PEARCE SIMPSON

ESCORT II

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ESCORT II

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SECTION I

GENERAL INFORMATION

1.1 DESCRIPTION

Your new Pearce-Simpson ESCORT II is a compact all-transistorized 11 channel Citizens Band Transceiver. This radio, because of its low current drain, it ideally suited for mobile operation from a 12.6 negative ground DC power source. Included with your ESCORT II is a 12 VDC power cord and an adjustable universal mounting cradle. To provide the crystal-controlled 11 channel operation, the Pearce-Simpson transistorized Mono-Crystal HetroSync® circuit was designed for use in the ESCORT II. This circuit allows you to add new channels to your radio by adding only one crystal for each new channel.

The receiver is a sensitive superheterodyne circuit featuring: Dual conversion, low noise RF stage, adjustable squelch, automatic noise limiting, external speaker jack, and instantaneous selection of any of the 11 crystal-controlled channels.

The transmitter section was designed around highly reliable silicon transistors and the Mono-Crystal circuit. This circuit makes use of the output of 2 crystal-controlled oscillators which are beat together to produce the desired frequency. The oscillator frequencies were chosen such that the spurious beat frequencies are spaced far enough outside the passband of the transmitter so that they are attenuated to an insignificant level. The transmitter final is a conservatively rated stud-mounted high gain RF power transistor, which feeds into a double Pi-Network Output Circuit and a TVI low-pass filter for harmonic suppression.

The modulator provides high level amplitude modulation employing saturation limiting and negative peak clipping. This allows high talk power without splatter.

1.2 SPECIFICATIONS

1.2.1 GENERAL

Channels:	11 Crystal-Controlled
Size	8-1/2" Wide x 2-3/4" High x 8-1/2" Deep
Weight:	6 Pounds
Antenna:	52-Ohm Coaxial
Primary Power:	Input Voltage - 13.8 VDC (EIA Standard)

Transistor Complement:

Q1	2N2672	RF Amplifier
Q2	2N2672	1st Receiver Mixer
Q3	2N2672	2nd Receiver Mixer
Q4	2N2672	1st IF Amplifier
Q5	2N2672	2nd IF Amplifier
Q6	MPS2716	1st Receiver Audio Amplifier
Q7	MPS2716	2nd Receiver Audio Amplifier
Q8	2N1540	Audio Power Amplifier
Q9	MPS2716	1st Transmit Audio Amplifier
Q10	MPS2716	2nd Transmit Audio Amplifier
Q11	MPS706	33 mc Oscillator
Q12	MPS706	Transmit Mixer
Q13	MPS706	Transmit Buffer
Q14	SM7991	Transmit Driver
Q15	SM7989	Transmit Final
Q101	MPS706	Receiver 6 mc Oscillator
Q102	MPS706	Transmit 6 mc Oscillator

Diode Complement:

CR1	1N34A	Detector
CR2	1N34A	A.N.L. Gate
CR3	11V Zener	Voltage Regulator
CR4	1N2069	Reverse Polarity Protector
CR5	1N2069	Negative Peak Clipper
CR6	1N2069	Squelch Gate
CR7	1N34A	A.G.C. Detector
CR8	1N2069	Reverse Polarity Protector
CR9	1N2069	Transient Suppressor

1.2.2 RECEIVER

Frequency Range:	26.965 – 27.255 mc
Sensitivity:	12 db S+N/N at 1 uv using 1000 cps, 30% modulation
Selectivity:	6 db Bandwidth – 6 kc 20 db Bandwidth – 12 kc 50 db Bandwidth – 20 kc
Image Rejection:	70 db Minimum
Spurious Rejection:	80 db Minimum
Adjacent Channel Rejection:	50 db Minimum
Squelch Range:	Adjustable From 0.5 uv – 2000 uv
Squelch Sensitivity:	0.5 uv or Less Will Open Squelch
Noise Limiter:	Preset Automatic
1st IF Frequency:	5995kc
2nd IF Frequency:	455kc
Speaker:	2-1/4" x 6-1/2" Oval

1.2.3 TRANSMITTER

Frequency Range:	26.965 – 27.255 mc
Carrier Frequency Stability:	± .003% -30° to +65°C
Collector Power Input To Final:	5 Watts Maximum
Output Power:	3 Watts into 52 Ohms with 13.8 VDC Supply
Emission:	8A3
Modulation Capability:	100%
Spurious & Harmonic Suppression:	60 db Minimum

1.3 CITIZENS RADIO SERVICE

According to FCC Rules and Regulations, Part 95, Section 95.1, the Citizens Radio Service is intended "to provide for private short-distance radiocommunications service for the business or personal activities of licensees".

The following are some of the rules and regulations of particular importance to the new licensee:

95.3 (A) **CITIZENS RADIO SERVICE.** "A radiocommunications service of fixed, land and mobile stations intended for short-distance personal or business radiocommunications, radio signaling and control or remote objects or devices by radio; all to the extent that these uses are not specifically prohibited in this part."

