
AR3030

SERVICE MANUAL

AOR, LTD.

SIGNAL PATH CIRCUITS

Refer to Figure 1 Functional Block Diagram, signals selected by antenna switch enter in 10/20dB attenuator then fed to antenna filter block.

4 bandpass filters for 3.5MHz -18MHz, a low pass filter for 30-540kHz, a high pass filter for 18-30MHz, 10dB attenuator for 0.54-1.8MHz are provided.

One of these elements is selected automatically by data from CPU.

Then signals pass through the low pass filter (cutoff 32MHz) and enter in singly balanced mixer to get 51.655MHz I.F.

Monolithic crystal filters limit the bandwidth of +/-7.5kHz and feed to 2nd balanced mixer after some amplification.

The 2nd mixer makes 455kHz I.F. with stable 51.200MHz local carrier injection which is multiplied by 12.800MHz standard clock. ($12.800 \times 4 = 51.200$)

The 2nd I.F. signal of 455kHz passes through selected filter. In mode of AM, S.AM, SSB and CW, signals are amplified and detected by 4 stage IF AGC/amplifier and each detector.

In FM mode, 2 stage IF amplifier and combination IC MC3357 works as amplifier/limiter/detector.

In S.AM mode, synchronous pilot carrier is generated by PLL IC 4046N locked with received 455kHz carrier.

Detected audio signal for each mode is selected by CMOS analog switch and then amplified in audio power amplifier to drive internal loud speaker.

LOCAL OSCILLATORS

1st LOCAL OSCILLATOR

PLL synthesizer VCO oscillates 51.655MHz higher frequency than receiving frequency including upto date DDS technique in 5Hz steps with very low noise oscillation in the loop. 5 ppm TCXO (temperature controlled crystal oscillator) is included as standard reference clock.

2nd LOCAL OSCILLATOR

Fixed 51.200MHz is produced by multiplied (x4) of 12.8MHz TCXO.

BFO(beat frequency oscillator)

In mode LSB, USB, FAX, 14MHz band crystal units are provided for frequency to be divided in 32 to get precise injection carrier and filtered for better wave form.

In CW mode, ceramic resonator generates stable variable carrier to be injected to product detector.

MAINTENANCE

TEST EQUIPMENT REQUIRED

Following is a list of test equipments recommended for maintenance of this receiver.

1. DC power supply well regulated 12V 1 ampere capacity x2 units.
2. Digital multimeter.
3. RF millivolt meter.
4. Spectrum analyzer.
5. Tracking generator.
6. Oscilloscope.
7. Resistor 470 ohm 1/4 watt.
8. Capacitor 0.1uF 50 V mylar or other.
9. Frequency counter precision type 0.05 ppm.

ALIGNMENT AND CALIBRATION

It is not necessary to align a new receiver. Each receiver is carefully aligned and checked by our expert technicians before it is forwarded from the factory.

If it comes necessary to align any of the units in the AR3030 receiver, proceed as follows:

FRONT RF BOARD

Tracking generator/Spectrum analyzer setup

Output level	-30dBm
Start frequency	300kHz
Stop frequency	900kHz
R/bandwidth	10kHz
V/bandwidth	30kHz
Analyzer RF level	-30dBm
Vertical scale	5 dB/div

Preparation

Remove 7 screws of RF board to be off the board from chassis. Desolder the bridge at input pattern of L28 toroid coil foils side. Set the RF board at normal position and fix it with 4 screws at corners only.

Connect tracking generator output to ANT terminal.

Connect analyzer input at the test point (2 pins component side) at L28 toroid coil.

Antenna filter reference as follow:

<u>Receiver range</u>	<u>Wc-Low</u>	<u>Wc-High</u>	<u>Coils</u>
30kHz - 540kHz	*****	580kHz	L20, L21, L22
1.8MHz- 3.5MHz	1.68MHz	3.7MHz	L16, L17, L18, L19
3.5MHz- 7.0MHz	3.2MHz	7.5MHz	L12, L13, L14, L15
7.0MHz- 11MHz	6.5MHz	12.8MHz	L8, L9, L10, L11
11MHz - 18MHz	10.3MHz	21.8MHz	L4, L5, L6, L7
18MHz - 30MHz	16.8MHz	*****	L1, L2, L3

Where WC-Low, Wc-High mean cut-off frequency

L20, L21, L22 adjustment

Receiver setup at 400kHz, ATT 0dB, AGC FAST.
Tracking generator/Analyzer setup, marker frequency 580kHz/High.
Adjust three coils at the best point for inband loss, inband ripple, outband attenuation.

L16, L17, L18, L19 adjustment

Receiver setup at 2.5MHz, ATT 0dB, AGC FAST.
Tracking generator/Analyzer setup, change START frequency at 1MHz, STOP frequency at 5MHz, Marker freq. 1.68MHz/Mark-low 3.7MHz/Mark-high, R/bandwidth 30kHz, V/bandwidth 100kHz.
Adjust four coils at the best point for inband loss, inband ripple, outband attenuation.

L12, L13, L14, L15 adjustment

Receiver setup at 5.5MHz, ATT 0dB, AGC FAST.
Tracking generator/Analyzer setup, START freq. 2MHz, STOP freq. 10MHz, Marker freq. 3.2MHz Mark-low 7.5MHz/Mark-high, R/bandwidth 100kHz, V/bandwidth 300kHz.
Adjust four coils at the best point for inband loss, inband ripple, outband attenuation.

