JOHNSON

OPERATING/SERVICE MANUAL

VIKING 352

CITIZENS RADIO TRANSCEIVER
PART NO. 242-0352-002

First Printing
Covers:
Viking 352 "A" Model
June, 1975

THE JOHNSON ONE YEAR GUARANTEE

WITHIN ONE YEAR OF PURCHASE THE E. F. JOHNSON COMPANY WILL PROVIDE THE PARTS AND LABOR TO REPAIR YOUR JOHNSON EQUIPMENT IF IT IS DEFECTIVE IN MATERIAL OR WORKMANSHIP. JUST RETURN THE UNIT TO ANY AUTHORIZED JOHNSON SERVICE CENTER IN THE UNITED STATES.

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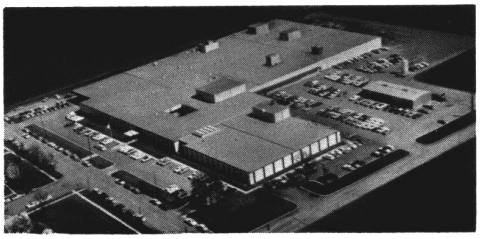

The E. F. Johnson Company and its subsidiary, Comco, manufacture communications equipment to serve more markets than any other firm in America. In addition to two-way radio equipment for business and industrial users and for government, aeronautical, marine, public safety and personal communications, Johnson produces FM radio paging systems and electronic components.

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SPECIFICATIONS

(Measurements are made per EIA Standard RS-382 and are nominal unless otherwise stated.)

GENERAL	
Channels	23
Frequency Range	26.965 to 27.255 MHz
Frequency Control	±0.005% crystal, -30°C to +60°C transmit and receive
Overall Dimensions	6.1 cm H x 19 cm W x 27.2 cm D (2.4 in H x 7.5 in W x 10.7 in D)
Weight -	
Unit	2.75 kg (6 lbs)
Shipping	3.20 kg (7 lbs)
Microphone	Ceramic microphone with neoprene cord
Antenna Impedance	50 ohms
Circuitry	32 transistors, 54 diodes, 2 integrated circuits
Intermediate Frequency	7.8 MHz
Metering	Received signal strength/relative power output
Power Requirements	13.8 VDC positive or negative ground 0.4A squelched receive 1.8A fully modulated transmit
Circuit Protection	4 ampere fuse
Compliance	FCC Type Accepted Rule 95 (D)
RECEIVER	
Sensitivity	
AM	10 dB (S+N)/N at 0.5 (1.0)*µV input
SSB	10 dB (S+N)/N at 0.35 (0.5)*µV input
Selectivity	4.5 kHz minimum bandwidth at -6 dB and 30 kHz maximum bandwidth at -60 dB
Spurious Rejection	50 dB
Audio Output Power	2 watts with less than 10% distortion at 1000µV, 1000 Hz
Tight Squelch	
AM	50 (30)*µV minimum and 2000µV maximum (NB on)
SSB	25 (15)*µV minimum and 1000µV maximum (NB on)
Squelch Sensitivity	3 dB or less signal change for 40 dB quieting at 1µV
AGC Characteristics	
AM	Flat within ±6 dB from 250,000 to 5µV with 15 dB ±4 rolloff from 5 to 0.5µV
SSB	Flat within +2/-8 dB from 250,000 to 5µV with 15 dB ±4 rolloff from 5 to 0.5µV
Speaker Impedance	8 ohms
Receiver Incremental Tune	±1350 maximum ±600 Hz minimum
TRANSMITTER	
Emission	
AM	6A3
SSB	3A3J
RF Power Output	
AM	3 watts minimum/4 watts maximum at 13.8 VDC
SSB	8 watts PEP minimum/12 watts PEP maximum at 13.8 VDC
RF Spurious and Harmonic Attenuation	50 dB
Audio Frequency Response	
AM	+2/-16 dB from 300 to 3000 Hz
SSB	+2/-20 dB from 300 to 3000 Hz
Modulation	80 (70%)* minimum positive and negative
Carrier Suppression	
SSB	40 dB
Unwanted Sideband Suppression	
SSB	50 dB

* MINIMUM PERFORMANCE SPECIFICATIONS are shown in parenthesis if other than NOMINAL value

OPERATING INSTRUCTIONS

GENERAL INFORMATION

Introduction

The Viking 352 is a compact 23 channel AM/SSB Citizens Radio transceiver which operates in a full carrier AM mode or a fully suppressed upper or lower A3J single sideband mode. It includes a fully synthesized 23 channel single conversion receiver for both AM and SSB modes.

Features

- o ALL SOLID STATE - Transistorized construction for low current drain and a long, trouble-free life.
- o FULL 23 CHANNEL OPERATION - No additional crystals are required for full Citizens Radio coverage.
- o METERING - The illuminated front panel meter indicates received signal strength in the receive mode. In the transmit mode you can read percent of modulation, and relative power output.
- o LARGE CHANNEL SELECTOR - An illuminated dial lets you see several channel numbers at once for easy channel selection.
- o PUBLIC ADDRESS FUNCTION - Useful for paging, remote monitoring and other needs.
- o FULL LEGAL POWER - RF output level is controlled by an automatic level control (ALC) circuit which provides full legal undistorted "talk power" for any voice.

Inspection

Carefully inspect your transceiver for possible shipping damage. Report any damage immediately to the transportation service--not to the E. F. Johnson Company.

Citizens Radio License

DO NOT TRANSMIT WITH YOUR EQUIPMENT UNTIL YOU HAVE RECEIVED YOUR LICENSE FROM THE FCC. ILLEGAL OPERATION CAN RESULT IN SEVERE PENALTIES.

An FCC Citizens Radio License application, FCC Form 505, is included with each transceiver, as well as a copy of the Citizens Radio Service Rules and Regulations, Part 95. If you do not already have a license, fill out the license application (FCC Form 505) as soon as possible and forward it to the Federal Communications Commission, Gettysburg, Pennsylvania 17325.

Before filling out FCC Form 505, read the instructions carefully--they are clear and easy to follow. When you sign FCC Form 505, you are affirming that you are in possession of, understand, and agree to abide by all of the rules and regulations of the Citizens Radio Service. While waiting for the FCC to process your license, take the time to review and thoroughly understand all of them. Remember, "I didn't know" is no excuse for violation of rules.

IMPORTANT: Effective March 1, 1975, the FCC license fee for Class "D" Citizens Radio is $4.00.

Use FCC Form 505 for license application and make your check payable to Federal Communications Commission.

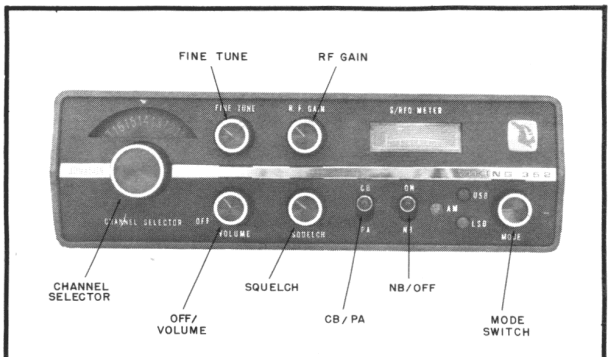
FEDERAL COMMUNICATIONS COMMISSION RULES AND REGULATIONS PROHIBIT TAMPERING WITH ANY INTERNAL RADIO ADJUSTMENTS. TAMPERING WITH INTERNAL ADJUSTMENTS CAN SOMETIMES CAUSE ILLEGAL OPERATION.

ONLY QUALIFIED TECHNICIANS HOLDING A VALID COMMERCIAL FIRST OR SECOND CLASS RADIO OPERATOR'S LICENSE, OR PERSONS UNDER THEIR IMMEDIATE SUPERVISION, ARE AUTHORIZED TO ADJUST RADIO TRANSMITTERS.

WARRANTY REGISTRATION

Fill the warranty registration card out completely on both sides and return it to the E. F. Johnson Company as soon as possible to ensure that your warranty will be effective.

OPERATING SUMMARY



FRONT VIEW
FIGURE 1

Note: Refer to the Installation Section of this manual for instructions concerning installation of the transceiver.

To Receive:

OFF-Volume - Rotate clockwise past click position and set for a comfortable message volume level.

CB-PA - Set to CB position.

NB-OFF - Set to OFF position when receiving normal signal. Set to NB (Noise Blanker) position when noisy signal is being received.

USB-LSB-AM MODE - A red lamp indicates USB (Upper Sideband), a blue lamp indicates LSB (Lower Sideband) and an amber lamp indicates AM (Amplitude Modulation). Set this switch to the desired mode of operation.

CHANNEL SELECTOR - Set to the desired operating channel.

RF GAIN - Adjust this control clockwise on weak received signal levels.

FINE TUNE CONTROL - Adjust this control to the point where the received signal sounds most natural.

SQUELCH - Advance this control clockwise to the point where speaker sound is "squelched" or cut off.

To Transmit:

USB-LSB-AM MODE - Set this switch to the desired mode of operation.

CHANNEL SELECTOR - Set to the desired operating channel.

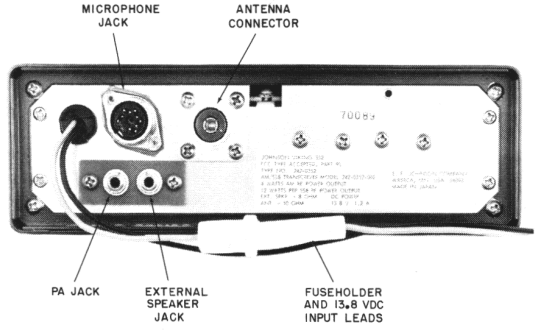
CB-PA - Ensure that this switch is in the CB position.

MICROPHONE - Depress the push-to-talk (PTT) button and speak directly into the microphone grille (one or two inches away) in a normal voice. Release the PTT button to hear reply.

Note: When the microphone PTT switch is depressed, the VIKING logo will glow red.

To Use PA (Public Address):

CB-PA - Set to PA position.



REAR VIEW
FIGURE 2

PA SPKR JACK - An external speaker, E. F. Johnson Part No. 250-0064-001, must be connected to this jack for PA operation.

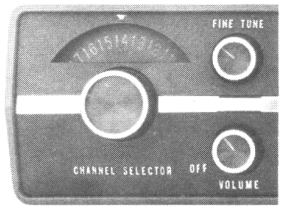
MICROPHONE - Depress the PTT button and speak directly into the mouthpiece.

GENERAL OPERATION

CHANNEL SELECTION

The channel selector switch is a 24 position switch. The open position between channels 22 and 23 disables the transceiver. Do not attempt to transmit in this switch position.

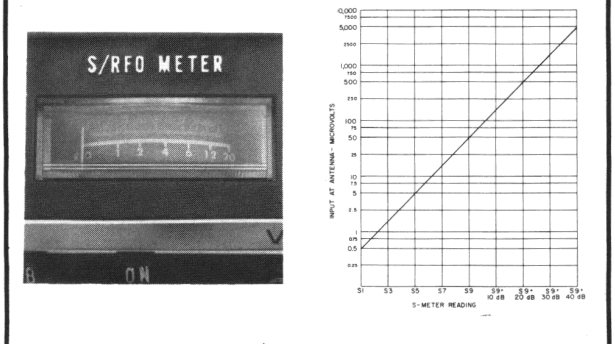
The illuminated channel selector indicator allows you to see the channel switch positions adjacent to the channel on which you are operating. This is an aid in channel switching, since it reminds you which direction you should rotate the channel selector switch for any desired channel.



CHANNEL SELECTOR SWITCH
FIGURE 3

SIGNAL STRENGTH - RELATIVE POWER OUTPUT METER

The transceiver features a front panel mounted meter which monitors received signal strength and transmitted relative power output. The upper scale indicates received signal strength (S). Refer to the graph to determine actual signal strength, expressed in microvolts (μV), of a received signal at given "S" meter readings. The meter indication varies when you speak into the microphone, indicating voice variations (modulation).



S/RFO METER
FIGURE 4

TRANSMITTER POWER CHECK

The relative output meter function measures the radio frequency voltage at the antenna jack on a scale that indicates power into a 50 ohm load. The nominal reading is "4." It is to be expected that your antenna will not present exactly a 50 ohm load to the transmitter, and that the antenna load will vary between channels 1 and 23. The power indication may, therefore, vary from the nominal reading of "4" on the relative output scale.

TRANSMITTER MODULATION CHECK

Transmitter modulation (voice transmission) is indicated by meter deflection variations when speaking into the microphone.

ANTENNA

Your transceiver is designed to operate into a 50 ohm, 27 MHz, CITIZENS RADIO antenna. Results obtained with your transceiver will be determined mainly by antenna system quality and proper antenna installation practices. (Refer to the antenna installation instructions included with your antenna.)

FCC rules and regulations concerning antenna structure height limitations allow the highest point of our omnidirectional antenna to be located up to 60 feet above ground level. However, there is a 20-foot height restriction on the highest point of a directional antenna (effective September 6, 1974).

Refer to FCC Part 95 Citizens Radio Service Rules and Regulations, Section 95.37 (C) for complete antenna requirement details.

The antenna should be as high as permissible, and as clear of surrounding objects (buildings, trees, power lines, etc.) as the location permits. If it is possible to increase antenna height by placing it on a nearby building, it may be worthwhile, even though the lead-in must be extended.

After installation of the antenna, the standing wave ratio (SWR) should be checked. The SWR should be regularly checked thereafter (consult a service technician for assistance).

OPERATING PROCEDURE

For most satisfactory transmitter operation, hold the microphone from one to two inches from your mouth and speak slowly and distinctly into the mouthpiece in a normal conversational manner. Depress the microphone push-to-talk switch before you start to speak and release it after you finish speaking. Do not shout into the mouthpiece or otherwise try to vary your normal voice. Shouting does not increase range; speaking distinctly can increase range.

