IC - M25D

N. OMOLOGAZIONE NAUTICA:

PROTOCOLLO DC SR/021389 2/2/144–01/39699

DEL 4/7/79

IC - M25D

THEORY OF OPERATION

1 Receiver:

The receiver is composed of the following sections:

A. Antenna Switching Circuit
B. RF Amplifier/Helical Resonator
C. First Mixer/1st IF Mixer
D. Second Oscillator and Mixer/Second IF Filter
E. Second IF Amplifier and Limiter
F. Discriminator/Pre-amplifier
G. Power Amplifier
H. Squelch Control Circuit.

The input signal coming from the antenna connector (J303) passes through the low pass filter and is fed to the antenna switching circuit. When received, Q101 becomes conductive thus a DC current flows into diodes D301, 302, and 303.
This makes these diodes conductive for RF frequencies and a signal is fed to the RF amplifier (Q102) and amplified. Q102 is a MOSFET in order to furnish excellent sensitivity, signal-to-noise ratio, and cross-modulation characteristics.
The helical resonator has a band width of 156 to 163 MHz and attenuates incoming out-of-band signals. When received current flows into D101, causing a backward bias across D102, thus applying only the signal passing through the helical resonator to the balanced mixer. The signal is combined with the output of the VCO, previously set to a channel frequency, to the balanced mixer (D103 through D106) which produces a signal of 21.4 MHz. This signal then passes through diode D107 which is conductive of RF signals, and is fed to the Second Mixer Q103, through the monolithic crystal filter FL101. Then, combined with the Second Oscillator's output signal of 20.945 MHz it produces the second IF signal of 455 KHz, which passes through Ceramic Filter FL102. The output is then amplified and limited in amplitude by IC101 and detected by Ceramic Discriminator DS101, as well as diodes D109 and D110, to obtain an audio signal. R125 and C141 act as an integrator to achieve the desired frequency characteristics. The signal, lightly amplified by Q105 is fed to AF Filter IC351, which compensate the frequency for low range (lower than 300 Hz) and high range (higher than 3 KHz) and is amplified by power amplifier IC102 to drive the speaker. The squelch signal is taken from immediately after the discriminator and fed to the Audio Amplifier IC103, whose gain can be varied by change of the DC bias applied to its No. 2 pin. The output of IC103 is amplified by Q107 and Q108 and detected by D112 and D113. Diode D111 functions to compensate the detection output voltage thermally. This output is applied, after DC amplification, to Q109, to vary the bias voltage of Q105 base thus switching the squelch circuit on and off.

2 Transmitter

The transmitter is composed of the following sections:

A. Microphone Amplifier and Instantaneous Deviation Control (IDC)
B. Splatter Filter
C. Modulator and TX Oscillator
D. Limiter Amplifier and Balanced Mixer
E. Exciter
F. Power Amplifier and Low Pass Filter
G. TX Power Control and RF LTD Control.

The signal from the microphone or handset is amplified by the microphone amplifier Q115 and Q116, then differentiated by C202 and R190. The differentiated audio signal is fed to the IDC Circuit. In the IDC circuit the audio signal is limited in amplitude so that any parts above 3 KHz are attenuated by the splatter filter. Q110 in the TX Oscillator circuit emits a signal of 21.4 MHz which is directly frequency-modulated by the splatter filter. Since frequency-modulated signals contain some amplitude modulated components a limiter amplifier is provided in the next stage to remove them. During transmission a 9V current moves through R160 to D108 to turn it on for RF signals, D107 is biased in reverse to return it off, so that the output from the limiter amplifier is applied only to the balanced mixer, where it combines with the signal from the VCO output to produce the transmitting frequency. The signal passes through D102 and is amplified by the exciter (driver) unit. At the same time spurious signals generated at the balanced mixer are attenuated by the tuning circuits L117, 118, 119, 120, 121 and 122. The power output of the exciter is about 200 mW and is amplified to 25W by the power amplifier IC30. The power amplifier is a one piece module having a frequency range of 156 to 158 MHz. Antenna Switching diodes D301, 302 and 303 detect RF output voltage from the PA unit, and this DC causes a reverse bias for these diodes, turning them off to RF signals. Thus RF is cut off from the receiver during transmissions. The low pass filter attentuates harmonic waves generated in the power amplifier, etc, by about 50 dB. The transmit power control circuit performs two functions.
One: selecting low and high power, by controlling the detected front voltage of the SWR circuit, and two, the voltage at Pin 3 of PA unit K301, thus the power can be controlled. Switching of power is done by dividing the SWR voltage proportionally among R309, 310, 311 and 312.
Two: protection of IC301 when SWR falls and lowers the RF output. When SWR falls, the reverse detection voltage rises and is amplified by Q305, 306 and 307 which reduces the voltage at Pin 3 of IC301, and lowers the RF power output. The RF LTD amplifies the SWR front detected voltage by Q301, 302 and 303 to illuminate D5, the RF indicator.

ALIGNMENT PROCEDURES

PLL and VCO Units

Test equipment required:

1. Frequency Counter, with a frequency range of 5 MHz to 150 MHz. Sensitivity of 1V or better. Accuracy of ± 1 ppm or better.

2. RF Millivolt meter, with a full scale range of 1V to 100mV.

3. FM Deviation Meter, frequency 100 to 169 MHz, and deviation of 5 KHz.

4. Oscilloscope.

5. Dummy load, 25W, 500 Ohms.

Setting coils and trimmer resistors:

1. Remove the PLL and matrix board cover. Turn the cores of L403, L404 and L405 to level with the top of the core holder, then one full turn clockwise. Turn R454 fully counterclockwise.

2. Remove the VCO cover. Turn the core of L504 to level with the top of the core holder, then one complete turn clockwise.

Alignment of offset local oscillator:

1. Set the channel selector to Channel 16. Unplug P502 from J401.

2. Connect the RF millivolt meter to test point FCP401 and adjust L403, 404, and 405 for maximum deflection on the meter when set at the 100 mV range.

3. Set the channel selector to weather, WX, and adjust the coils L403 through L405 to obtain the same output as for channel 16. After adjustment the output voltage of both channel 16 and weather should be more than 20mV.

4. Turn the channel selector back to channel 16. Connect the frequency counter to test point FCP401 and adjust L407 for 133.525 MHz.

5. Set the channel selector to weather and adjust L408 for 138.125 MHz.

6. Plug P502 back into J401.

Aligment of the VCO:

1. Connect the frequency counter to the feed-through terminal of P501, do not remove the plug. Place a jumper across pin 4 and 2 of P503.

2. Set the channel selector to weather and adjust C510 for about 138.4 MHz.

3. Set the channel selector to channel 16 and adjust C504 for about 138.4 MHz.

4. Alternate the previous two aligments until they are stable.

5. Remove the jumper wire from P503, and turn to channel 16.

6. Turn R454 clockwise until the power indicator LED stops flashing (VCO locked).

7. Connect the RF millivolt meter, set at the 1V range, to the center connector of P501 and adjust L504 to obtain approximately 8V on both channel 16 and weather.

PLL (cont'd)

Kept at 25 KHz, the same as the reference frequency sent to Pin 7 of IC406.

Should the loop unlock the voltage at Pin 4 of IC416 drops causing Q411 and Q410 to go on. The the base of Q409 drops through D421 causing Q409 to turn off, these actions cause the Transmit Mute circuit to inhibit, through Pin 5 of J406, and the RF indicator turns off. At the same time lamp control IC401 is turned on by the output of the collector Q410 through R437. The signal is amplified by lamp amplifier Q401, and through Pin 7 of J403 causes the unlock and power LED, D1 to flash.

When selecting a channel, if no diode has been placed in that particular channel section of the matrix this is detected by D415, 416, 417, 418 and 419 and voltage is sent to Q410 through D422. Again the Transmit Mute functions and at the same time LED D1 flashes and the RF indicator goes off.

When on receive only, or weather channel has been programmed the voltage of Pin 1 of J405 drops, and Q409 turns off, this also causes the Transmit Mute circuit to function.

Q406, 407, and 408 are the 8V constant voltage supply for all PLL circuits, with the exception of the Offset Oscillator Switch circuit.

VCO

The output signal of the phase comparator is sent to Pin 1 of P503 then to the base of Q502 to eliminate any 25 KHz spurious and then fed to variacap diode D501, which controls the frequency of Q501.

When in the receive duplex mode voltage from Pin 3 of P503 turns off C504 and the oscillation frequency is shifted up, thus it is possible to reach a frequency range of 134.6 MHz to 141.15 MHz, a difference of about 7 MHz.

Q503 and Q505 are the buffer amplifiers. Output voltages of about 800mV from P501, and 200mV from P502 are present. Q504 is a ripple filter to prevent ripples in the power source line to secure a stable oscillation frequency.

MATRIX UNIT

J408 and J409 are connected to the channel selector switch, S6, and the wiper of that switch is connected to select switch, S1. When the select switch is closed the common of S6 is grounded, causing one of the A through W lines on the matrix board to go to ground. Pins 3 through 7 of J407 are the terminals of the binary code output. Pin 1 of J407 detects receive only and will inhibit transmit functions when a diode is inserted for that purpose. Pin 2 detects Simplex channels and will shift the operation to Simplex when a diode is inserted. Pin 10 of J407 detects weather channel operation - it is not necessary to have a diode in the receive position for this function.

3. Auto Dimmer Control

Photo sensor R8 in the auto dimmer control circuit varies its resistance and the voltage developed across it depending on outside brightess.
This voltage is applied to the Schmitt circuit composed of Q122 and Q120.
When brightness is high the resistance of the photo sensor reduces the flow of current to the base of Q122, which turns on. This reduces the base voltage of Q120 and increases the collector voltage. The collector voltage is drawn from the emitter of Q121, the emitter follower circuit of Q120, and that output voltage rises to illuminate the lamps brightly. When outside light is dim, the reverse occurs to dim the lamps.

4. Regulator

The regulator of the 9V supply is Q601 for the receive circuits and obtains its reference voltage from D603. During transmission the base of Q601 is grounded through D602 and no output voltage appears. The regulator for transmit circuits is Q602 and obtains its reference voltage from D605.
When transmitting the base of Q603 is grounded through D607 which turns it off, supplying Q602 with a base voltage of 9V, supplying the transmitter with the 9V. During receive the base of Q603 is supplied with voltage through R606, whereas no voltage is supplied to the base of Q602 so no voltage is supplied to the transmitter.

Alignment of the reference oscillator:

1. Set the channel selector to 16.

2. Connect the frequency counter to the bare lead of R458 and adjust C430 for 1.875 MHz $\pm$ 10 Hz.

3. Remove the counter. Connect the dummy load and deviation meter, connect the oscilloscope to the output of the deviation meter. While observing RF power output adjust R454 to obtain minimum carrier noise.

Alignment of 1st and 2nd IF

1. Connect the counter to test point FCP101 and adjust C131 for 20.945 MHz ± 20 Hz.

2. Tune the signal generator to 156.8 and connect to the antenna connector.

3. Modulate the signal generator with a 1 KHz signal and a modulation level of ± 6 KHz.

4. Connect the AF voltmeter between pin 6 of J1 and ground.

5. Apply the signal generator output to channel 16.

6. Adjust L108 and L109 to achieve the maximum sensitivity.

Miscellaneous Alignments

1. Dimmer position alignment:

   Set R210 to its center position, when the sensitivity is low turn counterclockwise, to high, clockwise.

2. Squelch:

   With no signal present set the knob to the desired position and adjust R136 to open and close the squelch.

Alignment of the Receiver

Test equipment required:

1. VHF Sweep Generator, with a sweep range of 145 to 170 MHz, and output voltage of 1 mV to 1V.

2. VHF Signal Generator, with a frequency of 150 to 165 MHz, and an output voltage of 1 microvolt to 1000 microvolts.

3. AF Voltmeter, full scale 1V.

   Frequency counter, with up to 30 MHz, sensitivity of 1V, and accuracy of ± 1 ppm.

4. Oscilloscope with RF detector.

Setting of coils:

1. Turn the core of L101 to the top then two complete turns clockwise. If the remote control head is installed, remove it.

2. Turn the cores of L102, 103, and 104 to level with the PC board, then one complete turn clockwise.

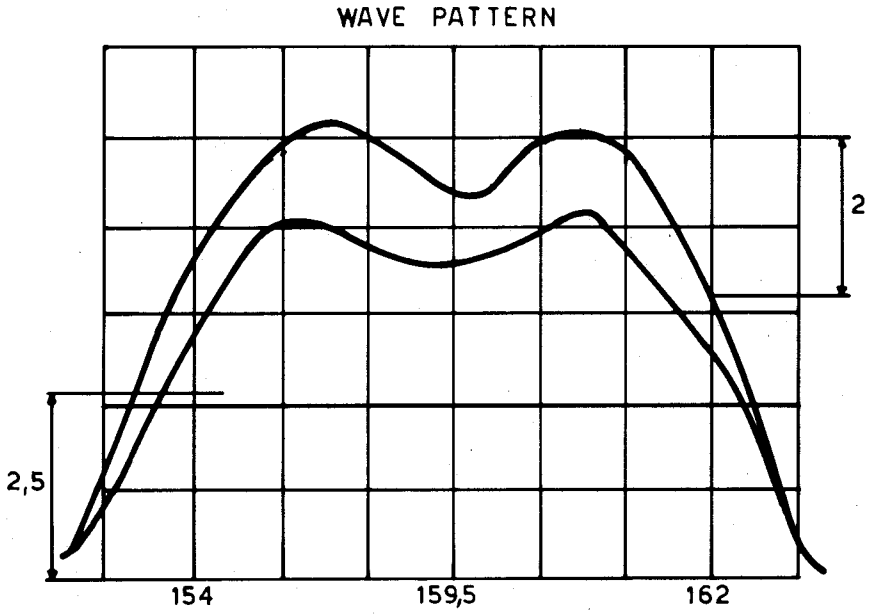
3. Turn the core of L105 four turns clockwise from the top.

Alignment of the helical resonator (the helical coil should be opened by L311 and 312 before this procedure).

1. Connect the oscilloscope detector lead between D107 and the bare lead of R112, on the L108 side (ground side).

2. Connect the sweep generator to the antenna connector, and adjust the sweep to a level that can be seen on the scope.

3. Adjust L101 through L105 to obtain the maximum output, 156.3 to 162.55 MHz, and ripple not to exceed 3 dB. (See below).



Alignment of the Transmitter Section.

Test equipment required:

1. Multimeter, 50.000 ohms per volt.
2. RF Voltmeter, 50 ohms, 50 W, 5W.
3. Power source, 13.6V, 8A, DC.
4. AF Oscillator, 1 KHz, sine wave, 1V rms.
5. Frequency counter, 30 MHz, sensitivity 1V, accuracy $\pm$ 1 ppm.
6. FM Modulation Meter, 0 to $\pm$ 5 KHz peak to peak.
7. Oscilloscope, 1 KHz.

Setting coils and trimmer resistors.

1. Set L112 core two turns clockwise from the top.
2. Set the cores of L117, 118, and 121 flush with the top.
3. Set the cores of L119 and L210 three turns clockwise from the top.
4. Turn R317 fully counterclockwise.
5. Turn R310 and 312 fully clockwise.

Transmit Oscillator Alignment.

1. Connect the RF power meter to the antenna connector and set for 50W.
2. Connect the frequency counter to FCP104 and set the channel to 16.
3. Short pins 5 and 6 of the microphone connector and press the PTT switch.
4. Adjust L115 for 21.4 MHz $\pm$ 1 ppm on the counter.

Alignment of the Final Drive.

1. Set the multimeter to 3V range and connect to FCP106.
2. Adjust L112 through L119 for maximum reading while transmitting on channel 16.
3. Connect the multimeter to CP101 and adjust L117 through L119 for maximum reading. The reading should be above 2V.

PA Alignment.

1. Turn R301 and R311 fully clockwise to obtain full power.

2. Turn R317 fully counterclockwise.

3. Adjust C246 to obtain maximum deflection on the power meter.

4. Check the power output on channels 80, 60 and 16 for minimum power variation.

Power Setting.

1. Adjust R303 to attain the minimum voltage reading at H307 with the multimeter set at the 3V range.

2. Set the Hi-Low switch to the Hi setting. Hook up a Wattmeter to the dummy load.

3. Adjust R310 for 25W output.

4. Set the Hi-Low switch to Low, and adjust R311 to 1W output.

APC Alignment.

1. Turn R317 fully clockwise.

2. Adjust R317 to reduce input current to less than 3A when the antenna connector is open or shorted.

Modulation Alignment.

1. Connect the FM Modulation Meter to the antenna connector.

2. Apply a 1 KHz 1V audio signal from the AF Oscillator to Pin 2 of the microphone connector.

3. Connect the oscilloscope to check point FCP105 and adjust R154 for symmetrical clipping of the wave forms on the scope.

4. Adjust R175 for $\pm$ 4.8 KHz modulation (peak deviation).

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VOLTAGES ON SEMICONDUCTORS No. 1

SYMBOL	TYPE	BASE (GATE 1)	COLLECTOR (DRAIN)	EMITTER (SOURCE)	(GATE 2)	NOTES
Q101	2SA639-G	7.5	8.0	8.3		R
Q102	MFE521	3.7	8.3	0.6	6.1	R
Q103	2SC763	1.6	4.0	0.8		R
Q104	2SC945-P	2.4	7.8	2.0		R
Q105	2SC1571-G	1.4	2.1	1.3		R Squelch-OFF
Q105	2SC1571-G	0	8.4	0		R Squelch-ON
Q106	2SC945-P	0.6	0	0 (E)		R
Q106	2SC945-P	0	8.8	0 (E)		T
Q107	2SC945-P	4.3	8.1	0.55		R Squelch-OFF
Q107	2SC945-P	4.2	7.9	0.35		R Squelch-ON
Q108	2SC945-P	1.15	5.3	0.6		R Squelch-OFF
Q108	2SC945-P	1.1	5.0	0.7		R Squelch-ON
Q109	2SC945-P	0.2	8.0	0 (E)		R Squelch-OFF
Q109	2SC945-P	0.5	0	0 (E)		R Squelch-ON
Q110	2SC945-P	4.5	9.0	4.0		T
Q111	2SC945-P	4.8	8.2	4.4		T
Q112	2SC945-P	0.65	5.9	0 (E)		T
Q113	2SC945-P	0.6	0.65	0 (E)		T
Q114	2SC1571-G	0.5	0.6	0 (E)		T
Q115	JA1050-G	6.5	8.0	8.7		T
Q116	2SC1571-G	7.0	8.0	6.7		T
Q117	-					
Q118	-					
Q119	-					
Q120	2SC945-P	3.5	13.6	4.2		R Dimmer-OFF
Q120	2SC945-P	7.7	7.0	7.0		R Dimmer-ON
Q121	2SD468	13.5	13.2	13.5		R Dimmer-OFF
Q121	2SC9468	7.3	13.2	6.5		R Dimmer-ON
Q122	2SC945-P	4.2	4.2	4.2		R Dimmer-OFF
Q122	2SC945-P	0.1	10.5	0.1		R Dimmer-ON
Q123	-					

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VOLTAGES ON SEMICONDUCTORS

No. 2

SYMBOL	TYPE	BASE (GATE 1)	COLLECTOR (DRAIN)	EMITTER (SOURCE)	(GATE 2)	NOTES
Q124	3SK-40-M	0	6.7	0.2	0.6	T
Q125	2SC2026	0.85	6.1	0.32		T
Q126	2SC2053	1.4	8.0	0.8		T
Q301	2SC945-P	0.74	0.03	0 (E)		T
Q302	JA1050-G	8.3	8.85	8.9		T
Q303	2SC945-P	0.2	0.03	0 (E)		T
Q304	2SC945-P	0.84	1.58	0.28		T High-Power
Q304	2SC945-P	0.88	1.57	0.28		T Low-Power
Q305	2SC945-P	0.1	1.58	0.28		T High-Power
Q305	2SC945-P	0.01	1.57	0.28		T Low-Power
Q306	2SD468	0.54	11.7	0 (E)		T High-Power
Q306	2SD468	0.53	12.4	0 (E)		T Low-Power
Q307	2SB529-D	12.0	3.5	12.6		T High-Power
Q307	2SB529-D	12.6	0.9	13.2		T Low-Power
Q601	2SD468	0.8	13.0	0.3		T
Q601	2SD468	9.5	13.0	9.0		R
Q602	2SD359	9.4	11.2	9.0		T
Q602	2SD359	0.9	13.8	0.4		R
Q603	2SC945-P	0.7	9.5	0.3		T
Q603	2SC945-P	0.4	0.25	0.8		R
Q604	2SC945-P	0	9.5	0.3		T
Q604	2SC945-P	0	0.25	0.8		R

VOLTAGES ON SEMICONDUCTORS

No.

