

**FT-70G  
FT-70F  
SERVICE MANUAL**

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# TABLE OF CONTENTS

	page
<b>INTRODUCTION</b> . . . . .	1
<b>SIGNAL PATHS</b> . . . . .	2
SSB Mode	2
A3H Mode	3
CW Mode	4
<b>CIRCUIT DESCRIPTION</b> . . . . .	5
Receiver Signal Path	5
A3H, AGC, Squelch & Noise Blanker	5
Transmitter Signal Path	5
ALC, Protection, PO Meter & Keying	6
1st Local Signal Production	6
Loop 2: Clarifier Control	7
Loop 3: Fine Steps	7
PLL Unit Miscellaneous Circuits	7
BPF, LPF & VCO Selection	8
Supply Voltages	8
<b>FT-70F CHANNEL FREQUENCY PROGRAMMING</b> . . . . .	9
Matrix Unit Parts Layout	14
Matrix Unit Schematic Diagram	15
<b>CIRCUIT ALIGNMENT</b> . . . . .	16
Test Equipment Required	16
Thumbwheel Alignment Unit for FT-70F	16
Preliminary Alignment Information	17
PLL Unit	17
Parts Layout	21
Schematic Diagram	22
RF/IF Unit	23
Parts Layout	25
Schematic Diagram	26
PA Unit	29
Parts Layout/Schematic Diagram	29
LPF Unit	30
Parts Layout	30
Schematic Diagram	31
Miscellaneous Adjustments	32
REG/CNTL Unit Parts Layout	33
REG/CNTL Unit Schematic Diagram	34
VR Unit, Mode Sw Unit & Sw Unit Parts Layouts/Schematic Diagrams	35
<b>FT-70F INTERCONNECTION DIAGRAM</b> . . . . .	37
<b>FT-70G INTERCONNECTION DIAGRAM</b> . . . . .	38
<b>PARTS LIST</b> . . . . .	39

## FT-70 SERVICE MANUAL



This manual provides complete technical information on the Yaesu FT-70F and FT-70G Portable HF Manpack Transceivers. General information required by users, including typical installation, use of options and operation are provided in the separate publication: the FT-70 Operating Manual.

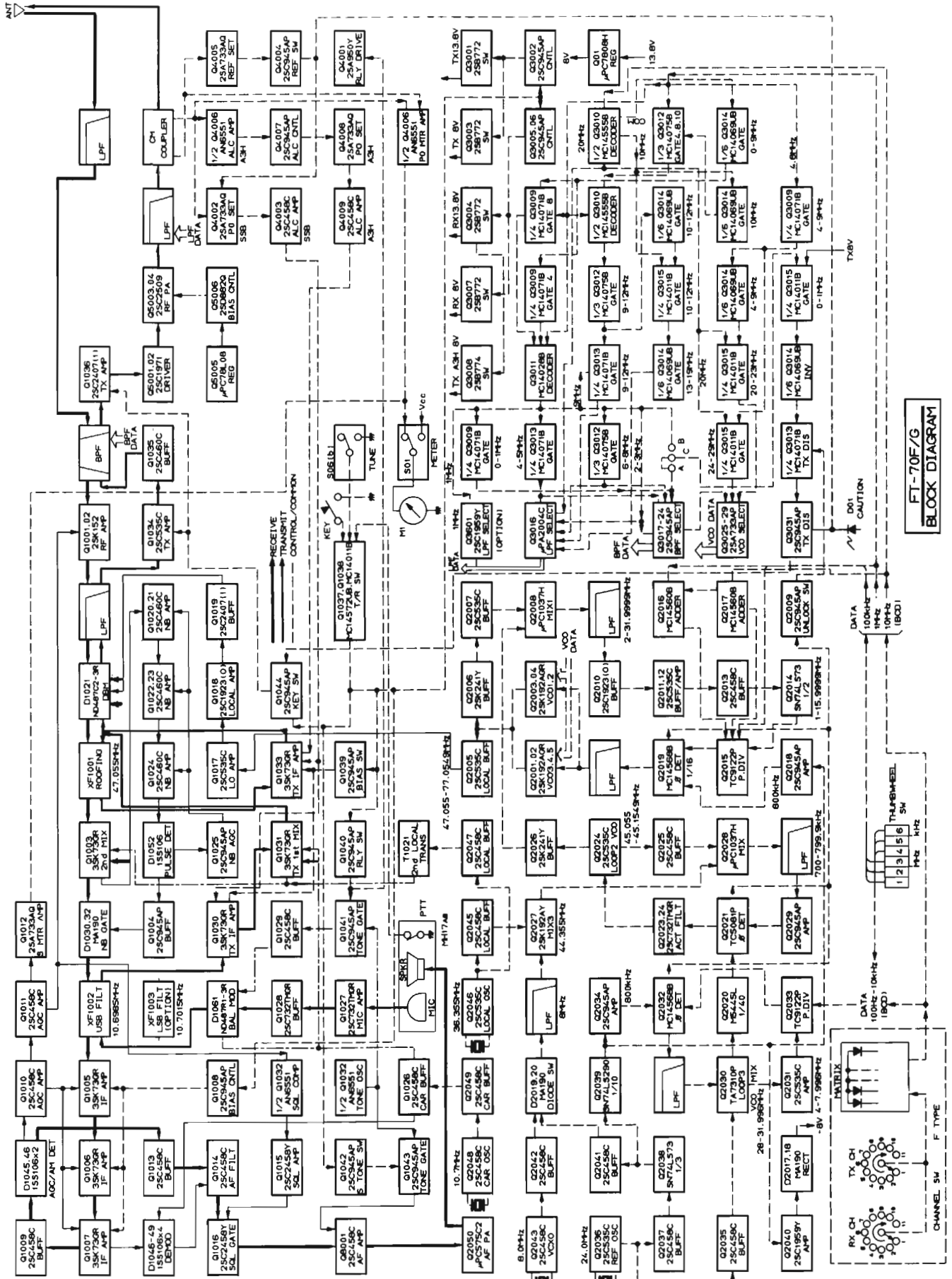
The purpose of this manual is to provide trained and properly equipped technical personnel with all information necessary to conduct periodic maintenance and realignment, and to troubleshoot and repair any faults that may occur. Before any servicing is performed, we recommend that the Circuit Description and Block Diagram be studied carefully to familiarize the serviceman with the overall design philosophy and signal paths.

The information provided herein is, to our knowledge at the time of writing, correct and reliable. However, our continual efforts to improve performance will result in modifications to the production line from time to time, which may modify or outdate portions of this manual. We would therefore appreciate your cooperation in bringing any inconsistencies to the attention of the nearest Yaesu representative.

Yaesu cannot accept liability for damages that may result from misuse of the technical information herein.

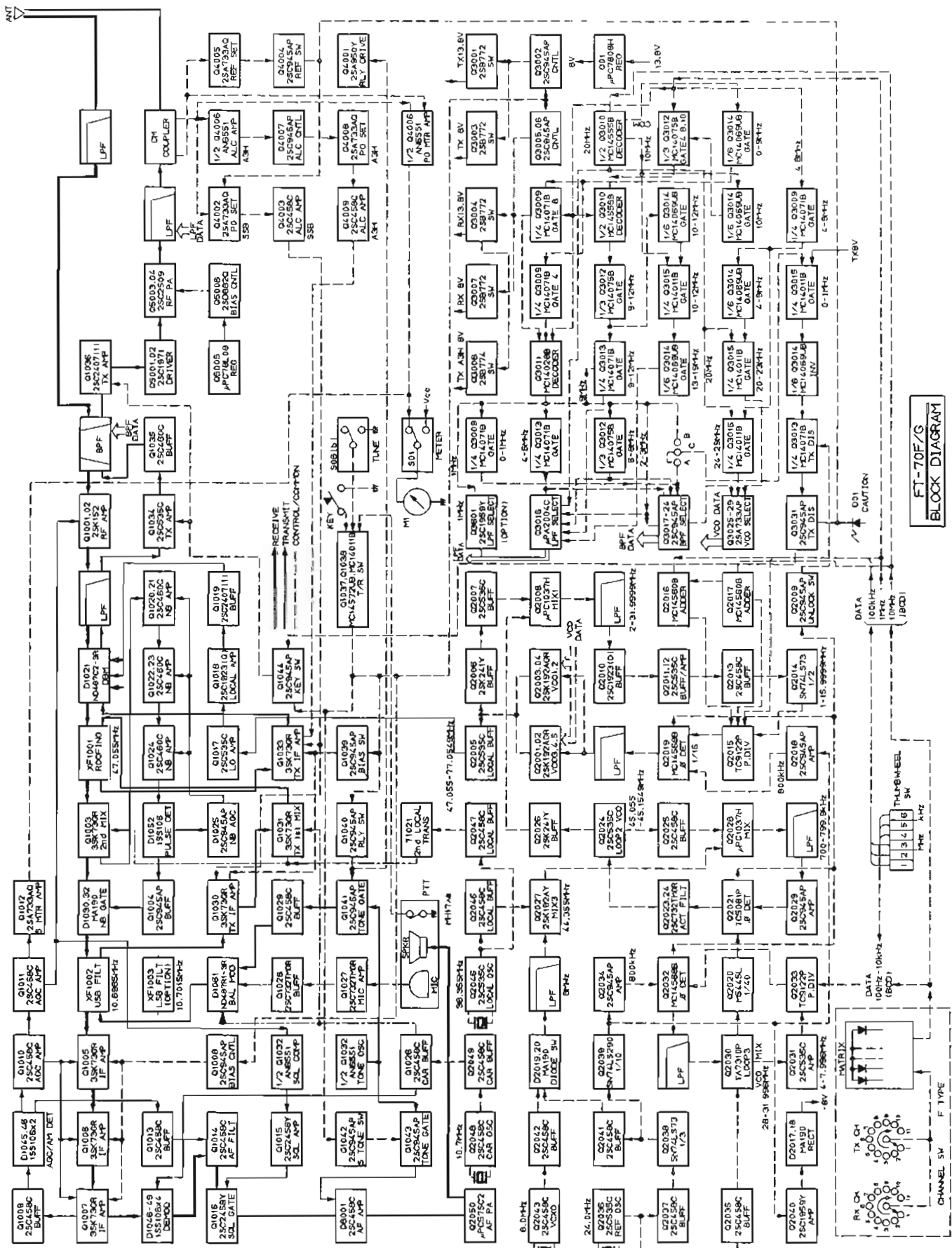


# SIGNAL PATH: A3H MODE



FT-70F/G  
BLOCK DIAGRAM

SIGNAL PATH: CW MODE



## CIRCUIT DESCRIPTION

This description is intended to be read in conjunction with the Block Diagram, to provide the general understanding of the overall system design of the FT-70 necessary for efficient troubleshooting and servicing. Specific circuit details are provided later in the schematic diagrams.

### Receiver Signal Path

Signals from the antenna are delivered to the LPF Unit and passed through the antenna changeover relay and lamp fuse PL4001 before delivery to the RF/IF Unit.

On the RF/IF Unit, the received signal is passed through one of eight diode-selected bandpass filters and then amplified by FET Q1001 (gain-controlled by FET Q1002), lowpass filtered and applied to 1st Mixer D1021 along with the 1st Local signal (described later).

The 47.055 MHz product of the 1st Mixer is passed through the roofing filter to 2nd Mixer Q1003, along with the 36.355 MHz 2nd Local signal from the PLL Unit. The 10.7 MHz product of the 2nd Mixer is then passed through the crystal IF filter, for amplification by Q1005 - Q1007 before demodulation by D1046 - D1049 (SSB and CW modes), which also receive the 10.7 MHz local carrier signal from the PLL Unit. The resulting audio is filtered by Q1014 and passed through Squelch Gate Q1016 before delivery to AF preamp Q8001 on the VR Unit, and then final amplification by Q2050 on the PLL Unit for delivery to the speaker/mic or handset.

### A3H, AGC, Squelch & Noise Blanker

A sample of the output of the last IF amplifier is buffered by Q1009 and rectified by D1043 and D1045. When the A3H mode is selected, the resulting AM signal is buffered by Q1013 and applied to AF filter Q1014 (mentioned above) in place of the demodulated signal from D1046 - D1049.

The AM product of D1043 and D1045 is also amplified by Q1010 to provide automatic gain control for the receiver IF amplifiers (Q1005 - Q1007, mentioned above), and further amplified by Q1011 to provide AGC for receiver RF amplifier Q1001. This AGC is also amplified again by Q1012 to provide an S-meter signal while receiving.

The RF AGC from Q1010, in addition to the above applications, is applied to one half of Q1032 serving as a squelch comparator, the output of which is amplified by Q1015 to control squelch gate Q1016 in the AF chain.

The output of 2nd Mixer Q2003 is sampled by one winding on transformer T1009 for noise blanking. The IF sample is amplified by Q1020 - Q1024, and then detected by D1052. The rectified signal is then applied through blanking pulse shaper Q2004 and the signal output winding of T1009 to double varactor D2031, which switches off the signal path for several milliseconds in response to received noise in the 2nd IF. A sample of the rectified signal from D1052 is amplified by Q2025 to provide noise blanker AGC delay back to Q1021, Q1023 and Q1024 in the amplifier chain, limiting the response time of these stages to the approximate duration of blankable hf noise pulses.

### Transmitter Signal Path

In voice modes, microphone audio is amplified by Q1027 and then buffered by Q1028 before application to balanced modulator D1061 along with the 10.7 MHz carrier from the PLL Unit. In CW mode, and when the TUNE switch is pressed, the 1.5 kHz audio from the tone generator half of Q1032 is applied through tone gate Q1041 and buffer Q1029 to the balanced modulator, in place of microphone audio.

The 10.7 MHz modulator product is passed through the same crystal IF filter used for receiving, and then amplified by Q1030 before mixing with the 36.355 MHz 2nd local signal from the PLL Unit at Q1031. The 47.055 MHz product of this mixer is passed through the roofing filter and amplified by Q1033 before mixing with the (1st) local signal at D1021. The mixer product at the desired transmitting frequency is then lowpass filtered, amplified and buffered by Q1034 and Q1035, passed through one of the eight bandpass filters and amplified by predriver Q1036 before delivery to the PA Unit.

On the PA Unit, the transmit signal is amplified by drivers Q5001/Q5002, and finals Q5003/Q5004, delivering up to 10W through one of seven or eight lowpass filters and the CM coupler on the LPF Unit before application to the antenna.

## ALC, Protection, PO Meter & Keying

Transmitted RF is sampled at the CM Coupler on the LPF Unit, detected and amplified by Q4002/Q4003 (for SSB & CW) or one half of Q4006 (for A3H mode) to provide Automatic Level Control voltage for transmitter IF amplifiers Q1030 (SSB & CW only) and Q1033. For A3H, the output of Q4006 is gated by RX8V at Q4007 and amplified by Q4008 and Q4009 before application to Q1033.

Protection against SWR mismatch is provided by a sample of the rectified reflected power sensed by the CM Coupler, and amplified by Q4005 to control the gain of Q4002 and Q4008 in the ALC chains, so that high reflected power results in reduced transmitter power. The output of Q4005 also switches on Q4004 and the CAUTION lamp when excessive reflected power is detected. High/low power selection utilizes the same control system, switching bias levels on the ALC amplifiers.

The power output (PO) meter signal is derived from one half of Q4006, serving as a comparator between the detected forward and reflected power samples from the CM Coupler.

CW keying is applied to Q1037 and Q1038 on the RF/IF Unit, which provide semi break-in delay and keying sequencing as follows;

- \* biasing off the receiver IF amplifiers via Q1008,
- \* opening sidetone gates Q1041 and Q1042 (to apply a 1.5 kHz tone from Q1032 to the modulator and for the speaker) via Q1040,
- \* T/R switching of the 8V bus on the REG-CNTL Unit (described later),
- \* activating the T/R relay on the LPF Unit via Q1040,
- \* biasing on low-level transmitter rf amplifiers Q1034 and Q1036 via Q1044.
- \* biasing on transmitter IF amplifier Q1033 via Q1039.

The TUNE switch makes use of the same circuitry, and the PTT switch uses all but the tone switching stages for manual T/R switching during voice mode operation.

## 1st Local Signal Production

The 47.555 - 77.0549 MHz 1st Local Signal is generated from the front panel thumbwheel switch (G model) or diodes on the Matrix Unit (F model), by three phase-locked loops on the PLL Unit. Loop1 controls 1's and 10's of MHz, and 100's of kHz. Loop2 controls receiver clarifier tuning, and Loop3 controls fine channel steps.

The main loop (Loop1) utilizes one of four VCOs as follows;

Freq Range	VCO1 (Q2004)	VCO2 (Q2003)	VCO3 (Q2002)	VCO4 (Q2001)
Tx/Rx	0.5-6MHz	6-13	13-20	20-30
PLL IF	2.5-8	8-15	15-22	22-32
VCO	47.555-53.055	53.055-60.055	60.055-71.055	71.055-77.055

Note: upper limits of each range are actually 100Hz lower than shown here.

The 1st Local output of the selected VCO is buffered by Q2005 and filtered before delivery to the RF/IF Unit, where it is amplified by Q1017 - Q1019 before application to the 1st Mixer in the signal path.

A portion of the output from the selected VCO is also buffered by Q2006 and Q2007, and then applied to Loop1 Mixer Q2008 along with the 45.055 - 45.1549 MHz output of the Loop2 VCO, described later. The resulting 2.5 - 31.9999 MHz product of the Loop1 Mixer is lowpass filtered and then buffered by Q2010 - Q2013 before division by two at Q2014. The resulting 1.25 - 15.9999 MHz output of the divider is applied to programmable divider Q2015, which also receives BCD frequency programming data from the 100's of kHz thumbwheel or Matrix Unit (F model), and 10's and 1's of MHz data from BCD adders Q2016 and Q2017.

The resulting 50 kHz divided output of Q2015 is applied to phase comparator Q2019, along with an 800 kHz reference signal derived from division of the 24 MHz reference generated by crystal oscillator Q2036. The 800 kHz reference is further divided by 16 within Q2019, providing a 50 kHz reference for phase comparison.

Phase difference between the input from the programmable divider and the divided crystal reference oscillator results in a pulsed out-



put from Q2019, which is applied through one of four individual lowpass filters to the varactor diode in the tank circuit of the selected VCO. The variation in the capacitance of the varactor caused by the DC voltage from the lowpass filter phase-locks the oscillating frequency to the crystal reference.

### **Loop2: Clarifier Control**

Output of Loop2 VCO Q2024 is in 100 Hz frequency steps over the 99.99 kHz between 45.055 and 45.15499 MHz with clarifier slewing, applied to the Loop1 Mixer as mentioned above, through Loop2 VCO buffer Q2026. (The actual frequency steps are carried over from Loop3, described later). A portion of the VCO signal is also buffered by Q2025 and applied to Loop2 Mixer Q2028, along with the 44.355 MHz product of Loop2 Local Premixer Q2027.

The Local Premixer derives its output from a sample of 36.355 MHz 2nd local crystal oscillator Q2046 buffered by Q2045, mixed (during receive) with the output of 8 MHz clarifier VCXO Q4043 buffered by Q2042; or (during transmit) with the 24 MHz reference signal from crystal oscillator Q2036, buffered by Q2037, divided by 3 at Q2038, and buffered by Q2041. Diodes D2019 and D2020 select the appropriate 8 MHz source.

Returning to Loop2 Mixer Q2028, the 700 - 799.9 kHz output product is lowpass filtered and amplified by Q2029 for application to Loop2 Phase Detector Q2021. (Loop2 has no programmable divider, since no channel steps are synthesized in this loop). This Phase Detector also receives a 700 - 799.9 kHz signal derived from the Loop3 VCO, divided by 40 at Q2020.

Pulse output resulting from phase difference between the Loop3 VCO signal (divided by 40) and the signal derived from the Loop2 VCO and the 8 (or 24/3) MHz oscillators is active lowpass filtered by Q2023 and Q2024, and fed back to the Loop2 VCO at varactor D2014, phase locking Loop2 to Loop3.

### **Loop3: Fine Steps**

Output of Loop3 Mixer/VCO Q2030 is in 4-kHz steps between 28 and 31.996 MHz. This is divided by 40 for application to Loop2 as described above. The Mixer stage within Q2030

receives a 24 MHz Local input generated by 24 MHz crystal oscillator Q2036, buffered by Q2035, and produces a PLL IF output between 4 and 7.996 MHz. This is lowpass filtered and amplified by Q2031 before being applied to Programmable Divider Q2033.

The 10's and 1's of kHz and 100's of Hz BCD data from the thumbwheel or Matrix Unit (F model) are also applied to Q2033, resulting in a constant 800 kHz output to Loop3 Phase Detector Q2032. Also input to Q2032 is an 800 kHz reference derived from 24 MHz crystal reference oscillator Q2036 via dividers Q2038 and Q2039, and buffered by Q2034.

Pulse output from the Phase Detector is lowpass filtered and applied to varactor D2015 in the tank circuit of Loop3 VCO Q2030 whenever a phase difference occurs between signals derived from the VCO and the reference oscillator, thus locking the Loop3 VCO (and consequently also Loop2) to the 24 MHz crystal reference.

### **PLL Unit: Miscellaneous Circuits**

The 800 kHz reference signal derived from 24 MHz oscillator Q2036 (as mentioned above) is also used to produce the minus 8 VDC supply needed by the ALC circuits on the LPF Unit, via buffer Q2040 and rectifiers D2017/D2018.

The 36.355 MHz 2nd LO, Q2046, provides both the local signal to 2nd Mixer Q1003 in the receive signal path and Transmit Mixer Q1031 (via buffer Q2047), and also to Loop2 PLL Premixer via buffer Q2045, as described previously.

The 10.7 MHz carrier signal for receive and transmit demodulator/modulator is produced by crystal oscillator Q2048, and buffered by Q2049 before delivery to the RF/IF Unit. Applications are as described previously.

PLL Unlock lines from all three Phase Detectors, Q2019, Q2021 and Q2032, are ORed together to control Unlock switch Q2009, which causes the CAUTION lamp to light and the transmitter to be disabled via Q3013 and Q3031 on the REG-CNTL Unit if one of the three Loops goes out of phase-lock.

Regulated 5V DC is derived from the +8V bus by Q2044, as Vcc for divider Q2014 in Loop1, and Q2020/Q2021 in Loop2.

Final audio power amplifier IC Q2050 is located on the PLL Unit, and drives the (external) speaker/microphone or handset during receive, and with the sidetone during CW transmit.

### **BPF, LPF & VCO Selection**

The bandpass filter used in the receive and transmit signal paths, VCO in Loop1 used to generate the 1st Local signal, and lowpass filter used at the transmitter output are all selected by switching data from the REG-CNTL Unit, derived from the 10's and 1's of MHz BCD data from the thumbwheel switch or Matrix Unit (F model).

