LCBS-4

40 Channel AM/SSB
Base/Mobile Transceiver

SERVICE MANUAL

Land
Command
by SBE®

TABLE OF CONTENTS

SECTION 1
GENERAL

1.1 CUSTOMER SERVICE

The SBE Technical Service Department functions as a source of information on the application, installation and use of SBE products. In addition, the Technical Service Department provides technical consultation on service problems and availability of local and factory repair facilities.

In any communications to the Technical Service Department, please include a complete description of your problems or needs, including model and serial numbers of the unit or units in question, accessaries being used, any modifications or attachments in use, or any non-standard installation details.

For assistance on any of the above matters, please contact SBE, Incorporated, Technical Service Department, 220 Airport Boulevard, Watsonville, California 95076. Phone: 408/728-2071.

1.2 PARTS ORDERS

SBE original replacement parts are available from the Factory Parts Department at 220 Airport Boulevard, Watosonville, California 95076.

When ordering parts, please supply the following information:

Model number of the unit.
Serial number of the unit.
Part number.
Description of the part.

1.3 FACTORY RETURNS

Repair services are available locally through SBE Certified Service Stations across the country. A list of these Service Stations is available upon request from the Technical Services Department. Do not return any merchandise to the Factory without authorization from the Factory.

SECTION 2
SPECIFICATIONS

2.1 GENERAL

Channels:	40
Frequency Range:	26.965 to 27.405 MHz
Frequency Composition:	PLL Synthesizer Circuitry
Operating Temperature Range:	–20°C to +50°C
Frequency Tolerance:	±0.003%
Operating Humidity Limit:	95%
Input Power Voltage:	117 volts AC, or 13.8 volts DC
Microphone:	Dynamic, 700 ohm, DIN Terminated
Size:	10-7/16" (265 mm)W x 4-59/64" (125 mm)H x 11-27/32" (300 mm)D
Weight:	16.72 lbs (7.6 kg)

2.2 TRANSMITTER

AM RF Power Output:	4 watts
SSB RF Power Output:	12 watts
SSB Carrier Suppression:	40 dB
Harmonic and Suprious Suppression:	60 dB
SSB Composition:	Dual Balanced Modulator

2.3 RECEIVER

AM Heterodyne:	Dual Conversion
SSB Heterodyne:	Single Conversion
AM Intermidiate Frequency:	10.695 MHz, 455 kHz
SSB Intermidiate Frequency:	10.695 MHz
AM Sensitivity at 10 dB S/N:	1 μV
SSB Sensitivity at 10 dB S/N:	0.25 μV

AM Selectivity at 6 dB down:	6 kHz
SSB Selectivity at 6 dB down:	2 kHz
Adjacent Channel Rejection:	70 dB
Clarifier Shift Range:	±800 Hz
Audio Output Power for 8 ohm:	2.7 watts
Squelch Range:	0.7 to 500 μV

SECTION 3
INSTALLATION

GENERAL

This 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 crowded AM sidebands, provides great range, and gives you more channel of communications. To provide the crystal controlled, 40 channel operation, SBE 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, Noise Blanker, Noise Limiter, Channel priority switch, external speaker jack, PA jack and instataneous 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 "3" crystal controlled oscillators which are beat together to produce the desired frequency. The transmitter final is a conservatively rated high gain RF power transistor.

3.1 BASE STATION INSTALLATION

The transceiver is designed to operate directly from a 117V AC power line. The transceiver should be placed in a convenient operating location close to an AC outlet and the antenna lead-in cable.

3.2 POWER CONNECTION

Attach the AC power cable connector to the matching male AC connector at the rear of the unit.

NOTE: Always line up the connector properly before pushing into the connector on the transceiver. Do not attempt to force it onto the pins — when properly lined up, the connector can be inserted easily.
Making sure the transceiver is off, insert the AC plug at the other end and cable into an outlet supplying 117V, 50/60 Hz AC.

For protection, the AC input to the transceiver is fused. As supplied, the transceiver is designed to operate from AC, as state above.

In an emergency, the transceiver may be operated from nominal 12V DC battery. Connect the supplied fused DC power cord to the socket on the rear of the transceiver and to the battery. 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 transceiver in an automobile, make sure that the vehicle has the Negative ground system.

3.3 ANTENNA CONNECTION

For best reception and transmission, your CB transceiver should use an antenna designed for a frequency of 27 MHz. Antennas are purchased separately and include installation instructions.

Numerous types of CB antennas are available that range from emphasis on ease of installation to emphasis on performance. Often the difference in performance between many CB antennas is modest. This transceiver has a standard antenna connector, type SO-239 (located on rear panel), for easy connection to a standard PL-259 coax plug. The antenna matching circuit in this model requires no adjustment if the antenna load is between 35 and 100 ohms. If the coax antenna cable must be made longer, use coax cable with impedance and frequency ratings for 27 MHz, and use only enough cable to suit your needs. This will insure a proper impedance match and maximum power from the transmitter to the antenna.

BASE STATION ANTENNAS: When using this CB transceiver as a Base Station, any Citizen Band ground plane, beam, dipole or vertical antenna may be used. The range of the transceiver depends basically on the height of the antenna. Whenever possible, select the highest location within the FCC limits. The Ground Plane antenna provides greater coverage and is nondirectional. Ideal for base-to-mobile (or to base) operation. It is designed for medium-long range communication. The Beam antenna is a highly directional type antenna and must be used with a rotor unless you are communicating with another Base Station. It is designed for long-range selective communication, and not usually selected for mobile use. Follow all safety instructions when installing base station antenna. Use coaxial cable rated for the 27 MHz frequency when connecting your Base Station antenna to the transceiver. Use 27 MHz connectors and terminate them well when installing the antenna system. Usually RG-58/U cable is adequate up to 50 ft. of cable, use RG-8u type to reduce any in-line signal loss. Antenna cable can also act as the antenna, so keeping length to minimum not only reduces signal loss from cable but also pick up of static signals.

3.4 ANTENNA TUNING

The output circuit of this model, LCBS-4 has been factory adjusted to operate into any good 50 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 50 ohms. An improperly adjusted antenna causes standing waves to appear on the feed line. Since this feed line is fixed at 50 ohms, and cannot be adjusted, this mismatch appears at the transmitter. If the transmitter is adjusted to compensate for this mismtach, both it and the antenna will no longer be operating at peak efficiency. Since the transmitter has already been adjusted to 50 ohms output and the coaxial feed line has a fixed 50 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 Citizen 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 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.

3.5 PUBLIC ADDRESS

An external 8 ohm 4 watts speaker may be connected to the PA jack located on the rear panel of the unit when it is to be used as a public address system. The speaker should be directed away from the microphone to prevent acoustical feedback.

3.6 FINAL CHECKOUT

Make an operational checkout of the transceiver to insure operation of it and all accessories installed. Contact other stations and inquire about their location and their reception of your signal. If an omnidirectional antenna is used, the distance to other stations contacted should be about the same in all directions. A directional antenna should reach more distant stations in the direction in which it is beamed. Also inquire whether the stations contacted are omnidirectional and if directional which way they are beamed.

SECTION 4
OPERATION THEORY OF PLL FREQUENCY SYNTHESIZING AM/SSB CB TRANSCEIVER

4.1 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 reference signal.

In other word, the PLL is an automatic frequency control loop or automatic phase control.

The PLL circuitry consists of the three main units in simple form as shown in Figure 1.

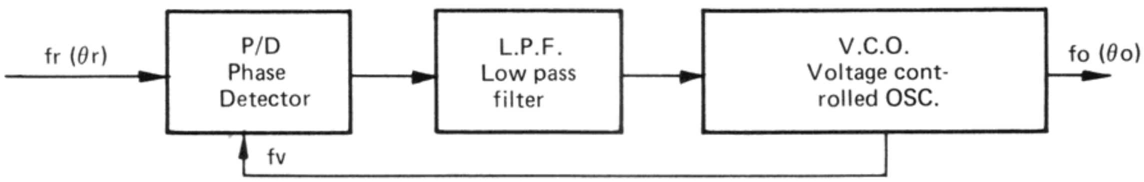


Figure 1. Fundamental Block Diagram of PLL Circuitry

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 comparison is made at every cycle, the DC output is, then, fed to the low pass filter (L.P.F.) and integrated or smoothed to continuous DC voltage in propotion to the phase difference.

The frequency of voltage controlled oscillator (V.C.O.) is controlle 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 — 40) according to the channel selection. Figure 2 is the new block diagram made with this modification. As you can see, a programmable divider, Mixer and Offset oscillator are newly added.

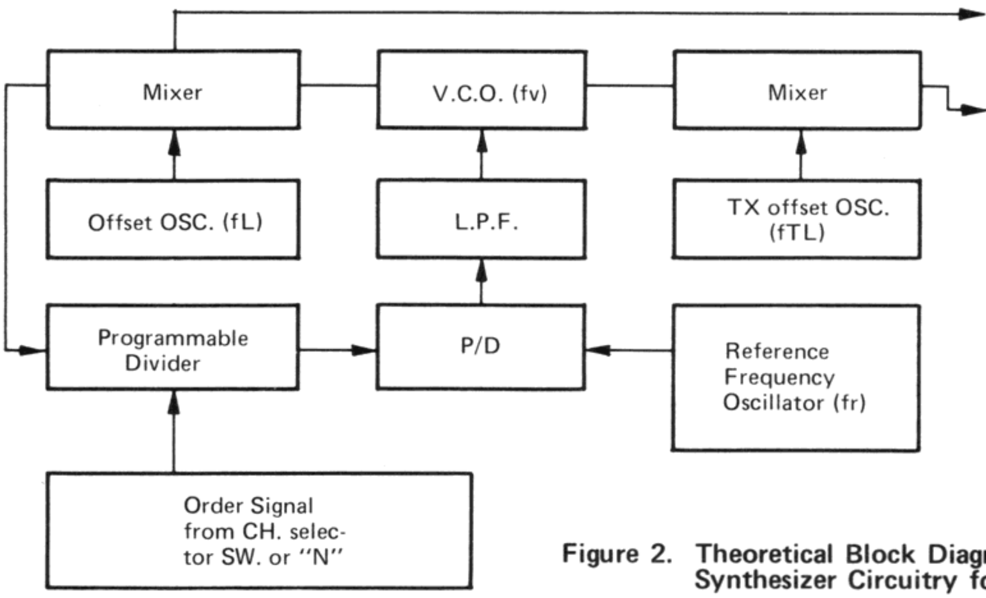


Figure 2. Theoretical Block Diagram of PLL Frequency Synthesizer Circuitry for CB Transceiver

In Figure 2, the first local oscillator frequency for reception fRL is given below

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

The transmit frequency fT is

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

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 VCO frequency fv is

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

Then, N code will be obtained by using equation 2

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

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.

Figure 3 is a practical operation block diagram of PLL section.

CIRCUIT DESCRIPTION OF AM/SSB TRANSCEIVER

PLL CIRCUIT

The offset frequency oscillator Q203 is being oscillates at a 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. (T201) and applied to the IC201, PIN No. 4 terminal to mix with the VCO output frequency being applied to the IC201, PIN No. 2 terminal. The resultant sum frequency is obtained from IC201, PIN No. 6 terminal and used as a first local frequency (37 MHz band). T202 and T203 are band pass filter for this frequency. While the difference frequency is amplified/buffered inside the IC201 and the resultant frequency output (2.55 – 2.11 MHz) is led to the PLL IC203 through IC201, PIN No. 9.

Q204 is the switching circuit to shift the oscillating frequency of Q203 by 1.5 kHz for LSB operation. In terms of first local frequency 3 kHz will be shifted toward minus direction.

Q202 is the standard reference oscillator (10.240 MHz).

Q201 is a switching transistor (unlock detector) provided to cut off the RF Pre-amp, Q206, when the PLL is out of locked, thus avoiding frequencies other than predetermined are amplified and radiated.

D225 is the diode through which DC voltage, which is supplied when the channel selector is placed between channels, is spplied to the IC202 to disable the mixing operation inside the IC202. Thus no frequency will be generated even though the channel selector is placed in a correct position.

For clearer understanding, please refer to the schematic diagram and the Block Diagram shown in Figure 4.