95.3 (B) **CLASS D STATION.** "A station in the Citizens Radio Service licensed to be operated on an authorized frequency in the 26.96-27.23 Mc/s band or on the frequency 27.255 Mc/s, with input power of 5 watts or less and for radiotelephony only."

95.105 **CURRENT COPY OF RULES REQUIRED.** "Each licensee in this service shall maintain as part of his station records, a current copy of Part 95, Citizens Radio Service, of this chapter."

TRANSMITTER IDENTIFICATION CARD. "In accordance with Rule 95.101, an identification card, legibly indicating the call sign and the licensee's name and address must be affixed to the transmitter. Attach this card to the side of the transmitter in a readily visible location."

DO NOT TRANSMIT WITH YOUR EQUIPMENT UNTIL YOU HAVE RECEIVED YOUR LICENSE FROM THE FCC. Illegal operation can result in severe penalties. Be sure that you have read and understand Part 95 of the FCC Rules and Regulations before operating your station.

FREQUENCIES AVAILABLE FOR CLASS D OPERATOR

CHANNEL	Mc/s	CHANNEL	Mc/s	CHANNEL	Mc/s
1	26.965	9	27.065*	17	27.165
2	26.975	10	27.075*	18	27.175
3	26.985	11	27.085*	19	27.185
4	27.005	12	27.105*	20	27.205
5	27.015	13	27.115*	21	27.215
6	27.025	14	27.125*	22	27.225
7	27.035	15	27.135	23	27.255*
8	27.055	16	27.155		

*Channels available for communications between units of different stations. (In accordance with FCC Part 95.41 (d) (2).

1.4 H.E.L.P.

The HIGHWAY EMERGENCY LOCATING PLAN was originated by the Automobile Manufacturers Association as a means of promptly summoning aid in the event of a highway emergency. C.B. CHANNEL 9 has been designated as the channel to be monitored and used for this program.

Operation for this purpose is simple:

1. To initiate a call for aid, turn on your ESCORT II, rotate the channel selector to CHANNEL 9.
2. Listen to be sure that the channel is not in use.
3. When the channel is clear, press the microphone button and speak as follows – "THIS IS (Give Radio License Number) CALLING A H.E.L.P. MONITOR. I NEED (Police, Garage, Doctor). GO AHEAD PLEASE.
4. Release the microphone button and listen for a reply. If none is heard, repeat the message.
5. When message is acknowledged, give specific information on – Name and location; description and license number of vehicle; the nature of your problem; kind of help desired.

Your ESCORT II is delivered to you with the crystals for CHANNEL 9 already installed for this use. Sockets are provided for additional Citizens Band crystals. When additional frequencies are specifically authorized for H.E.L.P. use, your ESCORT II can easily be modified to operate on these by inserting one crystal into the available socket.

Other features which are included in your ESCORT II to make it desirable for H.E.L.P. use:

1. The ESCORT II remains operational at battery voltages even below 9.5 volts. This means that when the battery is too low to operate the starter, a call for assistance can still be transmitted.
2. Sufficient channels are provided to accommodate not only special H.E.L.P. channels, but several Citizens Band channels as well.

SECTION II

INSTALLATION AND INITIAL ADJUSTMENT

IMPORTANT

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

2.1 MOBILE STATION INSTALLATION

2.1.1 MOUNTING

For mobile installation, the adjustable universal mounting cradle serves as a means of mounting your ESCORT II in any position and attitude which will be convenient to the user (See Figure 2.1 for a typical automobile installation). After you have determined the most convenient location in your vehicle, hold the ESCORT II, mounted in the cradle, in the exact location desired. If nothing will interfere with mounting it in the desired position, remove the cradle from the ESCORT II and use it as a template to mark the location for the mounting bolts. Before drilling the holes, make sure nothing will interfere with the installing of the mounting bolts.

Figure 2.1

2.1.2 POWER CONNECTION

The ESCORT II is constructed to be used in vehicles using negative ground systems ONLY. The red power lead is to be connected to the positive terminal of the battery. The black lead is to be connected to ground. (The radio is reverse polarity protected. If you make a mistake in connecting the power leads, the radio will not be damaged. It will be inoperative until the power is connected correctly.) If existing wiring is used, be sure that it is heavy enough to prevent voltage drop to the radio. A good source of positive battery voltage is at the accessory connection on the ignition switch. Using this as a power source insures the radio will be off when the ignition switch is turned "OFF", and power will be supplied to the radio when it is in the "ON" or "ACCESSORY" position.

