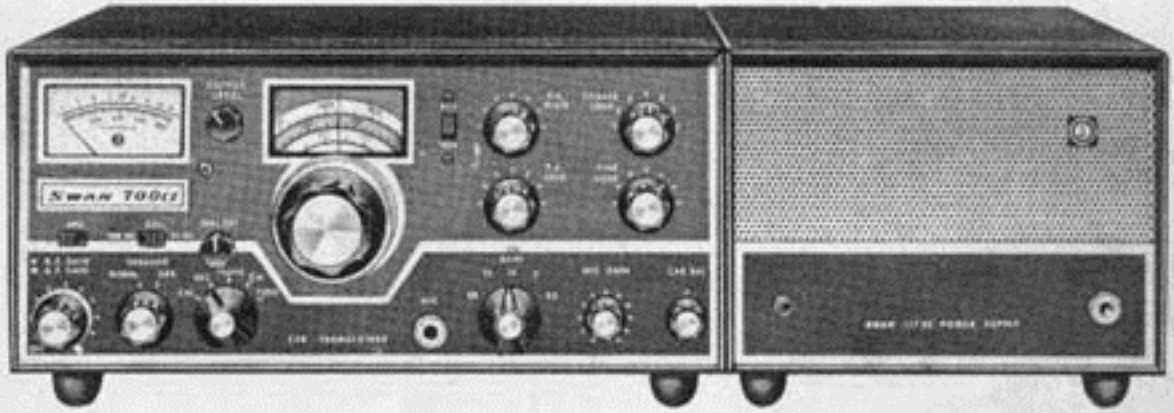
OPERATION AND MAINTENANCE



SWAN MODEL 700-CX

10/73

SWAN
ELECTRONICS
Oceanside, CA 92054
A subsidiary of Cubic Corporation

OPERATION AND MAINTENANCE
SWAN MODEL 700-CX
Transceiver

INTRODUCTION

The Swan Model 700CX Transceiver together with its accessories and optional equipment, is designed to be used in either CW, AM or SSB modes on all portions of the 80-, 40-, 20-, 15-, and 10 meter amateur radio bands. Many of the MARS frequencies may also be covered by using the Model 510X oscillator accessory.

The Model 700CX generates a single sideband signal by means of crystal lattice filter, and the transceive operation automatically tunes the transmitter to the received frequency. Provisions are included in the transceiver for operation on either upper or lower sideband.

Basic circuitry of the single conversion design has been proven in several thousand of the popular Swan transceivers. Mechanical, electrical, and thermal stability is exceptionally high. All oscillators are temperature compensated and voltage regulated. Push-to-talk operation is standard, with provision for plugging in the Model VX-2 accessory VOX unit for automatic voice control and CW break-in.

Operation may be fixed, station, portable, or mobile. Power input exceeds 700 watts, PEP, on single sideband, 400 watts on CW, and 125 watts on AM. The Model 700CX includes automatic gain control (AGC), automatic level control (ALC), automatic noise limiter (ANL), grid block keying, CW sidetone monitor, and provisions for break-in CW.

Recommended power supplies are the Model 117-XC for 117 volts AC operation, the Model 230-XC for 230 volts AC, and the 14-117 for 12-14 volts DC. These power supplies, as well as other accessories, are described in later sections of this manual.

CONTENTS

SPECIFICATIONS

FREQUENCY RANGES

80 Meters	3.5 to 4 mc.
40 Meters	7.0 to 7.450 mc.
20 Meters	14.0 to 14.450 mc.
15 Meters	21.0 to 21.450 mc.
10 Meters	28.0 to 29.7 mc.

POWER INPUT

Single Sideband, Suppressed Carrier:
700 watts, PEP input.
CW: 400 watts, dc input.
AM (Single Sideband with Carrier):
125 watts dc input.

DISTORTION

Distortion products down approx. 30 db.

UNWANTED SIDEBAND SUPPRESSION

Unwanted sideband down more than 50 db.

CARRIER SUPPRESSION

Carrier suppression greater than 60 db.

RECEIVER SENSITIVITY

Less than 0.5 microvolt at 50 ohms impedance for signal-plus-noise to noise ratio of 10 db.

AUDIO OUTPUT AND RESPONSE

Audio output, 4 watts to 3.2 ohm load. Response essentially flat from 300 to 3000 cps in both receive and transmit.

TRANSMITTER OUTPUT

Wide-range Pi-network output matches antennas essentially resistive from 15 to 500 ohms impedance, with coarse and fine load adjustment.

AMPLIFIED ALC

Limits modulation level.

AUDIO SIDETONE

For CW Monitoring

PLUG IN VOX

Optional accessory. Also provides bk-in CW.

FRONT PANEL CONTROLS

AF-RF Gain, Sideband Selector CAL-REC-TRANS-CW-TUNE, Mic. Gain, Bandswitch, Carrier Balance, PA Plate Tune, PA Grid Tune, PA Load Coarse, PA Load Fine, VOX-PTT Switch, ANL Switch, Dial set, Output Level, 25-100 kc calib. switch.

REAR PANEL CONTROLS AND CONNECTIONS

Bias potentiometer, CW key jack, Jones plug power connector, Vox connector, Antenna jack, S-Meter zero, Auxiliary relay switching, Outboard VFO connector.

VACUUM TUBE COMPLEMENT

V1	6EW6 VFO Amplifier
V2	12BE6 Transmitter Mixer
V3	6GK6 Driver
V4	8950 Power Amplifier
V5	8950 Power Amplifier
V6	6BZ6 Receiver RF Amplifier
V7	12BE6 Receiver Mixer
V8	12BA6 First IF Amplifier
V9	12BA6 Second IF Amplifier
V10	12AX7 Product Detector/Receive Audio
V11	6BN8 AGC/ALC Amplifier
V12	6GK6 Audio Amplifier
V13	6JH8 Balanced Modulator
V14	12AX7 Mic. Amplifier/Transmit Audio

DIODE AND TRANSISTOR COMPLEMENT

Q1	VFO
Q2	Emitter Follower
Q3	Carrier Oscillator
Q4	Crystal Calibrator
Q5	Crystal Calibrator
Q6	Crystal Calibrator
Q7	Crystal Calibrator
D401	Relative Output Diode
D701	Overload Diode
D1101	ANL Diode
D1102	ANL Diode
D1201	CW Switching Diode
D1202	CW Switching Diode
D1801	Zener
D1802	Relay Silencing Diode
D1803	AGC Diode
D1804	AGC Diode
D1805	AGC Diode

POWER REQUIREMENTS

Filaments	12.6 volts, 6.7 amps, ac or dc
Relay	12 volts dc, 250 ma.
Bias	– 110 volts dc, 100 ma.

Med. voltage
275 volts dc, 150 ma.
High voltage
800 volts dc, 1A Peak Trans.

DIMENSIONS AND WEIGHT

Height	5½ in.	Depth	11 in.
Width	13 in.	Weight	17¼ lb.

CIRCUIT THEORY

GENERAL DISCUSSION

The Swan 700CX transceiver provides single sideband, suppressed carrier transceive operation, and generates the single sideband signal by means of a crystal lattice filter. To permit a logical discussion of this mode of operation, certain definitions are necessary. In a normal AM signal, (double sideband with carrier), a radio frequency signal is modulated with an audio frequency signal. This is considered by many to be merely a case of varying the amplitude of the carrier at an audio rate. In fact, however, there are actually sideband frequencies generated, which are the results of mixing the RF and the AF signals. These sidebands are the sum of, and the difference between the two heterodyned signals. In the detection of this conventional AM signal, the two sidebands are mixed with the carrier to recover and reproduce the audio intelligence. This is an inefficient means of transmission, because only 25 percent of the transmitted power is used to transmit intelligence. There are other attendant drawbacks, also. The bandwidth of AM voice transmission is approximately 6 kc, while the actual demodulated audio is only approximately 3 kc. The result is inefficient use of the frequency band, and over half of the allotted band is unusable due to heterodynes, interference, and congestion.

In the single sideband, suppressed carrier mode of transmission, only one of the sideband signals is transmitted. The other sideband and the carrier are suppressed to negligible level. In addition to increasing the transmission efficiency by a factor of four, single sideband effectively doubles the number of stations or channels which can be used in a given band of frequencies.

It should be remembered that in the single sideband, suppressed carrier mode of transmitting, the unwanted sideband and carrier are only suppressed, not entirely eliminated. Thus, with a transmitted signal from a transmitter with 50 db sideband suppression, the other or unwanted sideband will be present, and will be transmitted, but its level will be 50 db below the wanted sideband. When this signal is received at a level of 20 db over S9, the unwanted sideband will be present at a level of approximately S5. The same is true of carrier suppression. With carrier suppression of 60 db, and a signal level of 20 db over S9, carrier will be present at a level of approximately S3 to S4.

In the Model 700CX transceiver, the single sideband suppressed carrier signal is generated by the crystal lattice filter method. For details, refer to the schematic diagram, and to Figures 1, 2, and 4

SIGNAL GENERATION

When the push-to-talk switch on the microphone is pressed, the transmitter portion of the transceiver is activated; and it generates a single sideband, suppressed carrier signal in the following manner. Carrier is generated by a crystal oscillator using transistor, Q3. This stage operates in both the transmit and receive modes. When transmitting, the RF output of the oscillator is injected into the control grid of the Balanced Modulator, V13. This balanced modulator is a beam deflection tube, and operates similar to a cathode ray tube in that the electron beam from the cathode is deflected to one output plate or the other by the charge appearing on the deflection plate. The carrier signal fed to the control grid of the balanced modulator appears on both plates of the output. The two plates are connected to Transformer T1301 in push-pull, so the carrier signal cancels itself out in T1301. The deflection plate DC voltages are adjusted by means of the carrier balance control so that the RF being fed to the output plates will cancel out, and the output from T1301 will be zero. Audio signals from the Microphone Amplifier, V15, are applied as a modulating voltage to one deflection plate, and the two sidebands resulting from the sum and difference frequencies of the audio and carrier signals appear in the output of transformer T1301. Carrier suppression is approximately 60 db.

The double sideband, suppressed carrier signal is then coupled from the secondary winding of T1301 to the crystal filter, which suppresses the lower sideband, and permits only the upper sideband to be fed to the First IF Amplifier, V8. The carrier frequency is generated at approximately 5500.0 kc, normal sideband. With the opposite sideband crystal, the carrier crystal frequency will be 5503.3 kc, and this positions the double sideband signal on the other side of the filter response curve, attenuating the upper sideband by at least 50 db. In the single conversion mixing process, these sidebands become inverted on 80 and 40 meters. Thus the Swan 700CX normally operates on lower sideband on 80 and 40, while on 20, 15, and 10 meters normal operation is on upper sideband.

Q1, the VFO 2N706 Oscillator, operates in the common base configuration as a colpitts oscillator. Q2, The Emitter Follower is used for isolation. The extremely good regulation achieved through using the Zener diode regulator D1801 across the bias supply voltage, also contributes to the stability. Bandswitching is accomplished by changing the tank circuit coil. The VFO in the Model 700CX exhibits extremely good stability after the initial warm-up period. Drift from a cold start will be less than 1 kc for the first hour on 80, 40, and 20-meter bands, and less than 2 kc on 10 and 15 meters. After the initial warm-up period, drift will be negligible.

