AZDEN

PCS-300

2M FM HANDHELD TRANSCEIVER

ADJUSTMENT & SERVICE MANUAL

AZDEN

- C O N T E N T S -

I GENERAL

The PCS-300 is a microcomputer-controlled 2-meter FM hand-held transceiver. The unit features wide frequency coverage of 142.000-149.995MHz, 8-channel memory with scan, programmable band scan, standard repeater offsets, programmable non-standard offset and LCD display with S/RF meter. Those many features and functions are packed in a very compact housing which consists of the three PC boards, the RX/TX, PLL and Control boards.

1. Precautions Before Service/Maintenance

Each of the three PC boards has many components densely mounted and employs many thin leadwires for inter-connecting those boards. In addition, there allows of only a little space between the RX/TX and PLL boards or the PLL and Control boards.

This eventually requires minute care to be taken when disassembling a unit and doing the service work on it. The precaution, simple yet most important, is that those thin leadwires should not be pulled strongly and or pinched between the chassis and the rear or front case.

2. How To Disassemble PCS-300 Unit

Follow the procedures mentioned below. (See the 'Exploded View' provided)

2-1 Push down the grooved tab marked 'OPEN V' to remove the battery case and the internal battery pack.

2-2 Remove the 4 binding screws on the rear case and take off the case. This step shows you the front face(side) of the RX/TX PC board and allows you to install the Tone Unit PT-67 as well as to adjust power output and sensitivity.

2-3 Remove the 4 hexagon screws tightened at the corners of the RX/TX PC boards with a 5m/m use box spanner and then remove the 2 screws that secure the power amplifier and heat sink on to the die-cast frame(chassis). Next, de-solder the coil and earth wire connected to the antenna connector. Now, you can lift up the RX/TX PC board carefully so as not to cut the 2 leadwires from the antenna jack. The step so far shows you the rear side of the PLL PC board and also the rotary switch for TX/OFFSET, etc. fitted from behind the top panel.

2-4 Remove the 2 remaining screws near to the heat sink and another 2 screws at the bottom corners of the battery case to open the front case. Next, take carefully off the 9P connector interconnecting the PLL PC board with the Control PC board and there appears the front side of the PLL board and the rear side of the Control board. Now at this stage, you can do all kinds of service work related to the PLL section and most repair service in connection with the Control section.

2-5 Note that the RX/TX PC board does not always have to be removed for servicing the PLL and or Control sections. Even in this case, you must remove the rear case.

2-6 Use a 5m/m use hexagon box spanner to remove the 2 hexagon screws that bind the Control PC board and the front case after following the procedures, 1, 2 and 4. See in this case that you do not lose the insulating fiber washer or mylar(polyester) film washer fitted in between the Control board and either of the 2 hexagon screws. (The only initial production units having the serial numbers 10001 through 11000 are supplied with the film or fiber washers.)

Next, remove the 6 tapping screws(2 m/m diameter) on the Control PC board. This will separate the Control board from the front case, making all kinds of service work possible. (Note: Do not remove the 3 each of 2.6m/m diameter screws located at the center of the Control board in a triangular form except when the LCD unit must be replaced. These screws are used for securing the LCD unit on to the Control board and one of the screws is fitted with a mylar film washer. So, take care that it is not lost.)

2-7 In case you should need to remove the PLL PC board from the frame(chassis), you have only to loosen the 4 screws(2m/m diameter) mounted on its front side. Nevertheless, however, it is recommended for precaution to remove the top panel as well.

II DETAILED EXPLANATION OF EACH SECTION

1. Transmitter/Receiver Section

1-1 How To Remove Rear Case

See page 1 and 'Expoloded View'.

1-2 Measuring Instruments Required

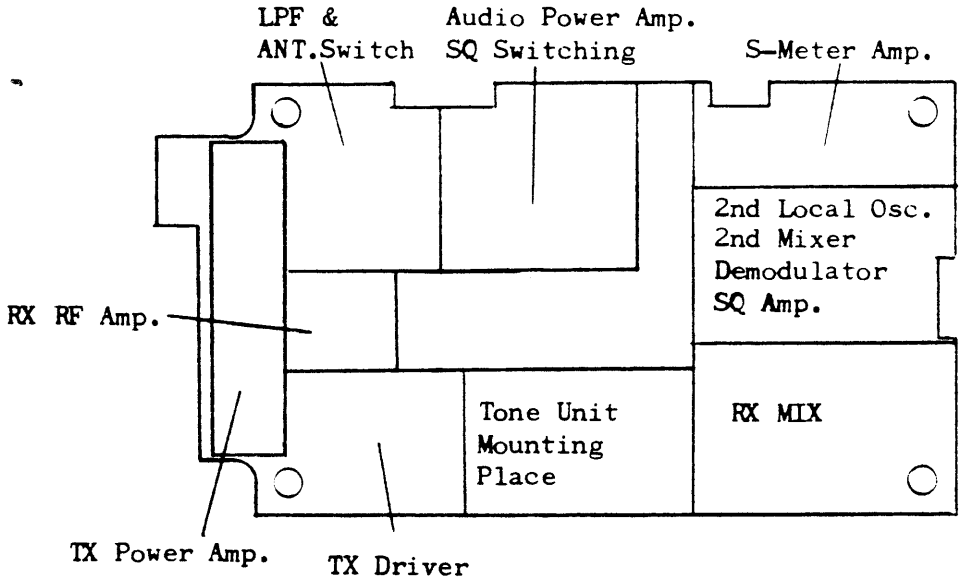
* Regulated DC Power Supply (over 2A)
* Spectrum Analyzer
* R.F. Power(Watt) Meter
* Power Splitter
* Signal Generator
* SINAD Meter
* VTVM

CAUTIONS:

When doing the service work, be sure to remove the battery pack and use a power supply with protection circuit. It is just because printed circuit patter(s) may be damaged or burnt down when if service is done with battery being operated and the power circuit should be short-circuited.

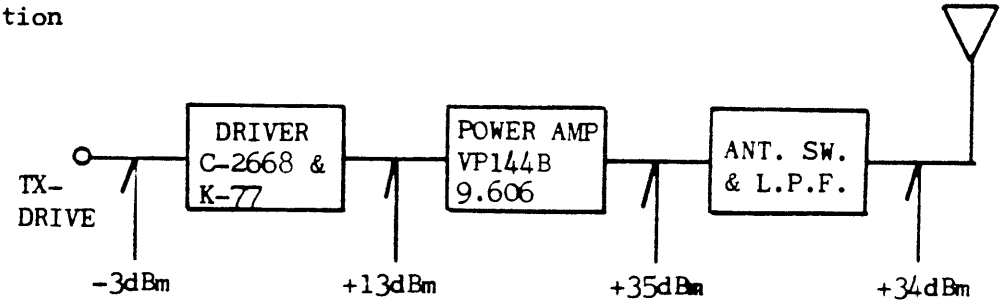
1-3 RX/TX PC Board (P/N 50-180-01)

1-3-1 Names of Circuit & Their Locations



1-3-2 Circuit Operation & Level

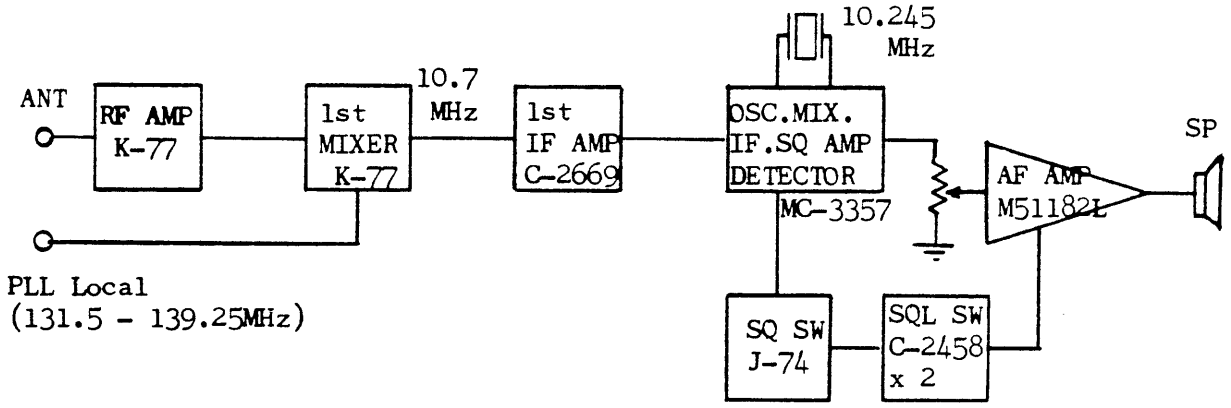
a) TX Section



The PLL output (TX Drive) signal, which is put out in the range of 142.000 through 149.995MHz, is directly amplified without being mixed to get an output of more than 2.5W. The output is rectified by the voltage doubler rectifier circuit to obtain DC voltage and then A/D-converted at the control section so that the microcomputer functions to light up an RF meter. The DC voltage thus obtained controls the 2nd gate of the K-77 driver FET to obtain the lower power of 0.6W.

The voltage to drive the transmitter is 9.5V which is supplied through the switching circuit from the battery voltage on the PLL board and it is not regulated. (Note that the power supplier voltage of the POWER AMP. is the battery voltage of 9.6V which does not pass through the switching circuit.)

b) RX Section



The incoming signal is RF-amplified by 3SK77 and then mixed down (by K77) with the PLL local output to get the 1st IF of 10.7MHz. The 10.7MHz signal is then amplified by C-2669 (1st IF AMP) and fed into MC-3357 where it is mixed with the 2nd local output of 10.245 to produce the 455kHz, 2nd IF and then demodulated to drive a speaker by and through AF amplifier IC M51182L.

c) S-Meter Circuit

A 455kHz signal from MC3357 is amplified and then voltage-doubler rectified to obtain DC voltage, thereby lightening an S-Meter of LCD as in the case of the RF meter.

d) SQL Switching Circuit

A noise element(component) is amplified by MC3357 to obtain SQL signal which passes through the SQL/SW. transistor 2SJ74Y to another SQL/SW(2 each of C2458) serving to switch AF Amplifier M51182L. When an optional tone squelch unit is used, the squelch signal is shut off by opening 2SJ74Y.

The voltage to operate the receiver is 6.5V regulated on the PLL PC board. (Note that the 9.6V battery voltage is directly supplied to SQL/SW and AF Power Amp.)

