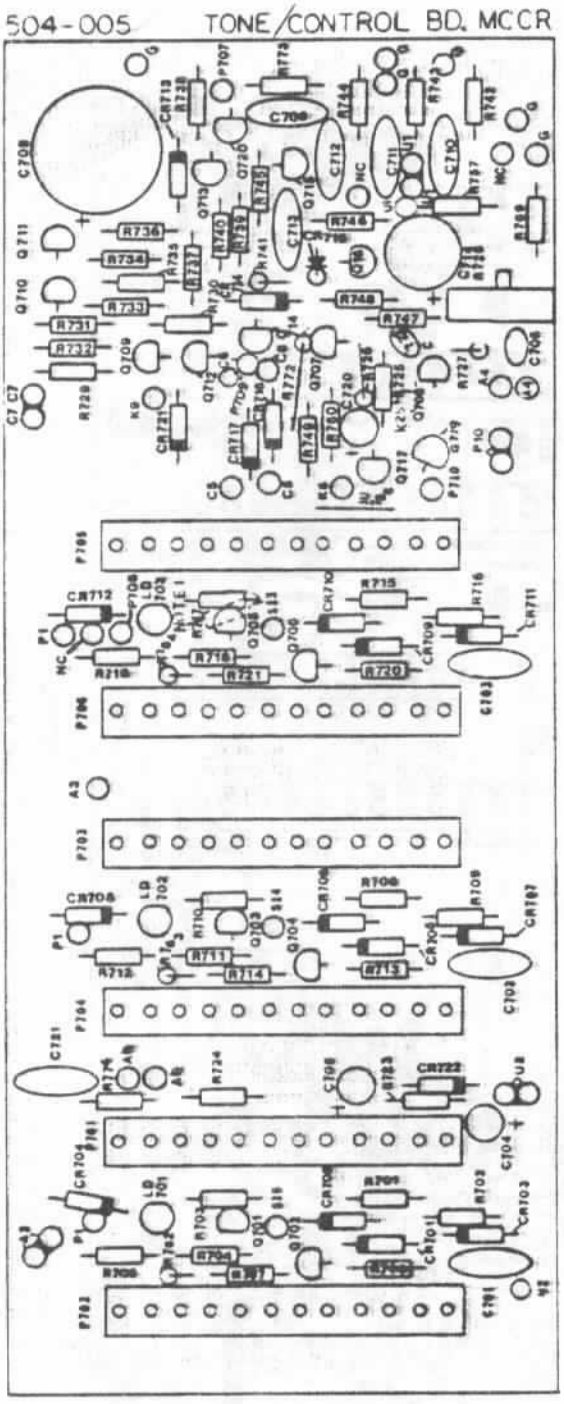
When the microphone is removed from its hanger, all received signals, regardless of whether they have the correct tone, or any tone, will be heard in the local loudspeaker. This permits the operator to monitor activity on the channel before transmitting.

7-7 THREE MINUTE TIMER, DROP-OUT DELAY, TIME-OUT WARNING OSCILLATOR

When the transmitter is not activated, Q709 is non-conducting, causing Q710 to be non-conducting, causing Q711 to be conducting.

Since the collector of Q711 is shunted across timing condenser C708, C708 cannot be charged through R735. When the transmitter is activated by the receipt of a signal, Q710 is turned on which makes Q711 non-conducting, thus removing the short across C708. C708 then is slowly charged through R735. When C708 becomes charged to about 1.2 volts, it causes Q713 to conduct. Once Q713 begins conduction, it turns on Q712 which puts more base current into Q713, causing it to conduct heavily and turn on Q714. Q714 acts as a short across the line leading to the base of Q716, turning Q716 off. Since Q716 collector is connected to the PTT lead of the transmitter, the short it creates between this lead and ground is removed, and the transmitter turns off as soon as the drop-out delay capacitor C714 is discharged.

When Q713 becomes conductive, it also supplies collector current to the time-out warning oscillator, Q715. Q715 is connected as a phase shift oscillator and its output is connected into the transmitter modulation input. The beep from the time-out warning oscillator is transmitted during the few seconds of the drop-out delay caused by C714. C714, in the base circuit of Q716 serves as a "drop-out delay". While the transmitter is turned on, C714 becomes charged. When the received signal disappears, the charge on C714 holds Q716 in conduction for about two seconds. Thus, the transmitter remains activated for about two seconds after the received signal disappears.