SYMBOL	TYPE	BASE (GATE 1)	COLLECTOR (DRAIN)	EMITTER (SOURCE)	(GATE 2)	NOTES	
Q401	2SC945	0.7	0.1	0			PLL
Q402	2SC945	0.3	13.0	0		CH16	PLL
Q403	2SD227	0.3	13.0	0		CH16	PLL
Q404	2SC945	0.7	0.08	0		CH16	PLL
Q405	2SC945	0.66	0.04	0			PLL
Q406	2SC945	0.66	0.75	0			PLL
Q407	JA7151	12.86	8.27	13.5			PLL
Q408	2SC945	0.61	7.84	0			PLL
Q409	2SC945	1.48	0.86	0.8			PLL
Q410	2SC945	0.2	8.27	0			PLL
Q411	JA1050	8.05	1.50	8.27			PLL
Q412	2SC945	0.67	0.04	0		SIMPLEX	PLL
Q413	2SC945	0.2	13.5	0			PLL
Q414	2SC945	0.4	3.37	0			PLL
Q415	2SC763	0.71	8.14	0.54			PLL
Q416	2SC763	3.04	7.29	2.6			PLL
Q501	2SK19	0	7.24	0.94			VCO
Q502	2SC1571	4.6	7.55	4.0		CH16	VCO
Q503	3SK40	0	7.24	0.48	2.95		VCO
Q504	2SC945	8.22	8.27	7.55			VCO
Q505	2SC2053	3.53	7.64	2.83			VCO

PLL

VOLTAGES ON INTEGRATED CIRCUITS

SYMBOL	TYPE	PIN NUMBER															NOTES
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
IC401	NJM4558	7.7	1.3	1.8	0	7.5	6.9	7.5	8.3									
IC402	SN76514	7.6	7.6	6.8	3.7	2.4	0	0	0	3.0	3.8	3.8	3.8	6.9	0			
IC403	TC5080P	8.2	8.2	1.5	8.2	1.5	1.5	8.2	0	0	0.6	0	0	8.1	-	3.4	8.1	CH16
IC404	μPC577H	5.0	1.7	1.7	0	6.5	2.7	7.2										
IC405	TC5082P	2.1	3.3	3.7	0	7.6	0	3.8	3.8	0								
IC406	TC5081P	4.7	3.5	3.5	7.1	7.1	-	3.8	0.5	0								

CHECK POINTS

SYMBOL	LEVEL	NOTES	SYMBOL	LEVEL	NOTES
FCP401	0.07	RF V	R458	1.875MHz	CH16
FCP401	133.525MHz	CH16	P501	0.8V	RF V
FCP401	138.125MHz	WX1	P502	0.25	RF V
R458	7VP-P				

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VOLTAGES ON INTEGRATED CIRCUITS

SYMBOL	TYPE	PIN NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	NOTES
IC101	H8D1152	0.65	0 (E)	4.0	6.0	0 (E)	1.2											R
IC102	AN7151	6.5	0 (E)	1.2	10.7	6.4	0 (E)	5.8	7.0	12.2	13.2	13.6						R
IC103	MC3340P	1.3	3.4	0 (E)	0	0	5.4	4.7	8.0									Squelch-OFF
IC103	MC3340P	1.3	2.4	0 (E)	0	0	5.2	4.6	7.9									Squelch-ON
IC351	RC4558D	4.2	4.2	3.8	0 (E)	3.8	4.2	4.2	8.6									R
IC104	BA-401	1.5	1.5	0 (E)	7.2	7.2												T
IC301	VP-15E12	0	E	3.5	E	13.6	E	0										High-Power
IC301	VP-15E12	0	E	1.2	E	13.6	E	0										Low-Power

CHECK POINTS

SYMBOL	LEVEL	NOTES
CP101	2.5V	T DC

SYMBOL	LEVEL	NOTES
FCP104	100mV	T RF
FCP105	1.5V	T AF
FCP106	1.0V	T DC
FCP107	0.4V	T DC

SYMBOL	LEVEL	NOTES
FCP101	500mV	R RF
FCP102 (ANT. INPUT = 30 dB)	40 mV	R RF
FCP103	100mV	R AF

ICOM M25D FREQUENCY PROGRAMMING

The frequency programming formula is shown below:

1. Injection (VCO) Frequency = Transmit Frequency – 21.4MHz
2. $P = 127 - \frac{\text{VCO Frequency} - 133.525}{0.025}$ (MHz)

The matrix position value printed on the diode matrix board is (64, 32, 16, 8, 4, 2, 1) subtracted from "P" until zero is achieved. These numbers represent diode positions.

EXAMPLE 1.
Desired Frequency and Mode: 156.8MHz Simplex

1. VCO Frequency = 156.8 – 21.4 = 135.4 (MHz)
2. $P = 127 - \frac{135.4 - 133.525}{0.025} = 52$

52 – 32 – 16 – 4 = 0

The frequency 156.8MHz Simplex would be programmed by placing diodes in positions 32, 16, 4 and SIM on the matrix board vertical line.

EXAMPLE 2.
Desired Frequency and Mode: 157.1MHz Duplex (Channel 22):

Since this is a Duplex frequency (one in which the transmit frequency and receive frequency are different), the transmit frequency is used in the formula.
(Transmit frequency: 157.1MHz)
(Receive frequency: 161.7MHz)

1. VCO Frequency = 157.1 – 21.4 = 135.7 (MHz)
2. $P = 127 - \frac{135.7 - 133.525}{0.025} = 40$

40 – 32 – 8 = 0

Again the frequency would be programmed by placing diodes in positions 32 and 8 on the matrix board vertical line.

SIMPLEX CHANNELS ARE PROGRAMMED BY PLACING DIODES IN THE "SIM" POSITION ON THE MATRIX BOARD VERTICAL LINE.

RECEIVE ONLY CHANNELS ARE PROGRAMMED BY PLACING DIODES IN THE "RX ONLY" POSITION ON THE MATRIX BOARD VERTICAL LINE. (In receive only channels, the receive frequency is used in the formula instead of a transmit frequency).

Divided numbers (N) in the phase locked loop follow the formula below:

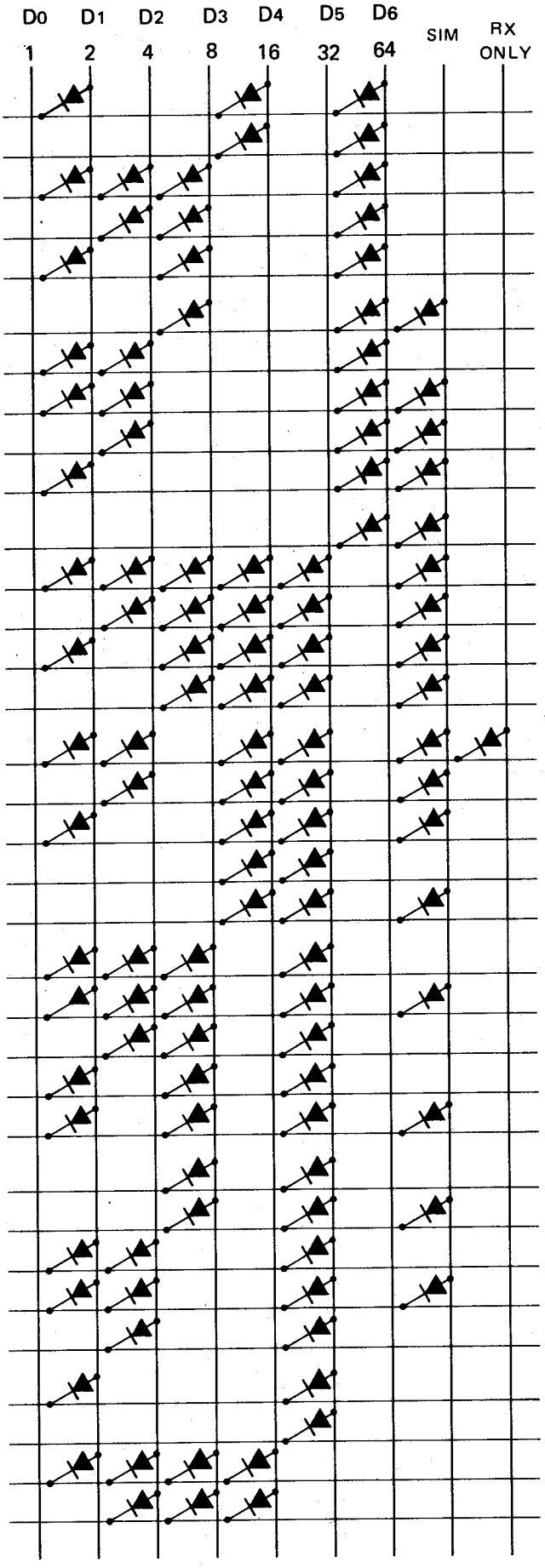
N = 127 – P (Formula 2)

The diodes can be inexpensive Silicon type available most anywhere. GERMANIUM DIODES CANNOT BE USED.

VHF MARINE MODEL ICOM M25D

FREQUENCY PROGRAMMING CHART (1)

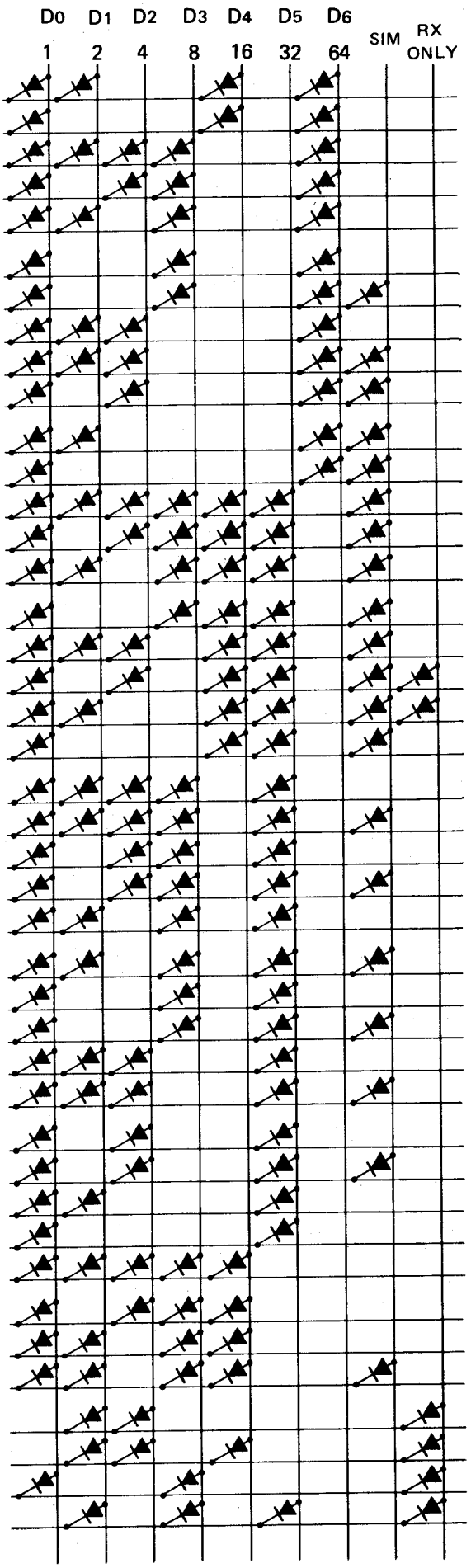
CHANNEL	TRANSMIT FREQ. MHz	RECEIVE FREQ. MHz	INJECTION FREQ. MHz
1	156.050	160.650	134.650
2	156.100	160.700	134.700
3	156.150	160.750	134.750
4	156.200	160.800	134.800
5	156.250	160.850	134.850
6	156.300	156.300	134.900
7	156.350	160.950	134.950
7A	156.350	156.350	134.950
8	156.400	156.400	135.000
9	156.450	156.450	135.050
10	156.500	156.500	135.100
11	156.550	156.550	135.150
12	156.600	156.600	135.200
13	156.650	156.650	135.250
14	156.700	156.700	135.300
15	—	156.750	135.350
16	156.800	156.800	135.400
17	156.850	156.850	135.450
18	156.900	161.500	135.500
18A	156.900	156.900	135.500
19	156.950	161.550	135.550
19A	156.950	156.950	135.550
20	157.000	161.600	135.600
21	157.050	161.650	135.650
21A	157.050	157.050	135.650
22	157.100	161.700	135.700
22A	157.100	157.100	135.700
23	157.150	161.750	135.750
23A	157.150	157.150	135.750
24	157.200	161.800	135.800
25	157.250	161.850	135.850
26	157.300	161.900	135.900
27	157.350	161.950	135.950
28	157.400	162.000	136.000

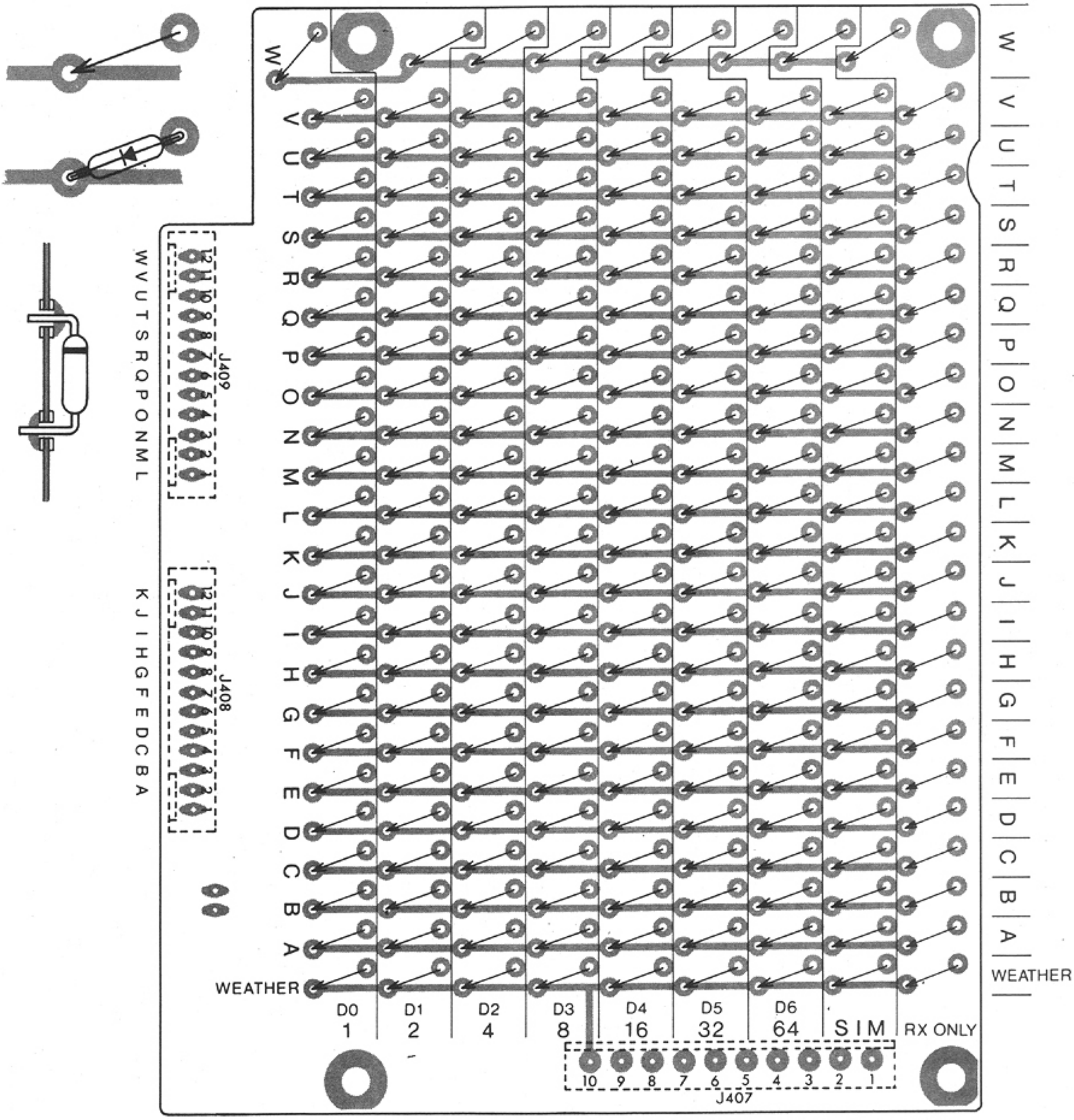


VHF MARINE MODEL ICOM M25D

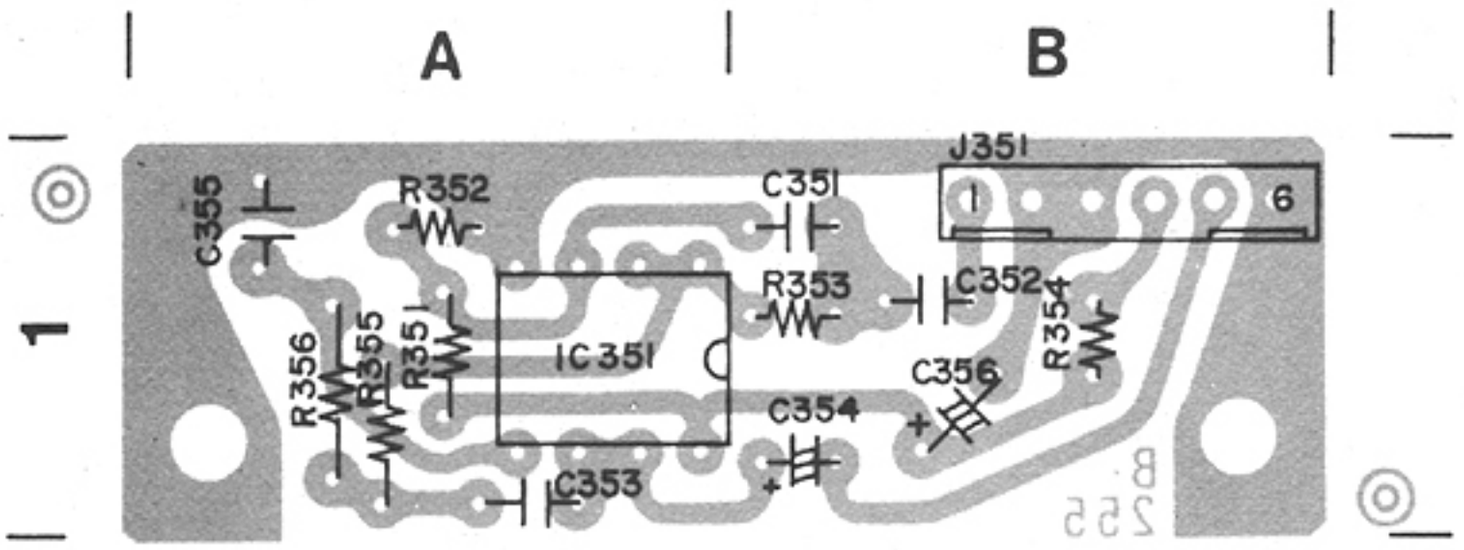
FREQUENCY PROGRAMMING CHART (2)