2.1.3 ANTENNAS

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

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

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

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

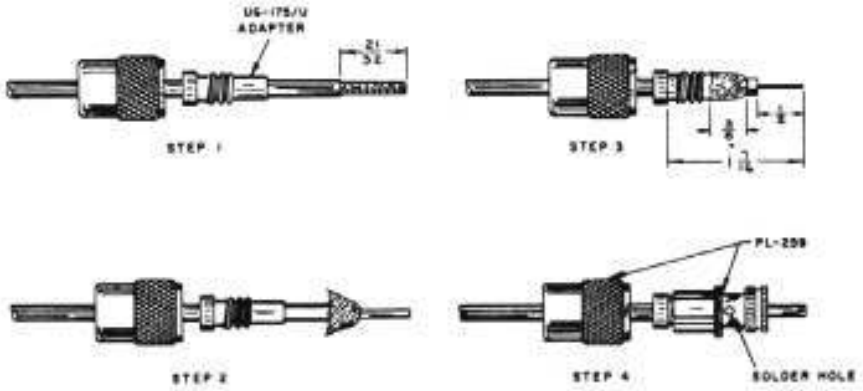
There are also newer mobile antennas on the market which are made to replace the entertainment radio antenna and are similar in appearance. These antennas serve three purposes: AM and FM entertainment broadcast reception and Citizens Band transmission and reception. With some of these antennas, it is possible to simultaneously transmit on CB and receive on AM broadcast without interaction. These antennas are quite efficient for all three types of operation when properly adjusted.

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

Your PEARCE-SIMPSON dealer is prepared to offer advice and will help you choose the most desirable antenna for your needs.

2.1.4 TRANSMISSION LINE

To connect an antenna to the transceiver, a 52 coaxial transmission line is required. RG-8/U coax is recommended for lengths in excess of 50 feet and RG-58/U coax is recommended for lengths less than 50 feet to connect to the transceiver. The RG-8/U requires a PL-259 type connector and the RG-58/U coax requires a PL-259 connector with a UG-175/U adaptor. (See Figure 2.2 for assembling connector to RG-58/U.)



ASSEMBLING ANTENNA PLUG TO RG-58U
OR OTHER ¼" COAXIAL CABLE

FIGURE 2.2

2.2 INITIAL ADJUSTMENTS

This unit HAS BEEN PRECISELY TUNED at the factory and is set for maximum power efficiency to conventional mobile and base antennas, provided the antenna in installed per manufacturer's instructions.

It is, therefore, NOT NECESSARY to make any adjustments in the field.

If a malfunction occurs, it will be necessary to follow Section 4.5 using the test equipment listed.

2.3 NOISE SUPPRESSION

The ESCORT II contains a built-in automatic noise limiter and input power filtering. In most vehicular installations, the noise suppression for the entertainment radio will be sufficient. Vehicles and boats not having this suppression may require that it be installed. In most cases, installation of distributor suppressors and generator condensers will be sufficient. In severe cases, the services of a qualified technician may be required. See your Pearce-Simpson Dealer for advice.

2.4 ADDING NEW CHANNELS

Because your ESCORT II has the new PEARCE-SIMPSON Mono-crystal HetroSync" circuit, you need to add only one crystal for both transmit and receive to add a new channel. Crystals should be ordered from your local dealer or directly from Pearce-Simpson, Inc.

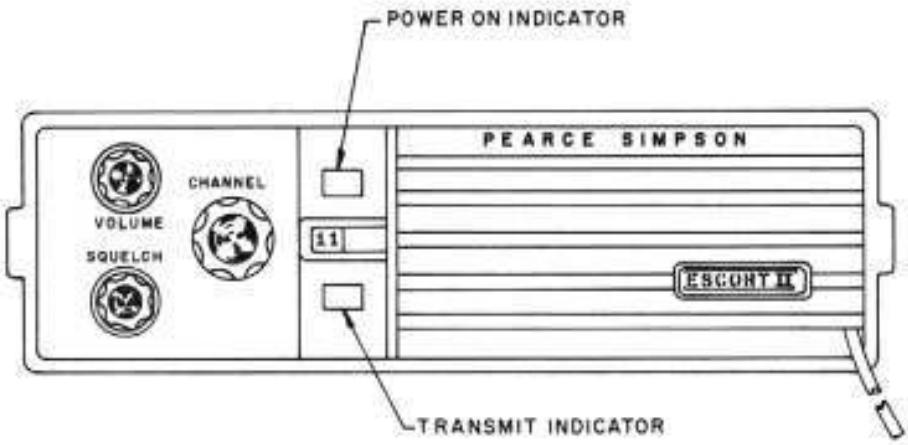
To install your new crystals, remove the top cover from your ESCORT II. Refer to Figure 4.3 "Component Layout" in order to determine which socket to insert the crystal for the channel (A through K) you wish to use. See Figure 4.2 "Crystal Chart" to select the crystal required for the channel you wish to add.

SECTION III

OPERATING INSTRUCTIONS

3.1 CONTROLS AND INDICATORS

There are three controls and two indicators on the front panel of your ESCORT II. See Figure 3.1



ESCORT II FRONT PANEL
FIGURE 3.1

3.1.1 Channel Selector

The Channel Selector Switch has 11 operating positions. This switch sets both transmit and receive frequencies simultaneously by switching the proper crystal into the Pearce-Simpson Mono-crystal HetroSync[R] circuit for any one of the selected 11 CB channels.

3.1.2 Squelch Control

The Squelch Control is used to silence background noises (atmospheric or man-made noise) in the absence of a received radio signal. In the full counterclockwise position, the ESCORT II is unsquelched, (No noise silencing at all). In the fully clockwise position, the unit is squelched for even very strong signals.