ICs Q3009 - Q3015 decode the MHz operating ranges for each of the circuits to be selected. In addition, if an invalid frequency is selected, the decoded data is ORed with the PLL Unlock signal from the PLL Unit at Q3013, to light the CAUTION lamp and disable the transmitter as mentioned previously.

Decoded band data for the selected band is applied through driver array Q3016 to the corresponding lowpass filter on the LPF Unit, and to one of switches Q3017 - Q3024 to select the corresponding bandpass filter on the RF/IF Unit (actual frequency range for each stage is indicated on the schematics). Optional units are required on the LPF and REG-CNTL Units (Q601) to allow transmission below 2.0 MHz when a jumper is installed between points B and C on the REG-CNTL Unit.

Switches Q3017 - Q3023 are also ORed together to select Loop1 VCOs 1, 2 or 3 via switches Q3025, Q3027 and Q3027, respectively, for frequencies below 20 MHz. Q3028 (20 - 23.9999 MHz) and Q3029 (24 - 29.9999 MHz) are selected by decoded logic to activate Loop1 VCO4 with different values of (fixed) capacitance in the tank circuit.

### **Supply Voltages**

The 13.8V DC supply line routes through the POWER switch to the REG-CNTL Unit for switching, Vcc derivation and delivery to the other boards. Regulated 8V DC is provided by regulator Q01 on the main chassis, connected to J3005.

The T/R control signal from Q1038 on the RF/IF Unit switches on Q3002 and Q3005 while the transmitter is active. Q3002 then switches on Q3001 to activate the TX13.5V bus for the PA Unit (bias control) and the RF/IF Unit, and Q3003 to pass TX8V to the PLL Unit. Meanwhile, Q3005 switches off Q3006, in turn switching off Q3004 to disable the RX13.8V line to the RF/IF Unit, and Q3007 to disable the RX8V line to the LPF and PLL Units.

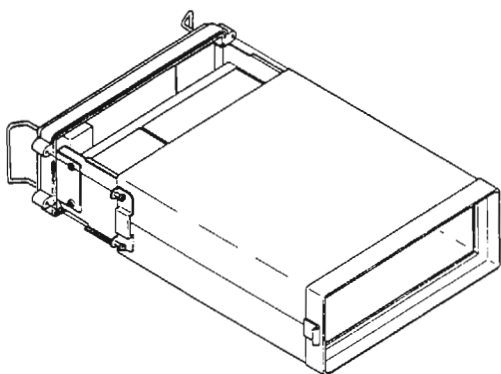
Turning off RX13.8V switch Q3004 turns on the A3H8V line to produce A3HTX8V (8V during AM transmission) for the RF/IF Unit, and CAR8V for the PLL Unit.

-8V derived from the 24 MHz oscillator on the PLL Unit is also routed through the REG-CNTL Unit for delivery to the ALC circuitry on the LPF Unit.

## FT-70F CHANNEL FREQUENCY PROGRAMMING

Each channel frequency for the eleven channels of the FT-70F can be programmed by installation of three diode arrays on Matrix Unit F2762000. For semi-duplex channels, six diode arrays are necessary: three each for transmit and receive frequencies. When the channel frequencies are specified in the original order, the diode arrays are installed at the factory. These instructions describe the process necessary to install new channel frequencies or modify those already installed.

- (1) Remove the battery pack and all connections to the transceiver. Remove the four screws affixing the cabinet housing, and slide the chassis forward and out of the cabinet.



**Figure 1.** Case Removal

- (2) Locate the Matrix Unit on the top right half of the chassis, and remove the pull-off connectors and four screws affixing the board. Referring to Figure 2, take a moment to study the layout of the Matrix Unit: there are 22 horizontal rows for installation of up to two sets of three diode arrays for each channel; channel 1 (labelled "1CH") at the front of the board (nearest the connectors), and channel 11 (labelled "11CH") at the rear. Simplex channels require only one row of diodes (in the frontmost row for that channel), while semi-duplex channels require two: the frontmost one for the receive frequency, and the other for transmit.

The rows themselves consist of 26 holes each, the rightmost 25 of which are used for diode array installation. Three of these 25 holes are labelled "COM", indicating locations where the white "common" jumper component at the left end of each

diode array will be installed. All but two of the remaining holes are marked in groups of four: one group for each digit of the programming frequency (1's of MHz labelled "1M"; 100's of kHz labelled "100k"; 10's of kHz labelled "10k"; 1's of kHz labelled "1k"; and 100's of Hz labelled "100Hz"). The remaining two holes (3rd and fourth from the left) are for the 10's of MHz digit, labelled "10M".

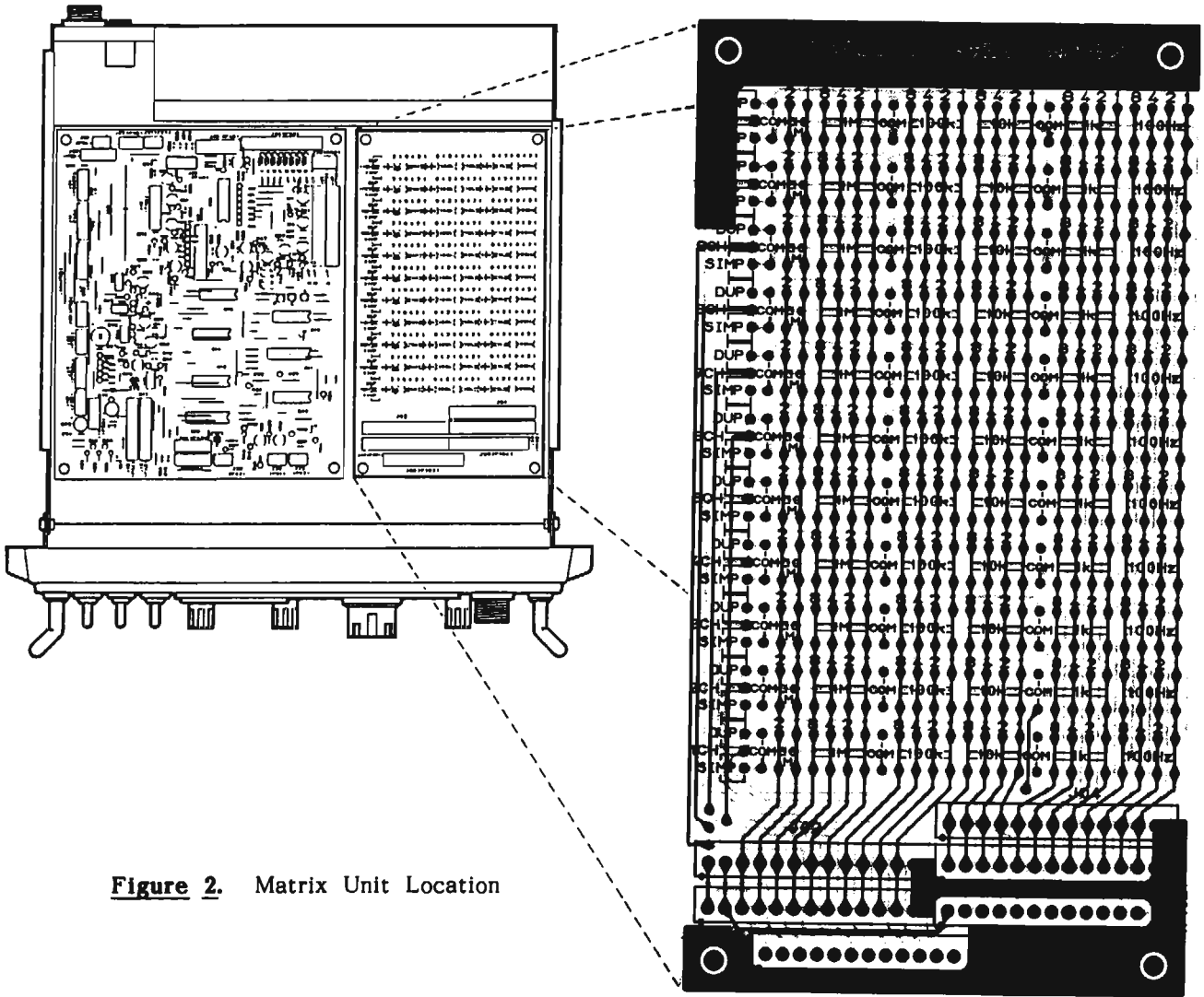
At the left end of each row is a jumpering hole, labelled either "SIMP" for simplex, or "DUP" for semi-DUPlex. Another jumpering hole is located in between each SIMP-DUP hole pair.

- (3) Install one short jumper wire in the SIMP or DUP location at the left edge of the Matrix Unit, for each channel being installed, according to whether that channel is to be simplex or semi-duplex. Note that this jumper must connect **either** the SIMP **or** the DUP hole to the hole between them: not both. Ensure that the number of jumpers matches the number of channels you are installing, and that they are in the correct locations.
- (4) For A3H or CW channels, the frequencies used for diode array programming are not the same as the intended operating frequencies, so the programming frequencies must be calculated by the following off-sets:

For A3H channels, the receive frequency used for programming calculations must be offset 0.5 kHz lower than the actual intended receiving frequency (the transmit frequency data, however, is not offset).

For CW channels, the programming frequencies for both transmit and receive must be offset 1.5 kHz lower than the intended operating frequency.

(For USB and LSB channels, the programming frequency is identical to the intended operating frequency)



**Figure 2.** Matrix Unit Location

(5) Before trimming, each diode array consists of eight diodes plus a 0-ohm "COM" jumper component (for common connection to the anodes of the diodes). The (left-most) arrays used to program the MHz digits for each channel must be shortened to fit on the Matrix Unit with the other arrays, by cutting off the common rail to

remove the two diodes furthest from the jumper component (see the Diode Arrays at the top of Figure 3). Thus each array to be used for MHz digits will be shorter than those used for kHz and Hz digits, and will have just 6 diodes (before programming), plus the jumper component. Be careful not to cut the jumper component.

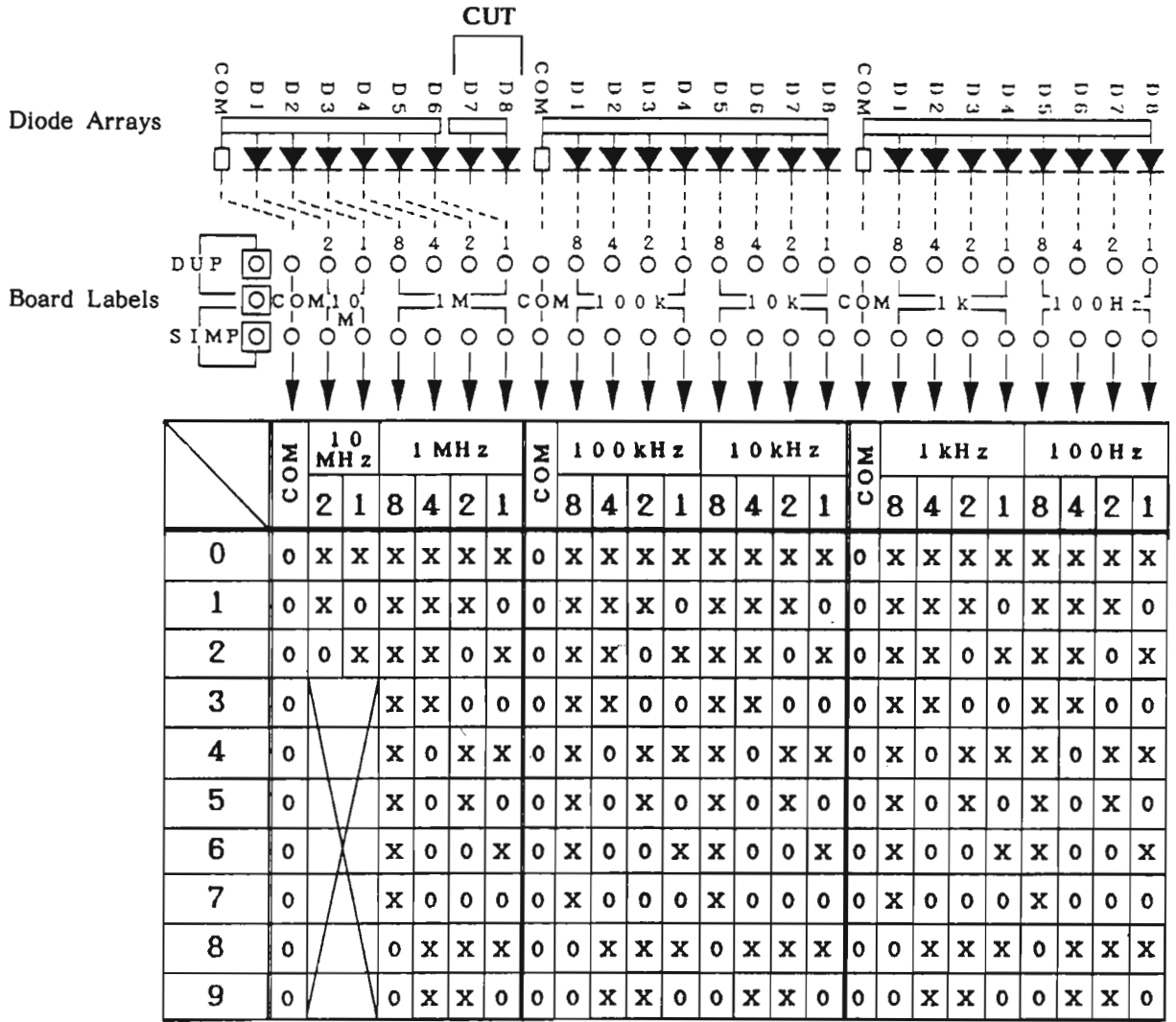


Figure 3. Diode Array Encoding Method and Installation

x=cut diode

(6) The diode arrays are programmed by cutting away individual diodes, so as to leave only those diodes which will select the digits of the programming frequency. Except for the 10MHz digit (which can be only 0, 1 or 2), each frequency digit is programmed (in BCD - Binary-Coded Decimal) by the four diode locations labelled on the board for that digit. The 10MHz digit is programmed (in BCD) by just two diode locations (those nearest the jumper component on the shortened array). The 1's of MHz digit is programmed by the four rightmost diodes on the shortened array; the 100's and 10's of kHz digits of the programming frequency are set by the eight locations of the center diode array, and the 1's of kHz and 100's of Hz are set by the eight locations of the rightmost diode array.

The four diode array positions for each digit of frequency (except 10's of MHz) are marked on the Matrix Unit according to their value: 8, 4, 2 and 1, in that order from left to right. Refer to the Board Labels in Figure 3. The accompanying table (lower part of Figure 3) indicates which diodes must be cut ("X" in the table) to set any digit from 0 to 9, but you can also calculate which diodes to cut without the table. For example, to program 7 as the 10 kHz digit, just cut the fourth diode from the right on the array you will install in the center position: leaving the diodes in the 1, 2 and 4 positions ( $1 + 2 + 4 = 7$ ). The 10's of MHz digit is programmed with the two leftmost diode positions (values 2 and 1) on the leftmost array.

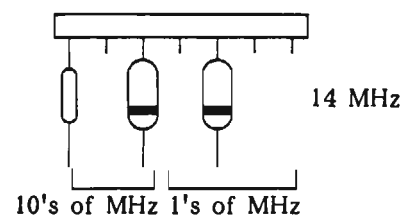
Be careful not to cut the white jumper component: if both digits programmed by a particular array are to be zero (such as the center and right arrays for 13.0000 MHz, or the rightmost array for 8.4500 MHz), simply do not install any diode array in that position. Also, be careful to install the arrays in the correct positions, once they have been cut. This is best done by soldering each array in place immediately once it has been programmed, to avoid mixing up the arrays.

Note that only one row of diodes is installed for simplex channels.

## DIODE ARRAY PROGRAMMING EXAMPLE

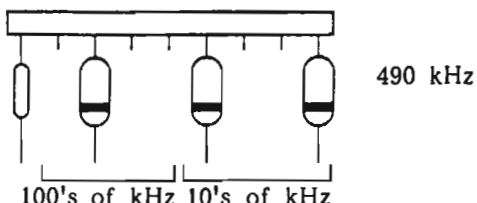
To program channel 6 for 14500 kHz receive, 14570 kHz transmit, A3H mode:

- (a) Because the receive and transmit frequencies are different, this is a semi-duplex channel, so a jumper must be installed between the DUP hole and the hole nearest the "6CH" label at the left edge of the "6CH" row pair on the board (step (3) on page 8).
- (b) Calculate the programming frequency (step (4) on page 8): in A3H mode, semi-duplex, the frequency used to program for receiving must be shifted 0.5 kHz below the actual receive frequency, so the programming frequency will be  $14500 - 0.5 = 14499.5$  kHz (14.4995 MHz). The transmit programming frequency for A3H mode is not offset, so it is the same as the desired operating frequency, 14570 kHz (14.570 MHz).
- (c) Six diode arrays are required for a semi-duplex channel. Cut the right end of the common rail (with two diodes) off of two of the arrays. Program both of these shortened arrays for 14 MHz, by cutting the leftmost diode nearest the white jumper component (the leftmost D1 at the top of Figure 3, labelled "2" on the board) leaving just D2 (value 1) for the 10's of MHz digit; and also cut the 3rd, 5th and 6th diodes (D3, D5 and D6, labelled "8", "2" and "1" on the board) leaving only D4 (value 4) for the 1's of MHz digit. Both of these "14 MHz" arrays should look like this:



Solder these arrays into the two "6CH" rows on the Matrix Unit, with the white jumper component in the "COM" hole adjacent to the last hole at the left.

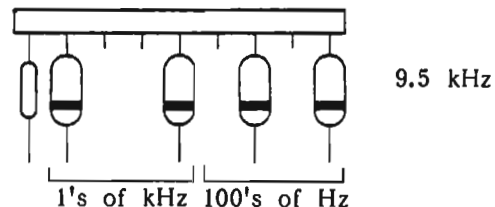
(d) Now trim one of the remaining four diode arrays for the 100's and 10's of kHz digits for receiving: 4 and 9. To do this, cut the 1st, 3rd, 4th, 6th and 7th diodes (counting right from the jumper component, indicated as D1, D3, D4, D6 and D7 at the top of Figure 3). This leaves just the "4" value for the 100's of kHz, and "8" and "1" values (= 9) for the 10's of kHz digit. The array should now look like this:



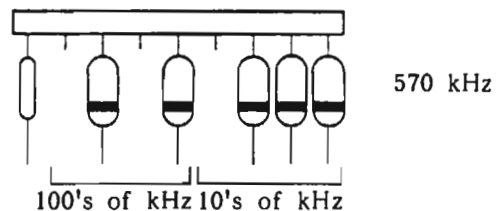
Solder this array in the more forward of the two "6CH" rows, at the center of the row (always put the jumper component at the left end of the array in the "COM" hole on the board).

(e) To finish programming of the receive frequency, trim another array for the 1's of kHz and 100's of Hz digits for receiving: 9 and 5. Cut the 2nd, 3rd, 5th and 7th diodes; D2, D3, D5 and D5, leaving values

of "8" and "1" (= 9) for the 1's of kHz, and values of "4" and "1" (= 5) for the 100's of Hz. Solder this array next to the previous one, in the same (receive frequency) row.

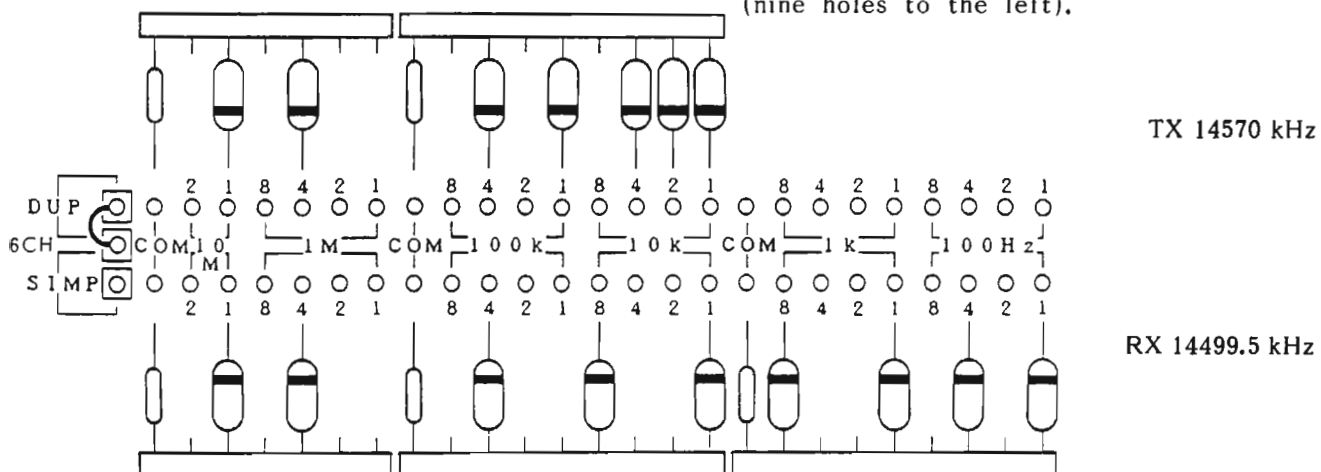


(f) Trim one of the two remaining arrays for the 100's and 10's of kHz of the transmit frequency: 5 and 7. To do this, cut D1, D3, D5. Solder this array in the "6CH" position, center of the back row.