CHANNEL	TRANSMIT FREQ. MHz	RECEIVE FREQ. MHz	INJECTION FREQ. MHz
60	156.025	160.625	134.625
61	156.075	160.675	134.675
62	156.125	160.725	134.725
63	156.175	160.775	134.775
64	156.225	160.825	134.825
65	156.275	160.875	134.875
65A	156.275	156.275	134.875
66	156.325	160.925	134.925
66A	156.325	156.325	134.925
67	156.375	156.375	134.975
68	156.425	156.425	135.025
69	156.475	156.475	135.075
70	156.525	156.525	135.125
71	156.575	156.575	135.175
72	156.625	156.625	135.225
73	156.675	156.675	135.275
74	156.725	156.725	135.325
75	—	156.775	135.375
76	—	156.825	135.425
77	156.875	156.875	135.475
78	156.925	161.525	135.525
78A	156.925	156.925	135.525
79	156.975	161.575	135.575
79A	156.975	156.975	135.575
80	157.025	161.625	135.625
80A	157.025	157.025	135.625
81	157.075	161.675	135.675
81A	157.075	157.075	135.675
82	157.125	161.725	135.725
82A	157.125	157.725	135.725
83	157.175	161.775	135.775
83A	157.175	157.175	135.775
84	157.225	161.825	135.825
85	157.275	161.875	135.875
86	157.325	161.925	135.925
87	157.375	161.975	135.975
88	157.425	162.025	136.025
88A	157.425	157.425	136.025
WX1	—	162.550	141.150
WX2	—	162.400	141.000
WX3	—	162.475	141.075
WX4	—	161.650	140.250

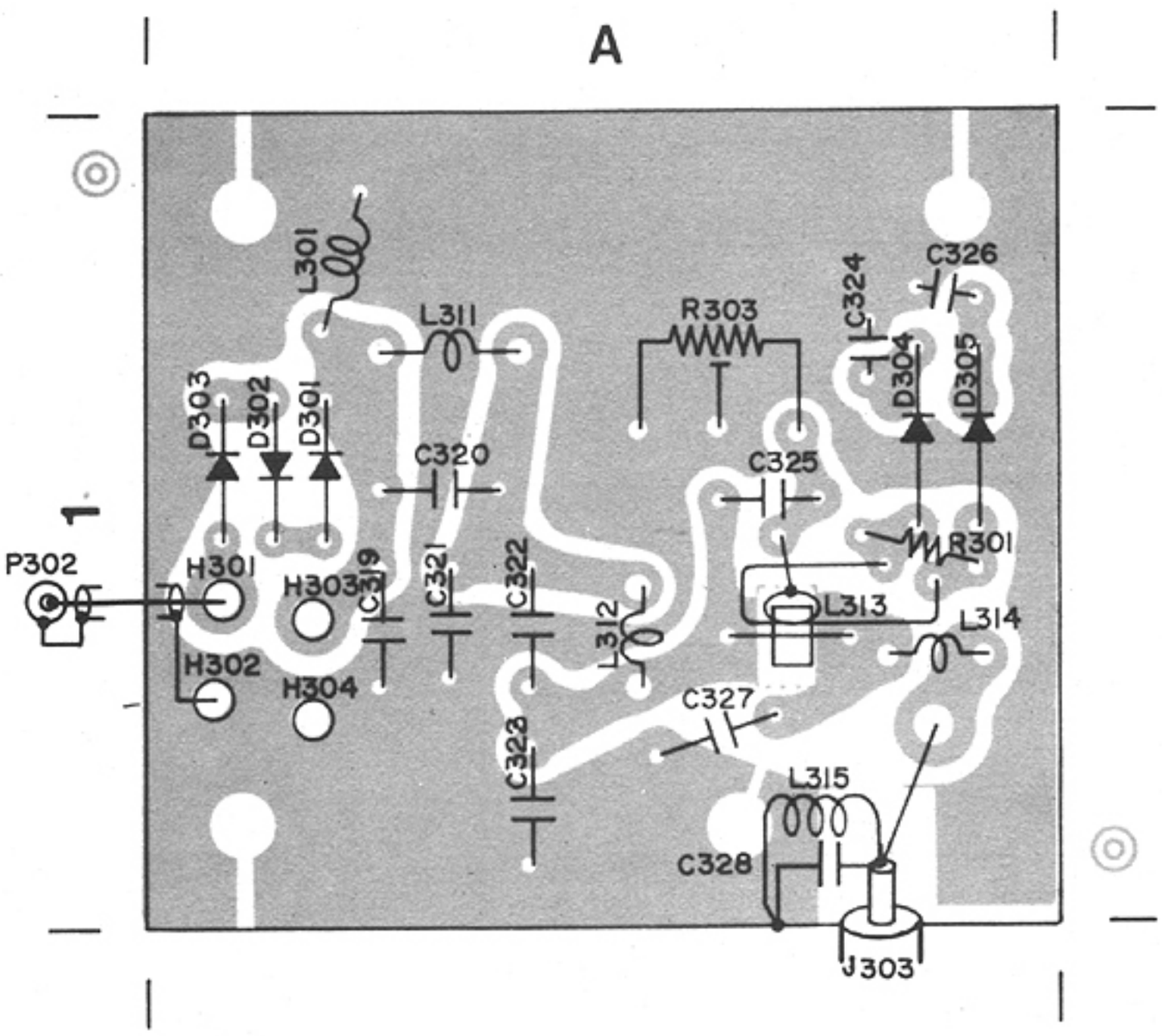




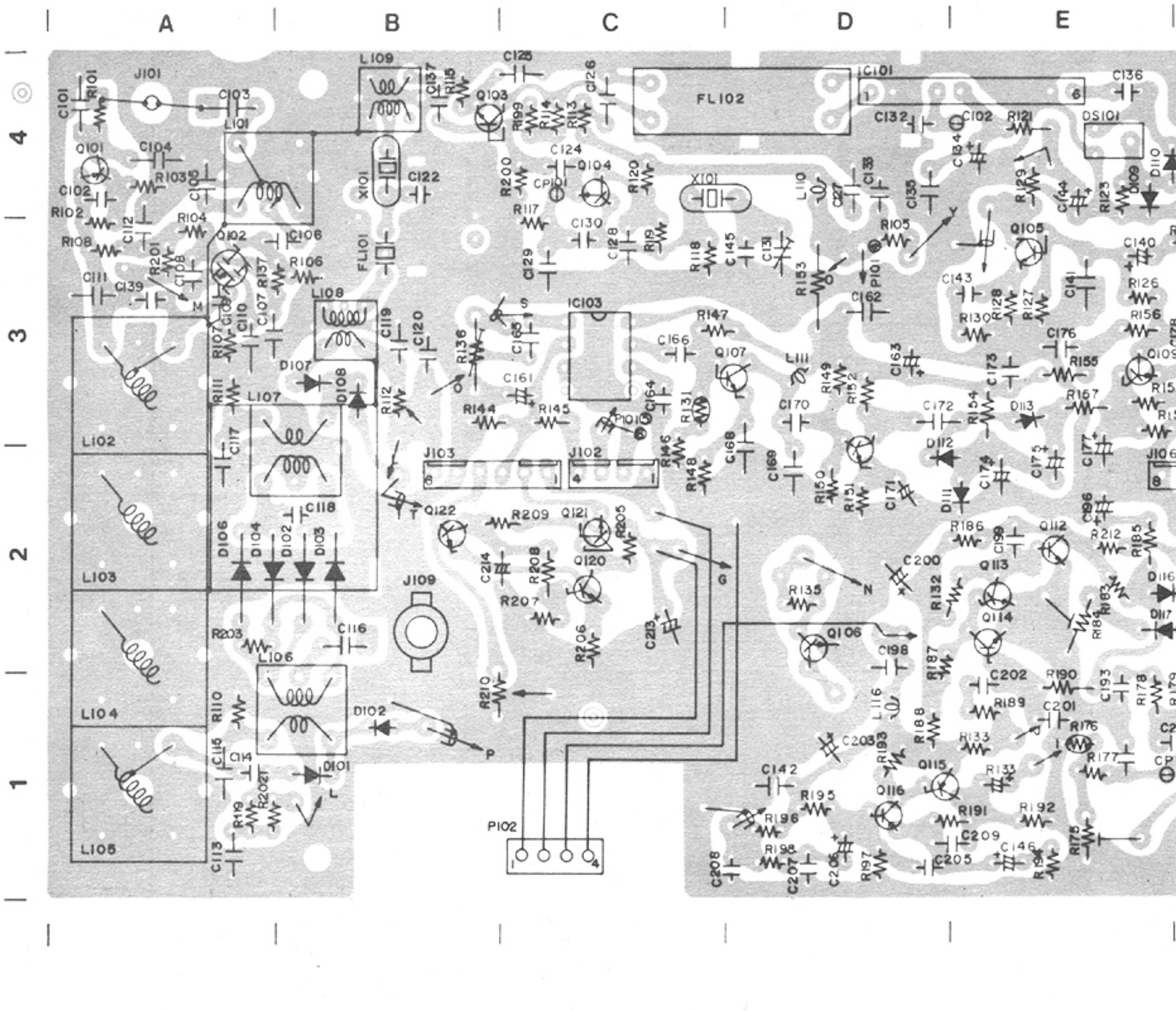
The weather position is connected to the weather button located on the front panel. The "RX ONLY" diode for the weather position need not be programmed, as it is already in the PLL unit.
Diodes must be placed along the arrows as shown on the board, and must lie flat on the surface of the board.

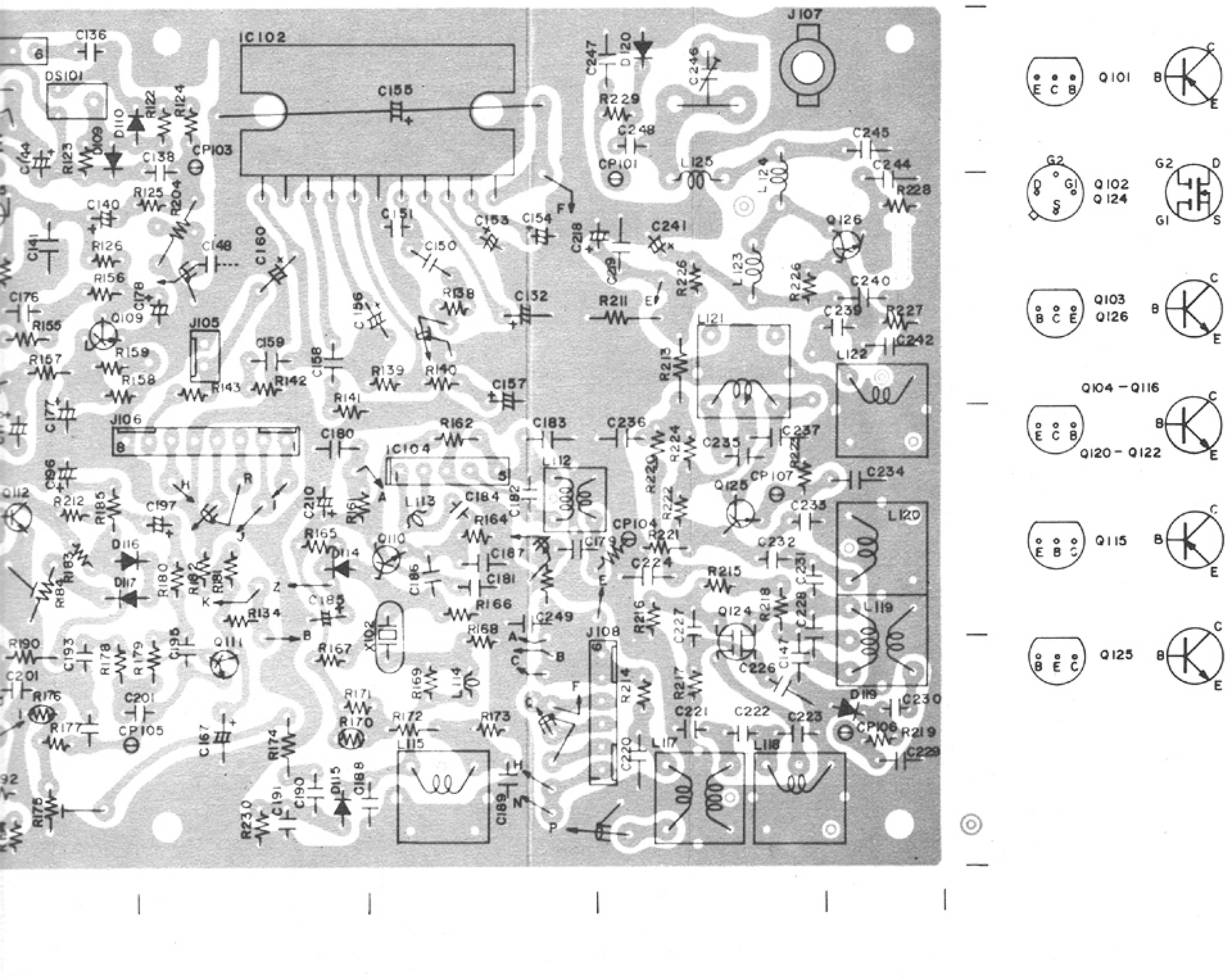


ICOM M25D AF FILTER UNIT
(U - 140)