3.1.3 Volume Control and ON-OFF Switch

This control turns the power ON and OFF and adjusts the loudness of receiver signals.

3.1.4 Power On Indicator

This Indicator is a red light which is turned on when the ON-OFF Switch is in the ON position and remains illuminated at all times when your ESCORT II unit is transmitting or receiving.

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® 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® 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® 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® 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" 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 Hetro-Sync" 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" 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® 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® 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® 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® 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 secondpeak 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® 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® 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® 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.

REPLACEMENT PARTS

RESISTORS

SYMBOL	DESCRIPTION	PART NUMBER
R-1	1000 Ohms ¼ Watt	2025-102
R-2	1000 Ohms ¼ Watt	2025-102
R-3	1000 Ohms ¼ Watt	2025-102
R-4	390 Ohms ¼ Watt	2025-391
R-5	1000 Ohms ¼ Watt	2025-102
R-6	470 Ohms ¼ Watt	2025-471
R-7	47 Ohms ¼ Watt	2025-470
R-8	1000 Ohms ¼ Watt	2025-102
R-9	1000 Ohms ¼ Watt	2025-102
R-10	4700 Ohms ¼ Watt	2025-472
R-11	10,000 Ohms ¼ Watt	2025-103
R-12	1000 Ohms ¼ Watt	2025-102
R-13	22,000 Ohms ¼ Watt	2025-223
R-14	100,000 Ohms ¼ Watt	2025-104
R-15	18,000 Ohms ¼ Watt	2025-183
R-16	150,000 Ohms ¼ Watt	2025-154
R-17	270,000 Ohms ¼ Watt	2025-274
R-18	50,000 Ohms Control (Vol.)	2008-054
R-19	220,000 Ohms ¼ Watt	2025-224
R-20	3,300,000 Ohms ¼ Watt	2025-335
R-21	22,000 Ohms ¼ Watt	2025-223
R-22	8,200 Ohms ¼ Watt	2025-822
R-23	47,000 Ohms ¼ Watt	2025-473
R-24	10,000 Ohms ¼ Watt	2025-103
R-25	27 Ohms 1 Watt	2002-470
R-26	33 Ohms ½ Watt	2001-330
R-27	180 Ohms 2 Watts	2003-181
R-28	5 Ohms 5 Watts	2011-018
R-29	2 Ohms 5 Watts	2011-003
R-30	100 Ohms ½ Watt	2001-101
R-31	820,000 Ohms ¼ Watt	2025-824
R-32	33,000 Ohms ¼ Watt	2025-333
R-33	10,000 Ohms ¼ Watt	2025-103
R-34	1,000 Ohms ¼ Watt	2025-102
R-35	2,700 Ohms ¼ Watt	2025-272
R-36	1,000 Ohms ¼ Watt	2025-102
R-37	22,000 Ohms ¼ Watt	2025-223
R-38	10,000 Ohms ¼ Watt	2025-103
R-39	1,000 Ohms ¼ Watt	2025-102
R-40	10,000 Ohms ¼ Watt	2025-103
R-41	8,200 Ohms ¼ Watt	2025-822

REPLACEMENT PARTS - RESISTORS (Continued)

SYMBOL	DESCRIPTION	PART NUMBER
R-42	680 Ohms ⅛ Watt	2025-681
R-43	50,000 Ohms Control (Squelch)	2008-055
R-44	22,000 Ohms ⅛ Watt	2025-223
R-45	4,700 Ohms ⅛ Watt	2025-472
R-46	4,700 Ohms ⅛ Watt	2025-472
R-47	470 Ohms ⅛ Watt	2025-471
R-48	1,800 Ohms ⅛ Watt	2025-182
R-49	6,800 Ohms ⅛ Watt	2025-682
R-50	470 Ohms ⅛ Watt	2025-471
R-51	10,000 Ohms ⅛ Watt	2025-103
R-52	470 Ohms ⅛ Watt	2025-471
R-53	180 Ohms ⅛ Watt	2025-181
R-54	2,200 Ohms ⅛ Watt	2025-222
R-55	1,000 Ohms ⅛ Watt	2025-102
R-56	120 Ohms ⅛ Watt	2025-121
R-57	100 Ohms ⅛ Watt	2025-101
R-58	12 Ohms ⅛ Watt	2025-120
R-59	2.7 Ohms ½ Watt	2000-017
R-61	47,000 Ohms ⅛ Watt	2025-473
R-101	8,200 Ohms ⅛ Watt	2025-822
R-102	15,000 Ohms ⅛ Watt	2025-153
R-103	680 Ohms ⅛ Watt	2025-681
R-104	15,000 Ohms ⅛ Watt	2025-153
R-105	8,200 Ohms ⅛ Watt	2025-822
R-106	680 Ohms ⅛ Watt	2025-681