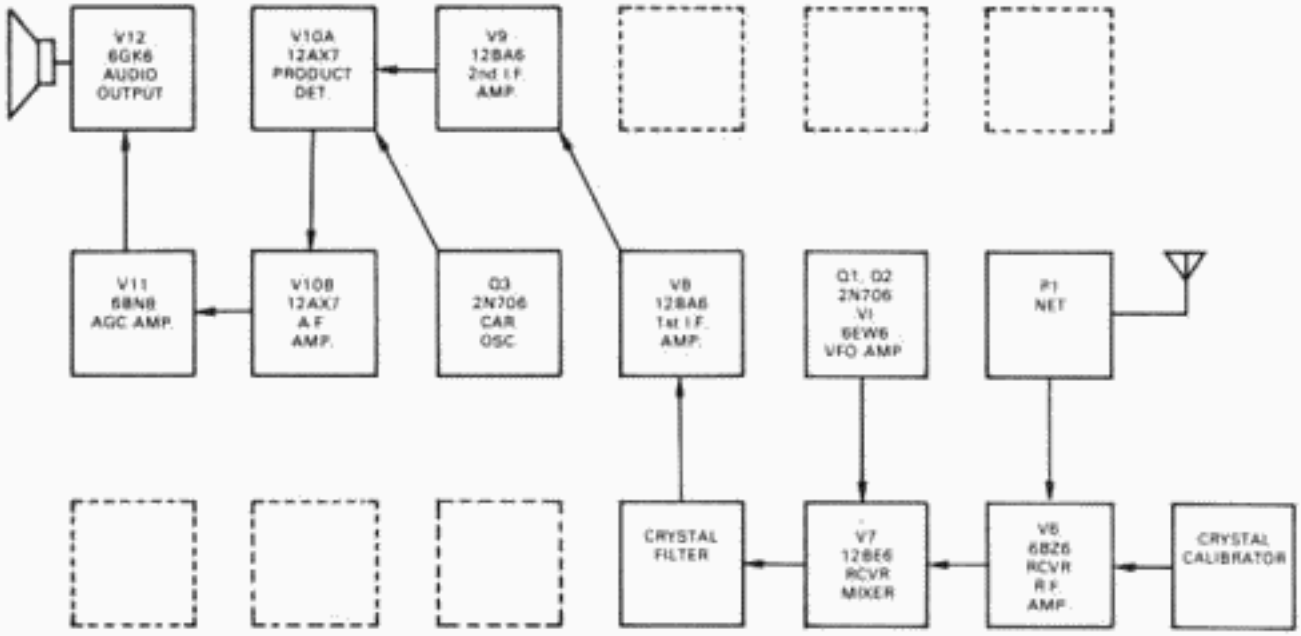


FIGURE 1. BLOCK DIAGRAM, RECEIVE MODE

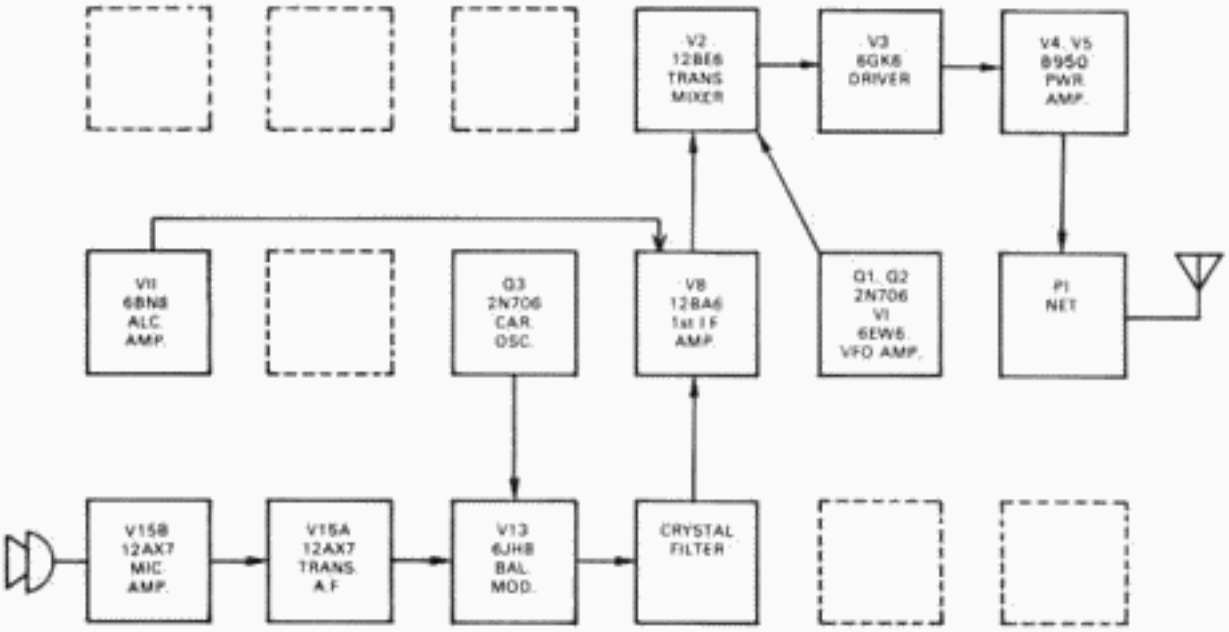


FIGURE 2. BLOCK DIAGRAM, TRANSMIT MODE

SIGNAL GENERATION (cont.)

The single sideband, suppressed carrier signal from the first IF Amplifier is fed to the Transmitter. Mixer, V2, where it is heterodyned with the VFO signal. The resultant signal at the desired transmit frequency is amplified by the Driver, V3, and the Power Amplifiers, V4 and V5. The signal from the VFO Amplifier is initiated in the transistorized VFO-Emitter Follower circuit Q1 and Q2. The signal from the VFO is routed to the VFO Amplifier, and on 40 and 80 meters, is subtractively mixed with the single sideband signal from the IF Amplifier, and result in LSB operation. On 20, 15, and 10 meters, the frequencies are additively mixed, resulting in output on the upper sideband.

When in TRANSMIT, the gain of the First IF Amplifier, is controlled by an amplified ALC circuit, V11, in response to the average input power to the Power Amplifiers. This ALC system will compensate for extremely strong input signals, but does not completely eliminate the necessity of proper adjustment of the Mic. Gain Control. This feature will help prevent the transmitter from flat topping and spurious emissions, but considerable distortion may occur if the Mic. Gain Control is not properly adjusted. Refer to Operating Instructions.

INSTALLATION

POWER SUPPLY

1. **AC Operation.** The Swan Models 117-XC or 230-XC Power Supplies provide all necessary voltage required by the transceiver for AC operation. The supplies come equipped with a prewired plug and cable, all ready for plugging into the transceiver.

2. **DC Operation.** The Model 14-117 supply for mobile operation includes all necessary cables, connector plug, fuses, and installation hardware. The Jones plug for connection to the transceiver is furnished with the unit.

Power requirements for the Swan 700-CX are listed in the following table. Pin connections to the Jones type power connector are listed as an aid in connecting other brands or home-brew supplies.

JONES PLUG CONNECTIONS

	Pin	Nominal	Minimum	Maximum
High Voltage	8	800 VDC 800 MA	600 VDC Low Pwr.	1200 VDC Hi. Power
Medium Voltage	10	275 VDC 150 MA	225 VDC	325 VDC
Bias Voltage	3	-110 VDC 100 MA	-100 VDC	-130 VDC
Filament Voltage	4	12.6 V* 6.7 Amp	11.5 V	14.5 V
Relay Voltage	5	12 VDC 250 MA	10 VDC	14.5 VDC
* AC or DC				

ANTENNA

1. **Fixed Station.** Any of the common antenna systems designed for use on the high frequency amateur bands may be used with the Swan transceiver, provided the input impedance of the transmission line is not outside the capability of the pi-output matching network. The transmission line should be of the coaxial cable type. An antenna system which shows a standing wave ratio of less than 4:1 when using 50 or 75 ohm coaxial transmission line, or a system that results in a transmission line input impedance that is essentially resistive, and between 15 and 500 ohms will take power from the transceiver with little difficulty. If open-wire or balanced type transmission line is used with the antenna, a suitable antenna tuner is recommended between the transceiver and the feed line. Methods of construction and operating such tuners are described in detail in the ARRL Antenna Handbook, and similar publications. For operation on the 75 and 40 meter bands, a simple dipole antenna, cut to resonance in the most used portion of the band, will perform satisfactorily. For operation on the 10, 15, and 20 meter bands, the efficiency of the station will be greatly increased if a good directional rotary antenna is used. Remember that even the most powerful transmitter is useless without a proper and efficient antenna system.

2. **Mobile Station.** Mobile antenna installations are critical, since any mobile antenna for use on the high frequency bands represents a number of comprises. Many amateurs lose the efficiency of their antenna through improper tuning. Points to remember about the mobile antenna used with the Swan 700-CX are:

a. The "Q" of the antenna loading coil should be as high as possible. There are several commercial models available which use high "Q" coils, including the Swan Model 45 and Model 55 five band "Swantennas."

b. The loading coil must be capable of handling the power of the Model 700-CX without overheating. In TUNE position, the power output of the transceiver may exceed 250 watts. Wide spaced, heavy wire loading coils are essential.

c. The SWR bridge is a useful instrument, but unfortunately it is quite often misunderstood, and overrated in importance. Basically, the SWR bridge will indicate how closely the antenna load impedance matches the transmission line. With long transmission lines, such as will be used in many fixed station installations, it is desirable to keep the impedance match fairly close in order to limit power loss. This is particularly true at the higher frequencies. The longer the line, and the higher the frequency, the more important SWR becomes. However, in mobile installations the transmission line seldom exceeds 20 feet in length, and an SWR of even 4 to 1 adds very little to power loss. The only time SWR will indicate a low figure is when the antenna presents a load close to 50 ohms, but many mobile antennas will have a base impedance as low as 15 or 20 ohms at their resonant frequency. In such a case, SWR will indicate 3 or 4 to 1, and yet the system will be radiating efficiently.

d. The really important factor in your mobile antenna is that it should be carefully tuned to resonance at the desired frequency. The fallacy in using an SWR bridge lies in the fact that it is sometimes possible to reduce the SWR reading by detuning the antenna. Field strength may actually be reduced in an effort to bring SWR down. Since field strength is the primary goal, we recommend a Field Strength Meter for antenna tuning.

ANTENNA (cont.)

e. For antenna adjustments, the Swan 700-CX should be loaded lightly to about 100 ma. cathode current instead of the usual 500-800 ma. This will limit tube dissipation during adjustments, and will also help reduce interference on the frequency. In any case, do not leave the transmitter on for very long at one time. Turn it on just long enough to tune and load, and get a field strength reading.

Start out with the antenna whip at about the center of its adjustment range. Set the VFO to the desired operating frequency and then adjust P.A. TUNE for dip, and P.A. LOAD for 100 ma. Then observe the field strength reading. The Field Strength Meter may be set on top of the dash, on the hood, or at an elevated location some distance from the car.

Change the whip length a half inch, or so, at a time, retune the P.A. for 100 ma. loading each time, and check field strength. Continue this procedure until the point of maximum field strength is found. This adjustment will be most critical on 75 meters, somewhat less critical on 40, etc., until on 10 meters the adjustment will be quite broad. After tuning the antenna to resonance, load the P.A. to full power.

MICROPHONE

The microphone input is designed for high impedance microphones only. The choice of microphone is important for good speech quality, and should be given serious consideration. The crystal lattice filter in the transceiver provides all the restriction necessary on audio response, and further restriction in the microphone is not required. It is more important to have a microphone with a smooth, flat response throughout the speech range. The microphone plug must be a standard ¼ in. diameter three-contact type. The tip connection is for push-to-talk relay control, the ring connector is the microphone terminal, and the sleeve is the common chassis ground. The microphone manufacturer's instructions should be followed in connecting the microphone cable to the plug. With many microphones, the push-to-talk button must be pressed to make the microphone operative. For VOX operation, this feature may be disabled, if desired, by opening the microphone case and permanently connecting the contacts which control the microphone.

EXTERNAL SPEAKER CONNECTIONS

Receiver audio output from the 700-CX is at 4 ohms voice coil impedance. This output is terminated at pin 12 of the Jones Power connector. When using the 117-XC matching power supply, connection is automatically made to the speaker which is built into the supply.

For mobile installations, an external speaker may be connected to pin 12 of the Jones connector. The other speaker terminal goes to pin 6, or chassis ground. The speaker may be any good 4 ohm permanent magnet type in the 4 inch or larger size.

INTERNAL SPEAKER

Provision is made for installation of a standard 3 X 5 inch speaker inside the 700-CX. This may be desirable particularly in mobile installations. The speaker mounts on the left side of the chassis – terminal lugs are provided near the 6GK6 audio output tube. Simply connect wires from the 2 speaker lugs to these terminals. One is "hot," and the other is ground.

AUXILIARY SWITCHING

A 3 lug terminal strip on back of the 700-CX provides for switching of external accessories. They are marked R, C, and T. R and C are connected when receiving. C and T are connected when transmitting. In particular, terminals C and T are used when the Swan Mark II Linear Amplifier is used.

V6 OUTPUT

A phono type output jack is provided on back of the 700-CX for connecting the antenna system to an auxiliary receiver. Thus, a separate receiver may be used, if desired, with the same antenna system. V6 is the 6BZ6 R.F. amplifier stage in the 700-CX receiver circuit, and it serves as a pre-amplifier for the auxiliary receiver.

CONTROL FUNCTIONS

On-Off Switch (On AF Gain Knob)
Turns power supply on and off.

Cal-Rec-Trans-CW-Tune

Calibrate
All voltages are applied to transceiver. Grounds emitters of Q4, Q5, Q6, and Q7. Removes ground from cathode of V14A.

Receive
All Voltages are applied to transceiver.