Each licensee is issued a call sign by the FCC (Federal Communications Commission) which identifies his station. There are 24 radio districts in the United States, and originally all Class D Citizens Radio station call signs began with prefixes 1W through 24W depending upon geographical location. More recently a series of three letters has been adopted in place of the earlier arrangement, for example--KLF0100.

Call signs must be used at the beginning and end of each series of communications. Proper procedure is shown in the following EXAMPLE:

When the operator of station KLF0100 unit 1 wishes to communicate with station KLF0100 unit 2 (which must be on the same channel), he transmits "KLF0100 unit 2 from KLF0100 unit 1, over."

The station called replies "KLF0100 unit 1 from KLF-0100 unit 2, go ahead."

KLF0100 unit 1 then proceeds with his message. When he wishes unit 2 to reply he says "over" and releases the PTT switch. Operators soon become accustomed to the change in background noise when the other station goes off the air, making the "over" unnecessary.

At the termination of communication the operator says, "This is KLF0100 unit 1, out" and the other station says, "This is KLF0100 unit 2, out." "Out" means end of communications for the time being.

Stations in the Citizens Radio Service use the 23 channels in the 27 MHz band on a shared basis. Since many people share this band, brevity and good operating procedure will save time and make best use of the channels available with minimum interference.

The term "Roger," a phonetic for "R" meaning "received and understood," is widely used. If it is necessary to break into a conversation between two stations, transmit "break, break" and your call sign and wait for an acknowledgment.

FULL 23 CHANNEL OPERATION

Your transceiver operates on all 23 Citizens Radio channels when purchased, eliminating the inconvenience and expense of purchasing and installing additional crystals.

You may communicate with any number of units operating under the same license on any one of the 23 Citizens Radio channels except channel 9, which is reserved for use in an emergency or to aid motorists, and between units operating under different licenses on channels 10 through 15 and on channel 23.

Channel 9 has been set aside for emergency communications involving the immediate safety of life of individuals or the immediate protection of property, or for communications necessary to render assistance to a motorist.

RADIO FREQUENCY INTERFERENCE

Your transceiver, when properly installed, will provide the reliability and efficiency necessary for good communications. But the operator must be aware of additional

factors which affect communications, such as radio frequency interference. Radio frequency interference can be caused by generator systems and ignition systems in automobiles, trucks and boats. Not only does this type of interference cause an annoying noise, it can also reduce effective communications range.

Another type of radio frequency interference sometimes encountered in large municipalities or near medical centers, which produces a rough, raspy signal in the speaker, is caused by industrial equipments and medical diathermy. These equipments are operated for the most part between Citizens Radio channels 13 and 14, and for this reason, these and adjacent channels are avoided in large municipalities or near medical centers.

Atmospheric conditions sometimes cause "skip" phenomena, whereby distant signals hundreds of miles away can be heard clearly. FCC regulations make long range communications via "skip" illegal on Citizens Radio. Normally, strong local signals override skip signals. Use of some sort of directional antenna (such as rotatable or switchable beam) can help minimize skip signal interference and also enhances both the received signal and the transmitted signal in the favored direction.

"TEN SIGNALS"

The so-called "Ten Signals" are widely used in two-way radio communications to save time and reduce interference. Use of them will identify you as a qualified and informed two-way radio communicator. If you wish to know the location of a mobile or other unit, merely call the unit and request its "ten twenty." In like manner, any "Ten Signal" will convey its basic meaning. As operators memorize the "Ten Signals," common exchanges are greatly expedited.

10-1 Unable to copy
10-2 Signals good
10-3 Stop transmitting
10-4 Message received
10-6 Busy, stand by
10-7 Out of service, leaving air
10-8 In service, subject to call
10-9 Repeat message
10-10 Transmission completed, standing by
10-13 Weather and road conditions
10-16 Pick up . . . . . at . . . . . .
10-18 Anything for us
10-19 Nothing for you
10-20 Location
10-24 Finished with last assignment
10-27 Moving to channel . . . . . .

INSTALLATION INSTRUCTIONS

The transceiver may be mounted under the dash or on the floor of a vehicle and will operate from either positive or negative ground battery voltage. A suggested installation procedure is as follows, for a more detailed installation procedure refer to E. F. Johnson booklet "Installing Your Citizens Radio" Part No. 004-2000-001.

a. Select a mounting location that will allow clearance for heater and air conductioning ducts. Install the antenna and route the transmission line to the intended mounting location.

b. Temporarily assemble the transceiver and the mounting bracket and hold it in the intended mounting location and check for clearance. Remove the bracket from the transceiver and hold the bracket in the mounting location and mark the mounting hole locations.

c. Center punch and drill the mounting holes where marked and install the mounting bracket.

d. Connect the antenna transmission line to the antenna connector, connect the red B+ lead to the positive (+) battery terminal, connect the black B+ lead to the negative (-) battery terminal and connect the external speaker, if used.

e. Install the transceiver in the mounting bracket using the enclosed hardware.

CIRCUIT DESCRIPTION

GENERAL

The Johnson Viking 352 is a 23 channel fully solid state citizens radio transceiver that operates on upper sideband, lower sideband and regular AM channels. All transmit and receive frequencies are generated by a ten crystal frequency synthesizer. The Carrier Insertion Oscillator is a separate oscillator which generates a 7. 8025 MHz carrier for sideband detection and transmission.

The receiver is a single conversion receiver with four IF stages and a crystal filter for good selectivity and image rejection. Also included in the receiver is a noise blanker to remove any impulse type noise, an automatic gain control circuit (AGC) to maintain a constant receive signal level and an automatic noise limiter circuit (ANL) to remove any audio noise from the receive signal.

The transmitter consists of a mixer stage and a Class B RF power output stage to provide 4 watts RF output in AM and 12 watts PEP output in SSB.

The transceiver also includes an S/RFO meter which indicates receive signal strength in receive and relative RF output power in transmit in both AM and SSB modes of operation. The transceiver also includes a public address (PA) function so that the audio amplifiers can be used without activating the RF stages of the transmitter.

CARRIER FREQUENCY OSCILLATOR

The Carrier Oscillator consists of Y501, Q19 and associated components. The crystal controlled oscillator uses a crystal operating at series resonance to produce its fundamental frequency of 7. 8025 MHz. Oscillator frequency adjustment is provided for by capacitor C510 and temperature compensation is provided by C501 and C502. Since

the oscillator is not used in the AM mode, the supply voltage is switched off by the mode switch, S2-2, in the AM position and on in the LSB and USB positions.

In the LSB transmit mode, the 7.8025 MHz is coupled from the emitter of Q19 through C512 to the base of the Buffer stage and then to the Balanced Modulator to be used in audio modulation. In the USB transmit mode, the 7.8025 MHz is used in the Balanced Modulator and it is also coupled by C505 through CR501 to tuned transformers T501 and T502. Transformers T501 and T502 are tuned to pass only 15.6050 MHz (second harmonic of 7.8025 MHz) which is then coupled to the second gate of the USB Mixer transistor through C514 to be used in the Frequency Synthesizer.

In the LSB receive mode, the 7.8025 MHz is coupled through C457 to the emitters of Q16 and Q17, the SSB Detector, to detect the audio signals. To receive USB, the 15.6050 MHz from T502 is coupled to the gate of the USB Mixer and the 7.8025 MHz is also used by the SSB Detector.

FREQUENCY SYNTHESIZER

General

The frequency synthesizer circuitry consists of six high frequency crystals and four low frequency crystals, a high frequency (HF) oscillator, a low frequency (LF) oscillator, a synthesizer mixer, a 19 MHz amplifier, an upper sideband mixer, a 35 MHz amplifier and a diode switching network.

The synthesizer output is 7.8025 MHz below the channel frequency for AM transmit and Lower Sideband (LSB) transmit and receive, 7.800 MHz below the channel frequency for AM receive and 7.8025 MHz above the channel frequency for Upper Sideband (USB) transmit and receive.

Low Frequency (LF) Oscillator

The LF oscillator consists of crystals Y607 through Y610, Q21 and its associated circuitry. The Channel Selector Switch, S1-3, selects one of these crystals and applies the signal to the base of the oscillator transistor, Q21. The oscillator is a modified Colpitts oscillator connected in a common collector configuration to provide high input impedance. In the transmit and receive SSB mode and the transmit AM mode, the crystals operate on their fundamental frequencies along with capacitors C601 and C602 to provide the low frequencies. In the AM receive mode, the LF crystal frequency is increased 2.5 kHz by CR603 so that the output of the synthesizer mixer will be 7.800 MHz below the channel frequency and the signal will pass at the center frequency of the crystal filter, F401.

The low frequency signal is coupled from the emitter of Q21 through C604 to the gate of the Synthesizer Mixer, Q25, where it is mixed with the signal from the high frequency oscillator.

High Frequency (HF) Oscillator

The HF oscillator consists of Q22, its associated circuitry, and crystals Y601 through Y606. The oscillator is a modified Colpitts oscillator connected in a common collector configuration to provide high input impedance. The crystals operate at series resonance to produce their fundamental frequencies and are adjustable ±800 Hz with the Fine Tune Control. Since the carrier is not transmitted in the SSB mode, the receiver reinserts the carrier and the Fine Tune Control allows the receive crystals to be compensated for any difference between the transmitter carrier frequency and the receiver carrier frequency. The Fine Tune Control, R626, varies the voltage across CR606, this voltage change is felt as a change in capacitance across the high frequency crystals which results in a corresponding change in oscillation and improved audio reproduction.

The desired HF crystal is selected by S1-1 at the same time as S1-3 selects the LF crystal. The crystal frequency is connected to the base of the HF oscillator transistor, Q22, through C638. The HF signal is amplified by the transistor and then coupled from the emitter of Q22 through C608 to the gate of the Synthesizer Mixer, Q25. To eliminate any crystal frequency other than the desired frequency, S1-2 shorts out the unused crystals. To prevent the transceiver from operating on the blank space between channels 22 and 23, S1-4 effectively shorts the synthesizer B+ through R608 to ground.

SYNTHESIZER OUTPUT

Lower Sideband (LSB) and AM

The signal from the LF oscillator is mixed with the signal from the HF oscillator at the synthesizer mixer, Q25. The synthesizer output circuitry T601 and T602 is tuned to pass the sum of the two frequencies, which is in the 19 MHz range and is coupled to the base of the 19 MHz amplifier, Q26, through C617. The output of Q25 is coupled to the switching diode CR602 through T603. The output frequency of Q26 for AM receive is 2.5 kHz higher than the AM transmit and the LSB transmit and receive frequencies. For example channel 1 on AM transmit and LSB would be; 11.700 MHz + 7.4625 MHz = 19.1625 MHz and channel 1 on AM receive would be; 11.700 MHz + 7.465 MHz = 19.165 MHz.

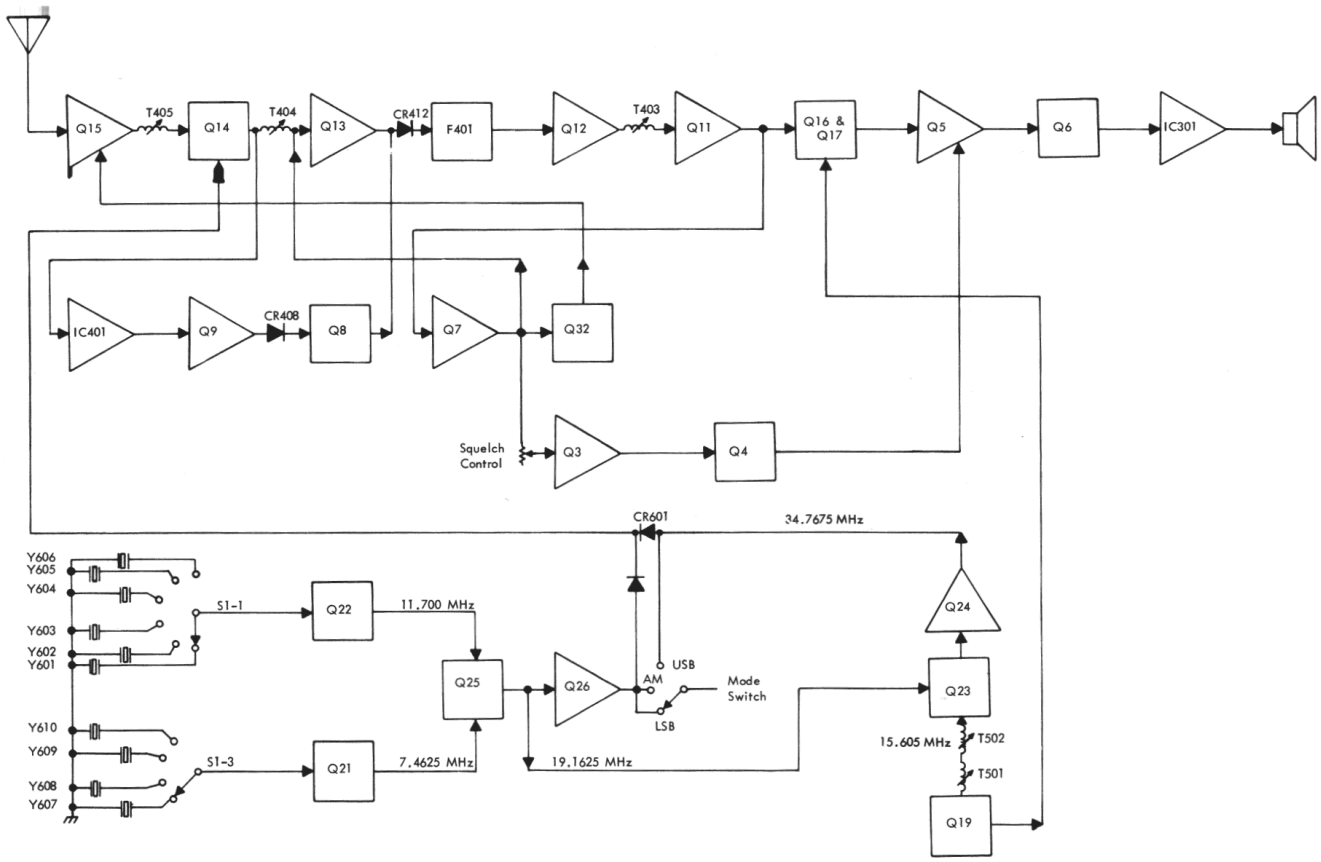
Upper Sideband (USB)

The 19 MHz signal from C616/T602 junction is coupled to the first gate of Q23, the USB Mixer, where it is mixed with 15.6050 MHz from the carrier oscillator. The output of the carrier oscillator is doubled by T501 and T502 to produce 15.6050 MHz which is then coupled through C514 to the second gate of Q23 to be mixed with the 19 MHz. The output circuitry of T604, C611, T605 and C612 is tuned to pass the sum frequency which is in the 35 MHz range. The 35 MHz signals are then coupled through C612 to the base of the 35 MHz Amplifier, Q24. The amplified 35 MHz signals are then coupled to the diode switch, CR601, through T606. The bias and supply voltage for the USB Mixer and 35 MHz Amplifier and CR601 are switched from the 19 MHz Amplifier by the Mode Switch S2-6.

