SECTION 1
GENERAL INFORMATION

DESCRIPTION

Your new PEARCE-SIMPSON transceiver is a compact, PLL Control Synthesizing System, 18 channel SSB/AM CB Transceiver. This Radio, because of its low current drain, is ideally suited for Mobile operation from a 12.6V, positive or negative ground DC power source. A 12V DC power cord and a mounting bracket are included with your transceiver. To provide the crystal-controlled, 18 channel SSB and AM operations, PEARCE-SIMPSON utilizes a PLL controlled synthesizing circuit.

[illegible] featuring: [illegible] Local Switch, Noise Blanker, S/RF Meter, Ceramic Filter, External Speaker Jack, PA Jack and instantaneous selection of any of the PLL controlled channels with LED indicator.

The transmitter section is designed around highly reliable silicon transistors and a PLL Controlled Synthesizing System. This circuit makes use of the output of two crystal-controlled oscillators which are beat together to produce the desired frequency. The transmitter final is a conservatively rated high gain RF power transistor. To provide a greatly reliable SSB transmission, the Double Balanced Modulator circuit with Crystal Latice Filter has been utilized.

SPECIFICATIONS

GENERAL

Circuitry	5 ICs, 2 FETs, 42 Transistors, 43 Diodes, 3 Zenors, and 1 VC
Frequency Control	PLL [phase lock loop] synthesizer
Channels	18 channels
Mode of operation	LSB, USB and AM
Power Source Voltage	13.8V DC
Speaker [built-in]	3" dynamic type
Microphone	Dynamic type with PTT bar

RECEIVER

System	SSB: Single Conversion Superheterodyne AM: Dual 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 range
Audio Output	3 watts at 10% distortion
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; 0.455 MHz

SSB TRANSMITTER

Generation	Double Balanced Modulator with Crystal Latice Filter
RF Output Power	12W PEP, at 13.8V DC
Carrier Suppression	More than 40 dB down
Unwanted Side band Suppression	More than 60 dB down
Harmonic Suppression	More than 60 dB down

AM TRANSMITTER

RF Output Power	4 watts, at 13.8V DC
Harmonic Suppression	More than 60 dB down
Modulation	High Level Class B

FREQUENCIES AVAILABLE FOR CB OPERATION

CHANNEL	CHANNEL FREQUENCY [MHz]	CHANNEL	CHANNEL FREQUENCY [MHz]
1	27.015	10	27.125
2	27.025	11	27.135
3	27.035	12	27.155
4	27.055	13	27.165
5	27.065	14	27.175
6	27.085	15	27.185
7	27.095	16	27.195
8	27.105	17	27.205
9	27.115	18	27.225

SECTION 2
INSTALLATION & INITIAL ADJUSTMENT

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

MOBILE STATION INSTALLATION

MOUNTING

For mobile installation, the mounting cradle is designed to serve as a means of mounting the transceiver in any position which is convenient. After you have determined the most convenient location, hold the unit and cradle in the exact location desired. If nothing interferes with it, remove the cradle from the unit and use it as a template to mark the location for the mounting bolts. Before drilling the holes, make certain nothing will interfere with the installation of the mounting bolts.

POWER CONNECTION

The transceiver is constructed to be used in vehicles using either positive or negative ground. The red lead is the positive lead and the black lead is the negative lead. If the existing wiring is used, be sure that it is heavy enough to prevent voltage drop to the radio. A good source of battery voltage is at the accessory connection on the ignition switch. Using this as a power source insures the radio will be off when the ignition switch is turned "OFF", and power will be supplied to the radio when it is in the "ON" or "ACCESSORY" position. Determine whether your vehicle has a positiver or negative grounded battery system before connecting the power cable.

ANTENNAS

Your SUPER PANTHER 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 mobile citizens band use.

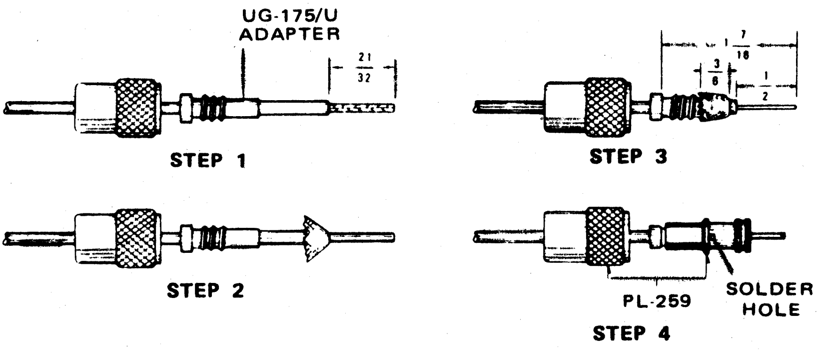
For an automobile installation, a whip may be used with good efficiency because the automobile acts as a counterpoise and reduces detuning effects. The mounting location also has a great effect on the efficiency.

