SOMMERKAMP ELECTRONICS S.A.S.
CH-6911 CAMPIONE/LUGANO

40 CHANNEL SSB/AM
BASE/MOBILE
CB TRANSCEIVER

SOMMERKAMP

TS-740SSB

- Phase Locked Loop (PLL) Circuit
- Digital Channel Readout
- SWR Measurement
- Dual Meters

SOMMERKAMP
ELECTRONICS
S.A.S.

SECTION 1
GENERAL INFORMATION

TO THE OWNERS

Your new SOMMERKAMP transceiver is a PLL control synthesizing system, 40 channel SSB/AM, BASE/MOBILE CB transceiver. This handsomely styled unit is designed to be used as either a base station or mobile unit. Advanced Single Sideband operation allows you the use of less clowded AM sidebands, provides great range, and gives you more channel of communications. To provide the greatly stable 40 channel operation, SOMMERKAMP utilizes a PLL (Phase Locked Loop) controlled synthesizing circuit.

The receiver is a sensitive superheterodyne circuit featuring: Large illuminated exclusive S meter, RF GAIN control, low noise RF stage, adjustable Squelch, Clarifier control, Phone jack, noise blanker, ceramic filter, external speaker jack, PA jack and instantaneous selection of any of the 40 channels with LED read-out.

The transmitter section is designed around highly reliable silicon transistors and a PLL controlled synthesizing system. This circuit makes use of the output of the voltage controlled oscillator and the reference frequency oscillator which are beat together to produce the desired frequency. The transmitter final is a conservatively rated high gain RF power transistor. The transmitter section features Large illuminated RF and SWR meter and Antenna SWR measurement facilities.

WARNING

Operation of this equipment requires a valid station license issued by the Federal Communications Commission. Illegal operation can result in severe penalties. Be certain that you have read Part 95 of the FCC Rules and Regulations before operating your station. By completing Form 555-B and applying for your license on Form 505 you may operate your station immediately and for 60 days while waiti g for your license.

You are required to maintain a current copy of Part 95 of the FCC Rules as a part of your station records. Part 95 and Forms 505 and 555-B are available from the Superintendent of Documents GPO, Washington .C., 20402.

SPECIFICATIONS

GENERAL

Circuitry . . . . 5 ICs, 2 FETs, 44 Transistors, 51 Diodes, 5 Zenors and a Vari-cap.

Frequency Control . . . . . . PLL (Phase Locked Loop) Synthesizer

Channels . . . . 40 channels

Mode of Operation . . . . . . LSB, USB and AM

Power Source Voltage . . . . 13.8 V DC or 220V AC 50/60 Hz

Speaker (Built-in) . . . . Dynamic type, 3¾" x 2"

Microphone . . . . Dynamic type with PTT bar

RECEIVER

System . . . . SSB: Single conversion superheterodyne
AM: Double conversion superheterodyne

Sensitivity . . . . SSB: 0.3 μV for 10 dB S/N
AM: 1 μV for 10 dB S/N

Selectivity . . . . SSB: 2 kHz at 6 dB down
AM: 6 kHz at 6 dB down

Clarifier . . . . ±800 Hz

Audio Output . . . . 3 W at 8 ohms

Squelch Range . . . . SSB: 0.7 μV to 300 μV
AM: 1 μV to 300 μV

Intermediate Frequency . . . SSB: 10.695 MHz
AM: 1st/10.695 MHz, 2nd/455 kHz

SSB TRANSMITTER

Generation . . . . Double balanced modulator with crystal latice filter

RF Output Power . . . . 12 W PEP maximum, at 13.8 V DC or 220V AC 50/60 Hz

Carrier Suppression . . . . . . More than 40 dB down

Unwanted Sideband Suppression . . . . More than 60 dB down

Harmonic Suppression . . . . More than 60 dB down

AM TRANSMITTER

RF Output power . . . . 4 W FCC maximum, at 13.8 V DC or 220V AC 50/60Hz

Harmonic Suppression . . . . More than 60 dB down

Modulation . . . . High level class B

FREQUENCIES AVAILABLE FOR CLASS D OPERATION

Channel	MHz	Channel	MHz	Channel	MHz
1	26.965	15	27.135	29	27.295
2	26.975	16	27.155	30	27.305
3	26.985	17	27.165	31	27.315
4	27.005	18	27.175	32	27.325
5	27.015	19	27.185	33	27.335
6	27.025	20	27.205	34	27.345
7	27.035	21	27.215	35	27.355
8	27.055	22	27.225	36	27.365
9*	27.065	23	27.255	37	27.375
10	27.075	24	27.235	38	27.385
11	27.085	25	27.245	39	27.395
12	27.105	26	27.265	40	27.405
13	27.115	27	27.275		
14	27.125	28	27.285		

*Channel 9 shall be used only for emergency communications.

SECTION 2
INSTALLATION & INITIAL ADJUSTMENT

IMPORTANT

BEFORE DISCARDING ANY OF THE PACKING MATERIALS, EXAMINE THEM CAREFULLY FOR ITEMS YOU MAY HAVE OVERLOOKED.

INSTALLATION

BASE STATION INSTALLATION

The transceiver is designed to operate directly from a 220V AC power line. The transceiver should be placed in a convenient operating location close to an AC outlet and the antenna lead-in cable.

POWER CONNECTION

Making the TS-740 SSB turned off, insert the AC plug at the end of cable into an outlet supplying 220V, 50/60 Hz AC. For protection, the AC input to the transceiver is fused. Although the transceiver is designed to operate from AC as stated above, in an emergency the transceiver may be operated from nominal 12V DC battery. Connecting the supplied fused DC power cord to the socket on the rear of the transceiver will automatically disconnect AC power from the transceiver even if the AC power cable plug is still inserted into AC outlet.
Be sure to connect the Red cable lead to the positive (+) battery terminal and the Black lead to the negative (—) terminal.

WARNING: If you install the TS-740 SSB in an automobile, make sure the vehicle has the Negative ground system.

ANTENNAS

Your radio has been adjusted at the factory to give optimum performance using a 52-ohm antenna. There are a number of 52-ohm antennas available for citizens band use.

There are two basic types of antennas for base station use.

a. Vertical Ground Plane Antennas: These are omni-directional antennas that provide optimum performance for contacting other fixed stations using vertical type antennas in additional to all mobile stations. These are for medium-long range communications work.
b. Directional Beam Antennas: Highly efficient and directional antennas generally intended for fixed-to-fixed long range communications.

NOTE: For a short range communications, within buildings, or from building to building, a short center-loaded whip antenna is available for use for base station. This antenna mounts directly onto the antenna connector on the transceiver and is ideally suited for short-range communications.

For an automobile installation, a whip may be used with good efficiency because the automobile acts as a counterpoise and reduces detuning effects. The mounting location also has a great effect on the efficiency.

The most efficient and practical installation is a full quarter wave whip mounted on the left rear deck of fender top midway between the rear window and bumper.

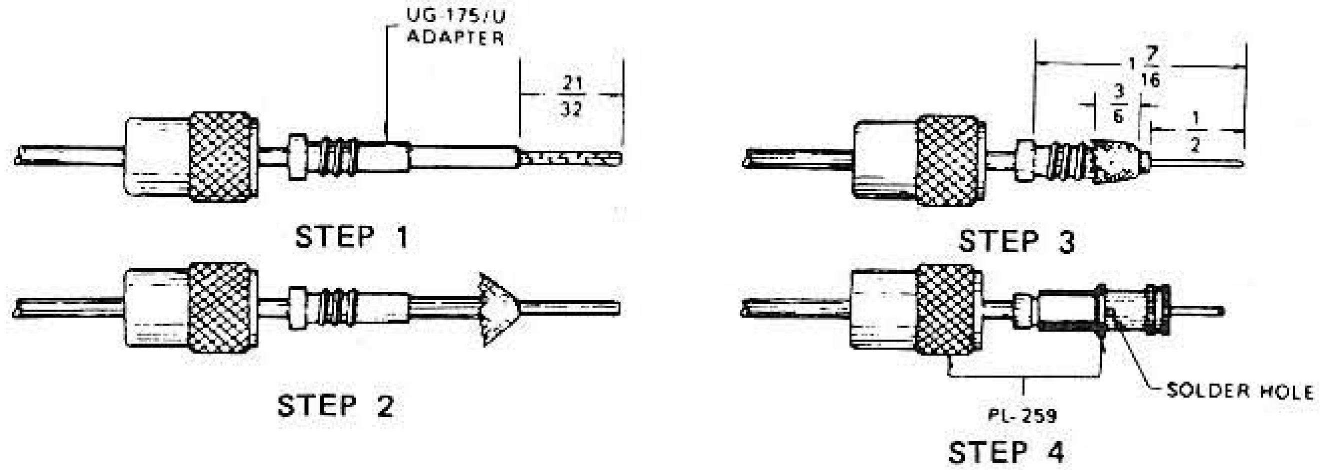


Fig. 1 Assembling PL-259

TRANSMISSION LINE

To connect an antenna to the transceiver, a 52-ohm coaxial transmission line is required. See Figure 1 for assembling connector to RG-58/u coaxial cable.

INSTALLATION ADJUSTMENTS

The output circuit of the transmitter has been factory adjusted to operate into any good 52-ohm antenna. No attempt should be made to tune the transmitter to the antenna. Instead, the antenna should be adjusted to present the lowest possible SWR (Standing Wave Ratio). A very low SWR means that the antenna is operating at maximum efficiency and will also mean that it is adjusted to 52 ohms. An improperly adjusted antenna causes standing waves to appear on the feed line. Since this feed line is a fixed 52 ohms, and cannot be adjusted, this mismatch appears at the transmitter. If the transmitter is adjusted to compensate for this mismatch, both it and the antenna will no longer be operating at peak efficiency. Since the transmitter has already been adjusted for 52 ohms output and the coaxial feed line has a fixed 52-ohm value, the only remaining element to be adjusted to this value is the antenna itself. When installed, the antenna is probably cut as near as is possible to this value. The location or building and surrounding objects affect the antenna however, and requires that it be adjusted to compensate for them.

Many of the newer Citizens Band antennas provide means of adjusting them for lowest SWR. Instructions for doing so are included with the antenna. For such antennas as the full quarter wave length whip, it is necessary to carefully vary the length until the lowest SWR is obtained. For all adjustments to the antenna, see "SWR MEASUREMENT PROCEDURE" in this manual.

The transceiver will work into an antenna system having on SWR as high as 3 : 1. For best communications, you will want this figure as near 1 : 1 as possible so that the antenna will be operating at its best efficiency.

NOISE SUPPRESSION

There are several kinds of interference that your transceiver may be subjected to in base station use. Some of these may be: interference from a nearby commercial AM broadcast station, interference from electrical appliance, lawnmowers, fluorescent buzz interference with TV reception, static from electrical stroms, etc.