TRANSCEIVER PLL CIRCUIT

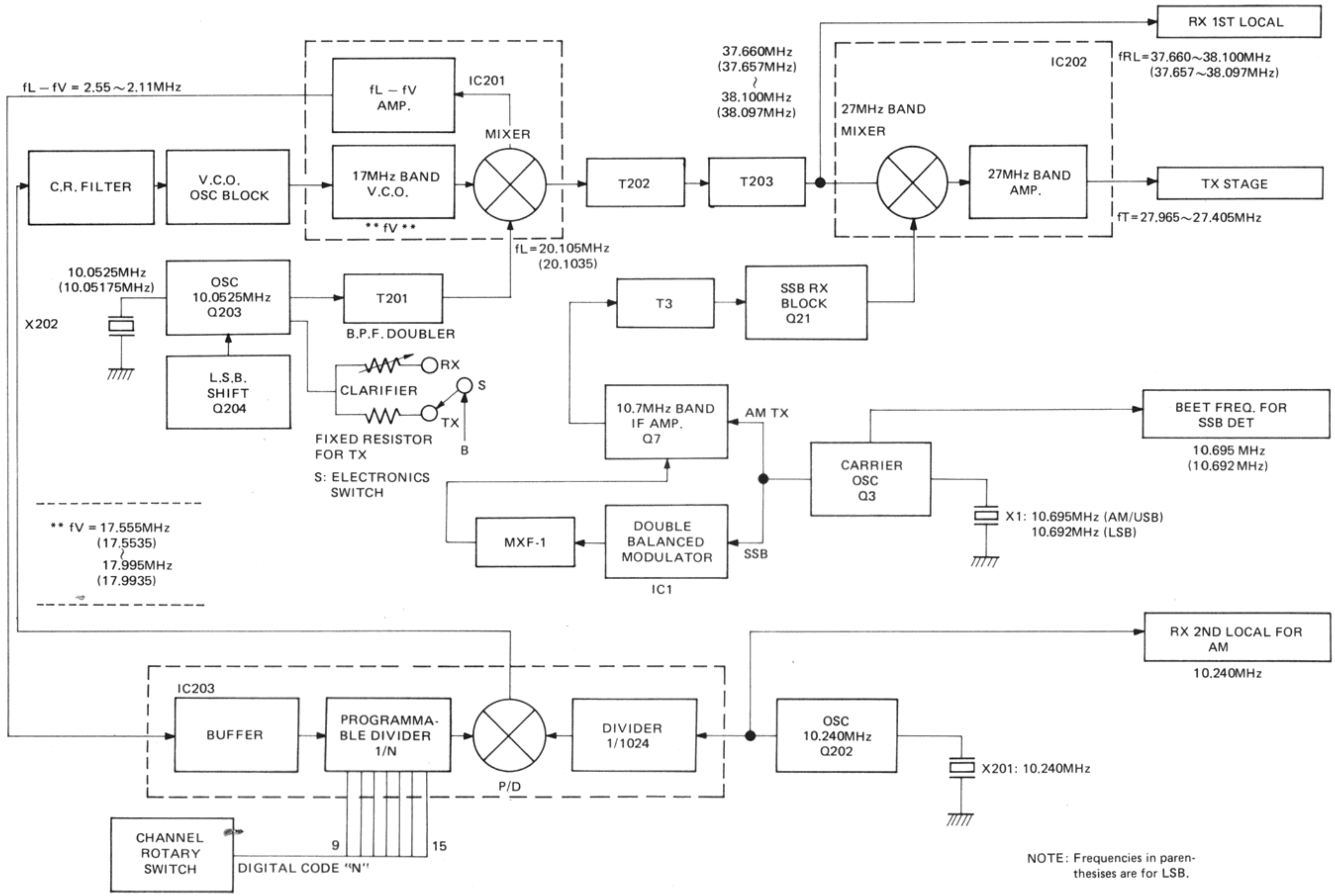


FIGURE 3. BLOCK DIAGRAM FOR PLL CIRCUIT

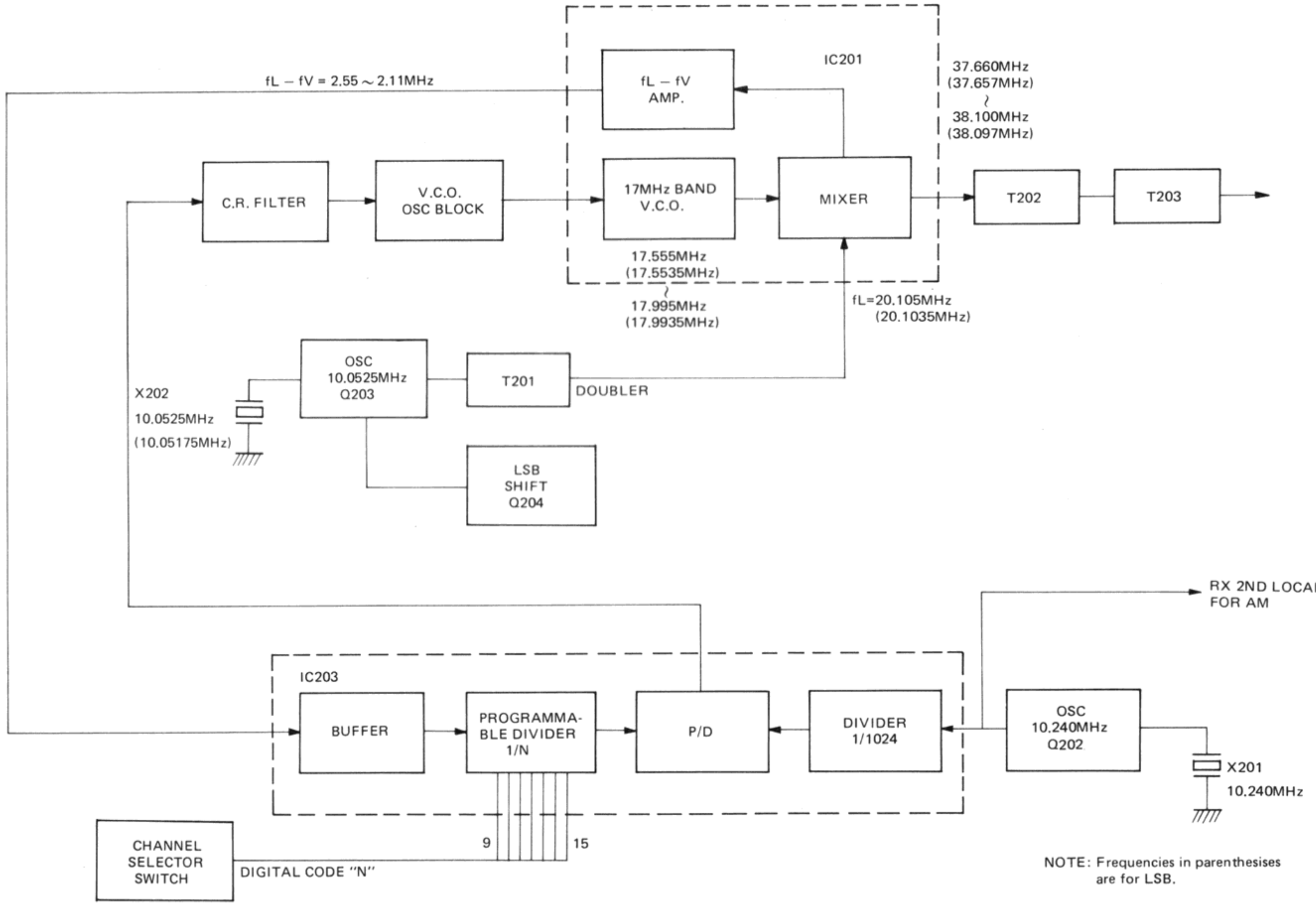


FIGURE 4. PLL CIRCUIT

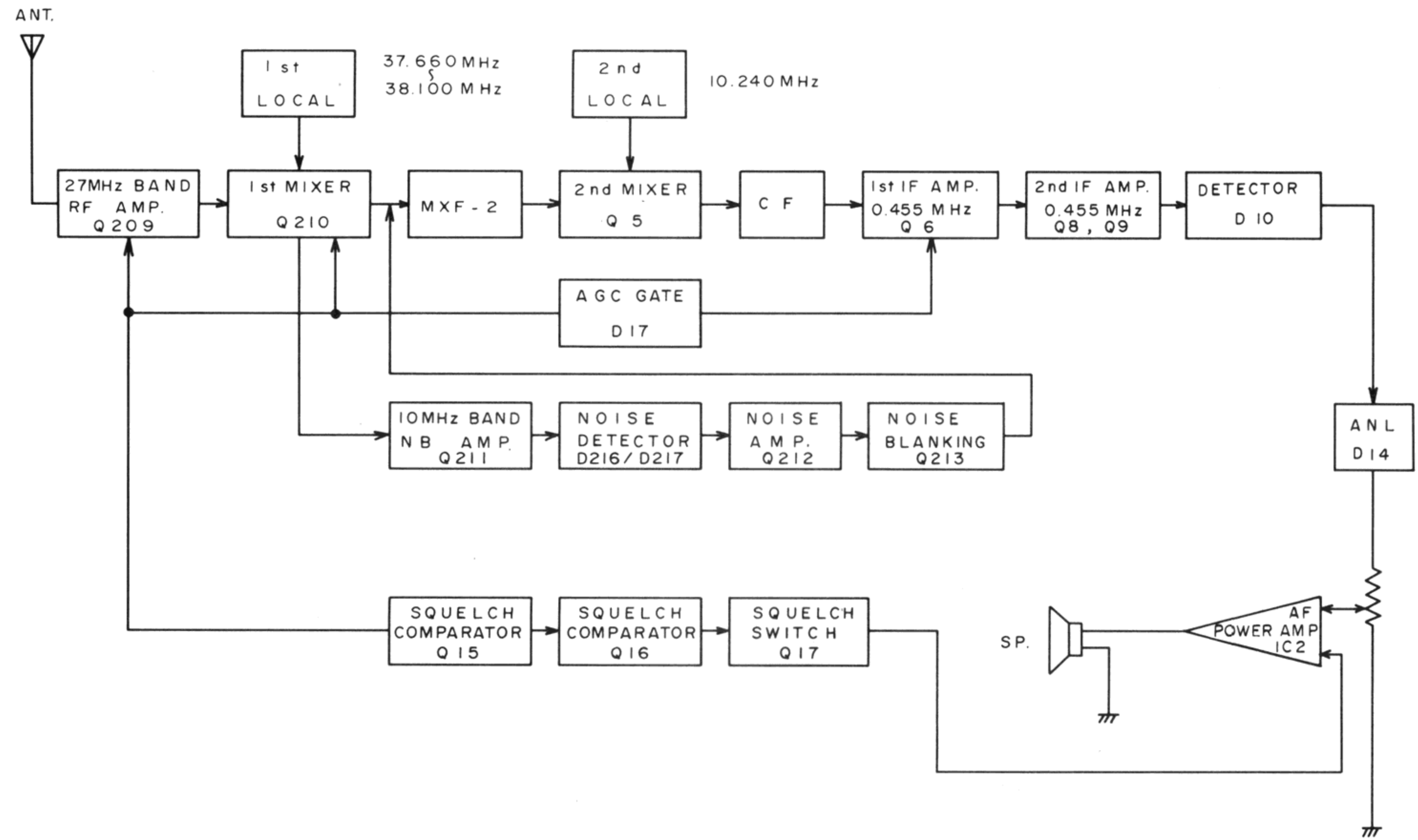


FIGURE 5. AM RECEIVER

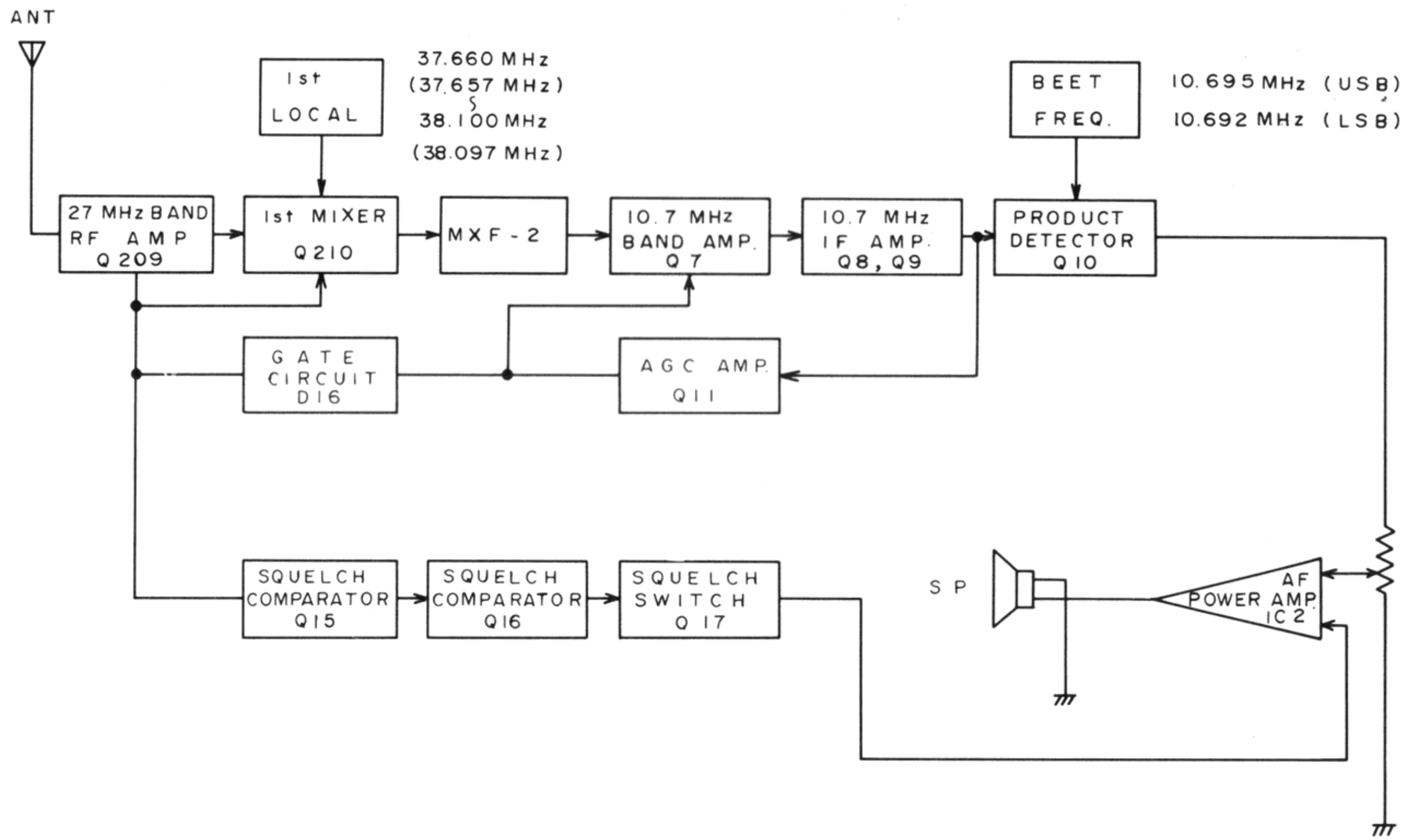


FIGURE 6. SSB RECEIVER

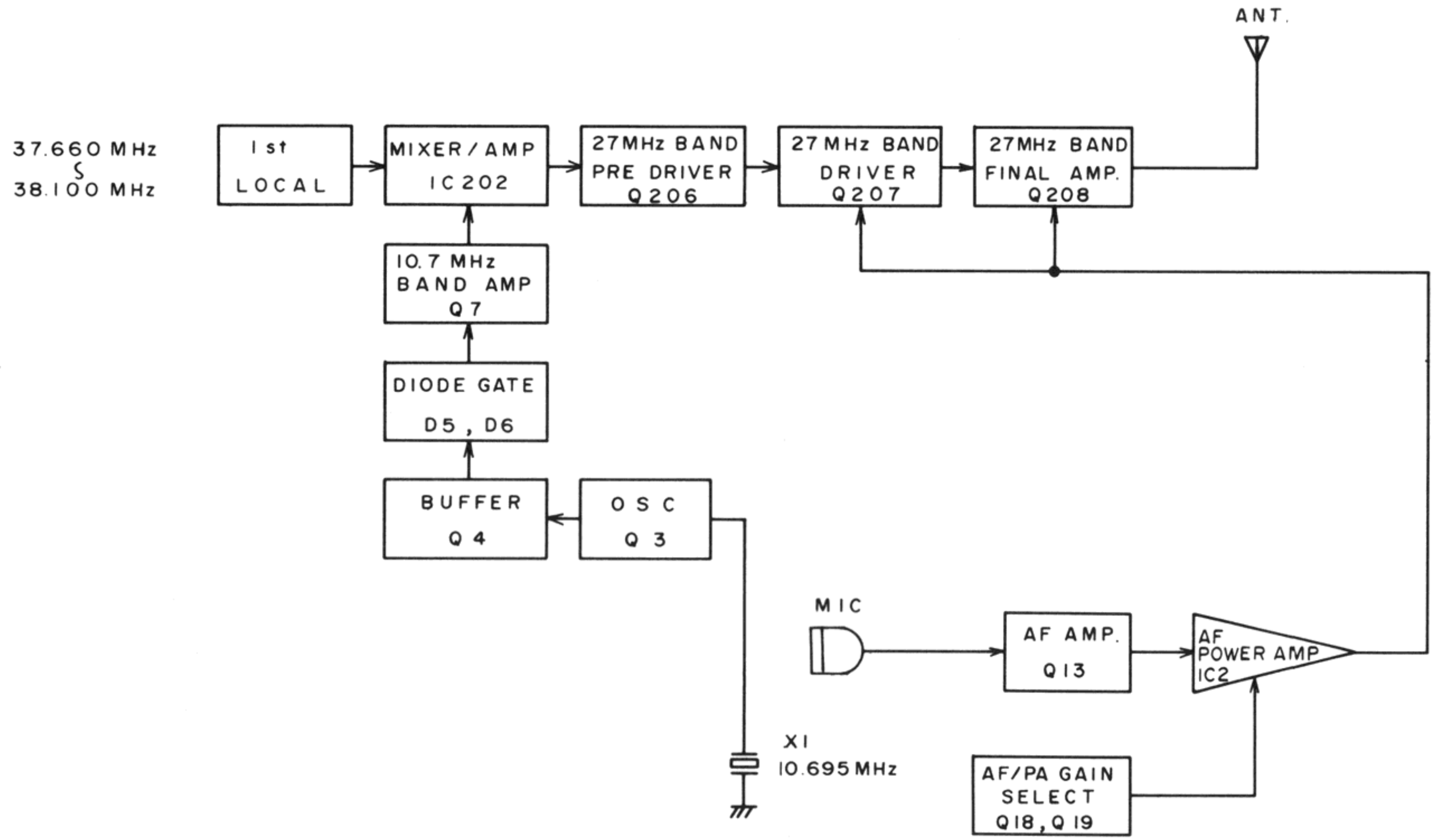


FIGURE 7 AM TRANSMITTER

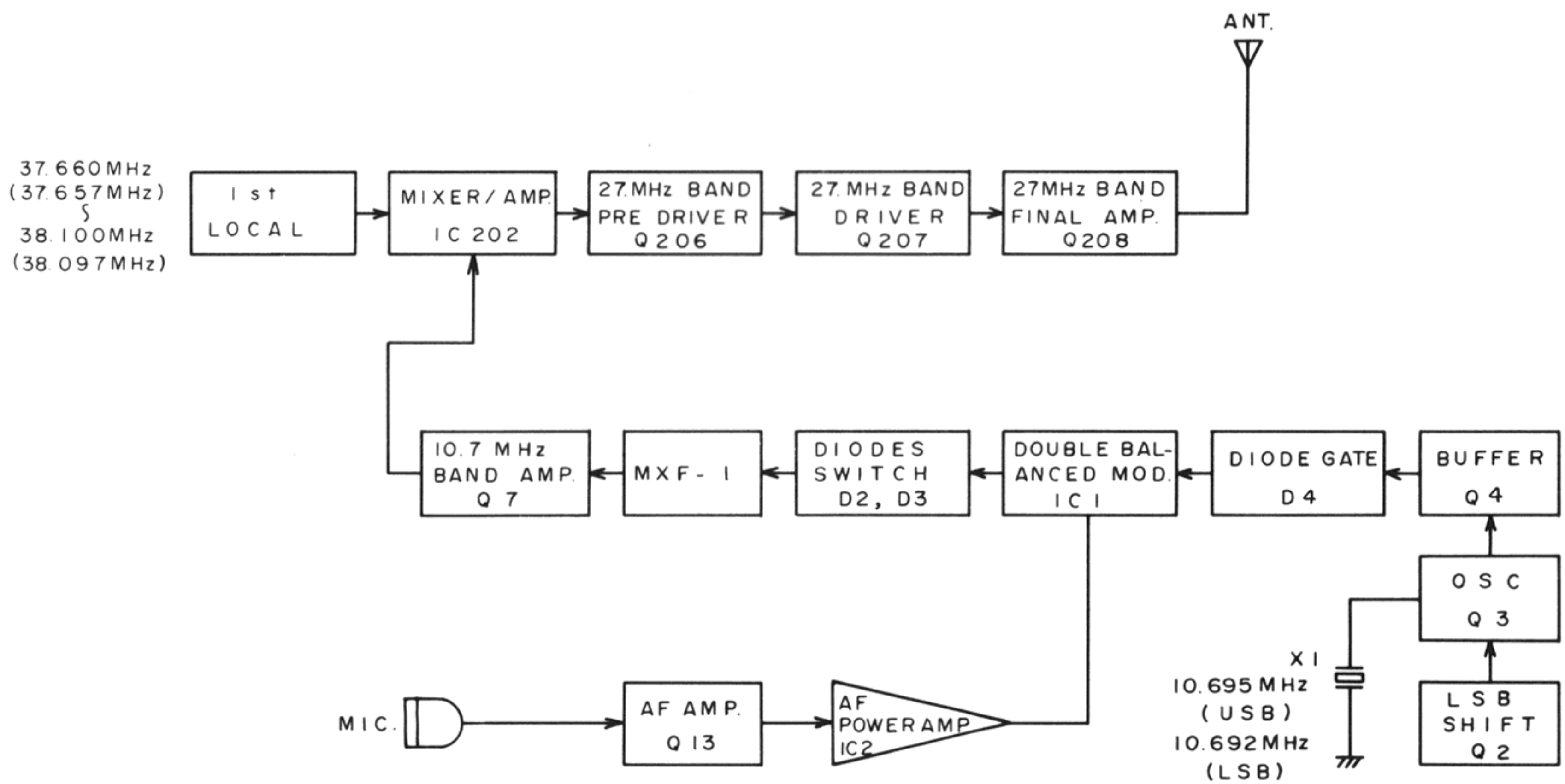


FIGURE 8. SSB TRANSMITTER

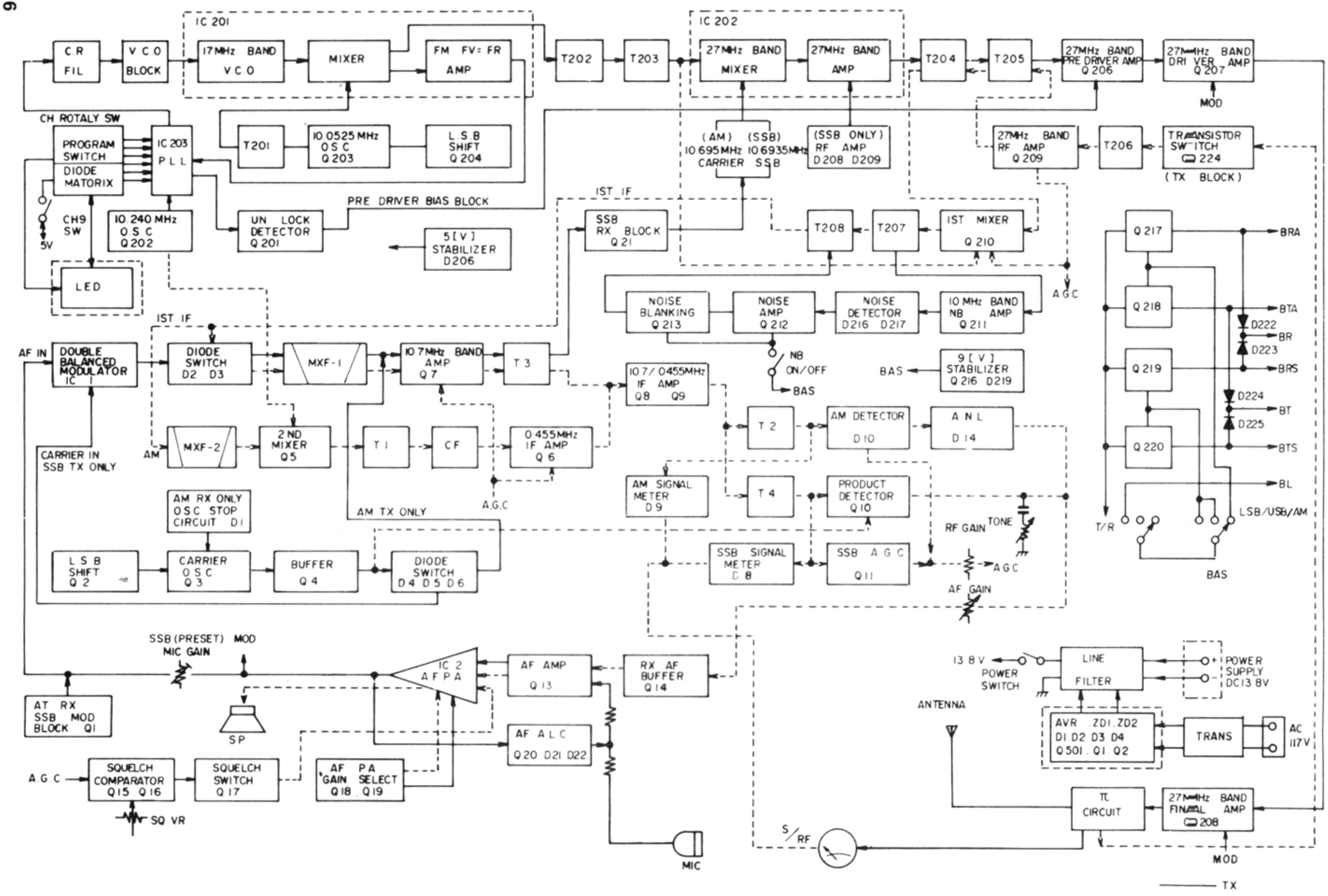


FIGURE 9. ENTIRE CIRCUIT BLOCK DIAGRAM

4.2 RECEIVER

GENERAL

[AM RECEIVER CIRCUITRY]:

A received signal passes T206, then amplified in Q209, and again passes the band pass filter consisting of T204 and T205, then, enters into the 1st Mixer stage of Q210. On the other hand the first RX local signal frequency is applied to the base of Q210 through the coupling capacitor C227. Then, both signals are mixed by Q210 and converted into the first IF signal (10.695 MHz) in passing through the T207 and T208. The 10.695 MHz signal and 10.240 MHz signal generated in Q202 are applied to the 2nd Mixer Q5 and 455 kHz 2nd IF frequency will result.