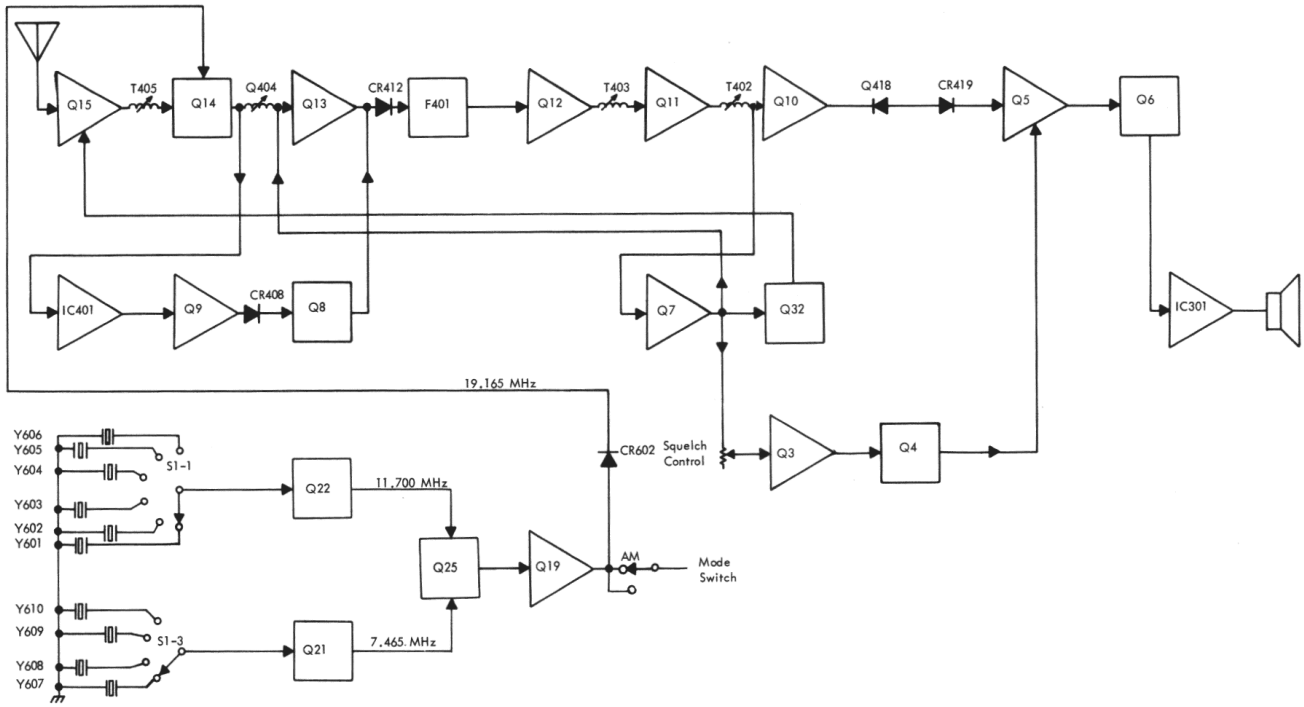
FREQUENCY SYNTHESIZER TABLE

CHANNEL NUMBER	HIGH FREQUENCY CRYSTAL	+	LOW FREQUENCY CRYSTAL	=	LSB SYNTHESIZER OUTPUT	+ 2 (x) CARRIER FREQUENCY	= USB SYNTHESIZER OUTPUT
1	Y601-11.700 MHz		Y607-7.4625 MHz		19.1625 MHz	15.605 MHz	34.7675 MHz
2	Y601-11.700 MHz		Y608-7.4725 MHz		19.1725 MHz	15.605 MHz	34.7775 MHz
3	Y601-11.700 MHz		Y609-7.4825 MHz		19.1825 MHz	15.605 MHz	34.7875 MHz
4	Y601-11.700 MHz		Y610-7.5025 MHz		19.2025 MHz	15.605 MHz	34.8075 MHz
5	Y602-11.750 MHz		Y607-7.4625 MHz		19.2125 MHz	15.605 MHz	34.8175 MHz
6	Y602-11.750 MHz		Y608-7.4725 MHz		19.2225 MHz	15.605 MHz	34.8275 MHz
7	Y602-11.750 MHz		Y609-7.4825 MHz		19.2325 MHz	15.605 MHz	34.8375 MHz
8	Y602-11.750 MHz		Y610-7.5025 MHz		19.2525 MHz	15.605 MHz	34.8575 MHz
9	Y603-11.800 MHz		Y607-7.4625 MHz		19.2625 MHz	15.605 MHz	34.8675 MHz
10	Y603-11.800 MHz		Y608-7.4725 MHz		19.2725 MHz	15.605 MHz	34.8775 MHz
11	Y603-11.800 MHz		Y609-7.4825 MHz		19.2825 MHz	15.605 MHz	34.8875 MHz
12	Y603-11.800 MHz		Y610-7.5025 MHz		19.3025 MHz	15.605 MHz	34.9075 MHz
13	Y604-11.850 MHz		Y607-7.4625 MHz		19.3125 MHz	15.605 MHz	34.9175 MHz
14	Y604-11.850 MHz		Y608-7.4725 MHz		19.3225 MHz	15.605 MHz	34.9275 MHz
15	Y604-11.850 MHz		Y609-7.4825 MHz		19.3325 MHz	15.605 MHz	34.9375 MHz
16	Y604-11.850 MHz		Y610-7.5025 MHz		19.3525 MHz	15.605 MHz	34.9575 MHz
17	Y605-11.900 MHz		Y607-7.4625 MHz		19.3625 MHz	15.605 MHz	34.9675 MHz
18	Y605-11.900 MHz		Y608-7.4725 MHz		19.3725 MHz	15.605 MHz	34.9775 MHz
19	Y605-11.900 MHz		Y609-7.4825 MHz		19.3825 MHz	15.605 MHz	34.9875 MHz
20	Y605-11.900 MHz		Y610-7.5025 MHz		19.4025 MHz	15.605 MHz	35.0075 MHz
21	Y606-11.950 MHz		Y607-7.4625 MHz		19.4125 MHz	15.605 MHz	35.0175 MHz
22	Y606-11.950 MHz		Y608-7.4725 MHz		19.4225 MHz	15.605 MHz	35.0275 MHz
23	Y606-11.950 MHz		Y610-7.5025 MHz		19.4525 MHz	15.605 MHz	35.0575 MHz

NOTE: The synthesizer output for AM transmit is the same as the LSB, the AM receive output is 2.5 kHz higher than the LSB output.



SSB RECEIVE
BLOCK DIAGRAM



AM RECEIVE
BLOCK DIAGRAM

The output of the USB Mixer for channel 1 USB transmit and receive frequencies would be 19.1625 MHz (from the Synthesizer Mixer) + 15.6050 MHz (2 x 7.8025 MHz from the Carrier Oscillator) = 34.7675 MHz.

RECEIVER

RF Amplifier

The received signal is coupled through the antenna switching diodes through C444 to the primary of tuned transformer T406. T406 passes the desired 27 MHz signals which are then applied to the gate of the RF Amplifier, Q15. The negative gate bias voltage for Q15 is supplied through CR415. CR425 provides stability of the RF amplifier by rectifying the AGC voltage and applying the resultant negative voltage as degenerative feedback to the gate of Q15. The gate voltage establishes the rate of conduction and the stage gain of Q15. As the received signal is applied to the gate of Q15, it is also applied to the receiver image trap, L404 and C461, which removes the first image frequency. The amplified RF Amplifier output is coupled to the Receive Mixer by T405 and C439.

Receive Mixer

Along with the receive RF signal on gate 1 of the mixer, the mixing frequency from the synthesizer diode switching network is coupled through C701 to gate 2 of the mixer. The output circuitry of the mixer, T404, is tuned to pass the difference between the received RF and the synthesizer mixing frequency. In the AM and LSB mode, the synthesizer frequency is low side injection and in the USB mode the synthesizer uses high side injection. The mix frequency for AM is 7.8 MHz below the receive RF, for LSB reception the mix frequency is 7.8025 MHz below the receive RF and for USB reception the mix frequency is 7.8025 MHz above the receive RF signal. The IF frequencies from T404 are applied directly to the base of the IF Amplifier, Q13.

IF Amplifier and Crystal Filter

The IF Amplifier amplifies the IF frequency enough to be applied to the crystal filter. The output of Q13 is coupled through C433 and through the noise gate diode CR412 and through C432 to the input of the crystal filter. C432, R426 and R425 provide a proper impedance match between the IF Amplifier and the crystal filter to get maximum signal coupling. The crystal filter has a center frequency of 7.8 MHz and a narrow bandwidth to provide good selectivity and image rejection of the received signal.

The output of the filter is coupled through C431 to the base of Q12, the second IF Amplifier. The IF frequency is amplified and coupled through three tuned transformer stages, at the collector of Q10 the IF signal is coupled through C459 to the AM Detector diodes CR417 and CR418.

AM Detector and Noise Limiter

In the AM mode, the amplified IF signal is coupled to the detector diodes through coupling capacitor, C459. When the signal is applied to the detector, current will flow only during the negative portion of the IF signal. This current causes C445 to charge to the peak value of the rectified voltage on each negative half cycle. Capacitor C446 acts as a filter to remove the IF frequency component of the detector output so that the remaining DC component varies only according to the modulation of the original signal.

The Noise Limiter, CR419, works in conjunction with the Noise Blanker circuit. With the Noise Blanker Switch, S4, in the "ON" position, nine volts bias is applied to CR419 anode through R443 to forward bias the diode. With the Noise Blanker Switch in the "OFF" position, the nine volts is applied to the anode and cathode of CR419 which biases the diode off.

With the Noise Blanker "ON", the amplitude of the audio signal is limited by the conduction of CR419. CR419 is biased so that it will conduct only when aided by a specified level of audio which removes the AM noise from the audio waveform. Capacitor C447 couples the audio to the detector switch diode CR420 which is forward biased in the AM mode by the Mode Switch, S2-2. In the AM mode, the audio is passed through CR420 to the Volume Control.

SSB Detector

The SSB Detector, detects audio from the IF frequency by mixing the received signal with the 7.8025 MHz carrier. Since the carrier is removed from the transmitted signal by the balanced modulator, the receiver must reinsert the carrier as a reference to detect the audio.

The SSB Detector functions as a product detector and consists of T409, Q16, Q17 and associated components. In the SSB mode, supply voltage for the detector transistors and carrier oscillator is provided through the Mode Switch, S2-2. The 7.8025 MHz carrier is taken from the emitter of Q19 and coupled to the emitters of Q16 and Q17 by C457 causing a balanced condition and no output. When a signal is received, a sample of the IF frequency is taken from T402 by coupling capacitor C448 and applied to T409. The IF frequency is then applied to the base of Q16 and Q17 causing Q16 and Q17 to conduct. With 7.8025 MHz on the emitters of Q16 and Q17, the modulation on the IF causes the transistors to conduct. Therefore the audio signal is reproduced on the collectors of Q16 and Q17. The audio from Q17 is then applied to the Volume Control through C325. The signal from Q16 is coupled through C451 to the SSB Meter Amplifier, Q18.

Audio

The audio at the volume control, either from the AM Detector or the SSB Detector, is coupled to the base of the Audio Preamplifier, Q5, through C304. The audio is amplified and filtered by Q6, R311, R312, R313, C309 and C310. The amplified and filtered audio is coupled through R315 and C312 from the emitter of Q6 to the input of the Audio Power Amp, IC301, on pin 5. The Audio Power Amp amplifies the audio to 3 watts which is taken from pin 10 of the integrated circuit to the receive contact of the relay, K1, through C322 through the external speaker jack to the speaker.

Automatic Gain Control (AGC)

The Automatic Gain Control (AGC) circuit causes the receiver audio output to remain constant at the level set by the volume control regardless of the received RF signal level. In the SSB mode the received signal disappears when there is no modulation, therefore the AGC must reduce the receiver gain quickly upon receiving a large signal and increase gain slowly when the signal decreases or disappears. This fast attack and slow release action compensates for short pauses in conversation. The AGC response time can be adjusted by the Q7 source resistor R467. Since the slow release AGC action is not required in the AM mode, CR401 and CR402 are switched out of the circuit in the AM mode by S2-7.