REDUCE TO 6.000 ±.003

REVISIONS

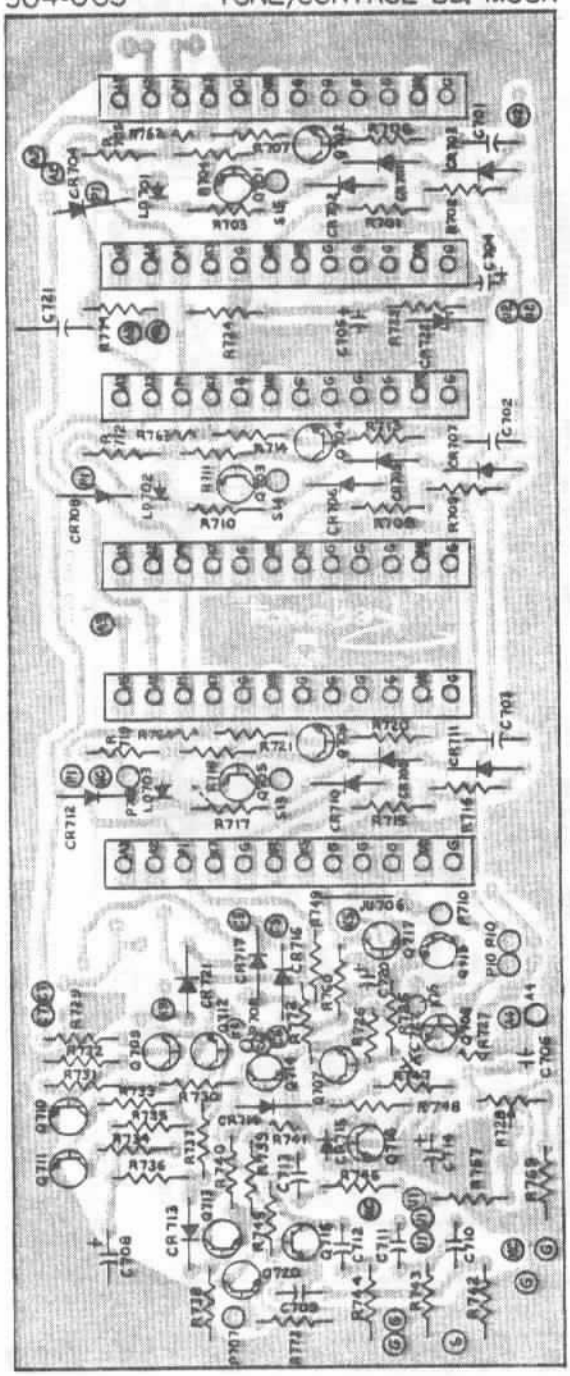
COMMUNICATIONS INC
SATELLITE BEACH, FLOR