This frequency is led to the T1, CF (Ceramic Filter), Q6, Q8, Q9 (amplified), T2 and finally led to the detector D10 (AM Detector). The audio signal is then applied to the AF amplifier Q13 and AF power amplifier IC2 through ANL (D14) circuit and RX AF buffer Q14. The IC2 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 Q209, Q210 and Q6 are provided.

Q224 is a switching transistor to short-circuit the primary circuit of T206 during transmit operation, thus disabling the receiver circuit. Refer to Figure 5.

[SSB RECEIVER CIRCUITRY]:

In the receive mode, an incoming signal induced on the antenna is fed to T206 and then to Q209 and amplified. The amplified output is applied to the Q210 1st Mixer through a band pass filter consisting of T204 and T205. While the first local frequency (fRL) is being applied to the base of the same transistor, both frequencies are mixed with each other and first IF frequency will result (10.695 MHz for AM/USB, 10.692 MHz for LSB). This IF signal then amplified in passing through the T207 and T208, Diode switch D22 and D23, crystal filter MXF-1, Q7, T3, Q8 and Q9 and finally detected into the audio signal with the product detector consisting of Q10.

The audio signal is fed to the Power IC (IC2) to drive the built-in speaker. To reduce the signal over load distortion in the SSB mode of operation, peak-value type AGC circuitry consisting of Q11 is employed for exclusive use in SSB operation.

Refer to the block diagram shown in Figure 6.

NOISE BLANKER CIRCUIT

An impulse signal included in the IF signals will be picked up through capacitor C272 and applied to D216 & D217.

The rectified positive-half voltage is then applied to the transistor Q212 and amplified to the enough level capable of turning the transistor Q213. The amplified impulse signal makes Q212 turn on while the impulse is being applied. In other word, the primary circuit of T208 is grounded to the chassis through emitter-collector of Q213, so no mixer output will be obtained during this period. In this way the impulse noise will be blanked out.

D217 is the diode provided to control the bias voltage to the Q212 in according to the signal strength of the normal signals received, thus avoiding operation error which would be caused by normal signals.

Refer to the Block Diagram shown in Figure 9.

SQUELCH CIRCUIT

When the AGC voltage lowers with a weak received signal, transistor Q15 and Q16 turn on and this makes Q17 turn off, controlling the bias voltage to the AF Power Amp. (IC2) and disabling the amplifier. On the other hand when the transistor Q17 is turned on, the amplifier will start to operate.

REGULATED POWER SUPPLY CIRCUIT

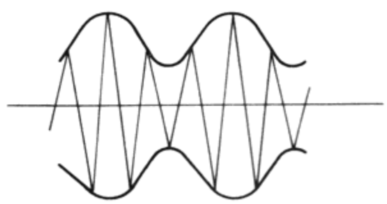
This circuit consists of Q216 and D219 and supplies the regulated voltage through switching transistors Q217, Q218, Q219 and Q220 depending upon the mode of operation.

AUDIO DETECTOR

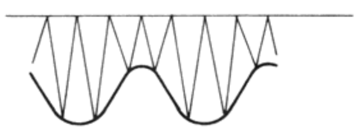
The AUDIO DETECTOR demodulates the AM received signal by rectifying the IF signal.

The detected audio signal is as follows:

[1] The secondary of T4 transformer output waveform



[2] The anode of D10 output waveform



[3] C36 output waveform

PRODUCT DETECTOR

The product detector demodulates the SSB received signal by mixing the IF signal with 10.695 MHz and selecting the audio frequency. The IF signal is fed to the base of Q10, detector amp through C44. On the other hand, the 10.695 MHz signal from OSC3 (Q3) is also fed to the emitter of Q10 through C80 and thus both signals are mixed at Q10 and the demodulated signal is obtained.

The audio output is as follow;

USB mode: 10.695 MHz – IF signal = 10.695 – (10.695 – audio frequency) = audio signal.
LSB mode: IF signal – 10.692 MHz = (10.692 + audio frequency) – 10.692 = audio signal.

AUTOMATIC GAIN CONTROL CIRCUIT

The AGC circuit reduces the gain of the receiver in respond to a strong signal by lowering the bias on the RF and IF amplifier stages. The bias point of AGC is decided within 1.8 – 2.0V by R57 and R55. This bias voltage is fed to each base of Q209, Q210 & Q6 and this variation of AGC bias makes the gain control. When the reception signal comes on, the variation in AGC bias voltage brings a negative potential to the anode of D9 and increase the negative potential in accordance with incomming signal strength and thus occured bias voltages are fed to each base of Q209, Q210 & Q6 through R55.

The more the negative potential increases, the more the AGC potential decreases, therefore each base bias is lower and this makes the overall gain reduce [AM AGC].

SSB AGC circuit also adopts a base bias methode. The bias voltage is fed to the base of Q7, Q209 & Q210. The operation of AGC is just same as AM AGC. The IF signal fed to D12 and D13 through C43.

Both diodes rectify the signal and the voltage produced by D12 & D13 is fed to the gate of Q11. This AGC bias at the gate of Q11 automatically controlles the gain of SSB RF/IF stages.

4.3 TRANSMITTER

GENERAL

[AM TRANSMITTER CIRCUITRY]:

The first local oscillator frequency (fRL) 37 MHz band and 10.695 MHz frequency generated in the Q3 through buffer transistor Q4 and Diodes Gate D5 & D6 are fed to the PIN No. 4 and PIN No. 1 of IC202, respectively, and mixed with each other, resulting in 27 MHz band transmit frequency. The 27 MHz output is fed to Q206 through T204 and T205, then fed to Q207 and Q208 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 band pass filter consisting of L212, L215, L214, etc..

On the other hand, the microphone input signal enters into the AF power IC (IC2, No. 6 PIN terminal) and amplified output is applied to the collectors of Q207 and Q208 through transformer T5 and diode D23 to modulate the transmit carrier frequency.

Transistor Q20 and Diode D22 are automatic level controller provided to suppress the audio input level to IC2 properly to avoid over modulation. D22 output controls Q20, thus keeping modulation signal level to a relatively constant value.

Refer to the block diagram shown in Figure 7.

[SSB TRANSMITTER CIRCUITRY]:

In the SSB mode of operation, either of the first local oscillator frequency of 37.660 – 37.100 MHz (AM/USB) or 37.657 – 38.097 MHz (LSB) will be led to the IC202, No. 1 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 by Q3 is fed to the balanced modulation IC (IC1). IC-1 is designed to produce carrier-suppressed double side band signals when an audio signal amplified by IC2 is supplied to the PIN No. 1. The DSB signal is fed to diode switch D2 & D3, then to MXF-1 (crystal filter) to remove the unwanted side band.

The side band signal is fed to Q7 and amplified, then, the output is fed to the PIN No. 4 of IC202 and mixed with the first local oscillator signal to produce the 27 MHz transmit signal.

The 27 MHz SSB output is fed to T204 and T205 and then to the liner amplifiers, Q206, Q207 and Q208.

The amplified RF output is finally fed to the antenna terminal through the band pass and low pass networks provided between Q208 and antenna connector.

To avoid over modulation distortion, an ALC circuitry consisting of Q20, D21 and Q13 is provided in the microphone amplifier circuit. Another ALC circuit (D208, D209) is also employed in the RF circuit (from Q208 to IF amp. Q7) to reduce the distortion in the RF stages. Transistor Q18 and Q19 are switching circuits to operate IC2 as a microphone amplifier.

Refer to the block diagram shown in Figure 8.

RF ALC CIRCUIT

RF output from C259 is fed to D208 and D209 which provides rectifying and switching.

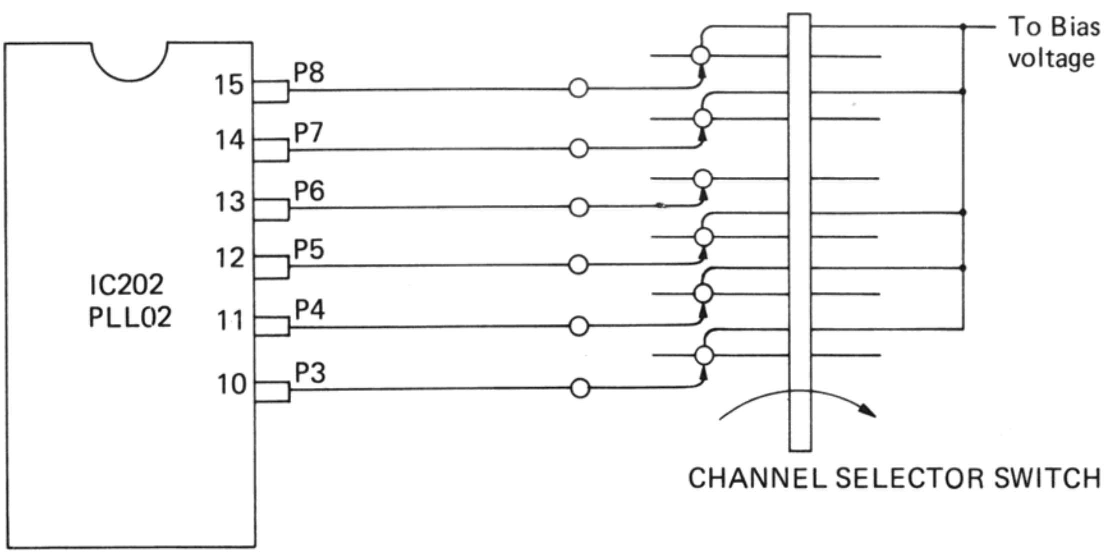
The DC negative potential produced by D208 and D209 is fed to IC202, pin No. 7 through R263 and this variation of DC potential is used to control the RF ALC level.

As the DC 8.5V from BTS line is supplied to D211 during the SSB transmit mode, the cathode potential of D209 will be varied by adjusting RV201. When the anode potential of D209 is lower than the cathode, D209 operates ON and then D208 also operates ON. While the D208 operates ON, the negative potential is supplied to R263.

Adjusting RV201 produces the variation of R263 DC potential so that the ALC level is controlled. Since the cathode potential is kept 8.5V through D210 in AM transmit mode, D209 operates OFF and thus RF ALC action is disable.

* Frequency Determining Digital Codes and Preset Selector Switch Connections.

— Example at CH 4 —



Refer to the Channel selector/Divisor-Code chart

SECTION 5
SERVICING

5.1 INTRODUCTION

Read this section carefully before attempting any repair of the LCBS-4 Refer to the circuit description, PLL circuit block diagram, each circuit block diagram for operating mode (AM/USB/LSB, TX/RX), entire circuit block diagram, PC Board component parts layout, Exploded view and Schematic diagram. The transistor and IC case diagram are shown on the schematic diagram. Refer to these diagrams before checking transistors or ICs. Component layout are provided to aid troubleshooting and alignment. Use only recommended replacement parts. Refer to the parts list in the back of this book. Never replace blown fuses with higher rated ones or fast acting with slow blow. To check operation of the unit, refer to Figure 5-2, Performance Verification Procedure, Figure 5-3, 5-4, Transmitter Test Connection and Receiver Test Connection respectively, show the proper manner to connect the unit to test instruments for performance verification or alignment. Figure 5-1 lists Recommended Test Instruments. Figure 5-7, 5-10 show proper Transmitter Alignment Procedure and Receiver Alignment Procedure respectively. Figure 5-11, Alignment Layout is placed next to the alignment procedures to show alignment adjustments at a glance.

5.2 TEST SIGNALS

Oscilloscope Waveforms are shown which were taken at various points in the LCBS-4 during normal operation into a dummy load. Check point numbers next to the wave form pictures correspond to numbers in boxes on both the schematic diagram and component layout drawing. Some waveform are shown in Figure 5-7, 5-8. Figure 5-8 shows RF amplification through a properly aligned transmitter. Figure 5-9 shows 50%, 100% and overmodulation respectively. Notice that the waveform at the base of Q206 – the TX predriver through the Mixer provided inside IC202 – contains several frequency components. Also notice that the waveforms at the collector of Q206. Next, notice that the waveforms at the base and the collector of Q207 RF Driver, and notice that the waveform at the base and the collector of Q208 – the TX Final.

This is proper since the TX final operates class C for greater efficiency. Figure 5-8F shows how the output should look at the collector of Q208.

Voltage measurement are shown on the schematic diagram for normal operation. All voltage were measured with a VTVM. Voltage measurements on high impedance RF points should be taken through a probe.

Mini-test clips are very usefull for making voltage measurements in hard to reach places.

Receiver Injection Voltage are given in Figure 5-12 together with check point numbers which correspond to numbers in boxes on both the schematic diagram and component layout drawings. This specifies the voltage level, carrier frequency and particular points in the receiver string at which a 30% – 1 kHz modulated signal injected through a .01 μF capacitor should produce at least 2V AC of audio across the speaker or 8 ohm load plugged into the speaker jack, EXT SP. While the value of this capacitor is not critical, capacitive coupling of the signal generator to the circuit is necessary to prevent grounding out the transistor biases.

Before setting up to measure Receiver Injection Voltages, small handheld "all purpose signal generators" can be used to provide a quick check of the receiver string. Basically, these devices generate pulses rich in harmonics from AF to RF to test whether a stage in working.

Figure 5-13, PLL Synthesizer Troubleshooting Procedure, should be used as a guide to locating problems in the PLL Frequency Synthesizer.

Figure 5-5, Channel Selector/Divisor-Code Chart shows a string reference of PLL frequency synthesizer, namely, channel No., channel frequency, select sw. output ("N" code), TX VCO frequency & divisor and RX VCO frequency & divisor which are assigned and selected by "N" code (preset) of channel selector.

ICs equivalent circuit provided inside Integrated Circuits in this model LCBS-4 show in Figure 5-14.

The Exploded View shows in Figure 5-15 and Component Layout (PC Board) shown in Figure 5-16.

FIG. 5-1 RECOMMENDED TEST INSTRUMENTS

TEST INSTRUMENT	REQUIRED SPECIFICATIONS	USE	RECOMMENDED INSTRUMENT TYPE
R.F. Signal Generator	Output frequency: **26.965 to 27.405 MHz.** Output level calibrated from .1 microvolts to 500,000 microvolts. Internal modulation capability of 30% minimum at 1 kHz. (Calibrated)	Receiver service and alignment.	Hewlett-Packard Model 606A or B. Wavetek Model 3000.
Oscilloscope	Vertical bandwidth of 25 MHz or greater at 3 dB point. Triggered sweep capability.	Transmitter and receiver test and alignment.	Tektronics Model T932. Tektronics Model 465. Hewlett-Packard Model 180. Phillips Model PM3260E.
Frequency Counter	Frequency range DC to 30 MHz. Sensitivity: 10mV R.M.S. at 30 MHz. Overall timebase accuracy ±.002%, 6 digit resolution.	Transmitter frequency check and synthesizer troubleshooting.	Heath-Schlumburger Model SM128A.
Wattmeter	25 watts full scale into 50 ohm load ±5% accuracy.	Measure power output and S.W.R.	Bird Model 43 with type 25A element. (May be terminated with antenna load.
AC VTVM	–40 to +20 dB range.	Measure audio output.	Heath Model IM-21.
Audio Oscillator	400 Hz to 4000 Hz output: Adjustable level, 0-1 volt output impedance 600 ohm.	Audio and modulator tests.	Hewlett-Packard Model 204C. Heath Model SG18A.
DC Power Supply	13.8 volt DC ±10% at 4 amperes.	Voltage for servicing.	Heath Model SP2720 (SBE Model SBE-4AC may be used if available.)
Pulse Generator	Repeat Frequency 10–500 Hz Variable, Impedance 50 ohm unbalanced.		
Spectrum Analyzer	Band width, nearby Sprious, measurable.		

FIG. 5-2 PERFORMANCE VERIFICATION PROCEDURE

TRANSMITTER

INITIAL SET-UP
Connect the LCBS-4 to 117V AC. Connect a wattmeter, dummy load and oscilloscope to the antenna connector on rear panel. Adjust RV1 (on PC Board, PTPW007COX) to obtain 13.8V DC at PIN terminal No. 3 with AC voltage of 117V supplied. Place the Band Mode switch in AM position and set the Channel Selector to CH19.
STEP 1 Key the transmitter and check that the TX lamp "TRANSMITING" comes on. Observe that the wattmeter indicates an output of at least 3.6 – 3.9 watts and that the S-RF meter indicates about the same.
STEP 2 Whistle into the microphone with transmitter keyed and verify that 90 – 100% modulation capability is obtained. (Modulation sensitivity may be adjusted by RV9).
STEP 3 Couple the frequency counter through the coupling coil to the dummy load and check the transmit frequencies on all channels. The frequency should be within ±800 Hz from each center channel frequency. (See the Channel Selector/Divisor-Code Chart).
STEP 4 Key the transmitter in LSB without modulation. Check for less than 0.1 Vp-p carrier on scope.
STEP 5 Whistle into microphone with transmitter keyed and observe that the wattmeter indicates an output of at least 12 watts output.
STEP 6 Repeat steps 4 and 5 in USB.

SYNTHESIZER

STEP 1

Connect a frequency counter to the test point TP2, (couple the probe of frequency counter to TP2). This frequency reading should be 10.240000 MHz ± 50 Hz. [10.240 MHz X'TAL reference oscillator check].

STEP 2

Set the unit into receive mode and connect a digital voltmeter (DC 12V range) between TP1 and ground. Verify that the meter reading obtains 3.6V ± 0.1V on CH1. Next, set the channel selector to CH40 and verify that the reading is 1.4 – 2.3V. [VCO Circuit check].

RECEIVER

INITIAL SET-UP

Connect LCBS-4 to 117V AC. (See the transmitter step).
Connect RF signal generator to the antenna jack and set to 27.185 MHz. Set the unit to channel 19. Turn the volume control to fully clockwise, the squelch control to fully counterclockwise, and set the clarifier control in 12 o'clock position. Connect 8 ohm load to the external speaker jack, EXT SP, and connect AC VTVM across the dummy load resistor. Place the NL switch in NL, the NB switch in OFF, the CB-PA switch in CB positions. (See Figure 5-6).

STEP 1

Set the Mode switch in AM position. Adjust signal generator for 1 μV output with 30%, 1 kHz modulation. Verify that at least 7.5V AC appear across the 8 ohm load.

STEP 2

Increase signal generator output level 40 dB. Check for "S" meter indication of approximately "S9"

STEP 3

Observe the meter lamp, RX lamp "RECEIVING" and channel LED to insure that each are operational.

STEP 4

Increase signal generator output level to 500 μV. Rotate squelch control fully clockwise and verify squelch of the receiver with input of 500 μV.