1-3-3 Transmitter/Receiver Checkup

When checking both transmitter and receiver sections, use a regulated DC power supply with its output voltage set to 9.6V. Do not use Ni-Cd battery.

a) Transmitter Check

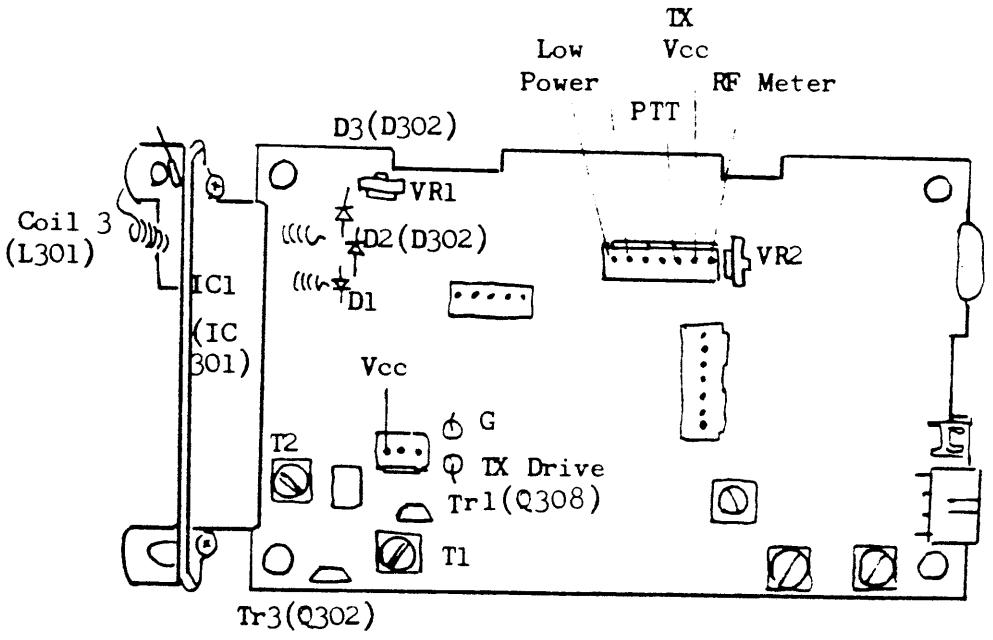
- o Make sure that the PLL is in the transmit mode by pressing the **PTT** switch. You can verify this by reading PLL output frequency.
- o Also make sure that the TX voltage is supplied from the PLL PC board to the TX/RX PC board.
- o Check output power with a power meter and make sure the high power is more than 2.5W for the frequency range of 144.000 through 147.995 and the lower power is 0.4 - 0.7W for the same frequency range. Also make sure that the high power will enable the RF-meter to light up 8 bars (of LCD) and the low power 3-4 bars.

b) Receiver Check

- o Make sure of the RX supply voltage and also check whether the squelch is on or off.
- o Next, check receiver sensitivity by a SINAD meter and make sure the sensitivity is less than 0.2uV (for 144.00-147.995MHz). At the input of -100dBu, the 7 bars of the S-meter should be lit up.
- o Also make sure whether or not scan signal is produced.

The flow charts of transmitter/receiver adjustment/check as well as trouble-shooting guides are given at page 7, 8, 9, 11, 12, 13 and 14.

1-3-4 Transmitter Adjustment & Parts Location



a) Power Adjustment

a-1. Set VR1 at its center position and turn PTT switch ON.

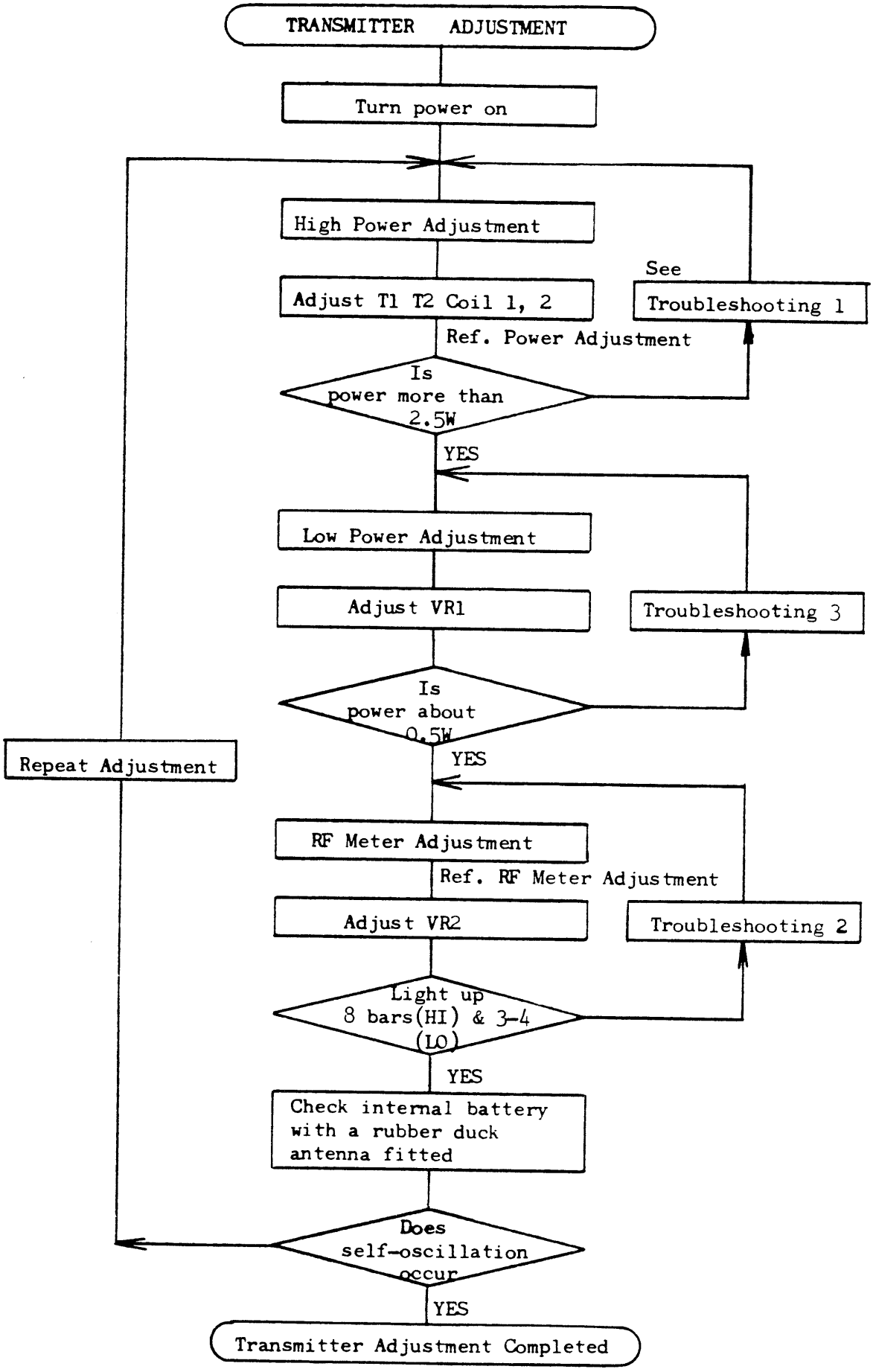
2. Set frequency to 144MHz and adjust T1 and T2 so that power will be maximized.

3. Set frequency to 147.995MHz and enlarge Coil 1 and Coil 2 so that power will be more than 2.5W and current value will be about 0.8A.

4. Push power switch to select lower power and adjust VR 1 so that low power will be about 0.4 to 0.7W.

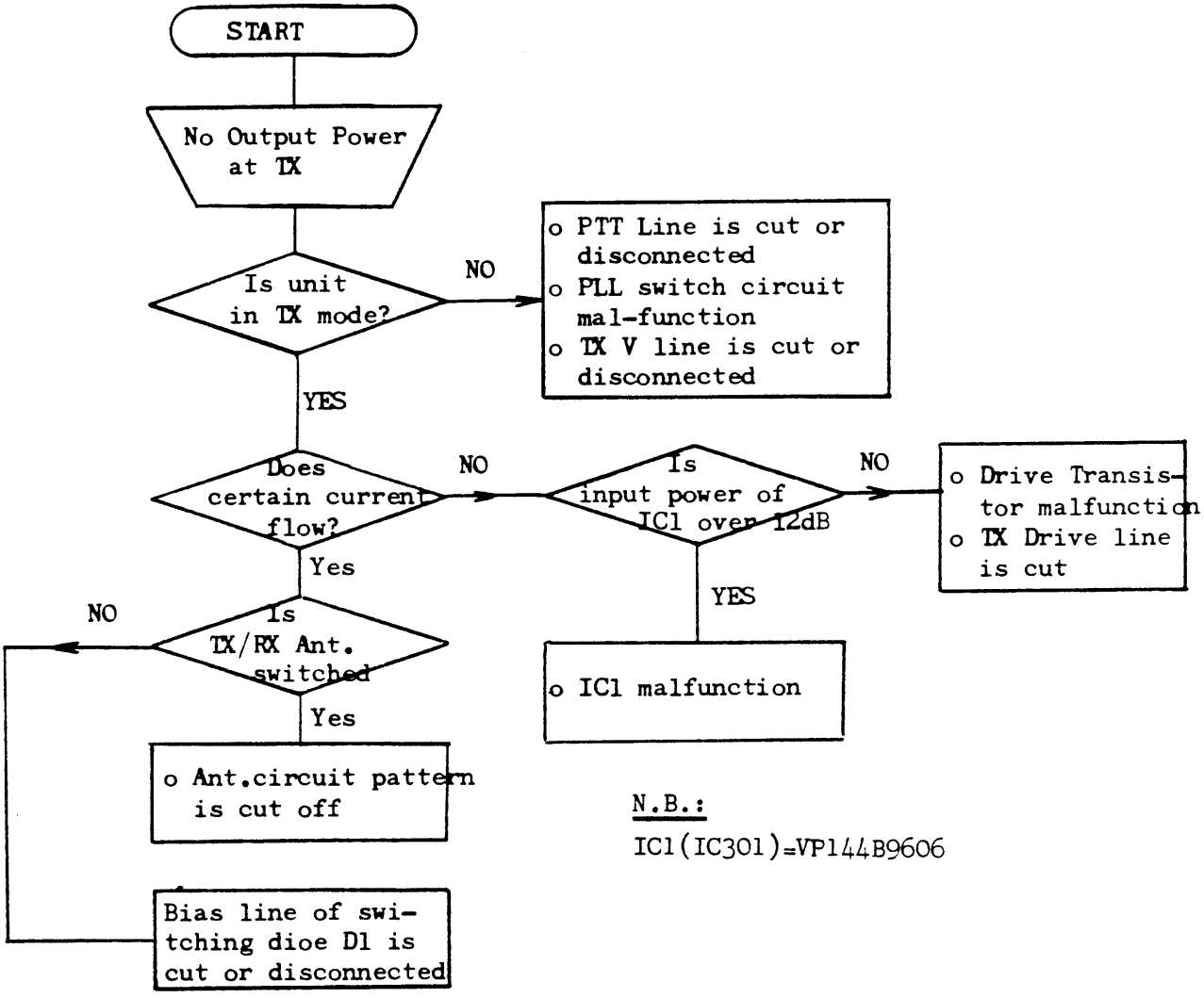
b) RF Meter Adjustment

Adjust VR2 so that 8 LCD bars will light up in the High Power and 3-4 bars light up in the Low Power.