Transmit
12 volt DC circuit through relay K1 and K2 is completed, and tubes used only in receive are biased to cutoff. Meter reads P.A. cathode current.

CW
All circuits for transmit are energized, as above. Capacitor C1501 in the carrier oscillator is removed from ground. Carrier must be inserted with CAR. BAL. control. Meter reads P.A. cathode current.

Tune
Same as CW except that carrier is fully inserted. Meter reads relative output.

CONTROL FUNCTIONS (cont.)

Mic. Gain
Controls potentiometer R1402 in the grid of V14A. Controls amount of audio to the balanced modulator.

Car. Balance
Controls potentiometer R1307 in the balanced modulator deflection plate circuit, and permits nulling out the carrier.

RF Gain
Controls variable resistor R1809. Controls gain of receiver mixer, RF Amplifier, and IF Amplifiers.

AF Gain
Controls potentiometer R1201 in grid circuit of V12 AF Output. Controls audio volume.

Main Tuning
Controls C1708 in frequency determining tank circuit of VFO.

Panel Meter
Reads S-Units in Receive mode, P.A. cathode Ma. in trans. and CW, mode, and relative output in TUNE Mode.

Main Bandswitch
Switches plate coils, and associated capacitors of VFO, VFO Amplifier, V1, Transmitter Mixer, V2, and Driver, V3. Also switches tank coil of pi-coupling system and associated capacitors in PA output tank.

Output Level
Adjusts meter reading when in TUNE mode. Note that this control has no effect on power output, but determines only the relative meter reading.

Sideband Selector
Selects Normal Opposite sideband. Normal is LSB on 80 and 40 meters, USB on 20, 15 and 10 meters.

PA Bias (Rear Control)
Adjust idling cathode current of Power AMP.

S-Meter Zero (Rear Control)
Adjusts S-Meter to Zero Reading with antenna disconnector.

PTT-VOX
Switch PTT position for press-to-talk operation VOX position for voice control with VX-2 accessory.

ANL
Automatic noise limiter on in right hand position.

CAL. 100KC-25KC
Selects 100KC or 25KC calibration markers.

PA Grid
Controls C1812A and C1812B in plate tanks of transmitter mixer and driver.

PA Plate
Controls C411 on pi-network to tune final power amplifier plate to resonance.

PA Load, Fine
Controls C412 in pi-network to match impedance of output load. Tunes input to Receiver RF Amplifier.

PA Load, Coarse
Switches in progressively more capacitance in parallel with PA LOAD, Fine.

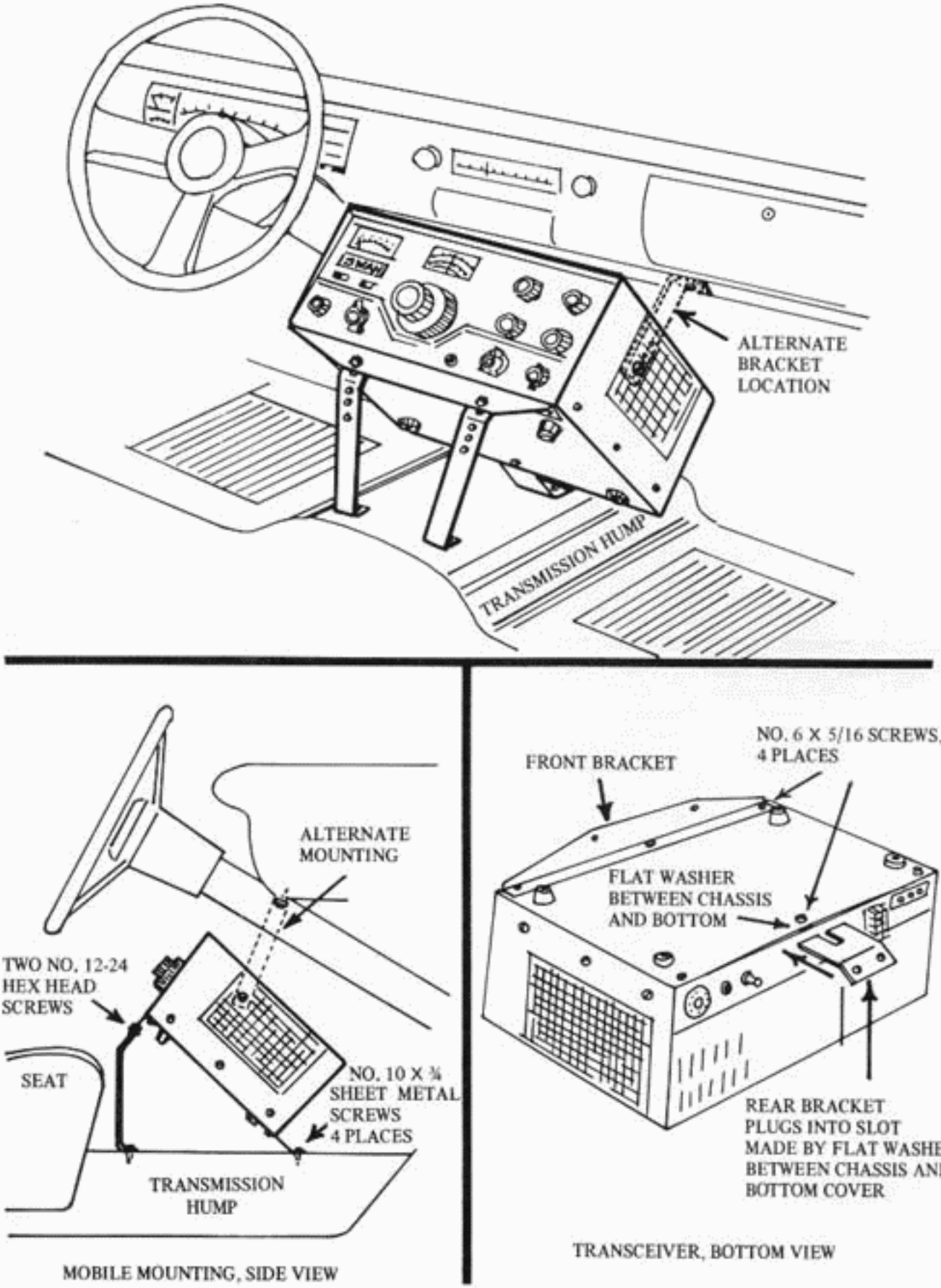


FIGURE 3. MOBILE MOUNTING ON TRANSMISSION HUMP UNDER DASH

OPERATION

Before connecting any cables to the Swan 700 CX perform the following steps:

1. Locate the P.A. compartment and remove the packing material from the P.A. tubes.

2. Rotate the CAL-REC-TRANS-CW-TUNE switch on the lower left of the front panel counterclockwise to REC.

3. Rotate the AF GAIN control counterclockwise to OFF.

4. Connect wire from earth ground to ground stud provided on rear of chassis.

5. Connect a 50 to 75 ohm antenna feed-line to the coaxial connector on the rear chassis panel.

6. Connect the power supply cable to the Jones connector on the rear chassis.

7. Connect the power supply to the proper voltage source.

WARNING

Dangerous high voltage is present on the plate of the power amplifier whenever the power supply is energized. Never turn power on when the power amplifier cover is removed. High voltage is also present at Pin eight of the power plug.

RECEIVER

In RECEIVE position, or at any time when the transmitter is not in TRANSMIT, all circuits used in transmitting are diabled through the relay controlled circuits, K1, K2. The relays are energized for transmitting and de-energized for receiving. Relay K2, when de-energized, allows signals from the transmitting tank circuit and antenna to be fed to the receiver RF Amplifier, V6, where they are amplified and then fed to the control grid of the Receiver Mixer, V7. The local oscillator signal from the VFO Amplifier is now used to heterodyne the received signal to the IF frequency. All IF amplification is accomplished at this frequency, nominally 5500.0 kc, through V8 and V9 IF amplifiers. In the Product Detector V10A, the IF signal is heterodyned with the carrier frequency generated by Carrier Oscillator, Q3. The resultant audio signal is then put through a noise clipper network which is in our out of circuit by selection of ANL swtich. The signal is then amplified by V10B, which then couples to V11, the AGC Amplifier, and V12, the output audio stage.

RECEIVER OPERATION

1. Rotate the AF GAIN control clockwise to about the 3 o'clock position. The power switch will operate applying filament, relay, bias, medium, and 800 volt high voltage to the transceiver.

2. Wait approximately one minute to allow the tube filaments to reach operating temperature. During this period, perform the following steps:

   a. Rotate the BANDSWITCH to desired band.

   b. Rotate MIC. GAIN fully counterclockwise.

   c. Rotate CAR. BAL. control to the mid-scale position, with white dot on knob aligned with the long index mark on the panel.

   d. Preset PA PLATE control to mid-position.

   e. Preset PA GRID control to mid-position.

   f. Preset PA LOAD FINE to mid-position.

   g. Preset PA LOAD COARSE to position 1.

   h. Set tuning dial to desired frequency.

   i. Set RF GAIN control to approximately 3 o'clock position.

3. Carefully adjust the PA GRID and the PA PLATE controls for maximum receiver noise. NOTE: The PA GRID control resonates the transmitter driver stages and the receiver RF amplifier plate circuit. The PA PLATE and PA LOAD controls adjust the input and output capacitors in the transmitter power amplifier final plate circuit, as well as the receiver RF amplifier grid circuit. Proper adjustment of these controls in the receiver position will result in approximately resonant conditions in the transmitter stages.

RECEIVER TUNING

The tuning dial of the 700-CX has a green tinted scale reading from zero to 450 which is used on 40, 20 and 15 meters. Above the green scale is a separate calibration for 80 meters, reading from 3500 to 4000KC. Below the green scale is the 10 meter scale, reading from 28 to 29.7 MC.

Precise tuning of a single sideband signal is very important. Do not be satisfied to merely tune until the voice can be undersood, but take the extra care of setting the dial to the exact spot where the voice sounds natural. Above all, avoid the habit of tuning so that the voice is pitched higher than normal. This is an unfortunate habit practiced by quite a number of operators. The following points help to explain the effects of mistuning:

1. If you tune so the received voice is higher than normal pitch, you will then transmit off frequency, and your voice will sound lower than normal pitch to the other station. He will

RECEIVER TUNING (cont.)

probably retune his dial to make you sound right. If you keep this up, you will gradually waltz one another across the band. If both of you are mistuning to an unnatural higher pitch, you will waltz across the band twice as fast. (And someone will no doubt be accused of frequency drift.)

2. Mistuning results in serious harmonic distortion on the voice, and should be quite noticeable to the average ear. Some will claim that if they don't know how the other person's voice actually sounds, they can't tune him in properly, but this is not true. With a little practice, it is fairly easy to tell. Some voices are relatively rich in harmonics, and are easier to tune in than a person with a "flat" voice. Also, a transmitter which is being operated properly with low distortion will be easier to tune in than one which is being overdriven and is generating excessive distortion. There is no mistaking when you have a station tuned right on the nose. It will sound just like "AM," so to speak. Mainly, avoid the habit of tuning so everyone sounds higher than normal pitch, or like Donald Duck. This is incorrect, unnecessary, and sounds terrible.

3. A vernier control for receive frequency, sometimes referred to as "incremental tuning," is not available on the Swan 700-CX. Such a device is not necessary if proper tuning habits are exercised.

4. Your Swan 700-CX will automatically transmit on exactly the same frequency as the one to which you are listening. There is no adjustment for making them the same, since by using the same oscillator for both send and receive, it happens automatically. If separation of receive and transmit frequency control is desired, the Model 508 VFO unit may be used.

TRANSMITTER

Power Rating

The SWAN 700-CX is capable of 400 watts, PEP input under steady state two-tone test conditions, when operated with any of the recommended power supplies. The peak envelope power, when voice modulated, is considerably greater, typically 700 watts, or more.

Recommended power supplies produce a no-load plate voltage of approximately 925 volts. Under TUNE conditions, or CW operation, this voltage will drop to approximately 700 volts. Under steady state two-tone modulation, the voltage will drop to approximately 750 volts. If the power amplifier idling current is 50 ma, and the two-tone current, just before flat-topping, is 400 ma, the peak two-tone current will be 600 ma. Under these conditions the PEP input will be 750 volts times 600 ma = 450 watts. Under voice modulation, because average power is considerably less, the power amplifier plate and screen voltages will be maintained higher, even during voice peaks, by the power supply filter capacitors. Peak plate current will therefore also be higher than with two-tone test conditions. Under typical operating conditions, peak plate current before flat-topping may on some bands be as high as 1 amp at over 800 volts, to result in an input of over 800 watts, PEP. Readings of cathode current will not reflect this over 800 watt power input, however, because of the damping in the cathode current meter. Cathode current readings under normal voice input should not exceed approximately 225 ma on occasional peaks.