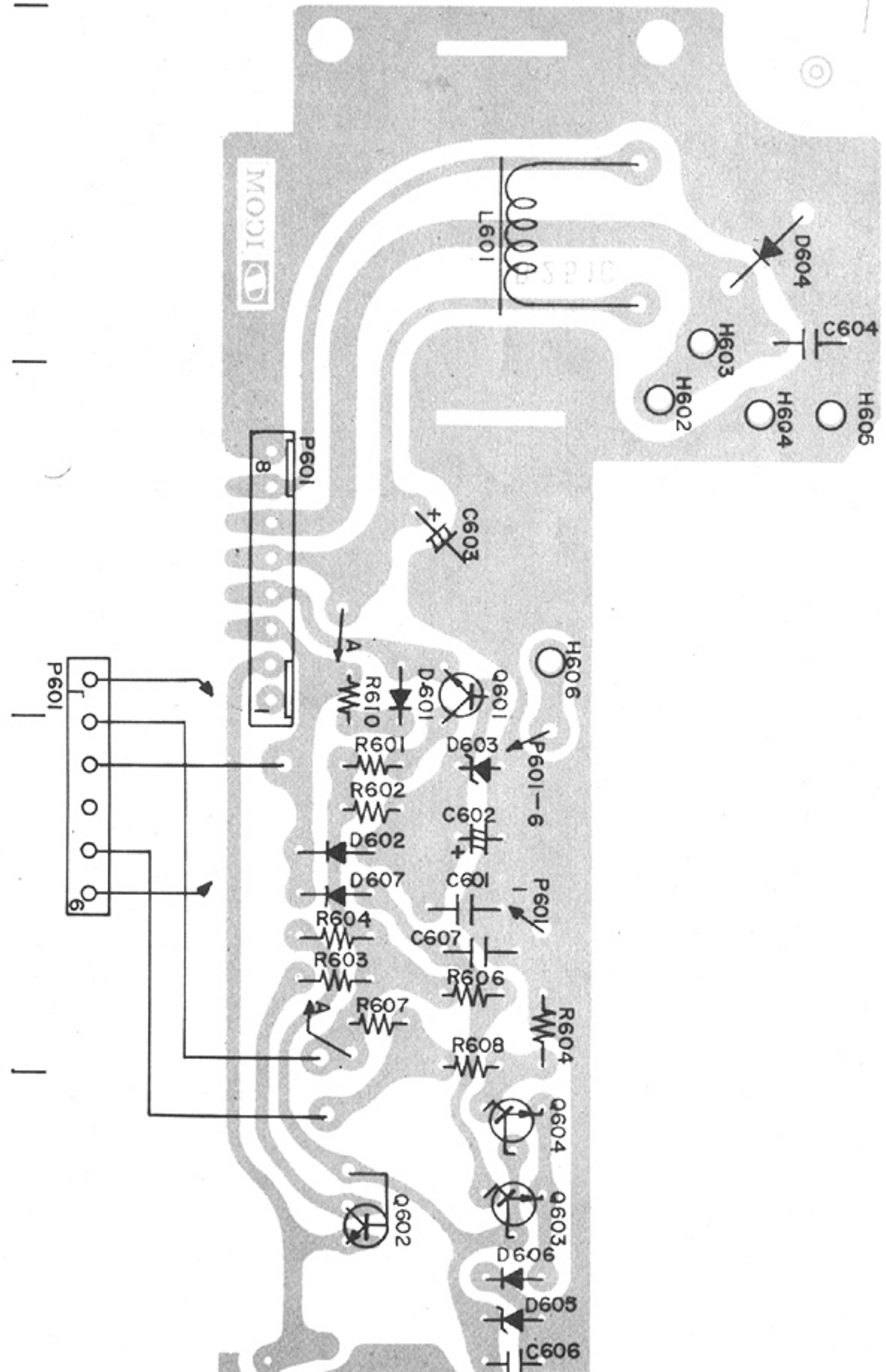


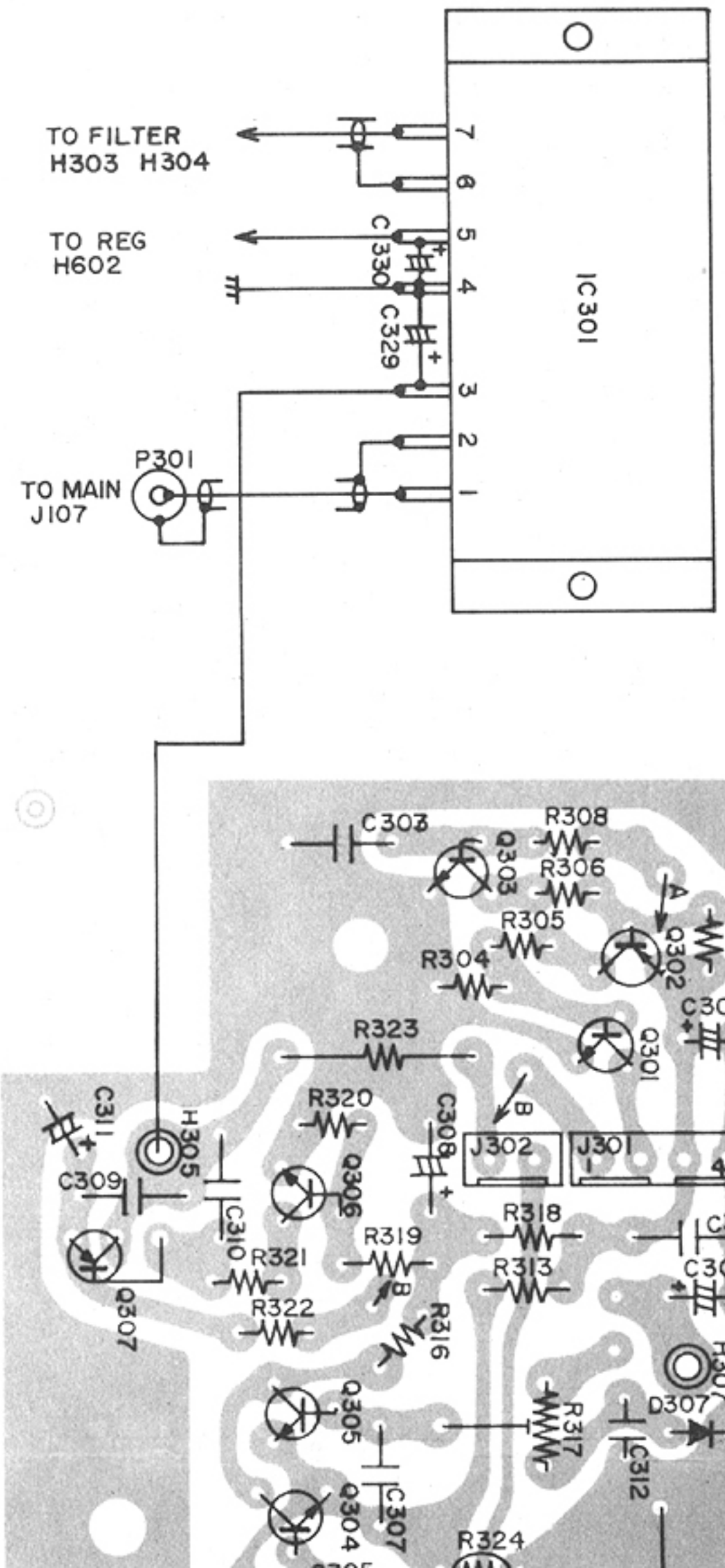
ICOM M25D FILTER UNIT
(U - 138)


A
B
C
D
E
4
3
2
1
J101
L101
L109
X101
FL101
FL102
IC101
IC103
L102
L103
L104
L105
L106
L107
L108
J102
J103
J109
P101
P102
Q101
Q102
Q103
Q104
Q105
Q106
Q107
Q109
Q112
Q113
Q114
Q115
Q116
Q120
Q121
Q122
D101
D102
D103
D104
D105
D106
D107
D108
D109
D110
D111
D112
D113
D116
D117
DS101
CP101
L110
L111
L116

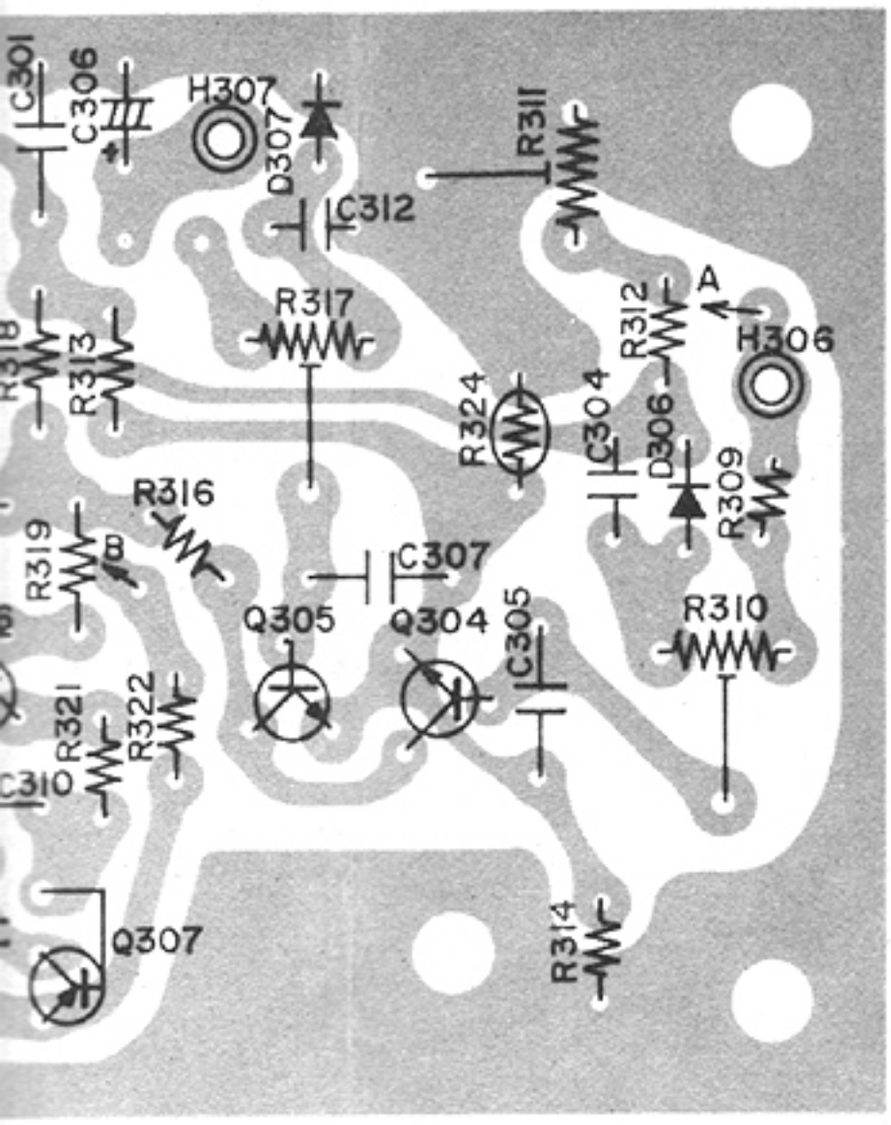


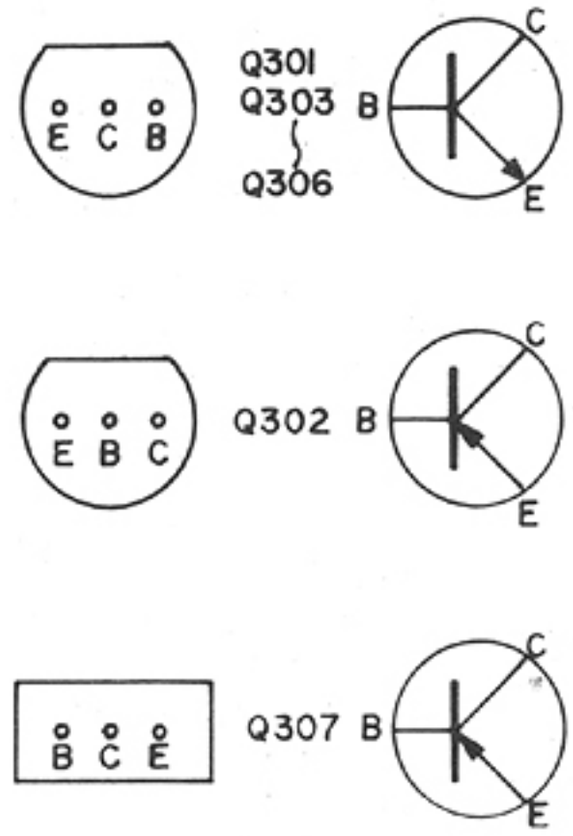
ICOM M25D MAIN UNIT
(U - 136)


1
2
A
B
C
D
ICOM
L601
D604
C604
H603
H602
H604
H605
P601
8
C603
P601
6
A
H606
R610
D601
Q601
R601
D603
R602
C602
D602
D607
C601
P601
1
R604
C607
R603
R606
R607
R608
R604
Q604
Q603
Q602
D606
D605
C606


1
2
A
B
C
D
TO FILTER
H303 H304
TO REG
H602
TO MAIN
J107
P301
IC301
7
6
5
4
3
2
1
C330
C329
C303
R308
Q303
R306
R305
R304
R307
Q302
C302
Q301
R323
C311
H305
R320
C308
J302
J301
C309
Q306
C310
R321
R322
R319
R318
R313
C301
C306
H307
D307
C312
R316
Q305
R317
C307
Q304
R324
Q307

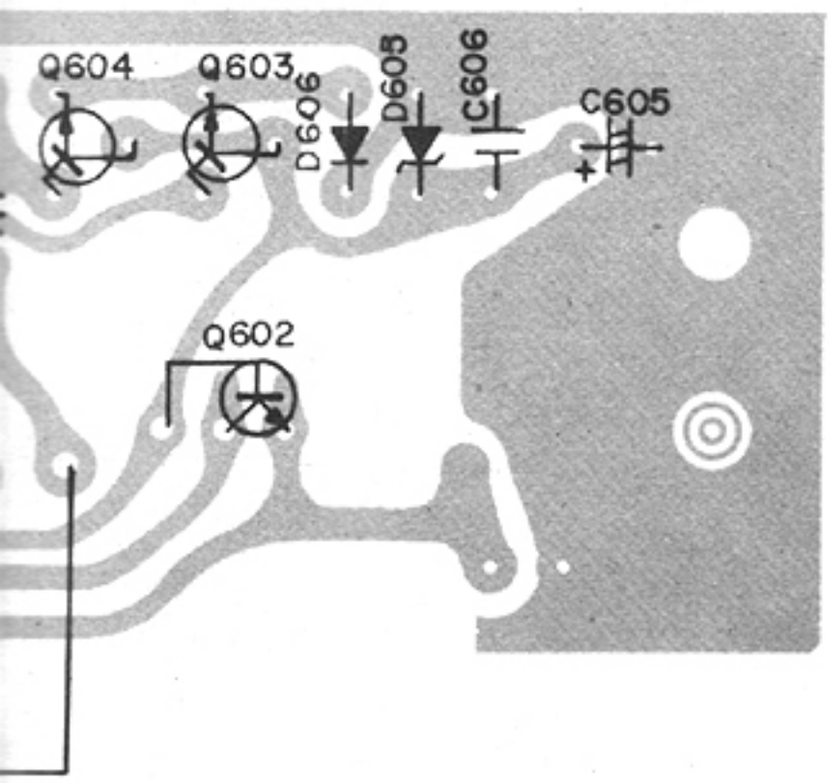
C D

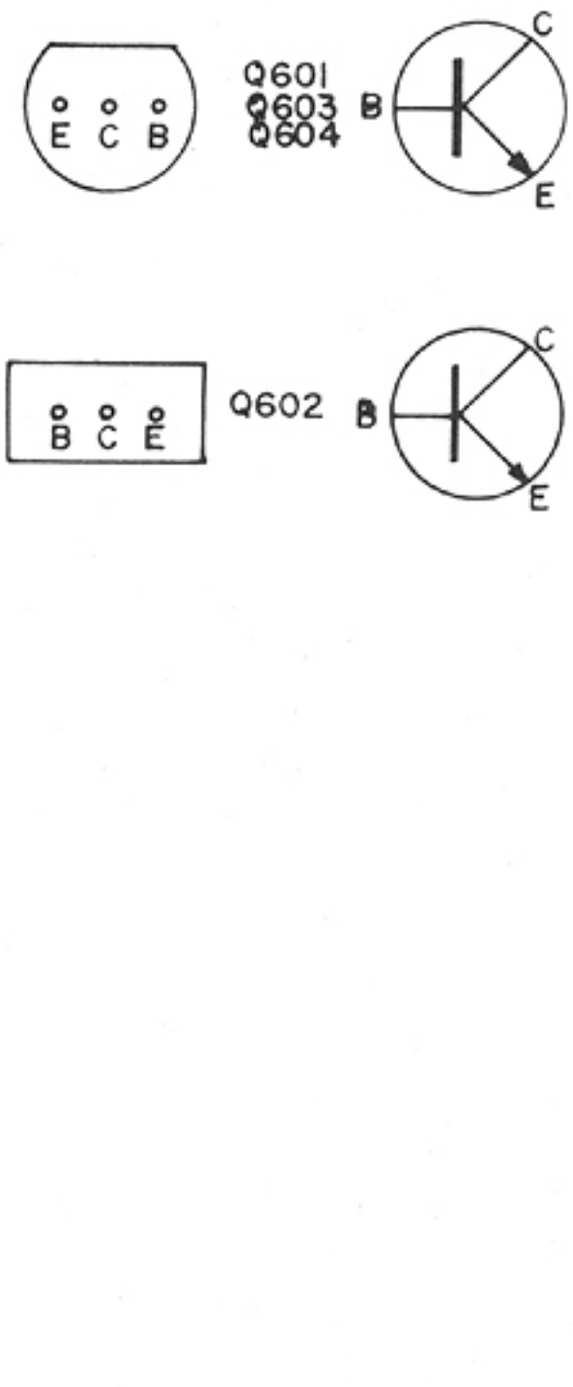




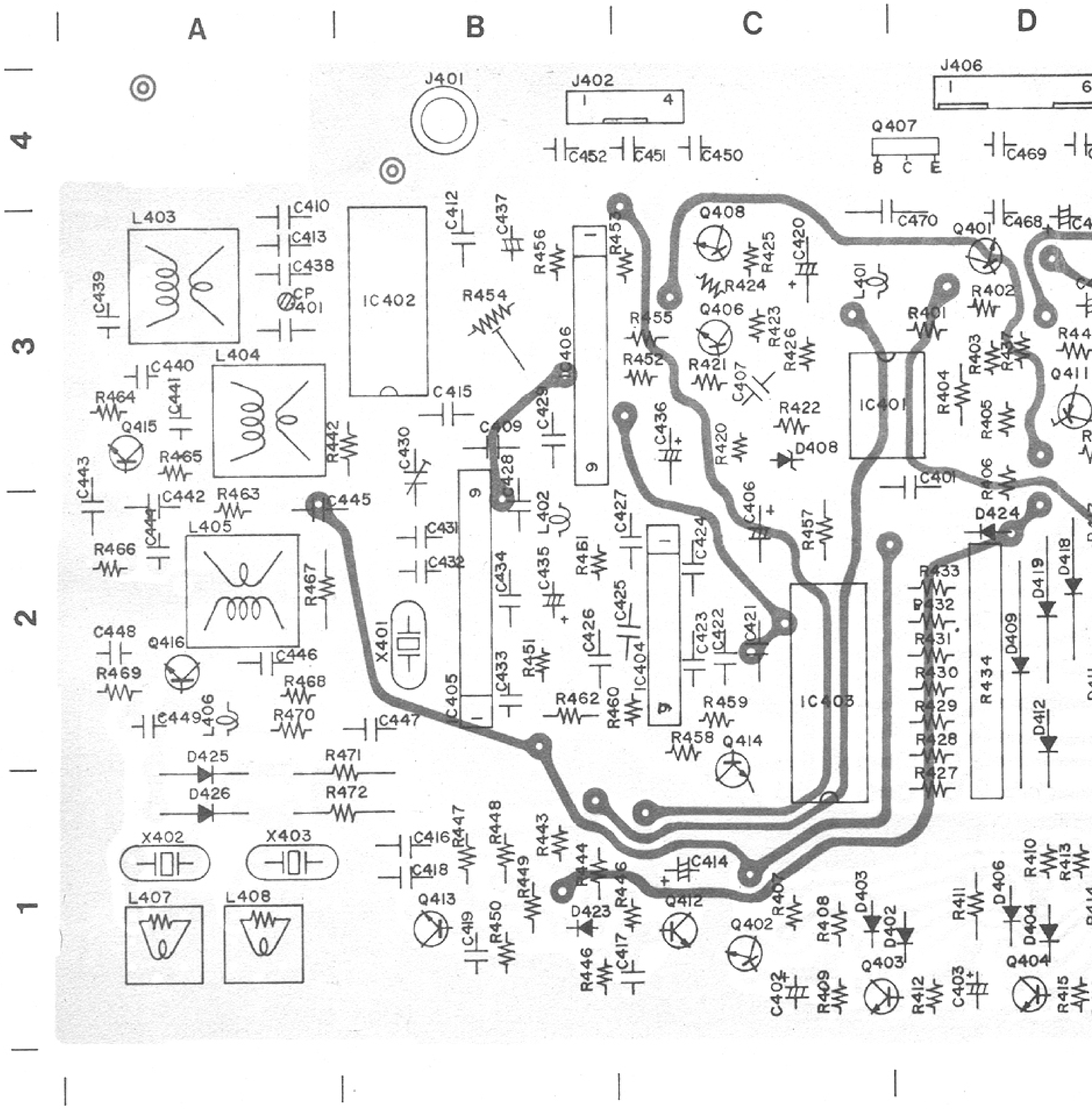
ICOM M25D PA UNIT
(U - 137)