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.

The so-called "short whip" is a less efficient antenna because the radiation area is reduced. However, full use of its capability may be achieved since a shorter antenna may be mounted in a more advantageous position on an automobile, such as in the middle of the top.

There are also newer mobile antennas on the market which are made to replace the entertainment radio antenna and are similar in appearance. These antennas serve three purposes: AM and FM entertainment broadcast reception and Citizens Band transmission and reception.

For a marine installation, the full-length quarter wave whip antenna is very efficient, however it requires radials which make it hard to mount in small boats. Another excellent antenna is the coaxial sleeve type which requires no radial. A similar antenna is the center loaded 1/2 wave which is about the same as the full length 1/4 wave whip and it requires no radials. Care must be used when choosing one of the shortened type antenna as considerable variation in efficiency will be found between the various makes and models. As a general rule, avoid those with short radiating elements because the greater the radiating area, the stronger the radiated signal will be.



ASSEMBLING ANTENNA PLUG TO RG-58U
OR OTHER COAXIAL CABLE

Fig. 1

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 received, the antenna is probably cut as near as is possible to this value. The mounting location on the vehicle 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, connect an SWR meter in the feed line to the antenna.

The SUPER PANTHER will work into an antenna system having an 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

The SUPER PANTHER contains automatic noise limiter, noise blanker and input power filtering. In most vehicular installations, the noise suppression for the entertainment radio will be sufficient. Vehicles and boats not having this suppression may require that it be installed. In most cases, installation of distributor suppressors and generator condensers will be sufficient. In severe cases, the services of a qualified technician may be required.

SECTION 3
OPERATING INSTRUCTIONS

CONTROLS AND INDICATORS

FRONT PANEL

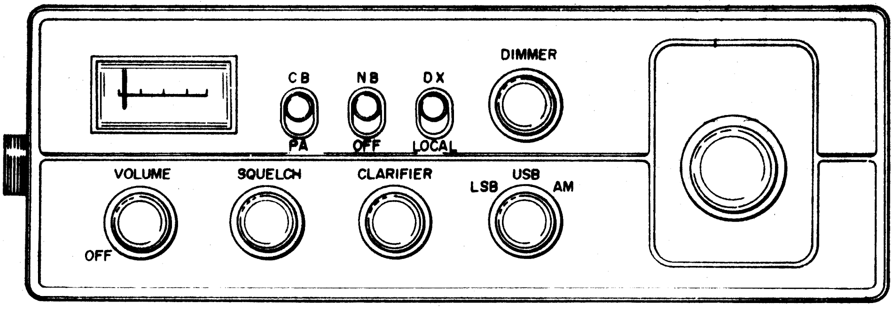


Fig. 2

REAR PANEL

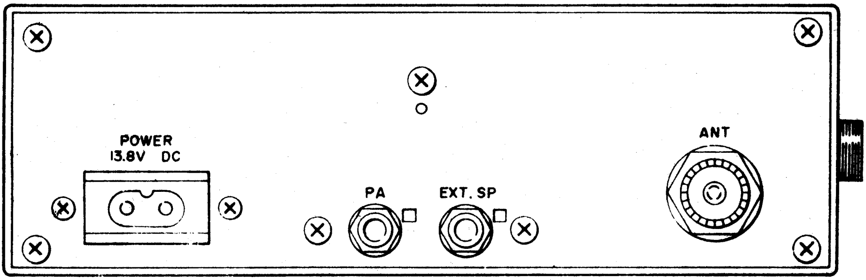


Fig. 3

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 (SPEAKER) 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.

CLARIFIER

This permits slight adjustment of receiver tuning. Used for clarity on SSB reception and fine tuning of stations on AM reception.

MODE SWITCH

This switch selects mode of operation — Lower Side Band, Upper Side Band and standard 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.

DX-LOCAL SWITCH

Place this switch in LOCAL position for strong station, and in DX position to receive weak or distant station.

DIMMER CONTROL

This controls the illumination strength of channel indicator LED (Light Emitting Diode).

S/RF POWER METER

This gives the relative strength of incoming signals when receiving and RF power output when transmitting.

CHANNEL SELECTOR

This selects one of the 18 channels desired. Channel Indicator LED will show the selected channel automatically.

MIC JACK

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

PA SP JACK

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

EXT. SP JACK

This is used for an external speaker connection. When the plug is inserted into this jack, the built-in speaker is automatically disconnected.

ANTENNA CONNECTOR

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

DC POWER SOCKET

This socket is used for connection of DC power cord supplied with the unit for DC power supply.