TRANSMITTER ADJUSTMENT
Turn power on
High Power Adjustment
Adjust T1 T2 Coil 1, 2
See
Troubleshooting 1
Ref. Power Adjustment
Is power more than 2.5W
YES
Low Power Adjustment
Adjust VR1
Troubleshooting 3
Is power about 0.5W
YES
Repeat Adjustment
RF Meter Adjustment
Ref. RF Meter Adjustment
Adjust VR2
Troubleshooting 2
Light up 8 bars(HI) & 3-4 (LO)
YES
Check internal battery with a rubber duck antenna fitted
Does self-oscillation occur
YES
Transmitter Adjustment Completed

Troubleshooting Flowchart 1

Case 1: No output power is available when transmitting.

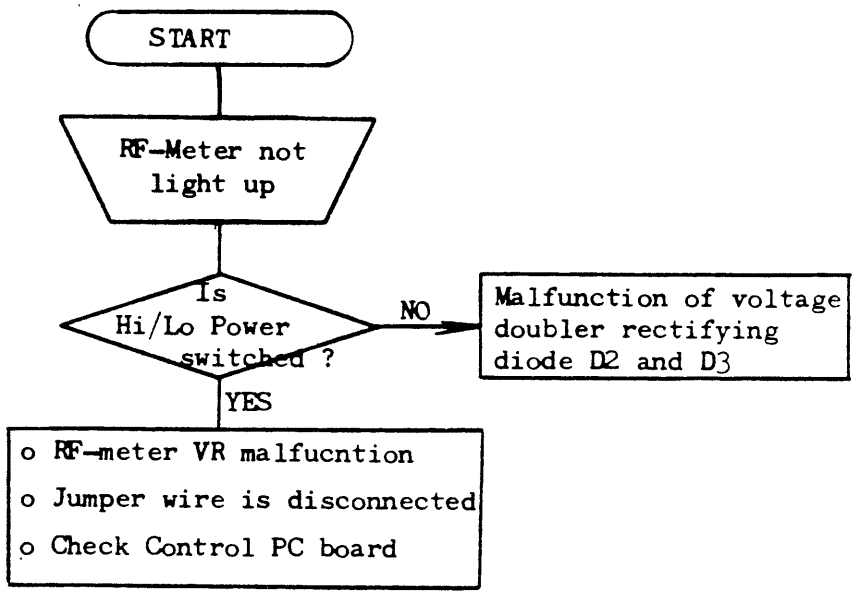


N.B.:

IC1(IC301)=VP144B9606

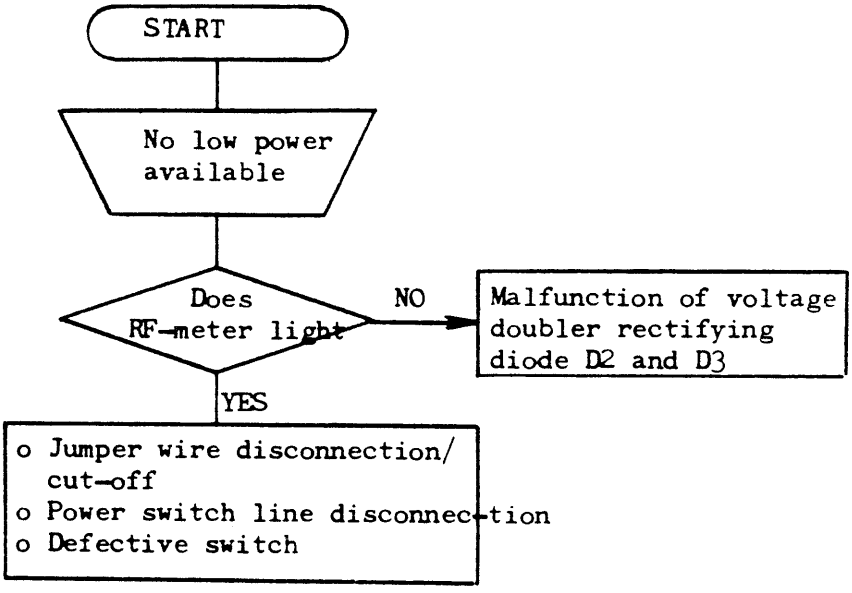
Troubleshooting Flowchart 2

Case 2: RF-Meter does not light up.

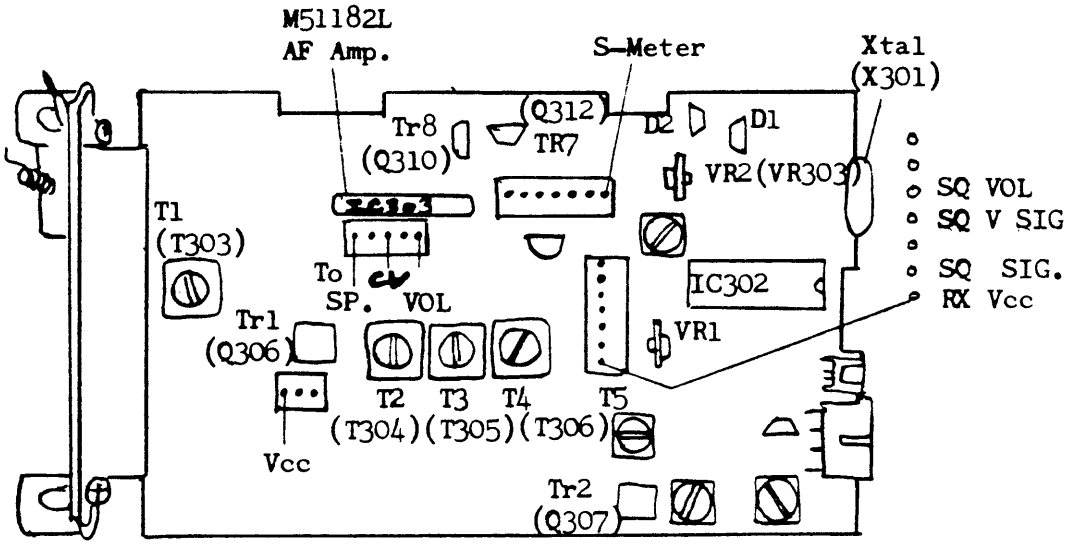


Troubleshooting Flowcharg 3

Case 3: Low power is not available.



1-3-5 Receiver Adjustment & Parts Location



a) Sensitivity Adjustment

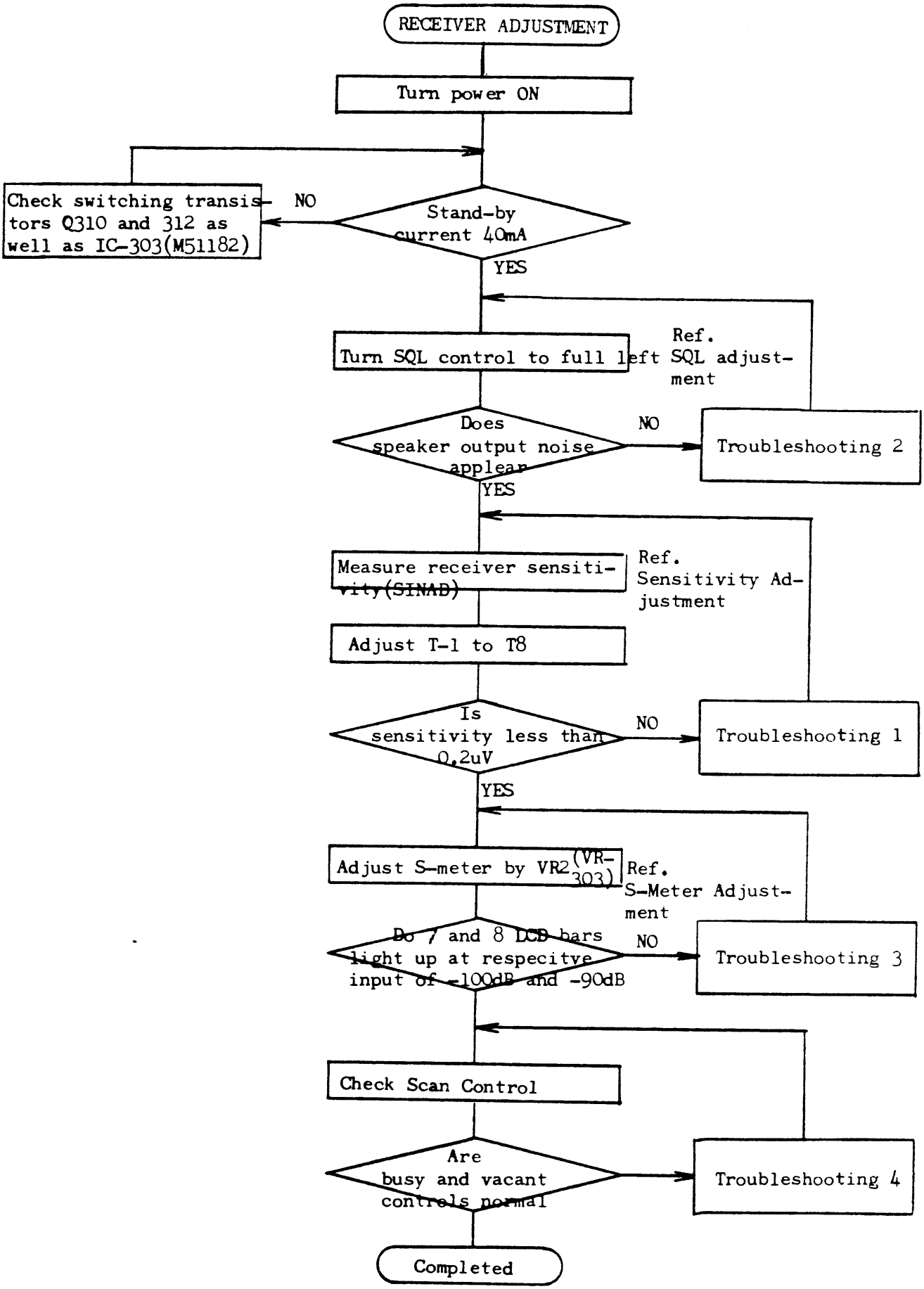
1. Set the PTT Lock Switch to the 'LOCK' side and turn off squelch control switch.
2. Adjust the T-1 to T-7 coil so that SINAD meter reading is minimized.
3. Adjust T8 coil to maximize demodulated output.
4. Set receive frequencies to 144.00 through 147.995MHz by the use of keyboard and make sure that sensitivity at each receive frequency is less than 0.2uV for 12dB SINAD.

b) Squelch Adjustment

Maximize VR1(VR304) and make sure whether the squelch is activated or not.

