3.1.5 Transmit Indicator

This Indicator is a white light which is turned on when you press the Push-To-Talk button on the microphone which indicates your ESCORT II is in the transmit mode. The light will fluctuate in brilliance when the transmitter is modulated. (See Fig. 3.1)

3.2 OPERATING THE ESCORT II

CAUTION

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

3.2.1 Rotate SQUELCH CONTROL fully counterclockwise.

3.2.2 Rotate the VOLUME CONTROL clockwise, to apply power, and advance the VOLUME CONTROL until noise or signal is heard in the speaker. (Since your ESCORT II uses all transistors, no warmup time is required.)

3.2.3 With no signal present, rotate the SQUELCH CONTROL clockwise to a position in which no noise is heard. Advance this control only far enough to prevent noise from being heard. Advancing it too far may result in a weak station being unable to open the squelch. Since the squelch has been adjusted, with no signal present, then when a station transmits on the channel to which your ESCORT II is tuned, the squelch circuit will be heard. When the station stops transmitting and no signal is received, the squelch gate will be closed and all sound will be "Turned Off". Sometimes noise will build up as a result of a passing truck, etc. If this happens, the SQUELCH CONTROL should be advanced just far enough to keep the circuit closed during these noise peaks.

3.2.4 Rotate the CHANNEL SELECTOR to the desired channel.

3.2.5 Adjust the volume as desired for the station you are listening to.

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

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

3.3 OPERATING PROCEDURE

Since the Citizens Band channels are used on a shared and equal basis, standard radio operating procedure and courtesies should be observed at all times so that full use of the service can be realized by everyone. Some points to remember are:

3.3.1 Monitor your channel before transmitting.

3.3.2 Do not transmit if you hear other stations using the channel. Wait for them to clear the air.

3.3.3 Limit your transmission to the minimum possible time required to complete your business or transaction. Under no circumstances, exceed the time period as outlined within the FCC Rules and Regulations pertaining to the Citizens Radio Service.

3.3.4 State the call sign of your station at the beginning and end of each communication (not each transmission). This procedure is required by the FCC and can be performed simply.

3.3.5 Correct operating procedures, use of call signs, signing off, etc. will be found in the FCC Rules and Regulations, or can be explained by your Pearce-Simpson dealer.

SECTION IV

MAINTENANCE AND SERVICING

4.1 CIRCUIT DESCRIPTION

Your ESCORT II consists of the following circuits: the Pearce-Simpson Mono-crystal HetroSync[R] circuit, which provides the receiver injection frequencies and the transmitter carrier frequency; a dual conversion superheterodyne receiver; and an AM-modulated transmitter. It is powered from a positive 12.6 VDC source (see Block Diagram, Figure 4.1, and schematic).

4.1.1 HetroSync[R] Circuit

Pearce-Simpson's method of frequency synthesis makes use of a total of 13 crystals to provide crystal controlled, 11 channel coverage on both transmit and receive functions. The circuit is composed of a 32.960 to 33.250 mc master oscillator (Q11), a 6.450 mc receive oscillator (Q101), a 5.995 mc transmit oscillator (Q102) and a transmit mixer (Q12).

In the transmit function, the output of the master oscillator (Q11) and the transmit oscillator (Q102) are fed into the transmit mixer (Q12). The two fundamental frequencies are combined in the mixer, whose output will contain the two frequencies fed in, plus the sum of the two and the difference of the two, as well as combinations of the harmonics of the input. We use only the difference frequency. Let us take Channel 9 as an example. The two input frequencies are 33.060 mc and 5.995 mc. The mixer outputs are 33.060 mc, 5.995 mc, 39.055 mc and 27.065 mc. The other frequencies present at much lower levels are the harmonics of the two input frequencies such as 11.990 mc, 17.985 mc, 23.980 mc, etc. In addition to these, will be the sum and difference frequencies from the mixing of the various harmonic and fundamental frequencies. Of all these frequencies, only one falls within the passband of the transmitter. This is 27.065 mc which is the carrier frequency for Channel 9. The nearest unwanted frequency to the carrier frequency is at least 3.0 mc away and outside of the transmitter passband is adequately suppressed. "Crystal Chart", Figure 4.2, shows the crystal frequencies used in the Mono-crystal HetroSync[R] circuit to produce the carrier required for each of 23 channels.

In the receiver function, the output of the master oscillator (Q11) is used as the injection frequency for the 1st receiver mixer (Q2) and the receiver oscillator (Q101) is used as the injection for the 2nd receiver mixer (Q3). Using Channel 9 as an example again, the master oscillator frequency is 33.060 mc and the receiver oscillator frequency is 6.450 mc. The use of these frequencies will be covered in the discussion on the receiver. Refer to the "Crystal Chart", Figure 4.2, for the crystal frequencies used, from the Mono-crystal HetroSync[R] circuit, for receiver injections for each of the 23 channels.