A sample of the received signal is coupled from the collector of Q10 through C416 to the junction of CR404 and the AGC attack rectifier CR405. When the received signal level increases, the signal is rectified by CR405 which applies a negative DC bias voltage on the gate of the AGC Amplifier, Q7. The rate of conduction of Q7 is slowed by a negative voltage on the gate which causes the voltage drop across the source resistor R467 to decrease. This negative going voltage is applied to the base of Q13 through T404 and to the base of Q12 through R424. This negative voltage acts as reverse bias and reduces conduction of both transistors and reduces the IF gain. The negative voltage from Q7 source is also applied to the AGC control, Q32, which causes Q32 conduction to decrease. Since Q32 is in series with the source of the RF Amplifier, the gain of the RF Amplifier decreases. The overall effect is to decrease the RF and IF gain to prevent receiver overloading.

Another IF sample is coupled from T402 through C415 to the AGC release rectifier, CR401. CR401 and CR402 rectify this IF signal which charges C402 which, along with R401, establishes an RC time constant for the AGC release time. When the received signal decreases, the attack rectifier voltage decreases. However the action of Q7, to increase receiver gain, is slowed down by the voltage on C402 discharging through R401 which is felt at the gate of Q7. This negative voltage causes the conduction of Q7 to increase gradually to allow for a conversational pause.

Noise Blanker

The Noise Blanker circuit removes any impulse noise from the received signal. In the "ON" position, the Noise Blanker ON/OFF switch applies B+ to IC401, the Noise Blanker Amplifier, Q9, the Noise Amplifier and, Q8, the Blanker Gate. A sample of the IF frequency is taken from T404 and coupled through L403, C460 and C414 to the 7.8 MHz trap, T407, which effectively removes all 7.8 MHz signal and passes any noise pulses through C412 to the input of IC401 on pin 3. The amplified noise is coupled to the Noise Amplifier, Q9, through T408 and C408. The output from the Drain of Q9 is rectified by CR408 and CR409 and the resultant positive going DC voltage is applied to the gate of Q8, the Blanker Gate. Any negative pulses that may appear at the gate of Q8 are removed by CR424. The positive voltage at the gate of Q8 drives the transistor into saturation which removes the forward bias from the anode of CR412 and blocks the IF frequency from Q13. Since the conduction of the Blanker Gate is coincident with the noise pulses only the noise pulses are removed and all audio is allowed to pass.

Squelch

The squelch circuitry will quiet the receiver until a signal is received to effectively eliminate any noise on the channel. The amount of signal necessary to open the squelch and enable the receiver is determined by the setting of the squelch control, R319. The farther clockwise the control is rotated, the larger the signal level required to open the squelch.

When a signal is received, a sample is coupled from Q10 collector through C416 causing an AGC action. The AGC voltage from the source of Q7 is felt on the base of the Squelch Amplifier, Q3. This voltage causes Q3 to conduct. With Q3 conducting, the collector voltage decreases and this negative going voltage forward biases the Squelch Gate, Q4. With Q4 conducting, the collector voltage decreases, causing Q5, the Audio Preamplifier, to conduct which enables the receiver audio.

When no signal is received, the Audio Preamplifier is reverse biased which disables the receiver audio. With no received signal, Q3 is cut off causing the collector voltage to increase. This positive voltage is felt at Q4 base causing Q4 to cut off. With Q4 cut off, its collector voltage goes high acting to reverse bias the Audio Preamplifier and disable the receiver audio.

TRANSMITTER

General

When the microphone push to talk button is depressed, the relay K1 is energized to switch the B+ voltage from receive to transmit circuitry. With K1 energized, the forward bias is removed from the switching diode CR201 which turns on the mike amp, Q2, (to isolate the microphone input from the receive circuit).

Microphone Amplifier and AM Modulator

Audio from the microphone is coupled through C204 through the Limiter, Q1, to the base of the Microphone Amplifier, Q2. In the AM mode, the audio is amplified by Q2 and coupled from the collector through C207 and C208 through S3-4, the CB/PA switch, to the Active Filter, Q6. The Active Filter, which consists of R311, C309, R312, C310, R313 and Q6, provides filtering and audio shaping to limit effective bandwidth of the audio before it is amplified by the Audio Power Amplifier, IC301. The audio is coupled from Q6 emitter through R315 and C312 to pin 5 of IC301. The amplified audio is taken from pin 10 through K1 and switch S3-3 through R217 and diode CR204 to the collectors of Q30 and Q31. This acts as modulated B+ for Q30 and Q31 at a level of approximately 7 volts DC for the required 3 to 4 watt power output.

Automatic Microphone Limiter (Audio Compressor)

In the AM transmit mode, a sample of the audio is coupled from IC301 pin 10 through C212. The compressor diode, CR203 applies negative bias voltage through limiter resistor, R202, to the gate of the Limiter, Q1. The negative voltage at the gate of Q1 decreases the gain of Q1 and limits the audio input from the microphone.

Balanced Modulator

In the SSB transmit mode, the audio from the microphone is coupled through C204 through the Limiter and to the base of the Microphone Amp, Q2, through C205. The audio is amplified by Q2 and is coupled to the Balanced Modulator through C207, CR202, C215 and L501. CR202 is forward biased through S2-3, the Mode switch, by placing 9.0 volts on the anode through R209 in either the LSB or USB position.

The Balanced Modulator consists of CR502, CR503, CR504, CR505, T503, R514 and associated components. With no audio input from the Microphone Amplifier, the Balanced Modulator is balanced with R514. The Carrier Oscillator frequency of 7.8025 MHz is coupled from the emitter of Q19 through C512 to the base of the Buffer, Q20. The Buffer stage is an emitter follower configuration to provide high input impedance and prevent any oscillator loading effects from the Balanced Modulator. The carrier frequency from the Buffer is coupled through C513 to R514 which is adjusted for no output from T503.

With audio applied to the junction of CR502/CR503 and CR504/CR505, the diodes will conduct with respect to the audio sinewave voltage polarity. As the modulator diodes conduct, an unbalanced condition arises and the carrier frequency varies at the audio rate. These variations are felt at T503 primary which induces a corresponding voltage at T503 secondary. The modulated carrier frequency is coupled through the switching diode CR413, which has been forward biased through K1 relay contacts and S3-1, to the 7.8 MHz crystal filter. The filtered, modulated 7.8025 MHz is then coupled to the IF Amplifier, Q12, through C431. After the signals are amplified at Q12 they are coupled through the switching diode CR407, which also is forward biased through the relay contacts, S3-1 and R706, to gate 2 of the Transmit Mixer, Q27.

Mixer

The Mixer, Q27, combines the audio modulated 7.8025 MHz from the Balanced Modulator that appears on gate 2 with the frequency synthesizer output present on gate 1 for Upper and Lower Sideband operation. In the AM mode, the mixer mixes the synthesizer frequency with the unmodulated carrier frequency, 7.8025 MHz. For example on Channel 1 frequencies,
AM; synthesizer output of 19.1625 MHz + carrier frequency of 7.8025 MHz = 26.965 MHz. The 26.965 MHz then is modulated by the Driver and Power Amplifier Stages.

LSB; synthesizer output of 19.1625 MHz + 1 kHz modulated carrier frequency of 7.8015 = 26.9640 MHz.

USB; synthesizer output of 34.7675 - 1 kHz modulated carrier frequency of 7.8015 MHz = 26.9660 MHz.

RF Stages

The output of the mixer is selected by tuned transformers T701 and T702 and coupled to the Transmit Amplifier, Q28. The Transmit Amplifier and the Pre-Driver, Q29, the Driver, Q30, and the Power Amplifier, Q31, amplifiy the SSB signals to an RF, PEP (peak envelope power) of 12 watts. In the AM mode, the unmodulated carrier frequency is amplified by Q28 and Q29 then modulated by Q30 and Q31 and amplified for approximately 4 watts RF output.

The power output of the transmitter is determined by the B+ voltage on the collectors of Q30 and Q31. In the AM mode, the collector voltage is approximately 7 volts and is modulated from audio power amp IC301 which results in a 4 watt RF level. In the SSB mode, the collectors are connected directly to the 13.8 VDC source through S2-4, the mode switch, which results in 12 watts PEP RF output.

Automatic Level Control (ALC)

The ALC is used to limit the modulation in SSB operation. A sample of the transmitted RF is coupled by C723 to the ALC Detector diode CR708, which rectifies the RF and the resulting negative voltage is applied to the gate of Q7 through CR406. The negative bias voltage decreases the gain of Q7 causing the source voltage to decrease. This negative going voltage is applied to the base of the IF Amplifier, Q12, and reduces the gain of Q12, which in turn limits the modulated 7.8025 MHz from the Balanced Modulator.

METER CIRCUITRY

The front panel meter serves the dual purpose of indicating received signal strength in "S" units and relative output power in the transmit condition.

In the AM receive condition, a sample of the IF signal is coupled from the secondary of T401 by C419 and is rectified by CR410 and CR411. This allows current to flow through meter giving an indication of the receive signal strength. Meter adjust potentiometer, R469, is adjusted for an S9 meter reading with a 50 μV signal at the antenna.

In the SSB receive condition, the SSB signal sample is coupled from the collector of Q16 through C451 to the emitter of the SSB Meter Driver, Q18. When Q16 is conducting the collector voltage is a negative going voltage which forward biases Q18. As Q18 conducts, the receive signal from Q18 is rectified by CR422 and CR423. This positive voltage causes current to flow through the meter and R470, the SSB meter adjustment potentiometer.

In the AM and SSB transmit mode, a sample of the output power is coupled through C725 and rectified by CR709. The resultant positive voltage causes current to flow through the meter which is proportional to the modulated RF output.

PUBLIC ADDRESS (PA)

The Public Address (PA) function allows the audio amplifier sections to be used without activating the transmitter so that with a PA speaker connected to the PA speaker jack, the transceiver becomes a public address amplifier. With the PA/CB switch in the PA position and the microphone keyed, audio from the microphone is amplified by Q2 and coupled through C208 through the CB/PA switch to the Volume Control. The Volume Control establishes the gain provided by the Audio Preamplifier, Q5. The amplified audio is coupled from Q5 collector through the Active Filter to the Audio Power Amp, IC301. The amplified audio from the power amp is coupled through the transmit contact of relay K1 through S3-3 and to the external PA speaker.

ALIGNMENT

Carrier Oscillator

a. Set the mode switch to LSB and connect the frequency counter to TP2, junction of C457 and R461.

b. Adjust C510 for 7.8025 MHz.

FREQUENCY SYNTHESIZER

Frequency Adjustment

a. Connect the frequency counter to the emitter of Q22 using an X10 RF probe. Set the Fine Tune control to mid-range and the Mode switch to LSB.

b. Rotate the Channel Selector switch and adjust the High Frequency Oscillator frequency as listed in Table 1.

TABLE 1
HIGH FREQUENCY OSCILLATOR FREQUENCIES

Channel Switch Position	Adjust	Frequency
1	C648	11.700 MHz
5	C647	11.750 MHz
9	C646	11.800 MHz
13	C645	11.850 MHz
17	C644	11.900 MHz
21	C643	11.950 MHz

c. Connect the frequency counter to TP1, junction of CR601 and CR602 and adjust the synthesizer output frequencies as listed in Table 2.

TABLE 2
SYNTHESIZER OUTPUT FREQUENCIES

Channel Switch Position	Adjust	Frequency
1	C642	19.1625 MHz
6	C641	19.2225 MHz
11	C640	19.2825 MHz
16	C639	19.3525 MHz

Synthesizer Output

a. Set the channel selector switch to channel 13 and set the mode switch to LSB.

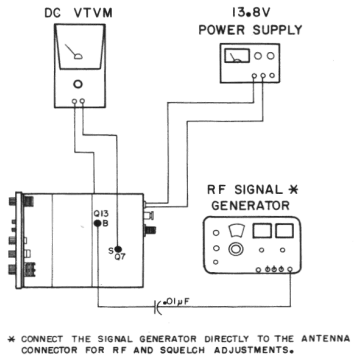
b. Connect an RF voltmeter to TP1, junction of CR601 and CR602. Adjust T601, T602 and T603 for a maximum meter reading.

c. Set the mode switch to USB and adjust T501, T502, T604, T605 and T606 for a maximum meter reading.

d. Readjust T606 and T603 for approximately equal voltage levels for USB and LSB respectively.