APPROVALS | DATE

REPEATER CONTROL BOARD TOP VIEW

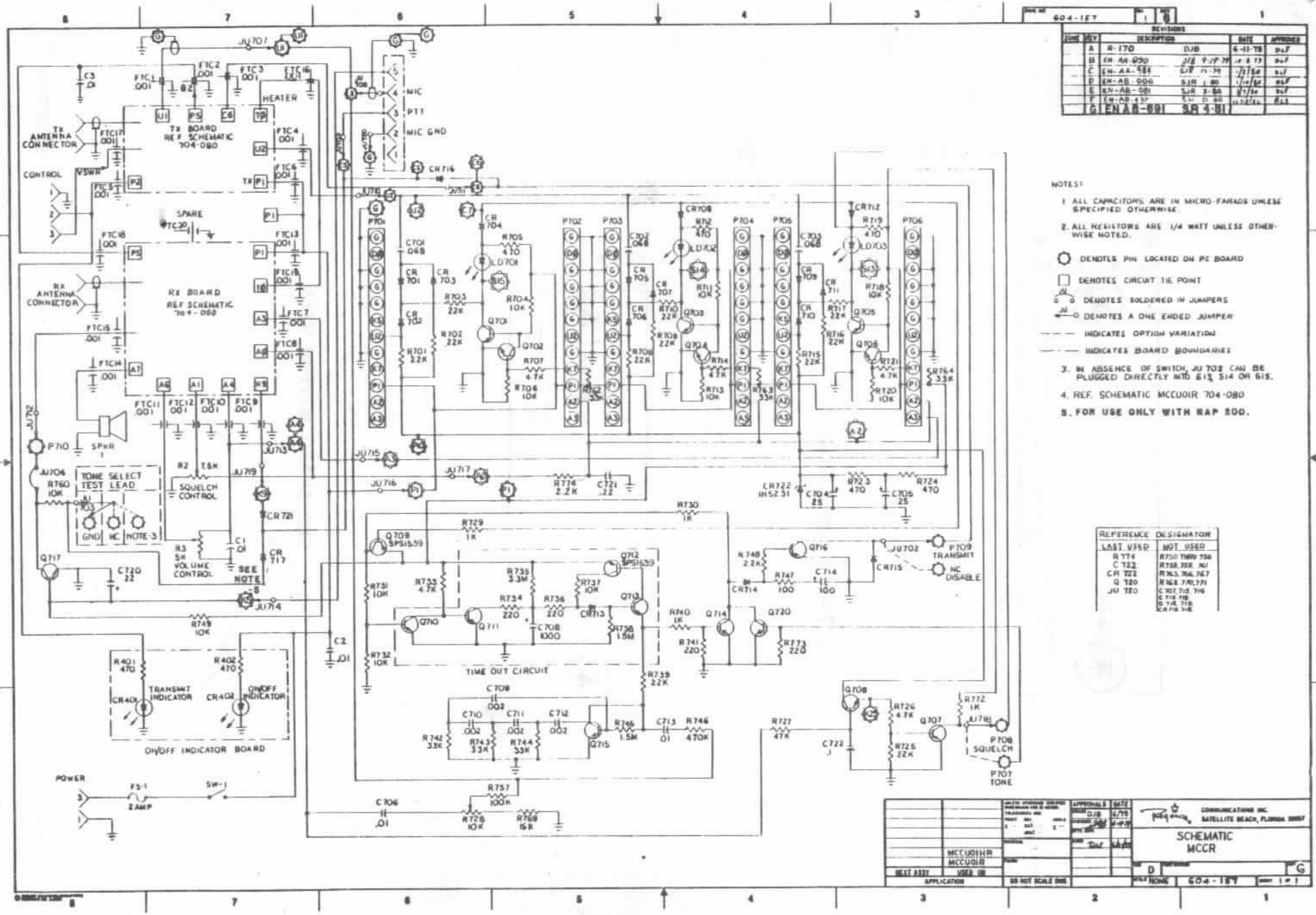
7-8

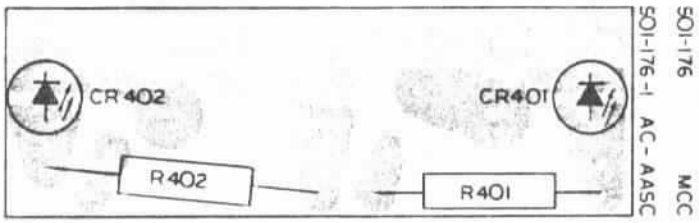
504-005 TONE/CONTROL BD. MCCR



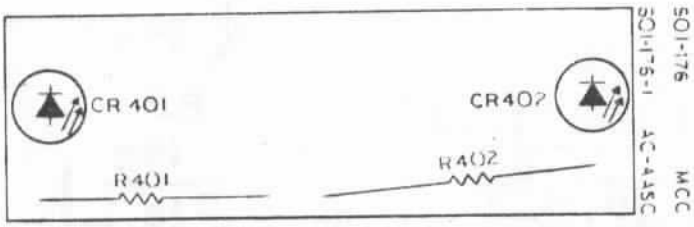
REPEATER CONTROL BOARD BOTTOM VIEW

7-9


REVISIONS
A R-170 DJB 6-11-79
B EN-AA-990 DJB 9/19/79
C EN-AA-984 DJB 11-79
D EN-AB-006 SJR 1-80
E EN-AB-001 SJR 3-80
F EN-AB-137 SJR 11-80
G EN-AB-691 SJR 4-81
NOTES:
1. ALL CAPACITORS ARE IN MICRO-FARADS UNLESS SPECIFIED OTHERWISE.
2. ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE NOTED.
DENOTES PIN LOCATED ON PC BOARD
DENOTES CIRCUIT TIE POINT
DENOTES SOLDERED IN JUMPERS
DENOTES A ONE ENDED JUMPER
INDICATES OPTION VARIATION
INDICATES BOARD BOUNDARIES
3. IN ABSENCE OF SWITCH, JU 703 CAN BE PLUGGED DIRECTLY INTO S13, S14 OR S15.
4. REF. SCHEMATIC MCCU01R 704-080
5. FOR USE ONLY WITH RAP 200.
REFERENCE DESIGNATOR
LAST USED
R 774
C 722
CR 722
Q 720
JU 720
NOT USED
R750 THRU 756
R758, 759, 761
R763, 766, 767
R768, 770, 771
C 707, 715, 716
C 718, 719
D 716, 718
CR 716, 718
TX BOARD REF SCHEMATIC 704-080
RX BOARD REF SCHEMATIC 704-080
TONE SELECT TEST LEAD
SQUELCH CONTROL
VOLUME CONTROL
TIME OUT CIRCUIT
TRANSMIT INDICATOR
ON/OFF INDICATOR
ON/OFF INDICATOR BOARD
SCHEMATIC
MCCR
MCCU01HR
MCCU01R
604-1FT



7-11 LED BOARD TOP VIEW



7-11 LED BOARD BOTTOM VIEW

7-12 REPEATER CONTROL BOARD VOLTAGES

REPEATER SETUP FOR TONE SQUELCH OPERATION