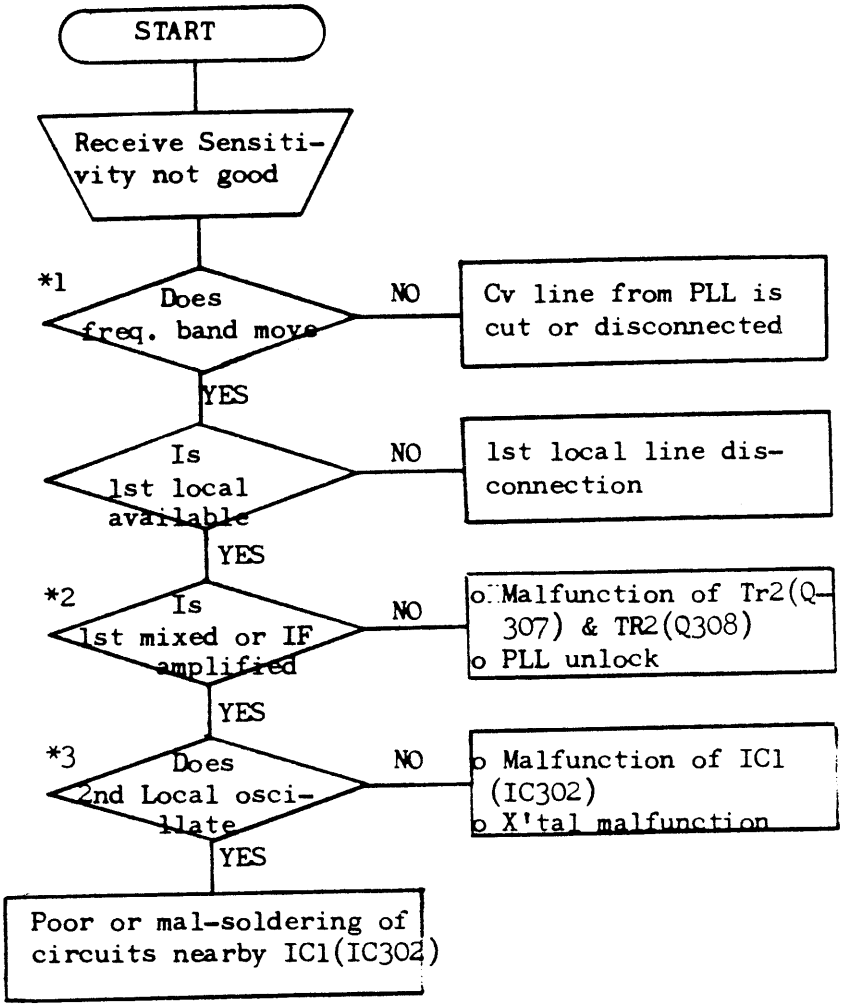
c) S-Meter Adjustment

Adjust VR-2(VR303) at an input of -100dBu so that 7 LCD bars will light up. Also make sure that 8 LCD bars will light up at an input of -90dBu.


RECEIVER ADJUSTMENT
Turn power ON
Stand-by current 40mA
NO
Check switching transistors Q310 and 312 as well as IC-303(M51182)
YES
Turn SQL control to full left
Ref. SQL adjustment
Does speaker output noise appear
NO
Troubleshooting 2
YES
Measure receiver sensitivity(SINAD)
Ref. Sensitivity Adjustment
Adjust T-1 to T8
Is sensitivity less than 0.2uV
NO
Troubleshooting 1
YES
Adjust S-meter by VR2 (VR-303)
Ref. S-Meter Adjustment
Do 7 and 8 LCD bars light up at respecitve input of -100dB and -90dB
NO
Troubleshooting 3
Check Scan Control
Are busy and vacant controls normal
Troubleshooting 4
Completed

Troubleshooting 1

Case 1: Poor receiver sensitivity



Notes:

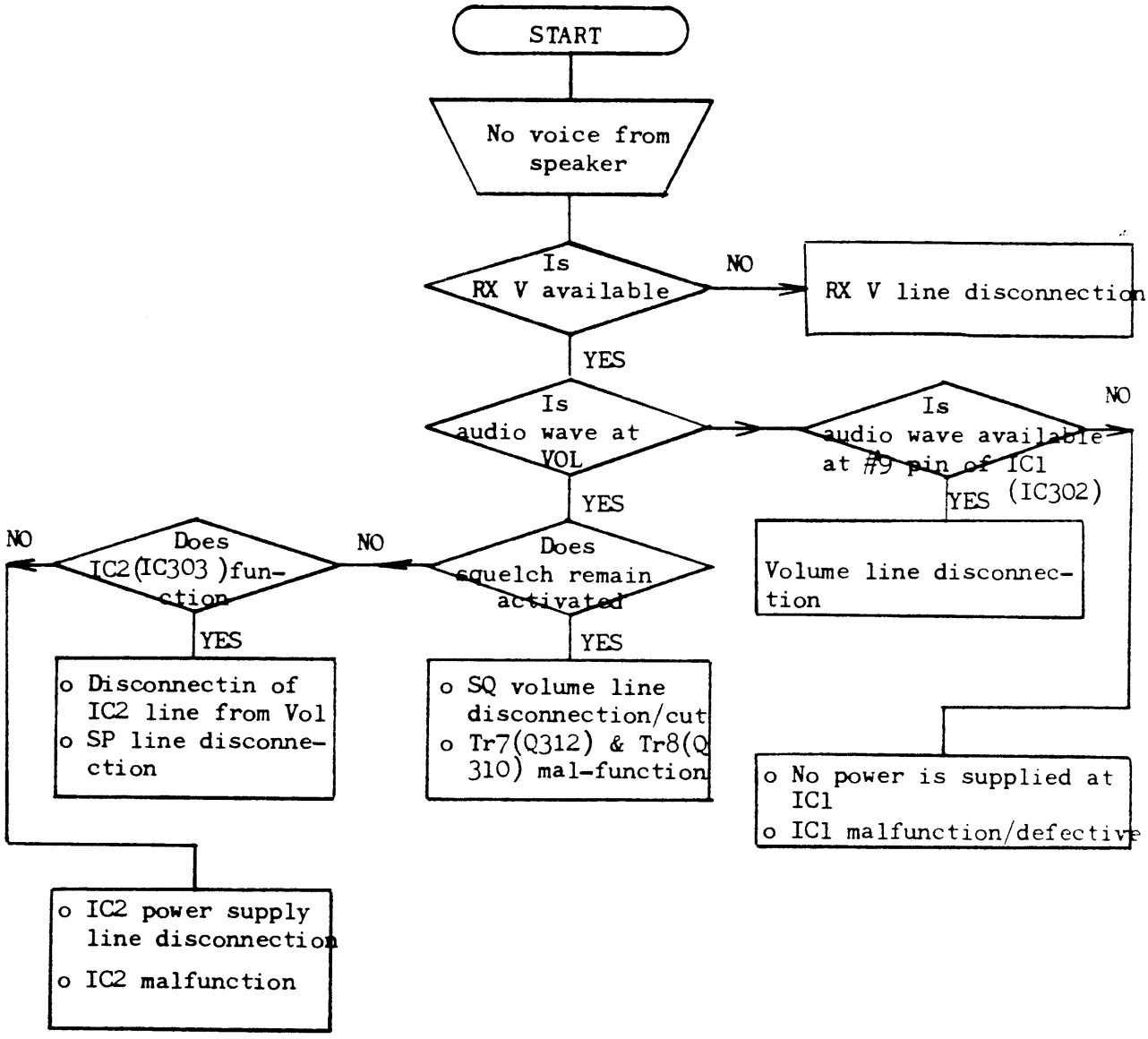
* 1 : Apply tracking generator to the antenna terminal and observe or check band at the test point terminal.

* 2 : Connect signal generator to antenna terminal with the level set to -30 to -20dBm and check the status of No. 16 pin of IC MC3357 with oscilloscope (where you can observe the waveform of 10.7MHz).

* 3 : Check 10.245MHz at No. 2 pin of MC-3357

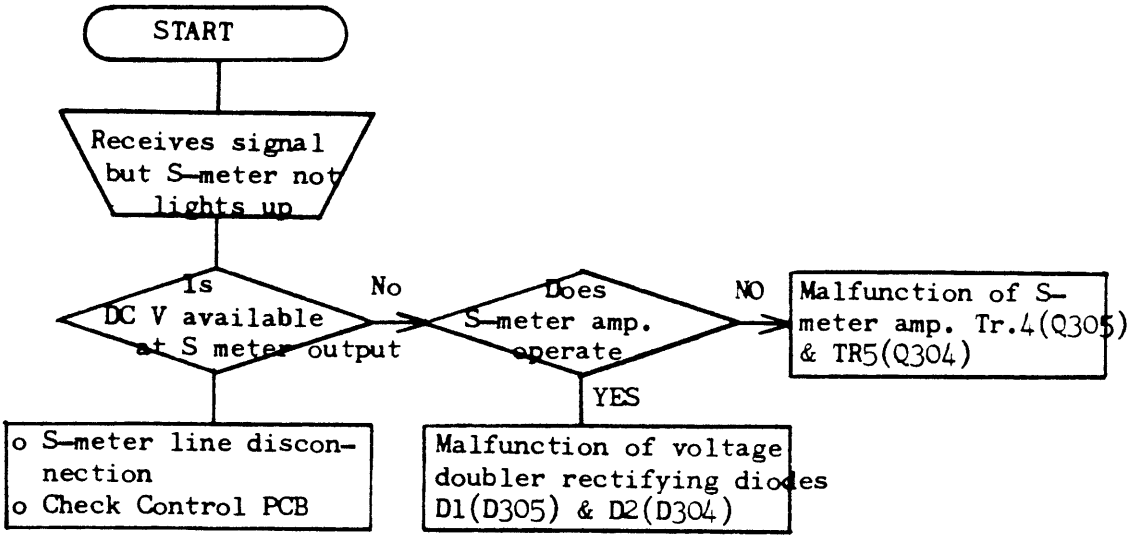
Troubleshooting Flow Chart 2

Case 2: No voice is produced from speaker.



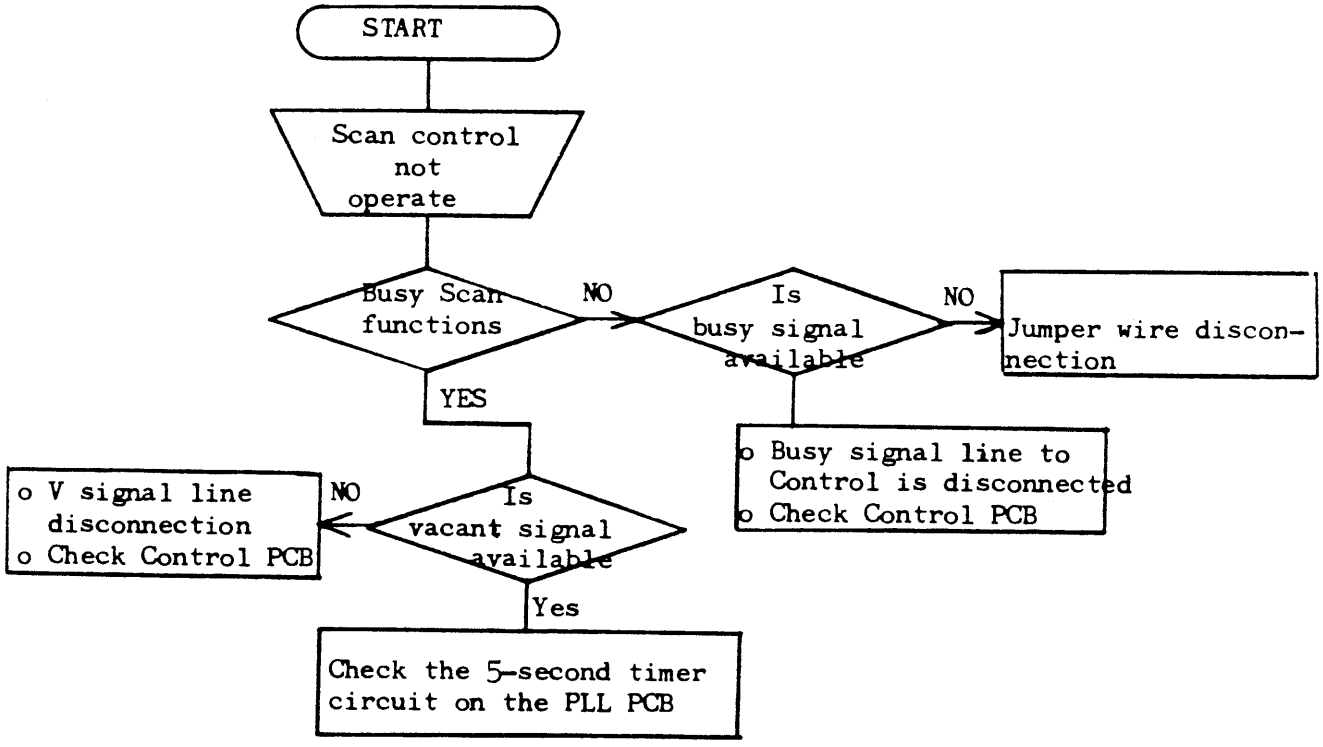
Troubleshooting Flowchart 3

Case 3: Incoming signal is received but S-meter will not light up.