L8, L9, L10, L11 adjustment

Receiver setup at 10.5MHz, ATT 0db, AGC FAST.
Tracking generator/Analyzer setup, START freq. 4MHz, STOP freq. 16MHz, Marker freq. 6.5MHz/Mark-low 11.7MHz/Mark-high, R/bandwidth 100kHz, V/bandwidth 300kHz.
Adjust four coils at the best point for inband loss, inband ripple, outband attenuation.

L4, L5, L6, L7 adjustment

Receiver setup at 15.5MHz, ATT 0dB, AGC FAST.
Tracking generator/Analyzer setup, START freq. 7MHz, STOP freq. 24MHz, Marker freq. 10.3MHz/Mark-low 19.8MHz/Mark-high, R/bandwidth 100kHz, V/bandwidth 300kHz.
Adjust four coils at the best point for inband loss, inband ripple, outband attenuation.

L1, L2, L3 adjustment

Receiver setup at 25.5MHz, ATT 0dB, AGC FAST.
Tracking generator/Analyzer setup, START freq. 12MHz, STOP freq. 40MHz, Marker freq. 16.8MHz/Mark-low 32MHz/Mark-high, R/bandwidth 100kHz, V/bandwidth 300kHz.
Adjust three coils at the best point for inband loss, inband ripple, outband attenuation.

L25, L26, L27 adjustment

In same condition as above for L1, L2, L3, adjustment, adjust these three coils too for the best result for higher range of the band.

Re-solder the bridge at input of the L28 to restore at foilside.

L29, L33, L34 adjustment

Again off the RF board from chassis.

Remove two coaxial cables at J2 and J8.

Connect generator output at test point of L28 component side.

Connect analyzer input terminal to secondary of L35.

(analyzer impedance at 50 ohm)

L33 and C25 work as L matching network with very low Q and no need to be aligned. Do not try to re-align L33.

Receiver setup at 10.5MHz, ATT 0dB, AGC FAST.

Tracking generator/Analyzer setup,

Output level -50dBm

Center freq. 51.655MHz

Span 50kHz

Marker freq. 51.655MHz

R/bandwidth 10kHz

V/bandwidth 30kHz

Analyzer RF level -30dBm

Vertical scale 5dB/div

Adjust L29 and L34 at the best point for inband loss, inband ripple, outband attenuation.

Restore the RF board with 7 screws and 2 coaxial cables on correct position. Short coaxial cable on J8 connector.

L37, L38, L35, L36 adjustment

Additional equipment requires as follow:

Standard Signal Generator SSG

Audio level meter

External speaker

Set SSG at 7.500MHz, 400Hz/60% modulation, 3 dBu/EMF output.

Set Receiver at 7.500MHz, AM mode, 0dB ATT, Fast AGC, Low Tone, Normal position Band Width BW.

Preparation:

Connect SSG output to antenna input connector of the receiver.

Connect external speaker at J13 SP socket of rear panel.

Connect audio level meter and oscilloscope parallel to the external speaker.

Pull out two coaxial cables again at J2/J8 and check with spectrum analyzer and frequency counter for levels as follow:

	<u>J-2 1st lo.</u>	<u>J-8 2nd lo.</u>
Injection signal level	-10 dBm	-20 dBm
Injection signal frequency	59.155000MHz	51.200000MHz

If it tolerates in big amount, see VCO board paragraph shown later.

Set receiver controls as follow:

RF GAIN full clock wise position

SQL full counter clock wise position

ANT SELECTOR LW/HF ANT position

VOL 12 o'clock position

Adjust L37, L38, L39 for maximum level at audio level meter. You may increase level of SSG if necessary in above adjustment. Upto 5.0 dBu/EMF level is recommended for under AGC start level.

After above, adjust L35, L36 for maximum audio level.

IF-AF board

Tracking Generator(TG)/Spectrum Analyzer(SA) setup

	<u>AM 6kHz</u>	<u>SSB 2.4kHz</u>	<u>CW 500Hz</u>	<u>FM</u>
1) output level	-70 dBm	-70 dBm	-70 dBm	-70 dBm
2) center freq.	455kHz	455kHz	455kHz	455kHz
3) Span	10kHz	5kHz	2kHz	50kHz
4) R/bandwidth	3kHz	3kHz	1kHz	3kHz
5) V/bandwidth	10kHz	10kHz	3kHz	10kHz
6) SA RF level	-50 dBm for all mode			
7) V/div	5 dB for all mode			

L2, L6, L3, L7, L4, L8 adjustment (IF filter)

- 1) Connect TG output to J-1 through 470 ohm resistor in series.
- 2) Connect SA input terminal to R-35 for Q-3 emitter through 0.1uF DC blocking capacitor in series.
- 3) Adjust each coil for minimum ripple at each mode vs coils.

AM	L3/L7
SSB	L2/L6
CW	L1/L5
FM	L4/L8

L15 adjustment (AM/AGC DET)

- 1) Connect TG output to J-1 through 470 ohm resistor in series.
- 2) Connect SA input to Pin 4-Pin 2 of J16 455kHz IF output. J16 is 8 pin DIN connector as AUX socket at rear panel.
- 3) Setup of TG/SA is as same as for AM mode except for SA RF level at -50dBm.
- 4) Set receiver at AM mode.
- 5) Adjust L15 for symmetric wave form on SA.