CAPACITORS

C-1	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-2	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-3	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-4	1PF 10% 500 WVDC Molded	0401-041
C-5	1PF 10% 500 WVDC Molded	0401-041
C-6	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-7	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-8	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-9	2.2PF 10% 500 WVDC Molded	0401-042
C-10	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-11	.05MFD +80 -20% 100 WVDC Disc Ceramic	0401-066
C-12	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-13	.05MFD +80 -20% 100 WVDC Disc Ceramic	0401-066
C-14	.001MFD 20% 1000 WVDC Disc Ceramic	0401-015
C-15	.001MFD 20% 1000 WVDC Disc Ceramic	0401-015

REPLACEMENT PARTS - CAPACITORS (Continued)

SYMBOL	DESCRIPTION	PART NUMBER
C-16	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-17	.47MFD 20% 10 WVDC Disc Ceramic	0401-054
C-18	.003MFD 20% 1000 WVDC Disc Ceramic	0401-016
C-19	.1MFD +80 -20% 50 WVDC Disc Ceramic	0401-034
C-20	.1MFD +80 -20% 50 WVDC Disc Ceramic	0401-034
C-21	160MFD 25 WVDC Electrolytic	0406-053
C-22	125MFD 16 WVDC Electrolytic	0406-049
C-23	1000MFD 16 WVDC Electrolytic	0406-057
C-24	1000MFD 16 WVDC Electrolytic	0406-057
C-25	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-26	15MFD 15 WVDC Tantalex	0409-001
C-27	2MFD 25 WVDC Electrolytic	0406-016
C-28	15MFD 15 WVDC Tantalex	0409-001
C-29	15MFD 15 WVDC Tantalex	0409-001
C-30	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-31	39PF 5% 500 WVDC Dur-Mica	0402-058
C-32	5-25PF Trimmer	0403-033
C-33	12PF 5% 500 WVDC Dur-Mica	0402-056
C-34	18PF 5% 500 WVDC Dur-Mica	0402-053
C-35	1000MFD 16 WVDC Electrolytic	0406-057
C-36	2.2MFD 3 WVDC Disc Ceramic	0401-060
C-37	2.2MFD 3 WVDC Disc Ceramic	0401-060
C-38	.05MFD +80 - 20% 100 WVDC Disc Ceramic	0401-066
C-39	.33MFD 20% 200 WVDC Mylar	0404-025
C-40	470PF 5% 100 WVDC Dur-Mica	0402-052
C-41	8PF 2% 500 WVDC Dur-Mica	0402-049
C-42	.05MFD +80 -20% 100 WVDC Disc Ceramic	0401-066
C-43	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-44	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-45	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-46	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-47	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-48	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-49	47PF 5% 500 WVDC Dur-Mica	0402-057
C-50	25-280PF Compression Trimmer	0403-041
C-51	.001 MFD 1000 WVDC Disc Ceramic	0401-015
C-53	50PF 10% 500 WVDC Dur-Mica	0402-039
C-54	75PF 5% 500 WVDC Dur-Mica	0402-061
C-55	330PF 5% 500 WVDC Dur-Mica	0402-055
C-56	.001MFD 20% 1000 WVDC Disc Ceramic	0401-015
C-57	130PF 5% 500 WVDC Dur-Mica	0402-043
C-58	.001MFD 20% 1000 WVDC Disc Ceramic	0401-015

REPLACEMENT PARTS - CAPACITORS (Continued)

SYMBOL	DESCRIPTION	PART NUMBER
C-101	39PF 5% 500 WVDC Dur-Mica	0402-058
C-102	47PF 5% 500 WVDC Dur-Mica	0402-057
C-103	270PF 5% 100 WVDC Dur-Mica	0402-060
C-104	.01PF 20% 50 WVDC Disc Ceramic	0401-032
C-105	470PF 5% 100 WVDC Dur-Mica	0402-052
C-106	.01PF 20% 50 WVDC Disc Ceramic	0401-032
C-107	47PF 5% 500 WVDC Dur-Mica	0402-057
C-108	50PF 10% 500 WVDC Dur-Mica	0402-039
C-109	270PF 5% 100 WVDC Dur-Mica	0402-060
C-110	.01MFD 20% 50 WVDC Disc Ceramic	0401-032
C-111	.05MFD +80-20% 100 WVDC Disc Ceramic	0401-066

TRANSFORMERS

T-1	27.1 mc Antenna Input	1201-153
T-2	27.1 mc Receiver Interstage	1201-152
T-3	6.015 mc IF	1201-151
T-4	455 kc IF	1201-150
T-5	455 kc IF	1201-150
T-6	455 kc IF	1201-150
T-7	455 kc IF	1201-150
T-8	Audio Driver	1202-096
T-9	Modulation	1202-136
T-10	27.1 mc Transmitter Interstage	1201-157
T-11	27.1 mc Transmitter Interstage	1201-154
T-12	27.1 mc Driver Transformer	1201-149

INDUCTANCES

L-1	RFC 5.6 uh	1201-144
L-2	RFC 15 uh	1201-145
L-3	RFC 5.6 uh	1201-144
L-5	RFC 5.6 uh	1201-144
L-6	Pi-Net Coil No. 1	1201-147
L-7	Pi-Net Coil No. 2	1201-148
L-8	TVI Filter Coil	1201-120
L-9	RFC 5.6 uh	1201-144
L-101	RFC 10 uh	1201-146
L-102	RFC 10 uh	1201-146