OPERATING THE SUPER PANTHER

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

Rotate SQUELCH CONTROL fully counter-clockwise. Place the CB-PA switch in the CB position and DX-LOCAL switch in the DX position. Rotate the Volume Control clockwise, to apply power, and advance the Volume Control until noise or signal is heard in the speaker. (Temporarily, MODE switch should be placed in AM.)
(Since your transceiver uses all transistors, no warn 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.

When listening to a weak signal, adjust your Clarifier control for strongest signal.

SECTION 4
MAINTENANCE & SERVICING

CIRCUIT DESCRIPTION

Your SUPER PANTHER is the SSB/AM Transceiver employing 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 Locked Loop" in which a given signal is processed to track the frequency and phase of a reference signal.
In other word, the PLL is of an automatic frequency control loop or automatic phase control.
The PLL circuitry consists of the three main units in simple form as shown in Fig. 4.

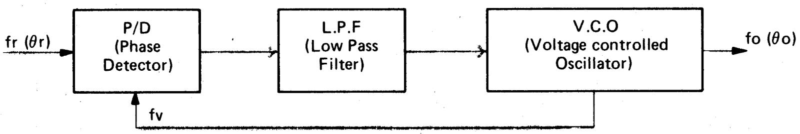


Fig. 4 Fundamental Block Diagram of PLL Circuitry

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 an 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 – 18] according to the channel selection. Figure 5 is the new block diagram made with this modification. As you can see, a programmable divider, mixer and offset oscillator are newly added.

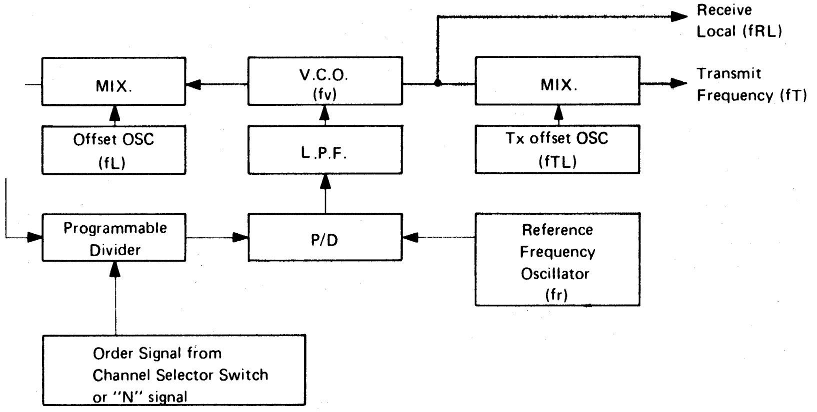


Fig. 5 Theoretical Block Diagram of PLL Frequency Synthesizer Circuitry for CB transceiver

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

$$fRL = fL + fv \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$
$$fv = fL - (N \times fr) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

The transmit frequency fT is

$$fT = fRL - fTL \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$
$$= fL + fv - fTL \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

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 1, 27.015 MHz, the first local frequency fRL should be,

$$fRL = 27.015 + 10.695 = 37.71 \text{ MHz}$$

The V.C.O. frequency fv is,

$$fv = fRL - fL = 37.71 - 20.105 = 17.605 \text{ MHz}$$

Then, "N" code will be obtained by using equation 2,

$$N = \frac{fL - fV}{fr} = \frac{20.105 - 17.605}{0.01} = 250.$$

This means that selecting the channel 1 is to select one of "N" codes (i.e. 250) 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 P.L.L. frequency synthesizer type transceiver.