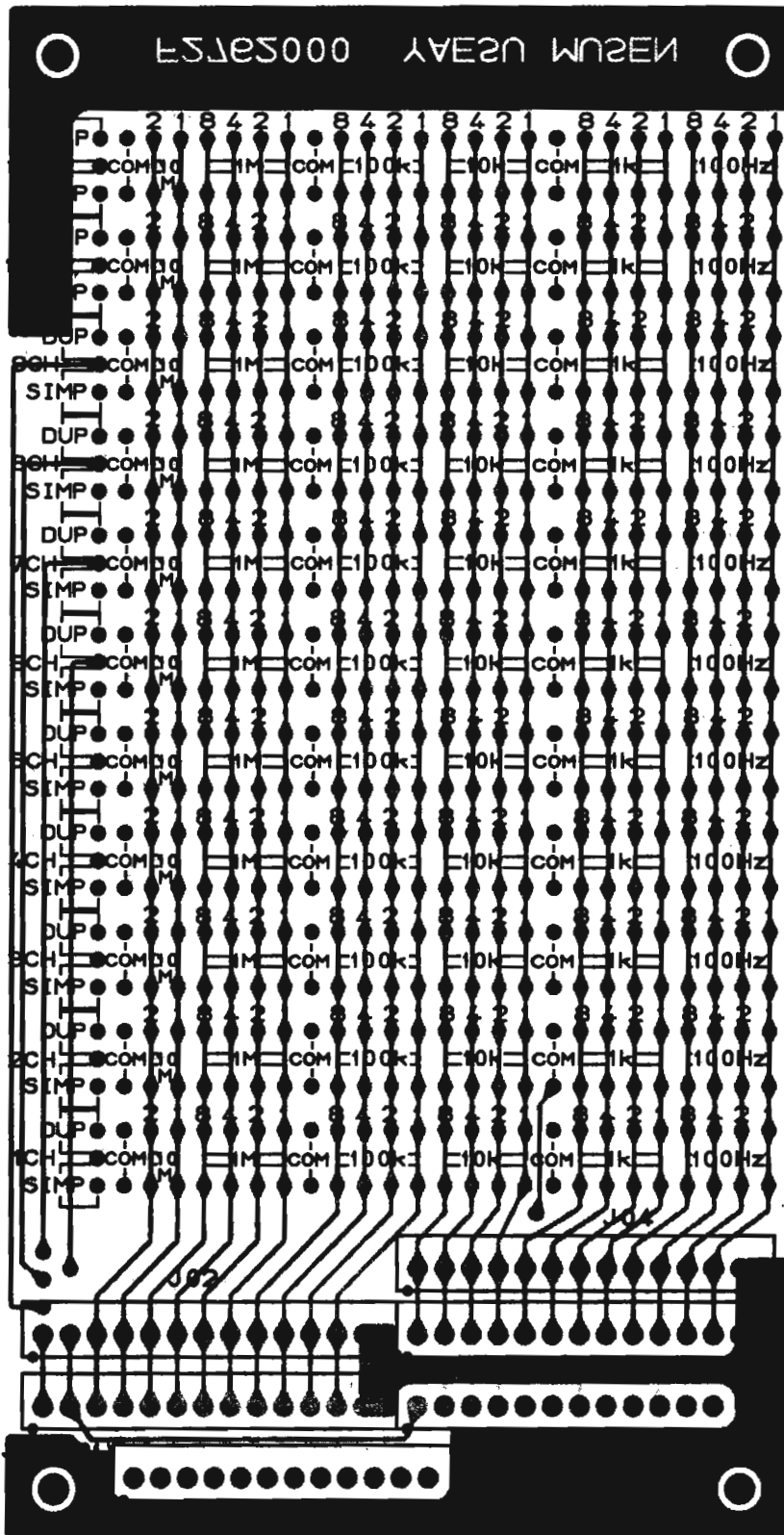


(g) Surprise! The transmit frequency, 14.5700 MHz, is already installed. The 1's of kHz and 100's of Hz digits of the transmit frequency in this example are both zero, so the last array is not required: it is not necessary to install an array when both digits are zero.

**NOTE:** The original production lot of Diode Matrix Boards, number F2752000 (with no letter suffix) is missing a foil track to the COM hole for the rightmost diode array on the 5CH SIMPLEX row. If installing Channel 5, add a 3cm jumper from this COM hole to the COM hole for the center diode array in the same row (nine holes to the left).



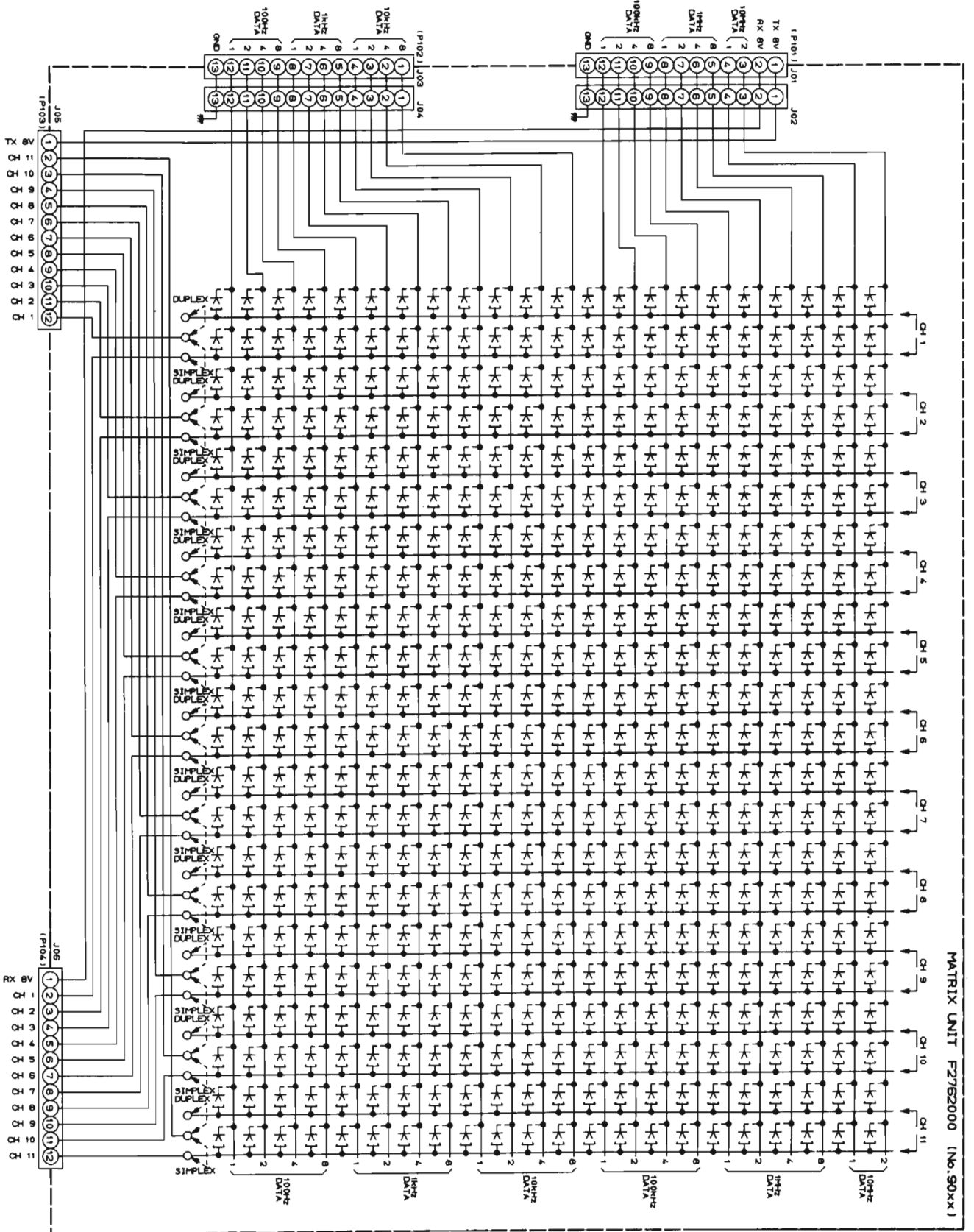
Matrix Unit Parts Layout



(component side)



# Matrix Unit Schematic Diagram



MATRIX UNIT F2752000 (No. 90xx)

## CIRCUIT ALIGNMENT

Each transceiver is carefully aligned at the factory, and no realignment should be necessary unless a major component failure occurs. Under no circumstances should re-alignment be attempted without the proper test equipment, and unless operation of the transceiver is fully understood, the malfunction carefully analyzed, and the fault definitely determined to be caused by misalignment. Sudden difficulties are almost always due to component failure, rather than misalignment. However, thorough familiarity with the circuitry sometimes allows measurements quoted in the alignment procedure to provide useful clues for troubleshooting. To further facilitate troubleshooting, voltage and frequency "check" steps have been included within the alignment procedures.

Regulated DC Power Supply: adjustable from 11 to 16 V @ 5A.

Thumbwheel Alignment Unit (required for FT-70F only, see below).

### Thumbwheel Alignment Unit for FT-70F

Most of the alignment steps require that the transceiver be set to a specific frequency. Since the FT-70F channel frequencies are set by the Diode Matrix Unit, this must be temporarily disconnected and replaced with the Thumbwheel Alignment Unit, as shown below.



### Test Equipment Required

RF Signal Generator: Hewlett-Packard model 8640B or equivalent, with 1V output at 50 ohms, 100 MHz.

RF Voltmeter: HP model 410B or equivalent, accurate to 100 MHz.

DC Voltmeter: at least 20 kilohms/volt.

50-ohm Non-reactive Dummy Load/Wattmeter, to 15W, 30 MHz.

10-ohm, 10W Non-reactive Resistor: NOT wire-wound. (For CAUTION threshold adj).

52-ohm (or 47-ohm) Load Resistor: 1/4W or larger, composition or film type (non-reactive).

AF Signal Generator: HP model 200AB or equivalent.

Frequency Counter: with at least 10 Hz resolution and accuracy at 100 MHz.

Oscilloscope: HP model 1740A or equiv.

Monitor Receiver: for Carrier Balance Adj.

## Preliminary Alignment Information

Before beginning alignment, allow the transceiver sufficient time in the shop for the chassis to reach room temperature (20 to 30°C).

Set the power supply for 13.8 VDC, except where specifically stated otherwise for BATT meter alignment.

For those steps that require transmitter activation, temporarily jump pin 6 (PTT) of the SP/MIC jack to pin 7 (GND) while the adjustment is being made. If the procedure calls for pressing the TUNE switch no jumper is necessary, but the switch must be held in position while the adjustment is made.

## PLL Unit Access

Remove the four screws affixing the RF Unit (marked 'A' in Figure 2). Then carefully lift the left edge of the RF Unit/shield assembly, to expose the PLL Unit underneath.

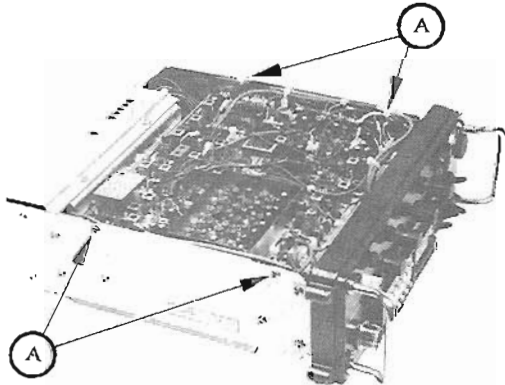


Figure 1.

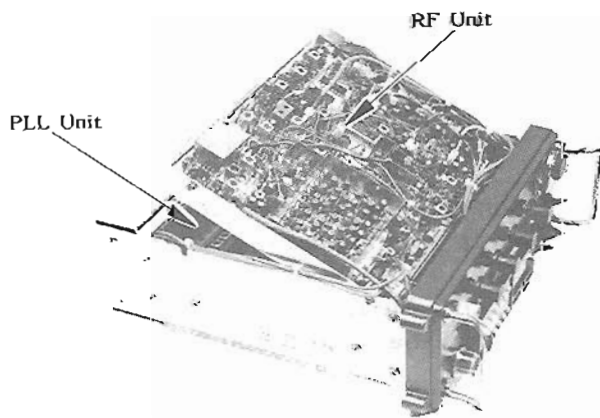


Figure 2.

## PLL Unit

- (1) 24.0 MHz Reference Oscillator  
Connect the frequency counter to TP2012 and adjust TC2001 for 24.0000 MHz  $\pm$ 12 Hz. Connect the RF voltmeter to TP2012 to confirm 120  $\pm$ 20 mV.
- (2) 8.0 MHz VCXO  
Set the CLARIFIER knob precisely to the 12 o'clock position and connect the counter to TP2008. Adjust TC2002 for 8.00000 MHz  $\pm$ 10 Hz. Confirm 160  $\pm$ 20 mV at TP2008 with the voltmeter.
- (3) 24.0 MHz Reference Check  
Connect the counter and voltmeter to TP2008. Activate the transmitter and confirm 8.00000 MHz  $\pm$ 5 Hz and 160  $\pm$ 20mV.
- (4) 2nd LO  
Preset trimmer TC2003 to midrange. Connect the 52-ohm resistor across J2002, and the voltmeter across the resistor. Adjust T2017 for peak voltage (250  $\pm$ 25 mV). Replace the voltmeter with the frequency counter, and adjust TC2003 and T2017, if necessary, to obtain 36.355 MHz  $\pm$ 180 Hz. Now confirm 550  $\pm$ 50 mV at TP2007. Remove the load resistor from J2002.
- (5) 10.7 MHz Carrier Oscillator  
Connect the load resistor across

J2006, and the counter and voltmeter to TP2013. Adjust TC2004 for 10.7000 MHz  $\pm$ 10Hz. Confirm a level of 650  $\pm$ 50 mV. Remove the load resistor.

(6) Loop3 VCO

Set the operating frequency for 99.9 as the last three digits. Connect the DC voltmeter to TP2011 and adjust T2016 for 1.5  $\pm$ 0.1 VDC (Varactor Control Voltage: VCV). Connect the frequency counter and RF voltmeter to TP2005 and confirm 31.996 MHz  $\pm$ 15 Hz at 300  $\pm$ 50 mV.

Next set the channel frequency so the last three digits are 00.0, and check for +5 to 7 VDC (VCV) at TP2011. Connect the counter and RF voltmeter to TP2005 and confirm 28.000 MHz  $\pm$ 15 Hz at 250  $\pm$ 50 mV.

(7) Loop2 VCO

Set the operating frequency for 99.9 as the last three digits. Connect the DC voltmeter to TP2006 and adjust T2012 for 6.5  $\pm$ 0.1 VDC (Varactor Control Voltage: VCV). Connect the frequency counter and RF voltmeter to TP2009 and confirm 45.1549 MHz at 93  $\pm$ 20 mV.

Next set the channel frequency so the last three digits are 00.0, and check for +5 to 6 VDC (VCV) at TP2009. Connect the counter to TP2009 and confirm 45.055 MHz.

(8) Loop2 Local Premixer (Q2027) BPF

With the channel frequency set so the last three digits are 00.0, connect the RF voltmeter to TP2010 and adjust coils T2014 and T2015 for peak voltage (60  $\pm$ 15 mV). Check for approximately 700.0 kHz at TP2010 with the counter.

(9) Loop2 VCO Output

Set the channel frequency to 5.9999 MHz. Connect the RF voltmeter to TP2002 and adjust T2013 for peak voltage (115  $\pm$ 15 mV).

(10) Loop1 VCO1

- a) With the channel frequency set to 5.9999 MHz, connect the DC voltmeter to TP2003 and adjust T2004, if neces-

sary, for 1.0  $\pm$ 0.1 VDC. Then set the channel frequency to 00.000.0 and check for 5 to 6.5 VDC on the voltmeter.

- b) Connect the 52-ohm load resistor across J2001, and the counter and RF voltmeter across the load resistor. Check for 47.055 MHz at a level within the range of -1.5dBm  $\pm$ 3dB.

- c) Return the channel frequency to 5.9999 MHz, and check for 53.0549 MHz at a level within the same range.

- d) Connect the RF voltmeter to TP2001 and confirm a level of 70  $\pm$ 15 mV. Remove the load resistor from J2001.

- e) Connect the counter to TP2003. This point should show approximately 7.9 MHz with a channel frequency of 5.9999 MHz. Change the channel frequency back to 0.000.0 and check for approximately 2.0 MHz on the counter.

(11) Loop1 VCO2

- a) With the channel frequency set to 12.9999 MHz, connect the DC voltmeter to TP2004 and adjust T2003, if necessary, for 1.0  $\pm$ 0.1 VDC. Then set the channel frequency to 06.000.0 and check for 5 to 6.5 VDC on the voltmeter.

- b) Connect the 52-ohm load resistor across J2001, and the counter and RF voltmeter across the load resistor. Check for 53.055 MHz at a level within the range of -0.5dBm  $\pm$ 3dB.

- c) Return the channel frequency to 12.9999 MHz and check for 60.0549 MHz at a level within the same range.

- d) Connect the RF voltmeter to TP2001 and confirm a level of 90  $\pm$ 30 mV. Remove the load resistor from J2001.

- e) Connect the counter to TP2003. This point should show approximately 14.9 MHz with a channel frequency of 12.9999 MHz. Change the channel frequency back to 6.000.0 and check for approximately 8.0 MHz on the counter.

(12) Loop1 VCO3

- a) With the channel frequency set to 19.9999 MHz, connect the DC voltmeter to TP2004 and adjust T2002, if necessary, for  $1.0 \pm 0.1$  VDC. Then set the channel frequency to 13.000.0 and check for 5 to 6.5 VDC on the voltmeter.
- b) Connect the 52-ohm load resistor across J2001, and the counter and RF voltmeter across the load resistor. Check for 60.055 MHz at a level within the range of  $-1.0\text{dBm} \pm 3\text{dB}$ .
- c) Return the channel frequency to 19.9999 MHz and check for 67.0549 MHz at a level within the same range.
- d) Connect the RF voltmeter to TP2001 and confirm a level of  $90 \pm 20$  mV. Remove the load resistor from J2001.
- e) Connect the counter to TP2003. This point should show approximately 21.9 MHz with a channel frequency of 19.9999 MHz. Change the channel frequency back to 13.0000 MHz and check for approximately 15.0 MHz on the counter.

(13) Loop1 VCO5

- a) With the channel frequency set to 29.9999 MHz, connect the DC voltmeter to TP2004 and adjust T2001, if necessary, for  $1.5 \pm 0.1$  VDC. Then set the channel frequency to 24.000.0 and check for 5 to 6.5 VDC on the voltmeter.
- b) Connect the 52-ohm load resistor across J2001, and the counter and RF voltmeter across the load resistor. Check for 71.055 MHz at a level within the range of  $-1.0\text{dBm} \pm 3\text{dB}$ .
- c) Return the channel frequency to 29.9999 MHz and check for 77.0549 MHz at a level within the same range.
- d) Connect the RF voltmeter to TP2001 and confirm a level of  $85 \pm 20$  mV. Remove the load resistor from J2001.
- e) Connect the counter to TP2003. This point should show approximately 31.9 MHz with a channel frequency of

29.9999 MHz. Change the channel frequency back to 24.000.0 MHz and check for approximately 26.0 MHz on the counter.

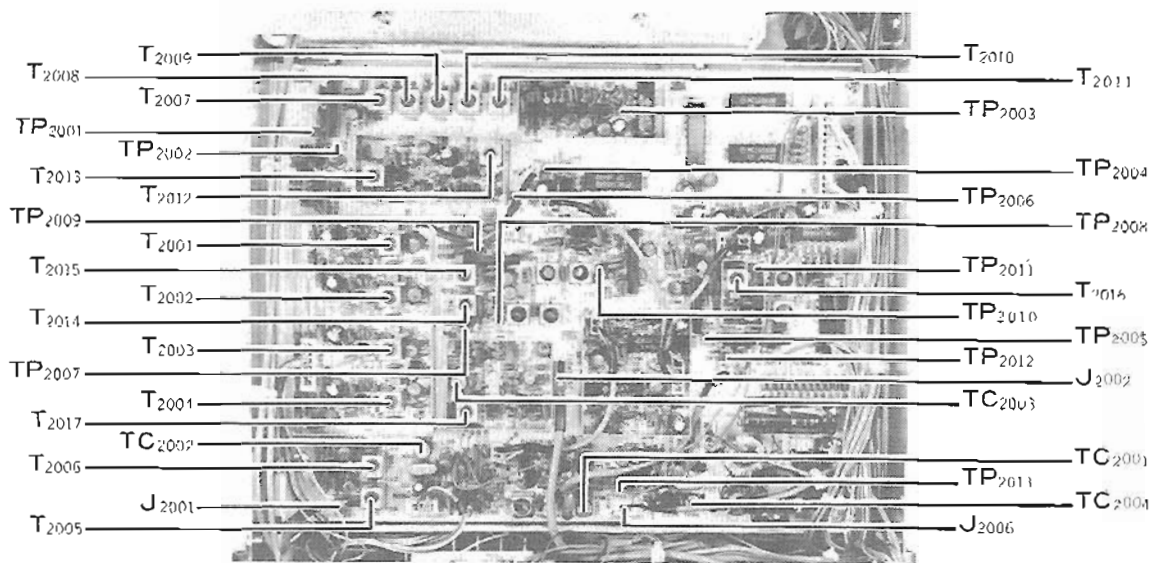
(13) Loop1 VCO4 (Check only)

- a) With the channel frequency set to 23.9999 MHz, connect the DC voltmeter to TP2004 and confirm 2.5 to 3.5 VDC.
- b) Connect the 52-ohm load resistor across J2001, and the counter and RF voltmeter across the load resistor. Check for 71.0549 MHz at a level within the range of  $-1.0\text{dBm} \pm 3\text{dB}$ .
- c) Retune the channel frequency to 20.0000 MHz and check for 67.055 MHz at a level within the same range.
- d) Connect the RF voltmeter to TP2001 and confirm a level of  $80 \pm 20$  mV. Remove the load resistor from J2001.
- e) Connect the counter to TP2003. This point should show approximately 22.0 MHz with a channel frequency of 20.0000 MHz. Change the channel frequency back to 23.999.9 MHz and check for approximately 25.9 MHz on the counter.

(14) Unlock Indicator (Check only)

Ground each of TP2004, TP2010 and TP2011 one at a time, and confirm that the CAUTION indicator lights each time.