D



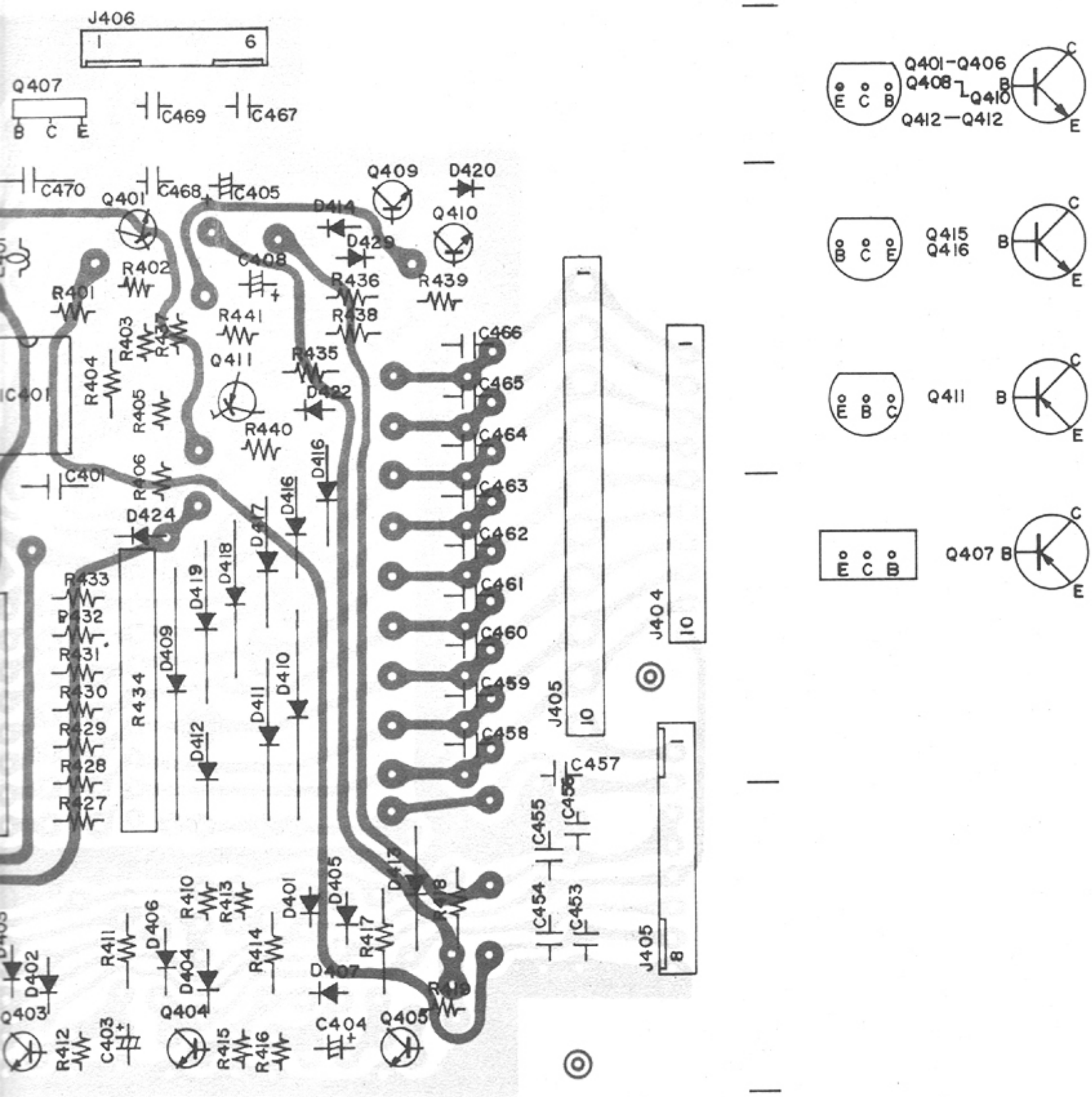


ICOM M25D REGULATOR UNIT
(U - 139)

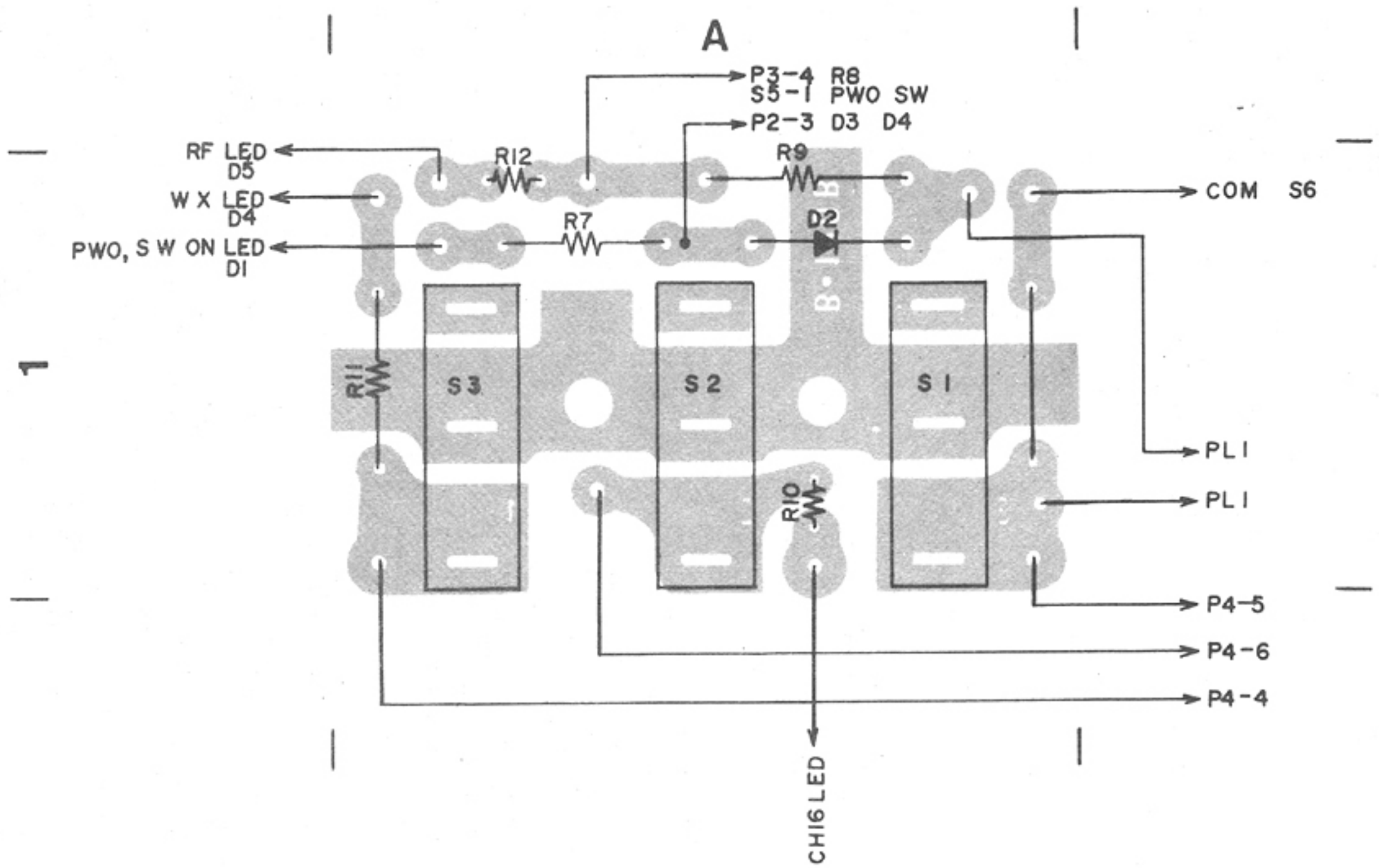

A
B
C
D
4
3
2
1
J401
J402
1
4
J406
1
6
Q407
B C E
C452
C451
C450
C469
C470
C468
Q401
L403
C410
C413
C438
CP 401
C439
IC402
C412
C437
R454
R456
R453
Q408
R425
R424
C420
L401
R402
R401
Q406
R423
R426
R455
R452
R421
C407
IC406
L404
C440
C441
R464
Q415
R465
C415
C409
C429
C430
R442
C436
R420
R422
D408
IC401
R404
R403
R405
Q411
C401
R406
D424
C443
C442
R463
C445
C428
L402
C427
C406
R457
C431
C432
C434
C435
R461
C424
L405
R466
C444
R467
D419
D418
R433
R432
R431
R430
R429
R428
R427
R434
D409
D412
C448
Q416
R469
C446
R468
X401
C425
C426
C423
C422
C421
R451
C433
C405
R462
R460
IC404
R459
IC403
C449
L406
R470
C447
R458
Q414
D425
D426
R471
R472
X402
X403
C416
R447
R448
R443
C418
R449
R444
C414
R410
R413
D406
L407
L408
Q413
R450
C419
D423
R446
Q412
Q402
R407
R408
D403
D402
R411
D404
Q403
Q404
C417
C402
R409
R412
C403
R415

D

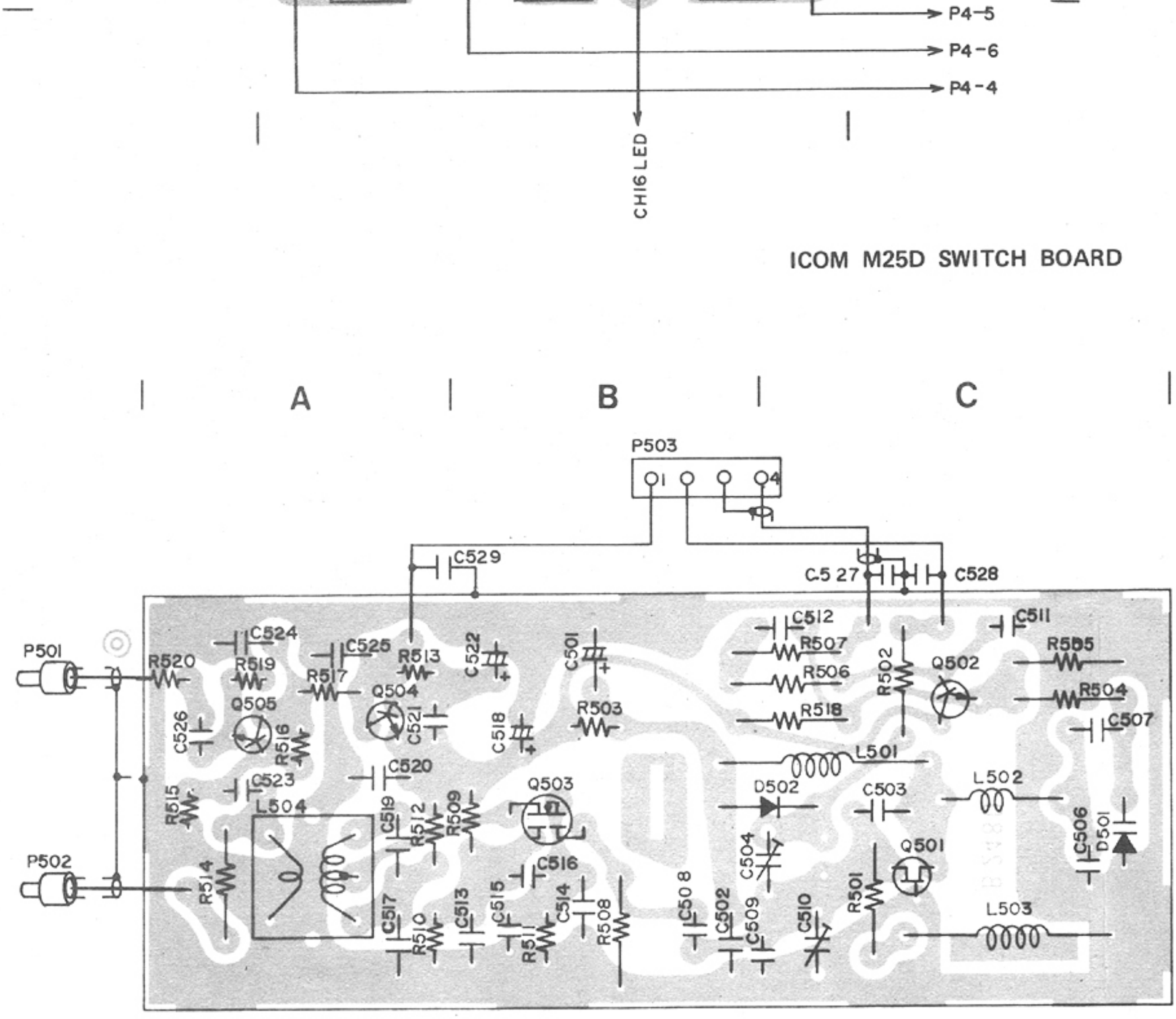
E



ICOM M25D PLL UNIT
(U - 141)