4.1.2 Transmitter Circuit

The transmitter circuit makes use of the carrier frequency signal output of the transmit mixer (Q12), which is part of the Mono-crystal HetroSync^R circuit. The signal is amplified by the buffer (Q13), which is a voltage amplifier, whose output is fed to the driver (Q14). Bandpass transformers T10 and T11 provide the selectivity to select the desired carrier frequency from the mixer (Q12) output. The driver is a low level Class C power amplifier which supplies the necessary RF power at the carrier frequency to drive the final power amplifier (Q15). The final supplies RF power to the antenna through a double Pi matching network and a TVI filter.

The primary purpose of a transmitter is to transmit intelligence from one place to another. The function of the modulator is to put the intelligence on the carrier. To do this, the microphone changes sound (mechanical to electrical energy) which is an audio frequency signal. Mic amplifier (Q9) and transmit audio amplifier (Q10) amplify this signal and drive the audio power amplifier (Q8). This audio power amplifier varies the supply voltage fed to the drive and final at an audio rate. This variation of the supply voltage varies the amplitude of the carrier output thus producing amplitude modulation.

4.1.3 Receiver Circuit

The receiver in the ESCORT II is a dual conversion superheterodyne circuit. Channel 9 (27.065 mc) will be used as an example to show how the receiver circuit works. A signal at 27.065 mc is received at the antenna and amplified by RF amplifier (Q1) and fed into 1st receiver mixer (Q2). The 27.065 mc signal is mixed with 33.060 mc injection from the HetroSync^R circuit. The 5.995 mc 1st IF output from the 1st receiver mixer is fed into the 2nd receiver mixer (Q3) along with the 6.450 mc injection from the HetroSync^R circuit. The 455 kc 2nd IF output from the 2nd receiver mixer is amplified by the IF amplifiers Q4 and Q5. Then, the signal is detected by detector diodes CR1 to remove the audio from the IF carrier. The audio is coupled from the detector through the automatic noise limiter network to the 1st receiver audio amplifier (Q6). This amplifier also acts as a squelch gate. If the squelch control has been properly adjusted, this amplifier is biased off and will not allow any noise to be passed. When a signal is received, the amplifier is biased on and audio is allowed to be passed on to the 2nd receiver amplifier (Q7). Q7, in turn, feeds the audio power amplifier (Q8) which drives the speaker.

4.2 CABINET REMOVAL

4.2.1 Top Cover

Remove the two screws located near the rear edge of the top cover. Now raise the rear edge slightly and slide the cover back at least 1/4 inch. This clears the clips holding the cover to the front panel and the cover can be lifted off the unit.

This allows you access to the following:

A. Transistor
B. Receive and transmit 6 mc oscillators and crystals
C. Tuning adjustments
D. A.G.C. and Squelch circuits
E. Relay
F. Master oscillator crystals

4.2.2 Bottom Cover

Remove two screws near edge of bottom cover and follow same procedure as for top cover.

This allows you access to the following:

A. Components
B. Collector current test jack
C. Tuning adjustments

4.3 HETROSYNC[R] SERVICING

4.3.1 Test Equipment Required

A. Hewlett-Packard 524C Frequency Counter with H.P. 525A Head, or any accurate means of frequency measuring.
B. VTVM - Heath Model IM-13 or equivalent
C. AC-VTVM - Heath Model AV-3 or equivalent

4.3.2 Adjustments

There is one adjustment in the Mono-crystal HetroSync[R] circuit which is C-32 in the master oscillator circuit. This adjustment affects the transmitter frequency and as a result must be made only by the holder of a Second Class Radio Telephone License or higher.

NOTE

This adjustment has been properly set and sealed at the factory. No change should be made in this setting, unless, after crystal replacement, a frequency check shows it to be necessary.

A. Turn the unit onto receive and remove the receiver oscillator transistor (Q101).
B. Hold a pickup loop, which is connected to the frequency counter, near the 33 mc master oscillator.
C. Measure the frequency of each of the 33 mc master oscillator crystals, and record the readings.

D. Determine the variations, above or below the frequency stamped on the case, for each crystal.

E. Select the two that exhibit the most plus variation and minus variation from correct frequency. If all are on the same side, select highest and lowest in variation.

F. Add these two figures together and divide by two.

G. Take this figure and add it to the center frequency of the crystal with the most plus variation.

H. Switch this crystal into the master oscillator circuit and adjust C-32 for the new frequency read on the frequency counter.

I. This will shift the frequency of all the master oscillator crystals so that they will group around the center frequency.