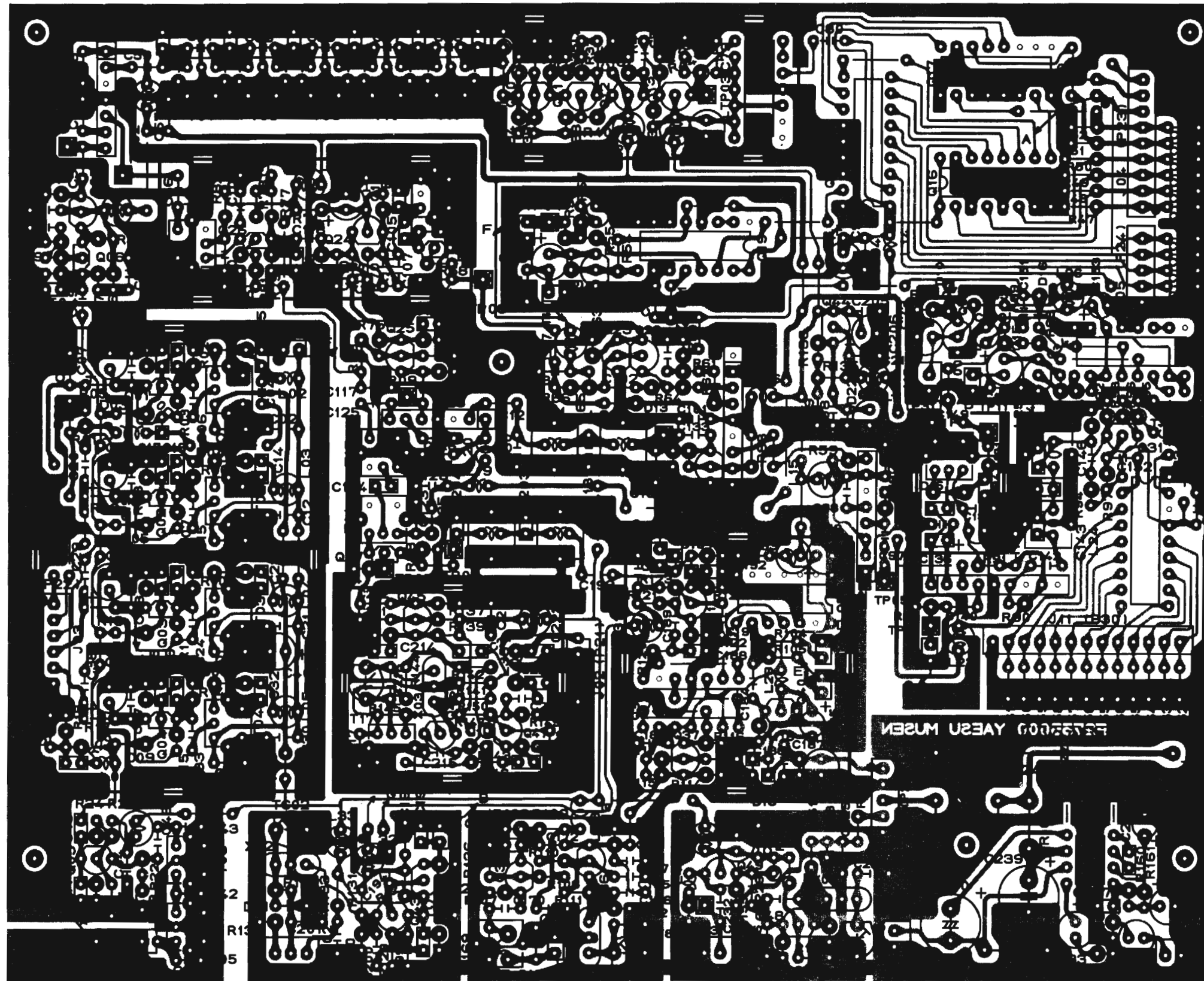
### PLL Unit Alignment Points



### PLL Unit Voltage Chart

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Q2008	7.9	7.0	6.4	0	3.5	3.5	3.5											
Q2014	1.7	4.8	4.8	4.8	4.8	4.8	4.8			4.8	0	1.3	1.6	1.6				
Q2015	8.0	1.9	7.4	0	0	0	0	7.9	0	0	7.9	0	0	0	0	0	0	0
Q2016	8.0	0	0	0	0	0	0	0	0	0	0	7.9	0	0	0	8.0		
Q2017	0	0	0	0	0	0	0	0	0	0	0	0	7.9	7.7	0	8.0		
Q2019	3.9	2.2	2.2	0	8.0	0	0	0	3.5	0	0	8.0	2.8	0.3	8.0	8.0		
Q2020	0	4.6	4.6	2.4	2.5	0	4.6	2.0										
Q2021	4.8	0	1.2	4.0	4.8	0	2.0	2.4	0									
Q2028	8.0	6.9	6.4	0	3.5	3.5	3.5											
Q2030	2.4	2.0	1.8	2.6	0	6.4	2.0	8.0	1.3									
Q2032	0.3	0.15	0.15	0	0	8.0	0	0	3.6	8.0	8.0	8.0	3.8	0	8.0	8.0		
Q2033	8.0	2.8	0	0	0	0	0	0	0	0	7.3	0	7.3	0	8.0	0	0	0
Q2038	2.3	4.8	4.8	4.8	2.3	4.8	0.8	1.5	0.8	4.8	0	0.8	1.0	1.5				
Q2039	0	0	0.1	1.5	1.4	0	0	0.8	1.6	0.8	0.9	0	0.1	4.8				
Q2050	1.4	13.5	12.8	7.8	6.5	13.6	0.1	1.9										

PLL Unit Parts Layout

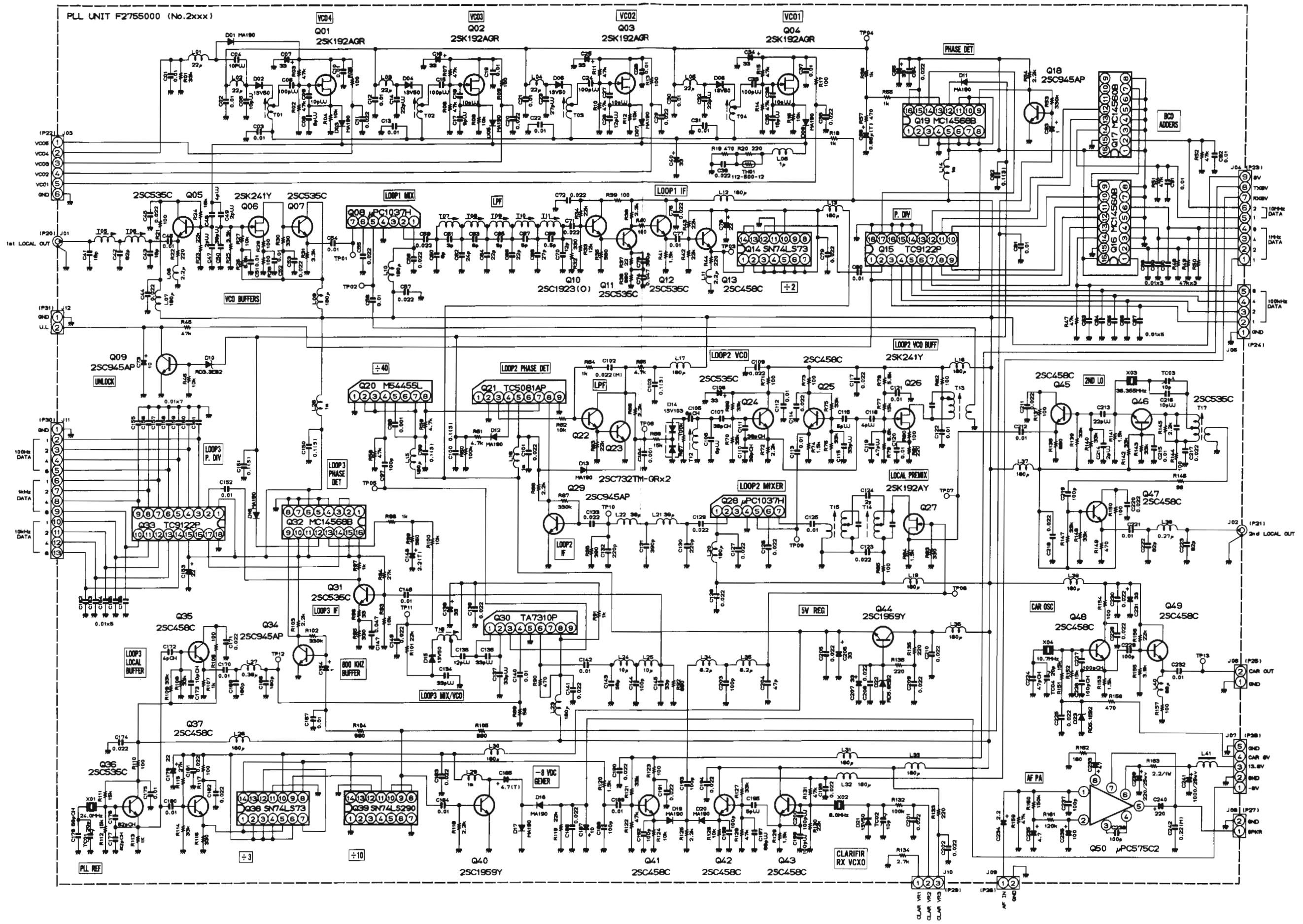


(component side)

PLL Unit Voltage Chart

	E(S)	C(D)	B(G)	
Q2001	0V	0V	0V	
Q2002	0V	0V	0V	
Q2003	4.2V	7.5V	3.5V	
Q2004	0V	0V	0V	
Q2005	2.0V	7.0V	2.7V	
Q2006	1.2V	6.0V	1.25V	
Q2007	5.3V	8.0V	6.0V	
Q2009	0V	0V	0.6V	
Q2010	1.6V	7.7V	2.3V	
Q2011	0.9V	5.0V	1.6V	
Q2012	5.5V	8.0V	5.0V	
Q2013	1.7V	4.8V	2.0V	
Q2018	0V	3.5V	0.6V	
Q2022	0.6V	6.0V	1.16V	
Q2023	0V	6.0V	0.6V	
Q2024	3.4V	7.8V	3.6V	
Q2025	3.0V	7.8V	3.6V	
Q2026	1.9V	7.4V	1.9V	
Q2027	0.95V	7.8V	0V	
Q2029	0V	2.4V	0.6V	
Q2031	1.15V	4.6V	1.8V	
Q2034	0V	3.5V	0.6V	
Q2035	3.1V	7.7V	3.7V	
Q2036	3.1V	7.6V	3.5V	
Q2037	2.2V	4.2V	2.1V	
Q2040	0V	4.6V	-0.6V	
Q2041	0V	0V	0V	RX
	3.9V	7.7V	4.4V	TX
Q2042	3.9V	7.9V	4.4V	RX
	0V	7.9V	0V	TX
Q2043	4.9V	7.9V	2.2V	RX
	0V	7.9V	0V	TX
Q2044	4.9V	7.9V	5.5V	
Q2045	3.0V	7.5V	3.5V	
Q2046	3.3V	7.7V	3.4V	
Q2047	2.7V	7.4V	3.3V	
Q2048	3.4V	7.8V	2.3V	
Q2049	1.15V	7.9V	1.0V	

# PLL Unit Schematic Diagram





## RF/IF Unit: Receiver

- (1) 1st Local Output Level (Check only)  
This step requires that the Thumb-wheel Alignment Unit be installed in the FT-70F. Set the channel frequency to 10.1500 MHz. Connect the RF voltmeter to TP1001 and confirm a level of +13dBm  $\pm$ 3dB.
- (2) IF Coils  
With the channel frequency set to 10.1500 MHz, set the MODE selector to USB, Squelch fully counterclockwise, NB off and S/PO - BATT to the S/PO position. Adjust VR1003 for S1 deflection on the meter. Set the RF signal generator to 10.1515 MHz, connect the (50-ohm) output of the signal generator to the ANTENNA jack, and adjust the output so that the S-meter deflects to around S5. Adjust T1007 through T1013 and T1021 for peak S-meter indication. Decrease the signal generator level if deflection exceeds S9.
- (3) Noise Blanker IF Coils  
This step requires that the Thumb-wheel Alignment Unit be installed in the FT-70F. Connect the DC voltmeter to TP1005. Set the transceiver and signal generator frequency to 7.5000 MHz, and connect the 50-ohm signal generator output to the antenna jack. Adjust T1015, T1016 and T1017 for minimum reading on the voltmeter (4.0 - 4.2 VDC).
- (4) Overall Receiver Gain  
Preset VR1001 fully counterclockwise, and adjust VR1003 for S-1 indication on the S-meter. Set the transceiver to 10.1500 MHz, and the signal generator (connected to the antenna jack) to 10.1515 MHz, with 0 dBu (0.5  $\mu$ V) output. Now adjust VR1001 so that the S-meter just begins to deflect above S-1. Leave the signal generator connected and perform the next step.
- (5) S-meter Sensitivity  
With the transceiver and signal generator tuned as in the previous step, increase the signal generator level to 30 dBu (15  $\mu$ V) and adjust VR1003 for S-9 on the S-meter. Now increase the signal generator level to 100 dBu (50 mV), and adjust VR1002 for full scale S-meter deflection (corresponding with '10' on the PO scale). Repeat this step (5) several times, and then confirm that the S-meter just starts to deflect above S-1 with 3 dBu (0.7  $\mu$ V) or more at the antenna jack.
- (6) 47.055 MHz IF Trap  
Set the transceiver to 29.9999 MHz and tune the signal generator (at the antenna jack) to 47.0535 MHz at a level of 100 dBu (50 mV). Adjust T1002 for minimum S-meter indication.
- (7) Squelch Threshold  
Set the SQUELCH control on the front panel to the 11 o'clock position ('4' on the scale). Adjust VR1011 so that the squelch just closes when no signal is applied to the antenna jack.
- (8) BATT Meter Calibration  
Set the S/PO BATT switch on the front panel to the BATT position. Reduce supply voltage to 11.5 VDC, and adjust VR6001 (on the SW Unit) for the low edge of the green scale (corresponding with '7' on the PO scale).

## RF/IF Unit: Transmitter

Set the MODE to USB, HIGH/LOW switch to HIGH, and S/PO BATT switch to S/PO for the following steps. All adjustments are made in the transmit mode.

- (1) 10.7 MHz Carrier Level Check  
Connect the RF voltmeter to TP1002. Confirm a carrier level of 730  $\pm$ 100 mV while transmitting.
- (2) Sidetone Oscillator Frequency & Level  
Connect the frequency counter and AF voltmeter to TP1003. Press and hold the TUNE switch while adjusting VR1008 for 1500  $\pm$ 5 Hz on the counter, and VR1007 for 90  $\pm$ 5 mV on the voltmeter.

(3) IF Coils

Set the transceiver to 10.1500 MHz, and connect the AF signal generator (tuned to 1500 Hz) to the center pin (8) of the SP/MIC jack. Remove the connector from J1021, and connect the 52-ohm dummy resistor in parallel with the RF voltmeter across J1021. Adjust the AF generator output while transmitting for just below 0 dBm indication on the RF voltmeter. Then adjust T1018 through T1022 for maximum voltmeter deflection (reducing AF generator output when the voltmeter reads above 0 dBm). Keep the resistor and RF voltmeter on J1021, and the AF generator on the SP/MIC jack for the next step.

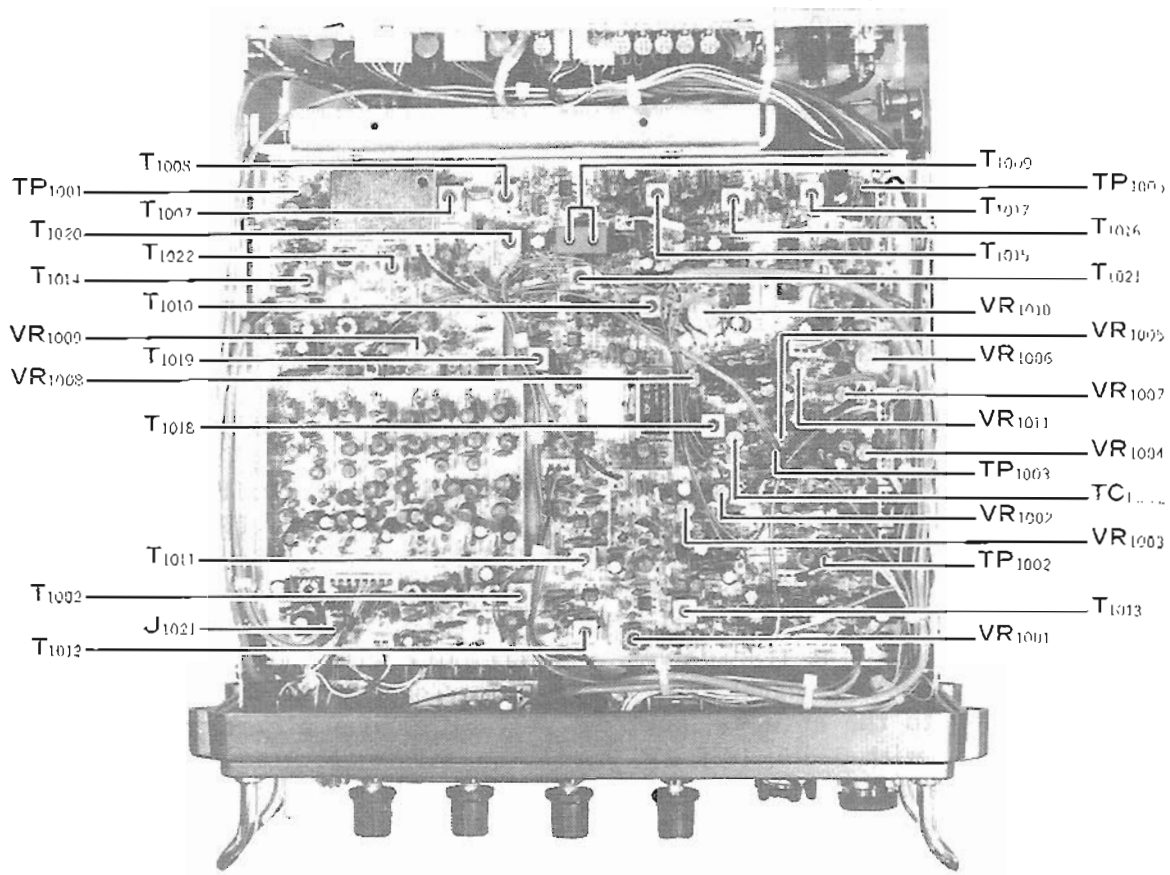
(4) Mic Gain

Set the AF generator for 1 mV output. Connect the AF voltmeter to TP1003, and adjust VR1004 for 30 ±3 mV on the AF voltmeter. Remove the AF generator from the SP/MIC jack.

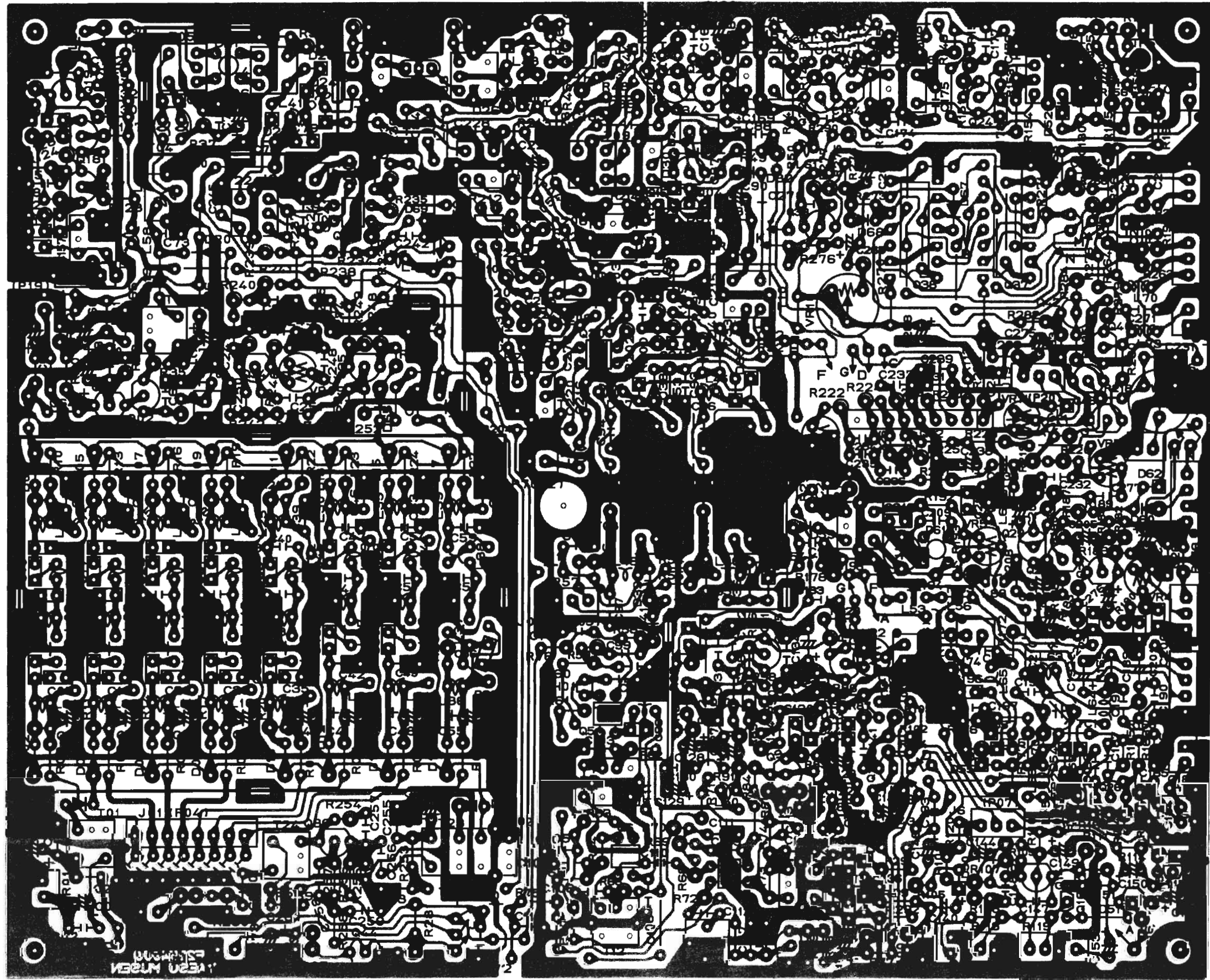
(5) Carrier Balance (Coarse Adj)

With the 50-ohm resistor and RF voltmeter connected to J1021 as in step (3), adjust TC1002 and VR1005 while transmitting for minimum RF voltage (transceiver in USB mode). Remove the test equipment and replace the connector at J1021.