Commercial products are available to reduce interference from these sources. Consult at a citizens radio repair shop.

SECTION 3
OPERATING INSTRUCTIONS

CONTROLS AND INDICATORS

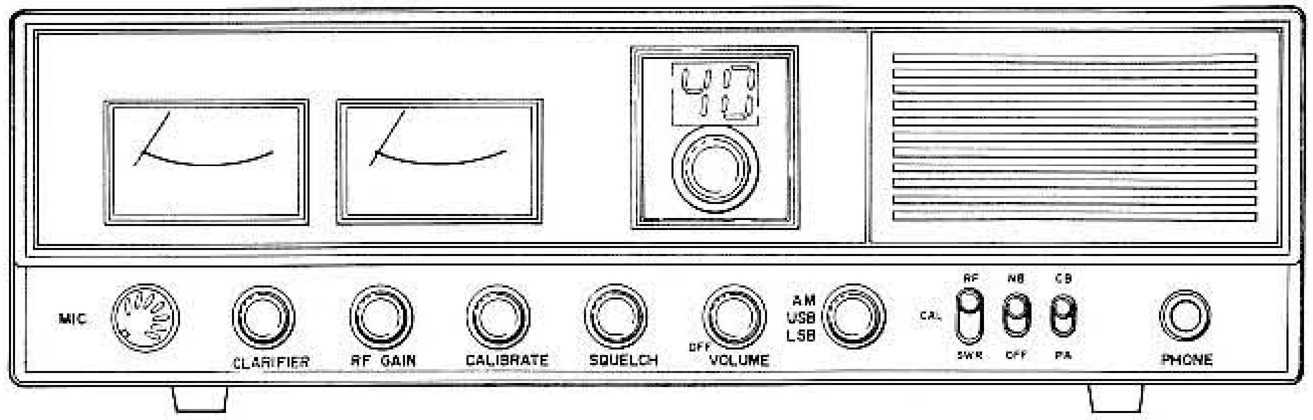


Fig. 2 Front Panel

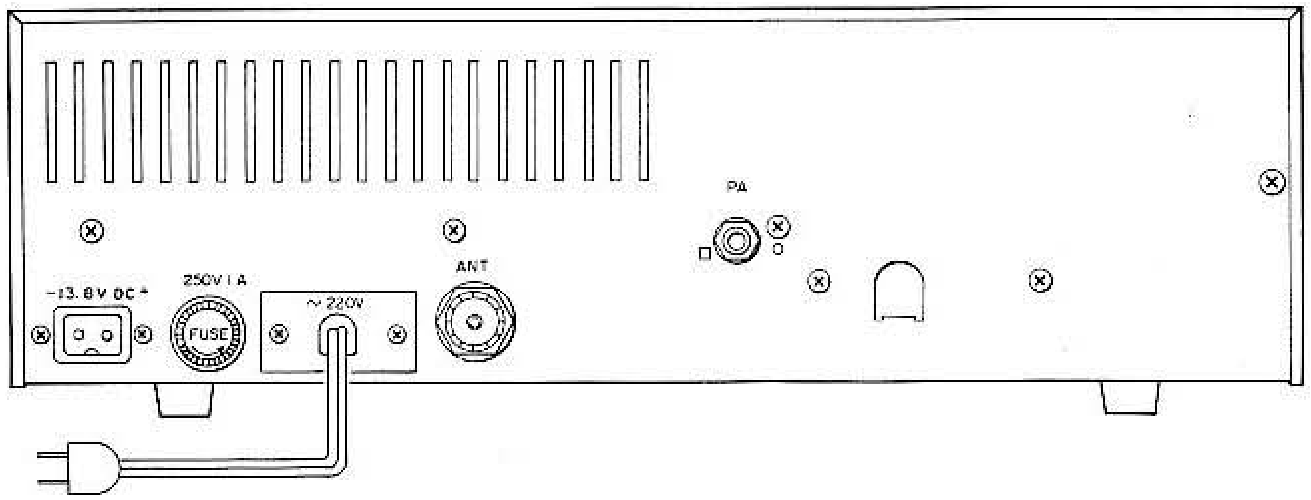


Fig. 3 Rear Panel

VOLUME CONTROL/POWER SWITCH

This turns the power on or off. This controls the sound output from the speaker when receiving or from the Public Address (PA) speaker connected to the PA SP JACK on the rear panel. The volume control does not affect the transmitted output.

SQUELCH CONTROL

To quiet undesirable background noises when no signal is received, rotate the squelch control clockwise. It functions only in the receive mode and does not affect the receiving volume during receive mode. Adjust this control as follows:
Turn the power on and rotate the volume control until the background noise is heard. Then rotate the squelch control clockwise until the noise just disappears. Incoming signals will automatically release the squelch. But take care not to rotate the squelch control too far, because it decreases reception sensitivity.

CALIBRATE CONTROL

This control is used in the SWR Measurement Procedure.

RF GAIN

This controls reception sensitivity for receiving. To increase RF GAIN, turn knob clockwise, to decrease turn counter-clockwise.

MODE SWITCH

This selects mode of operation; Lower Sideband (LSB), Upper Sideband (USB) and AM.

CB-PA SWITCH

Place this switch in the PA position when using the transceiver as a simple public address amplifier. For normal CB operation, always place this in the CB position.

NB-OFF SWITCH

This reduces impulse noises such as ignition noise from vehicles, etc., without significantly affecting the basic sensitivity of the receiver.

RF/CAL/SWR METER SWITCH

This switch changes meter functions in three ways:

a. Set this switch to "RF" position for normal operation.
b. Set this switch to "CAL" position when adjusting SWR CALIBRATE CONTROL for calibration of SWR meter.
c. Set this switch to "SWR" position to read the SWR of antenna system.

RF/SWR METER

This is a dual purpose meter.

a. With the RF/CAL/SWR switch in the RF position, RF (Radio Frequency) transmit power can be monitored on the upper AM or SSB scale while transmitting.
b. The lower scale is used in the SWR measurement Procedure.

S METER

This gives the relative strength of incoming signals when receiving.

CHANNEL SELECTOR

This selects one of the 40 channels desired. Channel indicator LED will indicate the selected channel automatically.

CLARIFIER

During AM operation, place the control in the "12" o'clock position. However, if a station received is not clear, adjust the control for clearer reception. During SSB operation, this control operates as a voice clarifier: also rotate the control for clearer voice reception.

PHONE JACK

This accepts a headphone having a standard phone plug for private listening or to avoid sound interference around you. Connecting the phone plug into this jack automatically silences the built-in speaker .

MIC JACK

This accepts microphone plug from the Push-to-Talk Microphone supplied with the unit.

ANTENNA CONNECTOR

This accepts a standard PL-259 type coaxial antenna connector.

PA JACK

To operate this transceiver as a simple PA amplifier, connect a PA speaker to this jack.

AC POWER CABLE

This is the cable for the AC power operation, which connects to an AC outlet supplying 220V AC, 50 or 60 Hz.
However, the transceiver is unoperable with AC power as long as DC power cord is plugged into the DC power socket.

AC FUSE

This provides protection during AC operation in the event of a malfunction in the unit.

DC POWER SOCKET

13.8V DC power for the transceiver will be supplied through this socket using DC power cord for an emergency or mobile use. Take care not to insert the plug upside down.

OPERATING TS-740 SSB

CAUTION:	DO NOT PUSH TRANSMIT SWITCH WITHOUT FIRST CONNECTING A 52-OHM ANTENNA OR DUMMY LOAD.

Rotate the RF GAIN CONTROL fully clockwise and the SQUELCH CONTROL fully counter clockwise.
Place the CB-PA switch in the "CB" position and the MODE switch in "AM" position.
Rotate the VOLUME CONTROL clockwise, to apply power, and advance the VOLUME CONTROL until noise or signal is heard in the speaker.
(Since your transceiver is fully transistorized, no warm up time is required.)

With no signal present, rotate the SQUELCH CONTROL clockwise to a position in which no noise is heard. Advance this control only far enough to prevent noise from being heard. Advancing it too far may result in the loss of weak signals. With the Squelch properly adjusted, only a transmitter operating on the channel to which your transceiver is tuned will be heard. With no transmitter operating, the Squelch gate will be closed and all sound will be turned off. Sometimes noise will build up as a result of a passing truck, etc. If this happens, the SQUELCH CONTROL should be advanced just far enough to keep the circuit closed during these noise peaks.

Rotate the CHANNEL SELECTOR to the desired channel.
Adjust the Volume as desired for the station you are listening to.
If a station received produces an unintelligible sound, it may be the SSB station. First place the LSB-USB-AM switch in the LSB or USB position, where the clearer voice reception is obtained. Then adjust the Clarifier control for better voice reception.

To transmit, hold the microphone 2 to 3 inches from your mouth. Normally, it is best to hold it so that you talk across it rather than directly into it. This will prevent the sound of your breathing being transmitted. Hold the Push-to-talk button on the Microphone in, and speak in a normal conversational level.

If you want to communicate with the station transmitting in a mode of SSB, place the LSB-USB-AM switch in the LSB or USB position. To transmit with the SSB mode, also press the Push-to-talk button on the Microphone.

When your transmission is completed, release the button on the microphone and listen for a reply.

SWR MEASUREMENT PROCEDURE

1. Connect a proper antenna system to the ANT connector on the rear panel.
2. Turn the power on.
3. Place CB-PA switch in CB position, and Mode switch in AM position.
4. Place RF/CAL/SWR switch in the CAL position.
5. Depress the Push-to-Talk Button on the Microphone without speaking into it.
6. Adjust the Calibrate control until the meter pointer coincides with the SET mark on the SWR meter scale. Release the Push-to-Talk button on the Microphone.
7. Place the RF/CAL/SWR switch in the SWR position and depress the Push-to-Talk button again. The SWR of your antenna system will be read directly on the meter.

   NOTE: If the SWR reading is more than 1.5, possible causes could be: antenna mismatch, damaged antenna elements, poor transmitter tuning, shorted or open coaxial cable, or antenna is mounted too close to a mass of metal.

SECTION 4
MAINTENANCE & SERVICING

CIRCUIT DESCRIPTION

Your TS-740SSB is an SSB/AM transceiver that employs the most advanced circuitry, PLL (Phase Lock Loop) Frequency Synthesizing circuit which obviates expensive crystals in great numbers but operates with a great reliability. The circuit theory is somewhat complicated but will be given below in a simple manner for your understanding of the new technology employed in your transceiver.

FUNDAMENTAL THEORY OF PLL CIRCUITRY

The word PLL is an abbreviation of the "Phase Loocked Loop" in which a given signal is processed to track the frequency and phase of a reference signal.
In other word, the PLL is an automatic frequency control loop with automatic phase control.
The PLL circuitry consists of the three main units in simple form as shown in Fig. 4.