L13 adjustment (FM DET)

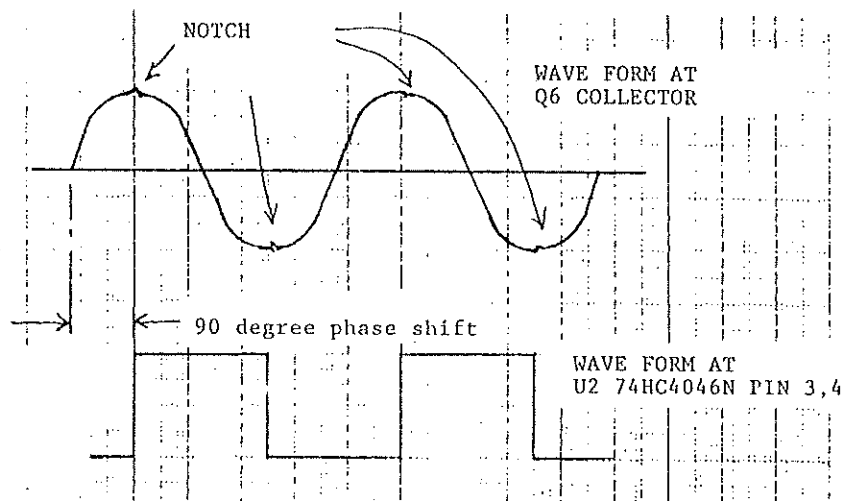
- 1) Connect 2 pin plug from RF board (as originally plugged in) to J-1.
- 2) Connect an oscilloscope at J-15 FAX output socket at rear panel.
- 3) Connect SSG output to ANT connector of the receiver.
- 4) SSG/receiver setup as follow:
SSG: 7.500MHz, 400Hz/3.5kHz deviation, 0 dBu/EMF output.
receiver: 7.500MHz, FM mode, ATT 0 dB, Tone LOW
- 5) Adjust L13 for best S/N, distortion watching wave form on the oscilloscope.

L12 adjustment (SSB/CW/S.AM DET)

- 1) Connect SSG/Oscilloscope as same as L13 adjustment.
- 2) SSG/receiver setup as follow:
SSG: 7.500MHz, MOD OFF, -5dBu/EMF level
receiver: 7.501MHz, LSB mode, ATT 0 dB, Tone LOW.
- 3) Adjust L12, L14 and L1 of BFO board for best wave form on the oscilloscope.
Check if L1 alignment is well at USB where receiver freq. at 7.499MHz.

S.AM adjustment

- 1) Connect SSG/Oscilloscope as same as for L13 adjustment.
- 2) SSG/receiver setup as follow:
SSG: 7.500MHz tolerance within +/-10Hz, MOD OFF, 34 dBu/EMF.
receiver: 7.500MHz, S.AM mode, ATT 0 dB, Tone LOW.
- 3) Connect oscilloscope at collector of Q-6 2SC2668 through 10:1 probe.
Oscilloscope setup as follow:
Vertical sensitivity 50 mV, Vertical AC coupling, 0.5u/sec.
- 4) Adjust trimmer capacitor C56/30pF for wave form of below shown:



- 5) Connect Digital Multimeter (DM) at C-64 4.7uF pattern land on component side.
- 6) Adjust C61 30pF trimmer capacitor to get 3.8 - 4.0 V on DM indication.
- 7) Modulation 400Hz/60% on SSG.
- 8) Watching wave form on oscilloscope, adjust a little for L1 on BFO board for the maximum output level and minimum distortion.

VCO BOARD

SSG setup

- 1) Center freq. 61.655MHz
- 2) RF level 0 dBm
- 3) Span 1 MHz
- 4) R/bandwidth 100kHz
- 5) V/bandwidth 300kHz
- 6) Vertical scale 10 dBm

Receiver setup

- 1) Freq. 10.000MHz
- 2) mode AM
- 3) VFO A

Preparation

- 1) Remove long size coaxial cable to RF board and connect it to SA (Spectrum Analyzer).
- 2) Check above level between -15 dBm and -10dBm.
- 3) Remove connection of coaxial cable to SA and then connect to Frequency Counter (FC).
- 4) Check if it is exact 61.655MHz.
- 5) For VCO adjustment purpose, write memory channel as follow:
Four channels, 500kHz, 29.500MHz, 950kHz, 10.000MHz
- 6) Connect a DM (disital multimeter) at L10 C41 side for measuring DC voltage of PLL.

L9, C40 adjustment

- 1) Set receiver freq. at 29.5MHz, adjust L9 core for DM showing 20.5 - 22.5V reading.
- 2) Set receiver freq. at 500kHz, check if DM reading 2.0 - 2.35V.
- 3) In case of less than 2.0V, decrease capacitance of C40.
- 4) Set receiver freq. at 29.5MHz again and adjust L9 for 20.0 - 22.5 V on the meter.
- 5) Set receiver freq. at 500kHz again and check if voltage of 2.0 - 2.35 V on the meter.