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

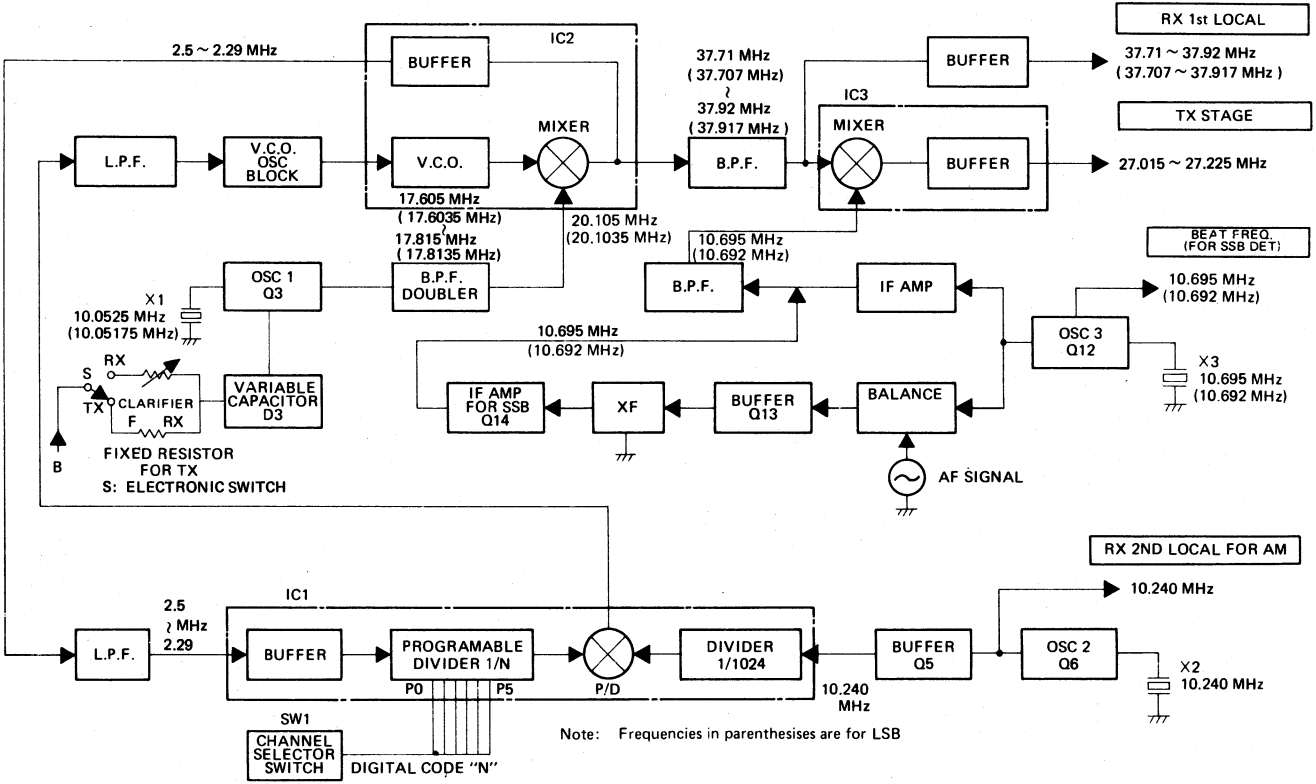


Fig. 6 BLOCK DIAGRAM FOR PLL CIRCUIT

FREQUENCY AND CODE CHART FOR AM/SSB TRANSCEIVER

Channel No.	Channel Freq. (MHz)	"N" Digital Code	VCO Freq. (MHz)		Channel Sw. Output						Rx 1st Local Freq. (MHz)	
			AM/USB	LSB	P0	P1	P2	P3	P4	P5	AM/USB	LSB
1	27.015	250	17.605	17.6035	0	1	0	1	1	1	37.71	37.707
2	27.025	249	17.615	17.6135	1	0	0	1	1	1	37.72	37.717
3	27.035	248	17.625	17.6235	0	0	0	1	1	1	37.73	37.727
4	27.055	246	17.645	17.6435	0	1	1	0	1	1	37.75	37.747
5	27.065	245	17.655	17.6535	1	0	1	0	1	1	37.76	37.757
6	27.085	243	17.675	17.6735	1	1	0	0	1	1	37.78	37.777
7	27.095	242	17.685	17.6835	0	1	0	0	1	1	37.79	37.787
8	27.105	241	17.695	17.6935	1	0	0	0	1	1	37.80	37.797
9	27.115	240	17.705	17.7035	0	0	0	0	1	1	37.81	37.807
10	27.125	239	17.715	17.7135	1	1	1	1	0	1	37.82	37.817
11	27.135	238	17.725	17.7235	0	1	1	1	0	1	37.83	37.827
12	27.155	236	17.745	17.7435	0	0	1	1	0	1	37.85	37.847
13	27.165	235	17.755	17.7535	1	1	0	1	0	1	37.86	37.857
14	27.175	234	17.765	17.7635	0	1	0	1	0	1	37.87	37.867
15	27.185	233	17.775	17.7735	1	0	0	1	0	1	37.88	37.877
16	27.195	232	17.785	17.7835	0	0	0	1	0	1	37.89	37.887
17	27.205	231	17.795	17.7935	1	1	1	0	0	1	37.90	37.897
18	27.225	229	17.815	17.8135	1	0	1	0	0	1	37.92	37.917

Note: 1; High Level = 4.5 – 5.5V
0; Low Level = 0.05 – 0.4V

CIRCUIT DESCRIPTION OF AM/SSB TRANSCEIVER

1. PLL Circuit

The offset frequency oscillator Q3 is being oscillated with the frequency of 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 (2.5 – 2.29 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.

Q1 Q7 is a switching transistor provided to cut off the RF Pre-emp, Q7, when the PLL 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, refer to the schematic diagram and the Block Diagram shown in Fig 7.

2. AM Receiver Circuitry

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 kHz 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 (IC 5) 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 stage 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 Circuitry

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 frequen-

cies 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 Circuitry

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, (IC 5, 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 IC 5 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 37.71 – 37.92 MHz (AM/USB) or 37.707 – 37.917 MHz (LSB) will be to the IC 3, 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 (IC 4). The IC is designed to produce carrier-suppressed double side band signals when an audio signal amplified with IC 5 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 IC 3 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 lowpass 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 IC 5 as a 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 (IC 5) and disabling the amplifier. On the other hand when the transistor Q34 is turned on, the amplifier will start to operate.