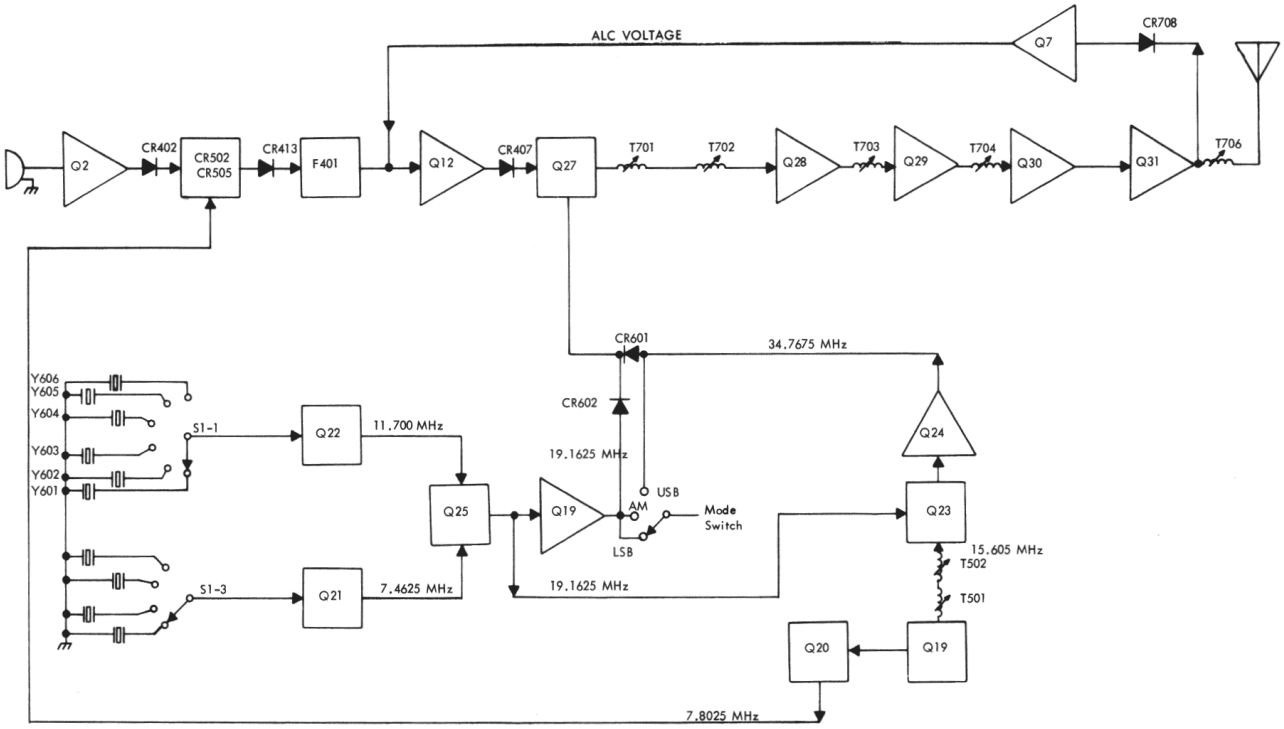
RECEIVER ALIGNMENT

Connect the receiver test circuit as shown in Figure 5 and refer to Figure 8 for alignment points location. Set the squelch control fully counterclockwise, the RF gain control fully clockwise, the fine tune control to its center position and the volume control for a suitable reading.

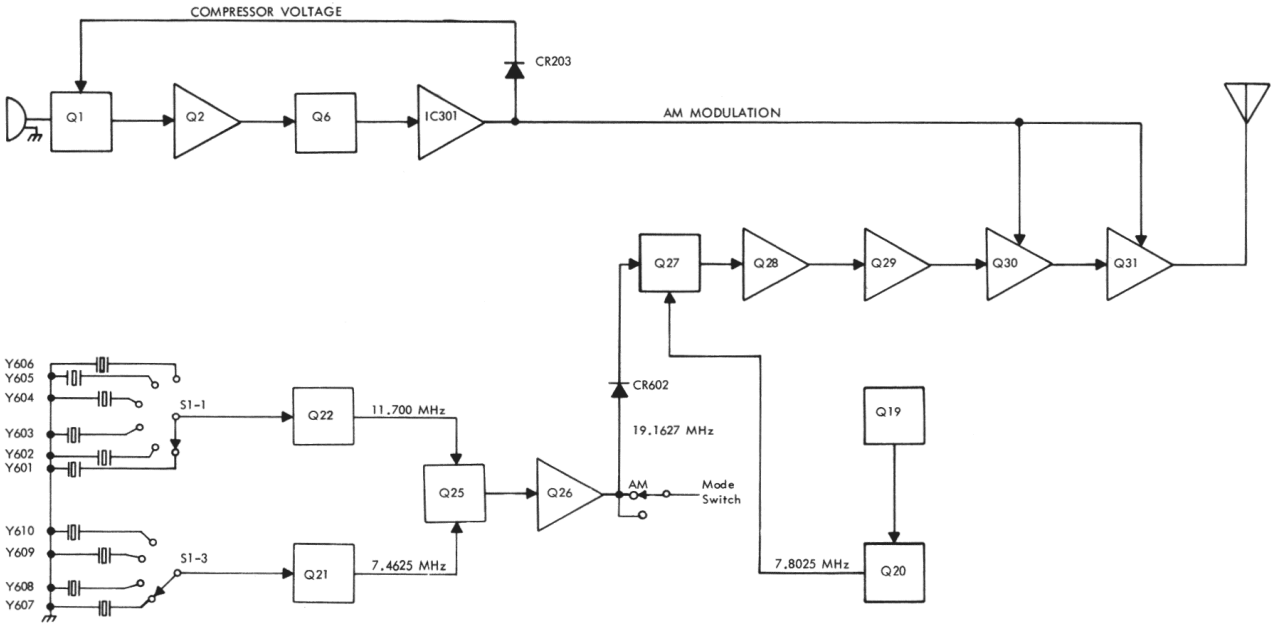


* CONNECT THE SIGNAL GENERATOR DIRECTLY TO THE ANTENNA CONNECTOR FOR RF AND SQUELCH ADJUSTMENTS.

RECEIVER TEST CIRCUIT
FIGURE 5



SSB TRANSMIT
BLOCK DIAGRAM



AM TRANSMIT
BLOCK DIAGRAM

RF AND IF SECTION

IF Adjustment (AM)

a. Connect the DC voltmeter to the source of Q7 and adjust R467 for 1.7 VDC.

b. Set the mode switch to AM and set the channel selector to channel 13. Set the signal generator to 27.115 MHz modulated 30% with 1 kHz and connect it to the base of Q13 through a ceramic 0.01 μF capacitor.

c. Adjust T401, T402 and T403 for maximum audio output while keeping the generator output to a minimum.

IF Adjustment (SSB)

a. Set the mode switch to USB and connect a signal generator to the base of Q13 through a 0.01 μF ceramic capacitor. Set the signal generator output to 7.8 MHz unmodulated.

b. Adjust T409 for maximum audio output. Readjust T401, T402 and T403 if necessary.

RF Adjustment

a. Set the mode switch to AM, set the channel selector switch to channel 13 and connect the signal generator to the antenna connector. Set the generator output to 27.115 MHz modulated 30% with 1 kHz.

b. Adjust T404, T405 and T406 for maximum audio output while keeping the generator output to a minimum.

Tight Squelch Adjustment

a. Set the mode switch to AM, set the channel selector switch to channel 13 and connect the signal generator to the antenna connector. Adjust the signal generator output for 27.115 MHz at a level of 250 μV.

b. Set the squelch control, on the front panel, fully clockwise then adjust R318 until the squelch just opens.

Receive Meter Adjust

a. Set the mode switch to AM, set the channel selector switch to channel 13 and connect the signal generator to the antenna connector. Adjust the generator output for 27.115 MHz at a level of 150 μV.

b. Adjust R469 for an S-9 reading on the front panel meter.

c. Change the mode switch to LSB and adjust R470 for an S-9 reading on the front panel meter with the same signal input as in step a.

Noise Blanker Adjustment

a. Set the mode switch to AM, set the Noise Blanker switch to the NB position, set the channel selector switch to channel 13 and connect the signal generator to the antenna connector. Set the generator output to 27.115 MHz unmodulated.

b. Connect the RF voltmeter to TP4, gate of Q9, and adjust C460 and T408 for a maximum meter reading.

c. Adjust T407 for a minimum meter reading with a modulated 27.115 MHz signal at the antenna connector.

Receiver First Image Trap Adjustment

a. Set the mode switch to USB, set the channel selector switch to channel 13 and connect the signal generator to the antenna connector. Set the generator output to the first image spurious frequency at USB (channel 13 = 42.7160 MHz).

b. Adjust C461 for a minimum audio output while keeping the generator output at a maximum.

TRANSMITTER TUNEUP

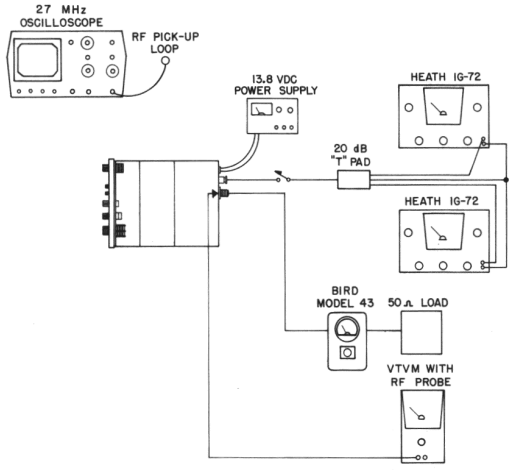
NOTE

The directional insertion wattmeter which is used to read CW signals will not read SSB peak envelope power directly. Therefore a PEP power meter should be used. If a PEP power meter is not available, the directional insertion wattmeter can be used. To convert the reading to PEP, use the following formula:

$$\text{Peak Envelope Power (PEP)} = \frac{\text{Wattmeter reading}}{0.405}$$

AM and SSB Power Adjustment

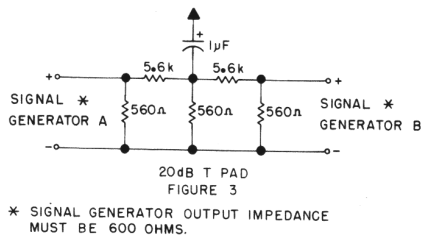
a. Set the mode switch to AM and connect the transmitter test setup as shown in Figure 6.



TRANSMITTER TEST CIRCUIT
FIGURE 6

b. Key the transmitter and adjust T701, T702 and T703 for maximum power output.

c. Set the mode switch to LSB and connect two audio generators to the microphone input as shown in Figure 7. Adjust the output of one generator to 500 Hz and the other to 2400 Hz at a level that will produce a good crossover waveform.



20dB T PAD
FIGURE 7

d. Key the transmitter and adjust T704, T705 and T706 for maximum RF output while keeping the two tone audio signal input to a minimum.

NOTE

To adjust T703 and T706; melt the wax, make the adjustment and reseal with wax.

SSB Carrier Suppression Adjustment

a. Set the mode switch to LSB and refer to the transmitter test setup.

b. Key the transmitter, with no modulation, and adjust C511, R514 and T503 for a minimum RF voltmeter reading at the antenna, approximately 20 mV.

Automatic Level Control (ALC) Adjustment

a. Connect the test setup as shown in Figure 2 and set the mode switch to LSB.

b. Connect the two tone generators to the microphone input, one generator set to 500 Hz and the other at 2400 Hz.

c. Key the transmitter and set the audio generator output level to produce 6 watts PEP (2.4W RMS) from the transmitter.

d. Increase the generators output level by 23 dB, and adjust R727 for a transmitter power output of 12 watts PEP (4.8W RMS).

Automatic Modulation Limiter

a. Connect a signal generator to the microphone connector and set the Mode switch to AM.

b. Set the audio generator output for 1 kHz at a level sufficient to provide 50% modulation.

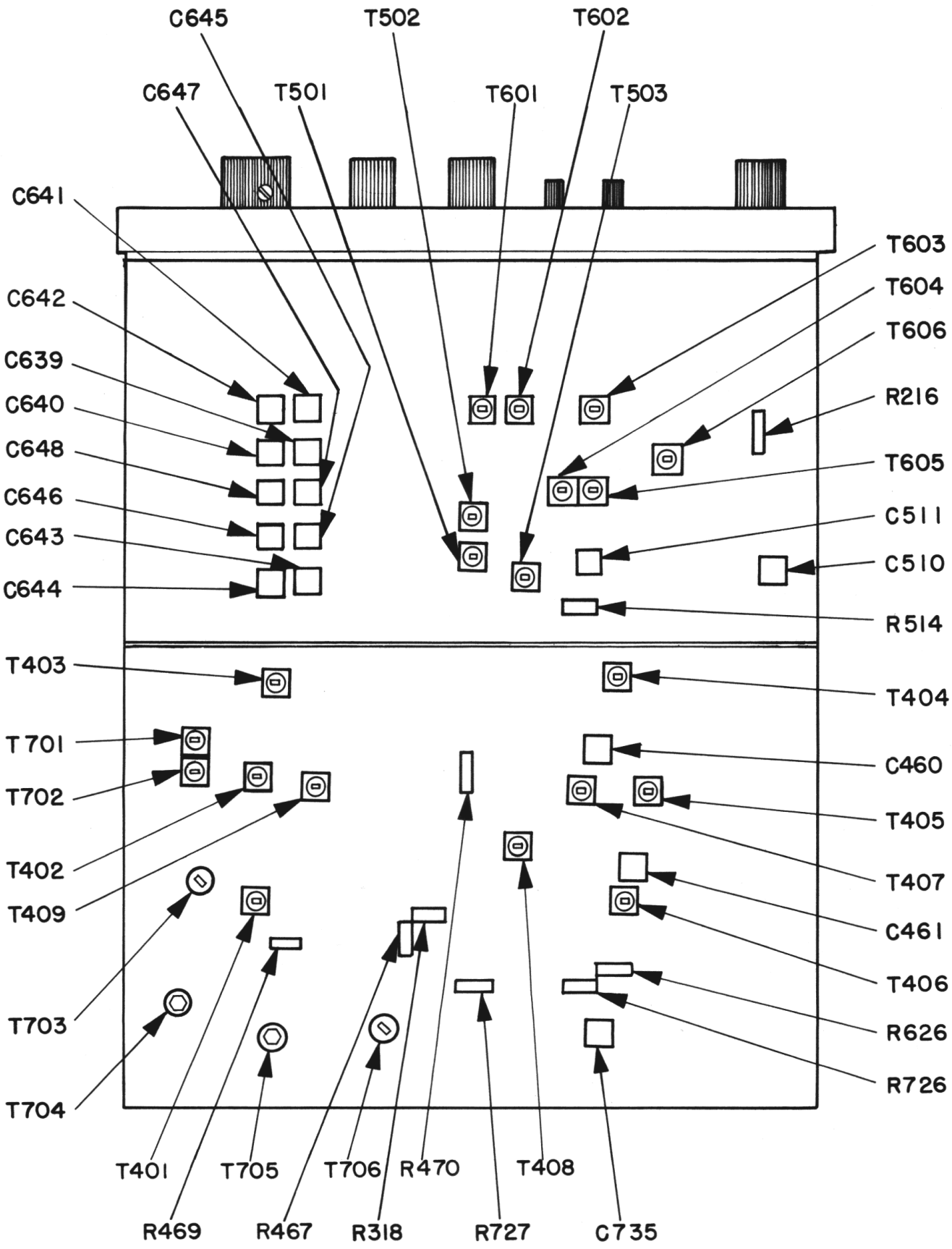
c. Increase the audio generator output level 16 dB and adjust R216 for 90% modulation.