POWER AMPLIFIER PLATE DISSIPATION

There is often a misunderstanding about the plate dissipation of tubes operated as AB1 amplifiers under voice modulation. In the Swan 700-CX, while in the transmit position, and with no modulation, the plate voltage will be 890 volts, the plate current 50 ma, and the power input will be at 45 watts.

Average voice power is from 10 to 20 db below peak voice power. Normally some peak clipping in the power amplifier can be tolerated, and a peak-to-average ratio of only 6 db may sometimes occur. Under such conditions, the average power input will be 125 watts, and average plate current will be 156 ma. With power amplifier efficiency of 65 percent, plate dissipation will be 44 watts, or 22 watts per tube. The 8950 is rated at 40 watts, continuous duty cycle. Thus it can be seen that under normal operating conditions, the power amplifier tubes in the Swan 700-CX are not being driven very hard. Note, however, that proper modulation level must be maintained by correct setting of Mic. Gain, and that the length of time in TUNE position should be limited to not more than 30 sec. at a time.

TRANSMITTER TUNNING

Special Notes: Read carefully. Be sure that you understand and remember these notes when turning the transmitter.

1. The most important detail to keep in mind when tuning the transmitter portion of your Swan transceiver is that the P.A. PLATE *must be resonated as quickly* as possible! The P.A. tubes are dissipating all the power input when they are not in resonance, and can be per-

manently damaged in just a few seconds. Once resonance has been established, the P.A. tubes can operate at full power input for a considerable length of time, although we recommend 30 seconds as a safe maximum. But, it is most important to realize that the 30 second limit assumes that the P.A. PLATE has been *immediately* resonated. This rule applies generally to all transmitters.

2. P.A. PLATE resonance may be accomplished by (1) tuning for the "dip" in P.A. cathode current, or (2) tuning for maximum transmitter output, depending on which circuit is being metered.

3. In the 700 CX you are reading P.A. cathode current when in Press-To-Talk, TRANS., or CW mode, so P.A. PLATE must always be tuned for the "dip" in meter reading when in any of these modes.

4. When the 700 CX Function Switch is in "TUNE" mode, the meter circuit is automatically switched to indicate transmitter output level, so P.A. PLATE must always be tuned for maximum meter reading when in "TUNE" mode.

—Read items (3) and (4) over carefully to be sure you understand.

5. The OUTPUT LEVEL control located on the right hand side of the panel meter adjusts the meter reading to a convenient level when in "TUNE" mode. It is important to realize that this control has no effect whatsoever on transmitter power. It is required because of wide variations in meter readings caused by various antenna loads, and different frequency bands.

When in "TUNE" mode, the meter reading is strictly a relative indication of power output.

6. When first tuning the 700 CX, you may find the 30 second time limit too short. In that event, switch back to REC mode for a minute or so, and then resume tuning procedures. With experience, transmitter tuning will require only 10 to 15 seconds. Do not tune more often than necessary. You should not have to retune except when changing bands or antennas. The P.A. tubes will last for many months or even years of normal operating, but constant tuning at full grid drive will shorten their life considerably.

7. **Caution:** The 700 CX may be tuned to frequencies outside the amateur bands. Do not tune or operate the transmitter unless you are within your permitted band limits.

TUNING STEPS:

1. The Sideband Selector must be in "NORM" position during transmitter tuning procedures. Bandswitch and tuning dial set to desired frequency, MIC. GAIN at minimum, CAR. BAL. straight up, 12 o'clock.

2. Move the Function Switch to TRANS. mode, and quickly rotate the CAR. BAL. control for minimum meter reading. If the control has no effect at this time, do not be concerned. The P.A. (Power Amplifier) stage is now "resting" or "idling", and there is no grid drive being applied. The meter is reading "idling" current, which should be about 50 ma. as read on the 800 ma. scale. The permissible idling range is between 40 and 60 ma. If the P.A. is idling above or below this range, adjust the P.A. Bias control on back of the chassis.

3. If this is the first time you are tuning the transmitter, set the COARSE LOAD control to position 4. (After experience in tuning, this control may be set to whatever position has been found optimum on each respective band.)

—Note: Up to now, the transmitter has been merely "idling," and there has been no particular time limit involved. The following step begins applying grid drive, and requires caution and observation of the recommended 30 second time limit.

4. With the Function Switch still in TRANS. mode:

a. Set the CAR. BAL. control to either 9 o'clock or 3 o'clock.

b. Rotate the P.A. GRID control for maximum meter reading.

c. *Immediately* rotate the P.A. PLATE control for minimum meter reading, or "dip." This is the critical adjustment known as "resonating" the plate circuit, and *must be performed quickly* to preserve P.A. tube life!

d. Re-adjust CAR. BAL. for minimum meter reading.

5. Switch to TUNE position and quickly adjust P.A. PLATE and P.A. LOAD controls for maximum meter reading.

a. If the meter goes off scale, use the OUTPUT LEVEL control to bring it back to about midscale.

b. Advance the COARSE LOAD control clockwise a step at a time, readjusting P.A. PLATE each time, until the position for maximum output is found. Use the FINE LOAD control for vernier load adjustment.

Each time a change in either load control is made, the P.A. PLATE must be re-tuned.

c. Switch back to REC. position.

d. Once the proper settings have been found, make notes on a card so they can be quickly re-set each time you change bands.

6. **Voice Transmission.** After tuning up as outlined above, switch to TRANS. position and then carefully set the CAR. BAL. control for minimum meter reading. Carrier balance will usually occur with the CAR. BAL. somewhere around mid-range, but the setting is not important or significant, as long as a null can be observed. While speaking into the mike, slowly rotate the MIC. GAIN control until occasional peak readings of 200 to 225 ma. are obtained. With most microphones, the MIC. GAIN control will be set between 9 and 12 o'clock, but it may vary considerably. The amplified ALC circuit will help limit cathode current to about 225 ma., but turning the MIC. GAIN up too high will still produce flat topping and spurious signals, so it is important to hold it down. The meter is quite heavily damped, and its reading with average voice modulation may not look very impressive, but the voice peaks are going well over the 700 watt power rating of your Swan transceiver. NOTE: Transceiver will not modulate with Function Switch in CAL. position.

7. **AM Operation** (Single-Sideband With Carrier)

a. Tune transmitter to full output on single sideband as described above.

b. Rotate MIC GAIN control to minimum, full CCW.

c. With Push-to-Talk pressed, rotate CAR. BAL. control until cathode current is approximately 150 ma.

d. While talking in a normal tone of voice into the microphone, increase MIC. GAIN setting until the meter kicks upward slightly. This setting will result in excellent AM transmission.

8. **CW Operation**

a. Insert a CW Key in the Key Jack on back of the 700-CX Transceiver.

b. After tuning up for maximum output as outlined in Step 5, switch to CW mode, press the key, and insert carrier by rotating the CAR. BAL. control until the meter indicates a P.A. Cathode Current of 500 ma. Power input will then be the rated 400 watts. It may be reduced to whatever level is required to maintain contact. Full power level is not always necessary. NOTE: PTT-VOX switch must be in PTT position.

c. In Manual CW operation it will be necessary to switch the Function control back to REC. for receiving and then to CW for transmitting.

d. **Semi-break-in CW**

When the VOX accessory, model VX-2 is used, Break-In operation may be employed. Move the PTT-VOX switch to VOX position, and rotate the Function control to CW mode. Rotate the VOX GAIN full clockwise and the ANTI-TRIP control on the VX-2 to full counterclockwise position. Press the CW key to transmit. When you stop keying the circuits will automatically switch back to receive mode. Adjust the VX-2 DELAY control to the position which gives the desired delay time in returning to Receive.

e. **Off-set CW Transmit Frequency:**

While receiving, the carrier oscillator frequency is located 300 cycles outside the passband of the crystal lattice filter, thus providing a single heterodyne note, or "single-signal" for CW reception. When transmitting in CW mode, the carrier frequency is moved approximately 800 cycles higher, placing it well inside the passband. This frequency shift is termed "Off-set CW transmit frequency," and avoids the problems encountered when the receive and transmit frequency are exactly the same. When receiving CW, the receiver must be tuned off frequency several hundred cycles in order to hear an audio beat. By providing this shift automatically in the 700-CX, CW operation is greatly amplified.

Sidetone Oscillator

A sidetone oscillator circuit is included in the 700-CX, and permits CW monitoring. An 800 cycle tone will be heard coming from the speaker or headphones. The strength, or volume of the tone may be changed if desired by changing the resistance value of R1202 in the sidetone circuit. Note that the A.F. GAIN control will have some effect on the sidetone.

9. After tuning for maximum output, it will be useful to know how much cathode current the P.A. is drawing at full power input. This will help indicate condition of the P.A. tubes, as well as the driver stage and other tubes in the transmitter circuitry.

a. This may be done by switching to CW mode, and inserting full carrier with the CAR. BAL. control. The key jack circuit must be closed by a CW key for this test.

b. Alternately, you can check P.A. cathode current by whistling a steady tone into the microphone. It will be found that cathode current is typically 700 ma. or more on the lower bands, but will be somewhat lower on 10 and 15 meters, typically between 450-500 ma. Several factors can affect cathode current, including AC input voltage, (or DC voltage in mobile use) tube condition, and circuit alignment. The reading should be used primarily as an indication of gradual change, or deterioration.

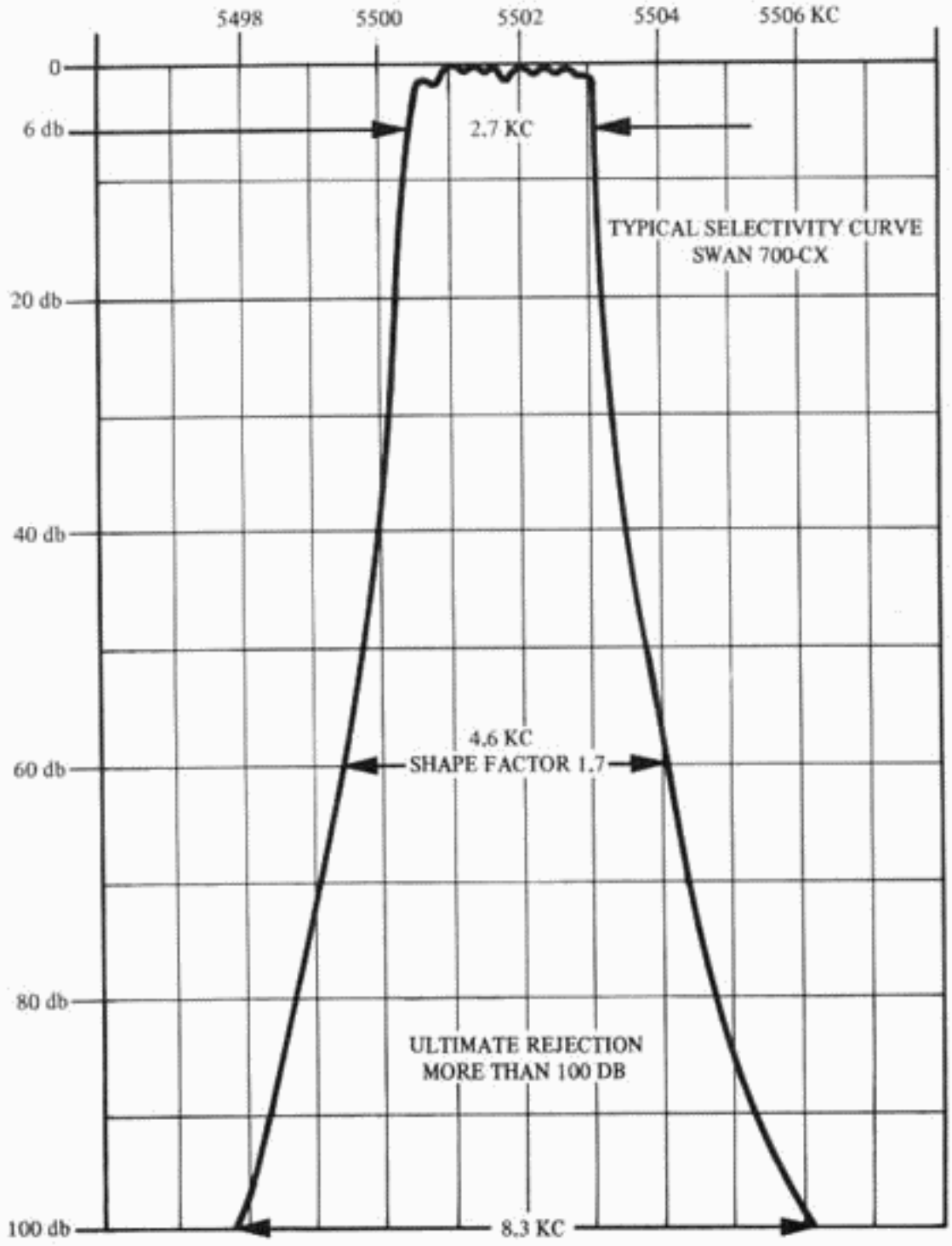


FIGURE 4. CRYSTAL FILTER TYPICAL CHARACTERISTIC

ALIGNMENT AND TROUBLESHOOTING

The following procedures are given in the order performed during the factory alignment for the transceiver. For home servicing, only partial alignment may be necessary. Read all procedures carefully before commencing either partial or complete alignment. See figures and for component placement. The following equipment will be required for complete alignment:

1. Audio Signal Generator
2. 500 watt dummy load with output meter
3. Vacuum tube voltmeter
4. Field Strength meter

RECEIVER ALIGNMENT

Receiver alignment involves only the adjustment of the Second IF coil and the 10 meter receiver coil. The 15, 20, 40 and 80 meter coils which affect receiver performance are also used in transmit mode. Their adjustment is covered under "Transmitter Alignment."