ICOM M25D SWITCH BOARD



ICOM

COM S6

PL I

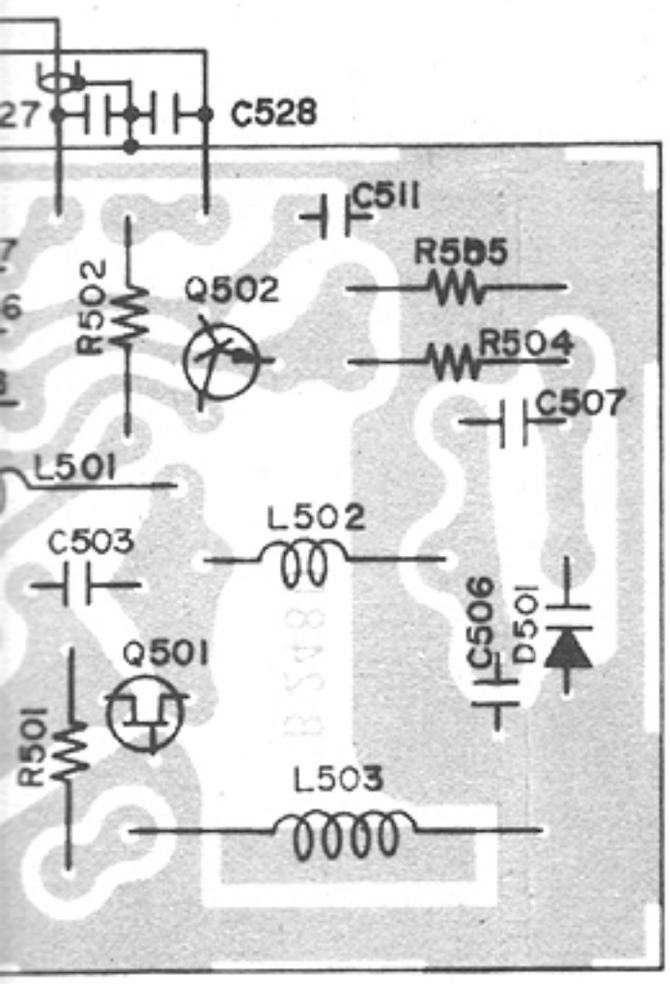
P4-5

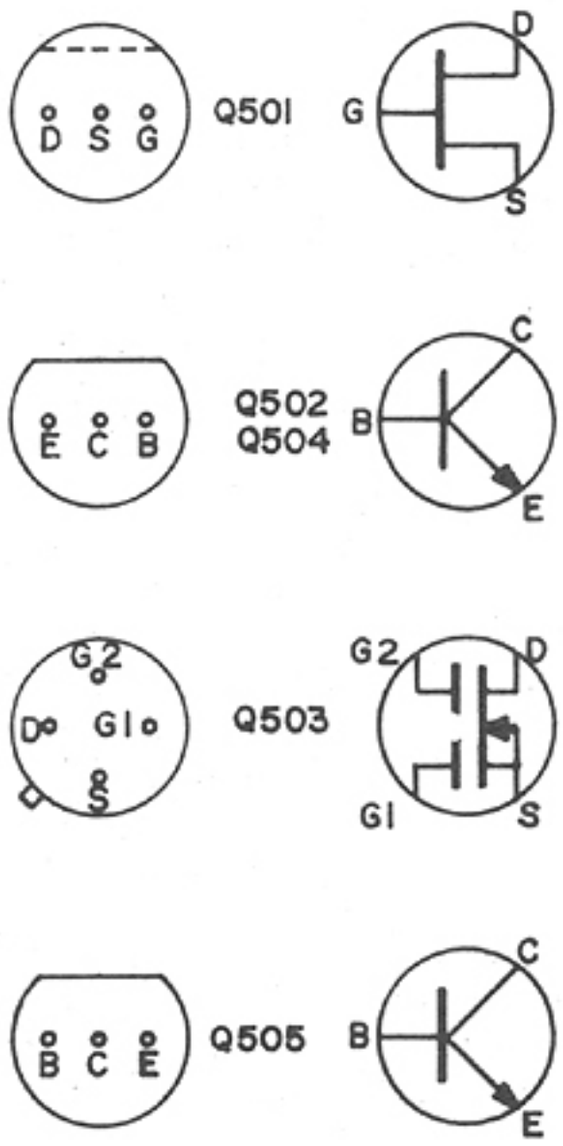
P4-6

P4-4

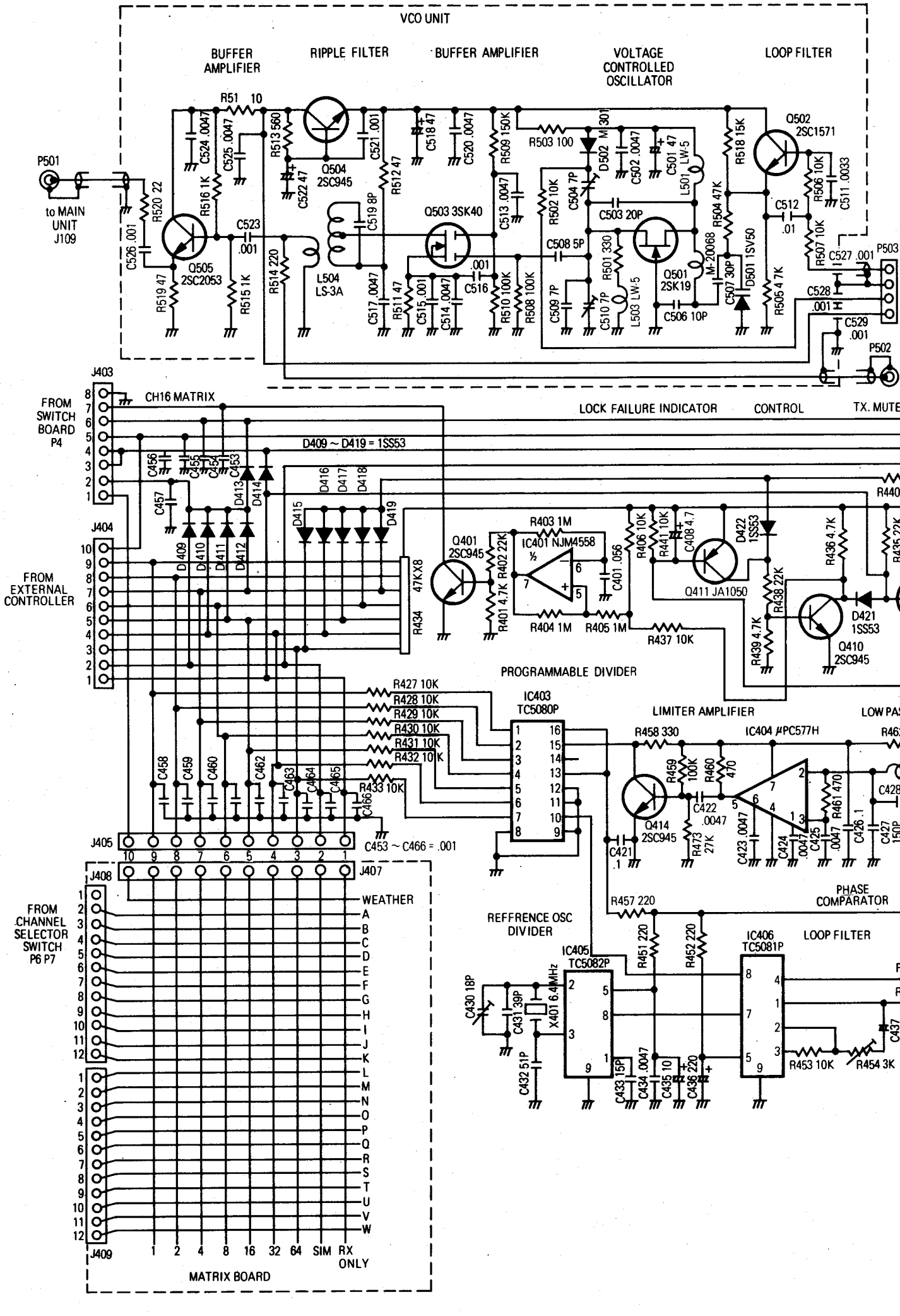
M M25D SWITCH BOARD

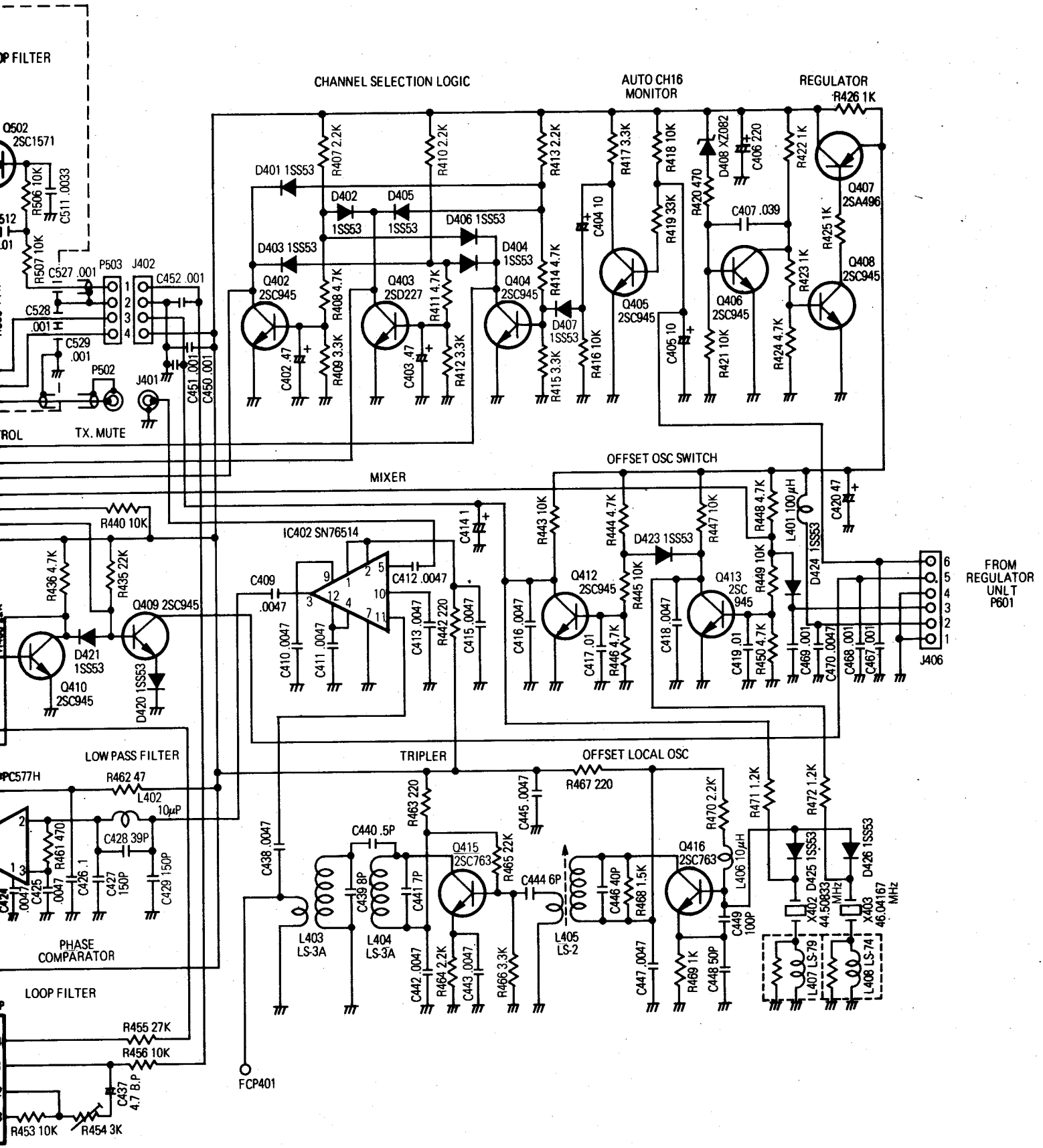
C





ICOM M25D VCO UNIT
(U - 142)

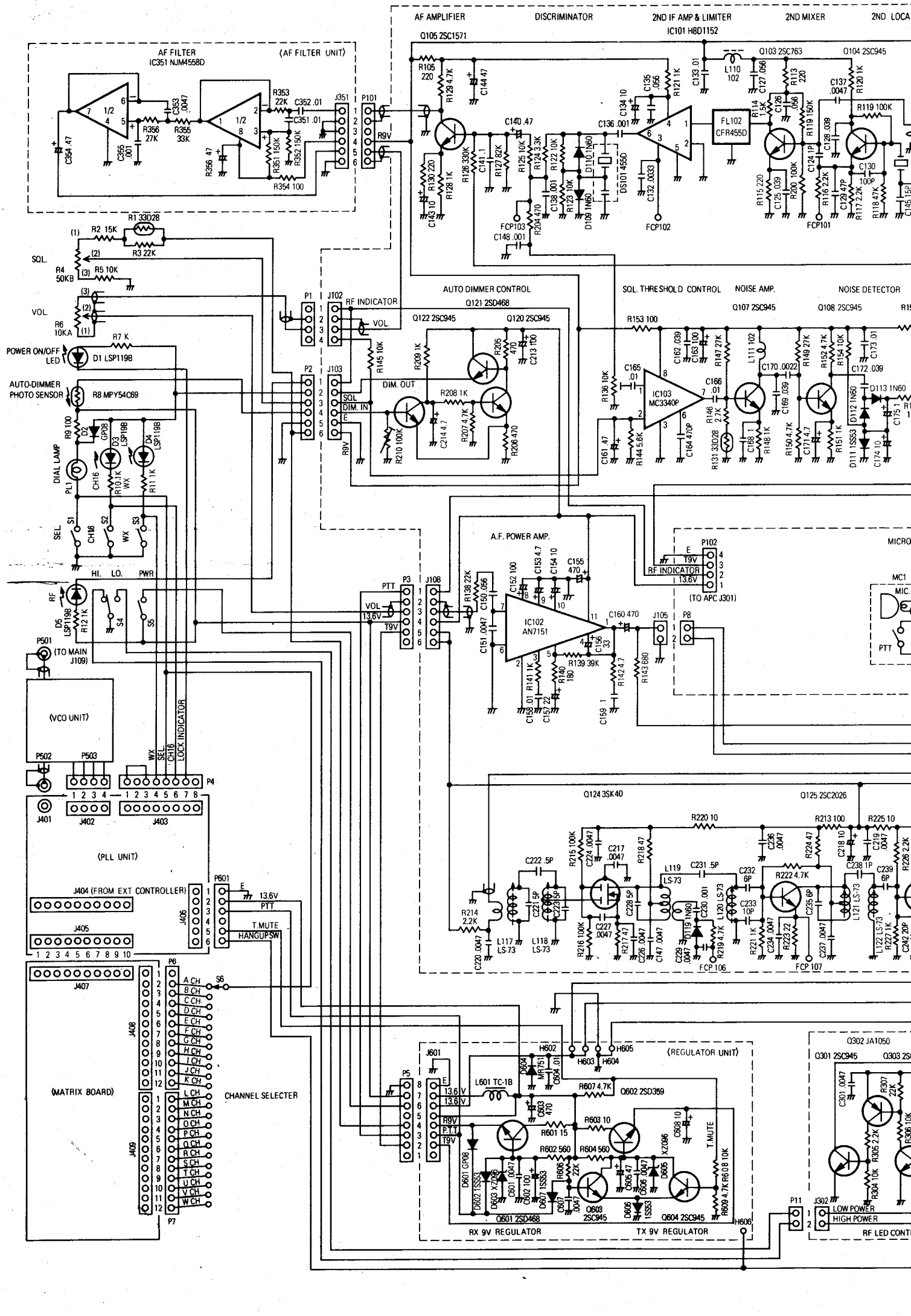

VCO UNIT
BUFFER AMPLIFIER
RIPPLE FILTER
BUFFER AMPLIFIER
VOLTAGE CONTROLLED OSCILLATOR
LOOP FILTER
P501
to MAIN UNIT J109
Q505 2SC2053
Q504 2SC945
Q503 3SK40
Q502 2SC1571
Q501 2SK19
L504 LS-3A
L501 LW-5
L503 LW-5
D502 M301
D501 1SV50
M-20068
P503
P502
J403
FROM SWITCH BOARD P4
CH16 MATRIX
LOCK FAILURE INDICATOR
CONTROL
TX. MUTE
D409 ~ D419 = 1SS53
J404
FROM EXTERNAL CONTROLLER
47KX8
R434
Q401 2SC945
IC401 NJM4558
Q411 JA1050
Q410 2SC945
D421 1SS53
D422 1SS53
PROGRAMMABLE DIVIDER
IC403 TC5080P
LIMITER AMPLIFIER
IC404 μPC577H
Q414 2SC945
PHASE COMPARATOR
REFFRENCE OSC DIVIDER
IC405 TC5082P
IC406 TC5081P
LOOP FILTER
X401 6.4MHz
R427 10K
R428 10K
R429 10K
R430 10K
R431 10K
R432 10K
R433 10K
C453 ~ C466 = .001
J405
J407
J408
FROM CHANNEL SELECTOR SWITCH P6 P7
WEATHER
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
J409
1 2 4 8 16 32 64 SIM RX ONLY
MATRIX BOARD

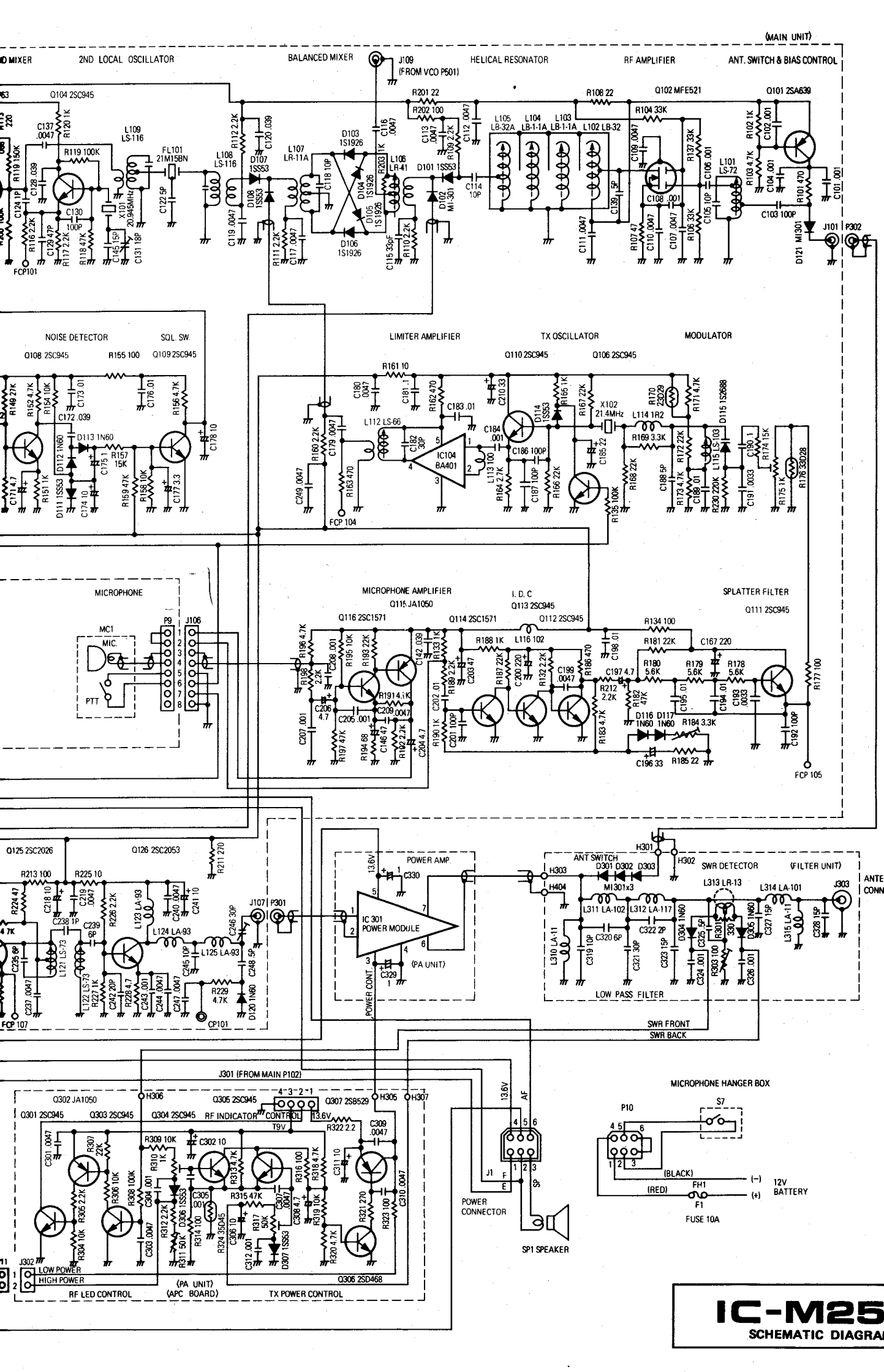


IC-M25D

SCHEMATIC DIAGRAM 1

FX-46A-4A1

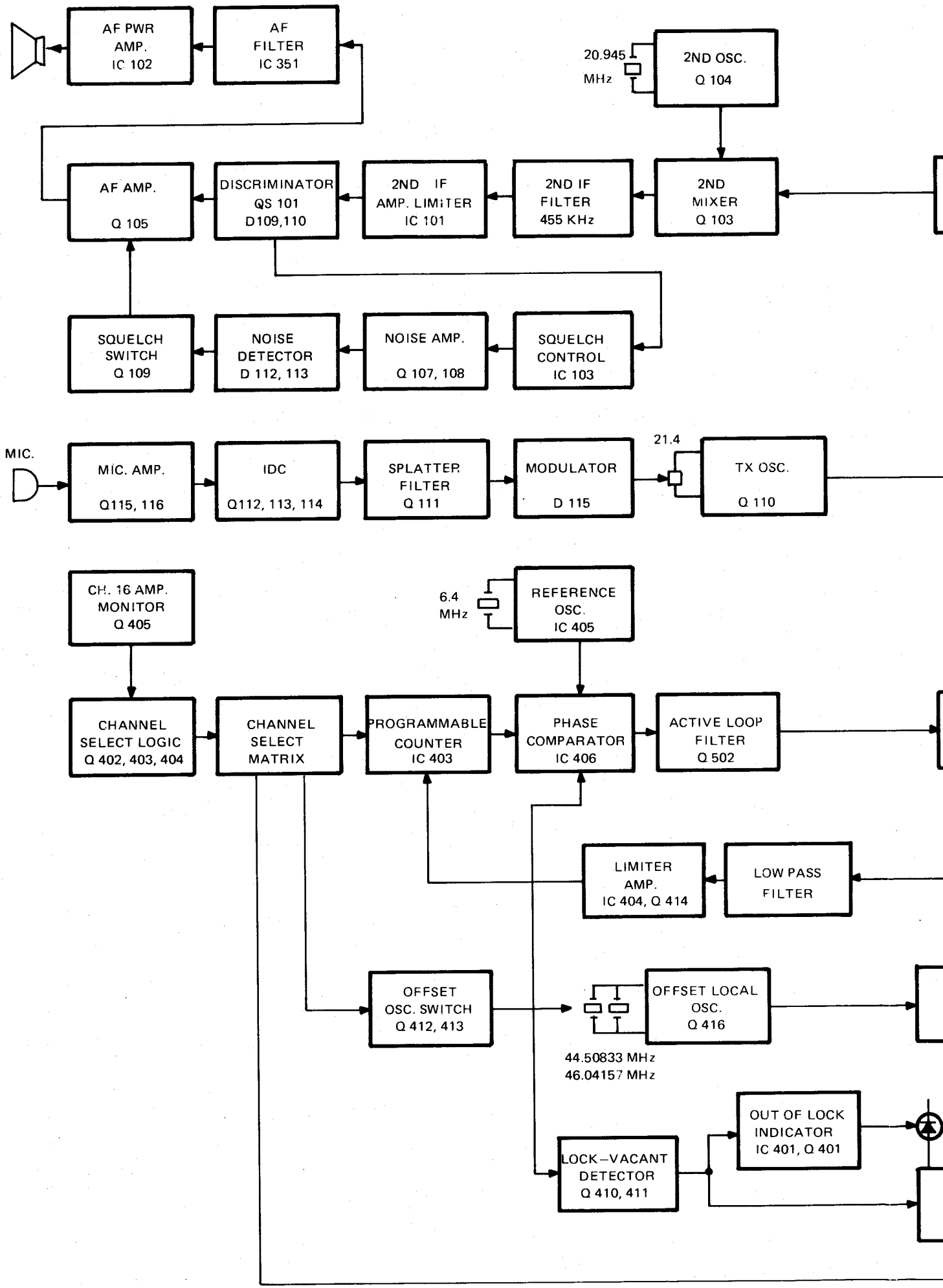

AF AMPLIFIER
DISCRIMINATOR
2ND IF AMP & LIMITER
IC101 H8D1152
2ND MIXER
2ND LOCA
Q105 2SC1571
Q103 2SC763
Q104 2SC945
AF FILTER
IC351 NJM4558D
(AF FILTER UNIT)
FL102
CFR455D
FCP101
FCP102
FCP103
AUTO DIMMER CONTROL
Q121 2SD468
Q122 2SC945
Q120 2SC945
RF INDICATOR
SQL. THRESHOLD CONTROL
NOISE AMP.
Q107 2SC945
Q108 2SC945
NOISE DETECTOR
IC103
MC3340P
POWER ON/OFF LED
D1 LSP119B
AUTO-DIMMER PHOTO SENSOR
R8 MPY54C69
DIAL LAMP
SEL.
HI. LO. PWR
A.F. POWER AMP.
IC102
AN7151
(TO APC J301)
MICRO
MIC.
PTT
(TO MAIN J109)
(VCO UNIT)
LOCK INDICATOR
(PLL UNIT)
J404 (FROM EXT CONTROLLER)
T.MUTE
HANGUPSW
(MATRIX BOARD)
CHANNEL SELECTER
(REGULATOR UNIT)
Q124 3SK40
Q125 2SC2026
Q602 2SD359
Q603 2SC945
Q604 2SC945
Q601 2SD468
RX 9V REGULATOR
TX 9V REGULATOR
Q302 JA1050
Q301 2SC945
Q303 2S
LOW POWER
HIGH POWER
RF LED CONTI