		No Signal Received, Trans Off	Signal Received, Trans On	Same, After Time-Out	Transmitter Turned On By Local Mike
Q701(Q703,Q705)	e	0	0	0	0
	b	.02	.9	.8	.02
	c	12.4	.16	.16	.9
Q702(Q704,Q706)	e	0	0	0	0
	b	.7	0	0	.7
	c	0	.9	.8	0
Q707	e	0	0	0	0
	b	.23	.75	.75	.23
	c	.84	.12	.12	.84
Q708	e	.28	1.7	1.7	.28
	b	.82	2.3	2.3	.82
	c	5.1	5.1	5.1	5.1
Q709	e	12.6	13.6	13.6	13.6
	b	13.2	12.7	12.6	13.2
	c	8	13.5	13.5	0
Q710	e	0	0	0	0
	b	0	.7	.7	.7
	c	.8	.02	0	.02
Q711	e	0	0	0	0
	b	.8	.02	0	.02
	c	0	.2	13	0
Q712	e	14	13.5	13.5	14
	b	13.5	13	12.8	13.5
	c	14	13.5	13.5	14
Q713	e	0	0	11.8	0
	b	0	0	12.2	0
	c	13.5	13.5	13	13.5
Q714	e	0	0	0	0
	b	0	0	.82	0
	c	10	10	.08	0
Q715	e	0	0	0	0
	b	0	0	.5	0
	c	0	0	6.2	0

REPEATER SETUP FOR TONE-SQUELCH OPERATION(cont.)

		No Signal Received, Trans Off	Signal Received, Trans On	Same, After Time-Out	Transmitter Turned On By Local Mike
Q716	e	0	0	0	0
	b	.001	.72	.45	1.1
	c	13	0	13.6	.3
Q717	(e	0	0	0	0
	(b	0	0	0	0
mike on hook	(c	3.5	.16	0	.012
Q720	e	0	0	0	0
	b	.84	.12	.12	.84
	c	10	10	.08	0
*513,514,515		11.5	.9	.9	.9

*Reading on socket or T.P. of tone receiver for tone being received.

SECTION 8- REPEATER SETUP INSTRUCTIONS

Assuming that the receiver and transmitter are tuned properly to their respective channels, and that the antenna system, with its duplexers and/or filters has been properly installed and tuned, the following instructions should be followed to set the repeater into operation.