RF/IF Unit Alignment Points

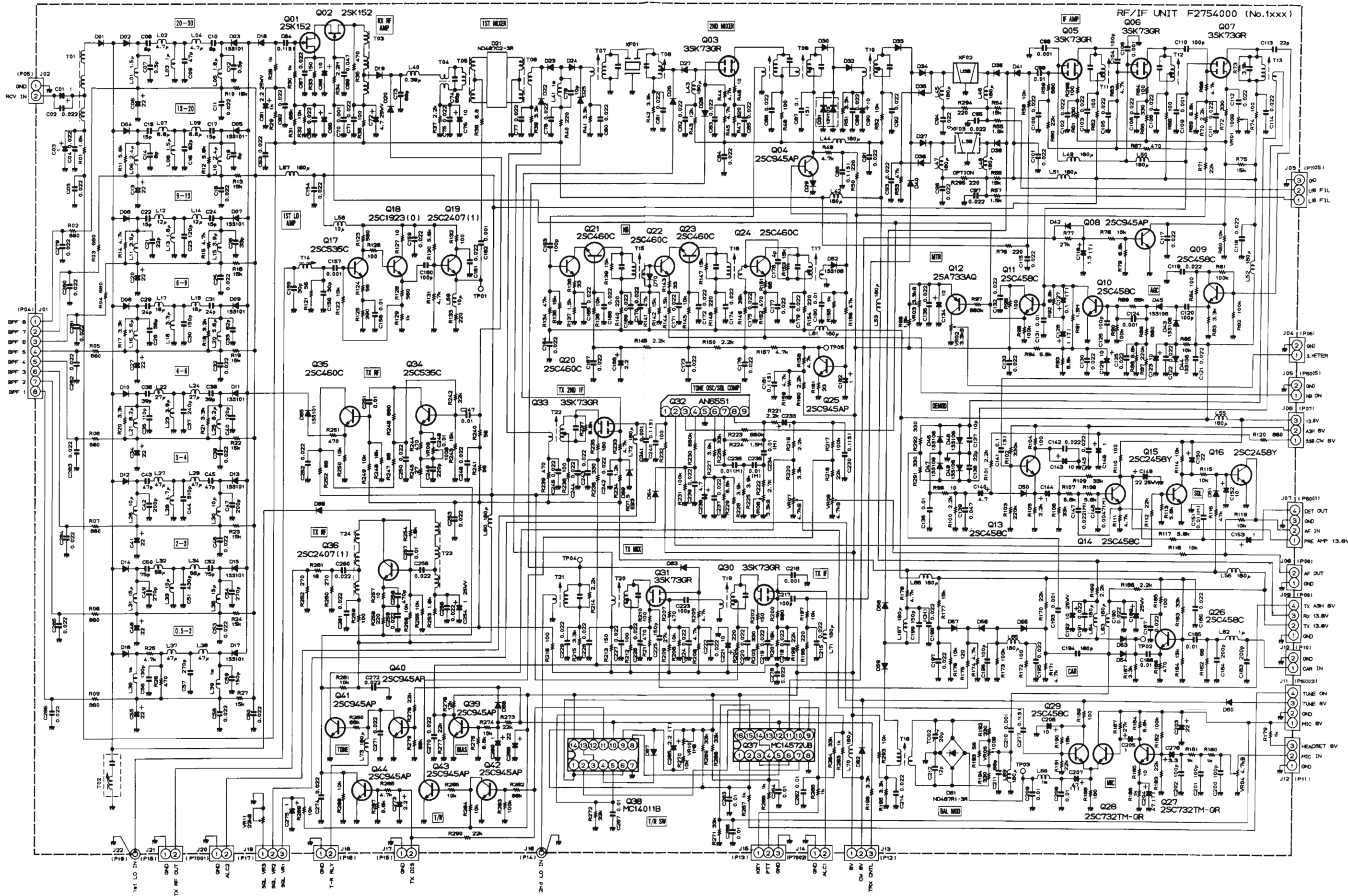


RF/IF Unit Parts Layout



(component side)

# RF/IF Unit Schematic Diagram



### RF/IF Unit Voltage Chart

	E(S)	C(D)	B(G1)	(G2)	REMARKS
Q1001	2.1V 0V	4.0V 0V	1.6V 0V		RX TX
Q1002	4.1V 0V	11.5V 0V	0.2V 0.2V		RX TX
Q1003	3.7V 0V	13.0V 0V	3.9V 0V	4.0V 0V	RX TX
Q1004	0V 0V	4.0V 4.0V	0V 0V		RX TX
Q1005	2.2V 5.2V	13.4V 13.4V	1.9V 1.9V	1.2V 1.2V	RX TX
Q1006	2.4V 5.2V	13.0V 13.4V	2.1V 2.1V	1.2V 1.2V	RX TX
Q1007	2.0V 5.2V	13.0V 13.4V	1.6V 1.6V	1.4V 1.2V	RX TX
Q1008	0V 0V	0.2V 5.2V	0.7V 0V		RX TX
Q1009	5.6V	13.4V	5.7V		
Q1010	0V	1.2V	0.1V		
Q1011	3.5V	8.0V	1.1V		
Q1012	3.5V	2.9V	2.5V		
Q1013	2.8V 2.0V	0V 8.0V	0V 2.2V		RX SSB.CW MODE RX A3H MODE
Q1014	6.0V	13.4V	5.8V		
Q1015	0V 0V	0V 0V	0.7V 0.7V		RX TX
Q1016	0V 0V	0V 0V	0V 0.7V		RX TX
Q1017	3.6V	9.0V	4.4V		
Q1018	8.3V	13.3V	8.9V		
Q1019	5.1V	11.0V	5.4V		
Q1020	2.5V	3.5V	3.1V		
Q1021	3.7V	13.2V	4.4V		NB ON NB ON

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Q1032	7.8 7.8	7.1 7.0	1.6 1.6	1.8 1.8	0 0	0 4.0	0 3.8	7.2 4.2	7.9 7.9									RX TX
Q1037	0 0	7.5 7.5	0 8.0	7.5 0.2	8.0 0	0 8.0	0 0	0 0	8.0 8.0	0 0	8.0 0	0 7.7	0 8.0	7.5 0.2	6.6 6.6	8.0 8.0		RX TX
Q1038	8.0 8.0	0 8.0	8.0 0	8.0 8.0	0 0	8.0 8.0	0 0	8.0 0	3.7 3.7	0 7.7	0 7.8	7.5 7.5	8.0 0	8.0 8.0				RX TX

### RF/IF Unit Voltage Chart

	E(S)	C(D)	B(G1)	(G2)	REMARKS
Q1022	2.5V	3.9V	3.1V		NB ON
Q1023	3.9V	13.2V	4.4V		NB ON
Q1024	2.9V	12.5V	2.9V		NB ON
Q1025	0V	5.0V	6V		NB ON
Q1026	3.4V	12.8V	4.0V		
Q1027	0.53V	3.0V	1.0V		
Q1028	3.5V	6.7V	4.1V		
Q1029	1.8V	5.3V	2.4V		TX TUNE ON
Q1030	5.1V 3.6V	13.5V 11.7V	3.5V 3.5V	1.1V 1.1V	RX TX
Q1031	0V 3.2V	0V 11.6V	0V 3.2V	0V 3.7V	RX TX
Q1033	5.1V 3.5V	13.5V 12.4V	0V 3.8V	1.1V 1.1V	RX TX
Q1034	6.7V 3.6V	13.4V 8.0V	5.4V 4.3V		RX TX
Q1035	0V 7.6V	13.4V 12.6V	0V 8.2V		RX TX
Q1036	6.7V 4.9V	13.5V 11.5V	6.7V 5.5V		RX TX
Q1039	0V 0V	5.3V 0.1V	0V 0.7V		RX TX
Q1040	0V 0V	11.5V 0V	0V 0.7V		RX TX
Q1041	0V 0V	0V 0V	0.6V 0V		RX TX
Q1042	0V 0V	4.3V 0V	0V 0.6V		RX TX
Q1043	0V 0V	0V 0V	0.6V 0V		RX TX
Q1044	0V 0V	6.7V 0.5V	0V 0.7V		RX TX

### PA Unit Voltage Chart

	E	C	B	
Q5001	0V 4.8V	0V 13.3V	0V 5.5V	RX TX
Q5002	0V 4.8V	0V 13.3V	0V 5.5V	RX TX
Q5003	0V 0V	13.6V 13.6V	0V 0.7V	RX TX
Q5004	0V 0V	13.6V 13.6V	0V 0.7V	RX TX
Q5006	0V 0.7V	0V 13.3V	0V 1.3V	RX TX

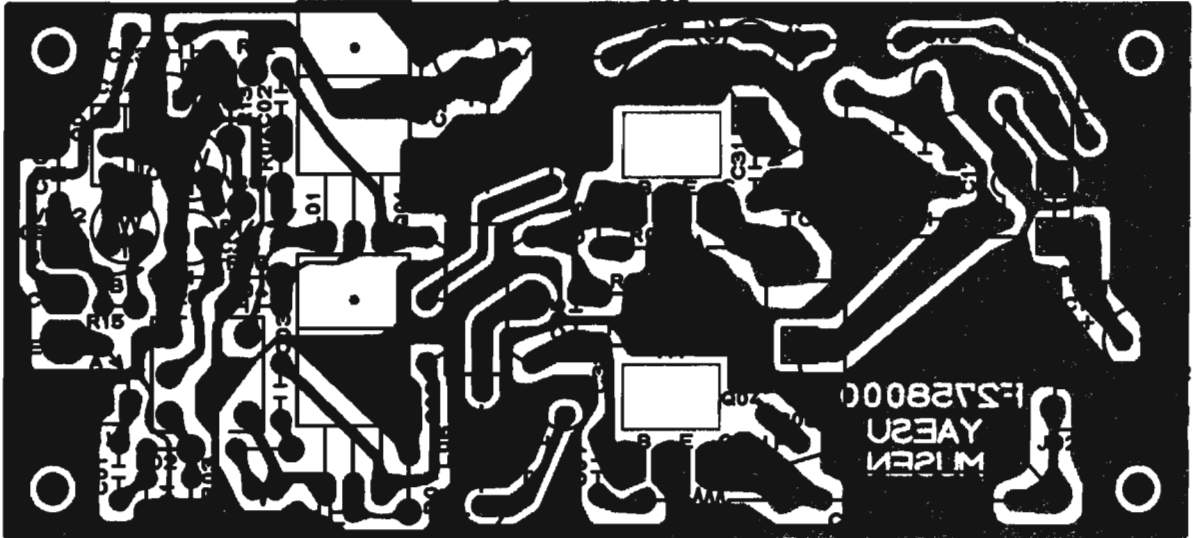
	1	2	3	
Q5005	0 13.3	0 8.3	0 0	RX TX

**PA Unit**

- (1) **Driver Bias Current**  
Connect the DC voltmeter to the emitter of Q5001 or Q5002. Adjust VR5001 while transmitting for  $4.8 \pm 0.2$  VDC on the voltmeter.

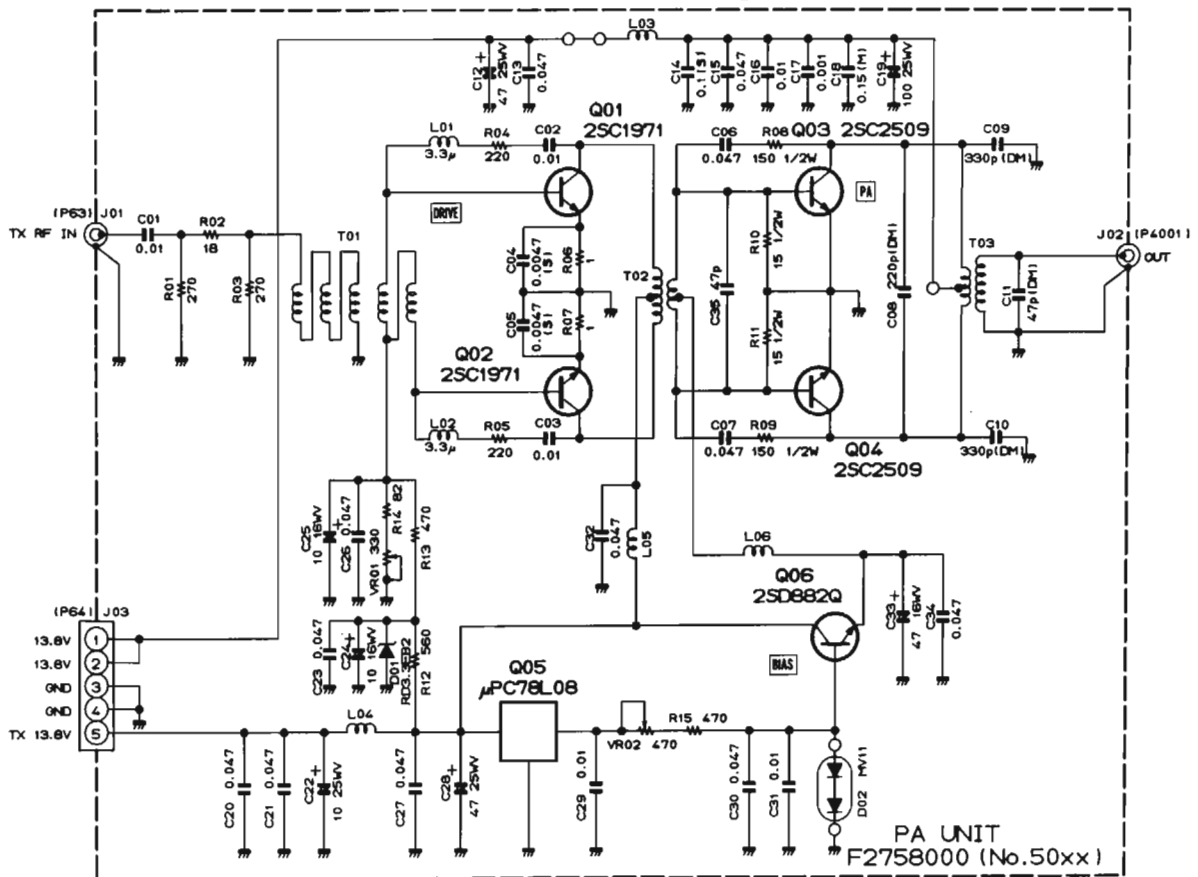
- (2) **Final Resting Current**  
Temporarily remove the jumper between TP5001 and TP5002. Connect the DC milliammeter across these TPs, positive lead to TP5001. Adjust VR5002 while transmitting for  $75 \pm 5$  mA. Replace the jumper.

**PA Unit Parts Layout**



(component side)

**PA Unit Schematic Diagram**



## LPF Unit

For the following steps, connect the 50-ohm dummy load and wattmeter to the antenna jack, and the AF generator (set to 1500 Hz) to the center pin (8) of the SP/MIC jack.

(1) CM Coupler Balance

Set the transceiver to 29.9999 MHz (USB mode). Adjust the AF level while transmitting for 10W output. Connect the negative lead of the DC voltmeter to the anode of D4001, and the positive lead to ground. Adjust TC4001 for minimum indication on the DC voltmeter while transmitting.

(2) Overall Transmitter Gain

Set the transceiver to 16.5000 MHz, (USB mode), and set the HIGH/LOW switch to HIGH. Set the AF generator for 1 mV output to the SP/MIC jack. Adjust VR1009 on the RF/IF Unit while transmitting for 10W output on the wattmeter.

(3) SSB/CW Output Power

Set the transceiver to 29.9999 MHz (USB mode, HIGH power). Set the AF generator for 3 mV output. Adjust

VR4001 for 10W transmitter output on the wattmeter. Then set the HIGH/LOW switch to LOW, and adjust VR4002 for 4W on the wattmeter.

(4) A3H Output Power

At 29.9999 MHz, set the transceiver to the A3H mode, HIGH power. Adjust VR4003 for 5.5W transmitter output on the wattmeter. Switch to LOW power and adjust VR4004 for 2.2W output.

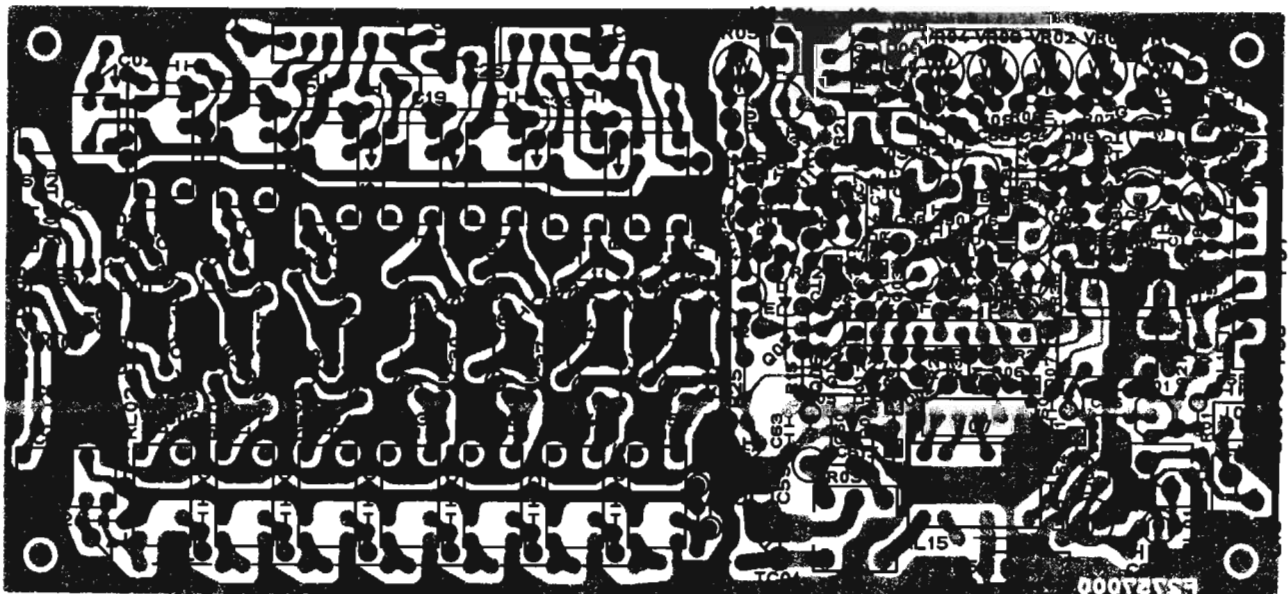
(5) PO Meter Calibration

At 29.9999 MHz, set the transceiver to the USB mode, HIGH power. Press the TUNE switch and adjust VR4006 so that the PO meter deflects to '8' on the scale.

(6) CAUTION Indicator Threshold

Set the transceiver to 10.1500 MHz, HIGH power. Remove the wattmeter and 50-ohm dummy load from the antenna jack, and connect the 10-ohm, 10W resistor in their place. Press and hold the TUNE switch while adjusting VR4005 so that the CAUTION lamp just begins to light.

LPF Unit Parts Layout



(component side)



## Miscellaneous Adjustments

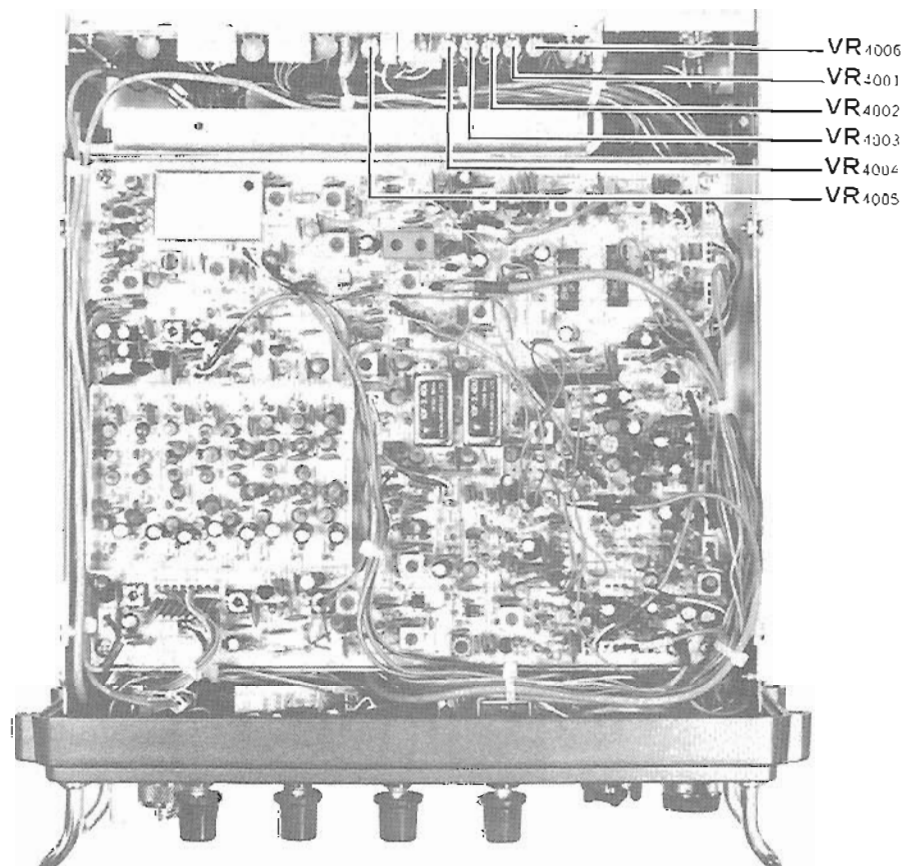
- (1) **CW Hang Time**  
 Set the MODE to CW and connect a CW key to the KEY jack on the front panel. Adjust VR1010 on the RF/IF Unit for the desired changeover time (from transmit to receive after key-up) between 10ms and 1.3 sec (factory preset at 1.0 sec).
  
- (2) **Carrier Balance (Fine Adj)**  
 Connect the 50-ohm dummy load to the antenna jack, and set the transceiver to USB mode. Tune the monitor receiver for peak signal strength on the FT-70 transmitted carrier. Now with no microphone input, adjust VR1005 and TC1002 on the RF/IF Unit for minimum transmitted carrier level on the monitor receiver. If the optional LSB filter is installed, switch to LSB mode and repeat the adjustment, switching back and forth and readjusting several times to obtain minimum signal strength of the carrier on the monitor receiver in both modes.