4.3.3 Trouble-Shooting the Mono-crystal HetroSync[R] Circuit

In case of a malfunction in this circuit, proceed as follows:

A. Determine if the failure affects either transmit or receive functions, or both.

B. If the unit is inoperative on both transmit and receive, for the channel(s) involved, the problem may be a crystal or contact in the master oscillator circuit.

C. If only the receiver function is affected, the receiver crystal or oscillator will be suspected.

D. If only transmit function is affected, the transmit crystal or oscillator will be suspected.

E. Troubles encountered in the oscillators of the HetroSync[R] circuit, other than those described above, may be dealt with using conventional trouble-shooting methods.

F. For component location see Figure 4.3 "Component Layout". For typical voltage values see Figure 4.4 "Voltage Chart".

4.4 RECEIVER SERVICING

4.4.1 Equipment Required

A. Hex-type alignment tool for IF cans
B. RF Generator - H.P. 606A or equivalent
C. VTVM - Heath Model IM-13 or equivalent
D. Power Supply - 13.8 VDC, 3 amps minimum, regulated
E. AC-VTVM - Heath Model AV-3 or equivalent

4.4.2 Alignment

A. Connect a 13.8 VDC source to the power cord.

B. Set Squelch control fully counterclockwise.

C. Rotate Volume clockwise to apply power and advance about 1/4 turn.

D. Insert a Channel 13 crystal, set channel selector to that Channel.

E. With a VTVM, measure the +11 volt regulated line (any point on the 912 wire). It should read within ±5% of the 11 volts.

F. Connect VTVM set to 5 volt range between junction of R14, C17, R16 and R19. This point provides a better indication of correct tuning than is possible with the A.G.C. line.

G. Connect signal generator, set to 455 kc, through a .01 mfd capacitor to base of Q3.

H. Adjust top slug of T7 to top of can. Adjust bottom slug of T7 and top and bottom slugs of T4, T5 and T6 for maximum indication on the meter.

I. Now, connect the signal generator to the ESCORT antenna terminal and set to Channel 13 frequency (27.115 mc).

J. With the VTVM connected as for IF alignment, adjust top and bottom slugs of T2 and T3 for maximum reading on meter. Adjust T1 slug to bottom of can and then return to second peak and adjust for maximum reading on meter.

K. If facilities are available to set the signal generator very accurately to channel frequency, the 455 kc IF's may be re-adjusted slightly for optimum performance.

L. With the receiver aligned, the reading on the VTVM should be in the range of 1 to 2 VDC.

M. With the generator connected to the antenna terminal, set it to the channel frequency at a level of 1 microvolt modulated 30% with 1000 cps.

O. Connect an AC-VTVM to the speaker terminal and adjust the volume to a good measurable level on the meter.

P. Note the reading on the meter and then remove the modulation on the generator and again note the meter reading. The difference in these two readings in db is your S+N/N ratio. It should be in the order of 12 db or more. If it is less than 8 db, a re-check of the receiver alignment should be made.

4.4.3 Trouble-Shooting

Since the receiver is a conventional dual conversion, the trouble-shooting procedure is also fairly conventional. If you do find your receiver inoperative, the following hints may be of aid to you:

A. Audio Circuit – Rotate the Squelch control fully counterclockwise. Turn on the power. With an audio generator, feed a signal into the limiter at the junction of CR1, R14, and R13. This will allow you to determine if the audio circuit is operating properly. If it is inoperative, standard audio trouble-shooting procedure may be used.

B. If the audio is functioning properly, then go to the next step. Now, apply a 455 kc signal, modulated 30% with 1000 cps, through a .01 uf capacitor to the base of Q3. The 1000 cps tone should be heard clearly with a signal level of approximately 10 microvolts. Then use standard trouble-shooting techniques in finding the loss in gain.

C. If the 455 kc IF is operating properly, then you must check the mixers (Q2 and Q3) and the RF amplifier (Q1). Set the channel selector to the Channel containing Channel 13 crystal.

D. Feed a 5.995 mc modulated signal into the base Q2. If you do not hear the tone in the speaker you may find either of the mixers are bad or you have lost the 6.450 mc injection from the HetroSync[R] circuit.

E. If the 2nd Receiver mixer appears to be operating correctly, then feed a 27.115 mc (Channel 13) modulated signal into the antenna connector. You should hear a fairly clear tone with 1 microvolt signal. If no tone is heard, trouble-shoot the 1st receiver mixer (Q2), the RF amplifier, and determine if there is any 33.110 mc injection from the HetroSync[R] circuit.

F. If you are able to get a signal through the receiver, but require a high signal level and the above-mentioned circuits appear to be operating correctly, then check the A.G.C. circuit.

G. Connect the DC probe of the VTVM to the (9) wire connecting RF-A.G.C. to the base of Q1 through R2. For 1 microvolt signal, this should be about 8 VDC and should increase, as you increase signal level, to a maximum of about 10.5 VDC. The components most likely to fail are CR1 (delayed A.G.C. gate diode) and C36 or C37 (de-coupling capacitors).