SEMICONDUCTORS

SYMBOL	DESCRIPTION	PART NUMBER
Q-1	2N2672 RF Amplifier	2904-016
Q-2	2N2672 1st Receiver Mixer	2904-016
Q-3	2N2672 2nd Receiver Mixer	2904-016
Q-4	2N2672 1st IF Amplifier	2904-016
Q-5	2N2672 2nd IF Amplifier	2904-016
Q-6	MPS2716 1st Receiver Audio Amplifier	2904-034
Q-7	MPS2716 2nd Receiver Audio Amplifier	2904-034
Q-8	2N1540 Audio Power Amplifier	2904-008
Q-9	MPS2716 1st Transmit Audio Amplifier	2904-034
Q-10	MPS2716 2nd Transmit Audio Amplifier	2904-034
Q-11	MPS706 33 mc Oscillator	2904-033
Q-12	MPS706 Transmit Mixer	2904-033
Q-13	MPS706 Transmit Buffer	2904-033
Q-14	SM7991 Transmit Driver	2904-032
Q-15	SM7989 Transmit Final	2904-030
Q-101	MPS706 Receiver 6 mc Oscillator	2904-033
Q-102	MPS706 Transmit 6 mc Oscillator	2904-033
CR-1	1N34A Detector	2102-010
CR-2	1N34A A.N.L.Gate	2102-010
CR-3	11V Voltage Regulator	2102-023
CR-4	1N2069 Reverse Polarity Protector	2102-014
CR-5	1N2069 Negative Peak Clipper	2102-014
CR-6	1N2069 Squelch Gate	2102-014
CR-7	1N34A A.G.C. Detector	2102-010
CR-8	1N2069 Reverse Polarity Protector	2102-014
CR-9	1N2069 Transient Suppressor	2102-014

MISCELLANEOUS

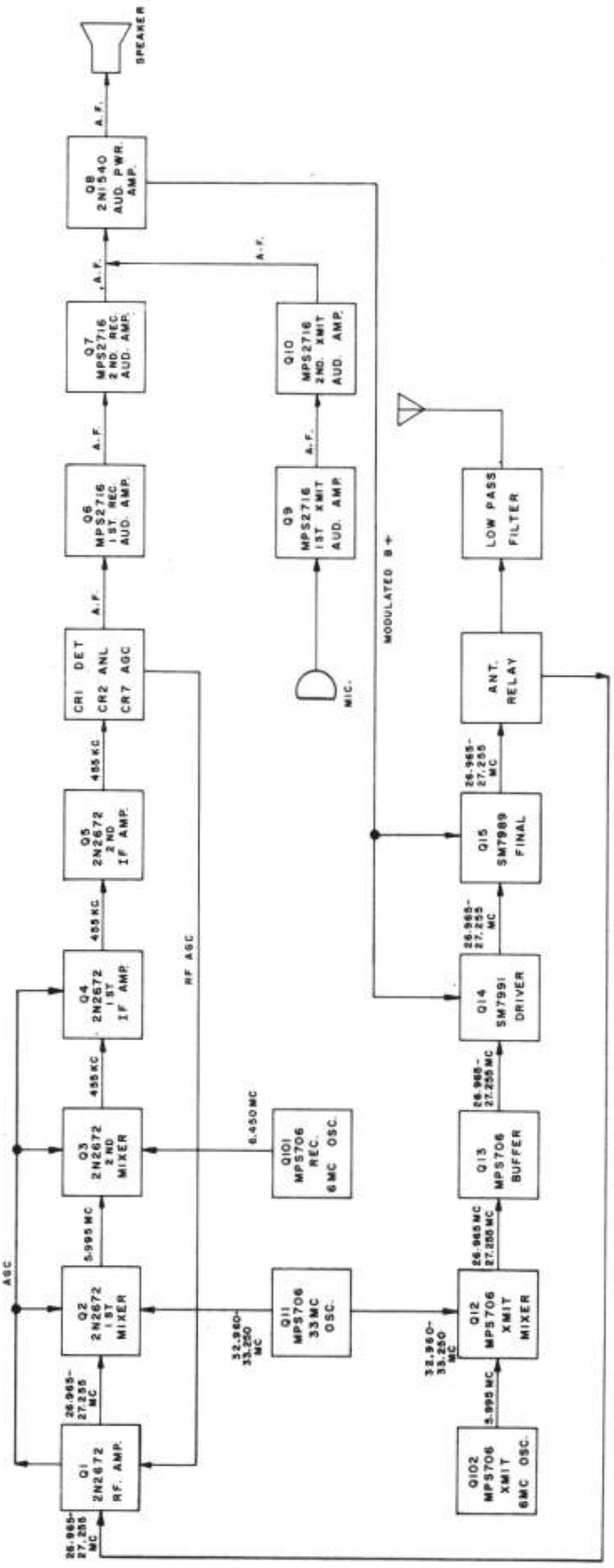
Fuse 3 Amp.	0801-002
Fuse Holder	0802-001
Knob, Screw Cradle	1103-077
Retainer, Transistor Socket	1103-107
Knob, Front Small	1301-055
Knob, Front Large	1301-056
Mounting Cradle Ass'y	2601-055
Side Rail	1508-051
Cover	1510-035
Channel Disc	1511-065
Panel Plastic Ass'y	2601-057
Microphone	1601-017
Pilot Lamp No. 1705	1801-023