8-1 PREPARATION FOR NOISE SQUELCH OPERATION

In this type of operation, no tone boards are installed in that tone receptacles, and the transmitter is activated by any signal that operates the receiver noise squelch system.

1. Check to see that a jumper is installed between A1 and A3 on P706.

2. Connect the "Tone Test Select Lead" JU703 (blk) to the "ground" Pin G.

3. Connect JU718 (yel) to the "Squelch" Pin P708.

4. Adjacent to each of the tone decoder plugs, P702, P704, P706, P802, P804 and P808, there must be a 33,000 ohm "pullup" resistor, connected to Pin P1 and K7 of the connector. Be sure that these are in place.

5. Connect JU702 (white) to P709 (transmit).

Turn up the front panel volume control so you can hear the receiver in the local loudspeaker. The transmitter should now be activated whenever a signal opens the noise squelch, or if the noise squelch is put into the noisy condition by a setting of the squelch control. Note that the transmitter will be automatically turned off if the noise squelch system has held it on continuously for about three minutes. Also, note that the transmitter does not turn off instantly after the noise squelch silences the receiver. About two seconds of delay is provided by C714.

8-2 AUDIO LEVEL SETTING, NOISE SQUELCH OPERATION

The proper setting of audio levels is very important in the repeater operation. Excessive audio level settings can cause the performance of the repeater to be seriously degraded and can make the repeater transmissions sound noisy and distorted. It is recommended that the following procedures be followed, without any attempts at shortcuts.

1. The transmitter modulation deviation control, R328, located on the transmitter chassis should be set as follows:

   Inject a 100 millivolt (.1 volt) tone at 1,000 Hz into the microphone jack, (Pin #4 high, Pin #1 ground), and adjust R240 so modulation just reaches $\pm$ 5 KHz peak. The transmitter may be activated by grounding C5 or C6.

2. Set the repeat function modulation input audio level control, R728, located on the tone/control board as follows:

   Connect a FM signal generator capable of being set to within .00025% of channel frequency to the receiver antenna port.

   Set the signal generator to the receive channel frequency, modulate the generator with a 1,000 Hz tone, with ±3 KHz peak modulation deviation. Adjust generator attenuator to provide a strong, noise free signal and assure yourself that the signal is properly centered in the receiver, and that the receiver is delivering a clean, 1,000 Hz tone output.

   Then monitor the transmitter modulation deviation and adjust R728 to obtain a reading of ±3 KHz peak modulation deviation.

8-3 PREPARATION FOR TONE SQUELCH OPERATION

Tone Encoder and Decoder Installations

The repeater has sockets to accomodate up to three different CTCSS tones. For each tone accommodated, one tone decoder and one tone encoder is used. (Some repeaters operate without any outgoing tone. For such use, the tone encoder need not be installed.) Normally, the tone encoders and decoders are installed at the factory, and the initial order specifies the tone frequencies to be used. However, if it is desired to add CTCSS tone in the field, or if additional CTCSS tones are to be added in the field, the following instructions apply.

One MA-121 tone encoder should be ordered for each tone frequency required.

One MA-116 tone decoder should be ordered for each tone frequency required.

NOTE: The MA-116s are the same items as the tone boards used in the MCU series mobiles. They are used as an encoder-decoder in the mobiles, but are normally used as a decoder only in the repeater.

Tone Squelch Operation

In tone squelch operation, the repeater transmitter is activated only by signals bearing the appropriate tone squelch frequency(s).

To prepare the repeater for tone squelch operation, plug JU718 (yel) to P707. Plug JU702 (wht) to P709. Then proceed with the following instructions for tone encoder and decoder installations.

For the first tone to be installed, install the encoder in P706.

Install subsequent tones as follows:

	Encoder	Decoder
Second Tone	P703	P704
Third Tone	P701	P702

When a tone decoder board is installed in each of the connectors P702, P703, etc., the 33,000 ohm "pull-up" resistor just adjacent to that connector should be clipped out of the circuit. This pull up resistor must remain in the circuit of each unused connector, and must be removed from the circuit on each connector which has a tone decoder installed.