L3, C5 adjustment

- 1) Apply 10.0 V DC from separate power supply to L2, 1.8uH which is placed as for test point on the board.
- 2) Set receiver freq. at 500kHz.
- 3) Adjust L3 for Frequency Counter reading of 52.150-52.300MHz.
- 4) Set receiver freq. at 29.5MHz.
- 5) Check if FC reading 80.900 - 81.400MHz.
- 6) In case of less than 80.900MHz,
 - a. Decrease capacitance of C5 trimmer capacitor.
 - b. Set receiver freq. at 500kHz .
 - c. Adjust L3 for 52.150-52.300MHz on the counter.
 - d. Set receiver freq. at 29.5MHz.
 - e. Check if FC reading 80.900 - 81.400MHz.

- 7) In case of more than 81.400MHz.
 - a. Increase capacitance of C5 trimmer capacitor.
 - b. Set receiver freq. at 500kHz.
 - c. Adjust L3 for 52.150-52.300MHz on the counter.
 - d. Set receiver freq. at 29.5MHz.
 - e. Check if FC reading 80.900 - 81.400MHz.
- 8) Remove 10.0V DC connection on L2, 1.8uH choke.
- 9) Set receiver freq. at 950kHz.
- 10) Connect multimeter on L2, 1.8uH choke coil test point.
- 11) Check if multimeter reading of 13.5 - 18.5 V DC.

TCXO FREQ. ADJUSTMENT

- 1) Set receiver freq. at 10.000MHz.
- 2) Remove top seal of the TCXO and adjust trimmer to get 61.655000MHz +/-20Hz on the counter.
- 3) FC should be high precision type for 5×10^{-8} (0.05ppm)

L6 ADJUSTMENT

SA setup

- | | |
|-------------------|-----------|
| 1) Center freq. | 51.655MHz |
| 2) RF level | -10dBm |
| 3) Span | 1 MHz |
| 4) R/bandwidth | 10kHz |
| 5) V/bandwidth | 30kHz |
| 6) Vertical scale | 10dBm |

Preparation

- 1) Remove short coaxial cable to RF board and connect it to SA.

Adjustment

- 1) Adjust L6 for maximum level wave form on the SA.
- 2) Check if level (2nd local injection) of -20dBm - -23dBm.
- 3) Change connection from SA to FC counter.
- 4) Check if exact 51.200MHz.
- 5) If level and freq. are good, restore the coaxial cable to J-8 of RF board.

FREQUENCY OFFSET

For mode of LSB/USB, frequency is offset by +/-1.4kHz
-1.4kHz for LSB and +1.4kHz for USB.

Factory default is +/-1.4kHz but it can be changed
for +/-1.55kHz offset for the case of optional Collins
mechanical filter installed for 2.5kHz bandpass SSB.
(BFO crystal units are 456.55kHz/453.45kHz in case)

IN CASE OF ERROR OFFSET

If frequency seems to be shifted by 100Hz or more,
(beat note can be heard on correct frequency in LSB/USB)
Turn the AR3030 set upside-down and find a small hole
in the bottom cabinet close to the main rotary tuning
control.

Connect power supply and power on the set.

Press and hold (0) key then momentarily press reset
switch and release using preferably a non-conductive
thin probe such as a cocktail stick or cotton bud.
After release of the reset switch, then release (0)
key.

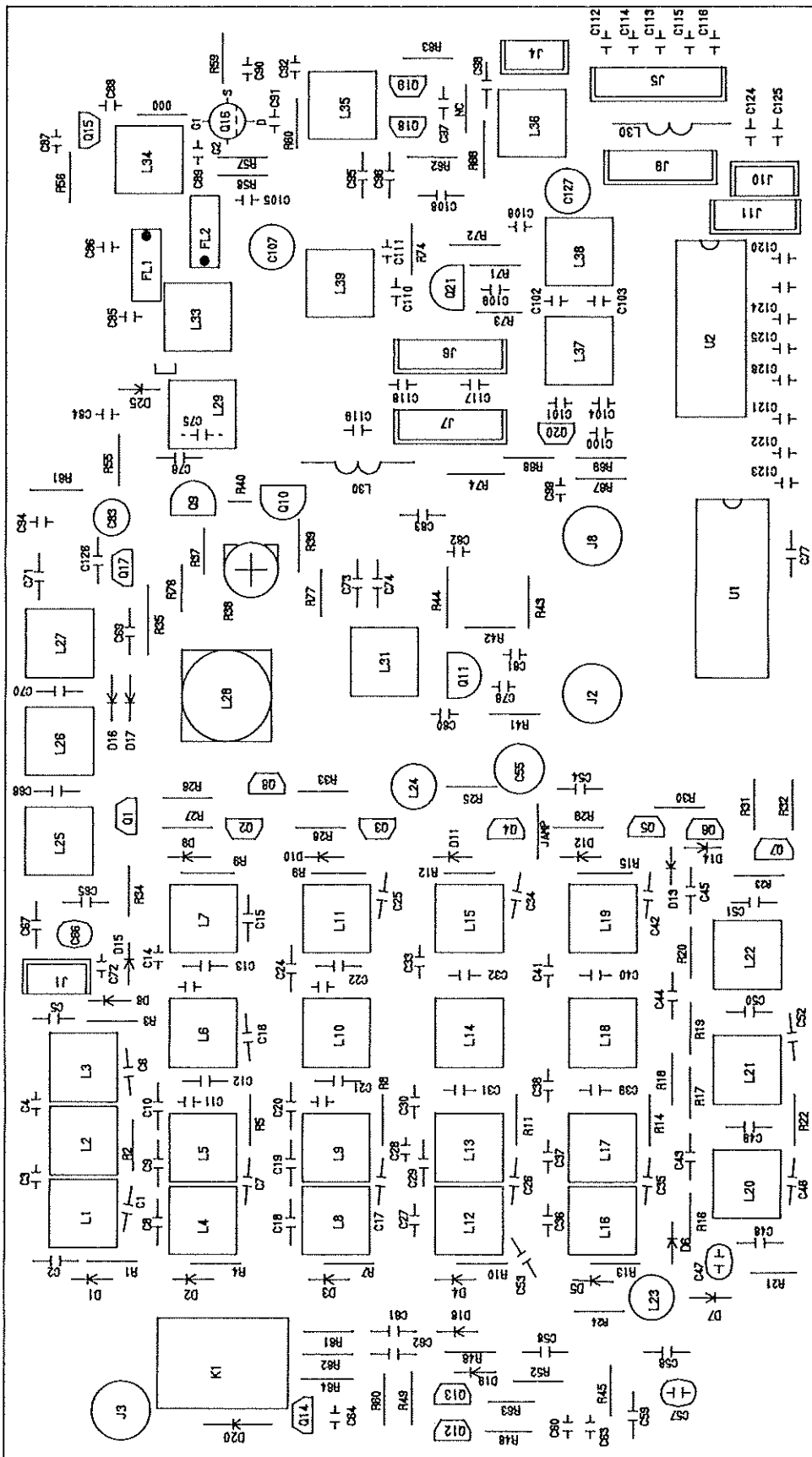
This action will reset the microprocessor for +/-1.4kHz
offset.