## LPF Unit Voltage Chart

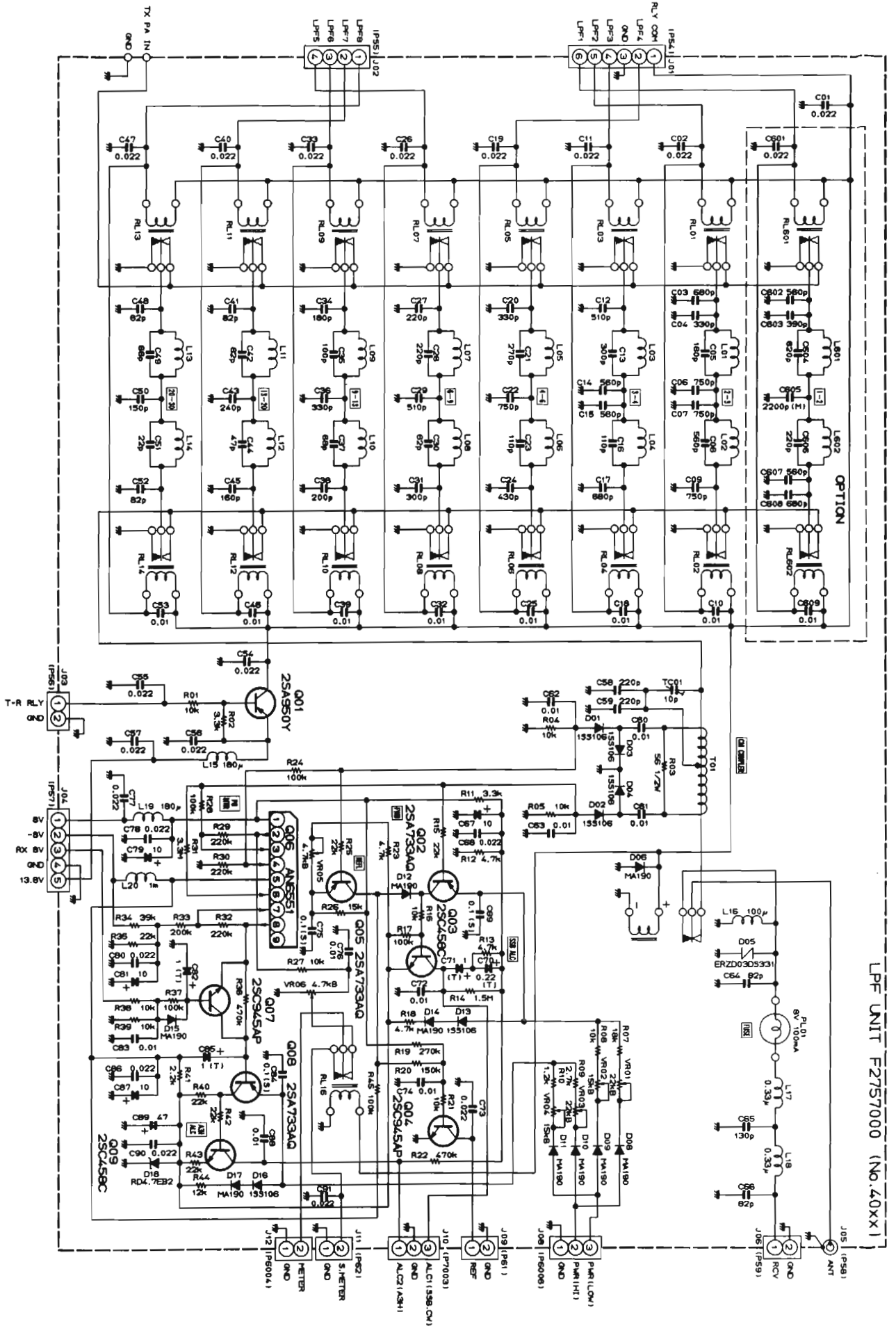
	E	C	B	
Q4001	13.6V	0V	13.1V	RX
	13.6V	13.5V	12.8V	TX
Q4002	-1.4V	-3.0V	0V	
Q4003	-3.5V	1.1V	-3.0V	
Q4004	0V	6.4V	-0.4V	
Q4005	-0.6V	-4.3V	0V	
Q4007	3.7V	3.4V	3.4V	
Q4008	2.2V	-3.4V	3.5V	
Q4009	-3.4V	2.3V	-3.3V	

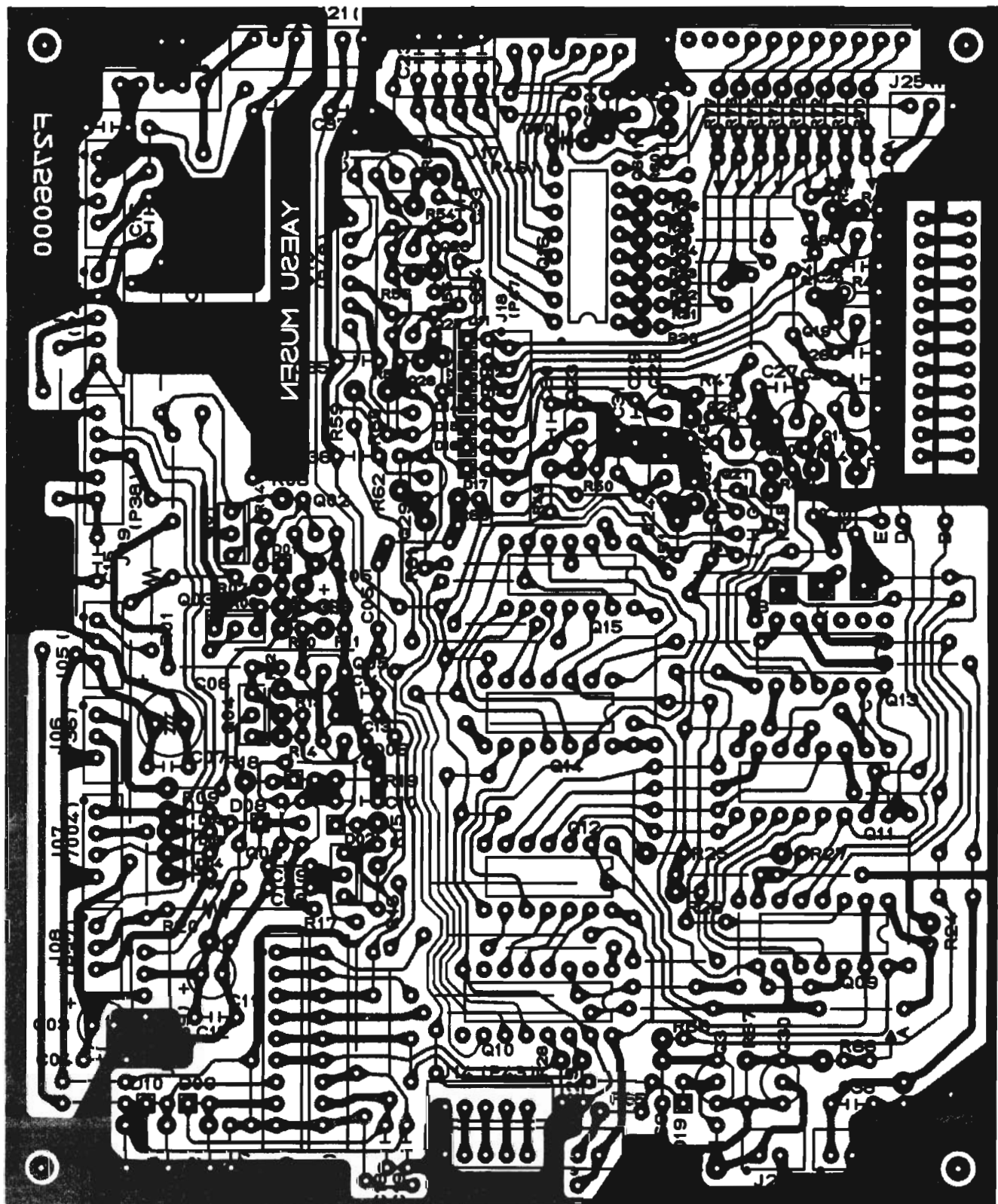
	1	2	3	4	5	6	7	8	9
Q4006	8.0	0	0	0	-8.3	0	0.5	3.7	8.0

## LPF Unit Alignment Points



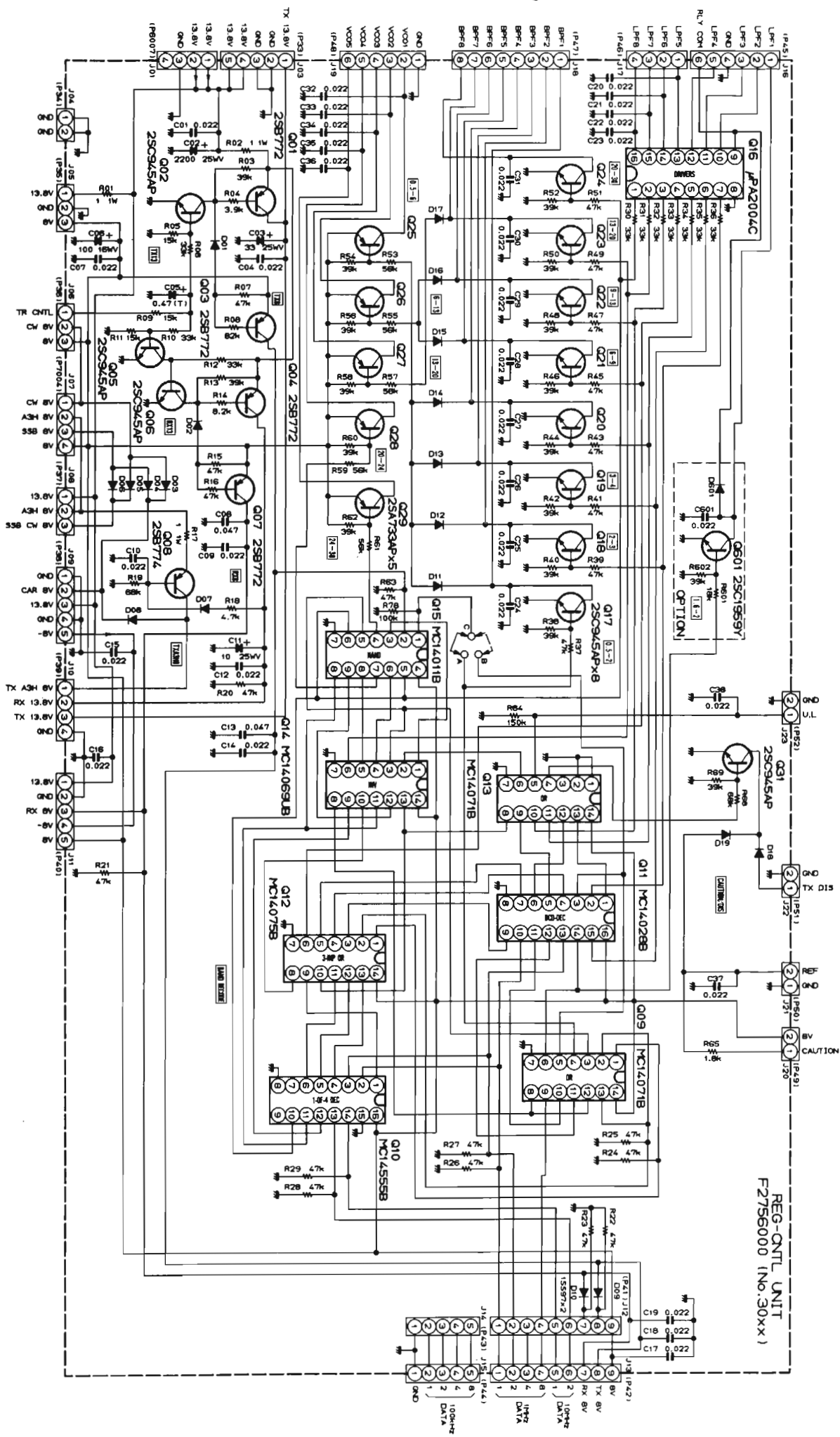
# LPF Unit Schematic Diagram





(component side)

# REG/CNTL Unit Schematic Diagram

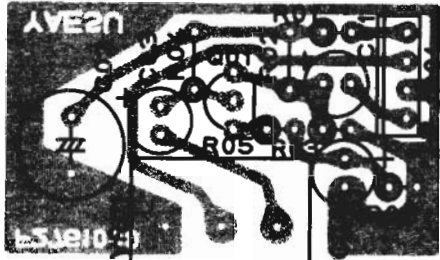


### REG/CNTL Unit Voltage Chart

	E	C	B	
Q3001	13.6V	0V	13.2V	RX
	13.4V	13.3V	12.6V	TX
Q3002	0V	13.3V	0V	RX
	0V	0V	0.6V	TX
Q3003	8.0V	0V	7.4V	RX
	8.0V	8.0V	7.4V	TX
Q3004	13.6V	13.6V	13.0V	RX
	13.4V	0V	13.0V	TX
Q3005	0V	0.6V	0V	RX
	0V	0V	0.6V	TX
Q3006	0V	0V	0V	RX
	0V	13.0V	0V	TX
Q3007	8.0V	8.0V	7.4V	RX
	8.0V	0V	7.4V	TX
Q3008	0V	0V	12.0V	RX
	0V	0V	0V	TX
Q3017	0V	13.2V	0V	
Q3018	0V	13.2V	0V	
Q3019	0V	13.2V	0V	
Q3020	0V	13.2V	0V	
Q3021	0V	13.2V	0V	
Q3022	0V	0V	0.7V	
Q3023	0V	13.2V	0V	
Q3024	0V	13.2V	0V	
Q3025	8.0V	0V	7.4V	
Q3026	8.0V	7.9V	7.3V	
Q3027	8.0V	0V	7.4V	
Q3028	8.0V	0V	7.6V	
Q3029	8.0V	0V	7.6V	
Q3031	0V	5.8V	0V	

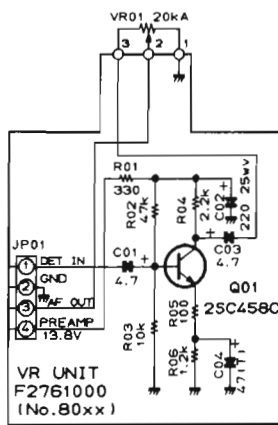
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Q3009	0	0	0	0	0	0	0	8.0	0	8.0	8.0	8.0	0	8.0			
Q3010	0	0	0	8.0	0	0	0	0	0	0	8.0	0	0	7.6	0	8.0	
Q3011	0	0	0	0	0	0	0	0	0	0	8.0	8.0	0	0	0	8.0	
Q3012	0	0	0	0	0	0	0	0	0	8.0	0	0	8.0	8.0			
Q3013	0	0	0	0	0	0	0	8.0	0	8.0	0	0	0	8.0			
Q3014	8.0	0	0	8.0	8.0	0	0	8.0	0	0	8.0	0	8.0	8.0			
Q3015	0	0	8.0	8.0	0	0	0	8.0	0	8.0	8.0	8.0	0	8.0			RX
	0	8.0	8.0	8.0	0	0	0	8.0	0	8.0	8.0	8.0	0	8.0			TX
Q3016	0	0	2.4	0	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	RX
	0	0	2.6	0	0	0	0	0	13.5	13.5	13.5	13.5	0.7	13.4	13.4		TX

### VR Unit Parts Layout

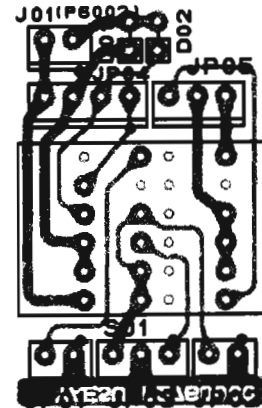


(component side)

### VR Unit Schematic Diagram

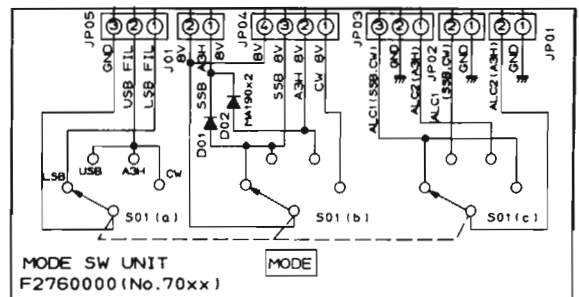


### Mode Sw Unit Parts Layout

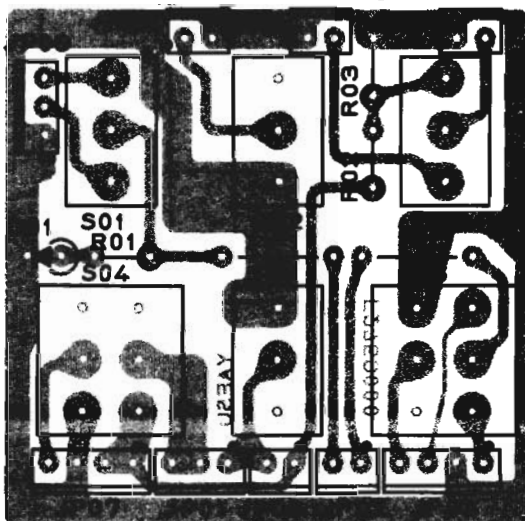


(component side)

### Mode Sw Unit Schematic Diagram

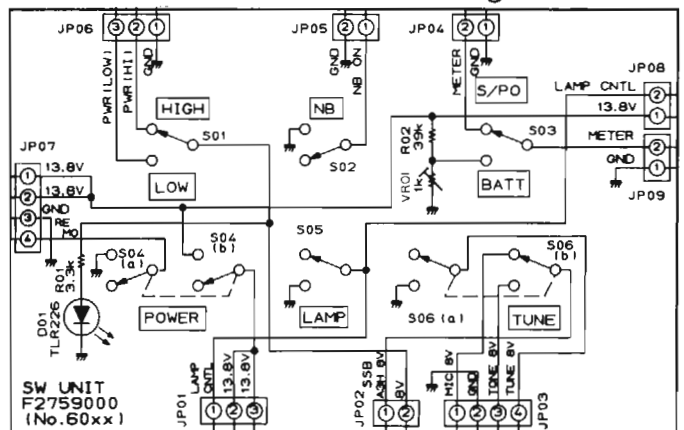


### Sw Unit Parts Layout

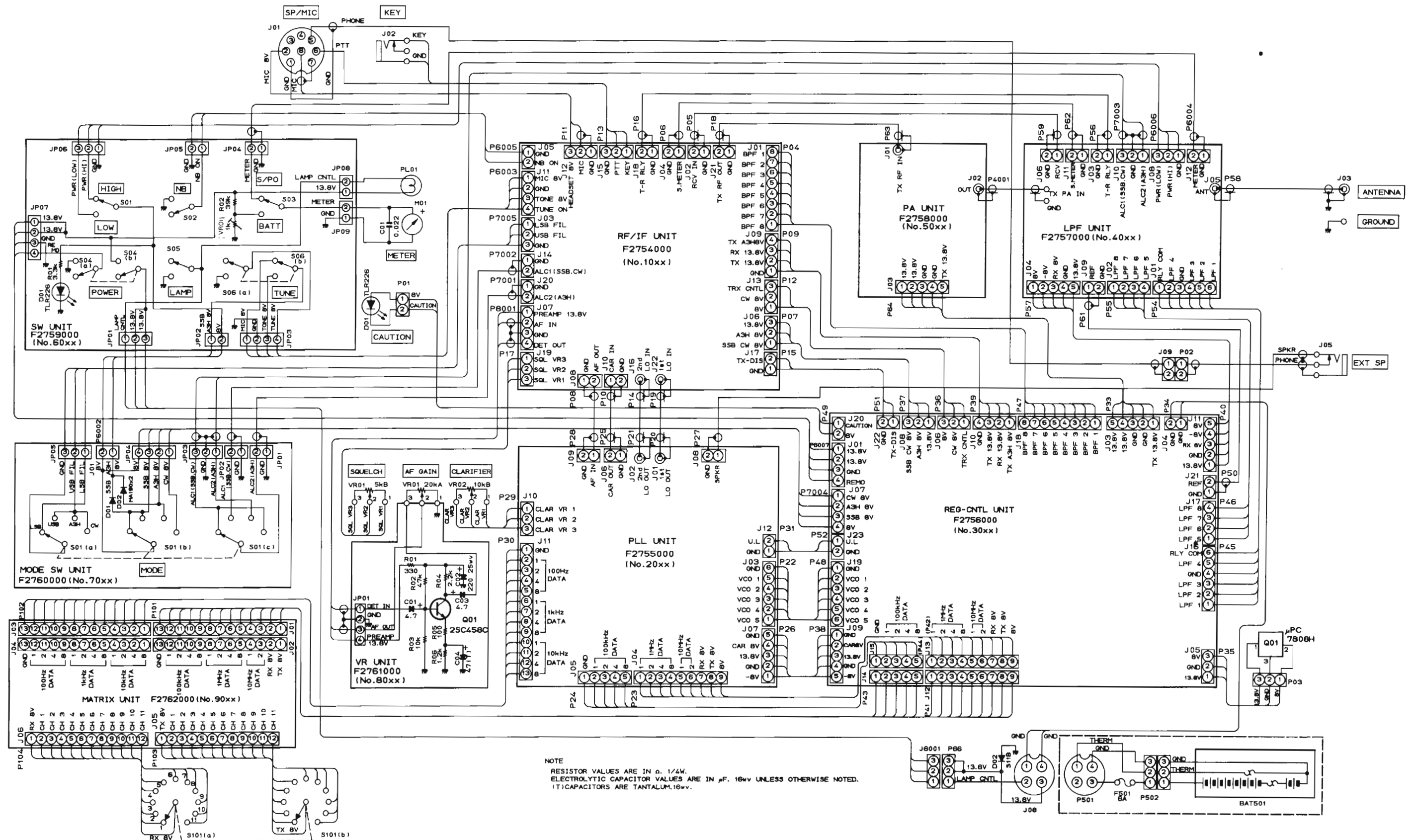


(component side)

### Sw Unit Schematic Diagram



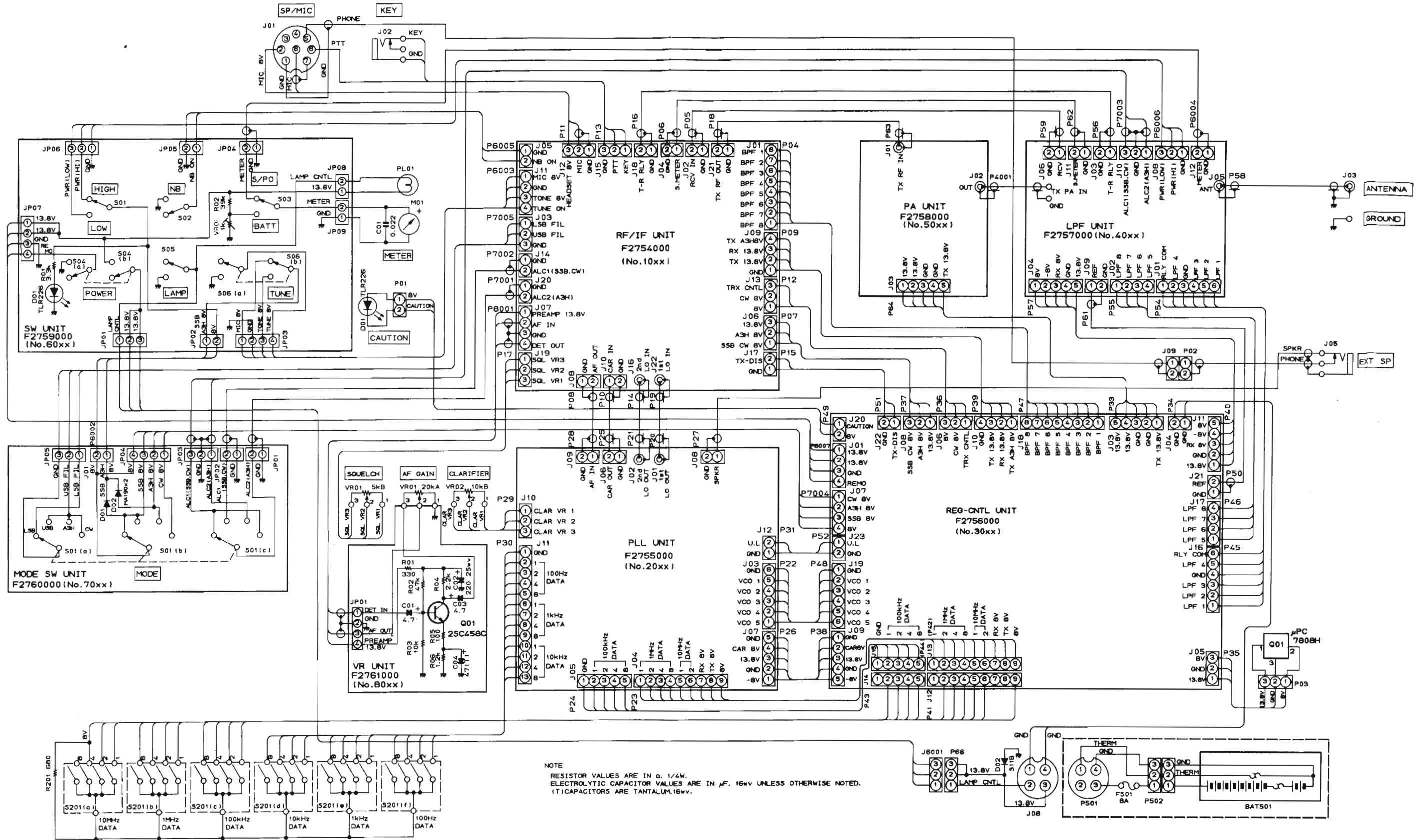
# FT-70F Interconnection Diagram



NOTE  
 RESISTOR VALUES ARE IN Ω, 1/4W.  
 ELECTROLYTIC CAPACITOR VALUES ARE IN µF, 16V UNLESS OTHERWISE NOTED.  
 (T) CAPACITORS ARE TANTALUM, 16V.