(continued)

STEP 5 Decrease signal generator output level to 1 μV, adjust squelch control to the point that the receiver is just muted. Increase signal generator output level by 0.7 μV and verify that the squelch opens.
STEP 6 Remove connection from external speaker jack if used. Adjust signal generator for 0.7 μV output with no modulation. Set the Mode switch to LSB position. Rotate the Clarifier control right and left directions. Tone should be heard at one end of the Clarifier.
STEP 7 Repeat step 6 in USB mode of operation.

FIG. 5-3 TRANSMITTER TEST CONNECTION

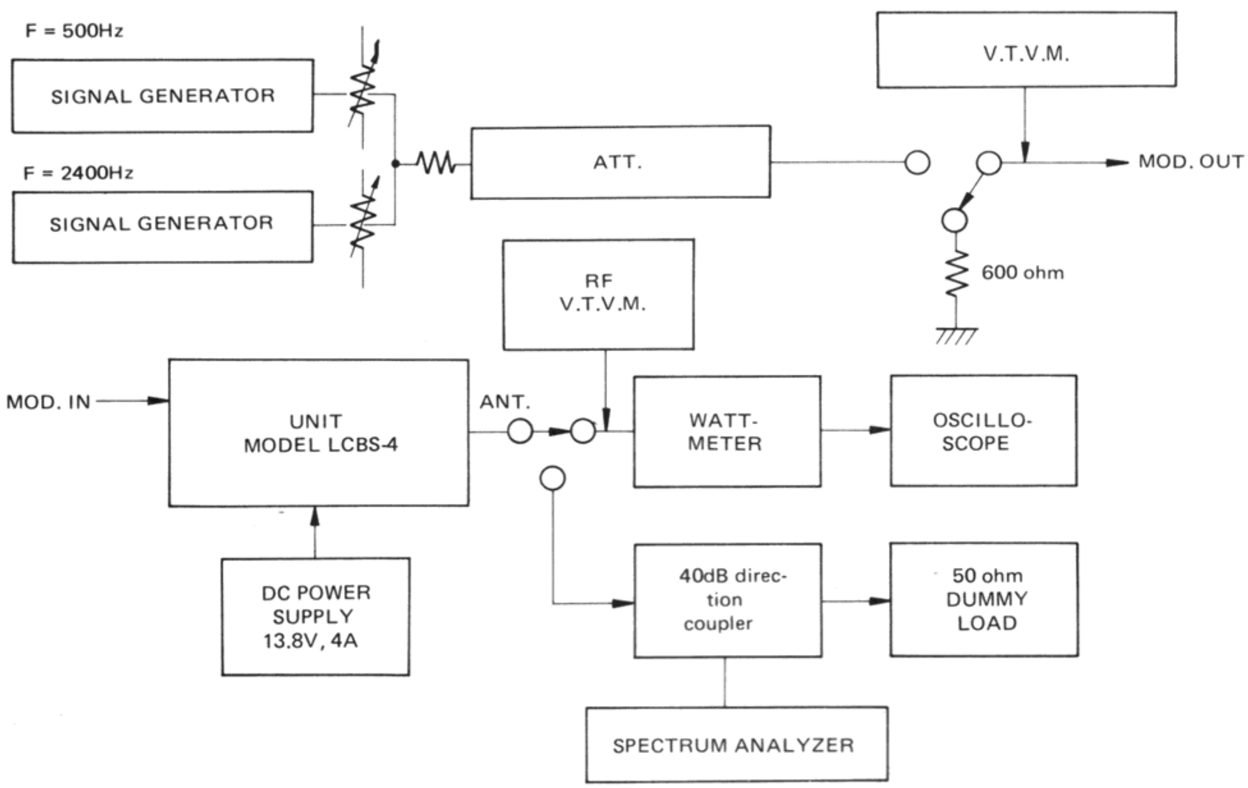
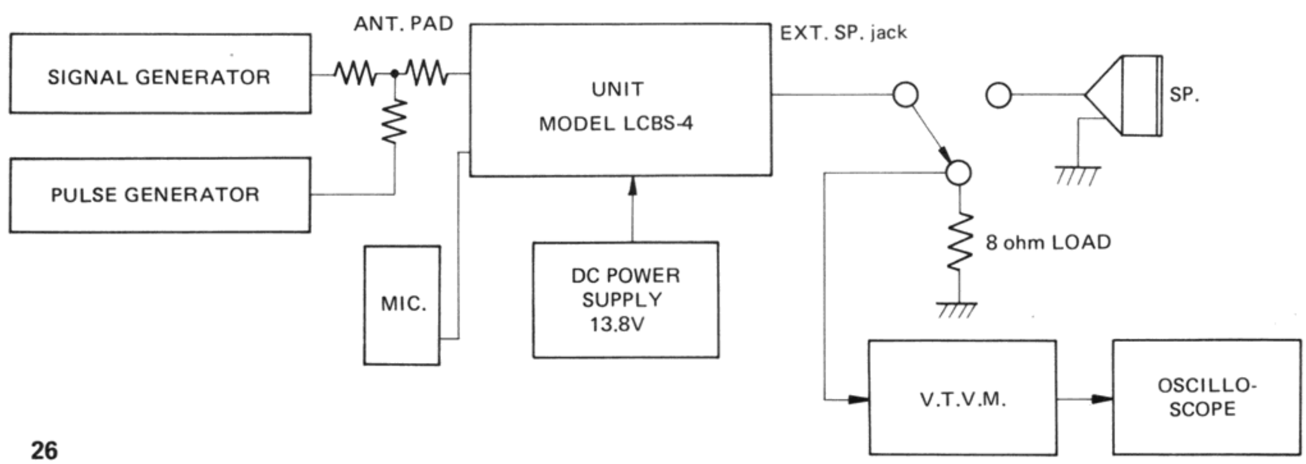


FIG. 5-4 RECEIVER TEST CONNECTION



CHANNEL SELECTOR/DIVISOR-CODE CHART

Channel No.	Channel Freq. (MHz)	"N" Digital Code	VCO Freq. (MHz)		Channel Sw. Output						RX 1st Local Freq. (MHz)	
			AM/USB	LSB	P8	P7	P6	P5	P4	P3	AM/USB	LSB
1	26.965	255	17.555	17.5535	1	1	1	1	1	1	37.66	37.657
2	26.975	254	17.565	17.5635	0	1	1	1	1	1	37.67	37.667
3	26.985	253	17.575	17.5735	1	0	1	1	1	1	37.68	37.677
4	27.005	251	17.595	17.5935	1	1	0	1	1	1	37.70	37.697
5	27.015	250	17.605	17.6035	0	1	0	1	1	1	37.71	37.707
6	27.025	249	17.615	17.6135	1	0	0	1	1	1	37.72	37.717
7	27.035	248	17.625	17.6235	0	0	0	1	1	1	37.73	37.727
8	27.055	246	17.645	17.6435	0	1	1	0	1	1	37.75	37.747
9	27.065	245	17.655	17.6535	1	0	1	0	1	1	37.76	37.757
10	27.075	244	17.665	17.6635	0	0	1	0	1	1	37.77	37.767
11	27.085	243	17.675	17.6735	1	1	0	0	1	1	37.78	37.777
12	27.105	241	17.695	17.6935	1	0	0	0	1	1	37.80	37.797
13	27.115	240	17.705	17.7035	0	0	0	0	1	1	37.81	37.807
14	27.125	239	17.715	17.7135	1	1	1	1	0	1	37.82	37.817
15	27.135	238	17.725	17.7235	0	1	1	1	0	1	37.83	37.827
16	27.155	236	17.745	17.7435	0	0	1	1	0	1	37.85	37.847
17	27.165	235	17.755	17.7535	1	1	0	1	0	1	37.86	37.857
18	27.175	234	17.765	17.7635	0	1	0	1	0	1	37.87	37.867
19	27.185	233	17.775	17.7735	1	0	0	1	0	1	37.88	37.877
20	27.205	231	17.795	17.7935	1	1	1	0	0	1	37.90	37.897
21	27.215	230	17.805	17.8035	0	1	1	0	0	1	37.91	37.907
22	27.225	229	17.815	17.8135	1	0	1	0	0	1	37.92	37.917
23	27.255	226	17.845	17.8435	0	1	0	0	0	1	37.95	37.947
24	27.235	228	17.825	17.8235	0	0	1	0	0	1	37.93	37.927
25	27.245	227	17.835	17.8335	1	1	0	0	0	1	37.94	37.937
26	27.265	225	17.855	17.8535	1	0	0	0	0	1	37.96	36.957
27	27.275	224	17.865	16.8635	0	0	0	0	0	1	37.97	37.967
28	27.285	223	17.875	17.8735	1	1	1	1	1	0	37.98	37.977
29	27.295	222	17.885	17.8835	0	1	1	1	1	0	37.89	37.987
30	27.305	221	17.895	17.8935	1	0	1	1	1	0	38.00	37.997
31	27.315	220	17.905	17.9035	0	0	1	1	1	0	38.01	38.007
32	27.325	219	17.915	17.9135	1	1	0	1	1	0	38.02	38.017
33	27.335	218	17.925	17.9235	0	1	0	1	1	0	38.03	38.027
34	27.345	217	17.935	17.9335	1	0	0	1	1	0	38.04	38.037
35	27.355	216	17.945	17.9435	0	0	0	1	1	0	38.05	38.047
36	27.365	215	17.955	17.9535	1	1	1	0	1	0	38.06	38.057
37	27.375	214	17.965	17.9635	0	1	1	0	1	0	38.07	38.067
38	27.385	213	17.975	17.9735	1	0	1	0	1	0	38.08	38.077
39	27.395	212	17.985	17.9835	0	0	1	0	1	0	38.09	38.087
40	27.405	211	17.995	17.9935	1	1	0	0	1	0	38.10	38.097

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

FIG. 5-5

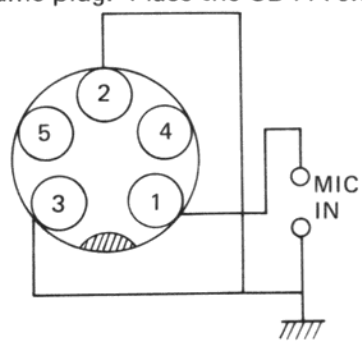
FIG. 5-6 PLL SYNTHESIZER/OSC ALIGNMENT PROCEDURE

PRELIMINARY

Connect the unit to 117V AC power source. Place the unit into receive mode. Verify that the voltage at PIN terminal No. 3 on PC Board, PTSW007COX is 13.8V with AC voltage of 117V supplied.
If not, adjust RV1 to obtain that voltage. (Alignment of Regulated Voltage Power Supply).

INITIAL SET-UP

Connect the test equipment to the unit as shown in Figure 5-3.
Place the unit 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. Place the CB-PA switch in CB.



STEP 1

Set the power supply voltage to 13.8V DC. Couple a High Input Impedance Probe to the frequency counter. Place the channel selector switch within CH1 – CH40, as desired position.
NOTE: This alignment should be conducted with the frequency counter having high sensitivity and high input impedance.

STEP 2 : PLL Circuit Alignment

Place the unit into the transmit mode or receive mode, as desired. Connect a frequency counter to the test point TP2, (couple the probe of frequency counter to TP2), and adjust the trimming capacitor CT201 to obtain a frequency reading of;

10.240000 MHz ± 50 Hz

STEP 3 : 10.0525 MHz Frequency Alignment

1. Place the Mode switch in the USB position and set the transceiver into the transmit mode. Couple the probe of frequency counter to the test point TP3 and adjust CT203 to obtain a frequency reading of;

   20.105 MHz ± 20 Hz
2. Reset the Mode switch in the LSB position and also set the unit into transmit mode.

Couple the probe of frequency counter to the test point TP3 and adjust CT202 to obtain a frequency reading of;

20.1035 MHz ± 20 Hz

NOTE: Verify that the frequency counter reading exactly indicates 20.1035 ± 20 Hz, even through vary clarifier control to right and left towards during the above step (2).

3. Next, place the Mode switch in USB position and set the unit into receive mode.
When the clarifier control is placed within "11 o'clock – 1 o'clock" position, verify a frequency reading of;

20.105 MHz ± 20 Hz

When the clarifier control is placed to the fully clockwise position, verify a frequency reading of;

20.105 MHz + [500 Hz – 1000 Hz]

When the clarifier control is placed to the counterclockwise position, verify a frequency reading of;

20.105 MHz – [500 Hz – 1000 Hz]

4. Next, place the Mode switch in LSB position.
When the Clarifier control is place within "11 o'clock – 1 o'clock" position, verify a frequency reading of;

20.1035 MHz ± 20 Hz

When Clarifier control is placed to the fully clockwise position, verify a frequency reading of;

20.1035 MHz + [500 – 1000 Hz]

When the Clarifier control is placed to the counterclockwise position, verify a frequency reading of;

20.1035 MHz – [500 – 1000 Hz]

STEP 4 : 10.692 MHz Frequency Alignment

1. Place the Mode switch in USB and set the unit to receive mode.
Connect a probe of frequency counter to the emitter of Q10 and adjust CT1 to read 10.695 MHz ± 50 Hz.
2. Place the Mode switch in LSB and adjust CT2 to read 10.692 MHz ± 50 Hz.
3. Verify that the oscillator ceases in AM mode.

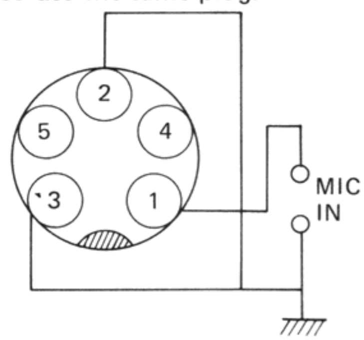
STEP 5 : VCO Circuit Alignment

1. Place the unit into transmit or receive mode, as desired.
2. Connect a VTVM or VOM (DC 12V range) between TP1 and chassis.
3. Place the channel selector in CH1.
4. Adjust core provided in the VCO block to obtain 3.6V ± 0.1V, starting from top to bottom when turning the core (the VTVM or VOM used in this alignment should be calibrated and has an input impedance of 20 kohm/V or higher).
5. Next, place the channel selector in CH40 and verify that the reading is within 1.4 – 2.3V.

FIG. 5-7 TRANSMITTER ALIGNMENT PROCEDURE

PRELIMINARY

Place the RV201 & RV204 in the counterclockwise position, RV3 in the center position, L214 in the fully downward, T209, L209 and L212 in the flat position.
Place the Mode switch in LSB position. Unsolder either emitter or collector and insert a milliamp meter in series with the un-soldered lead. Key the transmitter and adjust RV204 for a current reading of 150 mA. Remove meter and re-solder lead.
To set the transceiver into the transmit mode without the microphone, insert the plug wired as shown below into the MIC jack on the front panel. When applying the audio modulation signal to the microphone input circuit, also use the same plug.



STEP 1 : Carrier Suppression Alignment

1. Set the unit into the transmit mode with no modulation.
2. Place the Mode switch in LSB and alternately adjust RV1 & RV2 to obtain maximum level on the scope display.
3. Next, place the Mode switch in USB and readjust RV1 & RV2 to obtain minimum level on the scope display.

STEP 2 : Pre-driver Stage Alignment

1. Apply 500 Hz audio signal to the microphone input circuit and increase or decrease audio signal level so that RF power indicates 2 watts.
2. Change the audio signal generator frequency from 500 Hz to 2400 Hz and then increase or decrease audio signal level until RF power obtaines 2 watts.
3. Next, feed two tone (500 Hz and 2400 Hz) signals to the microphone input circuit and adjust T3 and T201 to obtain maximum amplitude of scope display in a desired channel within CH1 – CH40.
4. Place the channel selector in CH40 and adjust T202 to obtain maximum amplitude of scope display.
5. Place the channel selector in CH1 and adjust T203 to obtain maximum amplitude of scope display.
6. Repeat above steps (4) and (5) until further maximum amplitude is obtained.
7. Place the channel selector in CH40 and adjust T204 to obtain maximum amplitude of scope display.
8. Place the channel selector in CH1 and adjust T205 to obtain maximum amplitude of scope display.
9. Also repeat above steps (7) and (8) until further maximum amplitude is obtained on the scope.

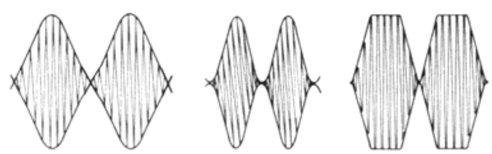
(continued)

STEP 3 : Final Stage Alignment

1. Place the Model switch in USB and the channel selector to CH20.
2. Apply single tone (2400 Hz 10 mVrms) signal to the microphone input circuit.
3. Adjust T209 to obtain maximum amplitude of oscilloscope display and then turn T209 core 1/2-downward.
4. Adjust L209 and L212 to obtain maximum amplitude of scope display.
5. Turn L209 core downward to indicate 14 watts on the wattmeter.

STEP 4 : SSB Power Stage Alignment

1. Place the Mode switch in USB and the channel selector to a desired channel.
2. Apply 2400 Hz 10 mVrms single tone to the microphone input circuit.
3. Next, apply 500 Hz audio signal to the microphone input circuit and increase or decrease 500 Hz audio signal level to observe cross over display on the oscilloscope.
4. Verify that the scope display of output wave shape shown below is obtained.



5. Feed two tone (500 Hz and 2400 Hz) signals to the microphone input circuit and adjust RV201 to obtain 68 Vp-p on the RF VTVM.
6. Also, adjust RV3 to obtain 65 Vp-p on the RF VTVM.
7. In this condition, verify that the RF VTVM reading at each channel is within 64 – 67 Vp-p.
8. Place the Mode switch in LSB and verify that the above alignments are not upset and the similar resultants are obtained in this mode of operation.
9. If these alignments have a major difference at each channel, readjust T204 and T205 to obtain similar level.

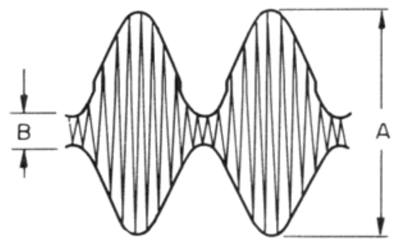
STEP 5 : AM RF Power Stage Alignment
1. Place the Mode switch in AM and the channel selector in CH19.
2. Adjust VR1 for RF power output of 3.75 watts on the wattmeter. Verify that the RF Power output at each channel is within 3.6 – 3.9 watts in this condition.

STEP 6 : RF Power Meter Alignment
1. Adjust RV202 so that the P/RF meter provided on the front panel indicates the same wattage as obtained on the wattmeter.

STEP 7 : Modulation Alignment (AM)

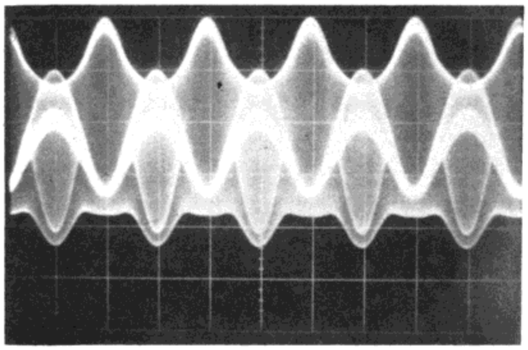
1. Apply 2400 Hz, 30 mVrms audio input signal to the microphone input circuit.
2. Adjust RV9 so that the modulation depth of 100% is obtained.