If an operator is stationed at the repeater location, it is normally desired that he will hear transmissions from mobiles on only one of the installed tones. To accomplish this, connect the Tone Select Test Lead ,JU703 (black), to one of the "TONE" test point pins which is physically located between the encode and decode module for that particular tone, i.e., S13 or S14, etc. (Monitoring provisions incorporating the grounded microphone hang-up clip permit the operator to monitor all incoming signals when the microphone is removed from its hanger.)

8-4 AUDIO LEVEL SETTING, TONE SQUELCH ENCODER OPERATION

The first steps in the level setting procedure are to set the transmitter modulation deviation, and the repeat function audio level control R728. The procedures to follow are the same as those outlined in step 1 and 2 of the noise squelch level setting procedure, given in Section 8-2.

Once these two steps have been completed, you are ready to set the transmit tone levels. Remove the signal generator from the receiver, and connect the tone select test lead (JU703) to S13. Then activate the transmitter by pushing the PTT switch on the microphone. Then set R618, the tone output level control, on the tone encoder in P705 to obtain .5 KHz tone modulation deviation, as indicated by a FM modulation meter. Then proceed to set the tone levels on the remaining tone generators as follows:

Connect JU703 Tone Select Test Lead To:	Set R618 Level Control On Tone Encoder Located In Connector:
S14	P703
S15	P701

The next step is to set the tone receive threshold on all of the tone decoders.

8-5 AUDIO LEVEL SETTING, TONE SQUELCH DECODER OPERATION

When the MA-116 Encoder-Decoder is used it is necessary to set the tone receive threshold adjustment, R612 (on the tone board) in this manner:

With the receiver in the receive condition, and the microphone hang up button grounded to the transceiver chassis, inject a signal of the appropriate channel frequency into the transceiver antenna jack, and modulate this signal with the wanted CTCSS tone frequency, with a deviation of plus and minus 250 Hz. Then, adjust R612 (on the tone board) until the signal just opens the tone squelch system. This is indicated by the corresponding LED (LD701, 702, 703).

After performing this adjustment of R612, check to be sure that the tone squelch will actually open when the tone deviation of the receive signal becomes as much as plus and minus 250 Hz. Further, check to be sure that noise bursts do not come through when the receiver is not receiving any incoming signal.

8-6 SQUELCH CONTROL SETTING

It is important that the squelch control for the noise operated squelch system in the receiver be set properly, regardless of whether noise squelch or tone squelch operation of the repeater is planned.

The typical squelch control setting method, i.e., merely setting the control to the "edge" of the noisy portion may be used. It is more satisfactory, however, to set the squelch control for a known level of signal. This will enable the repeater to operate at proper sensitivity, yet will avoid service calls to reset the squelch because of operator annoyance at squelch openings not caused by wanted signals.

The preferred method is this: Remove the microphone from the hang-up hook, to disable the tone squelch (if used). Inject a signal from a signal generator into the receiver as shown in the Receiver Alignment Chart. Set the signal generator attenuator to provide a .3 microvolt signal to the receiver. Then set the squelch control to the point at which the squelch opens reliably when the signal is connected, and closes when the signal is removed.

8-7 FINAL LISTENING TESTS OF AUDIO LEVEL SETTING

When the repeater has been placed in final operation, it is a good idea to make a listening test to be certain that the Audio Level Setting procedure has been done properly. This is emphasized, because an improperly high level setting can make the repeater sound as if close-in mobiles are at the fringes of coverage, thereby seriously compromising the overall performance of the system.

An ideal way to conduct this listening test is as follows: Have a mobile go to the fringe of reception, and monitor how it sounds on the local loudspeaker in the repeater itself. Have the mobile find a location where you can hear it coming in with a somewhat noisy, but readable signal, and arrange for the mobile to stay fixed at that location. Then monitor the repeater mobile speech by listening to it in close-in mobile, or at the control station. The apparent noise level should not be different than that observed in the repeater's local loudspeaker.

This procedure is suggested as a TEST of the setting of the Audio Level Setting --NOT as an appropriate way of making the setting. Once the listening test assures you that the level is set--mark its setting and be sure that it is not changed unless the proper test equipment and procedures (as outlined earlier) are carried through.