Troubleshooting Flowchart 4

Case 4: Scan control does not function.



2. PLL Section

2-1 How To Remove Rear Case

See page 1 and 'Exploded View'

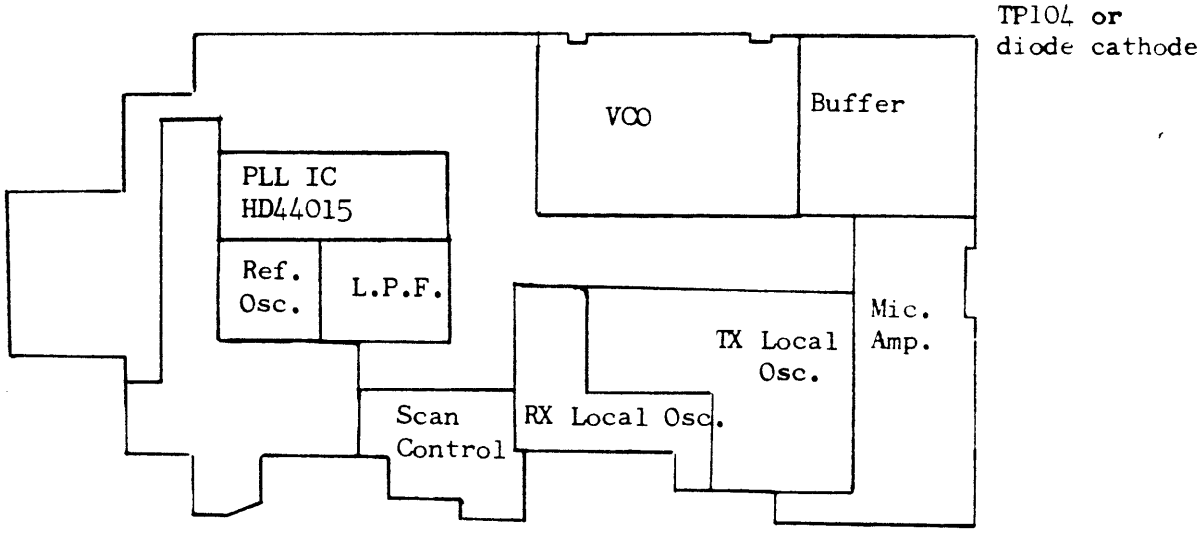
2-2 Measuring Instruments Required

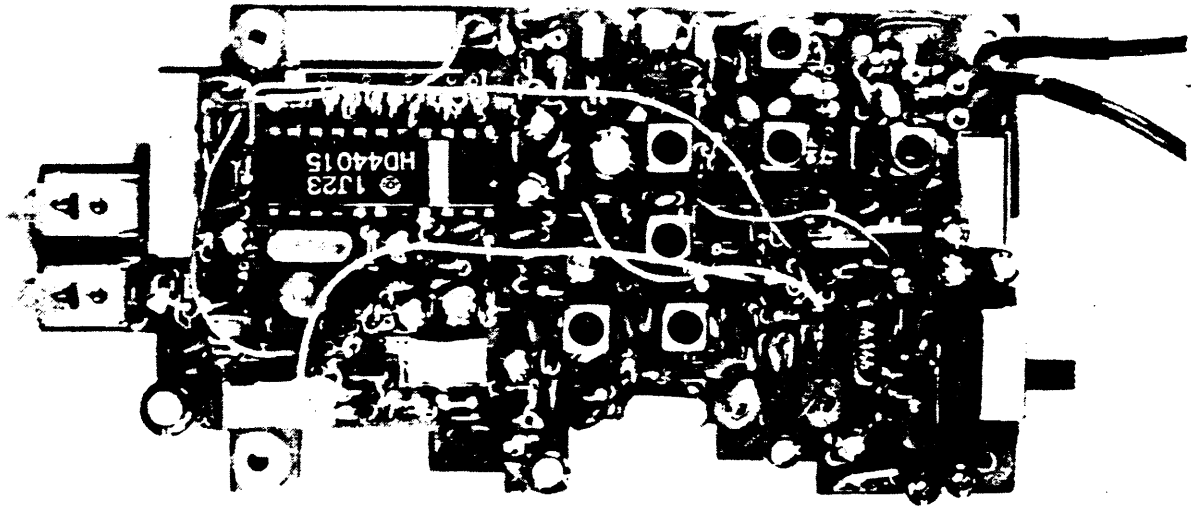
* Frequency Counter
* Oscilloscope (or RF voltmeter)
* DC Voltmeter

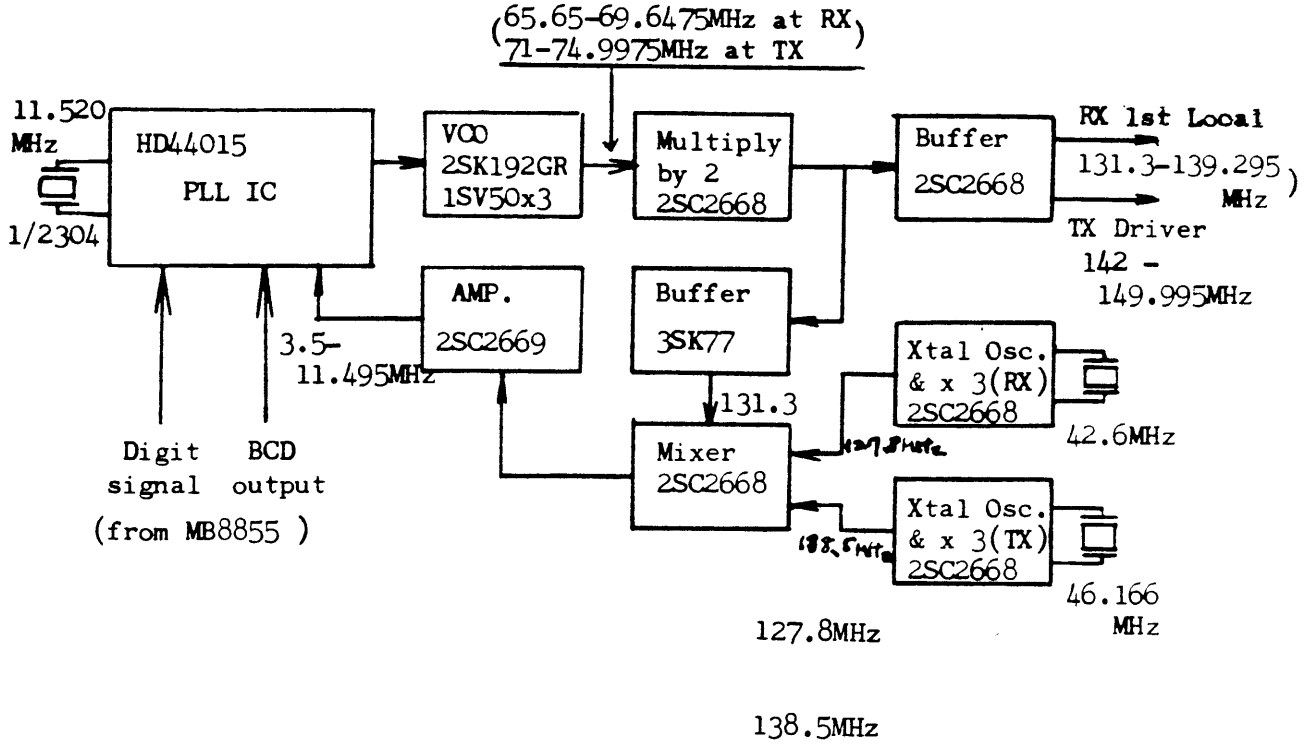
2-3 PLL PC Board (P/N 50-181-01)

2-3-1 Names of Circuits & Their Locations

Shown below is without the shielded cases.







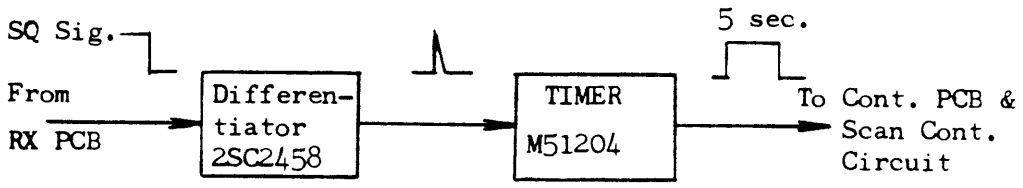
The PLL IC HD44015 is functionally comprised of Phase Detector, Low Pass Filter, Programmable Divider and Divider for reference frequency.

The reference oscillating frequency of 11.52MHz is divided by 2304 to obtain 5kHz. (In case of European version, 14.4MHz is divided by 1152 to obtain 12.5kHz). The Programmable Divider's number of division is set up by signal(4 bit parallel data x 4 digits) and its value is obtained per formula below.