3. Next, decrease the signal input to 2.4 mVrms and verify that the modulation depth is within 85 – 90%.



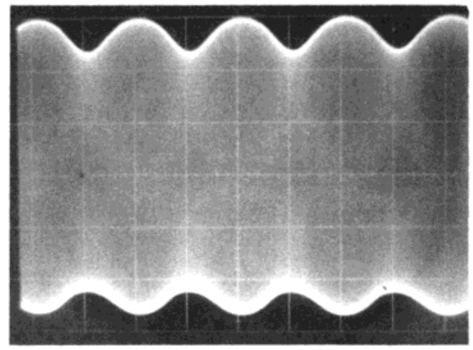
$$\text{Modulation ratio} = \frac{A - B}{A + B} \times 100\ [\%]$$

FIG. 5-8 TRANSMITTER ALIGNMENT WAVEFORMS



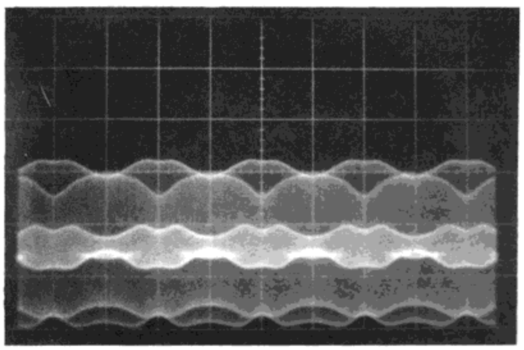
100 mV
0.5 ms

[A] TX PRE DRIVER BASE



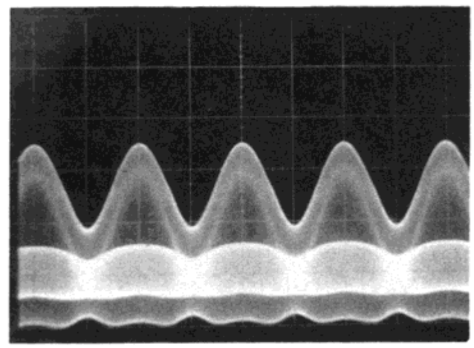
2V
0.5 ms

[B] PRE DRIVER COLECTOR



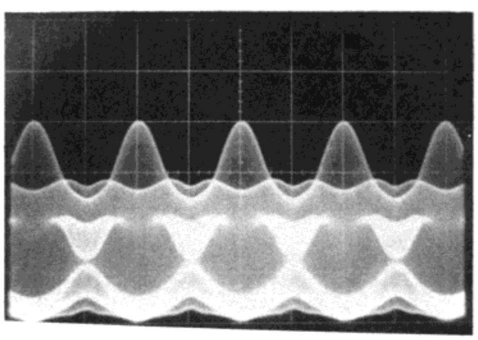
1V
0.5 ms

[C] RF DRIVER BASE



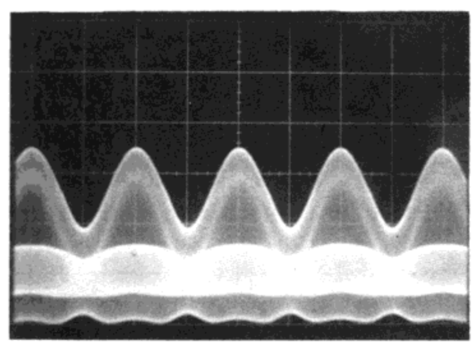
10V
0.5 ms

[D] RF DRIVER COLLECTOR



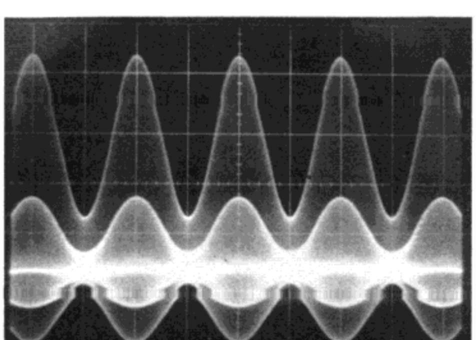
2V
0.5 ms

[E] TX FINAL COLLECTOR

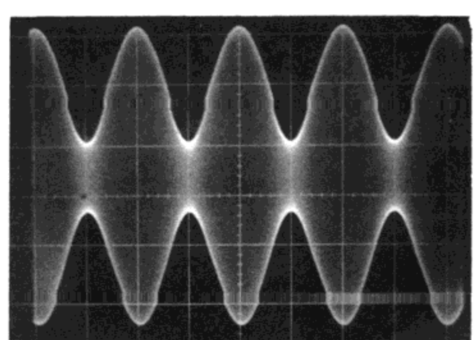


10V
0.5 ms

[F] ANT DUMMY LOAD



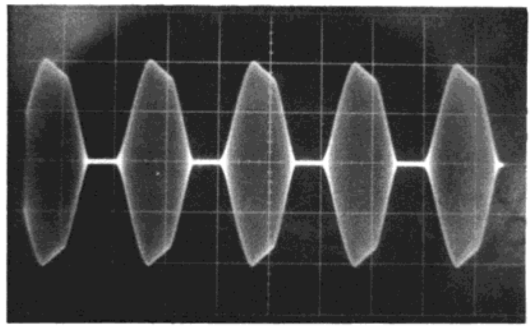
10V
0.5 ms



50% mod.
10V, 0.5ms

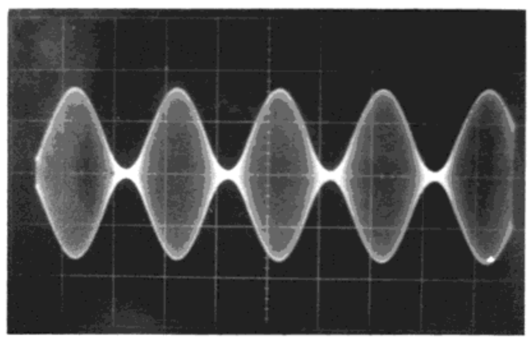
FIG. 5-9 MODULATION WAVEFORMS

[1] OVERMODULATION



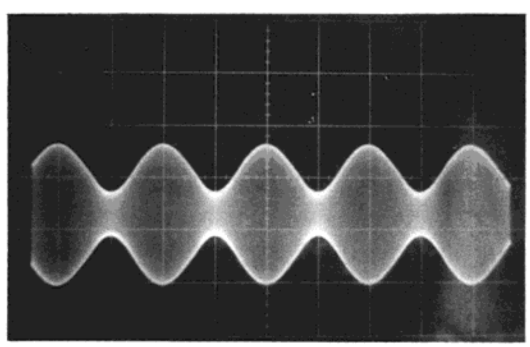
20V
0.5 ms

[2] 100% MODULATION



20V
0.5 ms

[3] 50% MODULATION



20V
0.5 ms

FIG. 5-10 RECEIVER ALIGNMENT PROCEDURE

INITIAL SET-UP

Unless otherwise noted, place the CB-PA switch in the CB position, the NB switch in OFF, the NL switch in NL, the Tone Control in maximum, AF Volume in maximum (fully clockwise), the Squelch Control in minimum (counterclockwise), the Clarifier Control in 12 o'clock and the channel selector in CH19 position.
Insert the microphone to the MIC jack on the front panel.

STEP 1 : AGC Alignment

1. Place the Mode switch to USB.
2. Connect circuit tester to the No. 8 terminal on PC Board PTBM085COX and chassis ground.
3. Adjust RV6 to obtain the reading of 2.1V.

STEP 2 : Receiver Alignment [SSB]

1. Set the signal generator frequency t 27.185 MHz + 1 kHz with no modulation. Also set the unit to 19 channel.
2. Increase or decrease signal generator level so that the AF audio output is not saturated.
3. Rotate the Clarifier control to obtain 1 kHz AF output.
4. Adjust T206, T207, T208 and T4 for maximum audio output.
   NOTE: Since the adjustments of T206 and T4 influence signal distortion, this alignment should be performed cautiously so that the maximum audio output is obtained with minimum distortion.

STEP 3 : Receiver Alignment [AM]

1. Set the signal generator, 27.185 MHz, 1 kHz 30% modulation.
2. Also, set the unit to 19 channel.
3. Increase or decrease signal generator level so that the AF audio output is not saturated.
4. Adjust T1 for maximum audio output.
5. Increase the signal generator level to maximum and adjust T2 to obtain maximum AF audio output.

STEP 4 : Squelch Circuit Alignment

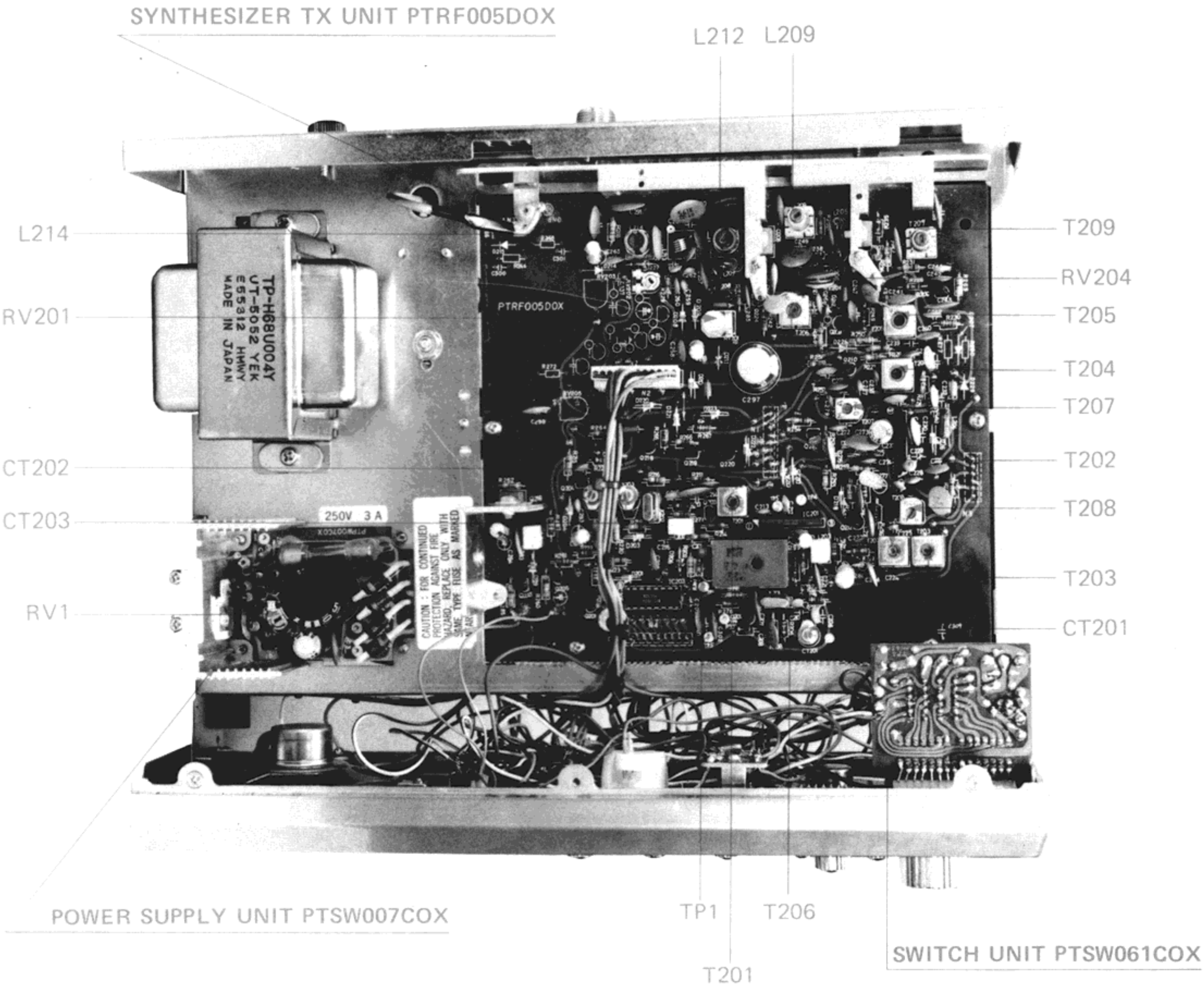
1. Place the Mode switch to AM.
2. Set the signal generator to provide RF input signal of 54 dB (1 kHz, 30% mod.) and rotate the squelch control in fully clockwise position.
3. Adjust RV7 so that the audio output just appears on the output terminal (scope-display).
4. Next, place the Mode switch to USB and set the signal generator to provide RF input signal of 54 dB (1 kHz shift up, no mod.).
5. Adjust RV8 in the similar way.

(continued)

STEP 5 : Signal Meter Alignment

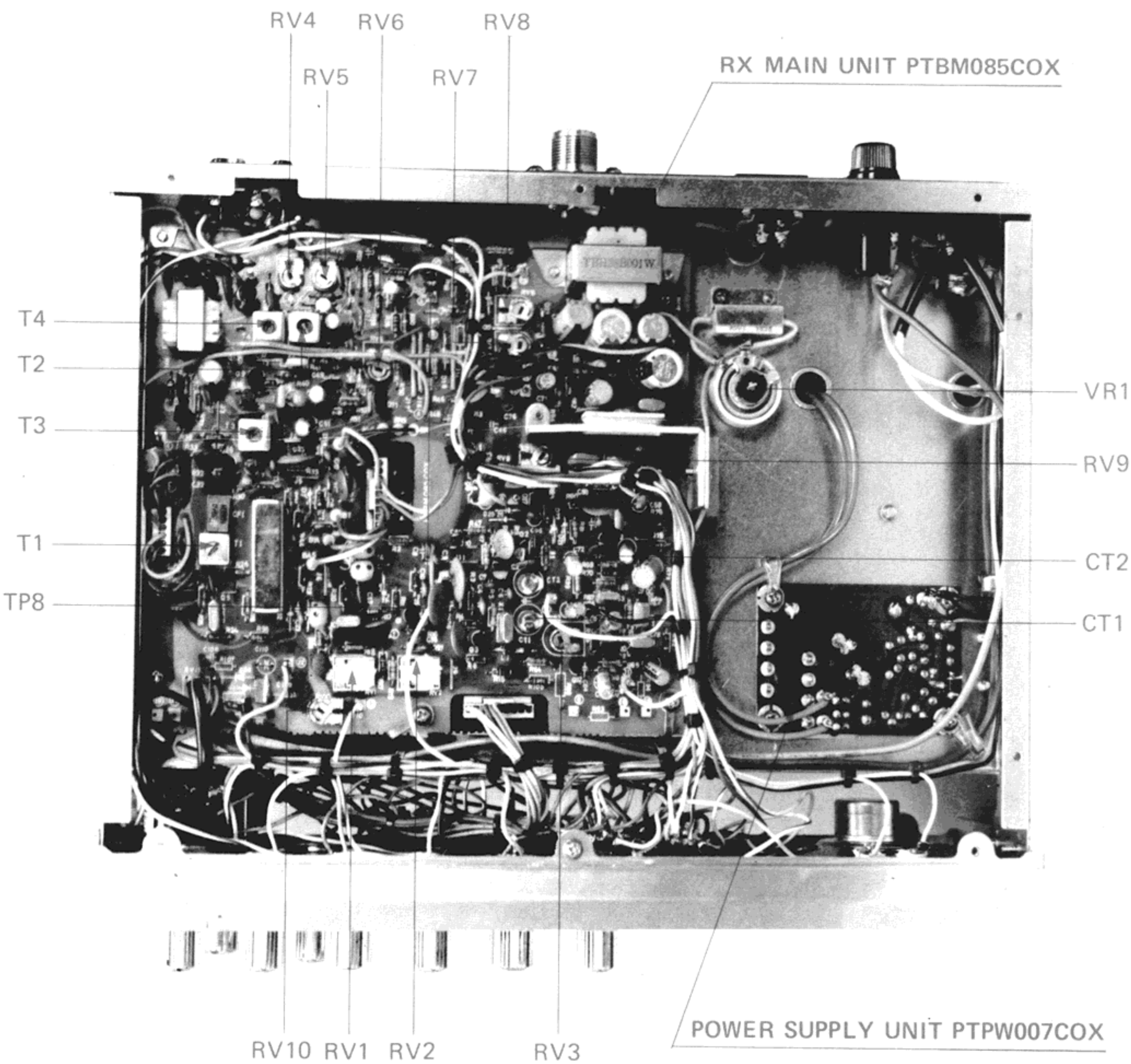
1. Set the signal generator to provide 40 dB output (100 μV) and place the Mode switch to AM.
2. Adjust RV5 so that the S-meter pointer should read "9".
3. Next, place the Mode switch to USB and retune the signal generator slightly to obtain 1 kHz shift up signal.
4. Adjust RV4 so that the S-meter pointer should read "9".