H. The last circuit in the receiver, we should mention, is the squelch. The squelch circuit provides a variable bias to the emitter of Q6 through R21 and to the RF-A.G.C. line through CR6. If the control is set, say for a 10 microvolt signal so that it just quiets the receiver, then a 20 microvolt signal will open the squelch to provide full volume. Checking the squelch performance up to 1000 microvolts by squelching a signal and then doubling the signal level to see if the squelch opens, is the best way to check if operation is correct or not.

I. For components location see Figure 4.3 "Component Layout". For typical voltage values see Figure 4.4 "Voltage Chart".

4.5 TRANSMITTER SERVICING

4.5.1 Test Equipment Required

A. 52-ohm load (See Figure 4.5, Pearce-Simpson Recommended Dummy Antenna).

B. Oscilloscope – 5" service type scope with R.F. pickup loop (See Figure 4.6)

C. Hex-type alignment tool for I.F. cans

D. Hex-type alignment tool for Pi-network coils

E. VTVM – Hewlett-Packard 410B or equivalent (this meter also serves as an AV-VTVM)

F. Audio Generator – Any service type generator

G. DC Ammeter, 0-1a

H. Power Supply – 13.8 VDC, 3 amps minimum, regulated

4.5.2 Alignment Procedure

> **WARNING**
>
> FCC rules require that transmitter adjustments which may affect frequency, power output, modulation percentage, or harmonic and spurious content of the output must be made by, or under the supervision of, the holder of a 2nd class or higher radio telephone license.

4.5.2.1 General

The ESCORT II transmitter has been carefully tuned and loaded for the maximum legal power input of 5 watts when operating into a 52-ohm resistive load. If the antenna does not exhibit an impedance of 52 ohms at resonance, it will be necessary to retune the transmitter double Pi-network.

The double Pi-network can be tuned to compensate for some reactance, but reactance in the antenna circuit should be reduced to a minimum for best efficiency. If you cannot obtain resonance by tuning C-50, then the antenna circuit is reactive and should be corrected before proceeding.

4.5.2.2 Alignment

NOTE – Do not align transmitter without the proper test equipment to observe the modulation envelope. Misadjustment can cause off-frequency operation.

A. Connect a 52-ohm load to the antenna connection. (See Figure 4.5 for Dummy Antenna.)

B. Connect a 0-1 amp DC meter to the collector current jack.

C. Preset the following adjustments:

T-12 SLUG	–	3/16" From Top
L-6 SLUG	–	To Top of Coil Form
L-7 SLUG	–	To Top of Coil Form
C-50	–	1/3 Turn From In Tight

D. Adjust top and bottom slugs of T-10 and T-11 for maximum collector current in the final. (If T-10 and T-11 are too far out of adjustment, an AC-VTVM may have to be connected to the base of Q-13. Adjust T-10 for maximum signal, then move to the base of Q-14 and adjust T-11 for maximum signal. Then, repeak using the method above.)

E. Adjust T-12 for maximum collector current.

F. Connect the RF Pickup loop to the oscilloscope and place the loop on or near L-7 (Pi net coil).

G. Turn the slug in L-6 in small steps and peak C-50 each time for maximum stable RF as noted on the oscilloscope. Retune T-12 for stable RF.

H. Continue Step G until 420 ma is drawn at resonance. This is the correct collector current for proper loading.

I. Remove the collector current meter.

J. Connect an audio generator between the white microphone lead and ground, and set for 1000 cps at a sufficient level to produce 100% modulation as seen on the oscilloscope.

K. Check the modulated wave on the scope. Slight touchup of T-12, or the double Pi-network tuning may be needed to obtain maximum clean modulated output.

4.5.3 Transmitter Loading

A. With the antenna connected through a wattmeter, retune C-50 for peak stable power.

B. If C-50 has to be tuned very far, the antenna reactance should be corrected before proceeding.

C. If further tuning into the antenna is attempted, proceed as in Steps 4.5.2.2, F through K using proper test equipment.

4.5.4 Trouble-Shooting

Trouble-shooting in the transmitter and modulator is best accomplished with the aid of an AC-VTVM or an oscilloscope and a VTVM.

A. If you have no power output, first find if the transmitter has B+ voltage on all stages.

B. If B+ is present, then check for RF signal from the HetroSync[R] circuit with an AC-VTVM. Then continue on toward the final checking the base and collector of each step for the presence of RF until you find where the signal is lost.

C. If you have no modulation, use the AC-VTVM or oscilloscope to isolate where the audio is lost. You may speak or whistle into the microphone to produce the audio, but an audio generator is the most convenient to use.