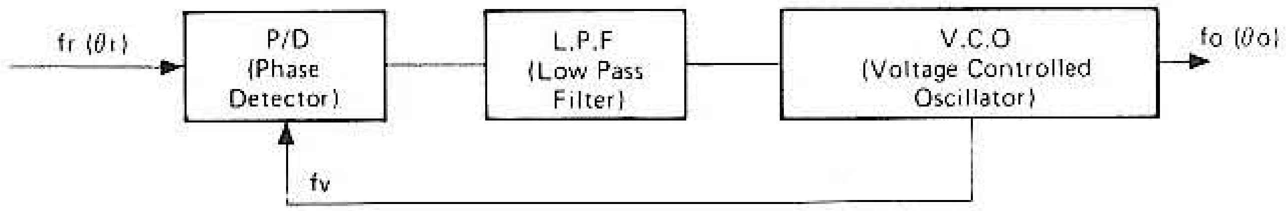


Fig. 4 PLL CIRCUIT

In the above block diagram, when the reference frequency fr and the VCO output frequency fv to be compared are applied to the Phase Detector P/D, fv is compared with fr in terms of phase lag and lead.
Then the resulting output (phase difference) is converted into the DC output voltage corresponding to the phase difference. Since the phase comparation is made at every cycle, the DC output is then led to the low pass filter (L.P.F.) and integrated or smoothed to continuous DC voltage in proportion to the phase difference. The frequency of voltage controlled oscillator (V.C.O.) is controlled by the L.P.F. output voltage. Thus controlled VCO output is then split into two: One used as a operating frequency of the unit and another will be returned to the P/D, making a closed loop. The closed loop will continue to operate until the following condition is met:

$$\theta r(t) = \theta o(t)$$

This condition is called locked.

Employing the PLL system into a CB transceiver requires some modifications so that the VCO generates specific frequency corresponding to each channel frequency [1—40] according to the channel selection. Fig. 5 is the new block diagram made with this modification. As you can see, a programmable divider, mixer and offset oscillator are newly added.

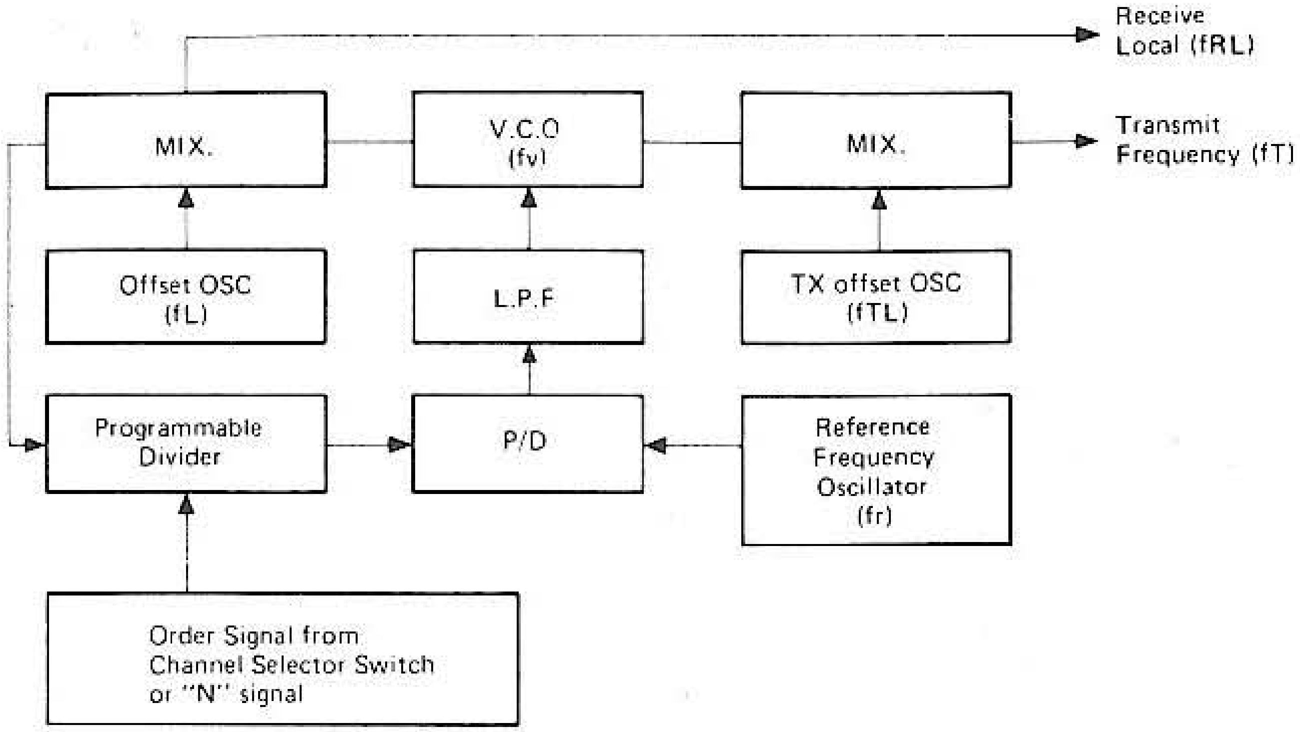


Fig. 5 BLOCK DIAGRAM OF PLL

In Fig. 5, the first local oscillator frequency for reception fRL is given below

$$fRL = fL + fv \quad \ldots\ldots\ldots\ldots \quad (1)$$

$$fv = fL - (N \times fr) \quad \ldots\ldots\ldots\ldots \quad (2)$$

The transmit frequency fT is

$$fT = fRL - fTL \quad \ldots\ldots\ldots\ldots \quad (3)$$

$$= fL + fv - fTL \quad \ldots\ldots\ldots\ldots \quad (4)$$

Where "N" is an order signal from the channel selector switch. When using the system in the transceiver, fr should have the same frequency as the channel spacing, namely, fr = 10 kHz. When receiving channel No. 1, 26.965 MHz, the first local frequency fRL should be,

$$fRL = 26.965 + 10.695 = 37.660 \text{ MHz}$$

The V.C.O frequency fv is

$$fv = fRL - fL = 37.660 - 20.105 = 17.555 \text{ MHz}$$

Then, N code will be obtained by using equation 2

$$N = \frac{fL - fv}{fv} = \frac{20.105 - 17.555}{0.01} = 255$$

This means that selecting the channel No. 1 is to select one of "N" codes (ie 255) instead of selecting a proper crystals in a conventional CB transceiver. Thus varying "N" numbers and selecting one of them, any channel can be selected. This is the major difference between a conventional crystal type and PLL Frequency Synthesizer type transceiver.

Fig. 6 is a practical operation block diagram of PLL section.

CIRCUIT DESCRIPTION OF AM/SSB TRANSCEIVER

1. PLL CIRCUIT

The offset frequency oscillator Q3 oscillates 10.0525 MHz for AM and USB mode of operation (10.05175 MHz for LSB operation). This frequency output is, then, doubled in passing B.P.F. (T3) and applied to the IC 2, PIN No. 4 terminal to mix with the VCO output frequency being applied to the IC 2, PIN No. 2 terminal. The resultant sum frequency is obtained from IC 2, PIN No. 6 terminal and used as a first local frequency (37 MHz band). T1 and T2 are band pass filter for this frequency. While the difference frequency is amplified/buffered inside the IC 2 and the resultant frequency output (2.55–2.11 MHz) is led to the PLL IC 1 through IC 2, PIN No. 9.

Q4 is the switching circuit to shift the oscillating frequency of Q3 by 1.5 kHz for LSB operation. In terms of first local frequency 3 kHz will be shifted toward minus direction.

Q6 is the standard reference oscillator (10.240 MHz) and Q5 is the buffer amplifier for the oscillator.

Q7 is a switching transistor provided to cut off the RF Pre-amp, Q7, when the PLL IC 1 is out-of-locked, thus avoiding frequencies other than predetermined are amplified and radiated.

D6 is the diode through which DC voltage, which is supplied when the channel selector is placed between channels, is applied to the IC 3 to disable the mixing operation inside the IC 3. Thus no frequency will be generated though the channel selector is placed between correct channel positions.

Q2 is the buffer amplifier for RX local frequency, operating only in the receiver mode of operation.

For clearer understanding, please refer to the schematic diagram and the Block Diagram shown in Fig. 7.

2. AM RECEIVER CIRCUIT

A received signal passes T7, then amplified in Q20, and again passes the band pass filter consisting of T8 and T9, then, enters into the Mixer stage of Q22. On the other hand the first RX local signal frequency is applied to the base of Q22 through a coupling capacitor of C14. Then, both signals are mixed with inside the Q22 and converted into the first IF signal (10.695 MHz) in passing through the T10 and T13. The 10.695 MHz signal and 10.240 MHz signal generated in Q6 are applied to the balanced mixer consisting of D22 and D23 and 455 K Hz 2nd IF frequency will be made.
This frequency is then led to the T14, CF (ceramic filter), Q27, Q28, Q29 (amplified), T15 and finally led to the detector D25. The audio signal is then applied to the AF amplifier (IC5) through ANL (D26) circuit. The IC output drives the built-in speaker.
To improve signal over load distortion which would be caused when the receiver is subjected to a strong signal, three stages of AGC loops, each for Q20, Q22 and Q27, are provided.
Q21 is a switching transistor to short-circuit the primary circuit of T9 during transmit operation, thus disabling the receiver circuit. Refer to Fig. 8.

3. SSB RECEIVER CIRCUIT

An incoming signal induced on the antenna is led to the T7 and then to Q20 and amplified. The amplified output is applied to the Q22 mixer through a bandpass filter consisting of T8 and T9. While the first local frequency is being applied to the base of the same transistor, both frequencies are mixed with each other and first IF frequency will be made (10.695 MHz for AM/USB, 10.692 MHz for LSB).
This IF signal then amplified in passing through the T10, crystal filter, Q14, T11, Q16 and Q17 and finally detected into the audio signal with the product detector consisting of Q19. The audio signal is led to the Power IC (IC 5) to drive the built-in speaker.
Q18 is the transistor to avoid undesirable impulse noise, which would be generated in pressing the push-to-talk switch, from entering into the AGC circuit.
To reduce the signal over load distortion in the SSB mode of operation, peak-value type AGC circuitry consisting of Q30, and Q31 is employed for exclusive use of SSB operation.
Refer to the Block Diagram shown in Fig. 9.