1. After allowing one minute for warm-up tune the receiver to the middle of either 15, 20, 40 or 80 meters and at a clear frequency.
2. Adjust the P.A. PLATE, P.A. GRID and P.A. LOAD front panel controls for maximum background noise.
3. Adjust IF coil L901 for maximum background noise.
4. Switch to the center of 10 meters and adjust L105 for maximum background noise.

TRANSMITTER ALIGNMENT

The alignment of transmitter circuits involves the adjustment of tuned circuits in the VFO amplifier, V1, the Transmit Mixer, V2 and Driver stage, V3. A dummy load should be connected to the antenna jack during this series of adjustements.

VFO Amplifier Plate Circuit

With VTVM from pin 1 of V7, Receiver Mixer, to ground, on -15 volt scale, adjust VFO Amplifier Plate coils for peak VTVM reading as follows:

Band	VFO Frequency (kc)	Dial Frequency (kc)	Coil
80	9,300	3,800	L104
40	12,625	7,125	L103
15	15,725	21,225	L102
10	23,000	28,500	L101

Transmitter Mixer and Driver Plate Circuit

1. Adjust P.A. BIAS control fully counterclockwise (maximum bias).
2. Loosely couple field strength meter to C308 (off pin 2 of V4) with alligator clip on ceramic capacitor body.
3. Remove screen voltage from V4 and V5 by disconnecting the wire from terminal strip immediately adjacent to V5 base. (Point A, Fig. 5.)
4. Connect VTVM across R401, 1K resistor between pins 1 and 2 of terminal strip, using 25 volt scale. (Points B and C, Fig. 5.)

PROCEDURE

Adjust bandswitch and P.A. Grid as shown below, and adjust coils for peak VTVM reading, with function switch in TUNE position:

Band	P.A. Grid	Dial Freq.	Adjust	
80	12 O'clock	3,800	L206	L305
40	11 O'clock	7,150	L204	L304
20	11 O'clock	14,150	L205	L303
15	2 O'clock	21,450	L202	L302
10	2 O'clock	29.0	L203	L301

Note: If VTVM and field strength meter exceed full scale reading, switch to REC position, actuate push-to-talk circuit, and insert carrier with carrier balance control to keep reading on scale. Field strength meter and VTVM must both peak at same time since it is possible to tune the coils to the VFO frequency on 10 meters. Care must be taken that the coils be tuned properly. Following the above procedures, replace screen wire to pin 1 of terminal strip adjacent to V5.

Carrier Frequency Adjustment

1. Tune up on the 20 meter band into a dummy load. Balance out the carrier and adjust the P.A. Bias for 50 ma.
2. Feed 1500 cycles of audio from the Audio Generator into the MIC input receptacle. Adjust the gain of the audio generator and the MIC GAIN control until the wattmeter reads about 10 or 15 watts.
3. Adjust both slugs of the Balanced Modulator transformer (T1301) for maximum output.
4. Adjust the First IF coil (L801) for maximum output.
5. Increase the gain of the audio generator until the wattmeter reads 40 watts. Sweep the audio generator down to 300 cycles. Adjust the Normal Sideband Carrier Oscillator trimmer (C1502) for a reading of 10 watts.
6. Switch to Opposite Sideband and adjust carrier oscillator trimmer (C1503) for 10 watts.

PROCEDURE (cont.)

7. Re-check with audio generator set at 1500 cycles and 40 watts. Sweep down to 300 cycles and re-adjust Carrier Oscillator Trimmer capacitors, if necessary, for 10 watts input.

P.A. NEUTRALIZATION

With P.A. COARSE LOAD in position 1, set freq. to 14,150, P.A. PLATE CONTROL at 9 o'clock, insert carrier and peak P.A. GRID control, adjusting CAR. BAL. control for 200 ma. Turn P.A. CONTROL slowly through resonance. Cathode current should dip smoothly and rise to 200 ma on the low capacity side of resonance. If, instead, there is a peak above 200 ma either side of the dip, stop rotation of the P.A. plate control at the peak and adjust C406 to reduce Ip to 200 ma. Repeat above check and re-adjust as necessary to obtain the desired smooth dip. For 10 meters, use above procedure but adjust No. C312.

NOTE: If replacement of the power amplifier tubes is necessary, it is recommended that a matched pair of 8950 be used for neutralizing purposes. A matched pair of tubes will also give longer tube life.

VFO ALIGNMENT

A trimmer condenser is provided for each VFO range. Trimmer adjustment for the five VFO ranges is through top cover of the VFO compartment. An insulated adjusting tool is recommended. Dial tracking has been factory set by pruning the coil, and will not ordinarily require further adjustment.

When dial calibration changes beyond the adjusting range of the front panel dial set control, calibration may be restored by carefully adjusting the trimmer for that range.

EXAMPLE:

The 40 meter band at 4000 KC point is off frequency approximately 8 KC on the high side and cannot be restored by adjusting dial set on front panel.

1. Set dial set to twelve o'clock position.

2. Set VFO at 7008 KC so as to hear 100 KC Calibrator.

3. With an insulated alignment tool in one hand and the VFO dial in the other, rotate the dial a small amount at a time down towards the 7000 KC point, but not enough to lose the 100 KC signal. Now rotate the trimmer so as to zero beat the 100 KC signal. Again rotate the dial a small amount down the band so you still hear the calibrator, stop and with trimmer rezero beat the signal again. Repeat these steps until you have reached 7000 KC point on the dial. Use caution so you do not lose the 100 KC signal. This will prevent you from aligning on the wrong 100 KC note which would put the VFO off frequency by a 100 KC. The following chart lists the actual oscillating frequency of the VFO at band edges.

FREQUENCY CALIBRATION

Frequency calibration of the Model 700-CX is in 5 kc increments on 80-, 40-, 20-, and 15-meters, and 20 kc increments on 10 meters. 80 meters is calibrated directly on the upper dial scale. 40-, 20-, and 15-meters are calibrated from zero to 450 on the green tinted center scale. "EXAMPLE": The dial is set at 200 on the green scale. (On 40 meters this would read 7.2 mc; on 20 meters this would read 14.2 mc, and on 15 meters this would read 21.2 mc). 10 meters is calibrated directly on the lower dial scale. Dial accuracy and tracking are quite good on the 700CX, but caution must always be observed when operating near band edges. Measuring the frequency with the calibrator when working near band edges is recommended.

DIAL SET

A dial-set control has been provided so that dial adjustment can be made at any 100 or 25 KC point of the dial. With calibrator on, set the dial to any 100 or 25 KC point closest to the frequency you wish to work. Now adjust dial-set control to zero-beat the VFO with the calibrator. This provides greater accuracy of dial readout.

CAUTION: Care must be exercised when tuning for the 100 or 25 KC harmonics of the calibrator. Spurious image signals may be heard, although they will be somewhat weaker than the actual harmonics.

VFO Frequency Chart

Dial Frequency (kc)	Oscillator Frequency (kc)
3,500	9,000
3,800	9,300
4,000	9,500
7,000	12,500
7,200	12,700
7,300	12,800
14,000	8,500
14,200	8,700
14,350	8,850
21,000	15,500
21,250	15,750
21,450	15,950
28,000	22,500
28,500	23,000
29,000	23,500
29,700	24,200

CRYSTAL CALIBRATOR FREQUENCY ADJUSTMENT

Adjustment of the Crystal Calibrator must be made with an outside source, such as an external receiver that will tune to WWV. Remove transceiver cabinet and bottom. Locate the R.F. Amplifier tube socket, V6. Wrap one end of an insulated wire lead loosely around Pin 1. Connect the other end to the antenna terminal of the external receiver. Tune external receiver to zero beat WWV. Now turn on calibrator in 700CX (either 100 or 25 kc position) and by listening to it on the external receiver, adjust trimmer capacitor C1603 (located on top of chassis next to 100 kc crystal) to zero beat with WWV.

25 KC MULTIVIBRATOR ADJUSTMENT

The calibrator circuit board, located underneath the chassis has a trimmer type potentiometer which is used to adjust the multivibrator circuit so it divides the 100 kc calibrator output by a factor of 4, thus providing calibration markers every 25 kc. If markers are received every 20 kc, or every 33-1/3 kc, adjustment is required. Use a small screwdriver, and carefully turn the control to the location where calibration markers are properly received. An oscilloscope may also be used as an aid, if available.

S-METER ADJUSTMENT

With antenna disconnected and with RF Gain fully clockwise, set R906, located on rear panel, for zero meter reading. Make sure no local signals are being received.

CARRIER BALANCE

A carrier balance control is provided on the front panel, and is labeled CAR. BAL. This control permits insertion of carrier during CW operation for power control, as well as carrier insertion for AM operation, and as an aid in tuning the transmitter circuits. In addition to the carrier control, there is another located under the chassis near the balanced modulator tube socket, V 13, the 6JH8. This control is called a "Quadrature control," and is of the screwdriver adjust, trimmer type. It will seldom require adjustment, but is recommended particularly when if the 6JH8 tube is replaced. A dummy load must be connected to the transceiver. Connect a sensitive VTVM across the dummy load, or across the coax. line. First tune for maximum output in normal manner. Then switch to TRANS. mode, and balance carrier with CAR. BAL. panel control. Finally, adjust trimmer, the Quadrature control, for carrier null.

L601 TRAP ADJUSTMENT

Set bandswitch to 14 mc range. Feed strong 11.9 mc signal from signal generator into antenna jack. Tune around 14,225 until signal is found. Adjust L601 for minimum.