Transmitter Frequency Adjustment

a. Connect the test setup as shown in Figure 2, set the mode switch to AM and set the channel selector switch to channel 13.

b. Loop couple the frequency counter to L707 and key the transmitter.

c. Adjust R626 for 27.115 MHz (unmodulated channel 13) and recheck the frequency on all channels. The transmitted frequency should be within ±0.005% of the channel frequency.



ALIGNMENT POINTS
FIGURE 8

Meter

a. Connect the test setup as shown in Figure 2 and set the mode switch to AM.

b. Key the transmitter, unmodulated, and adjust R726 for a reading of 4 on the meter.

Harmonic Trap

This adjustment is made at the factory and it removes the second harmonic frequency from the transmitted signal. Since the second harmonic is in the 54 MHz range, it can interfere with television channel 2. Therefore if there is some question about TV interference, proceed as follows:

a. Turn on a nearby TV and set it to channel 2.

b. Set the transceiver channel selector to channel 13, set the Mode Switch to AM, connect a 50 Ω dummy load and key the transmitter.

c. Adjust C735 for minimum TV interference.

TABLE 4
DC VOLTAGE READINGS

		AM	SSB									
Q1	G	0	0.45	Q2	B	1.6	Q3	B	0.6	Q4	B	8.6 (unsquelched)
	D	0	0		E	1.14		E	0.05		E	9.2
	S	0	0		C	2.8		C	8.8		C	1.15
Q5	B	1.8 (unsquelched)		Q6	B	4.8	Q7	D	3.7 (RF Gain Max.)	Q8	D	7.5
	E	1.15			E	3.9		G	-0.1		G	0.01
	C	4.0			C	9.2		S	1.5		S	0.49
Q9	D	9.3 (NB ON)		Q10	B	1.5	Q11	B	1.6	Q12	B	1.2
	G	0			E	0.9		E	1.0		E	0.7
	S	0			C	8.9		C	8.9		C	8.8
Q13	B	1.5		Q14	D	8.0	Q15	D	8.9	Q16	B	1.6
	E	0.8			G1	0		G	0.01		E	1.2
	C	8.5			G2	0		S	1.2		C	3.2
					S	4.0						
Q17	B	1.6		Q18	B	2.0	Q19	B	3.1	Q20	B	2.3
	E	1.2			E	1.4		E	3.3		E	2.5
	C	2.8			C	2.6		C	6.8		C	8.5
Q21	B	2.6		Q22	B	2.4	Q23	D	13.2	Q24	B	1.0
	E	2.4			E	2.5		G1	0.01		E	0.4
	C	9.2			C	8.4		G2	0.01		C	6.5
								S	0.62			
Q25	D	8.8		Q26	B	1.2			AM SSB	Q28	B	0.6
	G	0.06			E	0.5	Q27	D	10.8 12.0		E	1.3
	S	1.8			C	5.4		G1	1.9 6.7		C	9.0
								G2	2.6 3.8			
								S	1.0 0.8			
Q29	B	0.7				AM SSB			AM SSB	Q32	B	0.5
	E	0.1		Q30	B	0.5 0.6	Q31	B	0.6 0.6		E	0
	C	12.9			E	0 0		E	0 0		C	6.2
					C	5.3 13.2		C	5.0 13.2			
IC301	1	13.8	6 4.0	IC401	1	8.9	5 1.5					
	2	1.3	7 3.4		3	1.5	7 8.9					
	3	8.2	8 12.6		4	0	8 9.4					
	4	1.4	9 0									
	5	3.4	10 6.9									

PARTS LIST

SYMBOL NO.	DESCRIPTION	PART NO.
	CAPACITORS	
C101	Feedthru capacitor	022-2810-020
C102	2200 μF electrolytic 16 WV	022-2810-021
C103	220 μF electrolytic 16 WV	022-2810-017
C104	Same as C103	
C105	Same as C103	
C106	0.01 μF ceramic 50 WV	510-0001-103
C201	Same as C106	
C202	Same as C106	
C203	Same as C106	
C205	1 μF electrolytic 50 WV	022-2810-009
C206	47 μF electrolytic 16 WV	022-2810-015
C207	1 μF electrolytic 50 WV	022-2810-009
C208	0.02 μF ±20%, 16V	510-3010-223
C209	10 μF electrolytic 16 WV	022-2810-013
C210	0.04 mylar 50 WV	510-1003-473
C211	4.7 μF electrolytic 25 WV	022-2810-019
C212	Same as C211	
C213	10 μF electrolytic 16 WV	022-2810-013
C214	0.001 μF ceramic 50 WV	510-3001-102
C215	1 μF electrolytic 50 WV	022-2810-009
C216	0.01 μF ceramic	510-0001-103
C301	1 μF electrolytic 50 WV	022-2810-009
C302	Same as C301	
C303	0.01 μF ceramic 50 WV	510-0001-103
C304	1 μF electrolytic 50 WV	022-2810-009
C305	0.01 μF ceramic 50 WV	510-0001-103
C306	Same as C305	
C307	0.22 μF electrolytic 16 WV	022-2810-014
C308	47 μF electrolytic 16 WV	022-2810-015
C309	0.01 μF mylar 50 WV	022-2810-022
C310	Same as C309	
C311	0.0047 μF mylar 50 WV	022-2810-016
C312	0.01 μF mylar 50 WV	510-1003-103
C313	0.01 μF ceramic 50 WV	510-0001-103
C314	47 μF electrolytic 16 WV	022-2810-015
C315	220 μF electrolytic 16 WV	022-2810-017
C316	120 pF mica 50 WV	510-0001-121
C317	300 pF mica 50 WV	510-0001-301
C318	0.1 μF mylar 50 WV	510-1003-104
C319	0.033 μF mylar 50 WV	510-1003-333
C320	47 μF electrolytic 16 WV	022-2810-015
C321	470 μF electrolytic 16 WV	022-2810-018
C322	220 μF electrolytic 16 WV	022-2810-017
C323	Same as C322	
C324	0.1 μF mylar 50 WV	510-1003-104
C325	1 μF electrolytic 50 WV	022-2810-009
C326	10 μF electrolytic 16 WV	022-2810-013
C401	0.01 μF ceramic 50 WV	510-0001-103
C402	1 μF electrolytic 50 WV	022-2810-009
C403	0.1 μF mylar 50 WV	510-1003-104
C404	0.01 μF ceramic 50 WV	510-0001-103
C405	1 μF electrolytic 50 WV	022-2810-009
C406	0.001 μF ceramic 50 WV	510-3002-102
C407	20 pF mica 50 WV	022-2810-005
C408	Same as C407	
C409	0.01 μF ceramic 50 WV	510-0001-103
C410	20 pF mica 50 WV	022-2810-005
C411	0.01 μF ceramic 50 WV	510-0001-103
C412	20 pF mica 50 WV	022-2810-005
C413	0.01 μF ceramic 50 WV	510-0001-103
C414	15 pF mica 50 WV	510-0001-150
C415	4.7 pF mica 50 WV	022-2810-010
C416	Same as C415	
C417	0.01 μF ceramic 50 WV	510-0001-103
C418	0.04 μF mylar 50 WV	510-1003-473
C419	0.001 μF ceramic 50 WV	510-3002-102
C420	0.04 μF mylar 50 WV	510-1003-473
C421	Same as C420	
C422	Same as C420	
C423	Same as C420	
C424	Same as C420	
C425	Same as C420	
C426	20 pF mica 50 WV	022-2810-005
C428	0.04 μF mylar 50 WV	510-1003-473
C429	Same as C428	
C430	Same as C428	
C431	0.001 μF ceramic 50 WV	510-3002-102
C432	Same as C431	
C433	20 pF mica 50 WV	022-2810-005
C434	0.01 μF ceramic 50 WV	510-0001-103
C435	0.04 μF ceramic 50 WV	510-1003-104
C437	0.01 μF ceramic 50 WV	510-0001-103
C438	Same as C437	
C439	3 pF mica 50 WV	022-2810-011
C440	5 pF mica 50 WV	022-2810-004
C441	0.01 μF ceramic 50 WV	510-0001-103
C442	Same as C441	
C443	1 μF electrolytic 50 WV	022-2810-009
C444	0.01 μF ceramic 50 WV	510-0001-103
C445	100 pF mica 50 WV	510-0001-101
C446	0.1 μF mylar 50 WV	510-1003-104
C447	0.04 μF mylar 50 WV	510-1003-473
C448	1 pF mica 50 WV	022-2810-012
C449	0.04 mylar 50 WV	510-1003-473
C450	Same as C449	
C451	1 μF electrolytic 50 WV	022-2810-009
C452	0.01 mylar 50 WV	022-2810-022
C453	10 μF electrolytic 16 WV	022-2810-013
C454	0.01 μF ceramic 50 WV	510-0001-103
C455	1 pF electrolytic 50 WV	022-2810-009
C456	Same as C455	
C457	15 pF mica 50 WV	510-0001-150
C458	0.01 μF ceramic 50 WV	510-0001-103
C459	47 pF mica 50 WV	510-0002-470
C460	40 pF trim	022-2812-001
C461	10 pF trim	022-2812-004
C462	0.04 mylar 50 WV	510-1003-473
C463	56 pF mylar	022-2810-002
C464	1 μF electrolytic 50 WV	022-2810-009
C465	0.04 mylar 50 WV	510-1003-473
C466	Same as C465	
C501	22 pF ceramic NPO 50 WV	510-3013-220
C502	500 pF mica 50 WV	510-0001-511
C503	150 pF mica 50 WV	510-0001-151
C504	0.01 μF ceramic 50 WV	510-0001-103
C505	15 pF mica 50 WV	510-0001-150
C506	2 pF 500 WV	510-9002-209
C507	0.01 μF ceramic 50 WV	510-0001-103
C508	0.001 μF ceramic 50 WV	510-3002-102
C509	0.01 μF ceramic 50 WV	510-0001-103
C510	20 pF trim	022-2812-003
C511	10 pF trim	022-2812-004
C512	100 pF mica 50 WV	510-0001-101
C513	Same as C512	
C514	5 pF mica 50 WV	022-2810-004
C515	0.01 μF ceramic 50 WV	510-0001-103

PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.
C601	100 pF mica 50 WV	510-0001-101
C602	300 pF mica 50 WV	510-0001-301
C603	0.01 μF ceramic 50 WV	510-0001-103
C604	2 pF mica 50 WV	022-2810-001
C605	100 pF mica 50 WV	510-0001-101
C606	300 pF mica 50 WV	510-0001-301
C607	0.01 μF ceramic 50 WV	510-0001-103
C608	10 pF mica 50 WV	510-0001-100
C609	0.01 μF ceramic 50 WV	510-0001-103
C610	Same as C609	
C611	1P 500V	510-9002-109
C612	56 pF 500V	022-2810-002
C613	0.01 μF ceramic 50 WV	510-0001-103
C614	Same as C613	
C615	Same as C613	
C616	2 pF 500V	510-9002-209
C617	100 pF mica 500V	510-0001-101
C618	0.01 μF ceramic 50 WV	510-0001-103
C619	220 pF mica 50 WV	510-0001-221
C620	0.01 μF ceramic 50 WV	510-0001-103
C621	22 pF ceramic 50 WV	510-3013-220
C622	Same as C621	
C623	Same as C621	
C624	Same as C621	
C625	30 pF ceramic 50 WV	022-2810-003
C626	Same as C625	
C627	Same as C625	
C628	Same as C625	
C629	Same as C625	
C630	Same as C625	
C631	15 pF mica 50 WV	510-0001-150
C632	0.01 μF ceramic 50 WV	510-0001-103
C633	0.04 μF mylar 50 WV	510-1003-473
C634	0.01 μF ceramic 50 WV	510-0001-103
C635	Same as C634	
C636	Same as C634	
C637	56 pF mica 50 WV	510-0001-560
C638	0.001 μF ceramic 50 WV	510-3002-102
C639	40 pF trim	022-2812-001
C640	Same as C639	
C641	Same as C639	
C642	Same as C639	
C643	30 pF trim	022-2812-002
C644	Same as C643	
C645	Same as C643	
C646	Same as C643	
C647	Same as C643	
C648	Same as C643	
C649	0.01 μF ceramic 50 WV	510-0001-103
C650	Same as C649	
C651	Same as C649	
C652	Same as C649	
C701	100 pF mica 50 WV	510-0001-101
C702	5 pF mica 50 WV	022-2810-004
C703	0.01 μF ceramic 50 WV	510-0001-103
C704	Same as C703	
C705	100 pF mica 50 WV	510-0001-101
C706	1 pF 500V	510-9002-109
C707	220 pF 500V	510-0001-221
C708	0.01 μF ceramic 50 WV	510-0001-103
C709	Same as C708	
C710	130 pF mica 50 WV	510-0001-131
C711	0.01 μF ceramic 50 WV	510-0001-103
C712	Same as C711	
C713	Same as C711	
C714	30 pF mica 50 WV	022-2810-003
C715	100 pF mica 50 WV	510-0001-101
C716	0.01 μF ceramic 50 WV	510-0001-103
C717	Same as C716	
C718	56 pF mica 50 WV	510-0001-560
C719	150 pF mica 50 WV	510-0001-151
C720	0.01 μF ceramic 50 WV	510-0001-103
C721	Same as C720	
C722	150 pF mica 50 WV	510-0001-151
C723	20 pF mica 50 WV	022-2810-005
C724	400 pF mica 50 WV	022-2810-006
C725	2 pF mica 50 WV	022-2810-007
C726	0.01 μF ceramic 50 WV	510-0001-103
C727	65 pF mica 50 WV	022-2810-008
C728	200 pF mica 50 WV	510-0001-201
C729	0.01 μF ceramic 50 WV	510-0001-103
C730	0.1 μF mylar 50 WV	510-1003-104
C731	0.01 μF ceramic 50 WV	510-0001-103
C732	100 pF mica 50 WV	510-0001-101
C733	1 μF electrolytic 50 WV	022-2810-009
C734	0.01 μF ceramic 50 WV	510-0001-103
C737	22 μF	022-2810-023
C738	10 μF electrolytic 16 WV	022-2810-013
C801	0.01 μF ceramic 50 WV	510-0001-103
C802	Same as C801	
C803	Same as C801	
C804	Same as C801	
C805	Same as C801	
C806	0.04 μF mylar 50 WV	510-1003-473
C807	Same as C806	
	DIODES	
CR101	Silicon, U05B	022-2823-001
CR102	Zener 9V 1W	022-2823-002
CR103	Same as CR102	
CR104	Same as CR102	
CR201	Germanium 1N60	022-2823-003
CR202	Silicon WG713	022-2823-004
CR203	Germanium 1N60	022-2823-003
CR204	Silicon U05B	022-2823-001
CR301	Germanium 1N60	022-2823-003
CR401	Same as CR301	
CR402	Silicon WG713	022-2823-004
CR403	Same as CR402	
CR404	Same as CR402	
CR405	Germanium 1N60	022-2823-003
CR406	Silicon WG713	022-2823-004
CR407	Same as CR406	
CR408	Germanium 1N60	022-2823-003
CR409	Same as CR408	
CR410	Same as CR408	
CR411	Same as CR408	
CR412	Same as CR408	
CR413	Same as CR408	
CR414	Silicon WG713	022-2823-004
CR415	Silicon 1S2472	022-2823-005
CR416	Same as CR415	
CR417	Germanium 1N60	022-2823-003
CR418	Same as CR417	
CR419	Silicon WG713	022-2823-004
CR420	Same as CR419	
CR421	Same as CR419	
CR422	Germanium 1N60	022-2823-003
CR423	Same as CR422	
CR424	Germanium 1N34A	022-2823-006
CR425	Silicon WG713	022-2823-004
CR501	Same as CR425	