No. of Division N = (Displayed Frequency MHz - 138.5)/5000

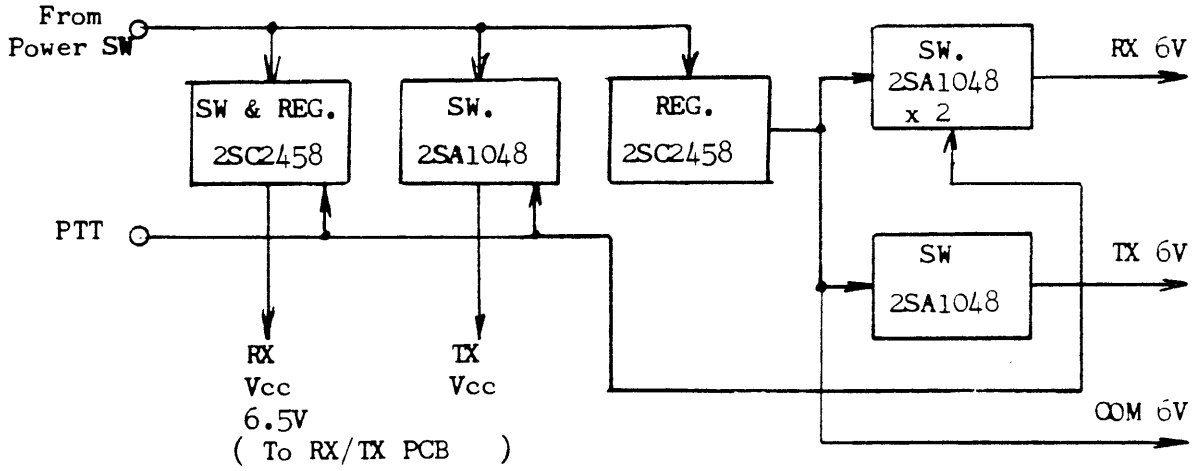
As shown in the PLL circuit block diagram, input frequencies to the PLL IC Programmable Divider (Pin No. 20) are 3.5MHz (when 142.00 displayed) through 11.495MHz (when 149.995 displayed). The VCO oscillates 1/2 frequency of the receiver 1st local (at RX) and also 1/2 frequency of transmit frequency. In addition, the separate Local Oscillators for transmit and receive(46.166MHz for transmit and 42.6MHz for receive) are provided.

a) Scan Control Circuit



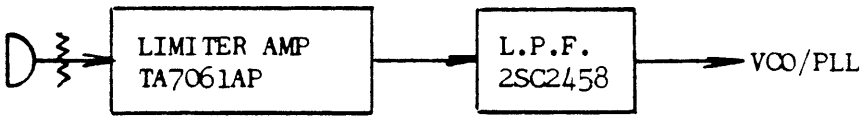
During Busy Scan, the scanning hold/delay time of about 5 seconds is preset by the internal timer.

b) Power Switching Circuit



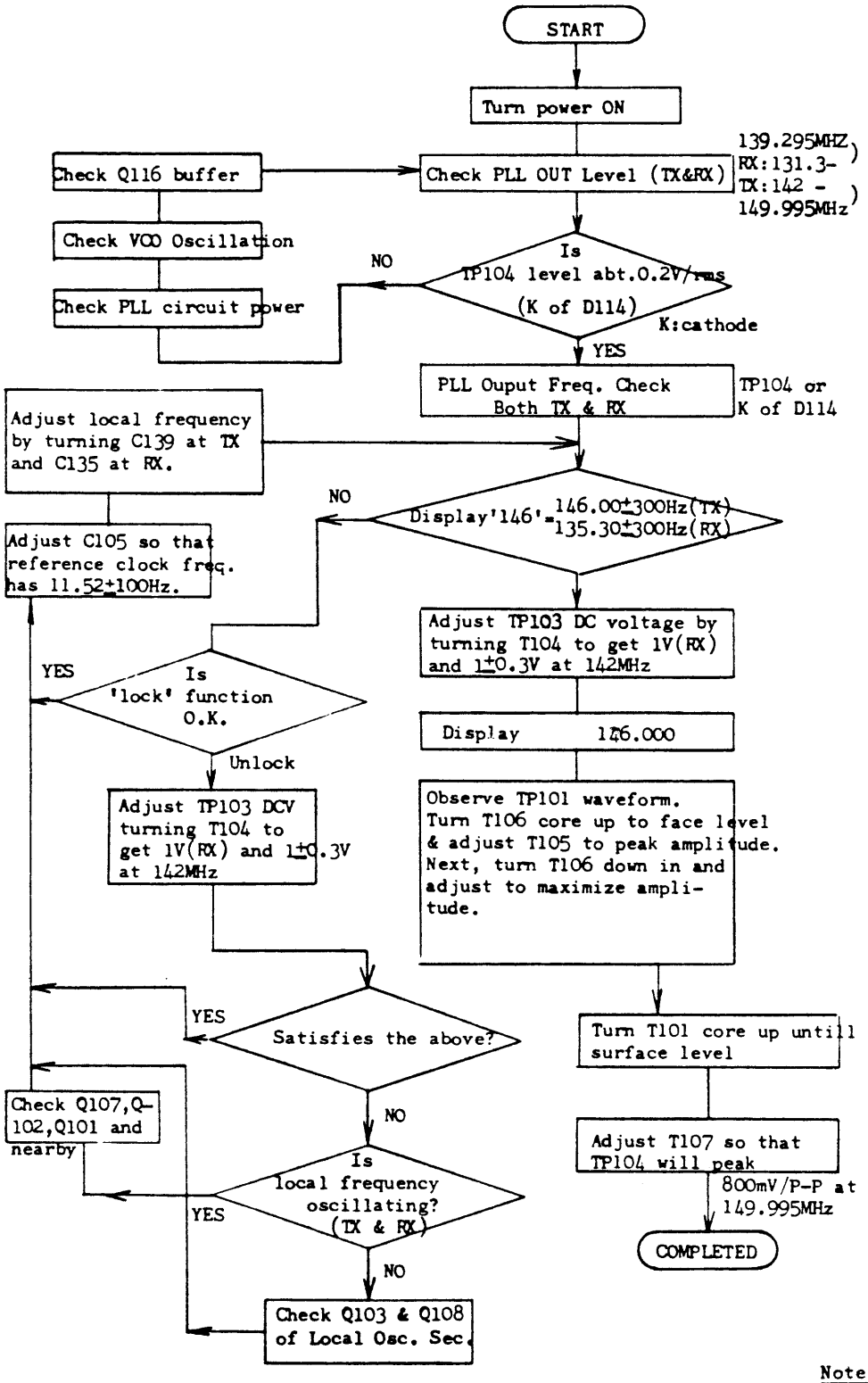
6V DC for oscillation circuit provided in the PLL circuit and also for receive is fed through regulator circuit. But the transmit power stage has only a switch circuit. So, RF output power is varied depending upon the change of power supply voltage. In other words, the output power largely changes when operating the unit immediately when battery is fully charged or when it comes near to its discharging end. Pressing the PTT Switch will turn TX/Vcc On and turn Off RX/Vcc 6.5V.

c) Modulator Circuit



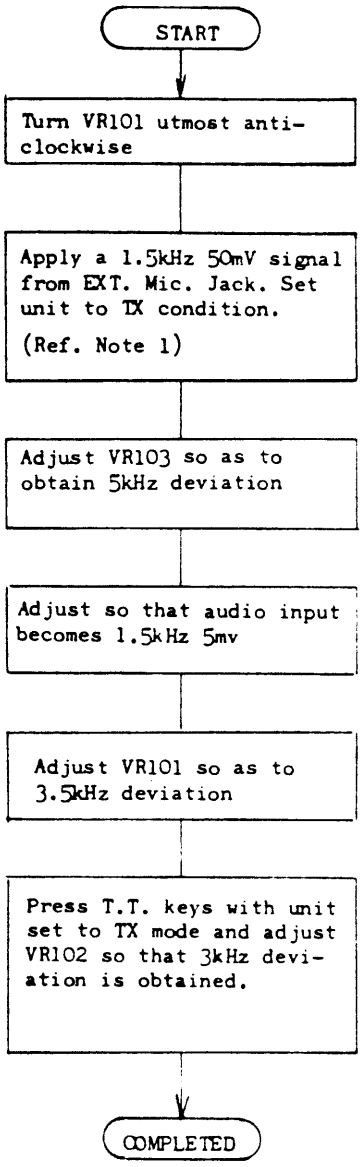
The microphone built-in is of electret type. Power is applied to IC TA7061AP only when pressing the PTT switch. Note that VR103 nearby determines frequency deviation.

Flowchart



Modulator Circuit Adjustment

Flowchart



Note 1

Plugging external speaker/ microphone into the 'EXT/MIC' jack will not set the unit into TX mode by presseing the PTT switch. Do some wiring onto the external speaker/mic plug so that the TX mode is made available.

3. Control Section

3-1 How To Remove Case

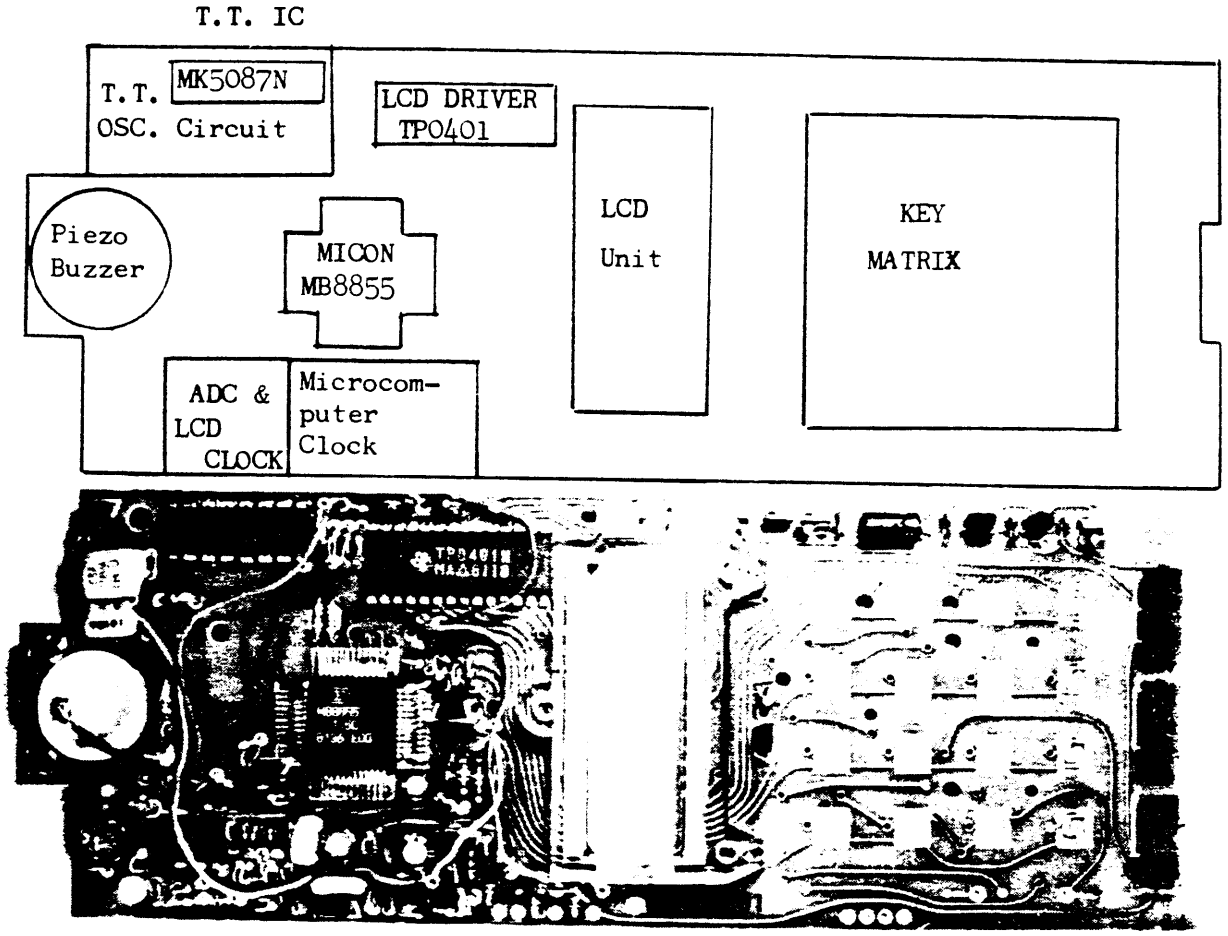
See page 1 and 'Exploded View'.