PARTS LIST

CAPACITORS

C101	.002, 20% 500V Disc
C102	.01, 80-20% 500V Disc
C103	.002, 20% 500V Disc
C104	10, 5% 500V Mica
C105	30, 5% 500V Mica
C106	.01, 80-20% 500V Disc
C107	.01, 80-20% 500V Disc
C201	.1 mf, 200V Tubular
C202	.01, 80-20% 500V Disc
C203	.002, 20% 500V Disc
C204	82, 5% 500V Mica
C205	100, 5% 500V Mica
C206	24, 5% 500V Mica
C207	1000, 5% 500V Mica
C208	20, 5% 500V Mica
C209	20, 5% 500V Mica
C210	50, 5% 500V Mica
C211	3.3 pf, 10% 500V Ceramic
C301	.01, 80-20% 500V Disc
C302	50, 5% 500V Mica
C303	100, 5% 500V Mica
C304	100, 5% 500V Mica
C305	24, 5% 500V Mica
C306	50, 5% 500V Mica
C307	.002, 20% 500V Disc
C308	.002, 20% 500V Disc
C309	.01, 80-20% 500V Disc
C310	220, 5% 500V Mica
C311	15, 20% 3KV Disc
C312	1.5-20 pf Mica Trimmer
C313	270, 5% 500V Mica
C314	3.3 pf, 3KV Disc
C315	510, 5% 500V Mica
C316	100, 5% 500V Mica
C317	390, 5% 500V Mica
C319	470, 5% 500V Mica
C320	330, 5% 500V Mica
C401	.002, 20% 500V Disc
C402	.01, 80-20% 500V Disc
C403	.01, 80-20% 500V Disc
C404	.01, 80-20% 500V Disc
C405	.01, 80-20% 500V Disc
C406	20 pf PA Neut. Trimmer
C407	270, 5% 2500V Mica
C408	270, 5% 2500V Mica
C409	.002, 20% 2KV Disc
C410	100, 10% 6KV Disc
C411	360 pf PA Plate
C412	410 pf PA Fine Load
C413	150, 10% 1500V Mica
C414	150, 10% 1500V Mica
C415	330, 10% 1000V Mica
C416	330, 10% 1000V Mica
C417	330, 10% 1000V Mica
C418	330, 10% 1000V Mica
C419	.002, 20% 500V Disc
C420	.01, 80-20% 500V Disc
C601	120, 5% 500V Mica
C602	5, 5% 500V Disc
C603	.01, 80-20% 500V Disc
C604	.01, 80-20% 500V Disc
C701	.001, 20% 500V Disc
C702	30, 10% 500V Disc
C703	.01, 80-20% 500V Disc
C704	430, 5% 500V Mica
C705	220, 5% 500V Mica
C801	68, 5% 500V Disc
C802	.01, 80-20% 500V Disc
C803	.01, 80-20% 500V Disc
C804	10 pf
C901	.01, 80-20% 500V Disc
C902	.01, 80-20% 500V Disc
C903	.01, 80-20% 500V Disc
C1001	150, 5% 500V Mica
C1002	220, 20% 500V Disc
C1003	.002, 20% 500V Disc
C1004	.002, 20% 500V Disc
C1005	500, 20% 500V Disc
C1101	500, 20% 500V Disc
C1102	.01, 80-20% 500V Disc
C1103	.001, 20% 500V Disc
C1104	.001, 20% 500V Disc
C1105	.001, 20% 500V Disc
C1201	220, 20% 500V Disc
C1202	.01, 80-20% 500V Disc
C1203	.001, 20% 500V Disc
C1204	.002, 20% 500V Disc
C1205	.001, 20% 500V Disc
C1206	.001, 20% 500V Disc
C1207	.01, 10% 1000V Tubular
C1301	.01, 80-20% 500V Disc
C1302	.01, 80-20% 500V Disc
C1303	.01, 80-20% 500V Disc
C1304	.01, 80-20% 500V Disc
C1305	220, 20% 500V Disc
C1306	.01, 80-20% 500V Disc
C1401	.01, 80-20% 500V Disc
C1402	.01, 400V Tubular
C1403	.01, 80-20% 500V Disc
C1404	100, 20% 500V Disc
C1405	.01, 80-20% 500V Disc
C1501	10, 5% 500V Mica 15 pf
C1502	1.5-20 pf Mica Trimmer
C1503	4-40 pf Mica Trimmer
C1504	.002, 20% 500V Disc
C1505	270, 5% 500V Mica
C1506	270, 5% 500V Mica
C1507	.01, 80-20% 500V Disc
C1602	390, 5% 500V Mica
C1603	5-80 pf Mica Trimmer
C1604	.01, 10% 500V Disc
C1605	.002, 10% 500V Disc
C1606	50, 5% 500V Mica
C1701	470, 5% 500V Mica
C1702	270, 2% 500V Mica
C1703	430, 2% 500V Mica
C1704	27, 5% 500V Mica
C1705	430, 2% 500V Mica
C1706	.01, 80-20% 500V Disc
C1707	2 pf Dial Set
C1708	12 pf Main Tuning
C1709	22 Disc, Neg Selected
C1710	2.5 Disc, Neg Selected
C1711	6.7 pf Trimmer
C1712	39 Disc, Neg Selected
C1713	20 Disc, Neg Selected
C1714	11.6 pf Trimmer
C1715	10 Disc, Neg Selected
C1716	10 Disc, Neg Selected
C1717	11.6 pf Trimmer
C1718	10 Disc, Neg Selected
C1719	30 Disc, Neg Selected
C1720	11.6 pf Trimmer
C1721	10 Disc, Neg Selected
C1722	5 Disc, Neg Selected
C1723	11.6 pf Trimmer
C1801	.002, 20% 2KV Disc
C1802	.001, 1KV Feedthru (7)
C1803	80 mf 150VDC
C1804A	40 mf 450VDC
C1804B	40 mf 450VDC
C1805	10 mf 150V
C1806	.01, 80-20% 500V Disc
C1807	.01, 80-20% 500V Disc
C1808	.47, 20% 200V Tubular
C1809	.05, 10% 200V Tubular
C1810	.05, 10% 200V Tubular
C1811	.002, 20% 500V Disc
C1812A	135 pf PA Grid
C1812B	135 pf PA Grid
C1813	20 mf 25VDC
C1814	.01, 80-20% 500V Disc

RESISTORS

R101	82 ohms
R102	56 ohms
R103	47K - 1 watt
R104	4.7K
R105	2.2K
R106	12K - 2 watt
R107	1K
R108	68 ohms - 1 watt
R109	27 Ohms
R201	27K
R202	27K
R203	18K - 2 watt
R204	6.8K
R205	6.8K
R206	6.8K
R207	4.7K - 1 watt
R301	270K
R302	100K
R303	100 ohms
R304	10K
R305	8.2K
R306	10K
R401	1K
R402	10K Bias Pot.
R403	10K - 1 watt
R404	1 ohm - 5% - 2 watt
R405	470 ohms - 5%
R406	680 ohms - 5%
R407	1 ohm - 5% - 2 watt
R408	100 ohms
R409	100 ohms
R410	1K
R411	10K
R412	100K Output Level Pot.
R601	100K
R602	56 ohms
R603	47K - 1 watt

Capacitors are in Picofarads when listed as a whole number. When listed as decimal number value is in microfarads. Unless otherwise specified. Resistors are 10% tolerance, and ½ watt rating, unless otherwise specified.

RESISTORS (cont.)

R701	47K
R702	27K
R703	18K - 2 watt
R801	470 Ohm
R802	33K - 2 watt
R803	1K
R901	270K
R902	100 ohms
R903	47 ohms - 5%
R904	27K - 1 watt
R905	100K
R906	1K S-Meter Zero Pot.
R907	1K
R1001	10K
R1002	47K
R1003	270 ohms
R1004	270K
R1005	1 Meg
R1006	10 Meg
R1007	47K
R1008	100K
R1101	6.8K
R1102	100K
R1103	4.7K
R1104	100K
R1105	2.2 Meg
R1106	2.2 Meg
R1107	270K
R1201	1 Meg AF Gain Pot.
R1202	47 ohms
R1203	1 Meg
R1204	270K
R1205	330K
R1206	330K
R1207	33K
R1208	680K
R1209	1K
R1210	27 ohms
R1301	1K
R1302	10K
R1303	10K Quad. Bal. Pot.
R1304	18K - 2W
R1305	100K
R1306	27K
R1307	5K Car. Bal. Pot.
R1308	1K
R1309	100K
R1310	27K
R1311	27K
R1401	1K
R1402	1 Meg Mic. Gain Pot.
R1403	150K
R1404	270K
R1405	2.2 Meg
R1406	47K
R1501	18K
R1502	1.5K - 5%
R1503	2.2K
R1504	100 ohms
R1602	10K
R1603	100K
R1604	100K
R1605	10K
R1606	27K
R1607	68K
R1608	47K
R1609	5K 25KC Adjust Pot.
R1610	2.2K
R1611	3.9K
R1612	5.6K
R1613	3.9K
R1701	1K - 5%
R1702	1K - 5%
R1703	1K - 5%
R1704	470 ohms - 5%
R1705	2.7K
R1706	2.7K
R1707	470 ohms - 5%
R1801	900 ohms - 10 watt
R1802	500 ohms - 10 watt
R1803	470 ohms
R1804	750 ohms - 10 watt
R1805	27K
R1806	27K
R1807	470K - 1 watt
R1808	27K
R1809	10K RF Gain Pot.
R1810	270K
R1811	10K
R1812	470K
R1813	270K
R1814	4.7K
R1815	1 Meg
R1816	470K

COILS

L101	10 mtr VFO Amp. Coil
L102	15 mtr VFO Amp. Coil
L103	40 mtr VFO Amp. Coil
L104	20-80 mtr VFO Amp. Coil
L105	10 mtr Rec. Coil
L201	RFC - 200 uh
L202	15 mtr Mixer Coil
L203	10 mtr Mixer Coil
L204	40 mtr Mixer Coil
L205	20 mtr Mixer Coil
L206	80 mtr Mixer Coil
L301	10 mtr Driver Coil
L302	15 mtr Driver Coil
L303	20 mtr Driver Coil
L304	40 mtr Driver Coil
L305	80 mtr Driver Coil
L306	RFC - 200 uh
L401	RFC - 100 uh
L402	RFC - 55 uh
L403	Final Tanl Coil
L404	RFC - 30 uh
L601	12 MC Trap Coil
L801	1st IF Amp. Coil
L901	2nd IF Amp. Coil
L1501	RFC - 200 uh
L1701	RFC - 200 uh
L1702	RFC - 200 uh
L1703	10 mtr VFO Coil
L1704	15 mtr VFO Coil
L1705	20 mtr VFO Coil
L1706	40 mtr VFO Coil
L1707	80 mtr VFO Coil
L1801	RFC - .82 uh
L1802	RFC - .82 uh
L1803	RFC - .82 uh
L1804	RFC - 200 uh
Z301	Parasitic Suppressor
Z401	Parasitic Suppressor
Z402	Parasitic Suppressor

TRANSFORMERS

T1301	Bal. Mod.
T1201	AF Output

272-001

SWITCHES

S1A-G	Bandswitch
S2	PTT - VOX
S3	ANL
S4	PA Coarse Load
S5	Power ON - OFF
S6	100KC - 25KC Cal.
S7	CAL-REC-TRANS-CW-TUNE
S8	Sideband Selector

RELAYS

K1	4PDT, 12 VDC Coil
K2	3PDT, 12 VDC Coil

CRYSTALS

Y1501	5503.3KC Car. Osc.
Y1502	5500.0KC Car. Osc.
Y1601	100KC Crystal Cal.

DIODES

D401	1N34A
D701	1N914
D1101	1N34A
D1102	1N34A
D1201	RCA 39804 (1N3195)
D1202	RCA 39804 (1N3195)
D1801	1N2974A Zener
D1802	RCA 39804 (1N3195)
D1803	1N914
D1804	1N914
D1805	1N914

TUBES

V1	6EW6 VFO Amp.
V2	12BE6 Trans. Mixer
V3	6GK6 Driver
V4	8950 Power Amp.
V5	8950 Power Amp.
V6	6BZ6 Rec. RF Amp.
V7	12BE6 Rec. Mixer
V8	1st IF Amp.
V9	2nd IF Amp.
V10	12AX7 Prod. Det. /Rec. AF
V11	6BN8 AGC/ALC Amp.
V12	6GK6 AF Output
V13	6JH8 Bal. Mod.
V14	12AX7 Trans. AF Amp. /Mic. Amp.

TRANSISTORS

Q1	2N706
Q2	2N706
Q3	2N706
Q4	MPS 3693
Q5	MPS 3693
Q6	MPS 3693
Q7	MPS 3693

LIGHTS

B1	GE 47, 6V
B2	GE 47, 6V

Resistors are ½ watt unless specified. K equals 1000 ohms.