4. AM TRANSMITTER CIRCUIT

The first local oscillator frequency (37 MHz band) and 10.695 MHz frequency generated in the Q12 are led to the PIN No. 4 and PIN No. 1 of IC 3, respectively, and mixed with each other, resulting in 27 MHz band transmit frequency. The 27 MHz output is led to the Q7 through T4 and T5, then led to the Q8, Q9 and Q10 in this order and amplified up to the high level necessary for transmission. Thus amplified Power output is applied to the Antenna

Connector through a bandpass filter consisting of L11, L12, L13, etc.
On the other hand, the microphone input signal enters into the Power IC, (IC5, No. 6 PIN terminal) and amplified output is applied to the collectors of Q9 and Q10 through the transformer T16 and diode D43 to modulate the transmit carrier frequency.
Transistor Q35 is the automatic level controller provided to suppress the audio input level to the IC5 properly to avoid the over modulation. Q37 obtains its input signal from the audio output circuit through D43 and its output controls Q35, thus keeping modulation signal level to a relatively constant value.
Refer to the Block Diagram shown in Fig. 10.

5. SSB TRANSMITTER CIRCUIT

In the mode of SSB operation, either of first local oscillator frequency of 37.660 – 38.100 MHz (AM/USB) or 37.657 – 38.097 MHz (LSB) will be led to the IC3, No. 4 PIN terminal. On the other hand the 10.695 MHz (in LSB mode, this will be shifted to 10.692 MHz as previously mentioned) generated with Q12 is led to the balanced modulation IC (IC4). The IC is designed to produce carrier-suppressed double side band signals when an audio signal amplified with IC5 is applied to the PIN terminal of No. 1. Thus produced DSB signal will flow to Q13 and amplified, then led to the XF (crystal filter) to separate the desired side band.
The side band signal is led to the Q14 and amplified, then, the output is led to the No. 3 PIN terminal of IC3 and mixed with the first local oscillator signal to produce 27 MHz transmit signal. The 27 MHz SSB output is the led to the T4 and T5, then further led to the linear amplifiers, Q7, Q8, Q9 and Q10.
Thus amplified RF output is finally led to the antenna terminal through the bandpass and low pass networks provided between the Q10 and antenna connector.

To avoid over modulation distortion, an ALC circuitry consisting of Q35 and Q38 is provided in the SSB microphone amplifier circuit. Another ALC circuit is also employed in the RF circuit (from Q10 to IF Amp Q14) to reduce the distortion in the RF stages.
Transistor Q36 and Q39 are switching circuits to operate IC5 as an SSB microphone amplifier.
Refer to the Block Diagram shown in Fig. 11.

6. NOISE BLANKER CIRCUIT

An impulse signal included in the IF signals will be picked up through the capacitor C113 and applied to the D21. The rectified positive-half voltage is then applied to the transistors Q24 and Q25 and amplified to the enough level capable of turning the transistor Q26. The amplified impulse signal makes Q26 turn on while the impulse is being applied. In other word, the primary circuit of T10 is grounded to the chassis through C121 and the emitter-collector of Q26, so no mixer output will be obtained during this period. In this way the impulse noise will be blanked out.
D20 is the diode provided to control the bias voltage to the Q24 in according to the signal strength of the normal signals received, thus avoiding operation error which would be caused by the normal signals.
Refer to the Block Diagram shown in Fig. 8.

7. SQUELCH CIRCUIT

When AGC voltage lowers with a weak received signal, transistors Q32 and Q33 turn on and this makes Q34 turn off, controlling the bias voltage to the AF AMP (IC5) and disabling the amplifier. On the other hand when the transistor Q34 is turned on, the amplifier will start to operate.

8. AVR (Automatic Voltage Regulator) CIRCUIT

This circuit consists of Q44 and D50 and supplies the regulated voltage through the switching transistors Q40, Q41, Q42 and Q43, depending upon the mode of operation.

9. REGULATED POWER SUPPLY CIRCUIT

The supplied 220 volts ac is stepped down by T201 and rectified by D1, 2, 3, and 4 to 13.8 volts dc. When the voltage between pin No. 3 and the chassis ground tends to decrease, the collector current of Q2 will decrease causing a decrease in the collector voltage. This will increase the bias of Q1 and Q201 and the voltage across the collector and emitter of Q201 will decrease thus restoring the initial output voltage drop.