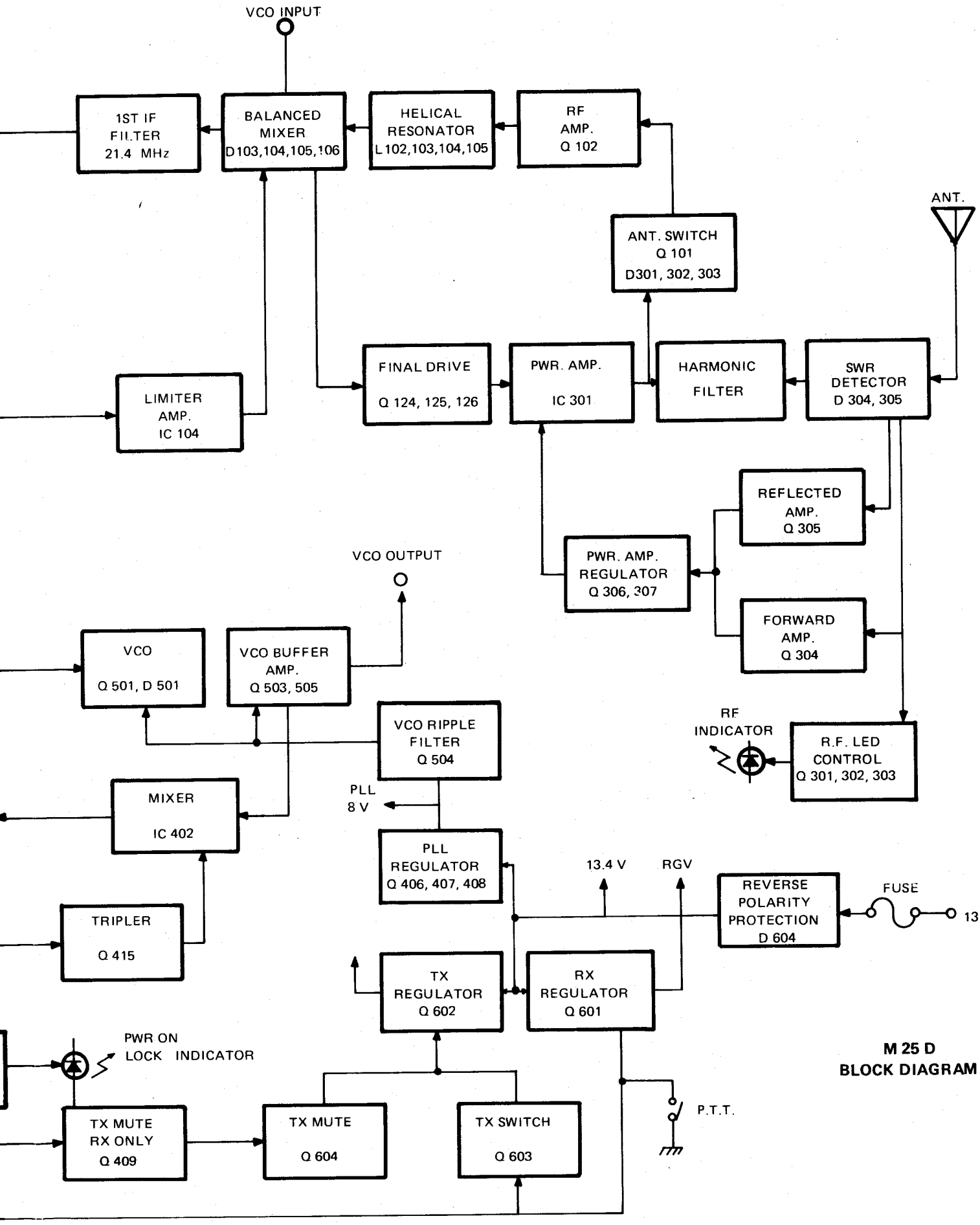


IC-M25D

SCHEMATIC DIAGRAM 2

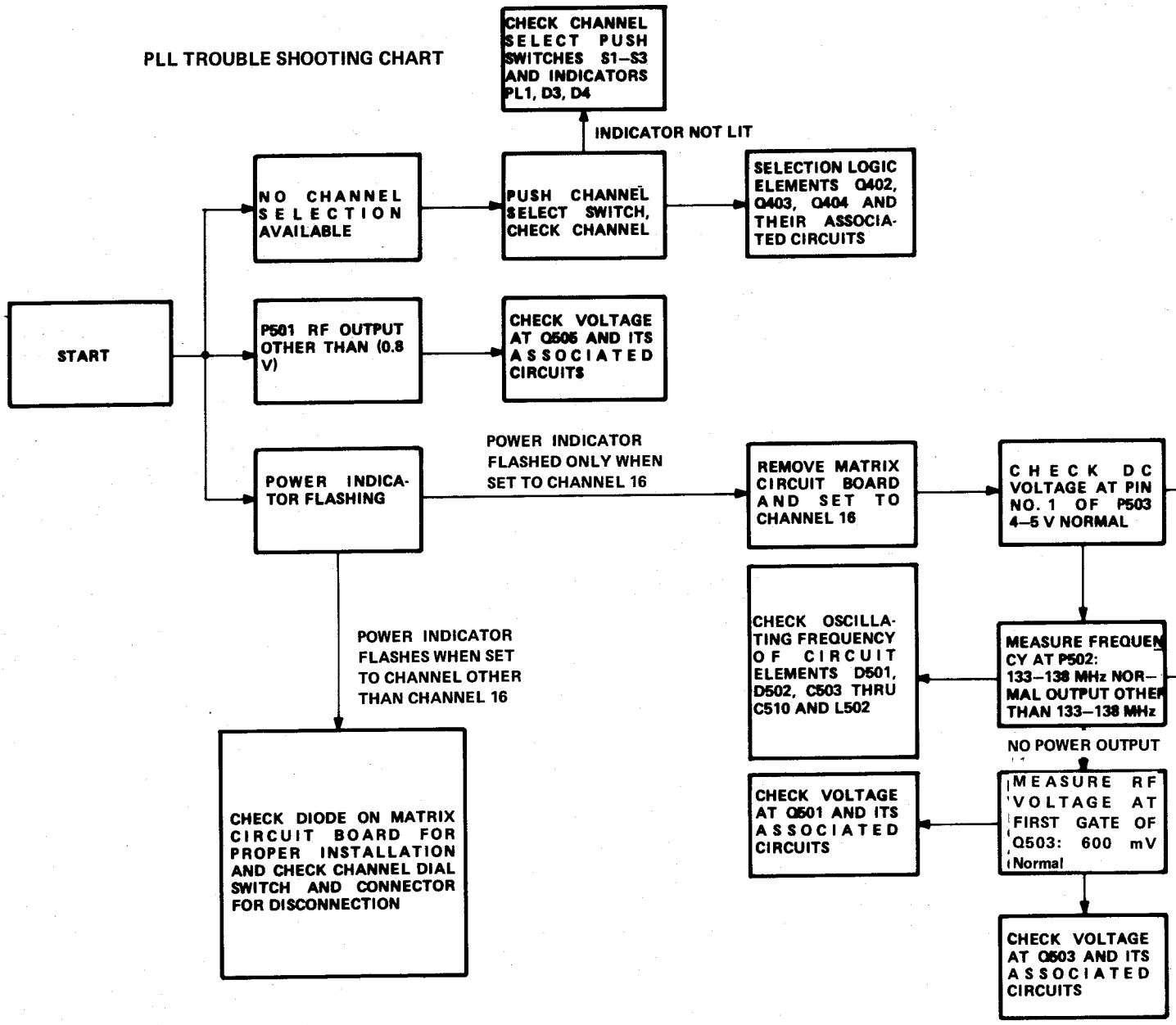
FX-46A-4A2

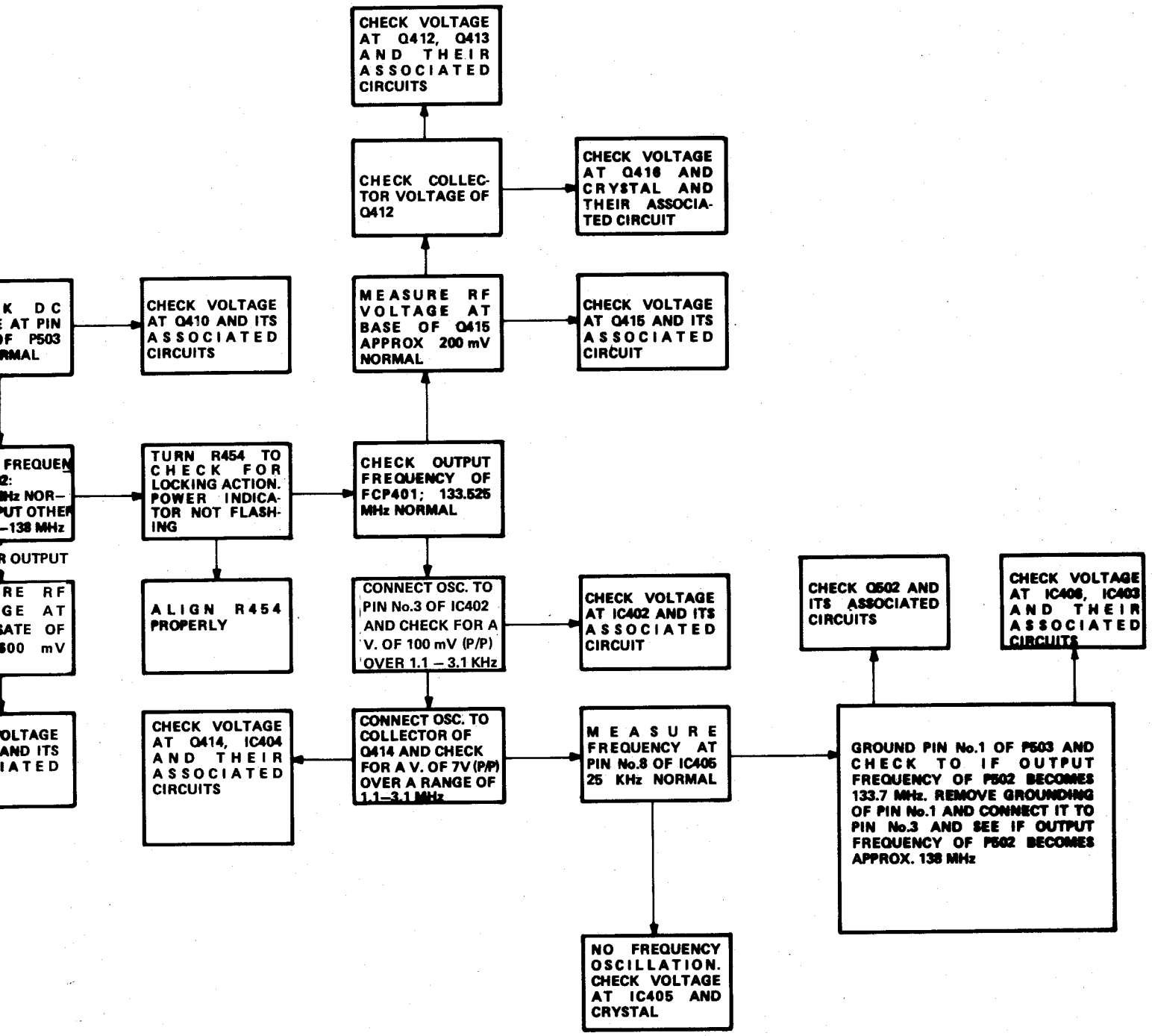

AF PWR AMP. IC 102
AF FILTER IC 351
20.945 MHz
2ND OSC. Q 104
AF AMP. Q 105
DISCRIMINATOR QS 101 D109,110
2ND IF AMP. LIMITER IC 101
2ND IF FILTER 455 KHz
2ND MIXER Q 103
SQUELCH SWITCH Q 109
NOISE DETECTOR D 112, 113
NOISE AMP. Q 107, 108
SQUELCH CONTROL IC 103
MIC.
MIC. AMP. Q115, 116
IDC Q112, 113, 114
SPLATTER FILTER Q 111
MODULATOR D 115
21.4
TX OSC. Q 110
CH. 16 AMP. MONITOR Q 405
6.4 MHz
REFERENCE OSC. IC 405
CHANNEL SELECT LOGIC Q 402, 403, 404
CHANNEL SELECT MATRIX
PROGRAMMABLE COUNTER IC 403
PHASE COMPARATOR IC 406
ACTIVE LOOP FILTER Q 502
LIMITER AMP. IC 404, Q 414
LOW PASS FILTER
OFFSET OSC. SWITCH Q 412, 413
OFFSET LOCAL OSC. Q 416
44.50833 MHz
46.04157 MHz
OUT OF LOCK INDICATOR IC 401, Q 401
LOCK–VACANT DETECTOR Q 410, 411