PARTS LIST (cont'd)

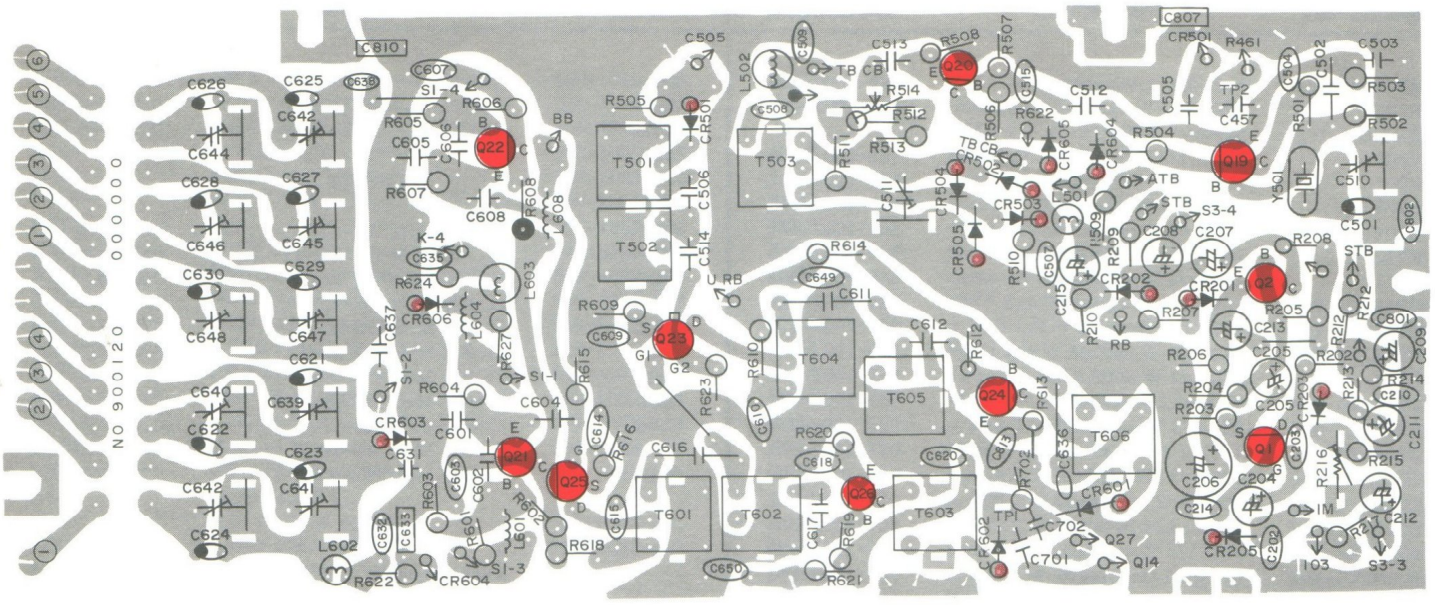
SYMBOL NO.	DESCRIPTION	PART NO.
CR502	Germanium 1N60P	022-2823-007
CR503	Same as CR502	
CR504	Same as CR502	
CR505	Same as CR502	
CR601	Silicon WG713	022-2823-004
CR602	Same as CR601	
CR603	Germanium 1S1007	022-2823-008
CR604	Silicon WG713	022-2823-004
CR605	Same as CR604	
CR606	Silicon	022-2823-009
CR701	Zener 0.7V 250 mW	022-2823-010
CR702	Same as CR701	
CR703	Same as CR701	
CR704	Silicon 10D4	022-2823-011
CR705	Same as CR704	
CR706	Germanium 1N60	022-2823-003
CR707	Same as CR706	
CR708	Same as CR706	
CR709	Same as CR706	
	LAMPS	
DS101	14V 75 mA	022-2849-001
DS102	16V 40 mA	022-2849-002
DS103	Same as DS102	
DS104	Same as DS102	
DS105	Same as DS102	
DS106	Red 16V 40 mA	022-2849-003
	FUSES	
F101	Fuse, 3A 250V	534-0003-026
F301	Fuse (pigtail) 1.5A	022-2834-001
TB302	Terminal strip	586-1001-019
	FILTER	
F401	Crystal filter 7.8 MHz	022-2832-501
	IC	
IC301	HA1339 audio amp	022-2844-001
IC401	Noise amp μA703	022-2844-002
	CONNECTORS	
J101	Mic connector	515-1003-001
J301	3.5 connector	022-2815-001
J302	Same as J301	
J701	Antenna connector	515-3003-001
	RELAY	
K1	Relay	022-2867-001
	SPEAKER	
LS1	Speaker	022-2889-001
	INDUCTORS	
L101	1 mH choke	022-2842-001
L401	470 μH choke	022-2842-002
L402	Same as L401	
L403	22 μH choke	542-3002-002
L404	1 μH choke	542-3002-001
L501	22 μH choke	542-3002-002
L502	150 μH choke	022-2842-003
L601	5.5 μH choke	022-2842-004
L602	470 μH choke	022-2842-002
L603	Same as L602	
L604	0.22 μH choke	022-2842-005
L608	22 μH choke	542-3002-002
L701	0.65 μH choke	022-2842-006
L702	Same as L701	
L703	0.22 μH choke	022-2842-005
L704	22 μH choke	542-3002-002
L705	Same as L704	
L706	0.65 μH choke	022-2842-006
L707	0.22 μH choke	022-2842-005
L708	C997ND 27 MHz ant	022-2842-007
L714	1.2 μH choke	022-2842-008
	METER	
M1	Meter	022-2854-001
	TRANSISTORS	
Q1	FET limiter	022-2876-001
Q2	NPN mic.amp	022-2876-002
Q3	NPN squelch amp.	022-2876-003
Q4	NPN squelch gate	022-2876-004
Q5	NPN audio preamp	022-2876-003
Q6	NPN active filter	022-2876-003
Q7	FET AGC amp	022-2876-005
Q8	FET blanker gate	022-2876-001
Q9	FET noise amp	022-2876-006
Q10	NPN IF amp	022-2876-007
Q11	Same as Q10	
Q12	Same as Q10	
Q13	Same as Q10	
Q14	FET receive mixer	022-2876-008
Q15	FET RF amp	022-2876-009
Q16	NPN SSB detector	022-2876-007
Q17	Same as Q16	
Q18	NPN SSB meter amp	022-2876-007
Q19	NPN 7.8025 MHz osc	022-2876-007
Q20	NPN 7.8025 MHz buffer	022-2876-007
Q21	NPN low frequency osc	022-2876-007
Q22	NPN high frequency osc	022-2876-007
Q23	FET USB mixer	022-2876-008
Q24	NPN 35 MHz amp	022-2876-007
Q25	FET synthesizer mixer	022-2876-005
Q26	NPN 19 MHz amp	022-2876-007
Q27	FET transmit mixer	022-2876-008
Q28	NPN transmit amp	022-2876-007
Q29	NPN predriver	022-2876-010
Q30	Driver	022-2876-011
Q31	NPN power amplifier	022-2876-012
Q32	AGC control	022-2876-007
	RESISTORS	
R101	56Ω 1 W metal oxide	569-1006-560
R102	Same as R101	
R103	33Ω 1 W metal oxide	569-1006-330
R202	270KΩ 1/4 W carbon	569-1002-271
R203	10KΩ 1/4 W carbon	569-1002-103
R204	3.3KΩ 1/4 W carbon	569-1002-332
R205	15KΩ 1/4 W carbon	569-1002-153
R206	470Ω 1/4 W carbon	569-1002-471
R207	Same as R206	
R208	2.2KΩ 1/4 W carbon	569-1002-222

PARTS LIST (cont'd)