FIG. 5-11 ALIGNMENT LAYOUT



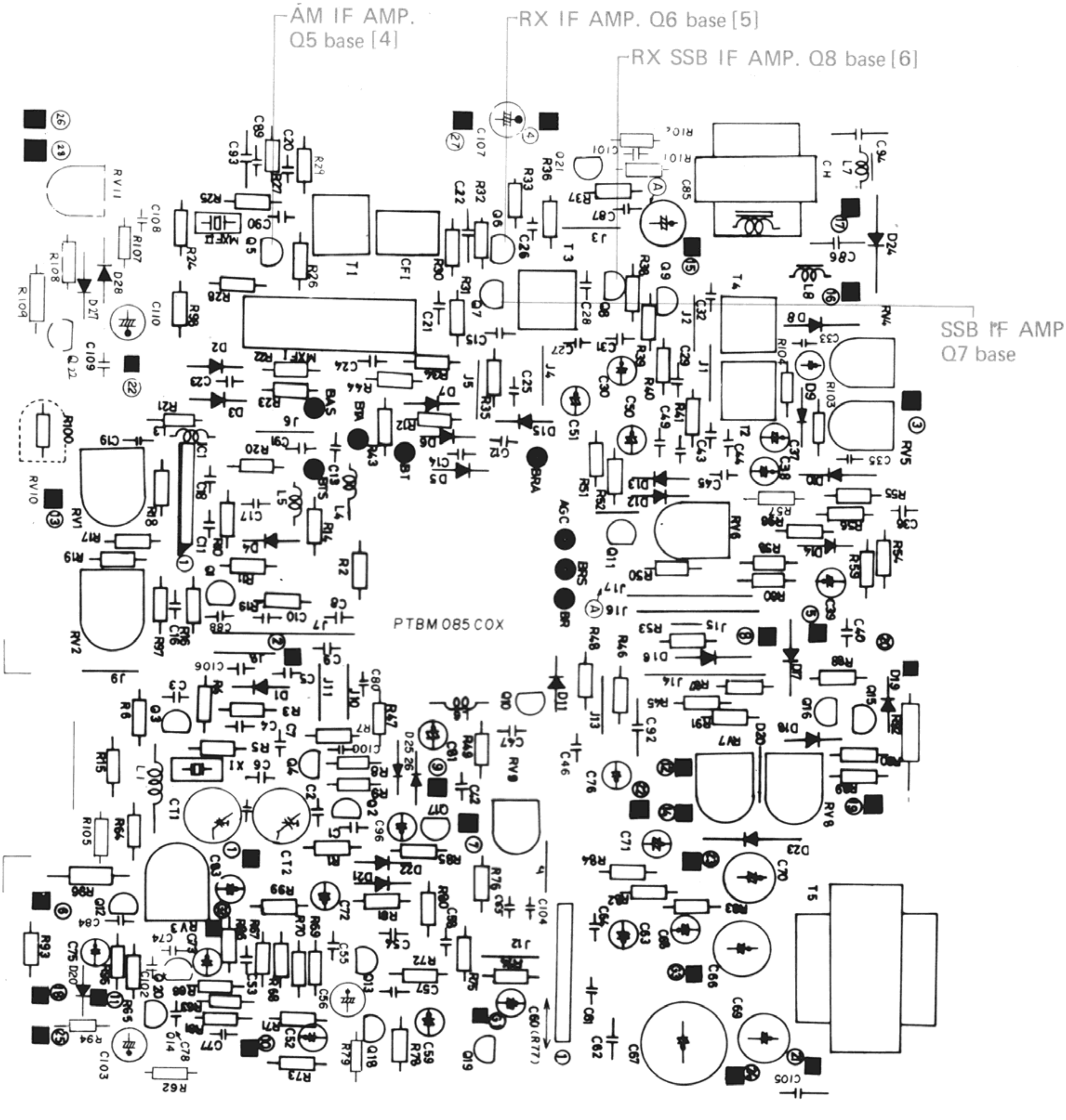
– TOP VIEW –

– ALIGNMENT LAYOUT –



– BOTTOM VIEW –

– RECEIVER INJECTION VOLTAGE CHECK POINT –



** Refer to the Next page.

— TRANSMITTER WAVEFORMS CHECK POINTS —

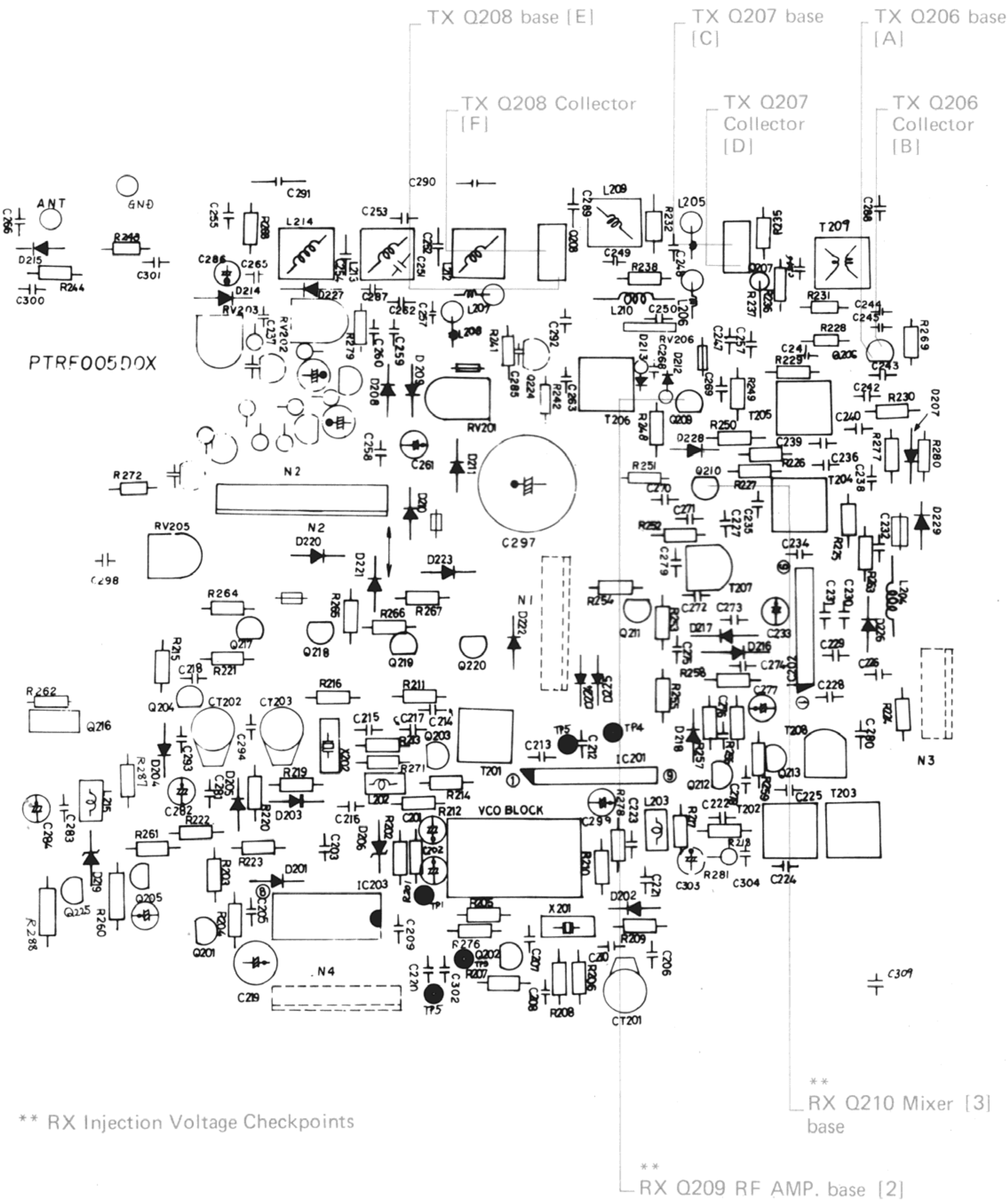


FIG. 5-12 RECEIVER INJECTION VOLTAGES

All injection voltage are 30% — 1 kHz modulation at the specified frequency fed through a 0.01 μF capacitor, and should produce at least 2V AC audio output measured across the speaker or an 8 ohm load connected at EXT. SP. jack on rear panel. Place the Noise Limiter NL switch in OFF position. Place the Mode switch in AM.

INJECTION POINT	INPUT LEVEL	AUDIO VOLTAGE	FREQUENCY
ANT jack J1	1 μV	7.5V	Channel Frequency
Q209 Base	0.5 μV	2.0V	Channel Frequency
Q210 Base	100 μV	2.0V	Channel Frequency
Q5 Base	4 μV	2.0V	455 kHz
Q6 Base	10 μV	2.0V	455 kHz
Q8 Base	35 μV	2.0V	455 kHz

** At Volume control — maximum.

FIG. 5-13 TROUBLE SHOOTING GUIDE

PLL CIRCUIT

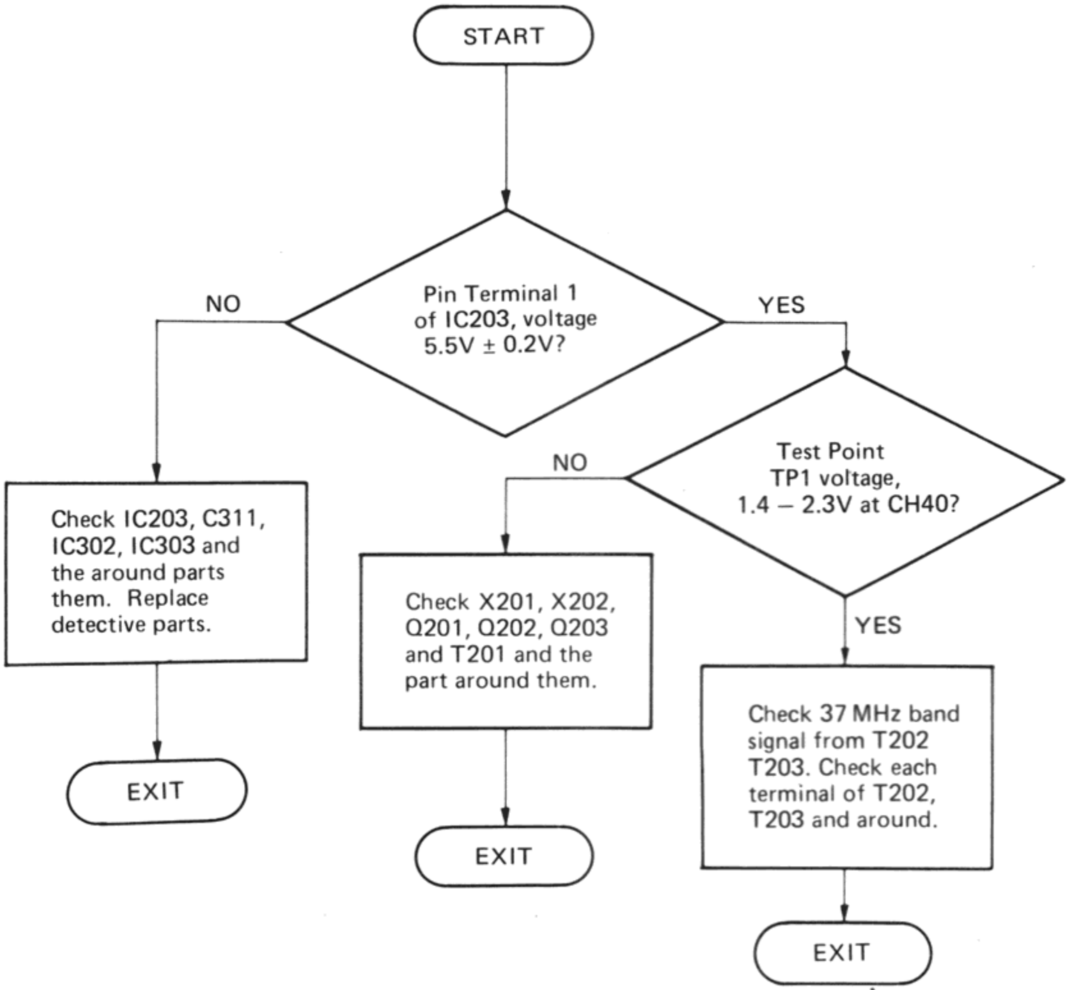
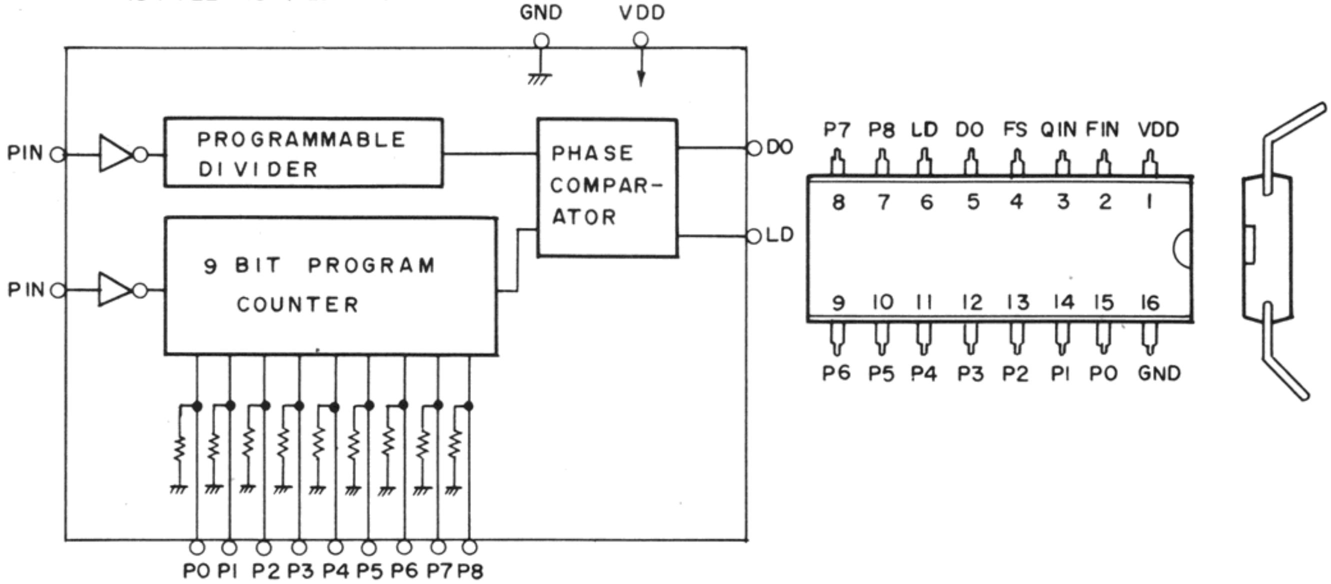
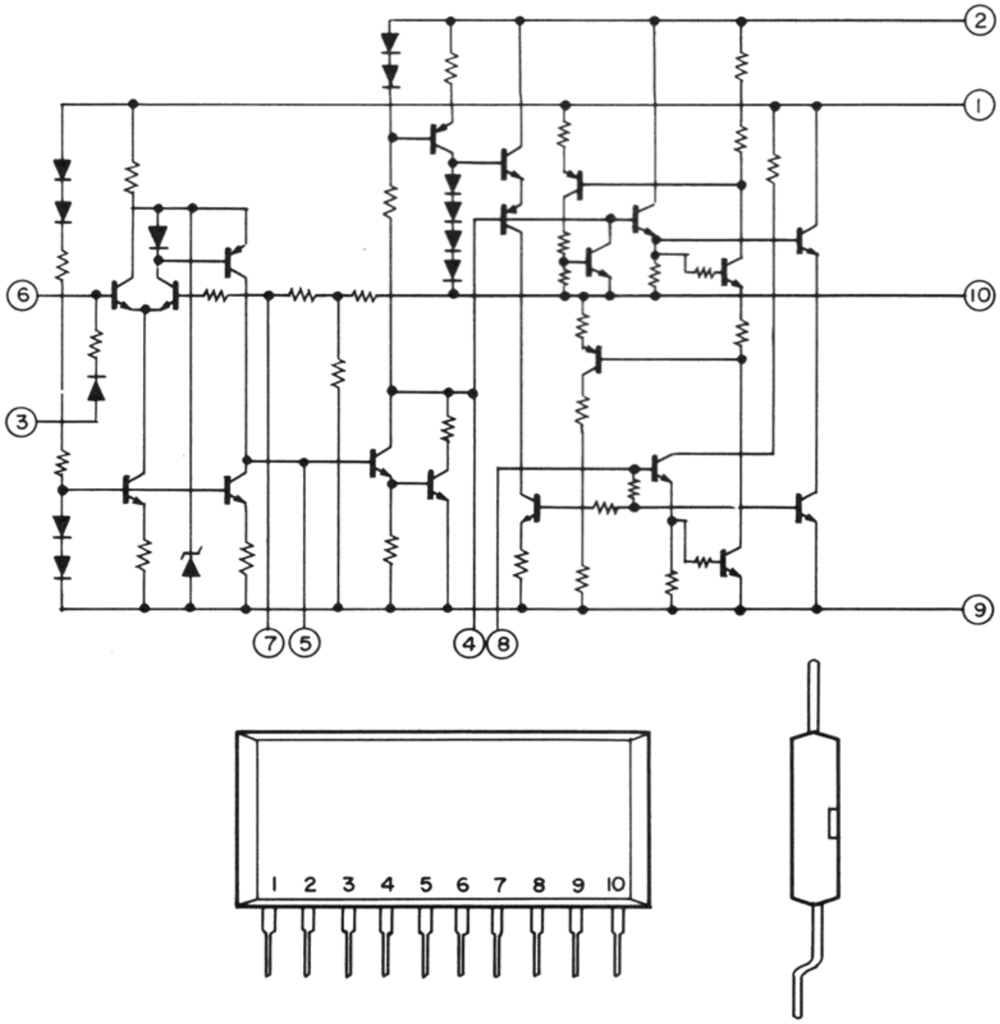


FIG. 5-14 IC EQUIVALENT CIRCUITS

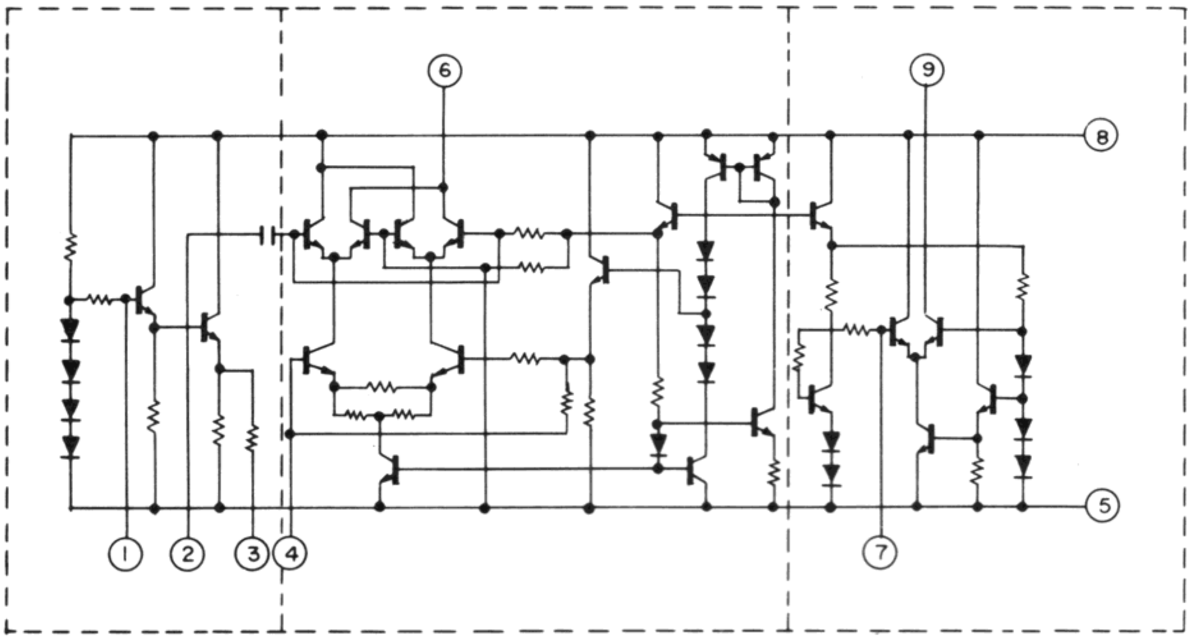
IC 1 PLL – IC (PLL 02A)

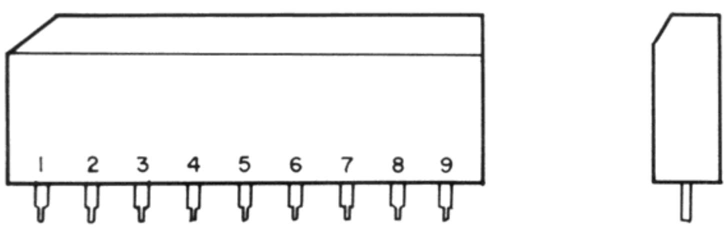


IC 4 AF AMP. (TA 7205P)

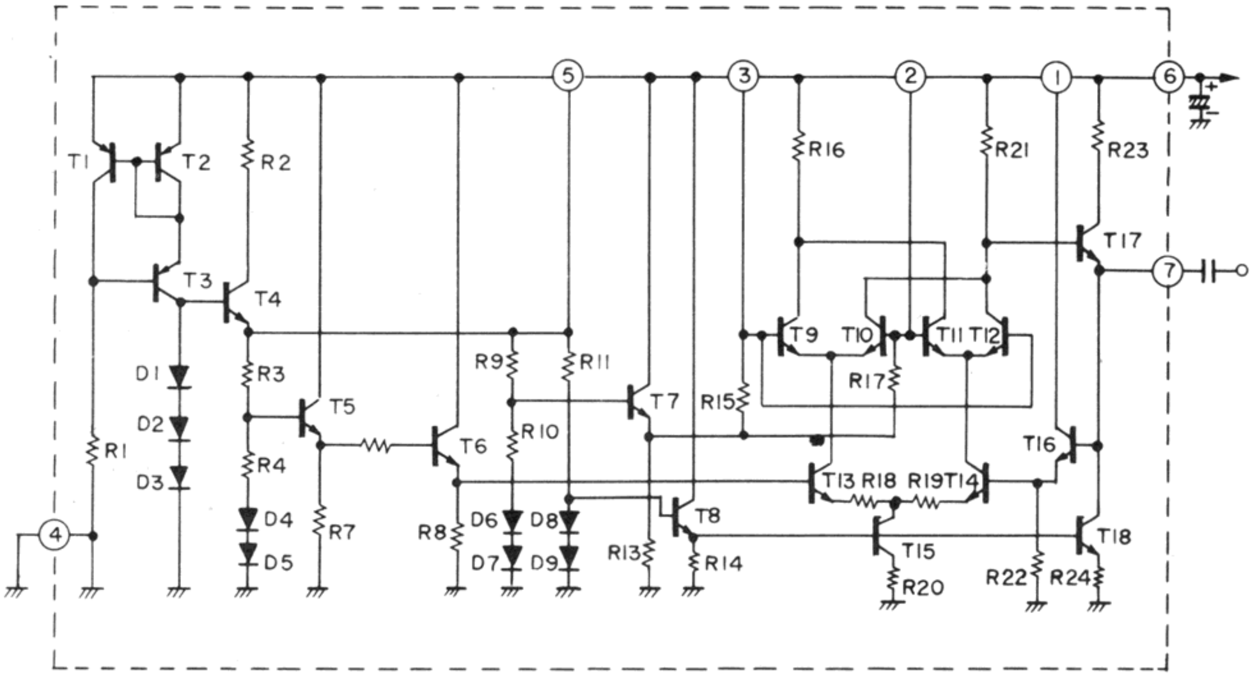


IC 2 & IC 3 : IC 2 V. C. O / MIXER / BUFFER . IC 3 OSC 2 / MIXER / RF AMP . (TA 7310P)





IC 4 : BALANCE MOD.