**FT-70F**  
 CONNECTION DIAGRAM

# FT-70G Interconnection Diagram



**FT-70G  
CONNECTION DIAGRAM**



## Parts List

Location No	Part No	Name & Description	Location No	Part No	Name & Description
***** FT-70F, FT-70G *****			***** RF, IF UNIT *****		
***** MAIN CHASSIS *****			F275400		Printed Circuit Board
			C027540A		PCB with components
		IC			
Q1	G1090294	uPC7808H			ICs
		DIODES	Q1032	G1090248	AN6551
D1	G2090142	TLR226 LED	Q1037	G1090037	MC14572UBCP
D2	G2090232	S11 Si	Q1038	G1090068	MC14011BCP
		POTENTIOMETERS			FETs
VR1	J60800121	K1611007BC-5k $\Omega$ B	Q1001,1002	G3801520C	2SK152-3
VR2	J60800113	K1611007BC-10k $\Omega$ B	Q1003,1005-1007,1030, 1031,1033	G4800730G	3SK73GR
		CAPACITOR			TRANSISTORS
C1	K13179010	Ceramic disc 50WV 0.022 $\mu$ F F (DD108F223Z50)	Q1004,1008,1025,1039- 1044	G3309451P	2SC945AP
		METER	Q1009-1011,1013,1014, 1026,1029	G3304580C	2SC458C
M1	M0290050	KL-218L-190	Q1012	G3107331Q	2SA733AQ
		LAMP	Q1015,1016	G3324580Y	2SC2458Y
PL1	Q1000047	BQ044-32514M	Q1017,1034	G3305350C	2SC535C
		THERMAL CONDUCTOR	Q1018	G33192300	2SC19230
	Q9000192	30F-T0220	Q1019,1036	G3090050	2SC2407(1)
		RECEPTACLES	Q1020-1024,1035	G3304600C	2SC460C
J1	P0090158	FM214-BSSA (Mic)	Q1027,1028	G3307320G	2SC732TM-GR
J2	P1090003	S-67615 (Key)			DIODES
J3	P1090193	FM-MR-M (Antenna)	D1001,1003,1005,1007, 1009,1011,1013,1015, 1017,1065	G2090223	1SS101 Schottky
J5	P1090005	S-68050 (Speaker)	D1002,1004,1006,1008, 1010,1012,1014,1016, 1018-1020,1022-1030, 1032-1042,1050,1051, 1053-1060,1062-1064, 1062-1064,1066-1068, 1070	G2090237	MA190 Si
J8	P0090011	FM-144S (Power Supply)	D1021	G2090135	ND487C2-3R Schottky Quad
J9	T9205119	SMR-02V-B	D1031	G2090245	1SV103 Varactor
P1	T9205118	TLS-U01X-A1	D1043-1049,1052	G2090244	1SS106 Schottky
S101 (FT-70F only)	N0190131	SRRN3CN-R20-03 Rotary Switch	D1061	G2090220	ND487R1-3R Schottky Quad
S201 (FT-70G only)	N7090037	A7BS-206-1 Thumb Wheel Switch	D1069	G2090192	RD7.5EB3 Zener
	R4506310A	Sub-Panel for FT-70F	D1071	G2090332	RD11EB1
	R4506320A	Sub-Panel for FT-70G			CRYSTAL FILTERS
(FT-70F only)	S4000031	Knob BM-255 for S101	XF1001	H1102090	47M15AU
(FT-70G only)	R3506370	Water Proof Cover for S201	XF1002	H1102103	10F-2.4DU (USB)
R201 (FT-70G only)	J01245681	Carbon film res. 1/4W 680 ohm TJ	XF1003 (Option)	H1102104	10F-2.4DL (LSB)
		MISCELLANEOUS			
		KNOBS			
	S4000032	BM-15F Mode,SQL,AF Gain,Clarifier			
	S6000090	Rubber Cap for Toggle Switch			
	R3112930	Rubber Cap for Key Jack			
	S5000017	Rubber Cap for Mic Jack			
	Q9000078	Terminal T-10 for GND			

Location No	Part No	Name & Description
		RESISTORS
R1038	J02245689	Carbon Film 1/4W 6.8 ohm SJ
R1046,1099,1127,1185, 1257	J02245100	" " " 10 ohm "
R1261	J02245180	" " " 18 ohm "
R1297	J02245220	" " " 22 ohm "
R1245	J02245270	" " " 27 ohm "
R1136,1143,1161	J02245330	" " " 33 ohm "
R1235	J02245470	" " " 47 ohm "
R1121,1124,1193,1240, 1241	J02245560	" " " 56 ohm "
R1151,1162,1247,1252	J02245680	" " " 68 ohm "
R1036,1048,1062,1064, 1066,1074,1084,1096, 1104,1110,1126,1132, 1165,1172,1189,1210, 1212,1216,1232,1238, 1259,1296	J02245101	" " " 100 ohm "
R1175	J02245121	" " " 120 ohm "
R1033,1202,1213	J02245151	" " " 150 ohm "
R1188	J02245181	" " " 180 ohm "
R1040,1043,1050,1076, 1133,1140,1148,1154, 1198,1204,1258,1294, 1295,1302	J02245221	" " " 220 ohm "
R1260,1262	J02245271	" " " 270 ohm "
R1061,1065,1072,1192, 1194,1203,1236,1291, 1292	J02245331	" " " 330 ohm "
R1125	J02245391	" " " 390 ohm "
R1035,1067,1152,1166, 1207,1211,1239,1244, 1251	J02245471	" " " 470 ohm "
R1026,1123,1128,1299, R1002-1009,1059,1086, 1120,1200,1246	J02245561	" " " 560 ohm "
R1047	J02245821	" " " 820 ohm "
R1028-1030,1129,1155, 1179-1181,1186,1263, 1265-1267	J02245102	" " " 1k ohm "
R1234	J02245122	" " " 1.2k ohm "
R1055,1057,1098,1137, 1144	J02245152	" " " 1.5k ohm "
R1001,1253,1254,1222	J02245182	" " " 1.8k ohm "
R1025,1037,1070,1100, 1101,1105,1146,1150, 1160,1168,1169,1214, 1219,1221	J02245222	" " " 2.2k ohm "
R1017,1018,1020,1021, 1039,1041,1051,1083, 1167,1195,1196,1215, 1220,1237	J02245332	" " " 3.3k ohm "
R1042,1073,1225,1227, 1228	J02245392	" " " 3.9k ohm "

Location No	Part No	Name & Description
R1014,1015,1044,1045, 1049,1063,1068,1111, 1131,1157-1159,1171, 1174,1178,1205,1206, 1233,1286,1298	J02245472	" " " 4.7k ohm "
R1011,1012,1094,1107, 1108,1113,1117,1130, 1287	J02245562	" " " 5.6k ohm "
R1069,1079,1088,1092, 1093,1118,1119,1184, 1229,1275	J02245682	" " " 6.8k ohm "
R1032,1052,1058,1078, 1080,1085,1114-1116, 1122,1138,1145,1176, 1197,1208,1249,1250, 1255,1256,1270,1274, 1281,1284,1285,1288, 1289,1293,1300	J02245103	" " " 10k ohm "
R1276	J02245123	" " " 12k ohm "
R1010,1013,1016,1019, 1022-1024,1027,1054, 1056,1075,1135,1139, 1142,1147,1153,1164, 1177,1243	J02245153	" " " 15k ohm "
R1190,1201,1248	J02245183	" " " 18k ohm "
R1060,1071,1112,1170, 1183,1191,1199,1218, 1226,1242,1273,1277, 1278,1290	J02245223	" " " 22k ohm "
R1077,1187,1209	J02245273	" " " 27k ohm "
R1106,1109,1163,1264, 1268,1269,1271,1272	J02245333	" " " 33k ohm "
R1149	J02245393	" " " 39k ohm "
R1053,1134,1141,1156	J02245473	" " " 47k ohm "
R1031,1089,1279,1280, 1282	J02245683	" " " 68k ohm "
R1081,1082,1090,1095, 1173,1182,1217,1231, 1283	J02245104	" " " 100k ohm "
R1087,1103	J02245224	" " " 220k ohm "
R1102	J02245334	" " " 330k ohm "
R1097,1223,1230	J02245684	" " " 680k ohm "
R1091,1224	J02245155	" " " 1.5M ohm "
R1034	J02245225	" " " 2.2M ohm "
		POTENTIOMETERS
VR1001	J51724101	PN822H101H 100 ohm B
VR1002,1003	J51745332	H0651A010-3.3KB 3.3k ohm B
VR1004,1007	J51745472	H0651A011-4.7KB 4.7k ohm B
VR1008	J51745682	H0651A012-6.8KB 6.8k ohm B
VR1005,1009	J51745101	H0651A001-100B 100 ohm B
VR1006	J51726472	H1051C011-4.7KB 4.7k ohm B
VR1010	J51726105	H1051C025-1MB 1M ohm B
VR1011	J51745223	H0651A015-22KB 22k ohm B

Location No	Part No	Name & Description
		CAPACITORS
C1007,1012	K00179001	Ceramic Disc 50W 0.5pF SL (DD104SL0R5C50)
C1288	K02179002	" " " 1.5pF CK (DD104CK1R5C50)
C1178	K00172040	" " " 4pF SL (DD104SL040C50)
C1008,1010,1014,1019	K00173080	" " " 8pF " (DD104SL080D50)
C1079,1137	K00173100	" " " 10pF " (DD104SL100D50)
C1212	K00175120	" " " 12pF " (DD104SL120J50)
C1015,1017,1022,1024	K00175150	" " " 15pF " (DD104SL150J50)
C1021,1113,1138	K00175220	" " " 22pF " (DD104SL220J50)
C1029,1031	K00179006	" " " 24pF " (DD104SL240J50)
C1155,1156	K00179007	" " " 30pF " (DD104SL300J50)
C1026	K00175330	" " " 33pF " (DD104SL330J50)
C1036,1038	K00175390	" " " 39pF " (DD104SL390J50)
C1009,1043,1045	K00175470	" " " 47pF " (DD104SL470J50)
C1028	K00175560	" " " 56pF " (DD104SL560J50)
C1016,1033	K00179011	" " " 62pF " (DD104SL620J50)
C1073,1074,1211	K00175680	" " " 68pF " (DD104SL680J50)
C1050,1052	K00175750	" " " 75pF " (DD104SL750J50)
C1104,1110,1120,1126, 1160,1163,1196,1200- 1202,1217,1223	K00175101	" " " 100pF " (DD105SL101J50)
C1035	K00179015	" " " 110pF " (DD105SL111J50)
C1023,1040	K00175121	" " " 120pF " (DD105SL121J50)
C1056	K00179017	" " " 130pF " (DD105-257SL131J50)
C1030,1059,1199,1225	K00175151	" " " 150pF " (DD106SL151J50)
C1194	K00175181	" " " 180pF " (DD106SL181J50)
C1042,1047,1183,1184	K00179019	" " " 200pF " (DD106SL201J50)
C1249	K00175221	" " " 220pF " (DD107SL221J50)
C1037	K00179020	" " " 240pF " (DD107SL241J50)

Location No	Part No	Name & Description
C1049,1054,1057	K00175271	" " " 270pF " (DD107SL271J50)
C1051	K00179023	" " " 430pF " (DD109SL431J50)
C1258	K00175471	" " " 470pF " (DD109SL471J50)
C1044	K00175511	" " " 510pF " (DD109SL510J50)
C1070,1098,1106,1109, 1124,1157,1162,1193, 1210,1216,1241	K12171102	" " " 0.001uF E (DD104E102P50)
C1099,1131,1136,1158, 1180,1185,1188,1208, 1209,1247,1248,1251, 1257,1262-1264,1266, 1267	K13179008	" " " 0.01uF F (DD106F103Z50)
C1002,1004,1005,1011, 1018,1025,1032,1039, 1046,1053,1058,1060, 1062,1063,1065,1067, 1071,1075,1077,1078, 1080-1086,1089,1091- 1097,1100-1103,1105, 1107,1108,1111,1112, 1114,1115,1117-1119, 1121,1122,1125,1130, 1132,1133,1135,1142, 1145,1154,1159,1161, 1164-1167,1169-1177, 1179,1186,1187,1190, 1191,1195,1197,1198, 1214,1215,1218-1220, 1222,1224,1226-1229, 1237,1239,1242-1246, 1252,1253,1255,1256, 1259-1261,1270-1272, 1274,1278-1287	K13179010	" " " 0.022uF F (DD108F223Z50)
C1069,1139	K13179009	" " " 0.047uF " (DD110F473Z50)
C1289	K22141904	Chip Ceramic 25WV 0.1uF D (C3216D1E104MFA)
C1064,1087,1088,1141, 1181,1230,1240,1277	K19149025	Barrier Layer " 0.1uF (UAT10X104K-L45AE)
C1127	K70167104	Tantalum 35WV 0.1uF (DN1V0R1M1S)
C1128	K70167105	" " 1uF (DN1V010M1S)
C1116	K70147155	" 25WV 1.5uF (DN1E1R5M1S)
C1204,1207	K70127476	" 16WV 47uF (DN1C470M1S)
C1265	K70147225	" 25WV 2.2uF (DN1E2R2M1S)

Location No	Part No	Name & Description	
C1148	K50177472	Mylar (50F2U472M)	50WV 0.0047uF
C1151,1234-1236	K50177103	" (50F2U103M)	" 0.01uF
C1147	K50177223	" (50F2U223M)	" 0.022uF
C1001,1003,1066,1144, 1146,1153,1182,1189, 1205,1223,1254,1269, 1275	K40179013	Electrolytic (RE-50V010M)	" 1uF
C1061,1168,1273	K40179009	" (RE-50V2R2M)	" 2.2uF
C1276	K40179011	" (RE-50V3R3M)	" 3.3uF
C1072,1140,1238	K40179012	" (RE-50V4R7M)	" 4.7uF
C1068,1076,1090,1123, 1129,1134,1143,1152, 1206,1221	K40129004	" (RE-16V100M)	16WV 10uF
C1199	K40149008	" (RE-25V100M)	25WV 10uF
C1006,1013,1020,1027, 1034,1041,1048,1055, 1150,1268	K40129016	" (RE-16V220M)	16WV 22uF
C1149	K40149025	" (RE-25V220M)	25WV 22uF
C1203	K40109001	" (RE-10V101M)	10WV 100uF
TC1002	K91000086	TRIMMER CAPACITOR CTZ51E117	20pF
INDUCTORS			
L1001,1008	L1190087	FL4H1R5M	1.5uH
L1002,1004	L1190095	LAL04NA4R7K	4.7uH
L1003,1062	L1190005	FL4H1R0M	1uH
L1005,1013	L1190007	FL4H1R8M	1.8uH
L1006,1010	L1190126	FL4H2R4M	2.4uH
L1007,1009	L1190235	LAL04NA6R8K	6.8uH
L1011,1015,1023	L1190010	FL4H3R9K	3.9uH
L1012,1014	L1190112	FL4H120K	12uH
L1016,1020	L1190111	FL4H5R6K	5.6uH
L1017,1019	L1190021	FL5H180K	18uH
L1018	L1190009	FL4H3R3M	3.3uH
L1021,1025	L1190070	FL4H8R2M	8.2uH
L1022,1024	L1190073	FL5H270K	27uH
L1026,1030,1033,1058, 1059	L1190014	FL5H100K	10uH
L1027,1029,1037,1038	L1190029	FL5H470K	47uH
L1028	L1190011	FL4H4R7K	4.7uH
L1031,1035	L1190019	FL5H150K	15uH
L1032,1034	L1190030	FL5H560K	56uH
L1036,1039,1041,1068	L1190017	FL5H102K	1mH
L1040	L1190233	LAL04NAR39M	0.39uH

Location No	Part No	Name & Description	
L1042,1044-1053,1055- 1057,1060,1061,1063- 1067,1069-1073	L1190022	FL5H181K	180uH
TRANSFORMERS			
T1001,1003,1023,1024	L0021350		
T1002	L0021535		
T1004	L0021123		
T1005,1006	L0021351		
T1007	L0021536		
T1008	L0021537		
T1009	L0021538		
T1010,1019	L0021540		
T1011,1012,1015,1016	L0021541		
T1013	L0021542		
T1014	L0021543		
T1017	L0021544		
T1018	L0021545		
T1020	L0021546		
T1021	L0021547		
T1022	L0021548		
MINI CONNECTORS			
J1001	P0090530	5483-08A	
J1002,1004,1005,1008, 1010,1014,1017,1018, 1020,1021	P0090524	5483-02A	
J1003,1006,1012,1013, 1015,1019	P0090525	5483-03A	
J1007,1009,1011	P0090526	5483-04A	
J1016,1022	P1090255	TMP-JA	
	T9205169		
	T9205168		
	T9205170		
	T9205177		
TERMINAL POSTS			
	Q5000011		
	L9190016	Coil Shield Case	
	R0113910	Shield Plate	
	R0113920	Shield Case F	
	R0113950	Shield Case G	
	R0113960	Shield Cover G	
	R0113880	Shield Plate F	
	R0113890	Shield Plate G	
	R0113900	Shield Plate H	
	R0110610	Ground Contact	

Location No	Part No	Name & Description
	*****	PLL UNIT *****
	F275500	Printed Circuit Board
	C027550A	PCB with components
		ICs
Q2008,2028	G1090101	uPC1037H
Q2014,2038	G1090195	SN74LS73N
Q2015,2033	G1090247	TC9122P
Q2016,2017	G1090298	MC14560BCP
Q2019,2032	G1090347	MC14568BCP
Q2020	G1090697	M54455L
Q2021	G1090473	TC5081AP
Q2030	G1090081	TA7310P
Q2039	G1090317	SN74LS290N
Q2050	G1090073	uPC575C2
		FETs
Q2001-2004	G3801921G	2SK192AGR
Q2006,2026	G3802410Y	2SK241Y
Q2027	G3801921Y	2SK192AY
		TRANSISTORS
Q2005,2007,2011,2012, 2024,2031,2036,2046	G3305350C	2SC535C
Q2009,2018,2029,2034	G3309451P	2SC945AP
Q2010	G33192300	2SC19230
Q2013,2025,2035,2037, 2041-2043,2045,2047- 2049	G3304580C	2SC458C
Q2022,2023	G3307320G	2SC732TM-GR
Q2040,2044	G3319590Y	2SC1959Y
		DIODES
D2001,2003,2005,2007, 2009,2011-2013,2016- 2020	G2090237	MA190 Si
D2002,2004,2006,2008, 2018	G2090023	1SV50 Varactor
D2013	G2090245	1SV103 "
D2021	G2090165	FC-52M-5 "
D2022	G2090156	RD5.6EB2 Zener
D2023	G2090152	RD5.1EB2 "
		CRYSTALS
X2001	H0102681	HC-49/U3P 24.0MHz
X2002	H0102682	HC-49/U3P 8MHz
X2003	H0102683	HC-49/U3P 36.355MHz
X2004	H0102684	HC-49/U3P 10.7MHz
		RESISTORS
R2163	J20306229	Metallic Film 1/4W 2.2 ohm
R2037	J02245220	Carbon Film " 22 ohm SJ
R2096	J02245330	" " " 33 ohm "

Location No	Part No	Name & Description
R2089,2146	J02245560	" " " 56 ohm "
R2005,2009,2013,2017, 2021,2028,2029,2039, 2040,2071,2073,2080, 2082,2085,2106,2110, 2117,2123,2137,2144, 2150,2154,2157	J02245101	" " " 100 ohm "
R2162	J02245181	" " " 180 ohm "
R2020,2022,2044,2081, 2133,2135,2136	J02245221	" " " 220 ohm "
R2030,2032,2083,2095, 2116	J02245331	" " " 330 ohm "
R2086	J02245391	" " " 390 ohm "
R2019,2057,2090,2149, 2158	J02245471	" " " 470 ohm "
R2035,2099,2104,2105	J02245561	" " " 560 ohm "
R2036,2092,2138	J02245681	" " " 680 ohm "
R2018,2055,2056,2064, 2091,2097,2098,2107, 2113	J02245102	" " " 1k ohm "
R2041,2074,2084,2120, 2129,2141,2153	J02245152	" " " 1.5k ohm "
R2038,2054,2066,2072, 2088,2103,2118,2125, 2145	J02245222	" " " 2.2k ohm "
R2134	J02245272	" " " 2.7k ohm "
R2025,2031	J02245332	" " " 3.3k ohm "
R2155	J02245392	" " " 3.9k ohm "
R2059,2061,2065	J02245472	" " " 4.7k ohm "
R2078	J02245562	" " " 5.6k ohm "
R2026,2079	J02245682	" " " 6.8k ohm "
R2004,2008,2012,2016, 2027,2046,2062,2093, 2100,2124,2126	J02245103	" " " 10k ohm "
R2033	J02245123	" " " 12k ohm "
R2068,2077,2111,2112, 2151,2152	J02245153	" " " 15k ohm "
R2024	J02245183	" " " 18k ohm "
R2023,2034,2042,2043, 2063,2101,2119,2130, 2156	J02245223	" " " 22k ohm "
R2094,2115	J02245273	" " " 27k ohm "
R2001,2069,2070,2075, 2076,2108,2109,2114, 2121,2127,2139,2140, 2142,2143,2147,2148	J02245333	" " " 33k ohm "
R2002,2003,2006,2007, 2010,2011,2014,2015, 2045,2047-2052,2058, 2122,2128,2131,2159	J02245473	" " " 47k ohm "
R2060,2067,2132	J02245104	" " " 100k ohm "
R2161	J02245124	" " " 120k ohm "
R2160	J02245154	" " " 150k ohm "
R2053,2087,2102	J02245334	" " " 330k ohm "