8. Regulated Power Supply 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.

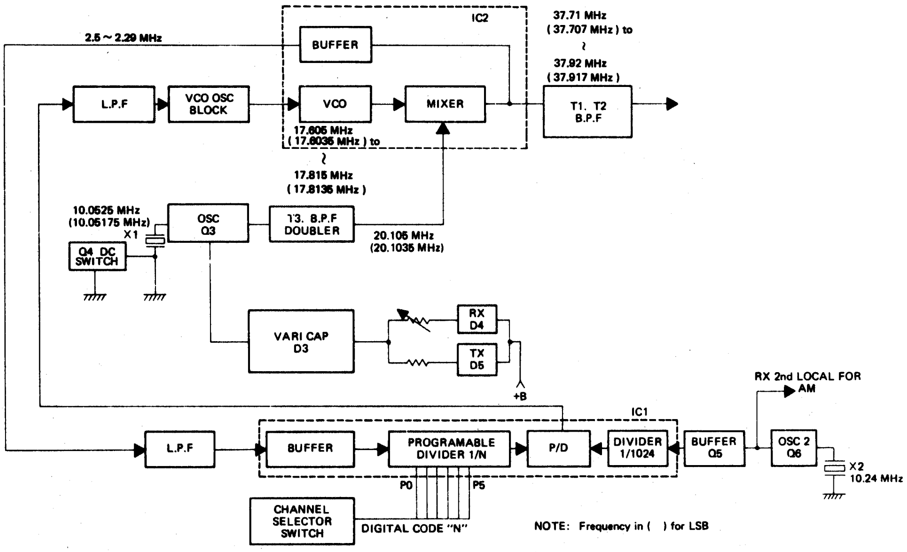


Fig. 7 PLL CIRCUIT

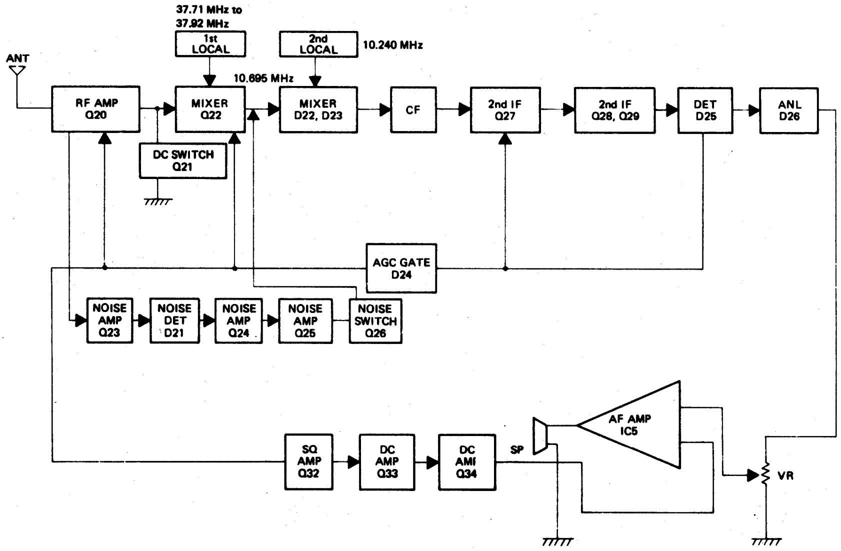


Fig. 8 AM RECEIVER

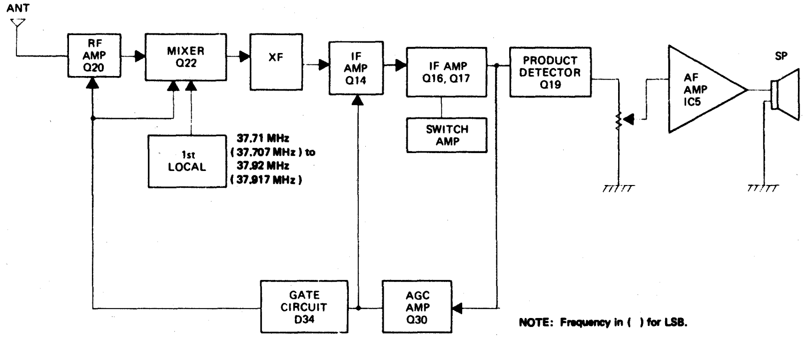


Fig. 9 SSB RECEIVER

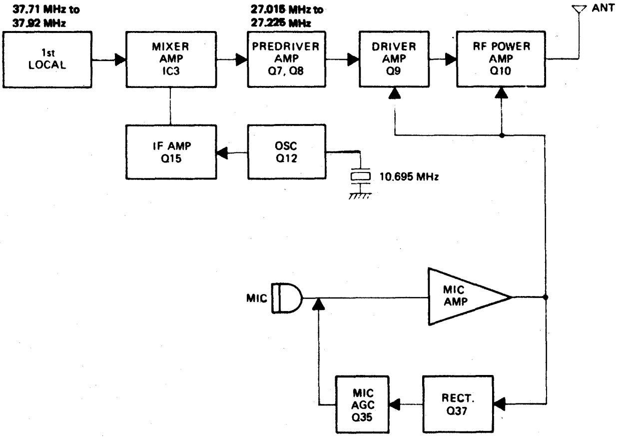


Fig. 10 AM TRANSMITTER

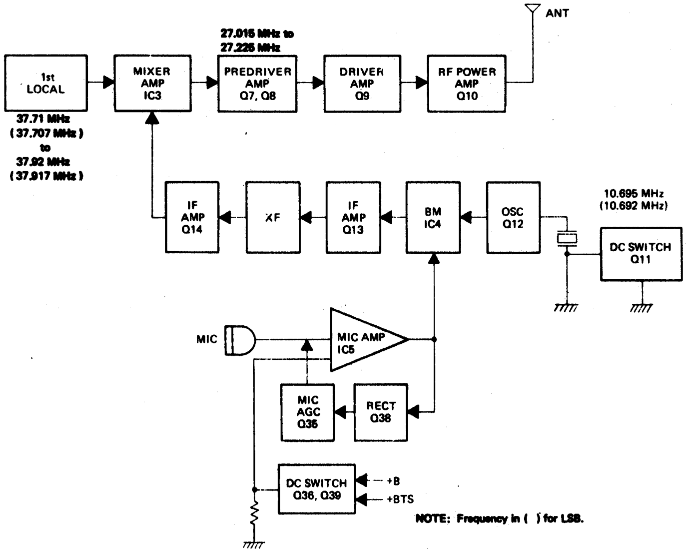


Fig. 11 SSB TRANSMITTER

ALIGNMENT PROCEDURES FOR AM/SSB TRANSCEIVER

1. Test Voltage

DC 13.8V ±5%, unless otherwise specified.

2. Test Equipment

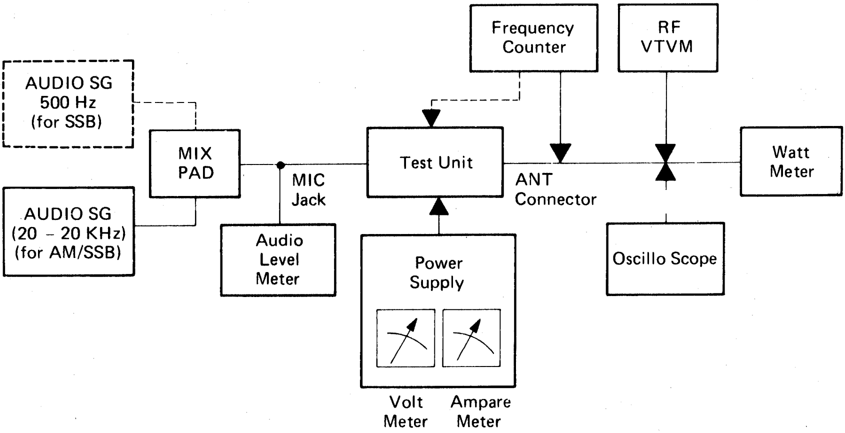
All test equipment should be properly calibrated.

1. Audio Signal Generator, 10 Hz to 20 kHz.
2. Audio Level Meter, 1 mV 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, Prove 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).

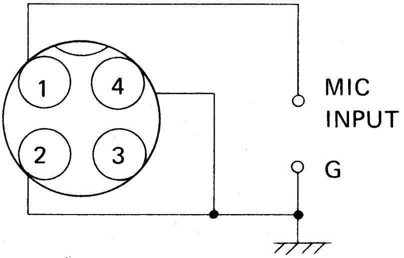
3. ALIGNMENT OF TRANSMITTER CIRCUITRY

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 channel 15 and mode switch in USB position Connect a frequency counter to the testpoint, TP2 through a 100 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 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 channel 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 kΩ/V or higher).
4. Next, place the channel selector in channel 18 and make sure the reading should be within 1.4 – 2.3V.