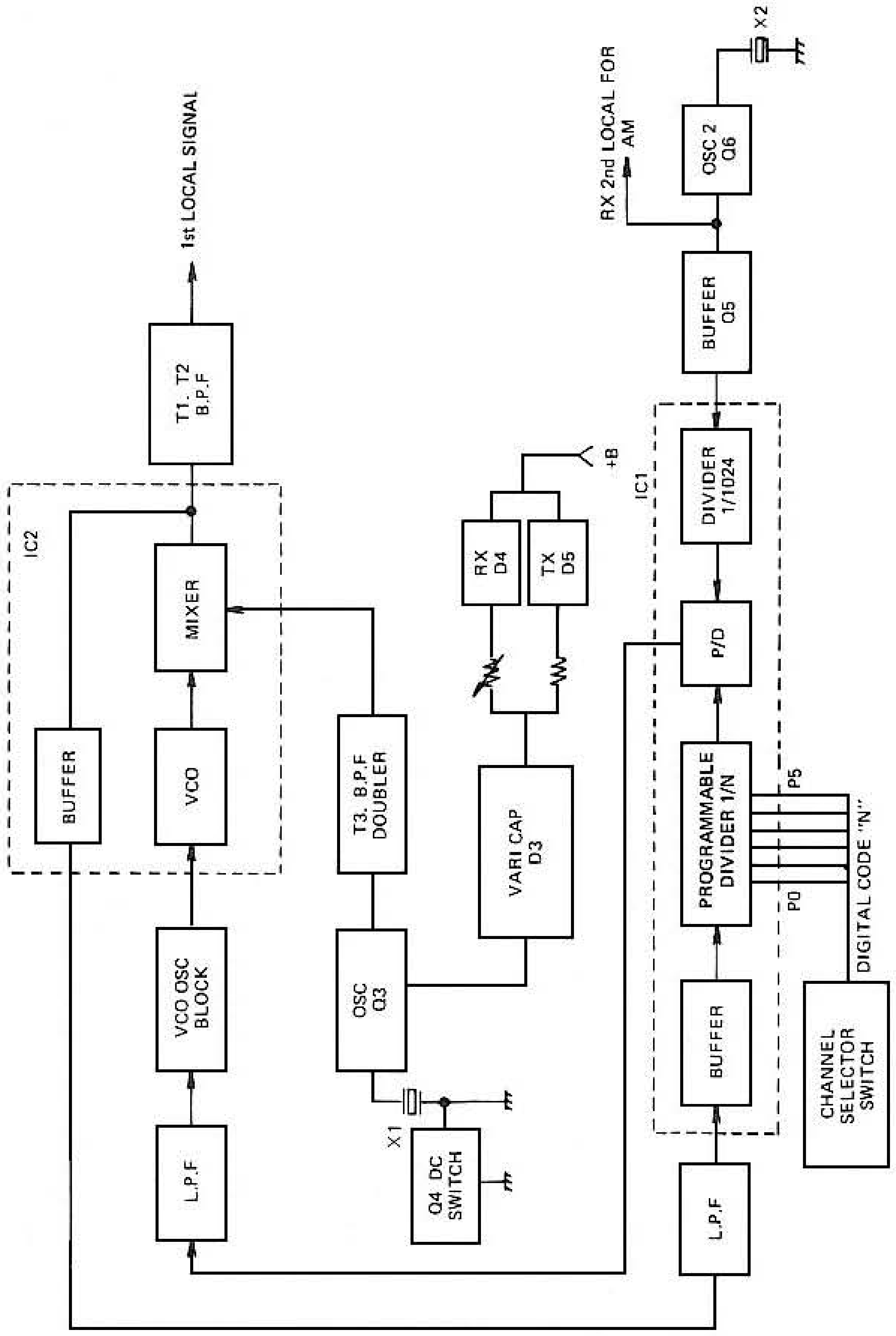


Fig. 7 PLL CIRCUIT

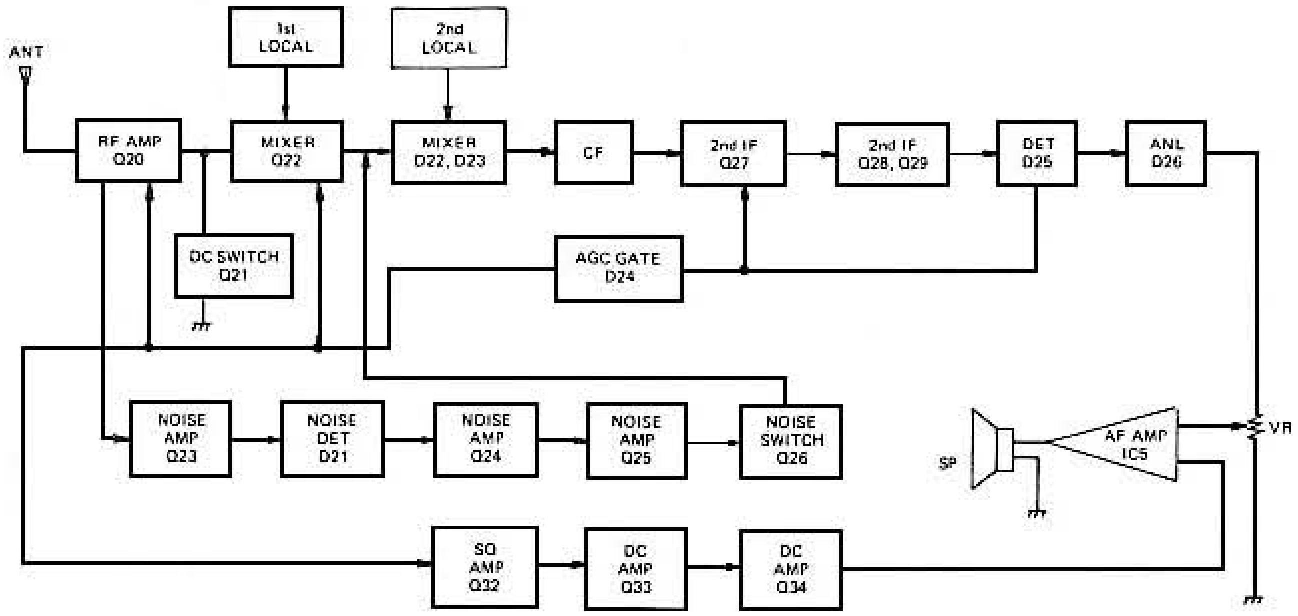


Fig. 8 AM RECEIVER

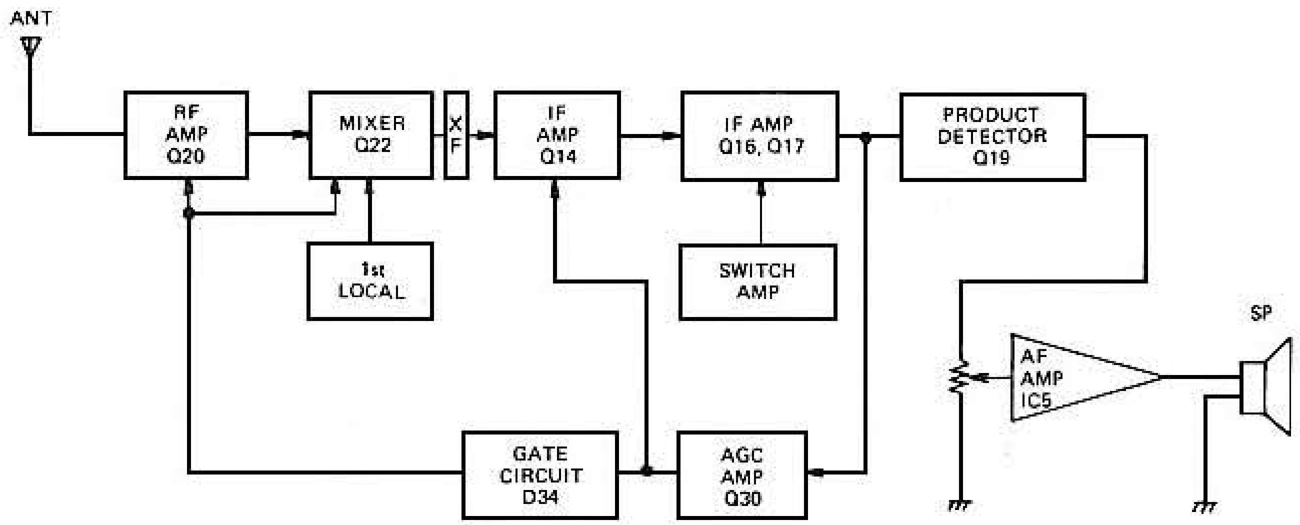


Fig. 9 SSB RECEIVER

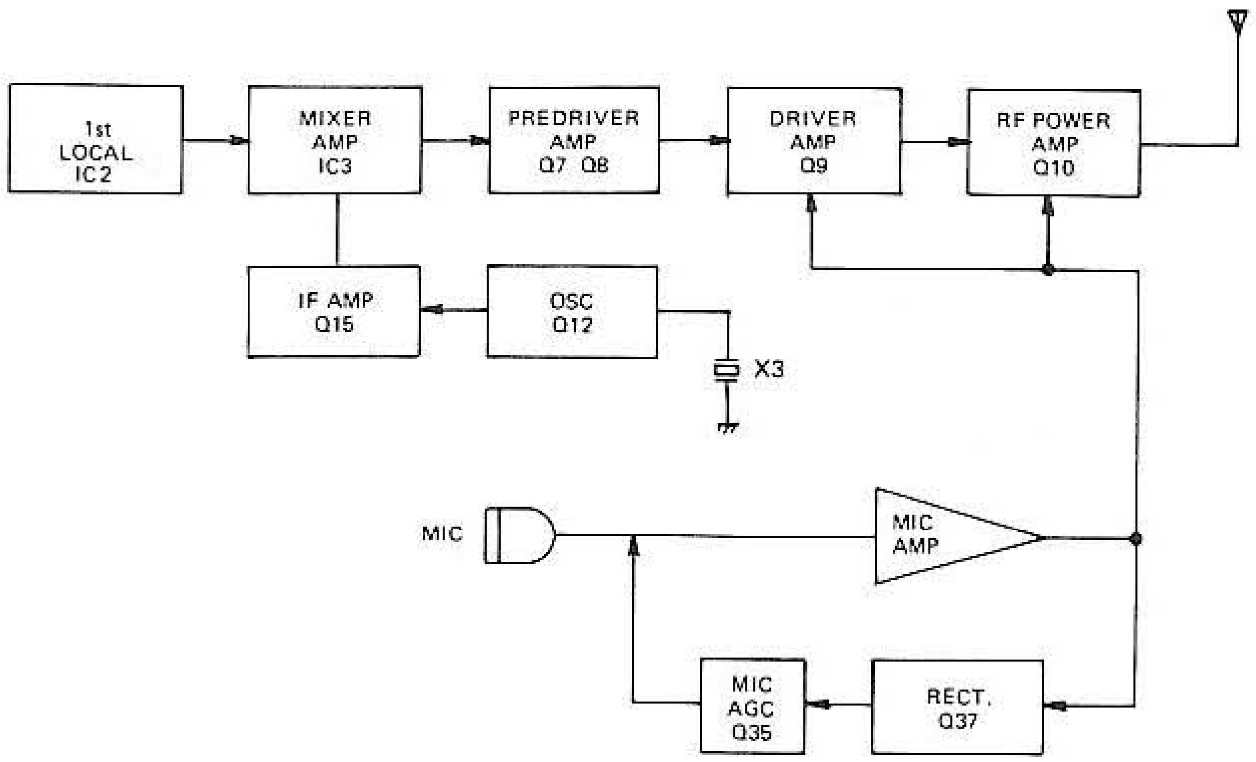


Fig. 10 AM TRANSMITTER

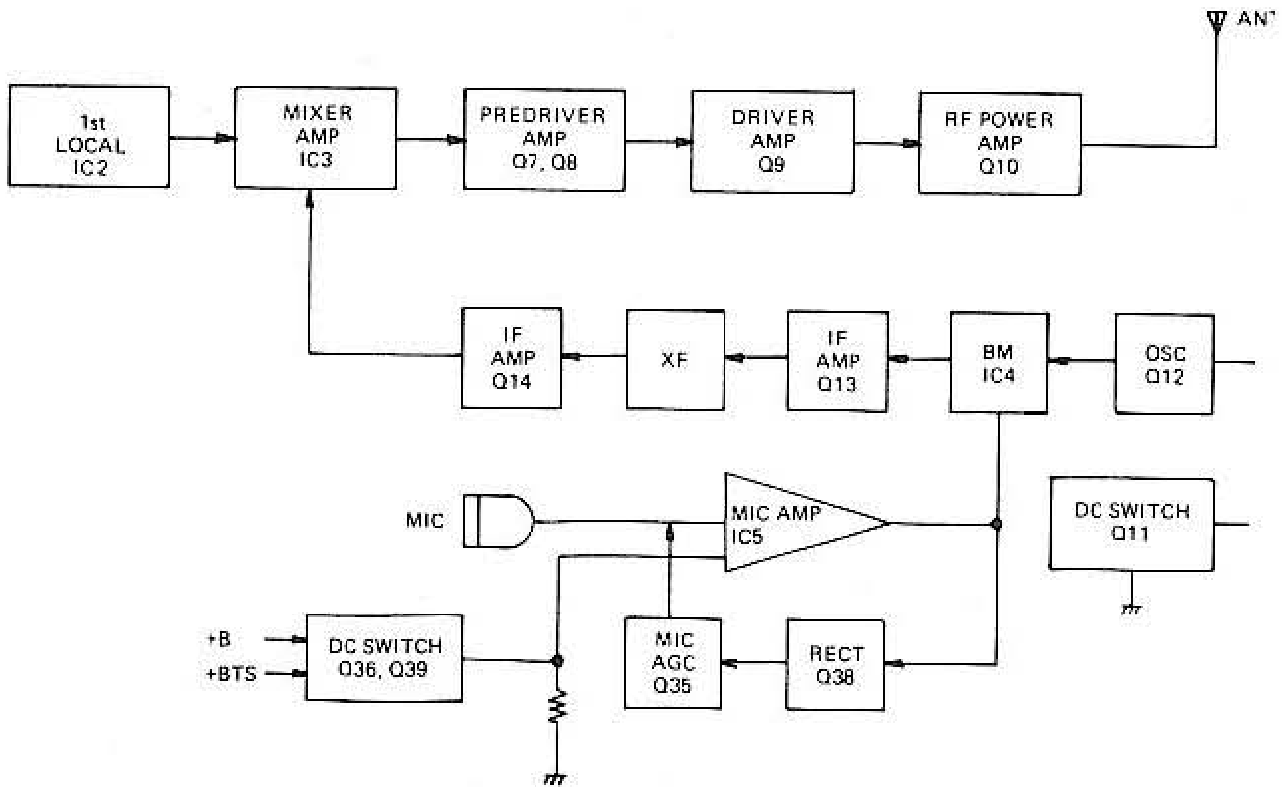


Fig. 11 SSB TRANSMITTER

WARNING

FCC Rules require that ALL transmitter adjustments, other than those supplied by the manufacturer as front panel operating controls, be made by or under the supervision of the holder of an FCC issued 1st or 2nd class radio operator's license.

Replacement or substitution of crystals, transistors, regulator diodes or any other part of a unique nature, with parts other than those recommended by the manufacturer may cause violation of the technical regulations of Part 95 of the FCC Rules or violation of the Type Acceptance requirements of Part 2 of the Rules.

ALIGNMENT PROCEDURES FOR AM/SSB TRANSCEIVER

1. TEST VOLTAGE

DC 13.8V ± 5%, unless otherwise specified.

2. TEST EQUIPMENT

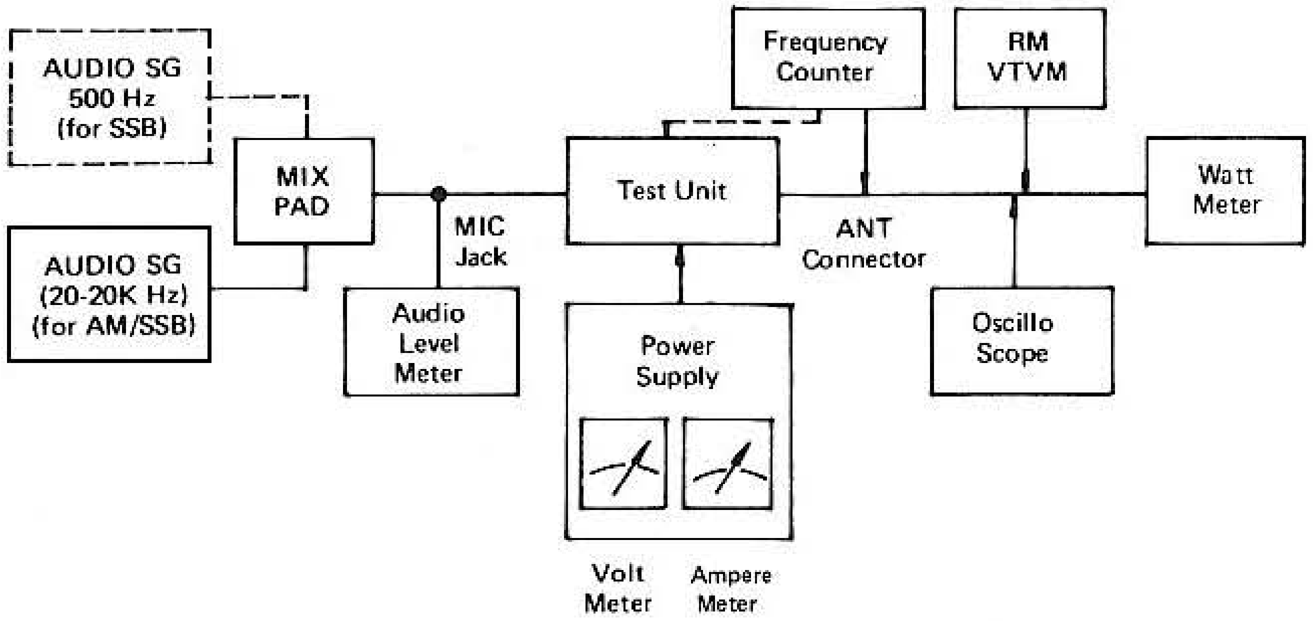
All test equipment should be properly calibrated.