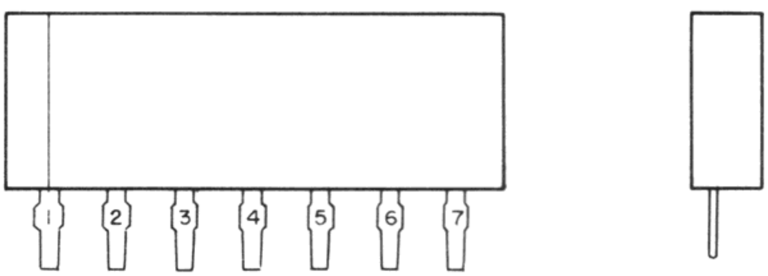


FIG. 5-15 EXPLODED VIEW OF LCBS-4

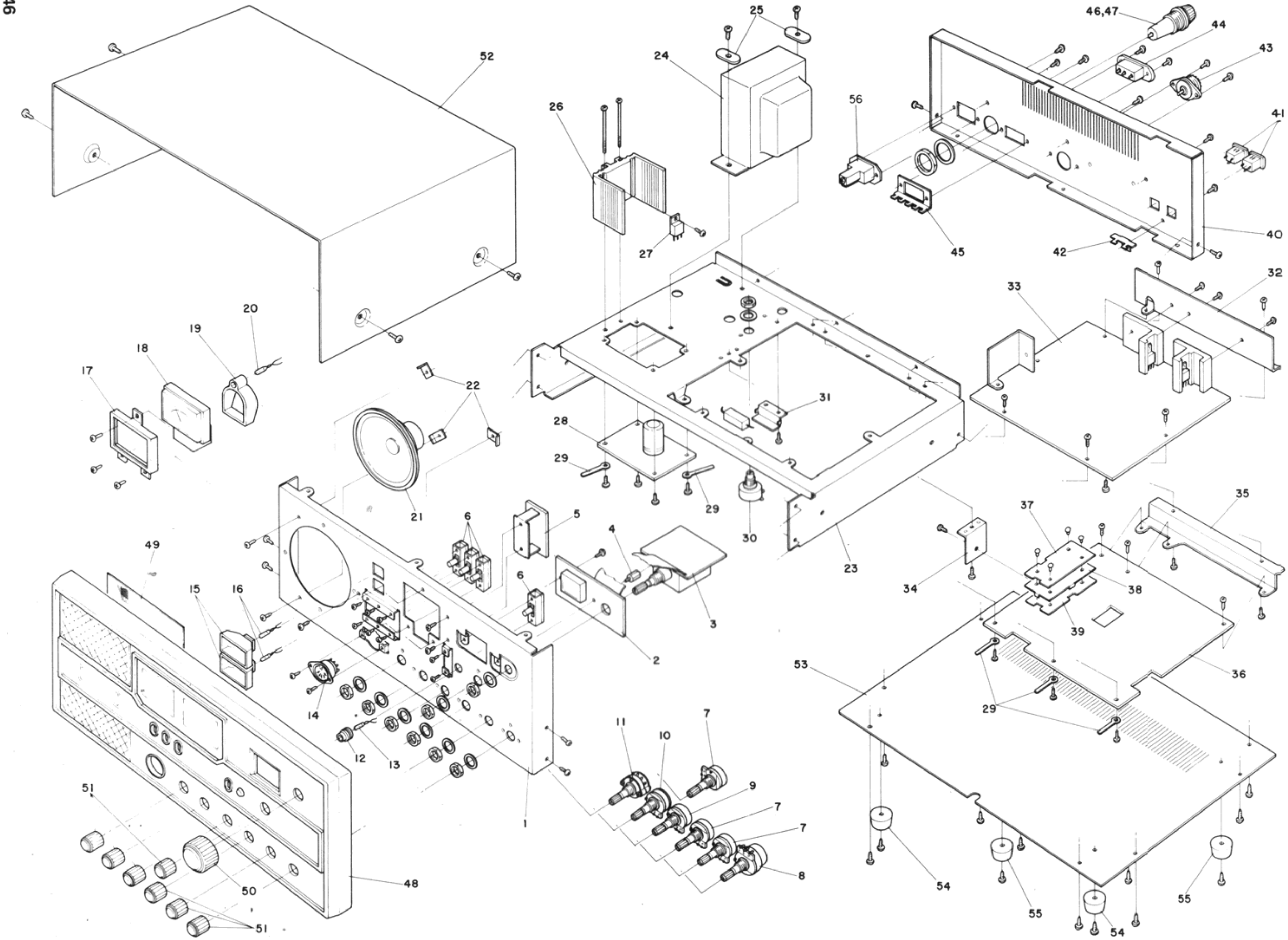
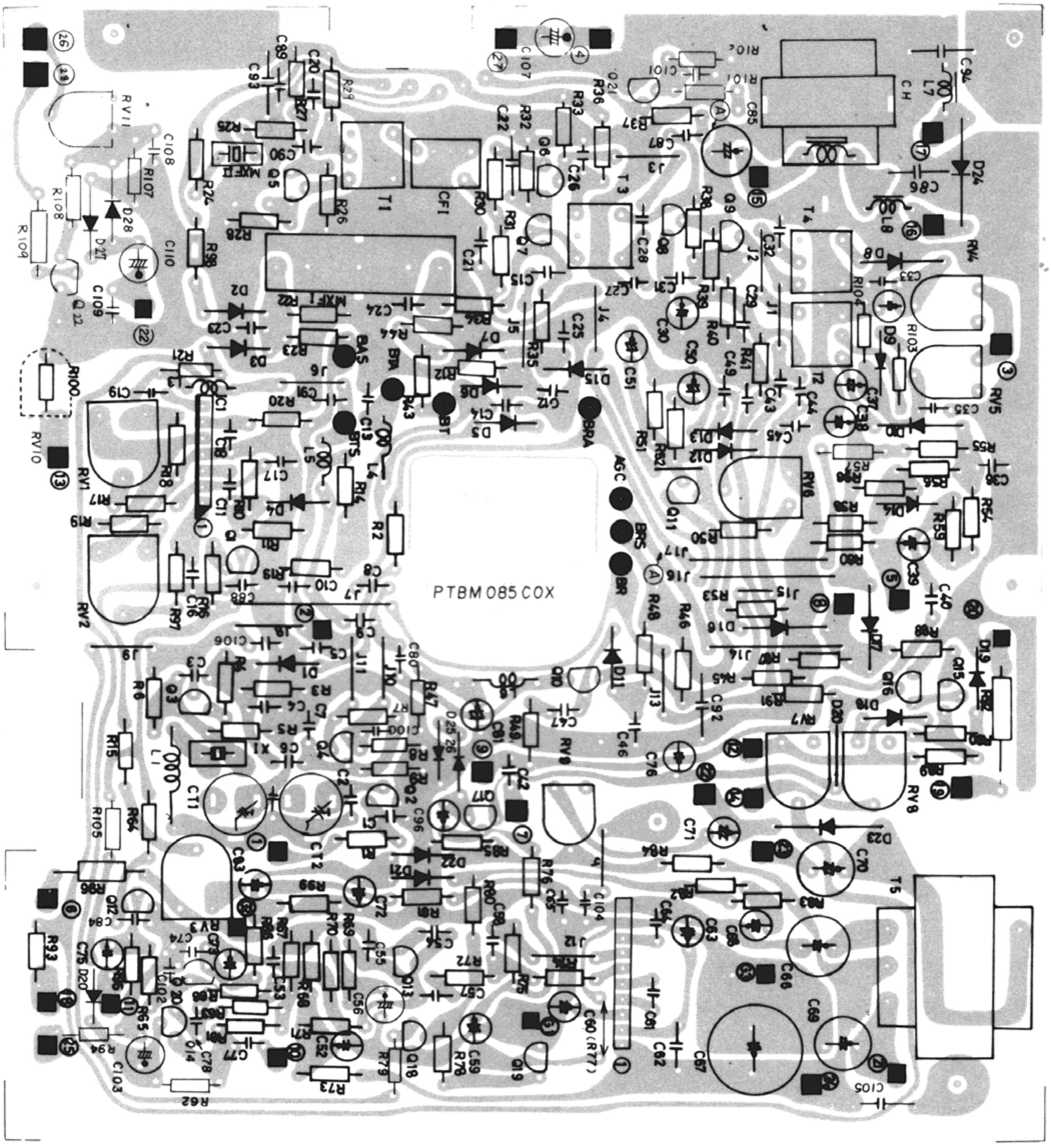
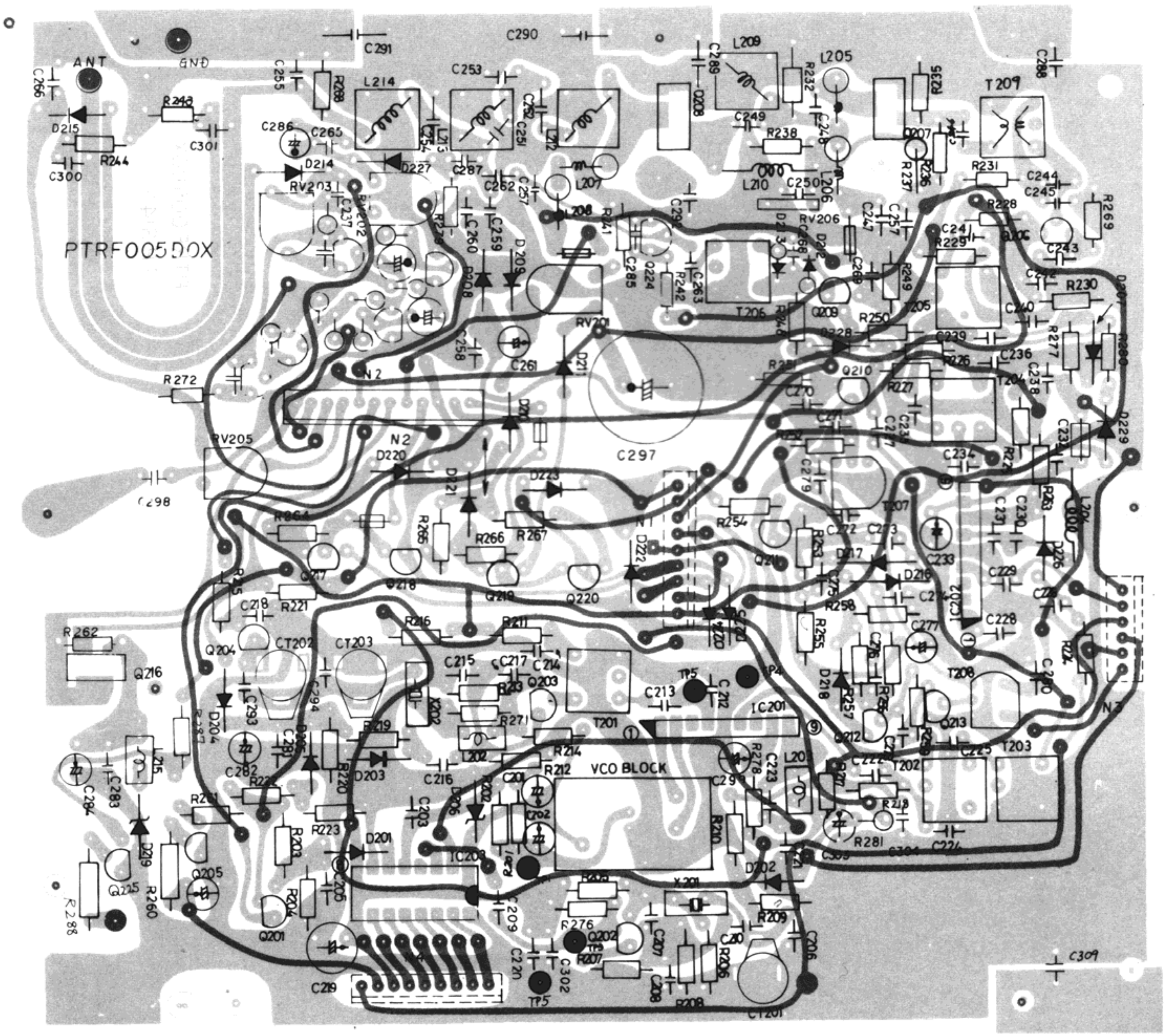


FIG. 5-16 COMPONENT LAYOUT (PC Board)

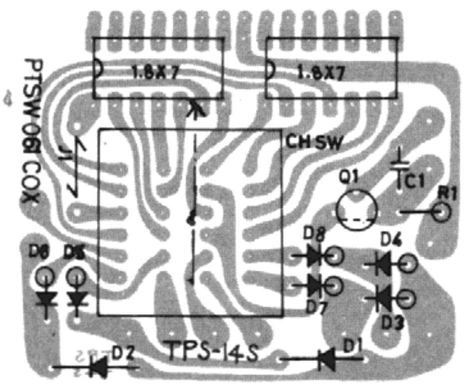


** PTBM085COX

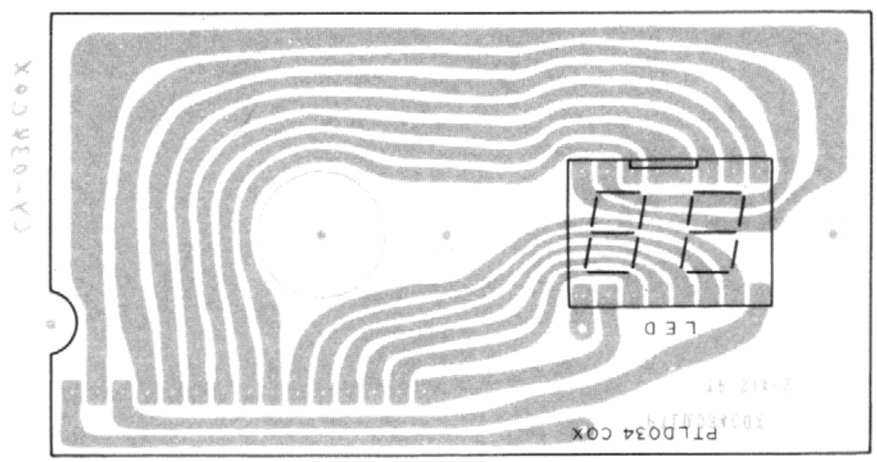
MAIN UNIT PC Board



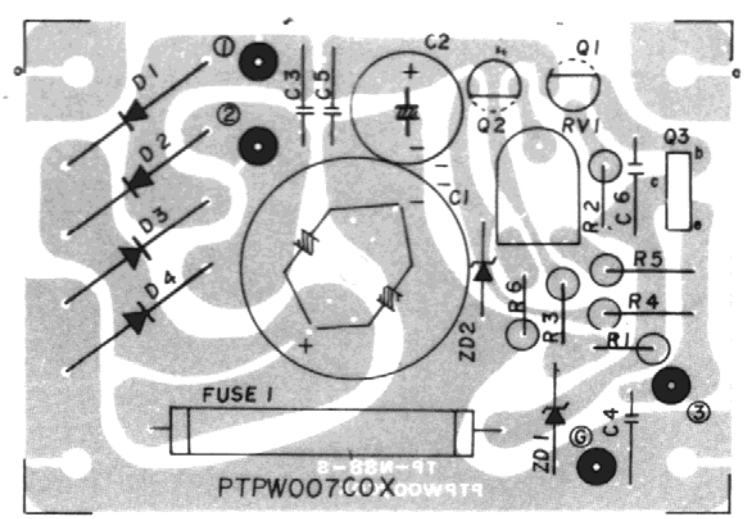
RF UNIT PC Board



PTSW061COX   SWITCHING UNIT PC Board



PTLD034COX   LED UNIT PC Board



PTPW007COX   POWER SUPPLY PC Board

PLL, TX Mixer, RF Amplifier, NB Circuits Board [PTRF005DOX]		
SYMBOL #	**PART #**	**DESCRIPTION**
Q201, 213	2SC711F	Tr., 2SC711F
Q202	2SC711E	Tr., 2SC711E
Q203, 204, 206	2SC710D	Tr., 2SC710D
Q205	2SC945A	Tr., 2SC945A
Q207	2SC2166	Tr., 2SC2166
Q208	2SC1969	Tr., 2SC1969
Q209	2SC763C	Tr., 2SC763C
Q210, 211	2SC710C	Tr., 2SC710C
Q212	2SA628F	Tr., 2SA628F
Q216	2SD359	Tr., 2SD359
Q217, 219	2SD355	Tr., 2SD355
Q218, 220	2SB525	Tr., 2SB525
Q224	2SC900U	Tr., 2SC900U
Q225	2SC945	Tr., 2SC945
IC201	11-95	IC, C3001T
IC202	11-96	IC, C3001M
IC203	11-97	IC, PLL02A
D204, 205, 208-213, 218, 221-226, 230	22-1-131	Diode, silicon, MA150
D202, 216, 217, 227	22-1-005	Diode, germanium, 1N60
D203	22-1-108	Diode, varicap., ITT310
D206	22-1-132	Diode, zener, MZ205
D219	22-1-133	Diode, zener, MZ309
D231	22-1-131	Diode, silicon, MA150
L201	33-150	RFC, 150μH
L202	33-2.2	RFC, 2.2 μH
L203, 215	33-68	RFC, 68 μH
L204	44-529	RFC, 330-ohm-core
L205, 207	44-530	RFC, ELR-11
L206, 208, 210	44-531	RFC, ELR-11/220-ohm
L209, 212	44-532	RFC, 10 mm
L213	44-533	RFC, coreless
L214	44-534	RFC
CT201-203	9-20P	Trimmer, 20 pF
T201	44-535	RFT, 10.0525 MHz
T202-205	44-536	RFT, 37 MHz, BPF
T207, 208	44-538	RFT
T209	44-539	RFT, TB-77
RV201	64-5K-2	VR, semi-var., 5k
RV202	64-20K-3	VR, semi-var., 20k
RV204	65-500-2	VR, semi-var., 500