In case of 456.55/453.45kHz crystals installed, press
and hold (3) key instead of (0) key in above process.
This makes +/-1.55kHz offset.

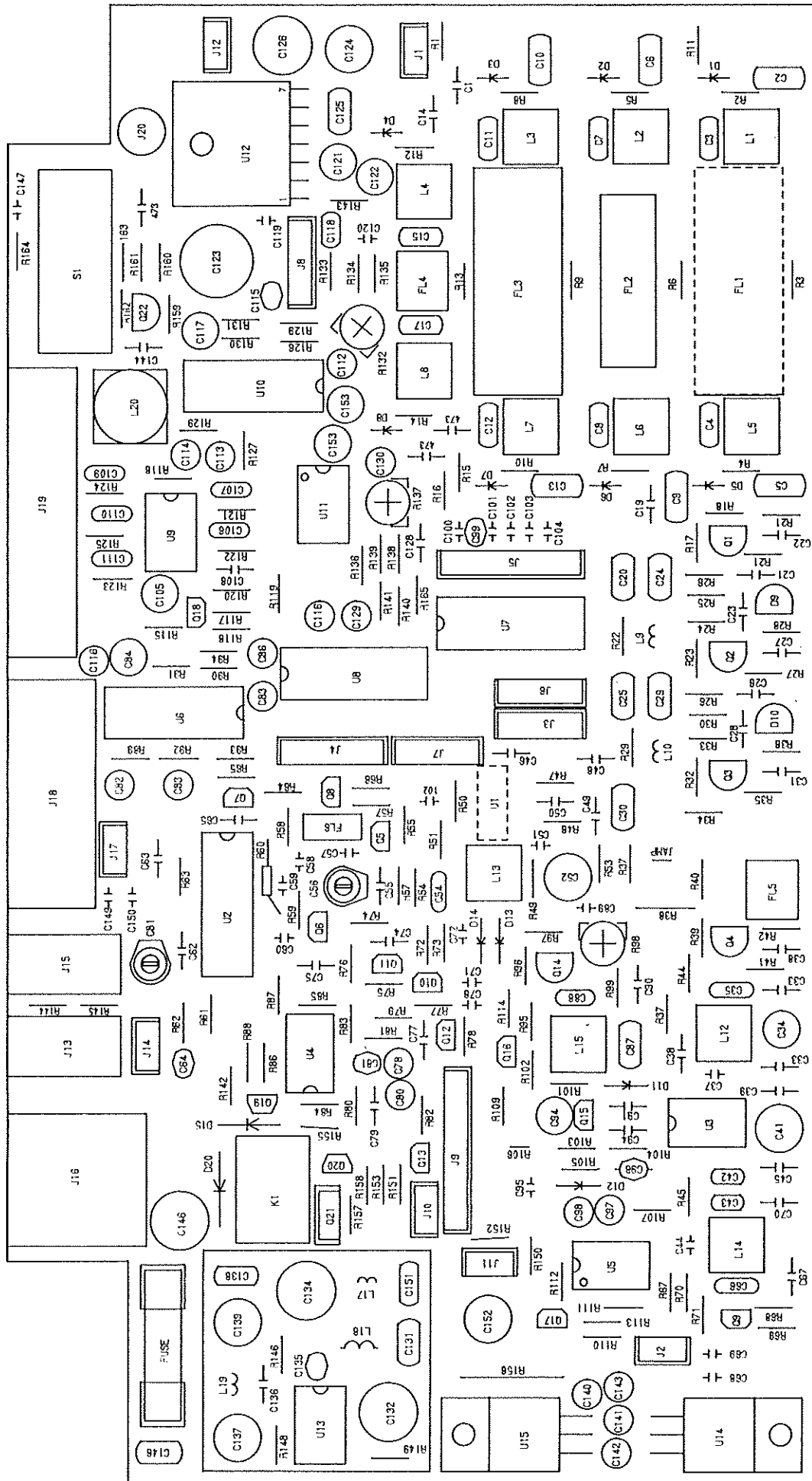
In above reset procedure, customer written memory data
can not be broken or not wiped off.