TROUBLESHOOTING GUIDE

DEFECT	POSSIBLE CAUSE
PA IDLING CURRENT UNSTABLE	1. Defective 6LQ6 2. Defective Bias Potentiometer 3. Defective Bias Supply
INABILITY TO LOAD TO 400-500 MA. (SEE PAGE 10)	1. PA Grid Improperly Tuned 2. Bandswitch Improperly Set 3. Antenna Not Resonant at Frequency 4. Defective Transmission Line 5. Defective Mobile Antenna Coil 6. V2, V3, V4, V5 Defective 7. R409 or R408 Defective
INSUFFICIENT CARRIER SUPPRESSION	1. Carrier Balance Control Improperly Adjusted 2. Defective 6JH8 Balanced Modulator 3. Carrier Oscillator Frequency Incorrect
INSUFFICIENT SIDEBAND SUPPRESSION	1. Excessive MIC. Gain 2. Incorrect PA Load Adjustment 3. Carrier Oscillator Frequency Incorrect
MICROPHONICS IN RECEIVER	1. L901 Improperly Tuned 2. V14, V10, V8, V7, or V6 Defective
LOW RECEIVER SENSITIVITY	1. PA Grid, Plate, or Load Improperly Set 2. Bandswitch Improperly Set 3. K2 Back Contacts Defective 4. V6, V7, V8, V9, V10, V11, V12 Defective

VOLTAGE CHART

TUBE TYPE		PIN NO. 1	2	3	4	5	6	7	8	9	10	11	12
V1-6EW6	R	0	.75	6.3 AC	0	140	130	0					
	T	-100	.75	6.3 AC	0	125	125	0					
V2-12BE6	R	-28	0	12.6 AC	0	240	215						
	T	0	0	12.6	0	245	100						
V3-6GK6	R	0	-34	0	6.3 AC	0	0	270	270				
	T	0	-6	0	6.3	0	0	270	250				
V4-8950	R	12.6	0	0	0	-90	0	0	0	-90	0	0	0
	T	12.6	.04	265	0	-80	.04	0	0	-80	0	265	0
V5-8950	R	0	0	0	0	-90	0	0	0	-90	0	0	12.6
	T	0	.04	265	0	-80	.04	0	0	80	0	265	12.6
V6-6BZ6	R	.5	.8	0	12.6 AC	270	150	0					
	T	-31	0	0	12.6	270	-20	0					
V7-12BE6	R	-26	0	12.6 AC	0	250	55	.1					
	T	.5	0	12.6	0	250	-20	.3					
V8-12BA6	R	.5	0	12.6 AC	0	230	130	0					
	T	-.05	0	12.6	0	250	150	0					
V9-12BA6	R	-.5	0	12.6 AC	0	240	125	1.9					
	T	115	0	12.6	0	255	-15	0					
V10-12AX7	R	45	.7	1	12.6 AC	0	175	0	1.5	0			
	T	.5	.7	-.5	12.6	0	245	-90	0	0			
V11-6BN8	R	1.6	2.6	.5	6.3 AC	12.6 AC	1.2	260	0	.5			
	T	0	2.6	1.6	6.3	12.6	0	200	0	1.6			
V12-6GK6	R	0	8	–	12.6 AC	6.3 AC	–	270	250	0			
	T	12	8	–	12.6	6.3	–	260	250	0			
V13-6JH8	R	12	11	0	6.3	0	-100	0	270	250			
	T	70	11	64	6.3	0	0	0	260	250			
V14-12AX7	R	75	0	0	6.3 AC	6.3 AC	114	0	.7	0			
	T	50	0	0	6.3	6.3	100	0	.4	0			