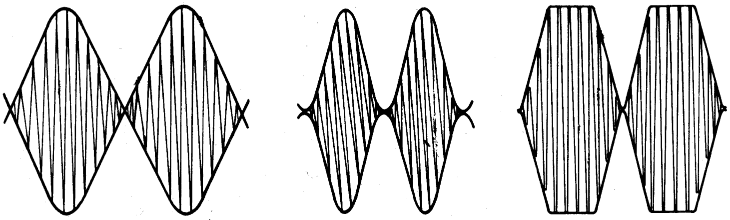
3.5 Driver Stage Alignment

1. Apply 2.4 kHz, 2.5 mV audio signal to the MIC input circuit.
2. Place the channel selector in channel 18 position and mode switch in USB position.
3. Connect an oscilloscope and 50 Ω dummy load across the ANT connector.
4. Adjust T1 for maximum amplitude of scope display.
5. Next, place the channel selector in channel 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 channel 18 position and adjust T4 for maximum amplitude of scope display.

8. Place the channel selector in channel 1 position and adjust T5 for maximum amplitude.

3.6 SSB RF Power Amplifier Stage Alignment

1. Place the channel selector in channel 15 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 Wattmeter.
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.

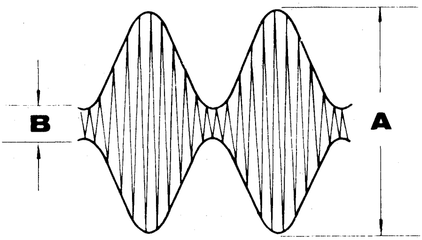
3.7 AM RF Power Stage Alignment

1. Place the switch in the AM position and the channel selector in channel 15 position.

2. Adjust VR5 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.



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

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 Wattmeter.

3.10 Lock Out Circuit Check

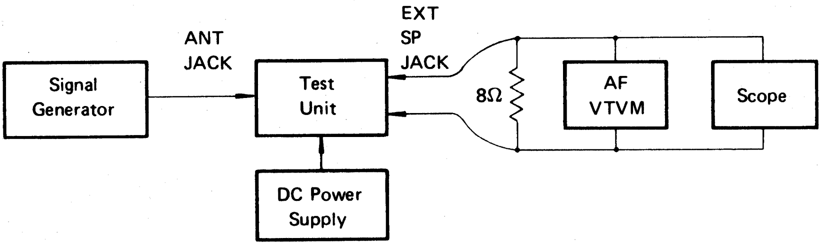
Place the channel selector in the open (blank) channel (detent) position. Make sure the Voltage at Q1 base is 0.05 – 0.4V, using a circuit tester.

3.11 Transmit Frequency Check

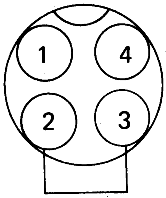
1. Set the transceiver into transmit mode (AM), no modulation.
2. Connect the frequency counter to the antenna connector.
   And read the frequency at each channel. The frequency should be within ±800 Hz from each center channel frequency as tabulated in the Frequency Table attached.

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. Place the mode switch in the AM position.
3. 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 15 channel position.
2. Tune the generator to the transceiver, 15 channel.
3. Adjust T7, T8, T9, T10, T13, T14 and T15 for maximum audio output between the 8 Ω 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.
4. After completation of the step 3, rotate the T7 core, so that the audio output decreases by 2 dB.

NOTE: Through the above alignments, place the NB switch in OFF, DX-LOC switch in DX, CB-PA switch in CB, Squelch control in minimum and clarifier control in "12 o'clock" position.

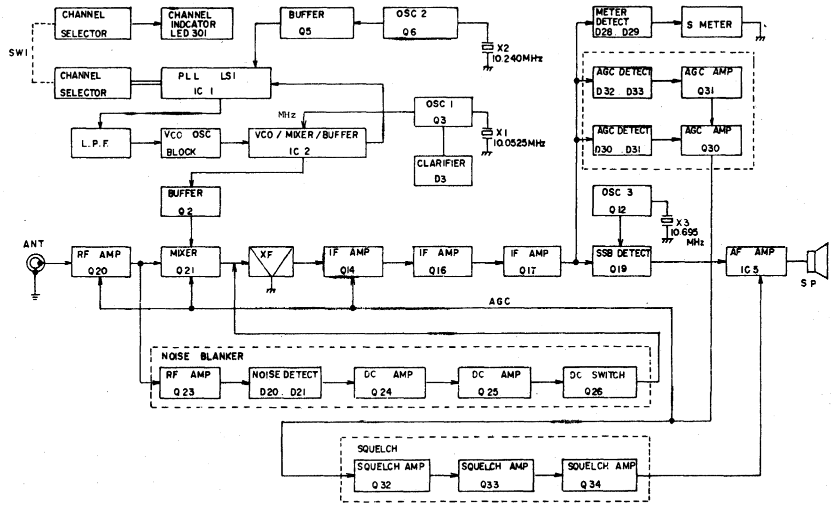
4.5 Squelch Circuit Alignment

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, palce the mode switch in USB position and adjust RV10 in the similar way.