IN CASE OF SCAN PROBLEM (NO SCANNING)

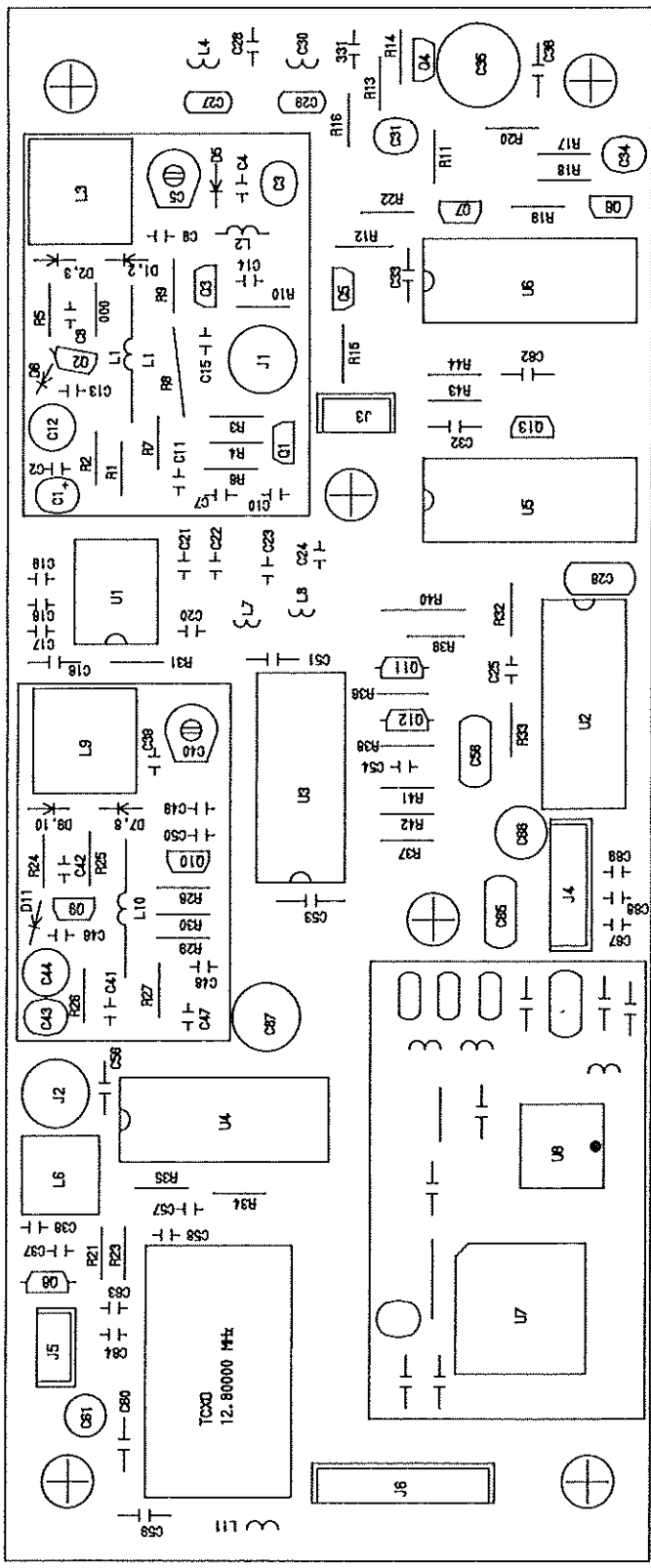
Press and hold (ENT/BS) key, then power on the AR3030.
All information characters/figures come on the LCD
screen and nest shifts to 10.000MHz receive automatically.
This means all memory channels are cleared.
Write memory channels at least two channels and check if
scan works when (SCAN) key is pressed.
Please note that above RESET action will wipe off all
memory channel data for initialization.