REPLACEMENT PARTS - MISCELLANEOUS (Continued)

DESCRIPTION	PART NUMBER
Relay	1902-020
Crystal Socket	2301-057
Crystal Socket Spec.	2301-069
Transistor Socket	2301-067
Antenna Connector	2303-004
Power Connector Male	2303-039
Power Connector Female	2303-040
Speaker 2-¼ x 6-½	2501-021
Channel Selector	2701-076
Teflon Terminal	2805-001
Teflon Feedthru	2805-002
Driver Heat Sink	2905-001

CRYSTALS

FREQUENCY	
32.960	0511-001
32.970	0511-002
32.980	0511-003
32.000	0511-004
33.010	0511-005
33.020	0511-006
33.030	0511-007
33.050	0511-008
33.060	0511-009
33.070	0511-010
33.080	0511-011
33.100	0511-012
33.110	0511-013
33.120	0511-014
33.130	0511-015
33.150	0511-016
33.160	0511-017
33.170	0511-018
33.180	0511-019
33.200	0511-020
33.210	0511-021
33.220	0511-022
33.250	0511-023

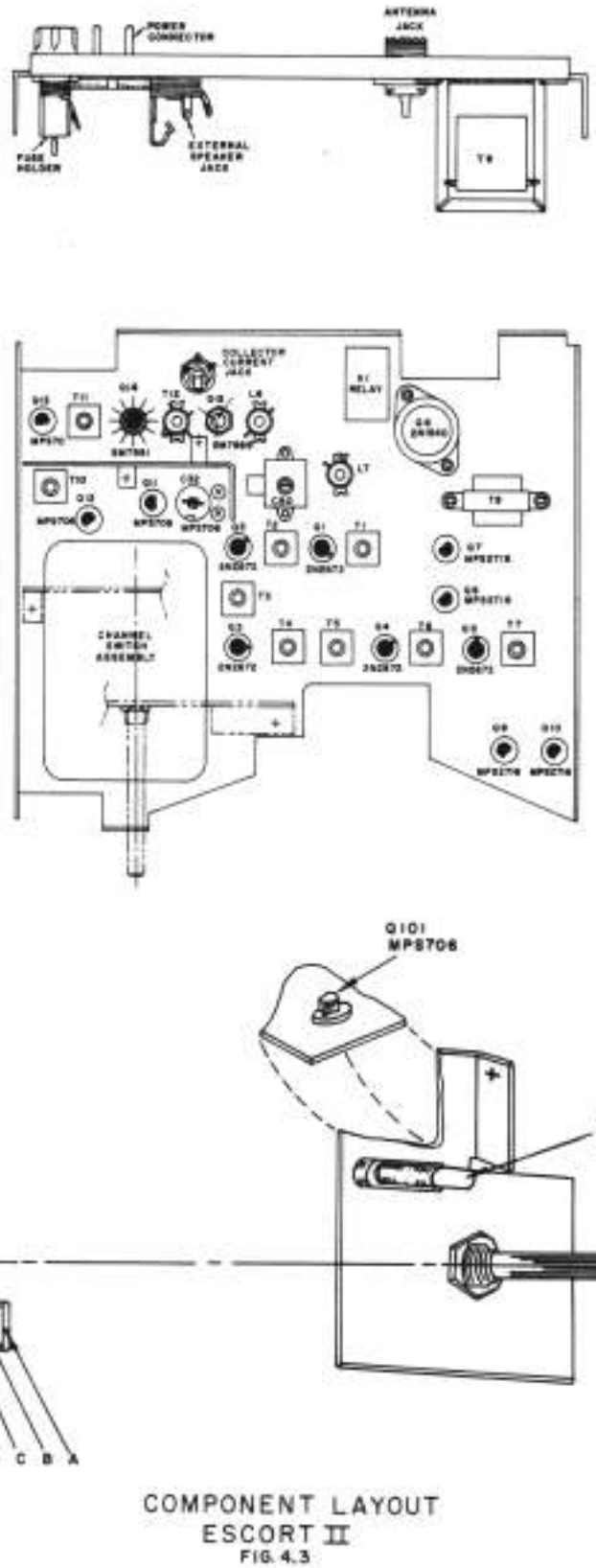


ESCORT II
BLOCK DIAGRAM
FIG. 4.1

FIGURE 4.1
BLOCK DIAGRAM

CHANNEL	CRYSTAL FREQUENCY
1	32.960
2	32.970
3	32.980
4	33.000
5	33.010
6	33.020
7	33.030
8	33.050
9	33.060
10	33.070
11	33.080
12	33.100
13	33.110
14	33.120
15	33.130
16	33.150
17	33.160
18	33.170
19	33.180
20	33.200
21	33.210
22	33.220
23	33.250