SYMBOL #	PART #	DESCRIPTION
X201	50-2-60	Crystal, 10.24 MHz
X202	50-2-59	Crystal, 10.0525 MHz
R232	77-560W1/2-3	Metal-oxide-res., 560, 1/2W
R237	77-100W1-3	Metal-oxide-res., 100, 1W
C201	5-10M15	Tant., 10, 15V
C202, 307	5-1M35	Tant., 1, 35V
C203, 205, 214, 220, 226, 232, 236, 238, 240, 258, 265, 268-271, 276, 280, 281, 283, 285, 298, 304, 313, 314, 234, 254, 308, 309	1-.01M50-1	Cer., 0.01, 50V
C204, 247, 257, 289, 290, 302	1-.022M50	Cer., 0.022, 50V
C206, 212, 228, 260	1-33P50	Cer., 33p, 50V
C207, 217, 249, 273, 275	1-220P50	Cer., 220p, 50V
C209, 216	3-.001M50	Mylar, 1000p, 50V
C210, 262	1-22P50	Cer., 22p, 50V
C213	1-12P50	Cer., 12p, 50V
C215	1-27P50	Cer., 27p, 50V
C218	1-2200P50	Cer., 2200p, 50V
C219	4-100M15	Elyt, 100, 15V
C208, 252	1-150P50	Cer., 150p, 50V
C221	1-100P50	Cer., 100p, 50V
C224	3-.0018M50	Mylar, 1800p
C225, 279	1-2P50	Cer., 2p, 50V
C227	1-10P50	Cer., 10p, 50V
C229, 293, 294	1-15P50	Cer., 15p, 50V
C230, 241, 248, 278	1-82P50	Cer., 82p, 50V
C231	1-56P50	Cer., 56p, 50V
C233	4-47M25	Elyt, 47, 25V
C242	1-39P50	Cer., 39p, 50V
C243, 250, 288, 291, 292, 311, 312, 263	1-.047M50	Cer., 0.047, 50V
C244, 251, 272	1-47P50	Cer., 47p, 50V
C253	1-560P50	Cer., 560p, 50V
C254	1-470P50	Cer., 470p, 50V
C259	1-5P50	Cer., 5p, 50V
C246	1-390P50	Cer., 390p, 50V
C261, 277	4-3.3M25	Elyt, 3.3, 25V
C274	1-.0047M50	Cer., 0.0047, 50V
C255	1-330P50	Cer., 330p, 50V
C282, 286, 299	4-1M50	Elyt, 1, 50V
C287	1-3P50	Cer., 3p, 50V
C284	4-10M16	Elyt, 10, 16V
C299	4-1000M16	Elyt, 1000, 16V
C303	4-33M6.3	Elyt, 33, 6.3V
C263	3-.047M50	Mylar, 0.047
VCO		VCO-assembly

SYMBOL #	PART #	DESCRIPTION
F201-205	44-547	Ferrite bead
F207, 208	44-548	Ferrite bead, for D216, 217
N1, 4	8-61-001	Internal connector, 9-pin
N2	8-61-002	Internal connector, 12-pin
N3	8-61-003	Internal connector, 6-pin
	8-61-004	Heat sink, for 2SC2166
	8-61-005	Heat sink, for 2SC1699
	8-61-006	Heat sink, for AVR circuit

Modulator, RX-IF, AF amplifier circuits Board [PTBM085COX]

SYMBOL #	PART #	DESCRIPTION
Q1, 12, 16, 17, 18, 21	2SC711F	Tr., 2SC711F
Q2, 3	2SC710D	Tr., 2SC710D
Q4, 10	2SC711E	Tr., 2SC711E
Q5-9	2SC710C	Tr., 2SC710C
Q11	2SK34E	FET, 2SK34E
Q13	2SC1312G	Tr., 2SC1312G
Q14	2SC900F	Tr., 2SC900F
Q15	2SA628F	Tr., 2SA628F
Q20	2SA719	Tr., 2SA719
Q23	2SD359/360	Tr., 2SD359/360
IC1	11-98	IC, AN612
IC2	11-99	IC, TA7205P
MXF1	55-2-017	Monolithic filter, 10.6935 MHz
MXF2	55-2-018	Monolithic filter, 10.695 MHz
CF	55-1-022	Ceramic filter, 455 kHz
X1	50-2-61	Crystal, 10.695 MHz
L1	33-8.2	RFC, 8.2 μH
L3-6	33-150	RFC, 150 μH
L7, 8	44-540	dc input filtering
T1, 2	44-541	IFT, 455 kHz
T3, 4	44-542	IFT, 10.695 MHz
T5	44-543	AF power output
CH	44-544	dc 13.8V filter
D1-4, 7, 9, 11, 14, 18-22	22-1-131	Diode, silicon, MA 150
D5, 8, 10, 12, 13, 15-17	22-1-005	Diode, germanium, 1N60
D6	22-1-134	Diode, silicon, MC301
D23, 24	22-1-135	Diode, silicon, GP25B
CT1, 2	9-20P	Trimmer, 20p

SYMBOL #	PART #	DESCRIPTION
RV1, 3, 9	64-1K-8	VR, semi-fixed, 1k
RV2, 5	64-10K-2	VR, semi-fixed, 10k
RV6	64-5K-3	VR, semi-fixed, 5k
RV7	64-20K-4	VR, semi-fixed, 20k
RV10	64-100K-4	VR, semi-fixed, 100k
RV4	64-2K-2	VR, semi-fixed, 2k
RV8	64-100K-4	VR, semi-fixed, 100k
R92	77-18W2-3	Metal-oxide-film res., 18, 2W
R120	77-10W1/2-3	Metal-oxide-film res., 10, 1/2W
C1, 46, 49, 74, 80, 88	3-.0022M50	Mylar, 2200p, 50V
C2, 4	1-47P50	Cer., 47p, 50V
C3	1-150P50	Cer., 150p, 50V
C5, 18, 22, 25, 47, 93, 94, 86, 106	1-.047M50	Cer., 0.047, 50V.
C6, 24, 43, 110	1-10P50	Cer., 10p, 50V
C7	1-33P50	Cer., 33p, 50V
C8, 9, 20	1-22P50	Cer., 22p, 50V
C11, 32, 100	1-100P50	Cer., 100p, 50V
C12, 44	1-5P50	Cer., 5p, 50V
C13, 17, 19, 21, 26, 33, 35, 22, 57, 87, 89-92, 101, 104, 105, 35	1-.01M50	Cer., 0.01, 50V
C14	1-.022M50	Cer., 0.022, 50V
C15, 23	1-15P50	Cer., 15p, 50V
C16, 38, 50	5-3.3M25	Tant., 3.3, 25V
C27, 118	1-220P50	Cer., 220p, 50V
C28	1-180P50	Cer., 180p, 50V
C30	5-10M16	Tant., 10, 16V
C36	3-.0068M50	Mylar, 6800p, 50V
C37	4-1M50	Elyt, 1, 50V
C39	4-4.7M50	Elyt, 4.7, 50V
C40	3-.0047M50	Mylar, 4700p, 50V
C42	3-.012M50	Mylar, 0.012, 50V
C45	1-39P50	Cer., 39p, 50V
C51, 56, 68	4-10M16	Elyt, 10, 16V
C52, 63	4-47M16	Elyt, 47, 16V
C53	3-.033M50	Mylar, 0.033, 50V
C54	1-.001M50	Cer., 1000p, 50V
C55, 64	1-.0047M50	Cer., 4700p, 50V
C58	1-390P50	Cer., 390p, 50V
C59	5-3.3M35	Tant., 3.3, 35V
C60	4-33M16	Elyt, 33, 16V
C61	1-270P50	Cer., 270p, 50V
C62, 65	3-.068M50	Mylar, 0.068, 50V
C66	4-470M16	Elyt, 470, 16V
C67	4-1000M16	Elyt, 1000, 16V
C69, 70	4-220M16	Elyt, 220, 16V
C71, 72, 83	4-3.3M25	Elyt, 3.3, 25V

SYMBOL #	PART #	DESCRIPTION
C73	4-33M10	Elyt, 33, 10V
C75	4-4.7M25	Elyt, 4.7, 25V
C76	4-22M16	Elyt, 22, 16V
C77, 78	3-.047M50	Mylar, 0.047, 50V
C85, 107	4-47M16	Elyt, 47, 16V
C111	4-.47M50	Elyt, 0.47, 50V
C102	1-.0047M50	Cer., 0.0047, 50V
C103	4-4.7M10	Elyt, 4.7, 10V
	8-61-007	Heat sink [large], for TA7205P
	8-61-008	Heat sink [small], for TA7205P
	44-545	Ferrite bead
	8-61-009	Internal connector, 6-pin
	8-61-010	Internal connector, 9-pin
Channel Selector Board [PTSW061COX]		
SW	88-1-040	40 Ch. rotary SW
D1-8	22-1-131	Diode, silicon, MA150
Q1	2SC1383	Tr., 2SC1383
C1	1-.01M50	Cer., 0.01, 50V
	77-1.8KX7	Resistor array, 1.8k [7]
Channel Readout LED Board [PTLD034COX]		
LED	22-2-014	LED, cathode-common type
AC to DC Power Supply Board [PTPW007COX]		
Q501	2SC945A	Tr., 2SC945A
Q502	2SC900	Tr., 2SC900
D501-504	22-1-135	Diode, silicon, GP25G
ZD501	22-1-136	Diode, zener, BZ-162
ZD502	22-1-137	Diode, zener, RD5.6E
RV504	64-500-6	VR, semi-fixed, 500
F501	99-3	Fuse, ac, 250V, 3A
C501	4-2200M35	Elyt, 2200, 35V
C502	4-100M25	Elyt, 100, 25V
C503, 506	1-.022M50	Cer., 0.022, 50V
C504	1-.01M50	Cer., 0.01, 50V

SYMBOL #	PART #	DESCRIPTION
C505	1-.04M50	Cer., 0.04, 50V
	Main Chassis Parts [electrical]	
S-2	88-1-041	Rotary, 4p-3t, **Mode**
S-3	88-2-031	Slide, 2p-2t, **NB**
S-4	88-2-031	Slide, 2p-2t, **CB-PA**
S-5	88-2-031	Slide, 2p-2t, **ANL**
S-6	88-2-031	Slide, 2p-2t, **Dial-Ch. 9**
VR-1	60-10W10	VR, 10, 10W, AM-power adj.
VR-2/S1	61-50K-9	VR/SW, 50kA, **Off-Volume**
VR-3	60-50K-6	VR, 50kA, **Squelch**
VR-4	60-50K-6	VR, 50kA, **Clarifier**
VR-5	60-50K-7	VR, 50kB, **RF Gain**
VR-6	60-200K-1	VR, 200kA, **Tone**
VR-7	60-20K-1	VR, 20kB, **Dimmer**
J1	8-4-069	SO-239, **Antenna**
J2	8-60-002	3-p, 1/8", **PA Sp**
J3	8-60-002	3-p, 1/8", **Ext Sp**
J4	8-60-003	3p, **dc 13.8V**
J5	8-60-001	DIN, 5-p, **Microphone**
J6	8-61-011	2-p, **ac input**
SP	8-61-012	Speaker, 3-1/2", 8-ohm, 2W
M	8-61-013	Meter, **S/RF**
PL1	8-61-014	Lamp, 16V, 80mA, **Receiving**
PL2	8-61-015	Lamp, 16V, 80mA, **On the Air**
PL3	8-61-016	Lamp, 9V, 40mA, meter illum.
PL4	8-61-017	Lamp, **Ch. 9** indic.
T6	44-546	ac power transformer
R501	77-15W5-4	Cement res., 15, 5W
R502	4703-00200	Solid [high voltage], 3.3M, 1/2W
C501, 503-505	1-.01M50	Cer., 0.01, 50V
C502, 506, 509	1-.001M50	Cer., 0.001, 50V
C507, 508	1-.047M50	Cer., 0.047, 50V
C510	1-33P50	Cer., 33p, 50V
Q501	2SD704	Tr., 2SD704
	Mechanical Parts	
	8-61-018	Escutcheon Panel
	8-61-019	Chassis [side portions]

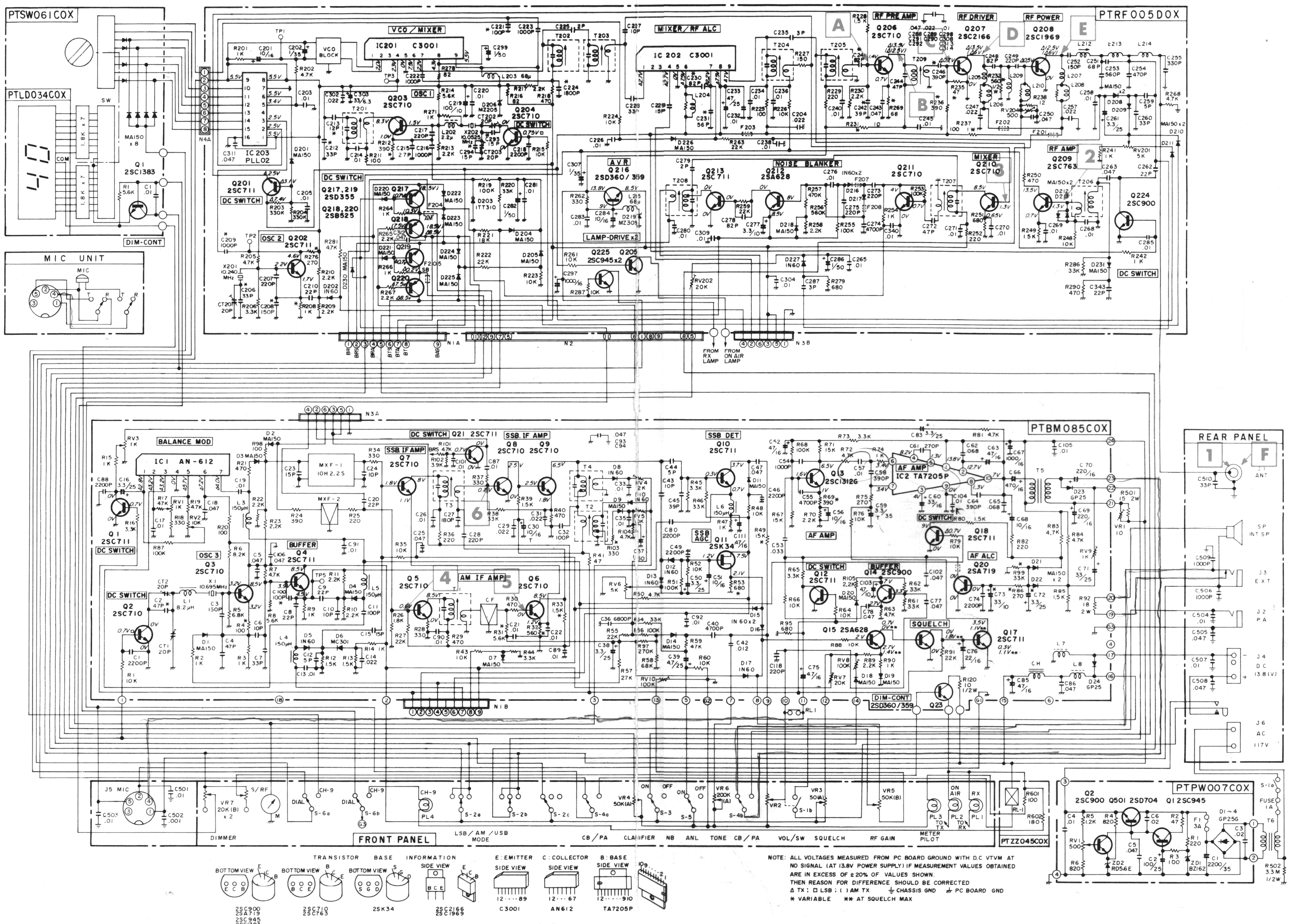
SYMBOL #	PART #	DESCRIPTION
	8-61-020	Chassis [front portion]
	8-61-021	Chassis [rear portion]
	8-61-022	Cabinet cover
	8-61-023	Bottom plate
		FCC ID plate [unavailable]
	8-61-024	Knob, for **Channel selector**
	8-61-025	Knobs, for other controls
	8-61-026	Lamp holder
	8-61-027	Sp grill net
	8-61-028	Holder, meter support

EXPLODED VIEW REFERENCE SHEET

EXPLODED VIEW SYMBOL NO.	DESCRIPTION
(1)	Front Panel
(2)	P.W.B. Ass'y LED PC Board PTLD034COX
(3)	P.W.B. Ass'y CH-SW PC Board PTSW061COX
(4)	Support LED P.W.B. Mtg.
(5)	P.W.B. Ass'y Relay
(6) S3-6	Slide SW NB/OFF, CB/PA, ANL/OFF, CH9
(7) VR3, VR4	Control Squelch/Clarifier 50kA
(7A) VR5	Control RF Gain 50kB
(8) VR2	Control Volume 50kA
(9) VR6	Control Tone 200kA
(10) VR7	Control Dimmer 20kB
(11) S2	Rotary Switch Function
(12)	Holder Lamp
(13) PL4	Lamp CH-9
(14) J5	Jack Microphone
(15)	Holder Lamp
(16) PL1, PL2	Lamp RX. On Air
(17)	Bracket Metre Mtg.
(18) M	Meter S/RF
(19)	Holder Meter Lamp
(20) PL3	Lamp Meter
(21) SP	Speaker 8 ohm 2W
(22)	Bracket Speaker Mtg.
(23)	Chassis
(24)	Power Transformer
(25)	Plate Power Transformer Mtg.
(26)	Heat Sink Power P.W.B.
(27) Q501	Transistor 2SD704
(28)	P.W.B. Ass'y AVR PTPW007COX
(29)	Clamper Cord
(30) VR1	Control AM Power
(31)	Bracket Cement Resistor Mtg.
(32)	Bracket P.W.B. Mtg.
(33)	P.W.B. Ass'y RF PTRF005DOX
(34)	Retainer Heat Sink
(35)	Bracket Heat Sink
(36)	P.W.B. Ass'y Main PC Board PTBM085COX
(37)	Barrier
(38)	Shield
(39)	Barrier
(40)	Rear Panel
(41)	Jack PA. EXT/SP 3P
(42)	Terminal GND
(43)	Jack ANT.
(44) J4	Jack DC Power
(45)	Bracket DC Jack
(46)	Holder Fuse
(47)	Fuse 1A 250V
(48)	Frame Ass'y
(49)	Sheet Speaker
(50)	Knob Channel

EXPLODED VIEW SYMBOL NO.	DESCRIPTION	
(51)	Knob	Control
(52)	Case	Upper
(53)	Cover	Bottom

SECTION 7
SCHEMATIC DIAGRAM MODEL LCBS-4



SCHEMATIC DIAGRAM MODEL LCBS-4

SBE, INC.
220 AIRPORT BLVD.
WATSONVILLE, CA 95076

KDLCBS4*XX
PRINTED IN JAPAN

PART NO. 9101-00189