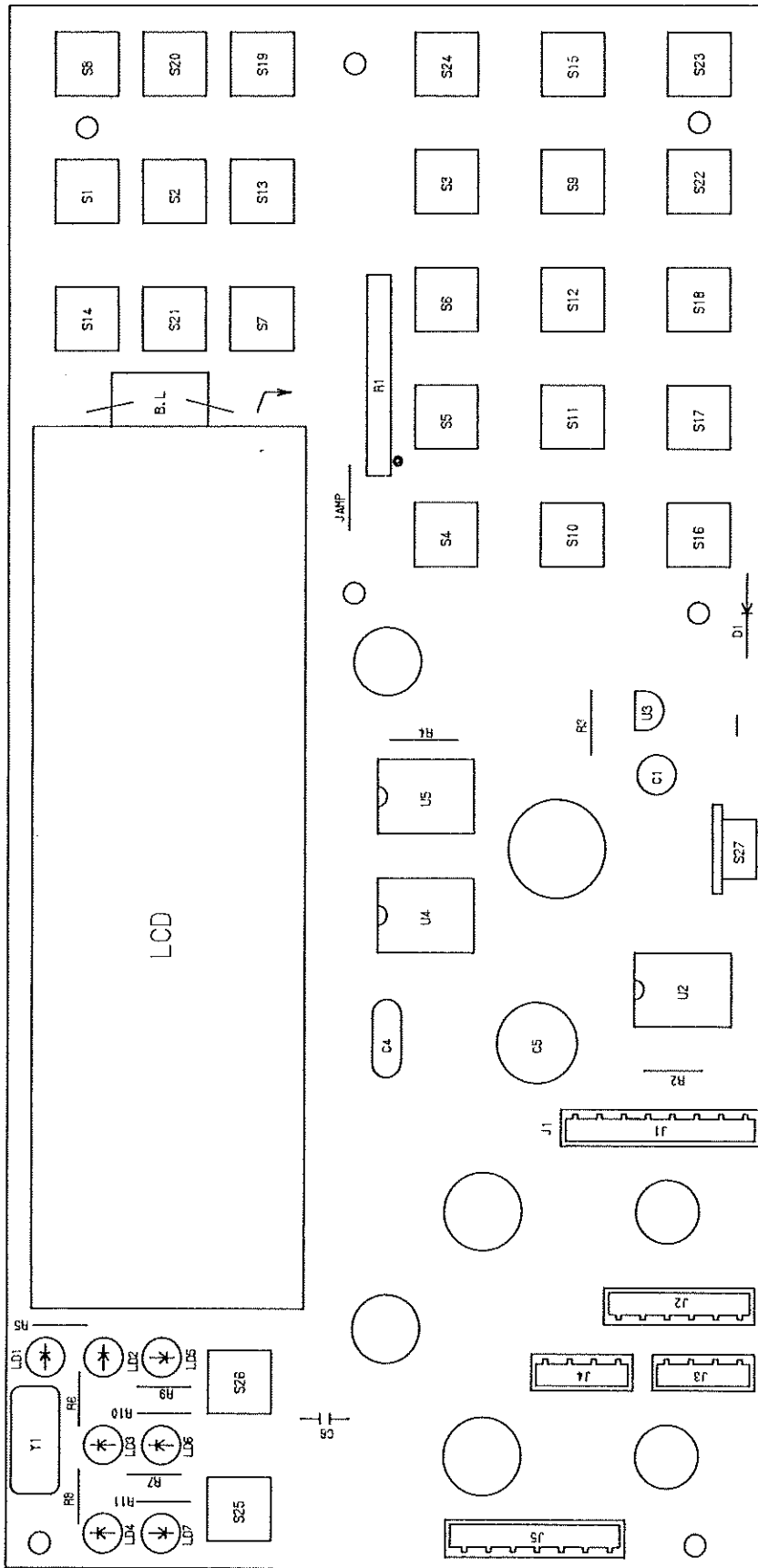
RF P.C. Board



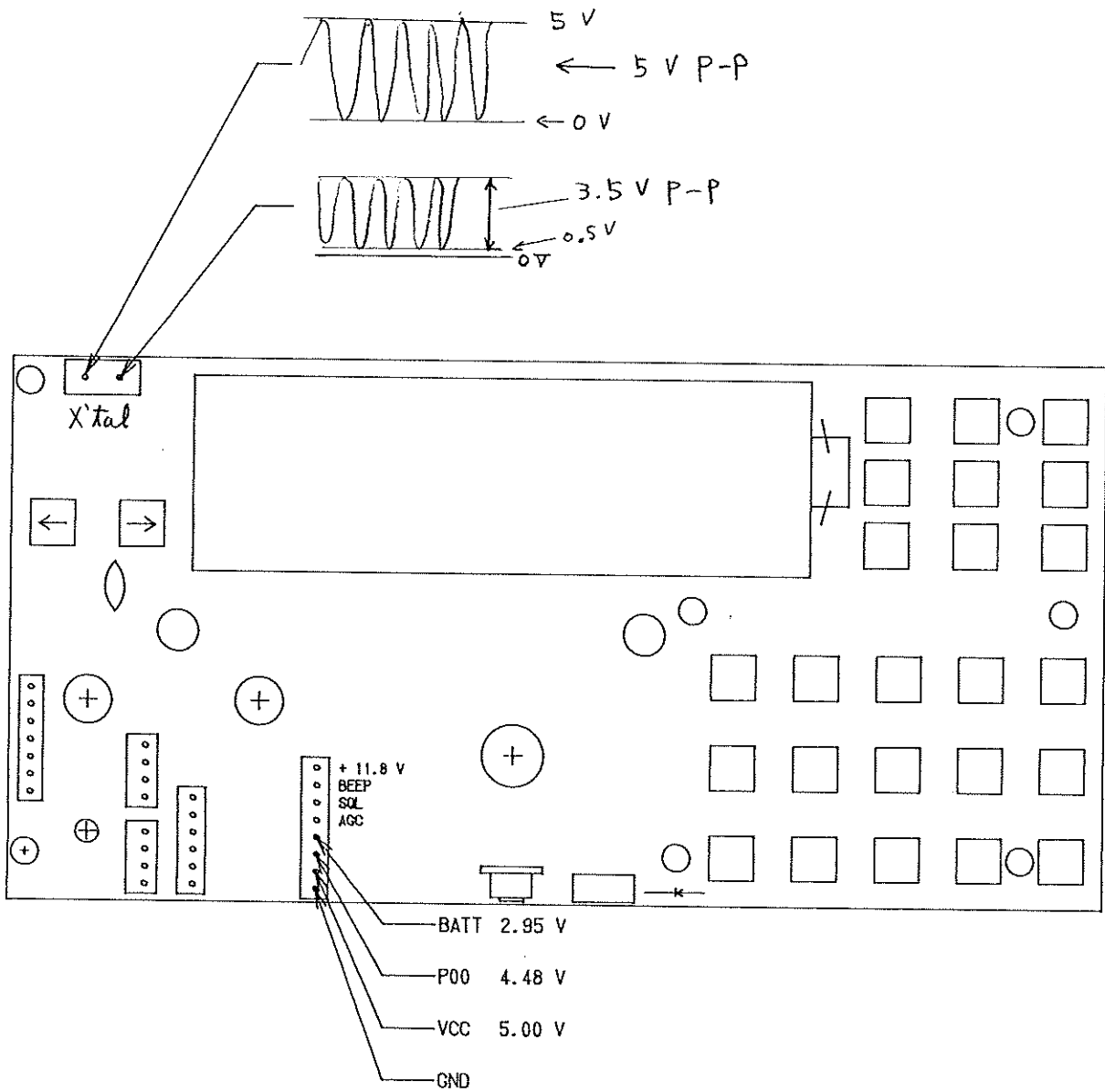
IF-AF P.C.B. board



VCO P.C. Board

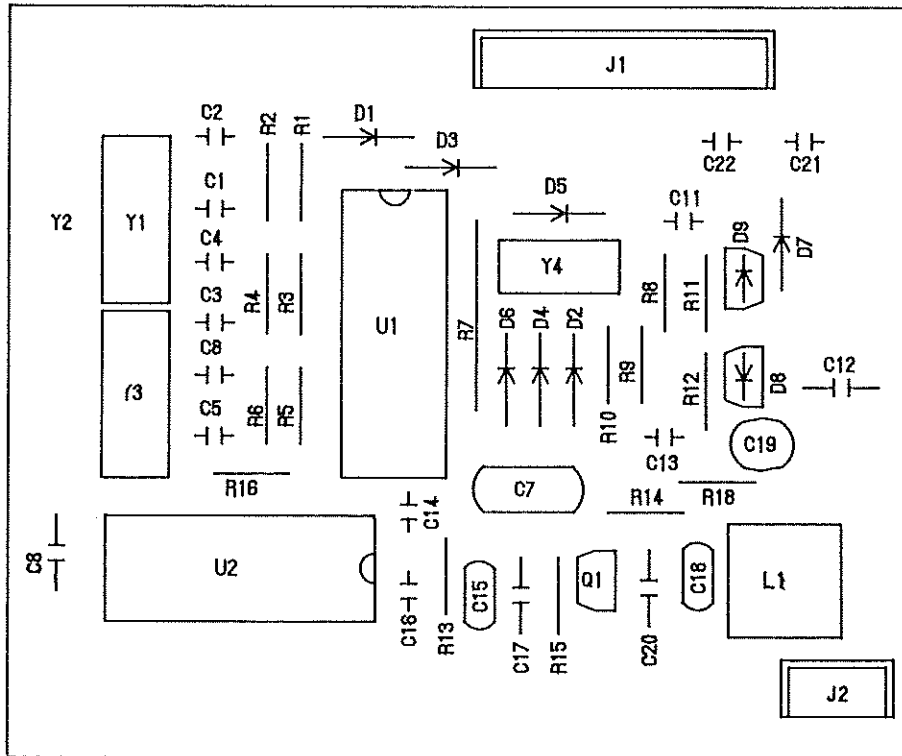