FIGURE 4.2
CRYSTAL CHART



COMPONENT LAYOUT
ESCORT II
FIG. 4.3

FIGURE 4.3
COMPONENT LAY-OUT

FIGURE 4.4
DC VOLTAGE CHARTS

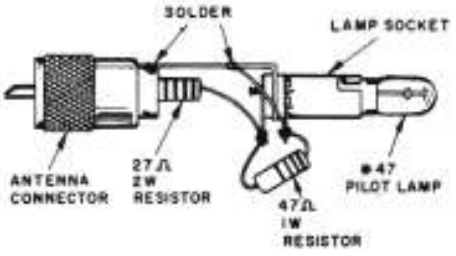
RECEIVER

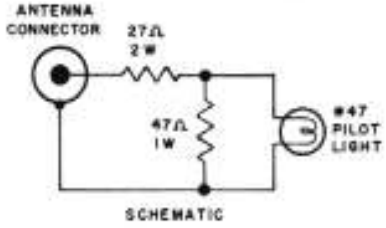
SYMBOL	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q11	Q101
EMITTER	+9.7	+10	+10	+10.1	+7.5	+1.0	+1.2	+11.2	+5.5	+6
BASE	+9.5	+9.8	+9.8	+9.7	+7.3	+1.5	+1.8	+11.0	+4.6	+3.2
Collector	0	0	0	0	0	+10.8	+10.5	+.5	+10.8	+10.8

TRANSMITTER

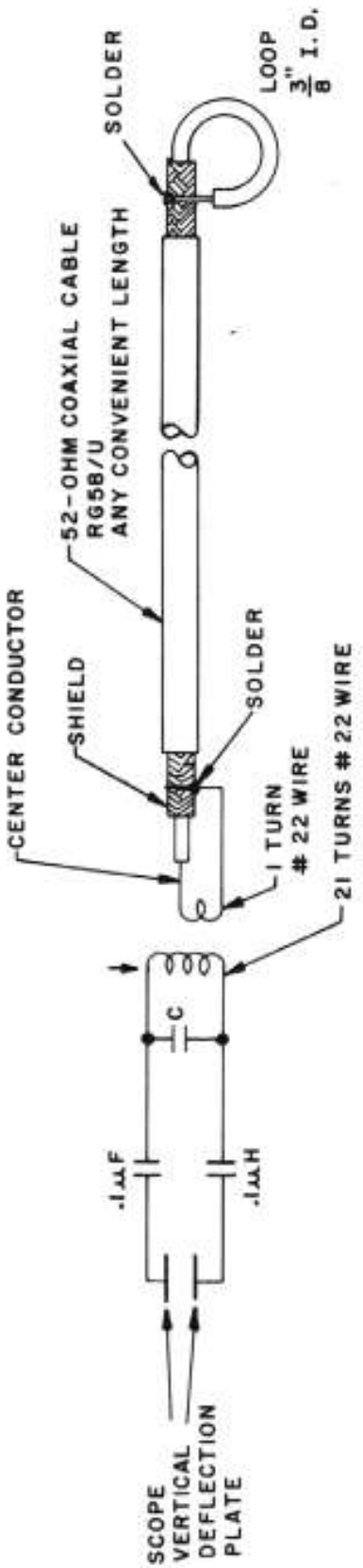
SYMBOL	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q102
EMITTER	+11.2	+1.2	+2.4	+5.4	1.0	+2.5	0	0	+5
BASE	+11.0	+1.8	+3.0	+4.4	.5	+3.0	−.2	−.2	+2
Collector	+1.5	+5.8	+10.0	+10.8	+10.8	+10.8	+12.2	+12.2	+10.8

NOTE - 1. Measurements made with VTVM.
2. Receiver measurements made with no signal and squelch control set fully CCW
3. Supply voltage set to 13.8 VDC
4. Transmitter was unmodulated and loaded to 5 watts input





PEARCE SIMPSON
RECOMMENDED DUMMY ANTENNA FOR CITIZENS BAND TRANSMITTER ADJUSTMENTS.



NOTES:

1. THE VALUE OF C IN THE TUNED CIRCUIT MAY RANGE FROM 5 TO 10PF DEPENDING ON THE OSCILLOSCOPE IT IS USED ON.
2. TRANSFORMER WOUND ON 3/8" COIL FORM WITH TUNABLE IRON CORE. SUGGESTED COIL FORM IS CAMBION # 1465-3-1
3. TUNE SLUG FOR MAXIMUM SCOPE VERTICAL DEFLECTION.

R.F. PICK-UP LOOP FOR OSCILLOSCOPE

FIG. 4.6

FIGURE 4.6
RF PICK UP LOOP

PEARCE-SIMPSON, INC.

P. O. Box 800, Biscayne Annex, Miami, Florida 33152