3-2 Measuring Instruments Required

* Oscilloscope
* Signal Generator

3-3 Control PC Board (P/N 50-182-01)

3-3-1 Circuit Names & Locations



3-3-2 Circuit Explanation & Normal Levels

The built-in microcomputer MB8853-115C is provided with the following functions.

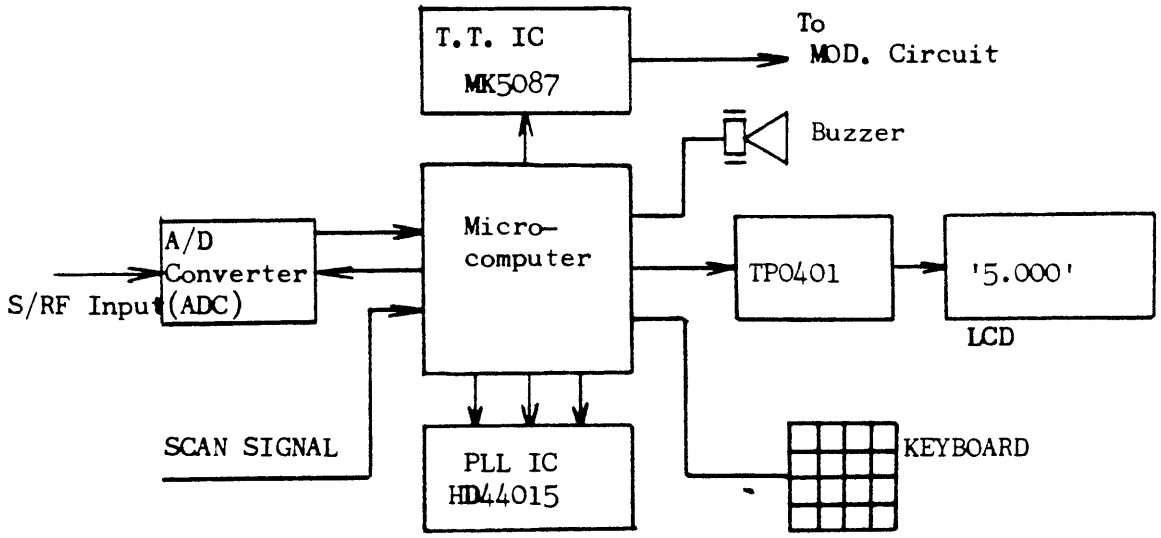
1) Frequency setup (Up/Down, Offset)
2) Frequency information transfer to PLL.(Ref. 2-3-2)
3) Transfer of display data to LCD Driver IC
4) Control of A/D Converter for S/RF-meter & Its data input
5) Control of Touch-Tone encoder
6) To drive piezo buzzer
7) Control of automatic lamp timer turn-off function
8) To judge automatic scanning stop

9) To judge battery check signal and subsequent display control

10) Memory capacity/function(9 channels)

11) Memory backup

3-3-3 Microcomputer Peripheral Circuit



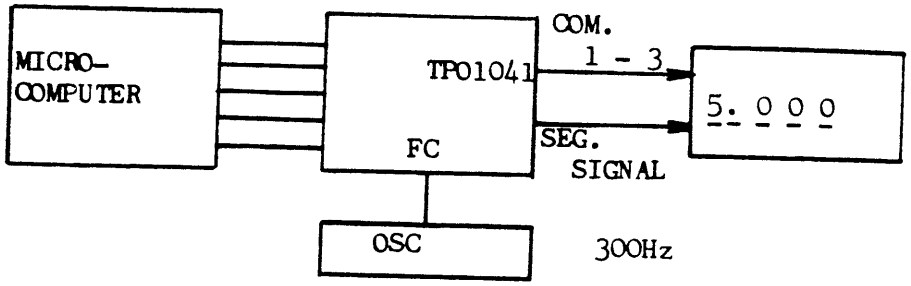
a) Keyboard Section

Tabulated below is the key matrix of the microcomputer.

OUTPUT PORT / INPUT PORT	PØ	P1	P2	P3	RØ	R1	R4
KØ	MHZUP	100KUP	5KUP	TX	STEP 2	LAMP TIMER	WRITE
K1	AUTO SCAN	100K DOWN	5KDOWN	MAIN	STEP 3	UNLOCK	+M
K2	± 600	M ADRS	M SCAN	HALT	WIDTH 2	BATT. CHECK	-M
K3	M1 CALL	M CALL	M WRITE	KEYLOCK	WIDTH 3	SQL	12.5kHz

N.B.: 'MAIN' of K1/P3 and 'UNLOCK' of K1/R1 are not used.

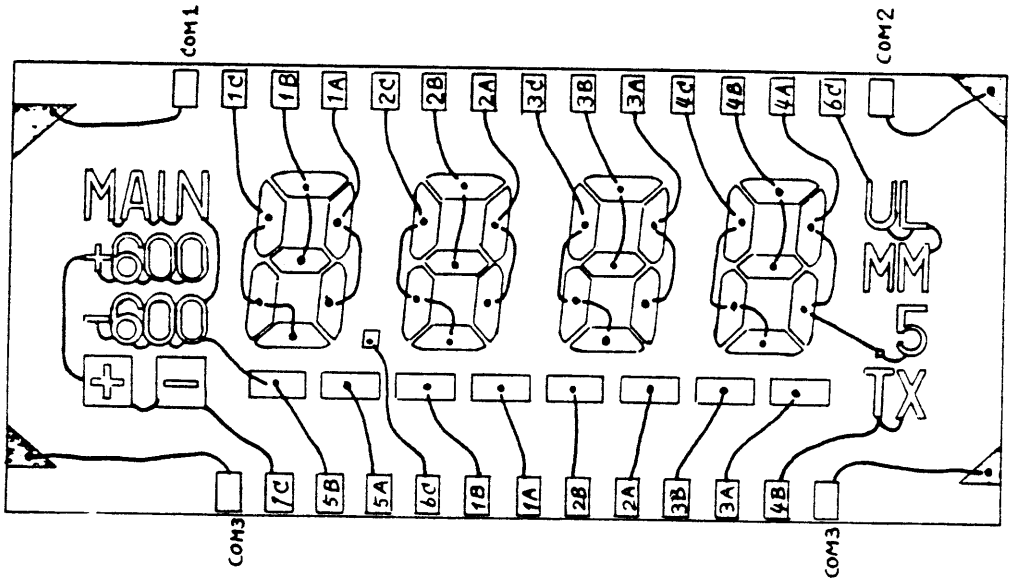
b) Display Section



An amount of signal equivalent to 6 digits of 12 is conveyed from the microcomputer to the LCD driver IC TP0401 as 4-bit parallel data where signal is converted by dynamic method to signal (for LCD display)in order to drive the LCD unit. The LCD unit segment numbers coincide with those terminal pins of IC TP0401. From this, you can easily check the driver voltage waveform when any specific LCD segment fails to light up. In short, the checkout of either something wrong with the IC or with the LCD can simply be carried out.

c) LCD Section

The LCD unit patters are indicated below.



The LCD unit terminal pin numbers like 1C, 5B, ... correspond to those of the LCD driver IC TP0401 pins.

c-1) Disassembly of LCD Unit

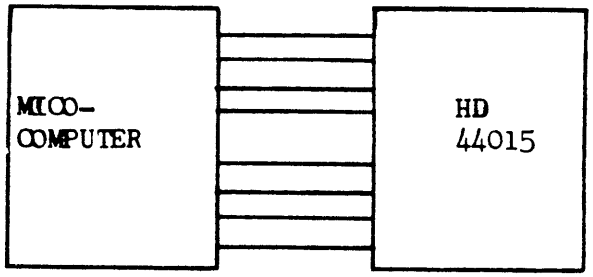
The LCD unit can be taken away from the Control board by removing 3 screws (M2.6) located in a triangular form on the reverse side of the control PC board. The central screw out of the three is fitted with a mylar film washer for short-circuit protection and do not lose it.

c-2) In case the upper or lower half of the LCD seven segments do not light...

Very rare, though, it may so happen that either upper half or lower half of the seven segments do not light up because the control PC board gets warped for some reason or other or there is something wrong with interconnecting conductive rubbers between the LCD elements and the control PC board.

In such a case, the unit had better be disassembled, checked in terms of connection and then re-built. Even when this procedure does not serve to solve this problem, you may have to doubt about the LCD unit performance itself.

d) Frequency Codes to PLL



Nϕ - N3 .... BCD Input

Dϕ - D3 .... Digit Strobe Signal

4-bit parallel signal (Nϕ - N3, N3=MSB) is transferred from the microcomputer to the PLL IC HD44015 one after the other in the form of digit signal (Dϕ - D3, Dϕ=1st digit).

You can carry out the checkout procedures about the input/output code between the microcomputer and the PLL IC HD44015 in the following manner.

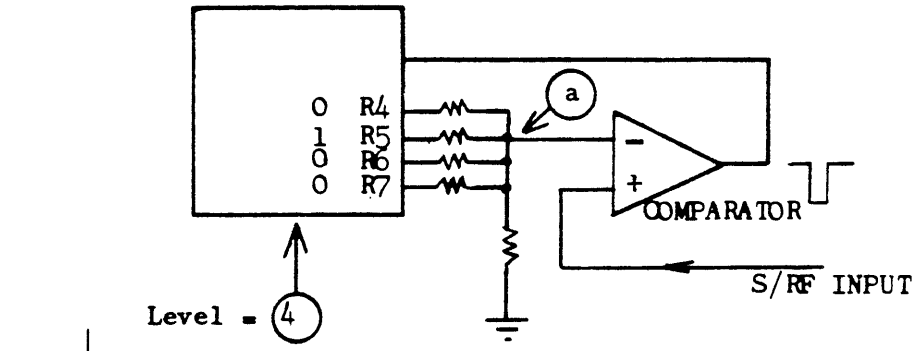
- o Check each of the PLL IC pins, Nϕ - N3 with oscilloscope.
- o When the logic level remains at 'H', a path between the microcomputer and the PLL IC is considered to be 'open'.
- o But in case the level is kept at 'L', it is most likely that somewhere between the microcomputer and the PLL IC is short-circuited to ground.
- o In normal operation, you can observe dynamic operation signal on the oscilloscope tube. When no signal is observed without circuit being open or short, something is probably wrong with the microcomputer itself.