Location No	Part No	Name & Description
TH2001	G9090013	THERMISTOR 112-501-2
C2069	K00179001	CAPACITORS Ceramic disc 50WV 0.5pF SL (DD104SL0R5C 150)
C2124	K00172020	" " " 2pF "
C2047,2049,2214	K06172020	" " " 2pF UJ (DD104UJ020C50)
C2061	K22172030	" " " 3pF "
C2172	K02172040	" " " 4pF CH (DD104CH040C50)
C2017,2048,2118	K06172040	" " " 4pF UJ (DD104UJ040C50)
C2116,2195	K06172050	" " " 5pF "
C2067	K00172050	" " " 5pF SL (DD104SL050C50)
C2008,2106	K06173080	" " " 8pF UJ (DD104UJ080D50)
C2105	K02173080	" " " 8pF CH (DD104CH080D50)
C2060,2063	K00173080	" " " 8pF SL (DD104SL080D50)
C2065	K00173090	" " " 9pF "
C2173	K02173100	" " " 10pF CH (DD104CH100D50)
C2004,2005,2009,2018, 2027,2036,2216	K06173100	" " " 10pF UJ (DD104UJ100D50)
C2026,2135	K06175120	" " " 12pF UJ (DD104UJ120J50)
C2070	K00175120	" " " 12pF SL (DD104SL120J50)
C2035	K06175150	" " " 15pF UJ (DD104UJ150J50)
C2041,2043	K00175180	" " " 18pF SL (DD104SL180J50)
C2064,2066	K00175220	" " " 22pF "
C2014,2032,2213	K06175220	" " " 22pF UJ (DD104UJ220J50)
C2062	K00179006	" " " 24pF "
C2068	K00175270	" " " 27pF "
C2023	K06175270	" " " 27pF UJ (DD104UJ270J50)
C2115,2134,2136,2137	K06175330	" " " 33pF "
C2145	K00175330	" " " 33pF SL (DD104SL330J50)

Location No	Part No	Name & Description
C2107,2110,2111	K02175390	" " " 39pF CH (DD104-257CH390J50)
C2050	K06175390	" " " 39pF UJ (DD104UJ390J50)
C2119	K06175470	" " " 47pF "
C2224	K02175470	" " " 47pF CH (DD106CH470J50)
C2204	K00175470	" " " 47pF SL (DD104SL470J50)
C2143	K00175560	" " " 56pF "
C2042	K00179011	" " " 62pF "
C2197	K06175680	" " " 68pF UJ (DD105-257UJ680J50)
C2178,2200	K02175680	" " " 68pF CH (DD107CH680J50)
C2199	K02179018	" " " 75pF CH (DD107CH750J50)
C2176,2177	K02175820	" " " 82pF CH (DD107CH820J50)
C2222,2223	K00175820	" " " 82pF SL (DD104SL820J50)
C2226,2227	K02175101	" " " 100pF CH (DD107CH101J50)
C2097,2144,2188,2192, 2193,2196,2203,2219, 2226,2237,2238	K00175101	" " " 100pF SL (DD105SL101J50)
C2006,2015,2024,2033	K06175101	" " " 100pF UJ (DD106UJ101J50)
C2168,2169	K00175181	" " " 180pF SL (DD106SL181J50)
C2130,2132	K00175221	" " " 220pF "
C2075,2131	K00175391	" " " 390pF "
C2098,2104	K12171102	" " " 0.001uF E (DD104E102P50)
C2001-2003,2008,2010, 2012,2019,2021,2022, 2028,2030,2031,2037, 2046,2051,2052,2054, 2056,2077,2080,2081, 2083-2092,2112,2113, 2120-2122,2125,2140, 2142,2146,2152,2155- 2167,2170,2175,2180, 2184,2189,2212,2215, 2221,2232	K13179008	" " " 0.01uF F (DD106F103Z50)
C2011,2020,2029,2038, 2039,2044,2045,2053, 2055,2057-2059,2071, 2072,2076,2079,2094,	K13179010	" " " 0.022uF F (DD108F223Z50)

Location No	Part No	Name & Description
2101,2109,2114,2117, 2123,2126-2129,2133, 2139,2141,2149,2171, 2174,2181-2183,2186, 2190,2191,2194,2198, 2201,2202,2205,2208- 2211,2217,2218,2220, 2225,2228,2230		
C2074,2147	K13179009	" " " 0.047uF " (DD110F473Z50)
C2082,2099,2100,2103, 2150,2151	K19149025	Barrier Layer " 0.1uF (UAT10X104K-L45AE)
C2102	K50177223	Mylar " 0.022uF (50F2U223M)
C2242	K52170004	Polyster film " 0.22uF (ECQ-V1H224JZ)
C2096	K70167684	Tantalum 35WV 0.68uF (DN1VR68M1S)
C2148	K70147225	" 25WV 2.2uF (DN1E2R2M1S)
C2185	K70127475	" 16WV 4.7uF (DN1C4R7M1S)
C2093,2154	K40179013	Electrolytic 50WV 1uF (RE-50V010M)
C2234	K40179009	" " 2.2uF (RE-50V2R2M)
C2235	K40179012	" " 4.7uF (RE-50V4R7M)
C2073,2187	K40129004	" 16WV 10uF (RE-16V100M)
C2078,2153,2179	K40129016	" " 22uF (RE-16V220M)
C2007,2016,2025,2034, 2040,2095,2108,2138, 2206,2207,2231	K40129008	" " 33uF (RE-16V330M)
C2233	K40129002	" " 47uF (RE-16V470M)
C2236	K40129007	" " 100uF (RE-16V101M)
C2240	K40129009	" " 220uF (RE-16V221M)
C2239	K40149016	" 25WV 220uF (RE-25V221M)
C2241	K41140108	" " 1000uF (TL-25V102M)
		TRIMMER CAPACITORS
TC2001,2004	K91000086	CTZ51E117 20pF
TC2002,2003	K91000085	CTZ51C122 10pF
		INDUCTORS
L2001-2005	L1190023	FL5H220K 22uH

Location No	Part No	Name & Description
L2006	L1190005	FL4H1R0M 1uH
L2007,2009,2010,2012, 2013,2015,2017-2020, 2023,2028,2030-2033, 2036,2037,2039	L1190022	FL5H181K 180uH
L2008,2011	L1190008	FL4H2R2M 2.2uH
L2014,2016,2026,2029	L1190017	FL5H102K 1mH
L2021,2022	L1190027	FL5H390K 39uH
L2024,2025	L1190014	FL4H100K 10uH
L2027	L1190233	LAL04NAR39M 0.39uH
L2034,2035	L1190070	FL4H8R2M 8.2uH
L2038	L1190234	LAL04NAR27M 0.27uH
L2040	L1190031	FL5H680K 68uH
L2041	L2030067B	
		TRANSFORMERS
T2001	L0021549	
T2002,2003	L0021550	
T2004	L0021551	
T2005,2006	L0021552	
T2007,2008,2010	L0021553	
T2009	L0021554	
T2011	L0021555	
T2012	L0021556	
T2013	L0021557	
T2014,2015	L0021558	
T2016	L0021559	
T2017	L0021560	
		MINI CONNECTORS
J2001,2002	P1090255	TMP-JA
J2003	P0090528	5483-06A
J2004	P0090531	5483-09A
J2005,2007	P0090527	5483-05A
J2006,2008,2009,2014	P0090524	5483-02A
J2010	P0090525	5483-03A
J2011	P0090535	5483-13A
		T9205171A
		T9205172A
		T9205173
		T9205174
		T9205175
		TERMINAL POSTS
		Q5000011
		L9190016 Coil Shield Case
		R0112970 Shield Case A
		R0112980 Shield Plate A
		R0112990 Shield Case B
		R0113000 Shield Case C
		R0113010 Shield Case D
		R0113020 Shield Case E

Location No	Part No	Name & Description
	R0113040	Shield Plate A
	R0113050	Shield Plate B
	R0113060	Shield Plate C
	R0113070	Shield Plate E
	***** REGULATOR UNIT *****	
	F2756000	Printed Circuit Board
	C027560A	PCB with components
		ICs
Q3009,3013	G1090029	MC14071BCP
Q3010	G1090309	MC14555BCP
Q3011	G1090088	MC14028BCP
Q3012	G1090028	MC14075BCP
Q3014	G1090126	MC14069UBCP
Q3015	G1090068	MC14011BCP
Q3016	G1090094	uPA2004C
		TRANSISTORS
Q3001,3003,3004,3007	G3207720Q	2SB772Q
Q3002,3005,3006,3017-3024,3031	G3309451P	2SC945AP
Q3008	G3207740	2SB774
Q3025-3029	G3107331P	2SA733AP
		DIODES
D3001-3008,3011-3019	G2090237	MA190 Si
D3009,3010	G2090118	1SS97 Schottky
		RESISTORS
R3001,3002,3017	J20306010	Metallic Film 1W 1 ohm
R3065	J02245182	Carbon Film 1/4W 1.8k ohm SJ
R3004	J02245392	" " " 3.9k ohm "
R3018	J02245472	" " " 4.7k ohm "
R3014	J02245822	" " " 8.2k ohm "
R3070-3077	J02245103	" " " 10k ohm "
R3005,3009,3011	J02245153	" " " 15k ohm "
R3006,3010,3012,3030-3036	J02245333	" " " 33k ohm "
R3003,3013,3038,3040,3042,3044,3046,3048,3050,3052,3054,3056,3058,3060,3062,3069	J02245393	" " " 39k ohm "
R3007,3015,3016,3020-3029,3037,3039,3041,3043,3045,3047,3049,3051,3063	J02245473	" " " 47k ohm "
R3053,3055,3057,3059,3061,3066	J02245563	" " " 56k ohm "
R3019,3068	J02245683	" " " 68k ohm "
R3008	J02245823	" " " 82k ohm "
R3078	J02245104	" " " 100k ohm "

Location No	Part No	Name & Description
R3064	J02245154	" " " 150k ohm "
		CAPACITORS
C3001,3004,3007,3009,3010,3012,3014-3038	K13179010	Ceramic disc 50W 0.022uF F (DD108F223Z50)
C3008	K13179009	" " " 0.047uF " (DD110F473Z50)
C3002	K41140228	Electrolytic 25WV 2200uF (TL-25V222M)
C3003	K40149021	" " " 33uF (RE-25V330M)
C3011	K40149008	" " " 10uF (RE-25V100M)
C3006	K40129007	" " " 16WV 100uF (RE-16V101M)
C3005	K70167474	Tantalum 35WV 0.47uF (DN1VR47M1S)
		MINI CONNECTORS
J3001,3007,3010,3017	P0090526	5483-04A
J3003,3009,3011,3014,3015	P0090527	5483-05A
J3004,3020-3023	P0090524	5483-02A
J3005,3006,3008	P0090525	5483-03A
J3012,3013	P0090531	5483-09A
J3016,3019	P0090526	5483-06A
J3018	P0090530	5483-08A
		TERMINAL POSTS
	Q5000011	
		***** LPF UNIT *****
	F2757000	Printed Circuit Board
	C027570A	PCB with components
		IC
Q4006	G1090248	AN6551
		TRANSISTORS
Q4001	G3109500Y	2SA950Y
Q4002,4005,4008	G3107331Q	2SA733AQ
Q4003,4009	G3304580C	2SC458C
Q4004,4007	G3309451P	2SC945AP
		DIODES
D4001-4004,4013,4016	G2090244	1SS106 Schottky
D4006,4009,4011,4012,4014,4015	G2090237	MA190 Si
D4018	G2090158	RD4.7EB2 Zener
		SURGE ABSORBER
D4005	Q9000292	ERZ-D03DS331



Location No	Part No	Name & Description
		RESISTORS
R4003	J01275560	Carbon film 1/2W 56 ohm TJ
R4010	J02245122	" " " 1/4W 1.2k ohm SJ
R4041	J02245222	" " " 2.2k ohm "
R4009	J02245272	" " " 2.7k ohm "
R4002,4011	J02245332	" " " 3.3k ohm "
R4012	J02245392	" " " 3.9k ohm "
R4013,4018,4023	J02245472	" " " 4.7k ohm "
R4001,4004,4005,4016, 4021,4027,4038,4039	J02245103	" " " 10k ohm "
R4044	J02245123	" " " 12k ohm "
R4010,4026	J02245153	" " " 15k ohm "
R4007,4015,4025,4035, 4040,4042,4043	J02245223	" " " 22k ohm "
R4034	J02245393	" " " 39k ohm "
R4017,4024,4028,4037, 4045	J02245104	" " " 100k ohm "
R4020	J02245154	" " " 150k ohm "
R4029,4030,4032,4033	J02245224	" " " 220k ohm "
R4019	J02245274	" " " 270k ohm "
R4022,4036	J02245474	" " " 470k ohm "
R4014	J02245155	" " " 1.5M ohm "
R4031	J02245335	" " " 3.3M ohm "
		POTENTIOMETERS
VR4001,4003	J50770223	H0652A015-22KB 22k ohm B
VR4002,4004	J50770473	H0652A017-47KB 47k ohm B
VR4005,4006	J50770472	H0652A011-4.7KB 4.7k ohm B
		CAPACITORS
C4051	K00175220	Ceramic disc 50WV 22pF SL (DD104SL220J50)
C4044	K00175470	" " " 47pF "
C4030,4048	K00179011	(DD104SL470J50) " " " 62pF "
C4049	K00175560	" " " 56pF "
C4037	K00175680	(DD104SL560J50) " " " 68pF "
C4052,4064,4066	K00175820	" " " 82pF "
	K00175101	(DD104SL820J50) " " " 100pF "
C4016,4023	K00179015	(DD105SL101J50) " " " 110pF "
C4035,4041,4042	K00175121	" " " 120pF SL (DD105SL121J50)
C4065	K00179017	" " " 130pF "
C4050	K00175151	(DD105-257SL131J50) " " " 150pF "
C4045	K00179018	(DD106SL151J50) " " " 160pF "

Location No	Part No	Name & Description
C4005,4034	K00175181	(DD106SL161J50) " " " 180pF "
C4038	K00179008	(DD106SL181J50) " " " 200pF "
C4027,4028,4048,4059	K00175221	(DD106SL201J50) " " " 220pF "
C4021,4043	K00175271	(DD107SL221J50) " " " 270pF "
C4013,4031	K00179021	(DD107SL271J50) " " " 300pF "
C4004,4020,4036	K00175331	(DD107SL301J50) " " " 330pF "
C4024	K00179023	(DD107SL331J50) " " " 430pF "
C4012,4029	K00175511	(DD109SL431J50) " " " 510pF "
C4008,4015,4016	K00175561	(DD109SL511J50) " " " 560pF "
C4003,4017	K00175681	(DD109SL561J50) " " " 680pF "
C4006,4007,4009,4022, 4046	K00175751	(DD110SL681J50) " " " 750pF "
C4010,4018,4025,4032, 4039,4046,4053,4060- 4063,4072,4074,4076, 4083,4088	K13179008	(DD111SL751J50) " " " 0.01uF F (DD106F103Z50)
C4001,4002,4011,4019, 4026,4033,4040,4047, 4054-4057,4068,4073, 4077,4078,4080,4086, 4090,4091	K13179010	" " " 0.022uF F (DD108F223Z50)
C4069,4075	K19149025	Barrier Layer 25WV 0.1uF (UAT10X104K-L45AE)
C4067,4079,4081,4087	K40129004	Electrolytic 16WV 10uF (RE-16V100M)
C4089	K40129002	" " " 47uF (RE-16V470M)
C4070	K70167224	Tantalum 35WV 0.22uF (DN1VR22M1S)
C4071,4082,4085	K70167105	" " " 1uF (DN1V010M1S)
TC4001	K91000087	TRIMMER CAPACITOR ECV-1ZW 10X60 10pF
		INDUCTORS
L4001	L0021564	
L4002	L0021565	
L4003	L0021566	
L4004	L0021567	
L4005	L0021568	
L4006	L0021569	
L4007	L0021570	

Location No	Part No	Name & Description	Location No	Part No	Name & Description
L4008	L0021571		R5010,5011	J01275150	Carbon film 1/2W 15 ohm TJ
L4009	L0021572		R5002	J02245180	" " 1/4W 18 ohm SJ
L4010	L0021573		R5008,5009	J01275151	" " 1/2W 150 ohm TJ
L4011	L0021635		R5004,5005,5013	J02245151	" " 1/4W 150 ohm SJ
L4014	L0021574		R5014	J02245221	" " " 220 ohm "
L4012	L0021575A		R5001,5003	J02245271	" " " 270 ohm "
L4013	L0021576		R5015	J02245471	" " " 470 ohm "
L4015,4019	L1190022	FL5H181K 180uH			POTENTIOMETERS
L4016	L1190016	FL5H101K 100uH	VR5001	J51745331	H0651A004-330B 330 ohm B
L4017,4018	L1190230	LAL04NAR33 0.33uH	VR5002	J51745471	H0651A005-470B 470 ohm B
L4020	L1190017	FL5H102K 1mH			CAPACITORS
T4001	L0021561	TRANSFORMER	C5011	K30275680	Dipped Mica 500WV 68pF (LCQ12680J5)
RL4001-4014,4016	M1190066	RELAYS G2Q-187P-V-H 12VDC	C5036,5038	K00175470	Ceramic Disc " 47pF SL (DD104SL470J50)
RL4015	M1190067	G5A-237P 12VDC	C5037	K00175101	" " " 100pF "
J4001	P0090528	MINI CONNECTOR 5483-06A	C5009,5010	K00175511	" " " 510pF "
J4002	P0090526	5483-04A	C5035	K00175621	" " " 620pF "
J4003,4006,4009,4011,4012	P0090524	5483-02A	C5017	K12171102	" " " 0.001uF E (DD109SL511J50)
J4004	P0090527	5483-05A	C5001,5016,5029,5031	K13179008	" " " 0.01uF F (DD106F103Z50)
J4005	P1090255	TMP-JA	C5002,5003,5004,5005,5006,5007,5013,5015,5020,5021,5026,5027,5030,5032,5034	K13179009	" " " 0.047uF " (DD110F473Z50)
J4008,4010	P0090525	5483-03A	C5039,5040	K22141904	Ceramic Chip " 0.1uF D (C3216D1E104MFA)
P4001	T9315510	LAMP BQ041-22803A	C5014	K19149025	Barrier Layer " 0.1uF (UAT10X104K-L45AE)
PL4001	Q1000010	L9190016 Coil Shield Case	C5018	K50177154	Mylar " 0.15uF (50F2U154M)
		***** PA UNIT *****	C5025	K40129004	Electrolytic 16WV 10uF (RE-16V100M)
	F2758000	Printed Circuit Board	C5022	K40149008	" 25WV 10uF (RE-25V100M)
	C027580A	PCB with components	C5033	K40129002	" 16WV 47uF (RE-16V470M)
Q5005	G1090080	IC uPC78L08	C5012,5028	K40149022	" 25WV 47uF (RE-25V470M)
Q5001,5002	G3319710	TRANSISTORS 2SC1971	L5001,5002	L1190087	INDUCTORS FL4H-1R5M 1.5uH
Q5003,5004	G3325090	2SC2509	L5003-5006	L1020717	
Q5006	G3408820Q	2SD882Q			TRANSFORMERS
D5002	G9090017	DIODES MV11 Varistor	T5001	L0021577	
R5006,5007	J20306680	RESISTORS Metallic film 1W 68 ohm	T5002	L0021578	
			T5003	L0020834A	

Location No	Part No	Name & Description
J5001,5002 J5003	P1090255 P0090543	MINI CONNECTORS TMP-JA 5483-05A
	Q5000011	TERMINAL POSTS
		***** SWITCH UNIT *****
	F2759000 C027590A	Printed Circuit Board PCB with components
D6001	G2090142	LED TLR226
R6001 R6002	J02245332 J02245273	RESISTORS Carbon film 1/4W 3.3k ohm SJ " " " 27k ohm "
VR6001	J50705102	POTENTIOMETER EVN-A1AA00B13 1k ohm B
C6001	K40129016	CAPACITOR Electrolytic 16WV 22uF (RE-16V220M)
S6001-6003 S6004 S6005 S6006	N2090038 N2090041 N2090039 N2090040 S6000090	SWITCHES 8A1012 8A2012 8A1062 8A2062 820143 Rubber Cap
P6002 P6003 P6004 P6005 P6006 P6007 J6001	T9205148A T9205149A T9205150A T9205151A T9205152A T9205153A T9205147	MINI CONNECTORS 5480-02 5480-04 5480-02 5480-02 5480-03 5480-04 SMR-03V-B
	R0113080A	Holder
		***** MODE SWITCH UNIT *****
	F2760000 C027600A	Printed Circuit Board PCB with components
D7001,7002	G2090237	DIODES MA190 Si
		SWITCH

Location No	Part No	Name & Description
S7001	N0190132	SRBU-S001
J7001	P0090524	MINI CONNECTOR 5483-02A
P7001 (with wire) P7002 ( " " ) P7003 ( " " ) P7004 ( " " ) P7005 ( " " )	T9205155A T9205156A T9205157A T9205158A T9205159A	5480-02 5480-02 5480-03 5480-04 5480-05
		***** VR UNIT *****
	F2761000 C027610A	Printed Circuit Board PCB with components
Q8001	G3304580C	TRANSISTOR 2SC458C
R8005 R8001 R8006 R8004 R8003 R8002	J02245101 J02245331 J02245122 J02245222 J02245103 J02245473	RESISTORS Carbon film 1/4W 100 ohm SJ " " " 330 ohm " " " " 1.2k ohm " " " " 2.2k ohm " " " " 10k ohm " " " " 47k ohm "
VR8001	J60800122	POTENTIOMETER K16110071C-20KA 20k ohm A
C8001,8003 C8002 C8004	K40179012 K40149016 K70127476	CAPACITORS Electrolytic 50WV 4.7uF (RE-50V4R7M) " 25WV 220uF (RE-25V221M) Tantalum 16WV 47uF (DN1C470M1S)
P8001	T9205160A	MINI CONNECTOR 5480-04
		***** MATRIX UNIT (for FT-70F) *****
	F2762000	Printed Circuit Board
J9001-9004 J9005,9006	P0090535 P0090534	MINI CONNECTORS 5483-13A 5483-12A

Location No	Part No	Name & Description
		***** ACCESSORIES *****
	M3090051	MICROPHONE MH-17A8
	T9016106	POWER CORD
	Q0000012	FUSE 6A
	G2090346	DIODE ARRAY 03-0277 for FT-70F Frequency Set (Not Programmed)