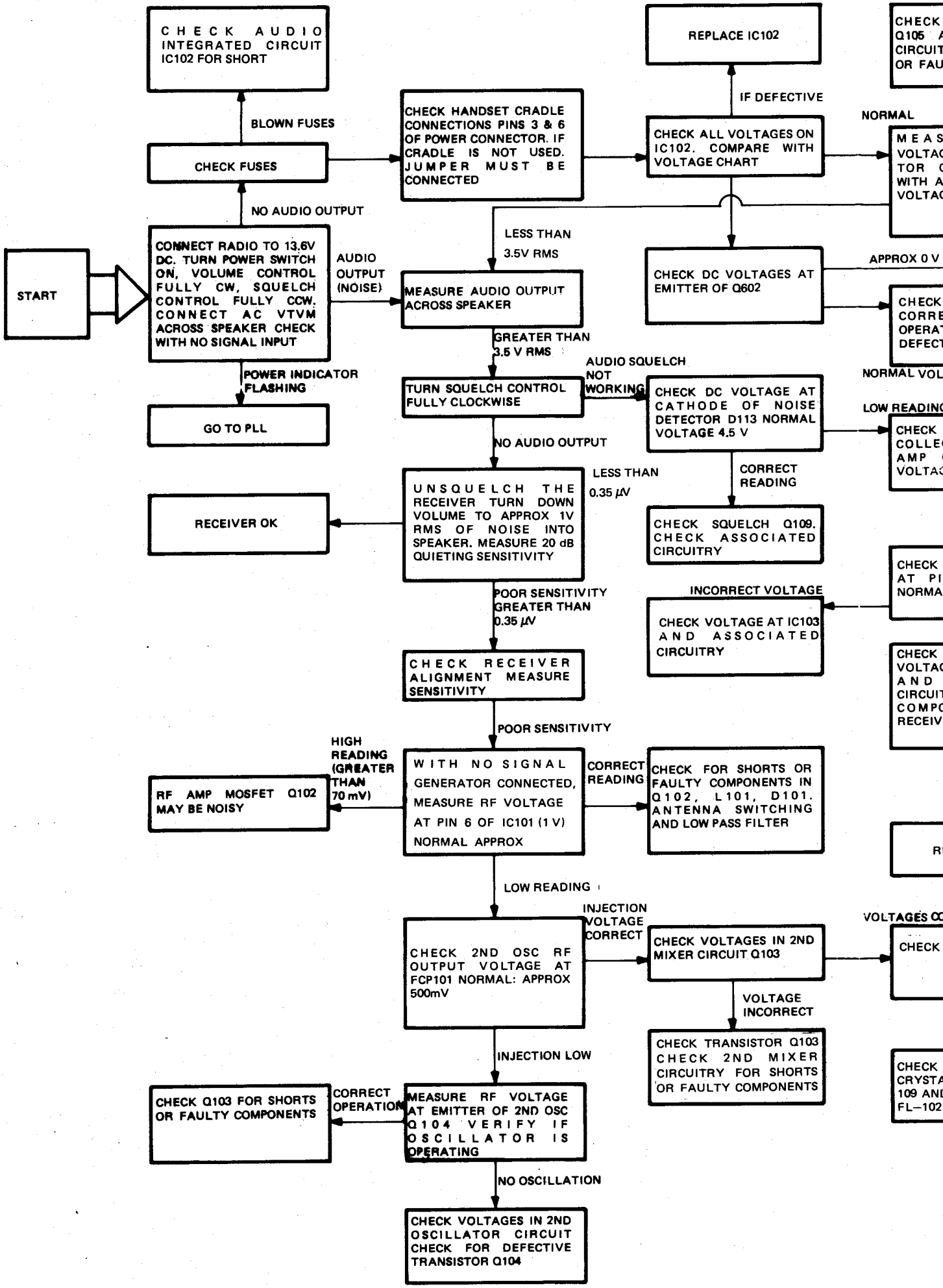
M 25 D
BLOCK DIAGRAM

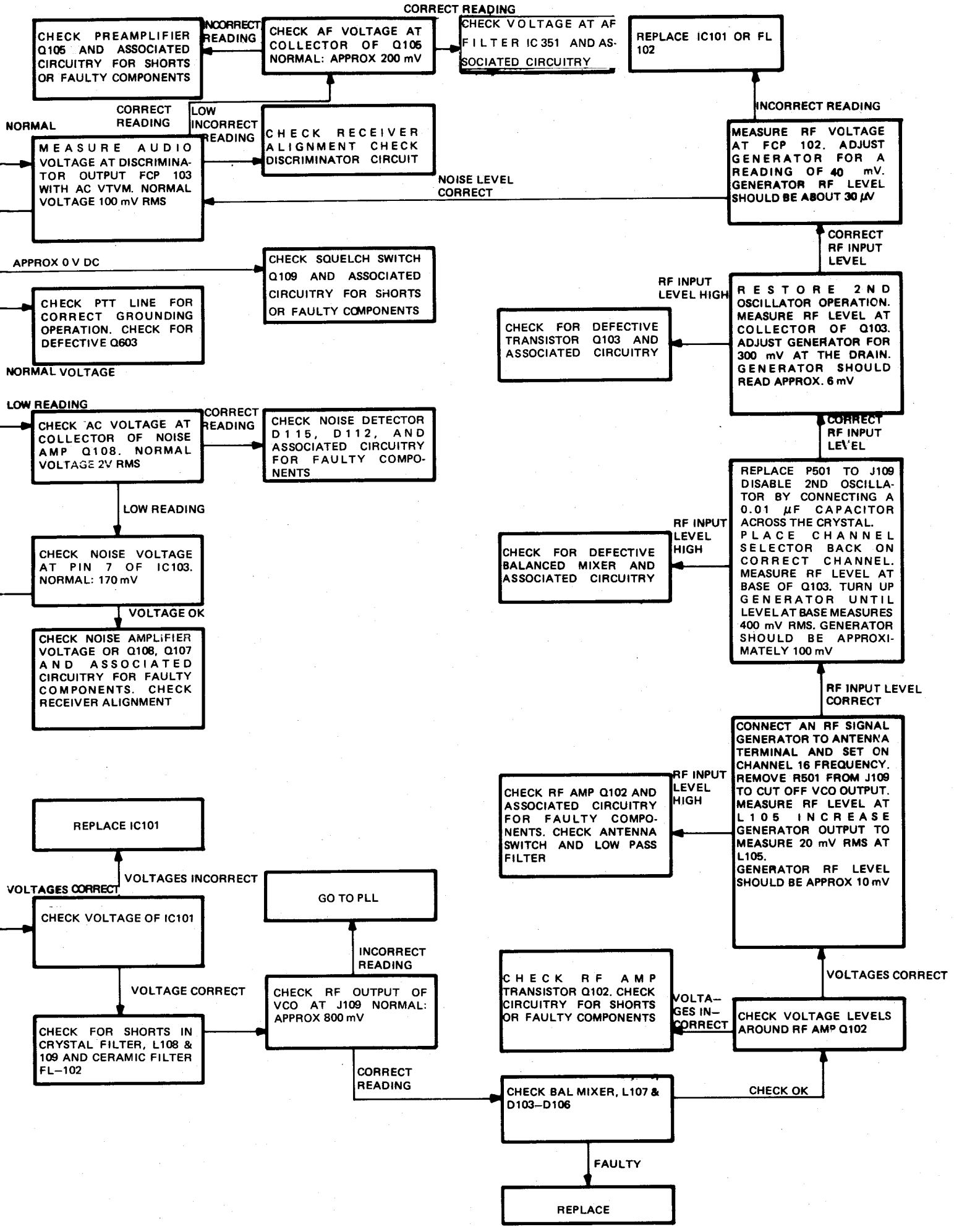
PLL TROUBLE SHOOTING CHART



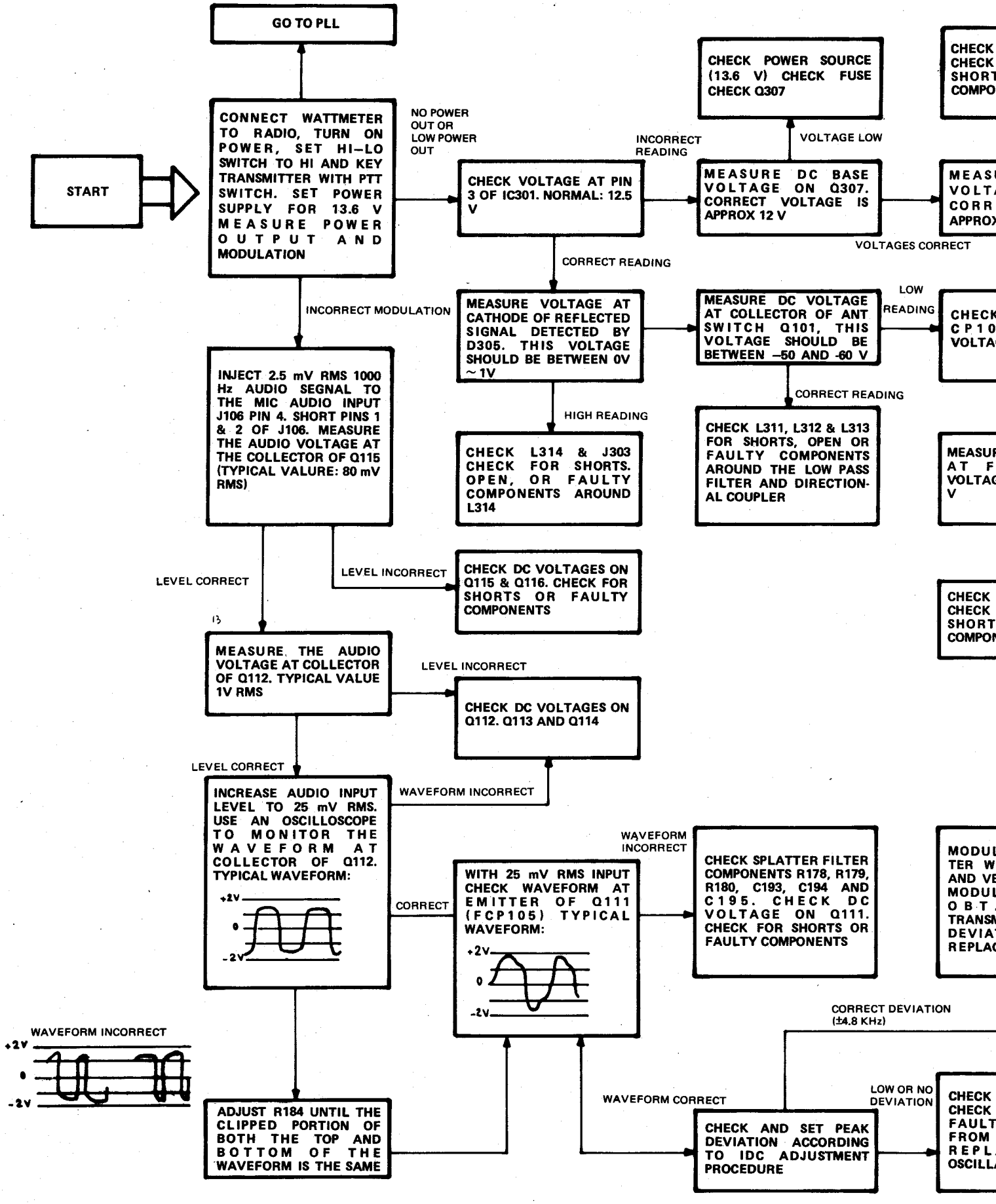

CHECK VOLTAGE AT Q412, Q413 AND THEIR ASSOCIATED CIRCUITS
CHECK COLLECTOR VOLTAGE OF Q412
CHECK VOLTAGE AT Q416 AND CRYSTAL AND THEIR ASSOCIATED CIRCUIT
MEASURE RF VOLTAGE AT BASE OF Q415 APPROX 200 mV NORMAL
CHECK VOLTAGE AT Q415 AND ITS ASSOCIATED CIRCUIT
CHECK VOLTAGE AT Q410 AND ITS ASSOCIATED CIRCUITS
CHECK OUTPUT FREQUENCY OF FCP401; 133.525 MHz NORMAL
TURN R454 TO CHECK FOR LOCKING ACTION. POWER INDICATOR NOT FLASHING
ALIGN R454 PROPERLY
CONNECT OSC. TO PIN No.3 OF IC402 AND CHECK FOR A V. OF 100 mV (P/P) OVER 1.1 – 3.1 KHz
CHECK VOLTAGE AT IC402 AND ITS ASSOCIATED CIRCUIT
CHECK VOLTAGE AT Q414, IC404 AND THEIR ASSOCIATED CIRCUITS
CONNECT OSC. TO COLLECTOR OF Q414 AND CHECK FOR A V. OF 7V (P/P) OVER A RANGE OF 1.1–3.1 MHz
MEASURE FREQUENCY AT PIN No.8 OF IC405 25 KHz NORMAL
NO FREQUENCY OSCILLATION. CHECK VOLTAGE AT IC405 AND CRYSTAL
CHECK Q502 AND ITS ASSOCIATED CIRCUITS
CHECK VOLTAGE AT IC406, IC403 AND THEIR ASSOCIATED CIRCUITS
GROUND PIN No.1 OF P503 AND CHECK TO IF OUTPUT FREQUENCY OF P502 BECOMES 133.7 MHz. REMOVE GROUNDING OF PIN No.1 AND CONNECT IT TO PIN No.3 AND SEE IF OUTPUT FREQUENCY OF P502 BECOMES APPROX. 138 MHz

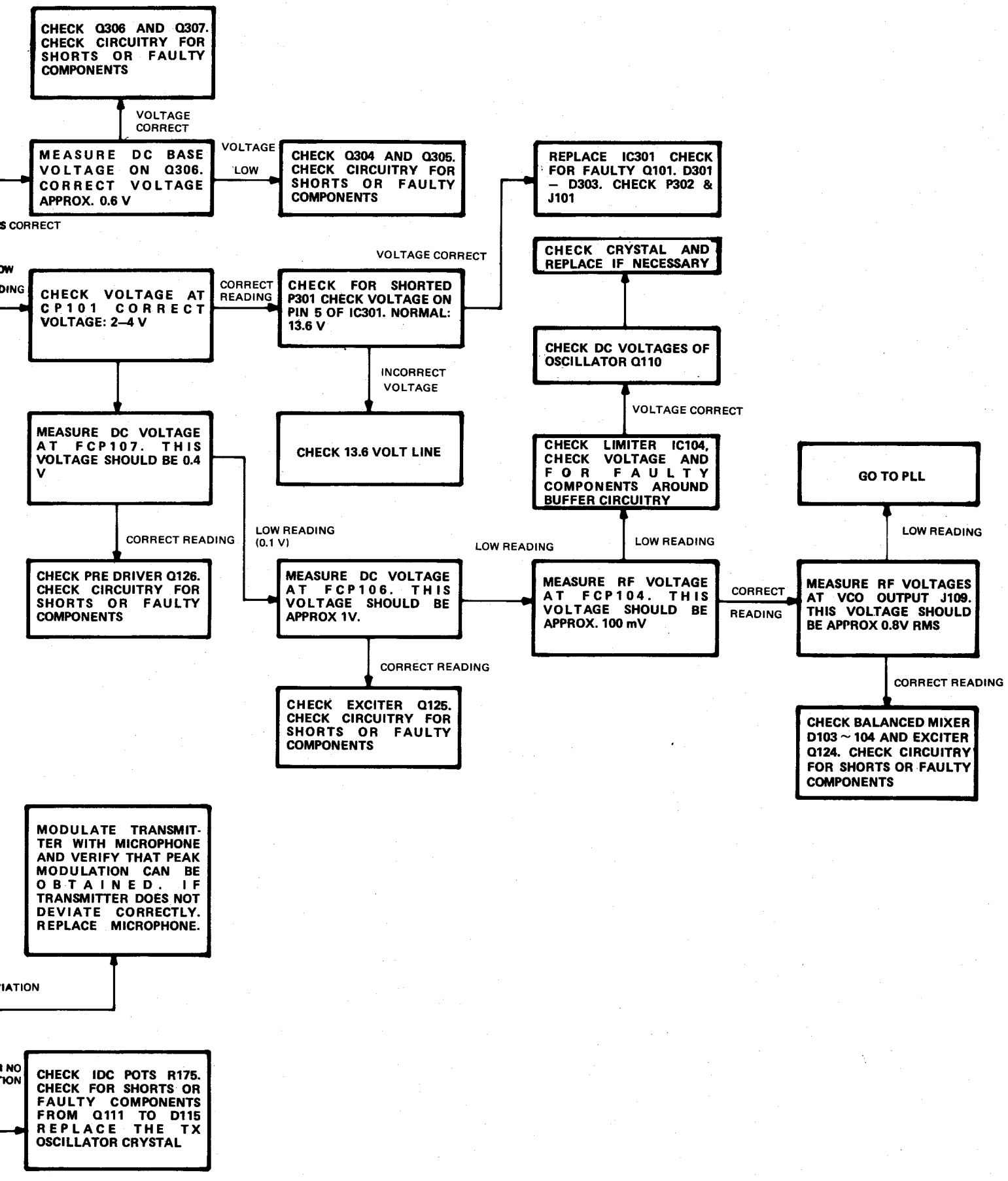
RECEIVER TROUBLE SHOOTING CHART




CORRECT READING
CHECK PREAMPLIFIER Q105 AND ASSOCIATED CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
INCORRECT READING
CHECK AF VOLTAGE AT COLLECTOR OF Q105 NORMAL: APPROX 200 mV
CHECK VOLTAGE AT AF FILTER IC 351 AND ASSOCIATED CIRCUITRY
REPLACE IC101 OR FL 102
INCORRECT READING
CORRECT READING
LOW INCORRECT READING
NORMAL
MEASURE AUDIO VOLTAGE AT DISCRIMINATOR OUTPUT FCP 103 WITH AC VTVM. NORMAL VOLTAGE 100 mV RMS
CHECK RECEIVER ALIGNMENT CHECK DISCRIMINATOR CIRCUIT
NOISE LEVEL CORRECT
MEASURE RF VOLTAGE AT FCP 102. ADJUST GENERATOR FOR A READING OF 40 mV. GENERATOR RF LEVEL SHOULD BE ABOUT 30 µV
CORRECT RF INPUT LEVEL
APPROX 0 V DC
CHECK SQUELCH SWITCH Q109 AND ASSOCIATED CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
RF INPUT LEVEL HIGH
RESTORE 2ND OSCILLATOR OPERATION. MEASURE RF LEVEL AT COLLECTOR OF Q103. ADJUST GENERATOR FOR 300 mV AT THE DRAIN. GENERATOR SHOULD READ APPROX. 6 mV
CHECK PTT LINE FOR CORRECT GROUNDING OPERATION. CHECK FOR DEFECTIVE Q603
NORMAL VOLTAGE
CHECK FOR DEFECTIVE TRANSISTOR Q103 AND ASSOCIATED CIRCUITRY
LOW READING
CORRECT READING
CHECK AC VOLTAGE AT COLLECTOR OF NOISE AMP Q108. NORMAL VOLTAGE 2V RMS
CHECK NOISE DETECTOR D115, D112, AND ASSOCIATED CIRCUITRY FOR FAULTY COMPONENTS
CORRECT RF INPUT LEVEL
REPLACE P501 TO J109 DISABLE 2ND OSCILLATOR BY CONNECTING A 0.01 µF CAPACITOR ACROSS THE CRYSTAL. PLACE CHANNEL SELECTOR BACK ON CORRECT CHANNEL. MEASURE RF LEVEL AT BASE OF Q103. TURN UP GENERATOR UNTIL LEVEL AT BASE MEASURES 400 mV RMS. GENERATOR SHOULD BE APPROXIMATELY 100 mV
LOW READING
RF INPUT LEVEL HIGH
CHECK FOR DEFECTIVE BALANCED MIXER AND ASSOCIATED CIRCUITRY
CHECK NOISE VOLTAGE AT PIN 7 OF IC103. NORMAL: 170 mV
VOLTAGE OK
CHECK NOISE AMPLIFIER VOLTAGE OR Q108, Q107 AND ASSOCIATED CIRCUITRY FOR FAULTY COMPONENTS. CHECK RECEIVER ALIGNMENT
RF INPUT LEVEL CORRECT
CONNECT AN RF SIGNAL GENERATOR TO ANTENNA TERMINAL AND SET ON CHANNEL 16 FREQUENCY. REMOVE R501 FROM J109 TO CUT OFF VCO OUTPUT. MEASURE RF LEVEL AT L105 INCREASE GENERATOR OUTPUT TO MEASURE 20 mV RMS AT L105. GENERATOR RF LEVEL SHOULD BE APPROX 10 mV
RF INPUT LEVEL HIGH
CHECK RF AMP Q102 AND ASSOCIATED CIRCUITRY FOR FAULTY COMPONENTS. CHECK ANTENNA SWITCH AND LOW PASS FILTER
REPLACE IC101
VOLTAGES INCORRECT
VOLTAGES CORRECT
GO TO PLL
CHECK VOLTAGE OF IC101
INCORRECT READING
VOLTAGES CORRECT
CHECK RF AMP TRANSISTOR Q102. CHECK CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
VOLTAGES INCORRECT
CHECK VOLTAGE LEVELS AROUND RF AMP Q102
VOLTAGE CORRECT
CHECK RF OUTPUT OF VCO AT J109 NORMAL: APPROX 800 mV
CHECK FOR SHORTS IN CRYSTAL FILTER, L108 & 109 AND CERAMIC FILTER FL–102
CORRECT READING
CHECK BAL MIXER, L107 & D103–D106
CHECK OK
FAULTY
REPLACE

TRANSMITTER TROUBLE SHOOTING CHART




CHECK Q306 AND Q307. CHECK CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
VOLTAGE CORRECT
MEASURE DC BASE VOLTAGE ON Q306. CORRECT VOLTAGE APPROX. 0.6 V
VOLTAGE LOW
CHECK Q304 AND Q305. CHECK CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
REPLACE IC301 CHECK FOR FAULTY Q101. D301 – D303. CHECK P302 & J101
S CORRECT
VOLTAGE CORRECT
CHECK CRYSTAL AND REPLACE IF NECESSARY
CHECK VOLTAGE AT CP101 CORRECT VOLTAGE: 2–4 V
CORRECT READING
CHECK FOR SHORTED P301 CHECK VOLTAGE ON PIN 5 OF IC301. NORMAL: 13.6 V
CHECK DC VOLTAGES OF OSCILLATOR Q110
INCORRECT VOLTAGE
VOLTAGE CORRECT
MEASURE DC VOLTAGE AT FCP107. THIS VOLTAGE SHOULD BE 0.4 V
CHECK 13.6 VOLT LINE
CHECK LIMITER IC104, CHECK VOLTAGE AND FOR FAULTY COMPONENTS AROUND BUFFER CIRCUITRY
GO TO PLL
CORRECT READING
LOW READING (0.1 V)
LOW READING
LOW READING
LOW READING
CHECK PRE DRIVER Q126. CHECK CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
MEASURE DC VOLTAGE AT FCP106. THIS VOLTAGE SHOULD BE APPROX 1V.
MEASURE RF VOLTAGE AT FCP104. THIS VOLTAGE SHOULD BE APPROX. 100 mV
CORRECT READING
MEASURE RF VOLTAGES AT VCO OUTPUT J109. THIS VOLTAGE SHOULD BE APPROX 0.8V RMS
CORRECT READING
CHECK EXCITER Q125. CHECK CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
CHECK BALANCED MIXER D103 ~ 104 AND EXCITER Q124. CHECK CIRCUITRY FOR SHORTS OR FAULTY COMPONENTS
MODULATE TRANSMITTER WITH MICROPHONE AND VERIFY THAT PEAK MODULATION CAN BE OBTAINED. IF TRANSMITTER DOES NOT DEVIATE CORRECTLY. REPLACE MICROPHONE.
CHECK IDC POTS R175. CHECK FOR SHORTS OR FAULTY COMPONENTS FROM Q111 TO D115 REPLACE THE TX OSCILLATOR CRYSTAL