1. Audio Signal Generator, 10 Hz to 20 kHz
2. Audio Level Meter, 1mV measurable
3. DC Ampere Meter, 3A
4. Regulated Power Supply, DC 0 to 20V, 3A or higher
5. Frequency Counter, 0 to 40 MHz, High Input Impedance Type
6. RF VTVM, Probe Type
7. Oscilloscope, 30 MHz, high input impedance
8. RF Watt Meter, thermo-couple type, 50 Ω, 15W
9. Standard Signal Generator, 100 kHz to 50 MHz, −10 to 100 dB, 50 Ω unbalanced
10. Speaker Dummy Resistor, 8 Ω, 5W
11. Circuit Tester, DC, 20 kΩ/V, High Input Impedance Type (20 kΩ/V or higher)

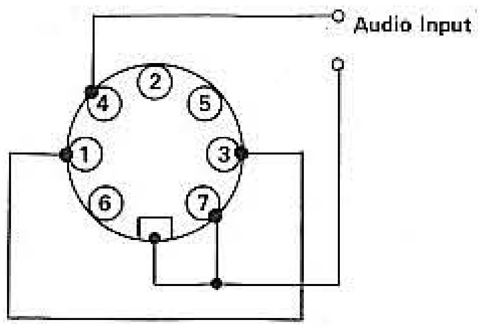
3. ALIGNMENT OF TRANSMITTER CIRCUITRY

3.1 Test Setup

Connect all test equipment as shown below:



3.2 To set the transceiver into transmit mode without the microphone, insert the plug wired as shown below into the MIC jack on the transceiver. When applying the audio modulation signal to the microphone input.circuit, also use the same plug.



3.3 PLL Circuit Alignment

NOTE: This alignment should be conducted with the frequency counter having high sensitivity and high input impedance.

3.3.1 10.240 MHz Frequency Alignment (USB.TX)

Place the Channel Selector in CH19 and mode switch in USB position. Connect a frequency counter to the testpoint, TP2 through a 1000 pF Coupling capacitor and adjust the trimming capacitor CT3 for the reading of:

10.240000 MHz ± 50 Hz

3.3.2 10.0525 MHz Frequency Alignment (USB.TX)

Connect both oscilloscope and frequency counter to the test point TP3 and adjust the core of T3 maximum amplitude of scope display (10.0525 MHz x 2), then adjust the trimming capacitor CT1 to obtain the reading of:

20.105 MHz ± 40 Hz

Next, place the mode switch in the LSB position and adjust CT2 to obtain the reading of :

20.1035 MHz ± 40 Hz

3.3.3 10.695 MHz Frequency Alignment

Connect the frequency counter to the TP5 and adjust CT5 to read 10.695 MHz ± 50 Hz in the USB mode of operation. Next, place the mode switch in the LSB and adjust CT4 to read 10.692 MHz ± 50 Hz.

3.4 VCO Circuit Alignment

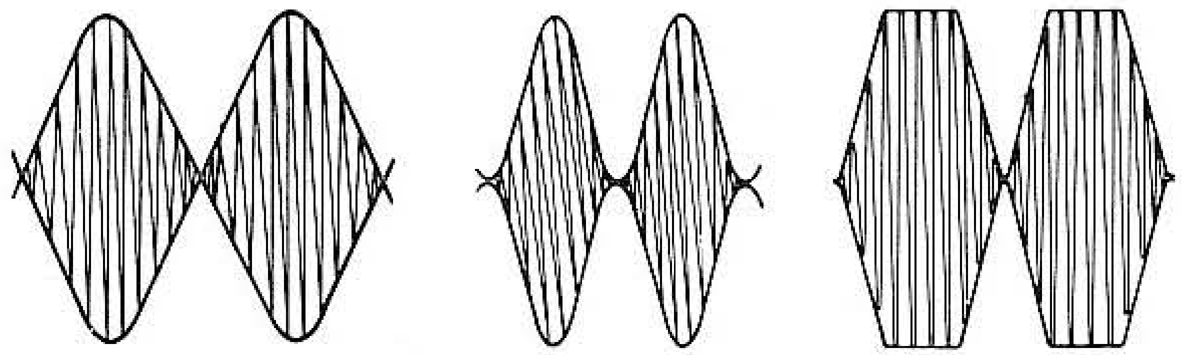
1. Place the channel selector in CH 1 position.
2. Connect a circuit tester (DC 12V range) between the ground and TP4.
3. Adjust core provided in the VCO Block to obtain 3.6V ± 0.1V, starting from top to bottom when turning the core (the circuit tester used in this alignment should be calibrated and has an input impedance of 20 kohm/V or higher).
4. Next, place the channel selector in CH 40 and make sure the reading should be within 1.4 - 2.3V.

3.5 Driver Stage Alignment

1. Apply 2.4 kHz , 2.5 mV audio signal to the MIC input circuit.
2. Place the channel selector in CH 40 position and mode switch in USB position.
3. Connect an oscilloscope and 50 ohm dummy load across the ANT connector.
4. Adjust T1 for maximum amplitude of scope display.
5. Next, place the channel selector in CH 1 position and adjust T2 for maximum amplitude.
6. Connect an ampere meter between the Q10 emitter and chassis ground and adjust RV1 to obtain bias current of 35 mA ± 10 mA.
7. Place the channel selector in CH 40 position and adjust T4 for maximum amplitude of scope display.
8. Place the channel selector in CH 1 position and adjust T5 for maximum amplitude.

3.6 SSB RF Power Amplifier Stage Alignment

1. Place the channel selector in CH 19 position and the mode switch in USB position.
2. Feed 2.4 kHz, 25 mV audio signal to the microphone input circuit.
3. Connect an oscilloscope to the Q7 emitter and adjust T11 for maximum amplitude of scope display.
4. Turn T6 core fully upward, then adjust RV11 to obtain the reading of 150 mV (peak-peak) on the scope.
5. Connect the oscilloscope to the ANT connector in parallel with the Watt-meter.
6. Temporarily adjust RV2 fully counter clockwise and adjust the L13 core so that the core top is flush with the top of coil bobbin.
7. Adjust T6, T11, L7 and L11 for maximum power output.
8. Decrease audio signal input to the microphone circuit to zero and adjust RV4 and RV5 for minimum amplitude of carrier leakage on the scope display.
9. Feed two tone (500 Hz and 2400 Hz) signals of 25 mV to the microphone circuit and adjust RV2 (ALC) to obtain PEP power of 10W. In this condition, make sure the PEP power output at each channel is within 9 - 11W. Also make sure the scope display of output wave shape shown below is obtained.



Correct Incorrect Incorrect

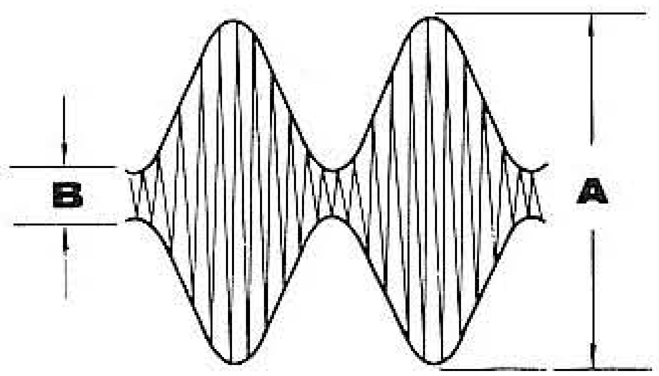
10. Place the mode switch in the LSB position and make sure the above alignments are not upset and the similar results are obtained in this mode of operation.

3.7 AM RF Power Stage Alignment

1. Place the mode switch in the AM position and the channel selector in CH 19 position.
2. Adjust VR4 for RF power output of 3.7W on the Wattmeter.

3.8 Modulation Alignment (AM)

1. Apply 2.5 kHz, 25 mV Audio input signal to the MIC input circuit.
2. Adjust RV12 so that modulation depth of 80 - 90% is obtained.
3. Next, decrease the signal input to 2.5 mV and make sure the modulation depth is still keeping 30% or higher.



Modulation ratio = $\frac{A - B}{A + B} \times 100$ [%]

3.9 RF Power Meter Alignment (AM)

Adjust RV3 so that the P-RF meter provided on the front panel should indicate the same wattage as the one obtained on the Watt-meter.

3.10 Lock Out Circuit Check

Place the channel selector in the open (blank) channel (detent) position. Make sure the voltage at Q1 base is 0.05 – 0.4V, using a circuit tester.

3.11 Transmit Frequency Check

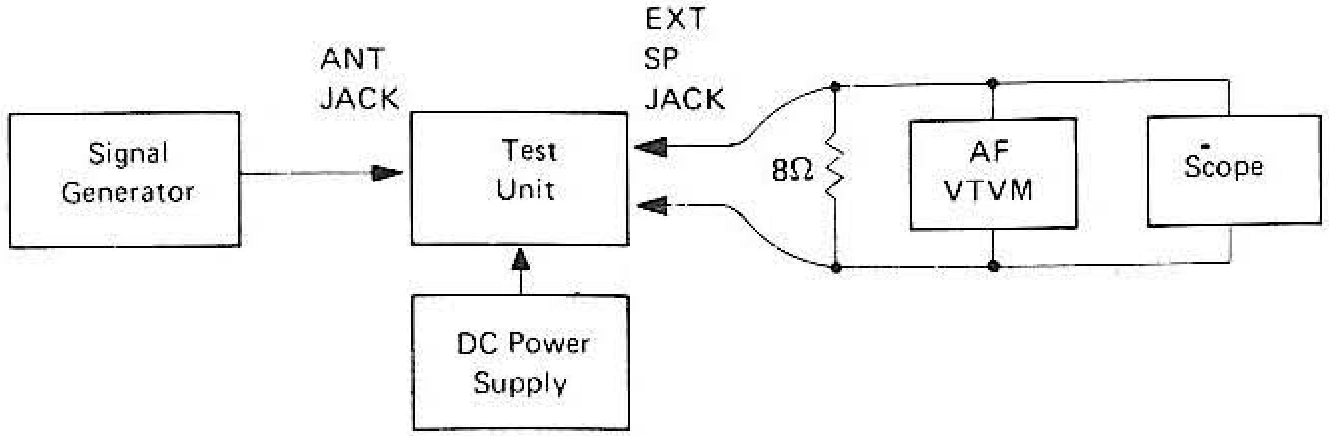
1. Set the transceiver into transmit mode (AM), no modulation.
2. Connect the frequency counter to the antenna connector. And read the frequency at each channel. The frequency should be within ±800 Hz from each center channel frequency as tabulated in the Frequency Table attached.