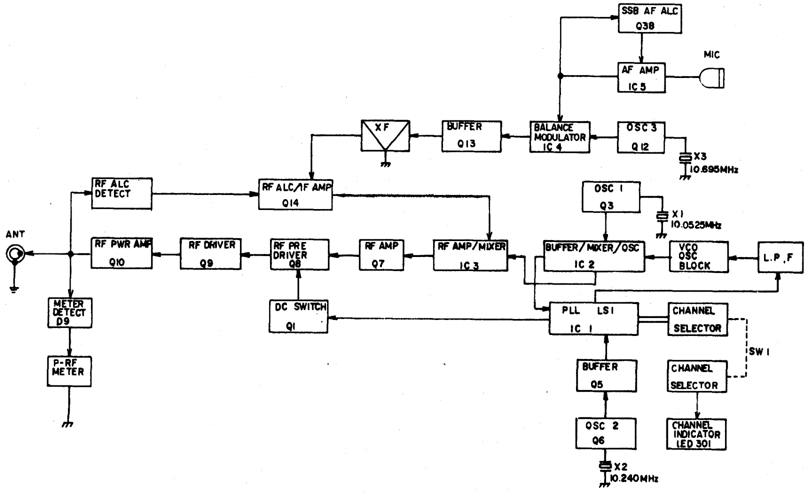
4.6 S-Meter Adjustment

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 output.
4. Adjust RV6 so that the S-meter pointer should read "9" on the meter.

BLOCK DIAGRAM (1)

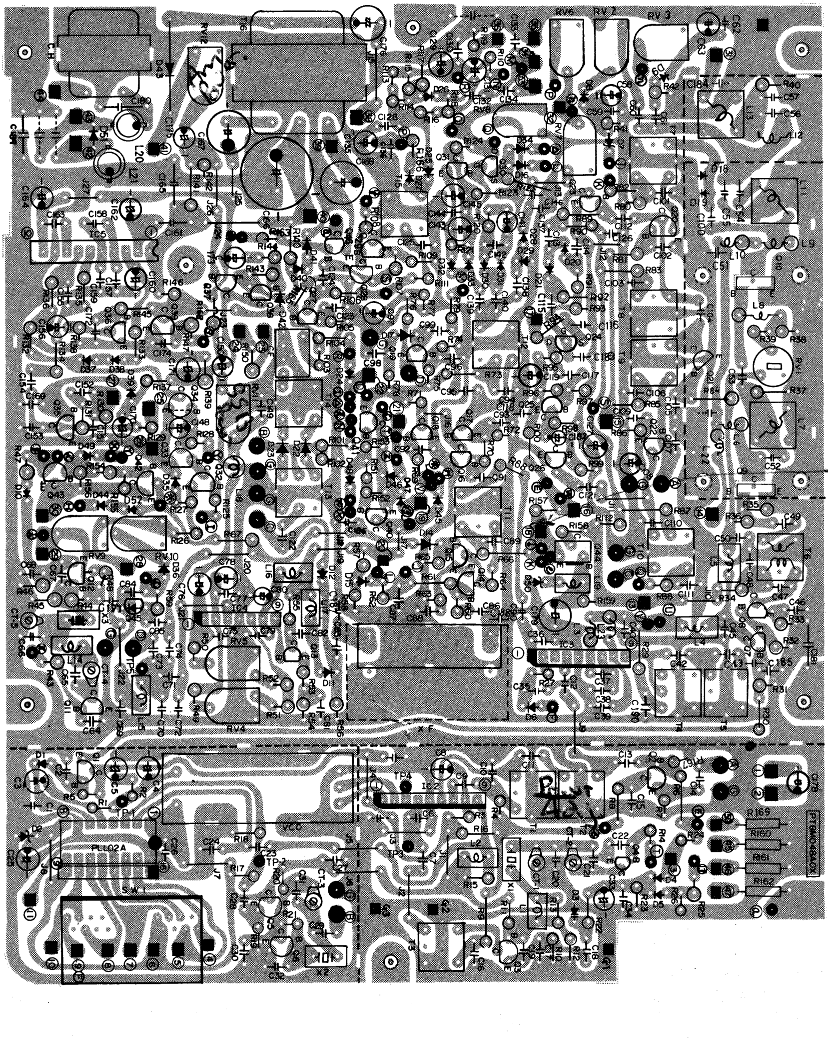


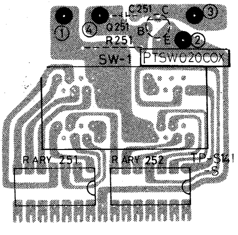
USB RX

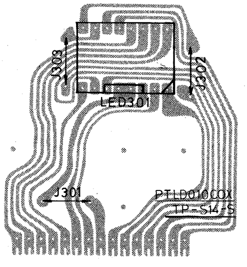


USB TX

PC BOARD DETAIL







SCHEMATIC DIAGRAM MODEL SUPER PANTHER