Voltage Checks Made With 20,000 Ohms Per Volt VTVM

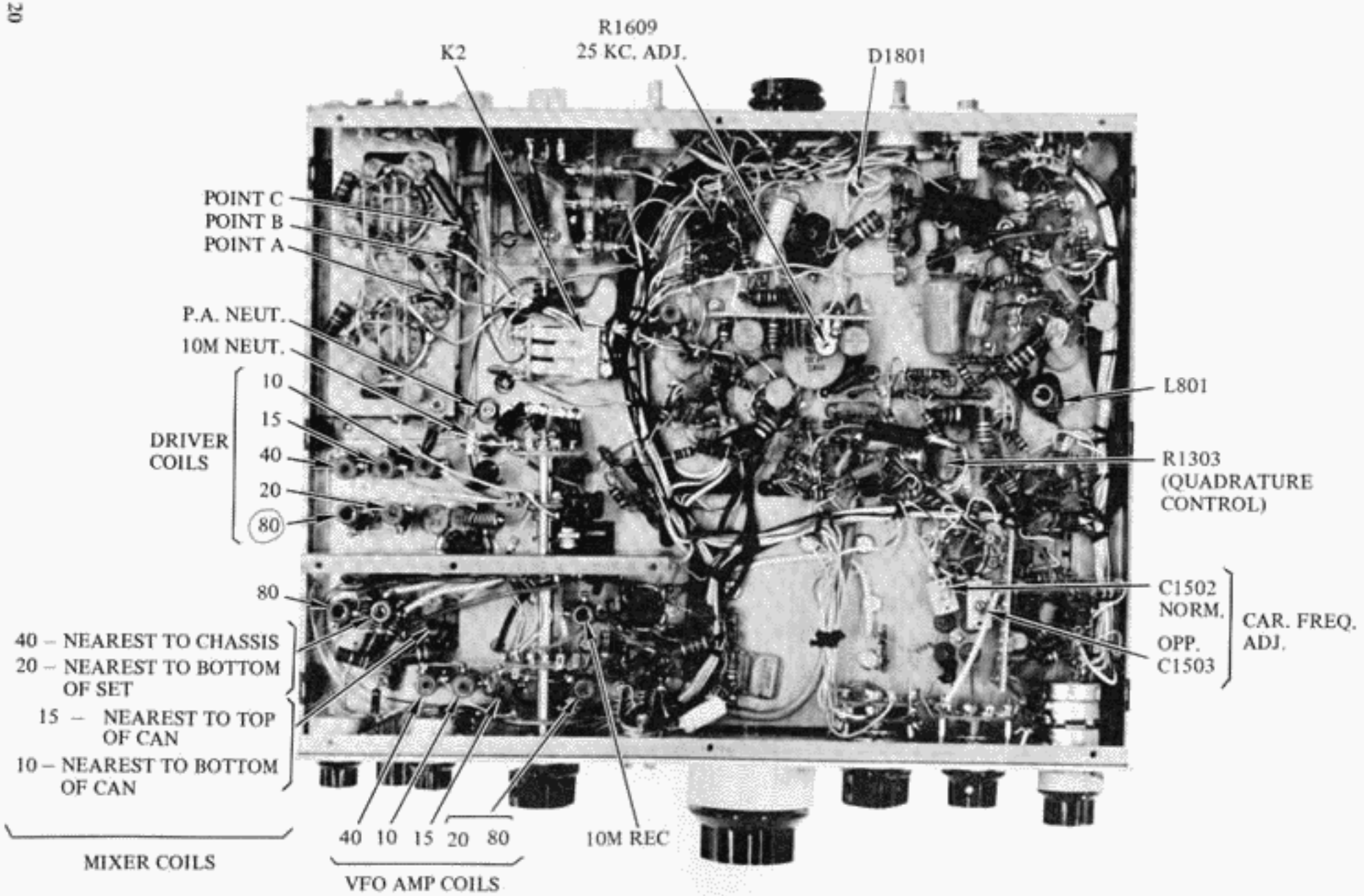


FIGURE 5. BOTTOM VIEW MODEL 700-CX

FIGURE 6. REAR VIEW MODEL 700-CX

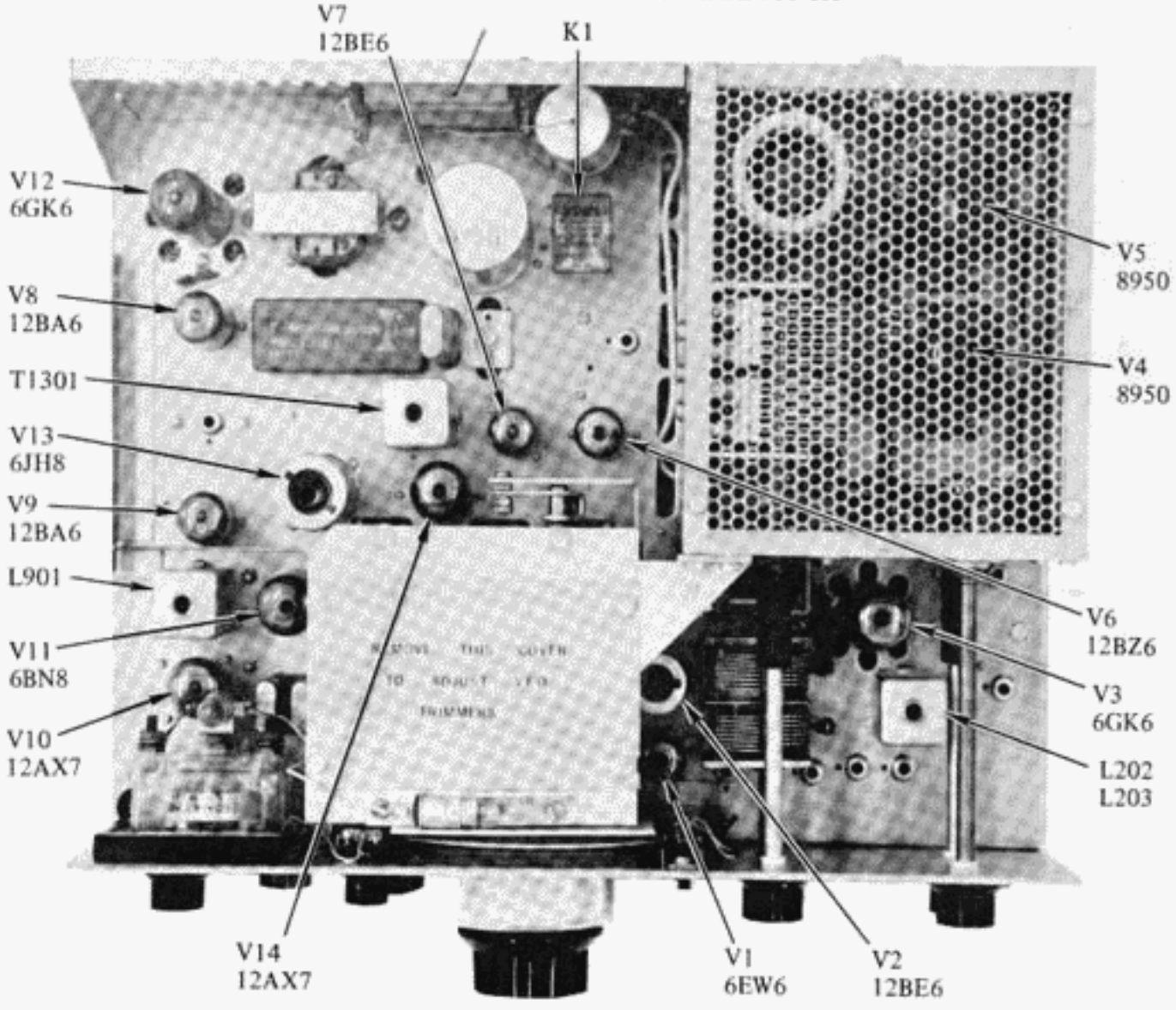
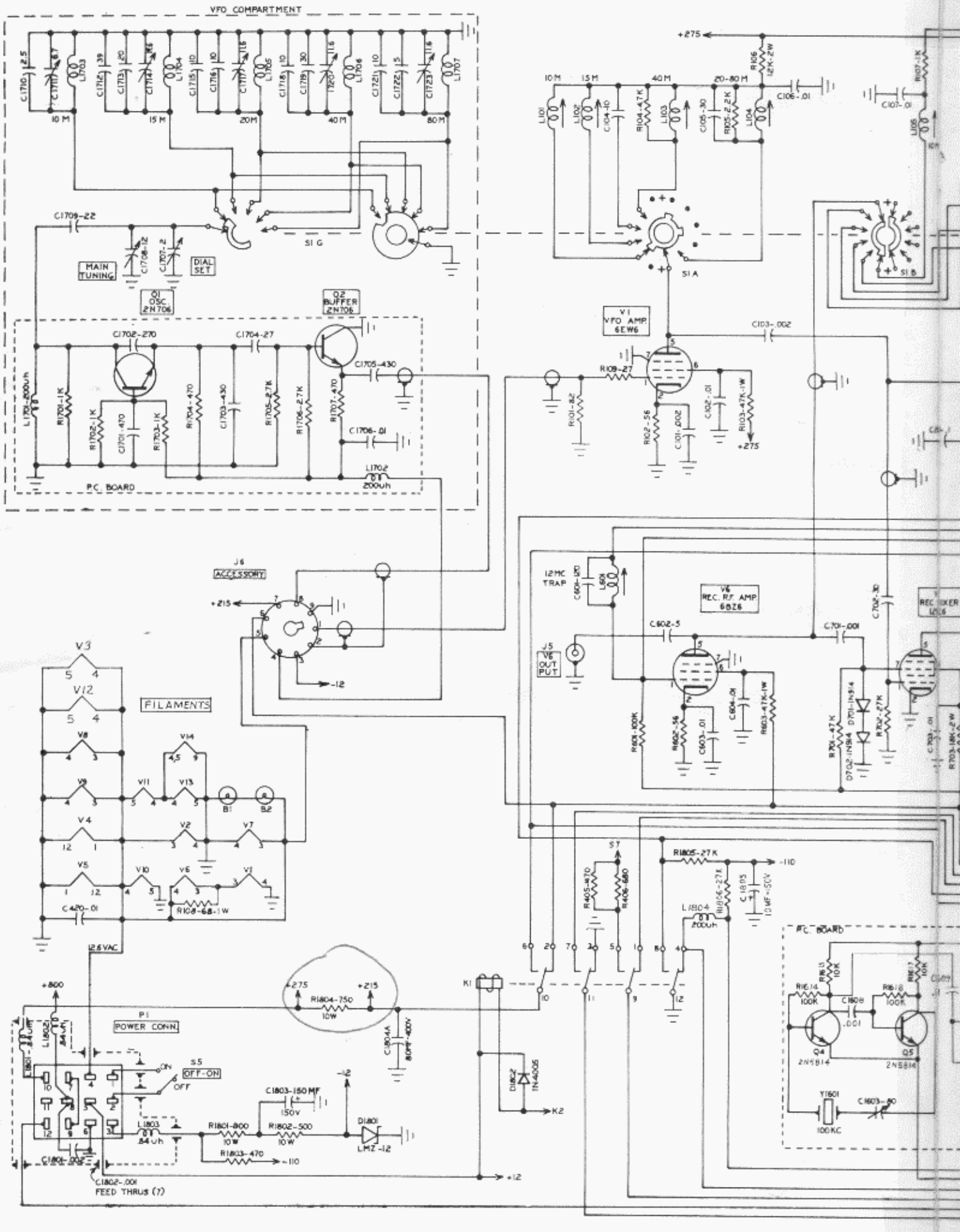
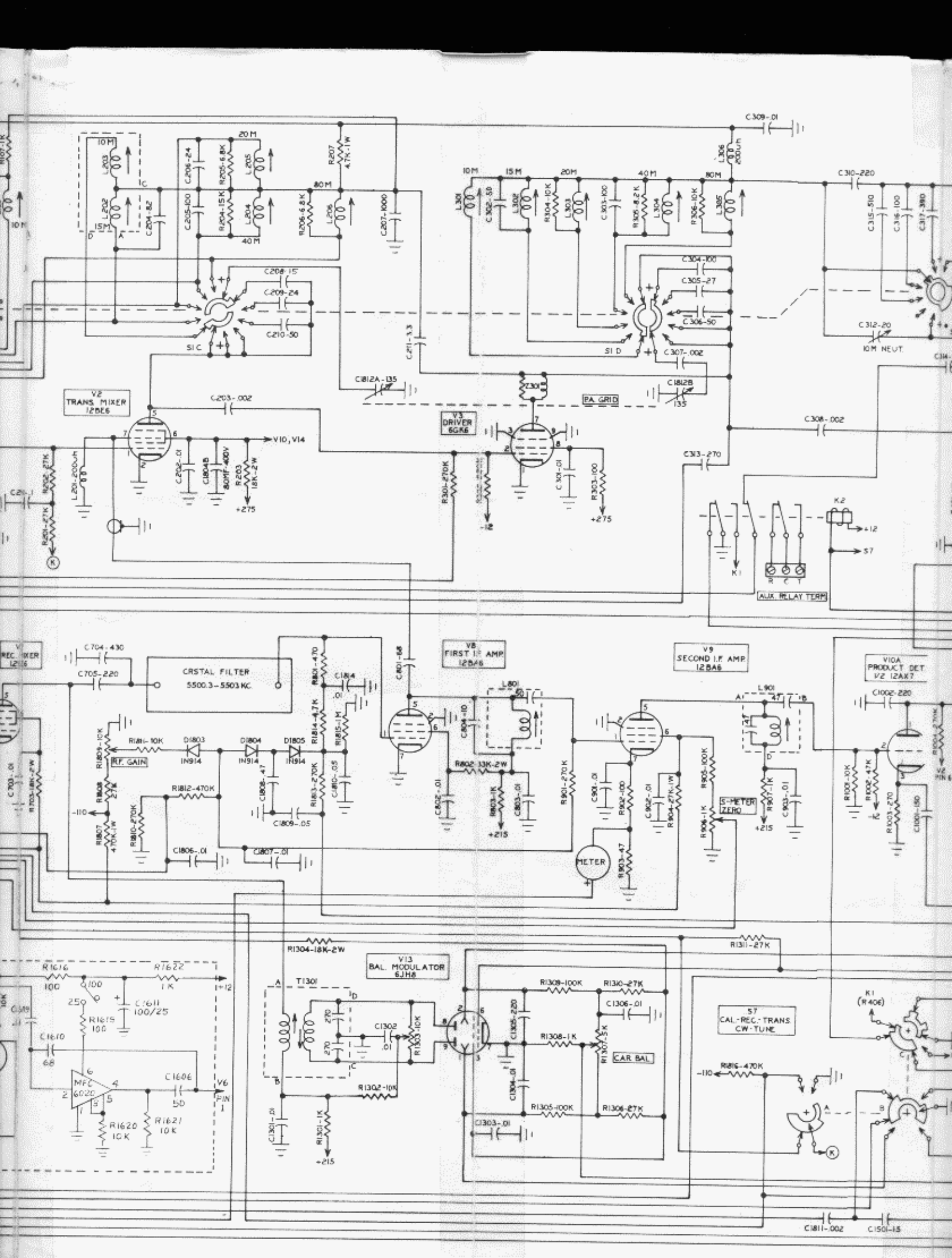
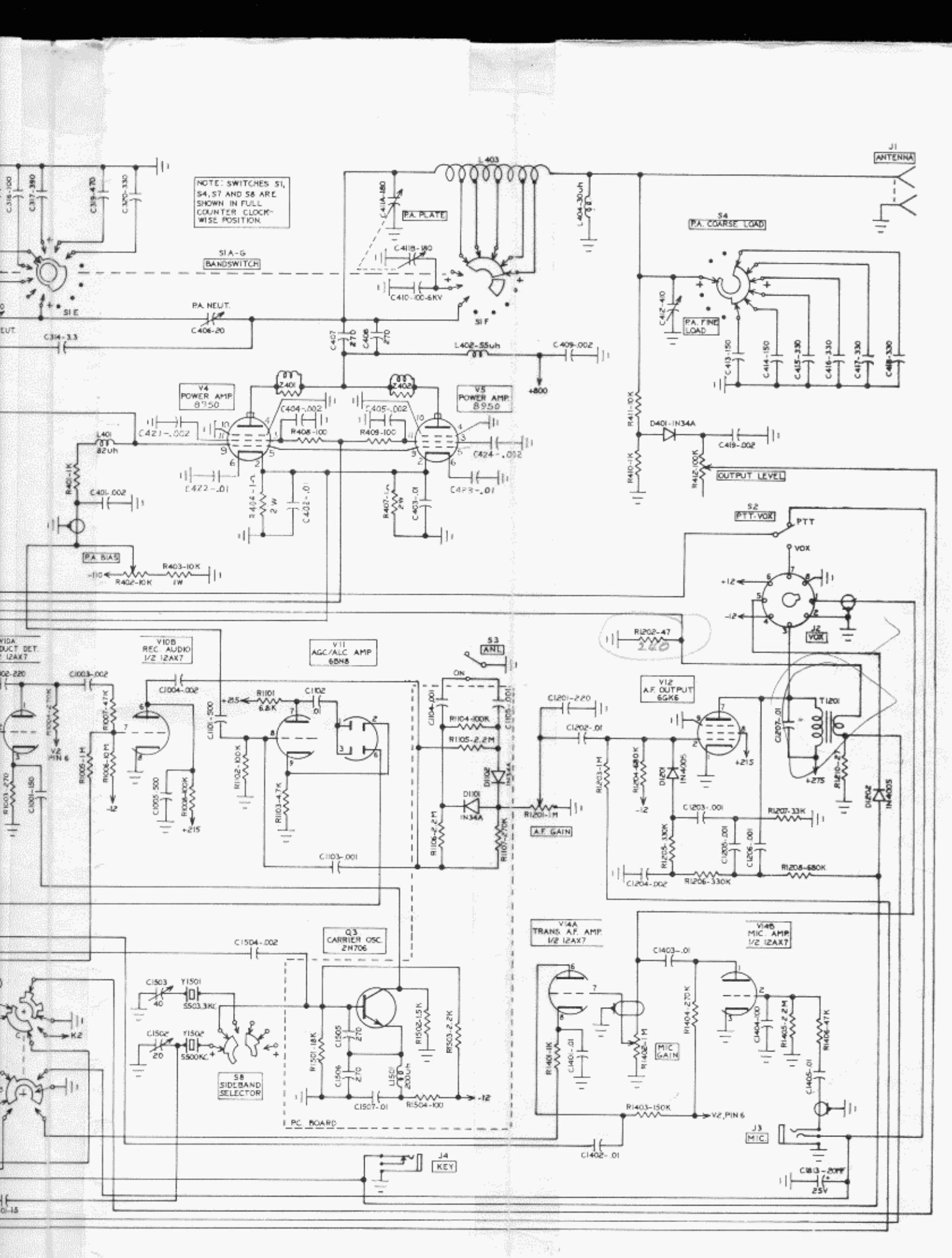


FIGURE 7. TOP VIEW MODEL 700-CX


VFO COMPARTMENT
10 M
15 M
20M
40 M
80 M
MAIN TUNING
DIAL SET
Q1 OSC. 2N706
Q2 BUFFER 2N706
P.C. BOARD
S1 G
S1 A
S1 B
V1 VFO AMP 6EW6
+275
-12
-110
J6 ACCESSORY
J5 V6 OUT PUT
V6 REC. R.F. AMP 6BZ6
12MC TRAP
FILAMENTS
V3
V12
V8
V14
V9
V11
V13
V4
V2
V7
V5
V10
V6
V1
B1
B2
R108-68-1W
C420-01
12.6VAC
P1 POWER CONN.
S5 OFF-ON
ON
OFF
L1803 .84uh
L1802 .84uh
L1801 .84uh
C1801-.002
C1802-.001 FEED THRUS (7)
C1803-150 MF 150V
R1801-800 10W
R1802-500 10W
R1803-470
D1801 LMZ-12
D1802 1N4005
K1
K2
S7
R1804-750 10W
C1804A 80MF-400V
R1805-27K
R1806-680
R1807-470
C1805 10MF-150V
L1804 800uh
P.C. BOARD
Q4 2N5814
Q5 2N5814
Y1601 100 KC
C1603-80
R1613 10K
R1614 100K
R1617 10K
R1618 100K
C1608 .001
L101
L102
L103
L104
L105
R106 12K-2W
R107-3K
C106-.01
C107-.01
R104-47K
R105-2.2K
C105-.30
C104-10
C103-.002
R109-27
R101-82
R102-56
C101-.002
C102-.01
R103-47K-1W
C1709-22
C1708-12
C1707-2
C1702-270
C1704-27
C1705-430
C1706-.01
L1702 200uh
L1701-200uh
R1701-1K
R1702-1K
C1701-470
R1703-1K
R1704-470
C1703-430
R1705-2.7K
R1706-2.7K
R1707-470
C1716
C1717
C1718
C1719
C1720
C1721
C1722
C1723
L1703
L1704
L1705
L1706
L1707
C602-5
C601-.001
L601
C604-.01
C603-.01
R602-56
R603-47K-1W
R601-100K
C701-.001
D701-1N914
D702-1N914
R702-47K
R701-47K
C702-.30
C703-.01
R703-18K-2W


V2
TRANS. MIXER
12BE6
V3
DRIVER
6GK6
V8
FIRST I.F. AMP.
12BA6
V9
SECOND I.F. AMP.
12BA6
V10A
PRODUCT DET.
V2 12AX7
V13
BAL. MODULATOR
6JH8
CRSTAL FILTER
5500.3-5503 KC.
R.F. GAIN
S-METER
ZERO
METER
CAR. BAL.
S7
CAL.-REC.-TRANS.
CW-TUNE
AUX. RELAY TERM
PA. GRID
10M NEUT.
K1
(R406)
K2
+12
S7
+215
-12
-110
+275


NOTE: SWITCHES S1, S4, S7 AND S8 ARE SHOWN IN FULL COUNTER CLOCK-WISE POSITION.
S1A-G BANDSWITCH
S1E
S1F
P.A. PLATE
P.A. NEUT.
L403
L404-.30uh
J1 ANTENNA
S4 P.A. COARSE LOAD
P.A. FINE LOAD
V4 POWER AMP 8950
V5 POWER AMP 8950
L401 82uh
L402-.55uh
+800
D401-IN34A
OUTPUT LEVEL
P.A. BIAS
S2 PTT-VOX
PTT
VOX
J2 VOX
V10B REC. AUDIO 1/2 12AX7
V11 AGC/ALC AMP 6BN8
S3 ANL
ON
V12 A.F. OUTPUT 6GK6
A.F. GAIN
Q3 CARRIER OSC. 2N706
Y1501 5503.3KC
Y1502 5500KC
S8 SIDEBAND SELECTOR
P.C. BOARD
V14A TRANS. A.F. AMP. 1/2 12AX7
V14B MIC. AMP 1/2 12AX7
MIC GAIN
V2, PIN 6
J3 MIC.
J4 KEY
25V