3.12 Alignment of Regulated Voltage Power Supply

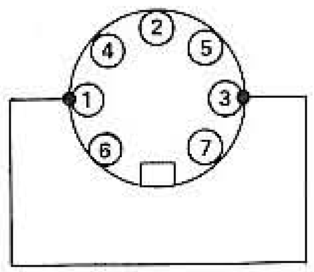
Make sure the voltage at PIN Terminal No. 3 on PTPW007COX is 13.8V with AC voltage of 220V supplied. If not, adjust RV 1 to obtain that voltage.

4. ALIGNMENT OF RECEIVER CIRCUITRY

4. 1 Test-Setup



4. 2 To make the transceiver into receive mode, insert the plug wired as shown below into the MIC jack on the front panel.



4.3 AGC Alignment

1. Connect the circuit tester to the No. 15 terminal on the P.C. board and chassis ground.
2. Rotate RF Gain control fully clockwise.
3. Place the mode switch in the AM position.
4. Adjust RV8 to obtain the reading of 2V.

4. 4 Receive Sensitivity Alignment (AM Mode)

1. Set the Signal Generator, 27.185 MHz, 1 kHz 30% modulation. Also set the transceiver into 19 channel position.
2. Adjust T7, T8, T9, T10, T13, T14 and T15 for maximum audio output between the 8 ohm dummy load resistor. This alignment should be performed with very small signal input from the signal generator to avoid inaccurate alignment due to AGC action.
3. After completion of the step 3, rotate the T7 core, so that the audio output decreases by 2 dB.

NOTE: Throughout the above alignment, place the RF Gain control in fully clockwise position, CB-PA switch in CB, Squelch control in minimum and Clarifier control in "12 o'clock" position.

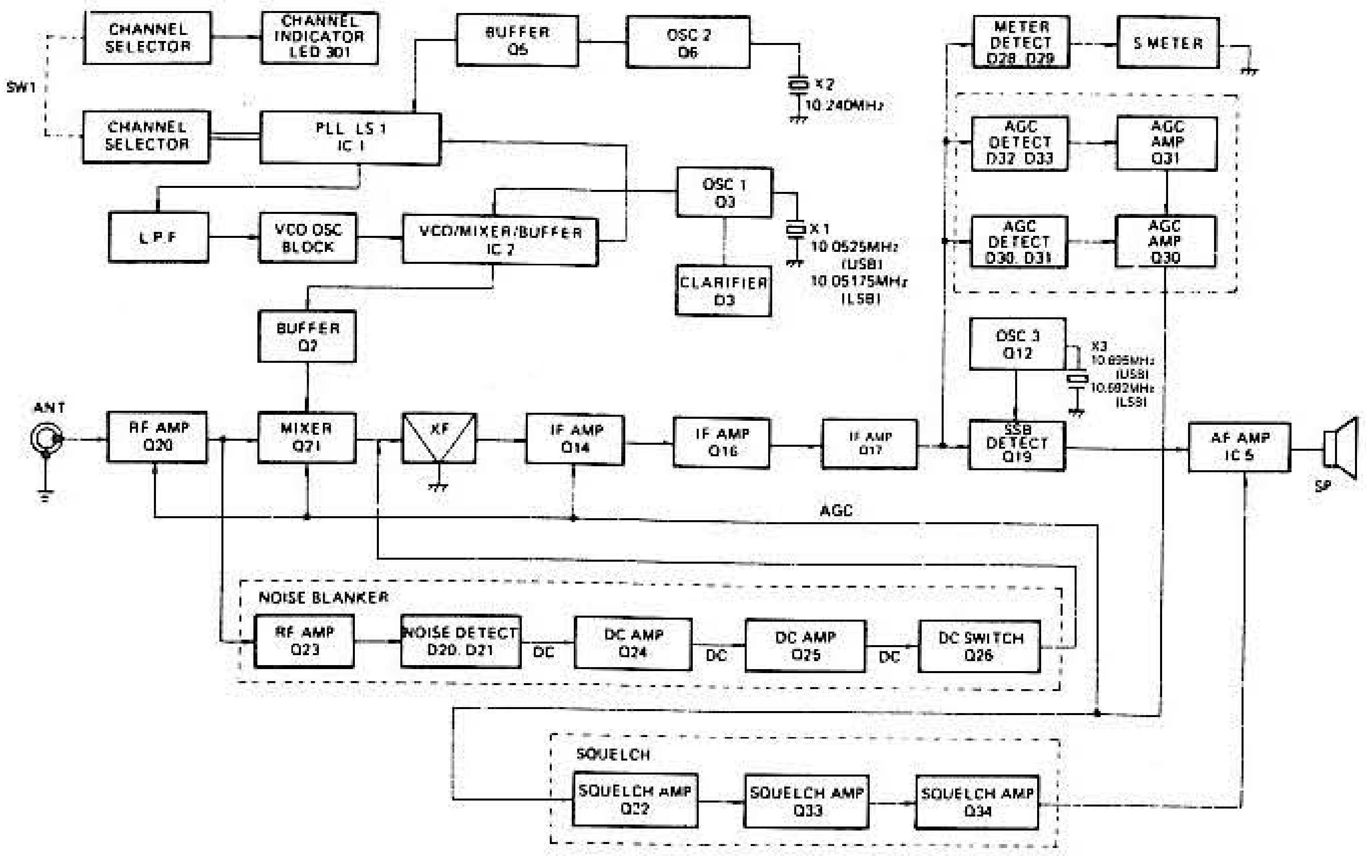
4. 5 Squelch Circuit Alignment

1. Place the mode switch in AM position.
2. Set the signal generator to provide RF input signal of 28 dB (1 kHz, 30% mod.) and rotate the squelch control in full clockwise position.
3. Adjust RV9 so that the audio output just appears on the output terminal (scope-display).
4. Next, place the mode switch in USB position and adjust RV10 in the similar way.

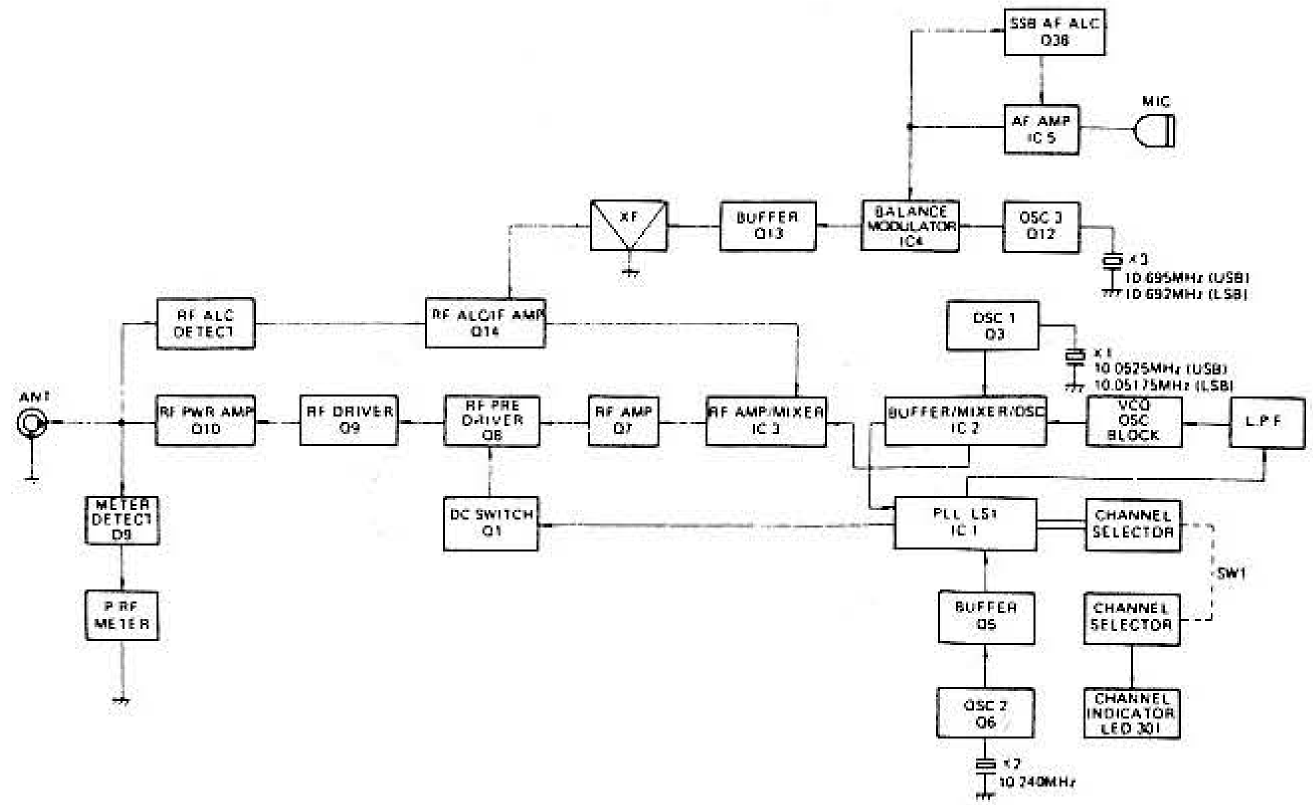
4. 6 S-Meter Adjustment

1. Set the signal generator to provide 40 dB output and place the mode switch in the USB position.
2. Adjust RV7 so that the S-meter pointer should read "9" on the meter provided on the front panel.
3. Next, place the mode switch in the AM position and retune the signal generator slightly to obtain maximum audio putput.
4. Adjust RV6 so that the S-meter pointer should read "9" on the meter.