CPU P.C. Board Parts Side

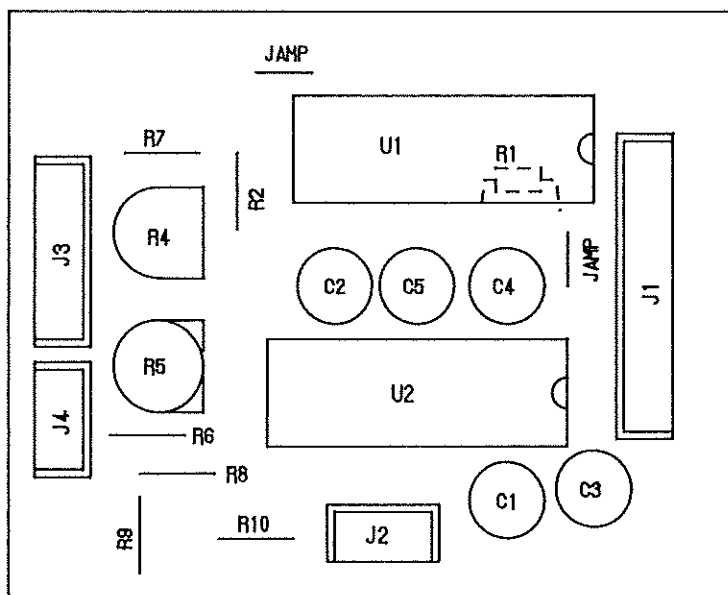


CPU P. C. BOARD

PARTS SIDE



BFO P.C. Board



RS-232/VR P.C. Board