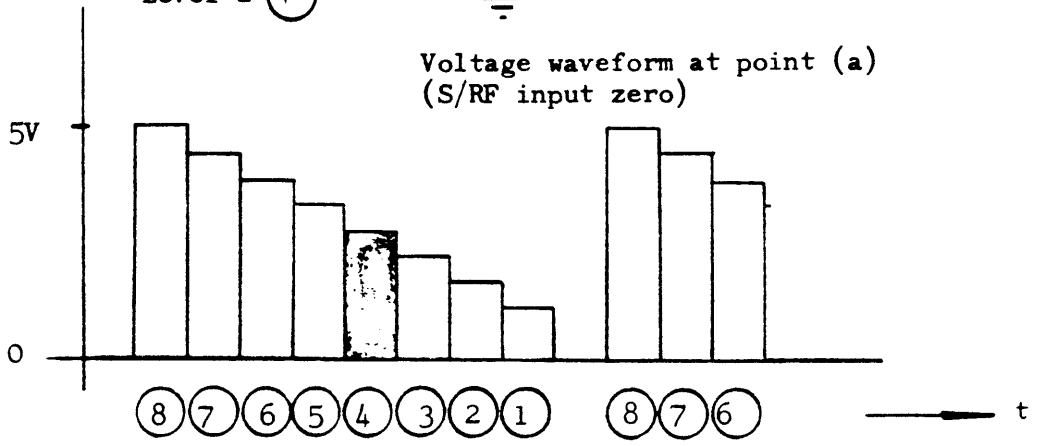
Care should be taken in checking/observing wave-forms since these lines are used to transfer other signals as well.

Check of Digit Strobe Signal:

Unless the entry key is pressed, Dϕ - D3 pins must be at the level of 'L'. Pressing either UP or DOWN key allows you to observe strobe signal to take in PLL BCD code at each digit pin every one time. If you fail to do so, transfer lines need check. When the lines are O.K., the microcomputer may malfunction.

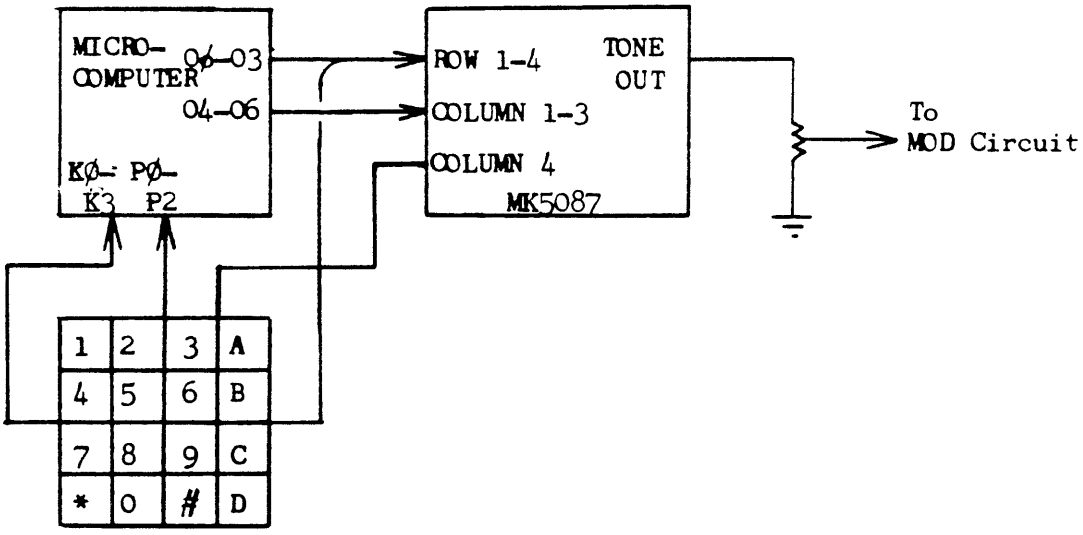
e) A/D Converter for S/RF Meter





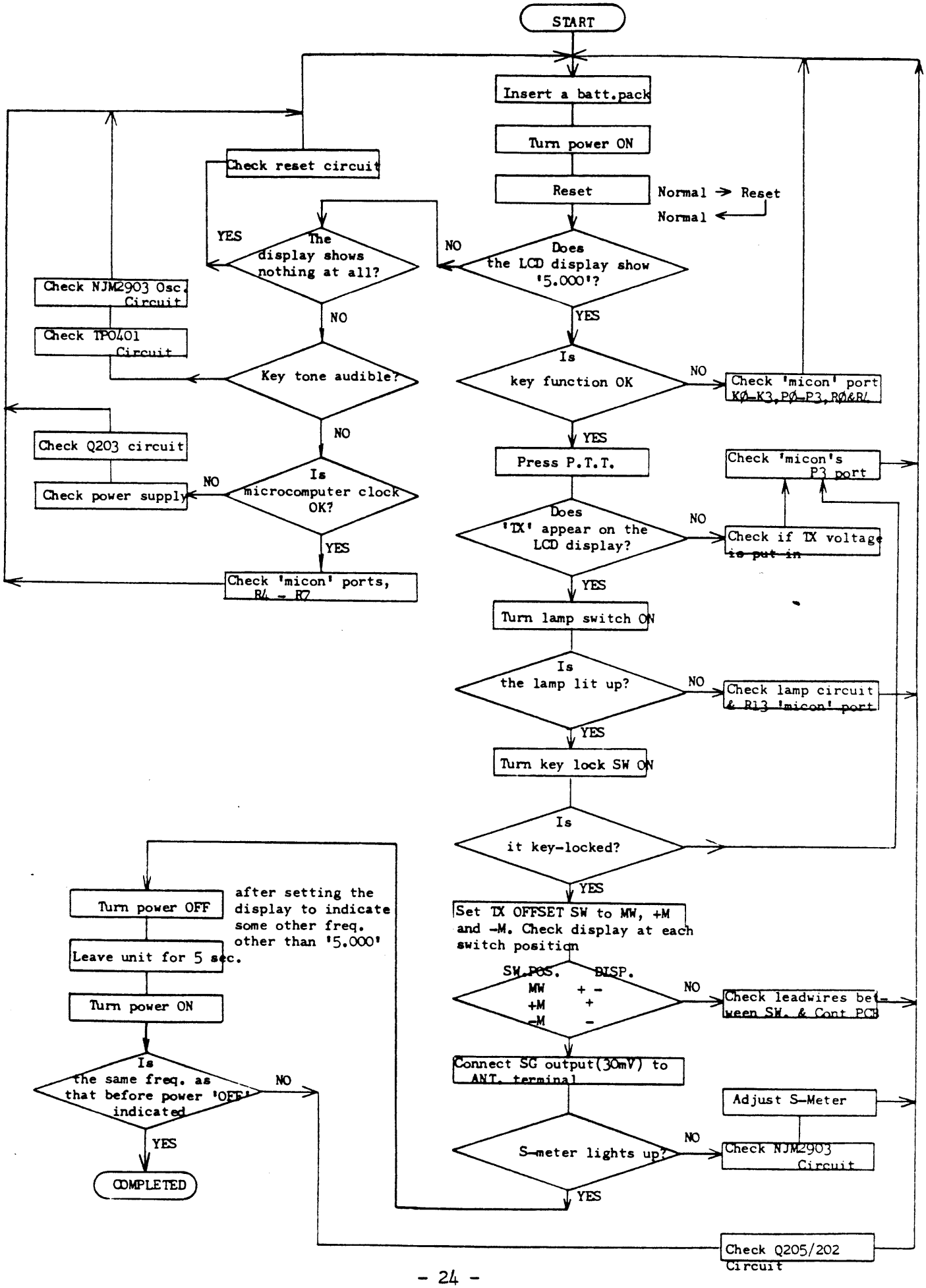
Voltage at the point of (a) is constantly supplied to the microcomputer port of R4 through R7 in sequence. When the S/RF-meter has an input voltage of equivalent to that of (4) and the voltage at the (a) point becomes equal to (4), the comparator output level changes from 'H' to 'L' and enters the R12 port as strobe signal. Then, the microcomputer takes the values of R4 through R7 (i.e. 0 1 0 0) as those for S/RF-meter display and transfer the data to TP0401 LCD driver IC thereby lighting the 4 LCD bars.

f) DTMF Encoder



16 keys on the keyboard will be so changed by the microcomputer as to serve as those for DTMF. (Note this is available only for the U.S. version unit. The European version unit does not include tone encoder IC MK5087 and its peripheral circuits)

Control Section Checkout Chart



1. NiCad Battery & Charging

1-1 General Handling Precautions

Refer to the page 4 and 5 of the instruction manual.

1-2 Charging Current

150mA is the nominal charging current which means the maximum 'idling current' at full charge. So, at an initial stage of charging, a flow of larger current, for instance, 150mA or 200mA is considered to be normal. Be sure to see, however, that a charging current of more than 150mA should not run after a battery reaches full charge. Also note that the battery will not become destructive at all even during long-hour continuous charge as long as the charging current is less than 150mA.

1-3 Chargers for PCS-300

See that owners of PCS-300 use its exclusive chargers mentioned below.

1-3-1 BC-1

This charger is designed specifically for use with the exclusive NiCd battery pack supplied with PCS-300. It is so designed to limit the running current to 150mA at most even after full charge that will require the maximum 6-7 hours. However, be careful especially when primary input voltage exceeds the specified level of 120V.

1-3-2 MC-1

This charger is designed to take in the charging current from car cigarett adaptor (jack) and the nominal operating voltage is DC12V to DC15V. The power supply voltage of just 12VDC will not allow charging current to flow more than 20-40mA and so, it will require more than 12-hour charging time but still will fail to reach the 100% full charge. The idling current of 150mA will be reached when DC15V is applied to the charger for 6-7 hours. So, it is preferable to apply 13-15VDC as a actual charging(operating) voltage.

2. PT-67 Tone Unit (Option)

The tone frequency of this unit is factory-preset to 100Hz. When using it for some other frequency, follow the procedures below.

2-1 Instruments Required

* AF Oscillator
* Oscilloscope
* Signal Generator
* Linear Detector

2-2 Mounting

Refer to page 16 of the instruction manual.

Insert a 5P connector and also insert the parts-mounted tone unit PC board into the 2 pins provided on the TX/RX board and solder these pins. Next, solder the read leadwire onto the test pin next to the crystal filter.

2-3 PL Tone Frequency Adjustment

The IC MC4138 oscillates by turning on TONE/SWL switch or PL TONE switch and pressing PTT switch (i.e. with PCS-300 set in TX mode).

Set AF oscillator to the desired frequency and apply(connect) an AF oscilloscope probe to R403. According to Lissajous fitures, adjust frequency to obtain the desired one by turning VR402.

2-4 PL Tone Frequency Deviation Adjustment

Turn on TONE/SWL switch or PL TONE switch and set PCS-300 to TX mode.

Use linear detector and adjust VR403 so as to have frequency deviation of 0.5kHz.

2-5 Input Level Setup (Tone Squelch Adjustment)

Set PCS-300 to RX mode and turn TONE/SQL switch on.

Set signal generator output frequency to the receive frequency of PCS-300.

Apply modulation by the frequency set by the procedure 5-3 with its frequency deviation set to 0.5kHz and adjust VR401(i.e. input adjustment) in order to open tone squelch. In this case, signal generator output level should be set more than -110dBu. Next set the frequency deviation to 0.4kHz and turn VR401 to the point that the tone squelch is closed.