BLOCK DIAGRAM (1)

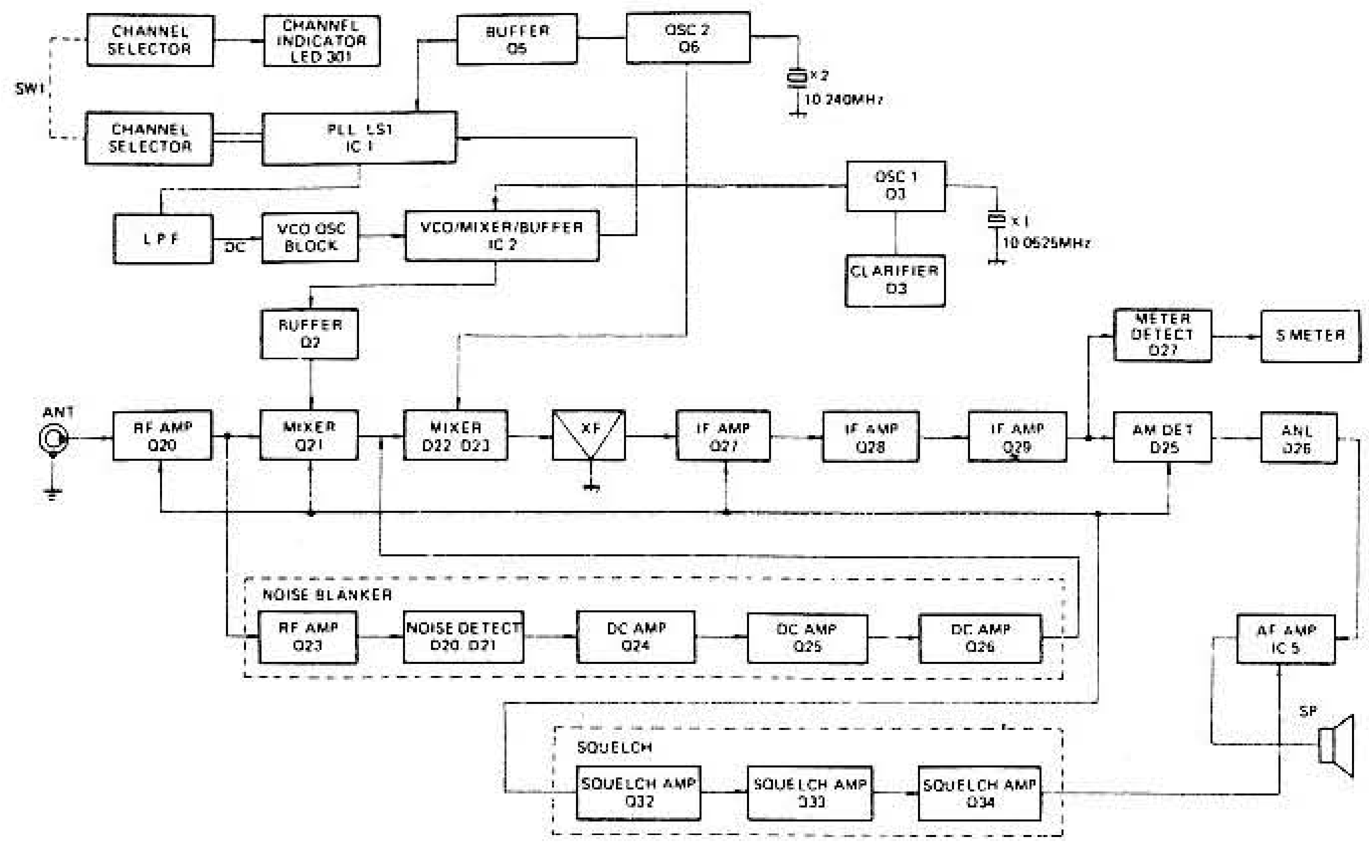


SSB RX

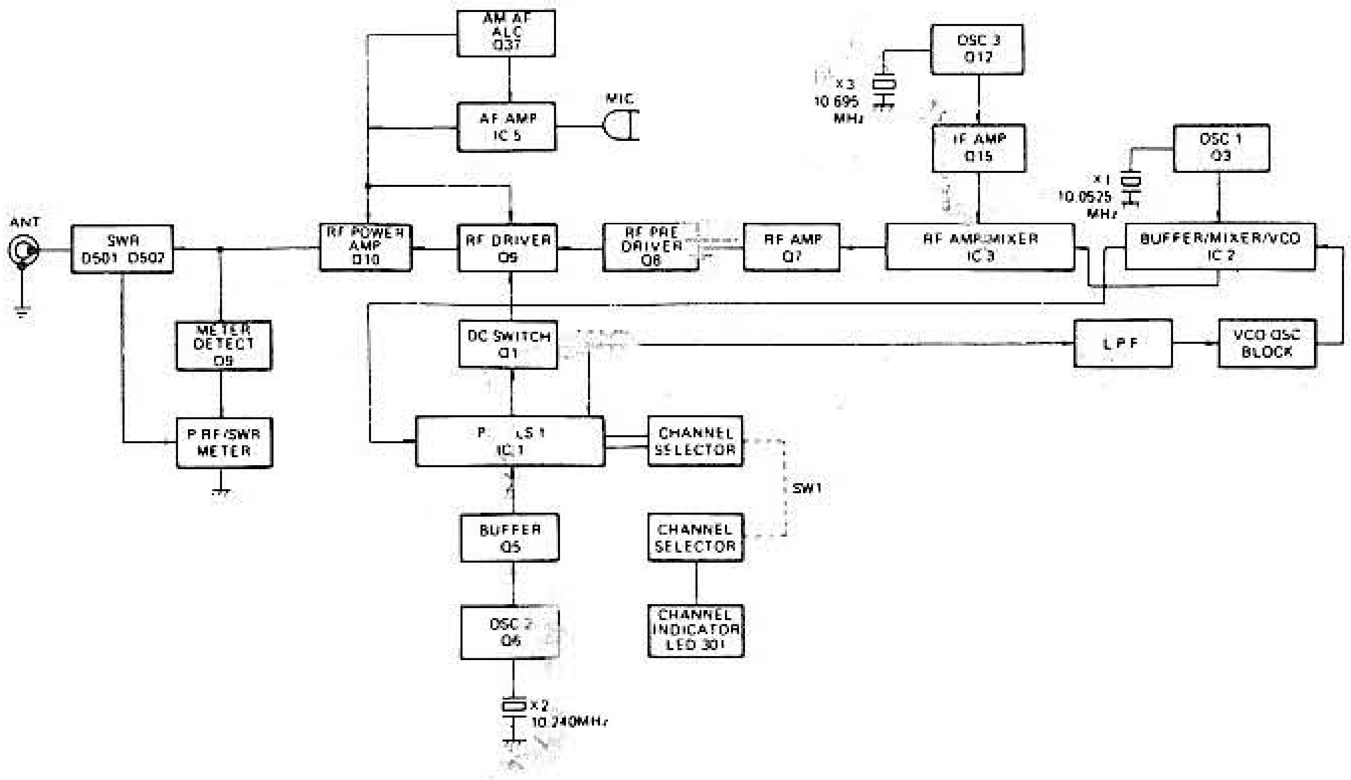


SSB TX

BLOCK DIAGRAM (2)

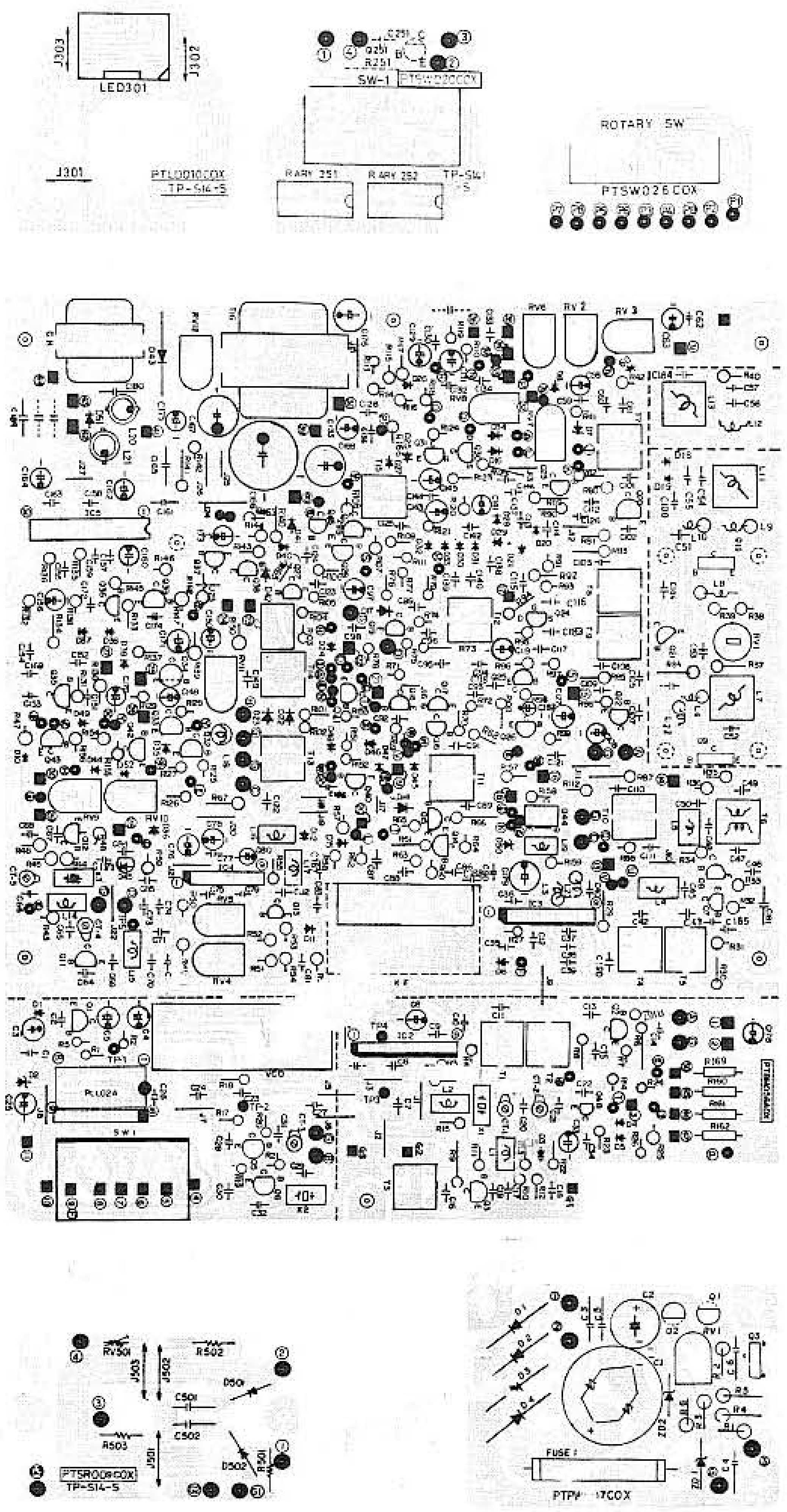


AM RX



AM TX

PC BOARDS DETAIL



SCHEMATIC DIAGRAM