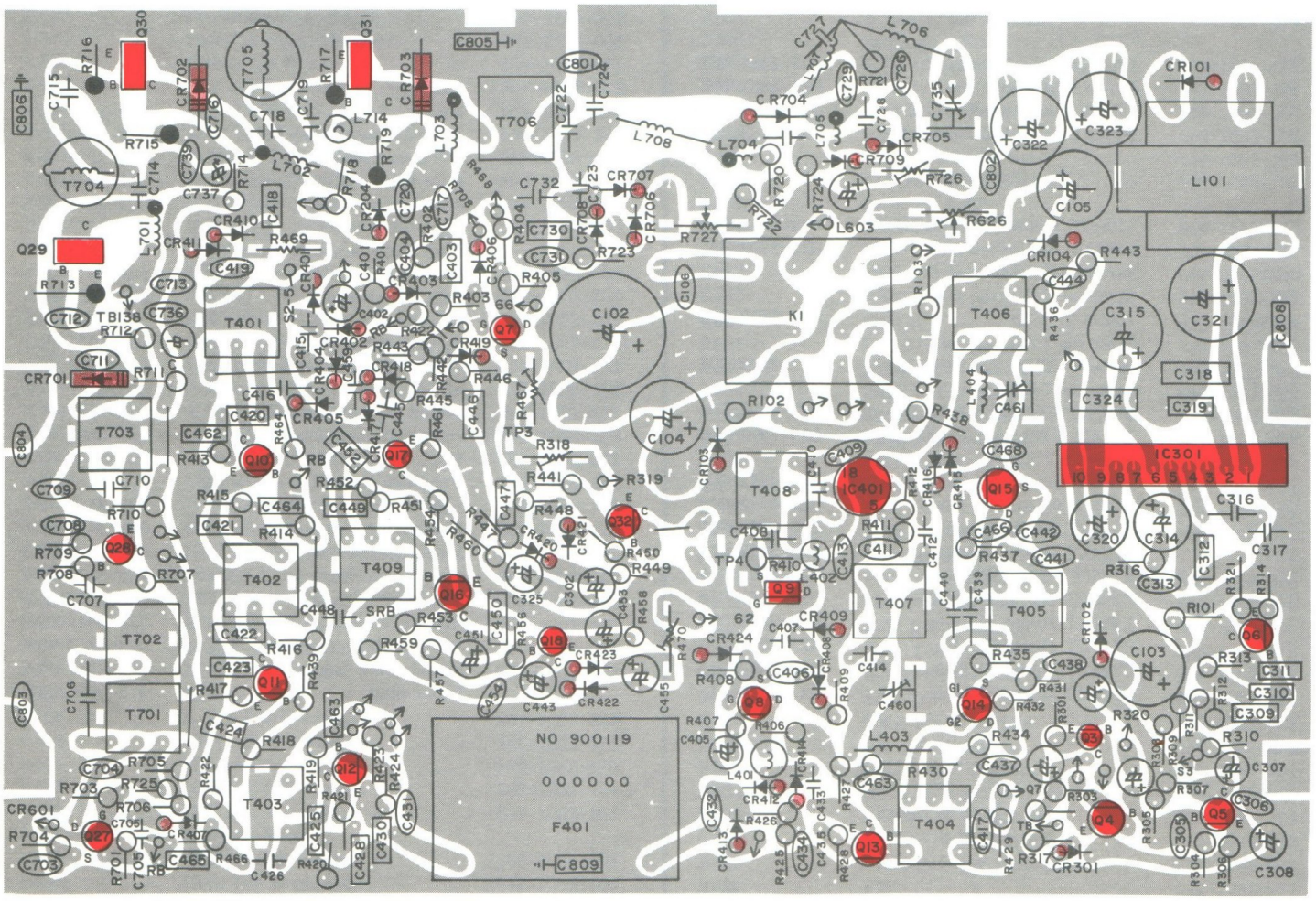
SYMBOL NO.	DESCRIPTION.	PART NO.
R209	10KΩ 1/4 W carbon	569-1002-103
R210	1KΩ 1/4 W carbon	569-1002-102
R212	22KΩ 1/4 W carbon	569-1002-223
R213	2.2KΩ 1/4 W carbon	569-1002-222
R214	10KΩ 1/4 W carbon	569-1002-103
R215	470Ω 1/4 W carbon	569-1002-471
R216	1KΩ	022-2862-006
R217	0.22Ω 1/4 W carbon	022-2869-003
R301	100Ω 1/4 W carbon	569-1002-101
R302	56KΩ 1/4 W carbon	569-1002-563
R303	33KΩ 1/4 W carbon	569-1002-333
R304	4.7KΩ 1/4 W carbon	569-1002-472
R305	15KΩ 1/4 W carbon	569-1002-153
R306	1KΩ 1/4 W carbon	569-1002-102
R307	3.3KΩ 1/4 W carbon	569-1002-332
R308	1KΩ 1/4 W carbon	569-1002-102
R309	10KΩ 1/4 W carbon	569-1002-103
R310	Same as R309	
R311	1.8KΩ 1/4 W carbon	569-1002-182
R312	4.7KΩ 1/4 W carbon	569-1002-472
R313	Same as R312	
R314	Same as R312	
R316	330Ω 1/4 W carbon	569-1002-331
R317	1KΩ 1/4 W carbon	569-1002-102
R318	10KΩ	022-2862-007
R319	Potentiometer, squelch	022-2862-002
R320	Potentiometer volume	022-2862-001
R401	470KΩ 1/4 W carbon	569-1002-471
R402	1KΩ 1/4 W carbon	569-1002-102
R403	100KΩ 1/4 W carbon	569-1002-104
R404	270Ω 1/4 W carbon	569-1002-271
R405	3.3KΩ 1/4 W carbon	569-1002-332
R406	2.7KΩ 1/4 W carbon	569-1002-272
R407	1KΩ 1/4 W carbon	569-1002-102
R408	1MΩ 1/4 W carbon	569-1002-105
R409	Same as R408	
R410	220KΩ 1/4 W carbon	569-1002-224
R411	20KΩ 1/4 W carbon	569-1002-203
R412	1KΩ 1/4 W carbon	569-1002-102
R413	220Ω 1/4 W carbon	569-1002-221
R414	15KΩ 1/4 W carbon	569-1002-153
R415	3.3KΩ 1/4 W carbon	569-1002-332
R416	470Ω 1/4 W carbon	569-1002-471
R417	1KΩ 1/4 W carbon	569-1002-102
R418	3.3KΩ 1/4 W carbon	569-1002-332
R419	470Ω 1/4 W carbon	569-1002-471
R420	1KΩ 1/4 W carbon	569-1002-102
R421	47Ω 1/4 W carbon	569-1002-470
R422	100Ω 1/4 W carbon	569-1002-101
R423	1KΩ 1/4 W carbon	569-1002-102
R424	200Ω 1/4 W carbon	022-2869-004
R425	47KΩ 1/4 W carbon	569-1002-473
R426	220Ω 1/4 W carbon	569-1002-221
R427	1KΩ 1/4 W carbon	569-1002-102
R428	Same as R427	
R429	3.3KΩ 1/4 W carbon	569-1002-332
R430	470Ω 1/4 W carbon	569-1002-471
R431	47Ω 1/4 W carbon	569-1002-470
R432	100KΩ 1/4 W carbon	569-1002-104
R433	1MΩ 1/4 W carbon	569-1002-105
R434	Same as R433	
R435	100KΩ 1/4 W carbon	569-1002-104
R436	10KΩ 1/4 W carbon	569-1002-103
R437	470Ω 1/4 W carbon	569-1002-471
R439	15KΩ 1/4 W carbon	569-1002-153
R440	220Ω 1/4 W carbon	569-1002-221
R441	22K 1/4 W carbon	569-1002-223
R442	Same as R441	
R443	33KΩ 1/4 W carbon	569-1002-333
R445	Same as R443	
R446	Same as R443	
R447	Same as R443	
R448	10KΩ 1/4 W carbon	569-1002-103
R449	Same as R448	
R450	Same as R448	
R451	15KΩ 1/4 W carbon	569-1002-153
R452	3.3KΩ 1/4 W carbon	569-1002-332
R453	10KΩ 1/4 W carbon	569-1002-103
R454	Same as R453	
R456	15KΩ 1/4 W carbon	569-1002-153
R457	4.7KΩ 1/4 W carbon	569-1002-472
R458	470Ω 1/4 W carbon	569-1002-471
R459	2.2KΩ 1/4 W carbon	569-1002-222
R460	3.3KΩ 1/4 W carbon	569-1002-332
R461	1KΩ 1/4 W carbon	569-1002-102
R464	100Ω 1/4 W carbon	569-1002-101
R465	2.2KΩ 1/4 W carbon	569-1002-222
R466	10KΩ 1/4 W carbon	569-1002-103
R467	5KΩ	022-2862-013
R468	Potentiometer, RF gain	022-2862-003
R469	20KΩ	022-2862-008
R470	100KΩ	022-2862-009
R501	4.7KΩ 1/4 W carbon	569-1002-472
R502	Same as R501	
R503	470Ω 1/4 W carbon	569-1002-471
R504	220Ω 1/4 W carbon	569-1002-221
R505	2.7KΩ 1/4 W carbon	569-1002-272
R506	33KΩ 1/4 W carbon	569-1002-333
R507	15KΩ 1/4 W carbon	569-1002-153
R508	1KΩ 1/4 W carbon	569-1002-102
R509	Same as R508	
R510	47KΩ 1/4 W carbon	569-1002-473
R511	330Ω 1/4 W carbon	569-1002-331
R512	100Ω 1/4 W carbon	569-1002-102
R513	330Ω 1/4 W carbon	569-1002-331
R514	500Ω	022-2862-010
R601	1KΩ 1/4 W carbon	569-1002-102
R602	33KΩ 1/4 W carbon	569-1002-333
R603	22KΩ 1/4 W carbon	569-1002-223
R604	330Ω 1/4 W carbon	569-1002-331
R605	22KΩ 1/4 W carbon	569-1002-223
R606	33KΩ 1/4 W carbon	569-1002-333
R607	330Ω 1/4 W carbon	569-1002-331
R608	100Ω 1 W	569-1006-101
R609	470Ω 1/4 W carbon	569-1002-471
R610	Same as R609	
R612	47K 1/4 W carbon	569-1002-473
R613	47Ω 1/4 W carbon	569-1002-470
R614	560Ω 1/4 W carbon	569-1002-561
R615	470K 1/4 W solid	569-1002-474
R616	1KΩ 1/4 W carbon	569-1002-102
R618	220Ω 1/4 W carbon	569-1002-221
R619	47KΩ 1/4 W carbon	569-1002-473
R620	47Ω 1/4 W carbon	569-1002-470
R621	680Ω 1/4 W carbon	569-1002-681
R622	1KΩ 1/4 W carbon	569-1002-102
R623	100KΩ 1/4 W carbon	569-1002-104
R624	3.3KΩ 1/4 W carbon	569-1002-332
R625	Potentiometer, fine tune	022-2862-004
R626	10K	022-2862-012
R627	100Ω 1/4 W carbon	569-1002-101
R701	100KΩ 1/4 W carbon	569-1002-104
R702	1KΩ 1/4 W carbon	569-1002-102

PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.
R703	3.3KΩ 1/4 W carbon	569-1002-332
R704	470Ω 1/4 W carbon	569-1002-471
R705	Same as R704	
R706	10KΩ 1/4 W carbon	569-1002-103
R707	2.7KΩ 1/4 W carbon	569-1002-272
R708	470Ω 1/4 W carbon	569-1002-471
R709	47Ω 1/4 W carbon	569-1002-470
R710	10Ω 1/4 W carbon	569-1002-100
R711	1KΩ 1/4 W carbon	569-1002-102
R712	5.6Ω 1/4 W carbon	569-1002-569
R713	2.2Ω 1/2 W solid	569-1004-222
R714	1KΩ 1/4 W carbon	569-1002-102
R715	47Ω 1/2 W solid	569-1004-470
R716	470Ω 1/2 W solid	569-1004-471
R717	22Ω 1/2 W solid	569-1004-220
R718	100Ω 2 W metal oxide	022-2869-001
R719	10Ω 1/2 W solid	569-1004-100
R720	150Ω 1 W metal oxide	022-2869-002
R721	3.3KΩ 1/4 W carbon	569-1002-332
R722	1KΩ 1/4 W carbon	569-1002-102
R723	4.7MΩ 1/4 W solid	569-1004-475
R724	1KΩ 1/4 W carbon	569-1002-102
R725	15KΩ 1/4 W carbon	569-1002-153
R726	100KΩ	022-2862-009
R727	10KΩ	022-2862-012
	SWITCHES	
S1	Channel selector switch	022-2883-001
S2	Mode switch	022-2883-002
S3	CB-PA slide switch	022-2883-003
S4	Noise blanker slide switch	022-2883-004
	TRANSFORMERS	
T401	S190AT 10MM 7.8 MHz IF	022-2892-001
T402	S183AT 10MM 7.8 MHz IF	022-2892-002
T403	Same as T402	
T404	Same as T402	
T405	10MM 27 MHz	022-2892-003
T406	Same as T405	
T407	S183AT 10MM 7.8 MHz IF	022-2892-002
T408	Same as T407	
T409	S185ZT 10MM 7.8 MHz detector	022-2892-005
T501	Z176IT 10MM 15.6 MHz multi	022-2892-006
T502	Same as T501	
T503	S111DT 10MM balance modulator	022-2892-007
T601	Z282IT 10MM 19 MHz	022-2892-008
T602	Z188AT 10MM 19 MHz	022-2892-009
T603	Z284AT 10MM 19 MHz	022-2892-010
T604	Z285IT 10MM 35 MHz	022-2892-011
T605	Z286KT 10MM 35 MHz	022-2892-012
T606	Z287AT 10MM 35 MHz	022-2892-013
T701	C181ZT 10MM 27 MHz	022-2892-014
T702	C182ZT 10MM 27 MHz	022-2892-015
T703	C042QD 10MM 27 MHz	022-2892-016
T704	C979NT 10MM 27 MHz	022-2892-017
T705	C996NT 10MM 27 MHz	022-2892-018
T706	C043ND 10MM 27 MHz	022-2892-019
	CRYSTALS	
Y501	7.8025 MHz HC-25/U	022-2820-011
Y601	11.700 MHz HC-25/U	022-2820-001
Y602	11.750 MHz HC-25/U	022-2820-002
Y603	11.800 MHz HC-25/U	022-2820-003
Y604	11.850 MHz HC-25/U	022-2820-004
Y605	11.900 MHz HC-25/U	022-2820-005
Y606	11.950 MHz HC-25/U	022-2820-006
Y607	7.4625 MHz HC-25/U	022-2820-007
Y608	7.4725 MHz HC-25/U	022-2820-008
Y609	7.4825 MHz HC-25/U	022-2820-009
Y610	7.5025 MHz HC-25/U	022-2820-010
	KNOBS	
	Knob, squelch	547-0014-002
	Knob, volume	547-0014-002
	Knob, mode switch	547-0014-002
	Knob, RF gain	547-0014-002
	Knob, fine tune	547-0014-002
	Knob, channel selector	547-0014-001
	HARDWARE	
	352 panel	022-2832-001
	Dial	022-2832-002
	352 overlay (Viking 352)	022-2859-001
	352 overlay (Johnson)	022-2859-002
	Pilot lamp bracket, red	022-2817-001
	Pilot lamp bracket, amber	022-2817-002
	Pilot lamp bracket, blue	022-2817-003
	Pilot lamp bushing	022-2813-001
	Johnson plastic trade mark	559-2018-002
	Front overlay	022-2859-003
	Rear panel	022-2817-004
	Battery cable stopper	586-1001-019
	3.5 connector mounting plate	022-2817-005
	Main chassis	022-2817-006
	Meter mounting panel	022-2817-007
	Heat sink for Q29,Q30,Q31	022-2814-001
	Heat sink for IC301	022-2814-002
	Feedthru capacitor mounting plate	022-2817-008
	Cabinet	022-2817-009
	Mounting bracket	537-9352-001
	Crystal holder	126-0110-005
	Insulator f/HA1339	022-2818-001
	Insulator f/mic connector	022-2818-002
	Rubber plate f/speaker	022-2818-003
	Mount plate f/speaker	022-2817-011
	Phone plug	515-0020-001

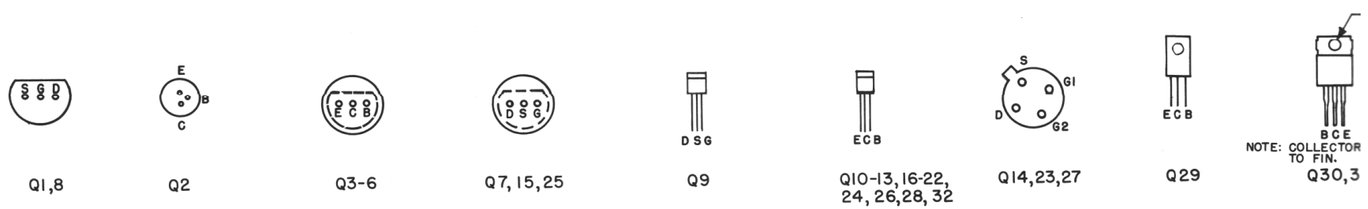


FREQUENCY SYNTHESIZER PC BOARD
(SOLDER SIDE VIEW)



TRANSCEIVER PC BOARD
(SOLDER SIDE VIEW)

NOTES:
1. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
3. M = ISOLATION CAPACITORS



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Printed in U.S.A. 6-75EFJ Part No. 002-9352-001