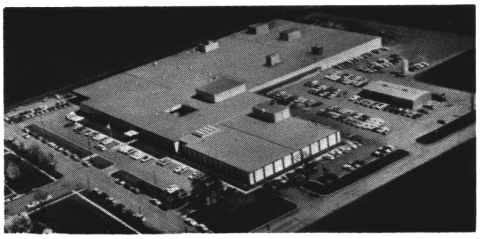
THE JOHNSON ONE YEAR GUARANTEE

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.

E. F. JOHNSON COMPANY
299 10th Avenue S. W.
Waseca, Minnesota 56093



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.

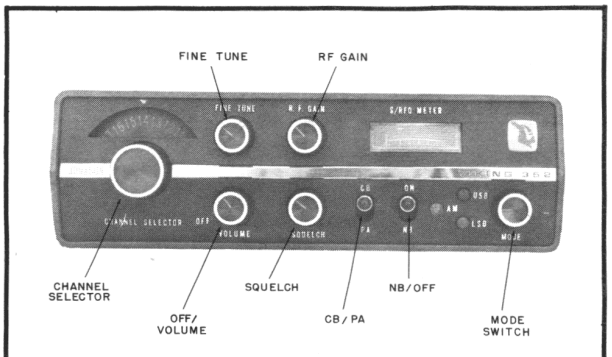
FEDERAL COMMUNICATIONS COMMISSION RULES AND REGULATIONS PROHIBIT TAMPERING WITH ANY INTERNAL RADIO ADJUSTMENTS. TAMPERING WITH INTERNAL ADJUSTMENTS CAN SOMETIMES CAUSE ILLEGAL OPERATION.

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.

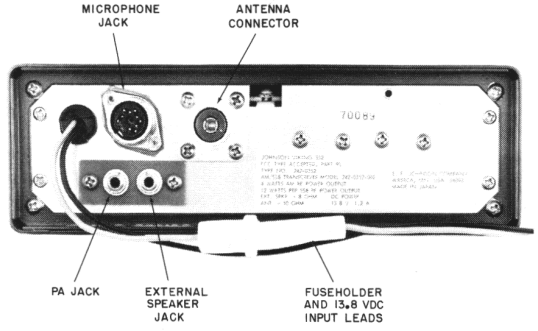
CB-PA - Ensure that this switch is in the CB position.

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.

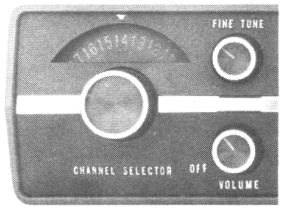
MICROPHONE - Depress the PTT button and speak directly into the mouthpiece.

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.

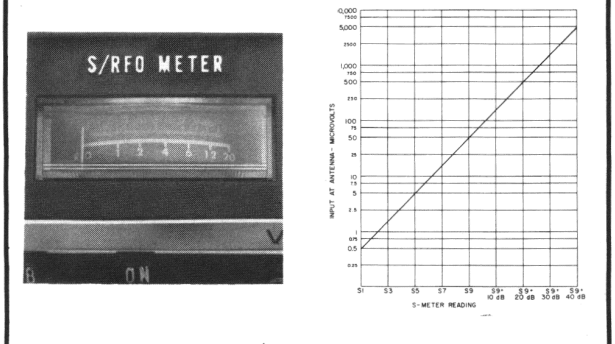
The illuminated channel selector indicator allows you to see the channel switch positions adjacent to the channel on which you are operating. This is an aid in channel switching, since it reminds you which direction you should rotate the channel selector switch for any desired channel.



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.

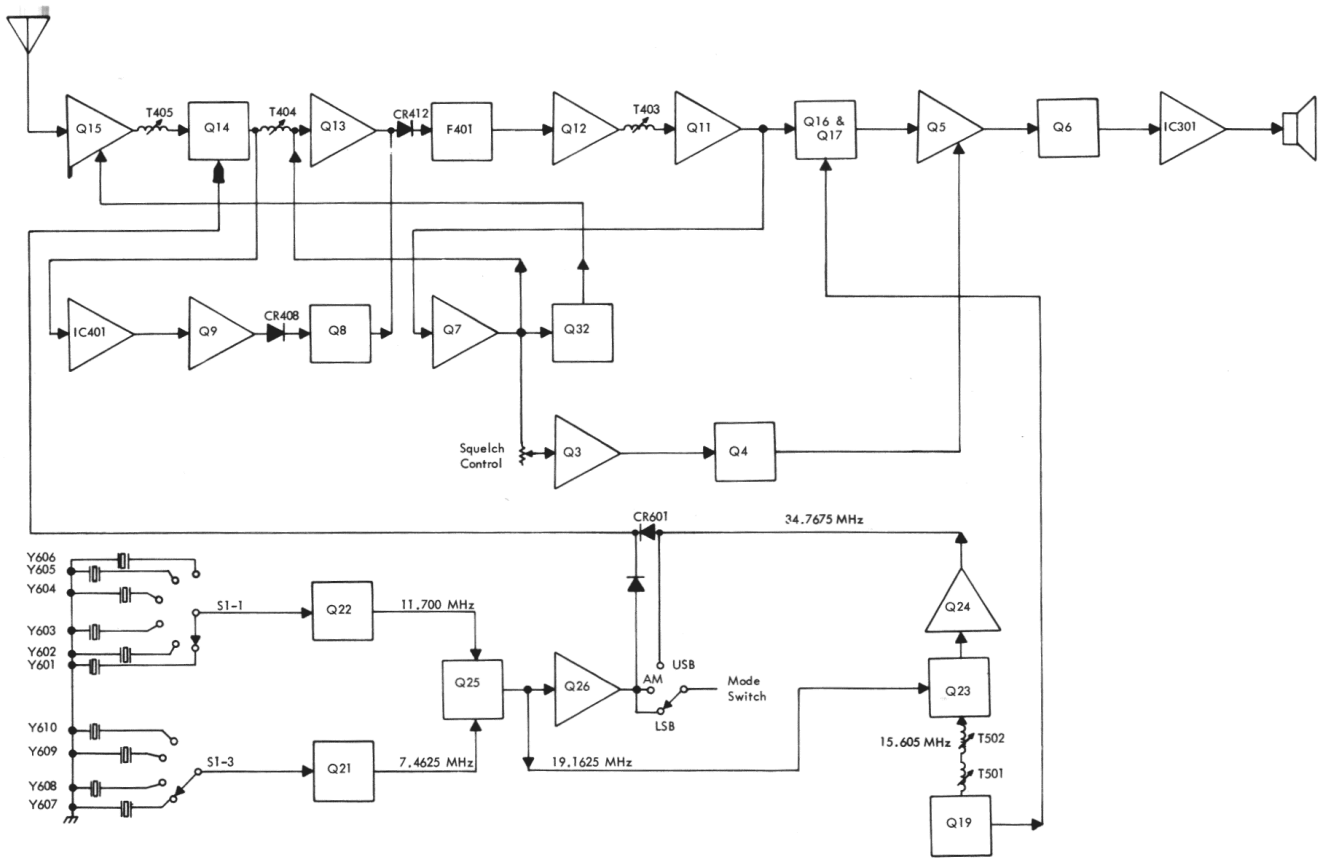
Upper Sideband (USB)

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.

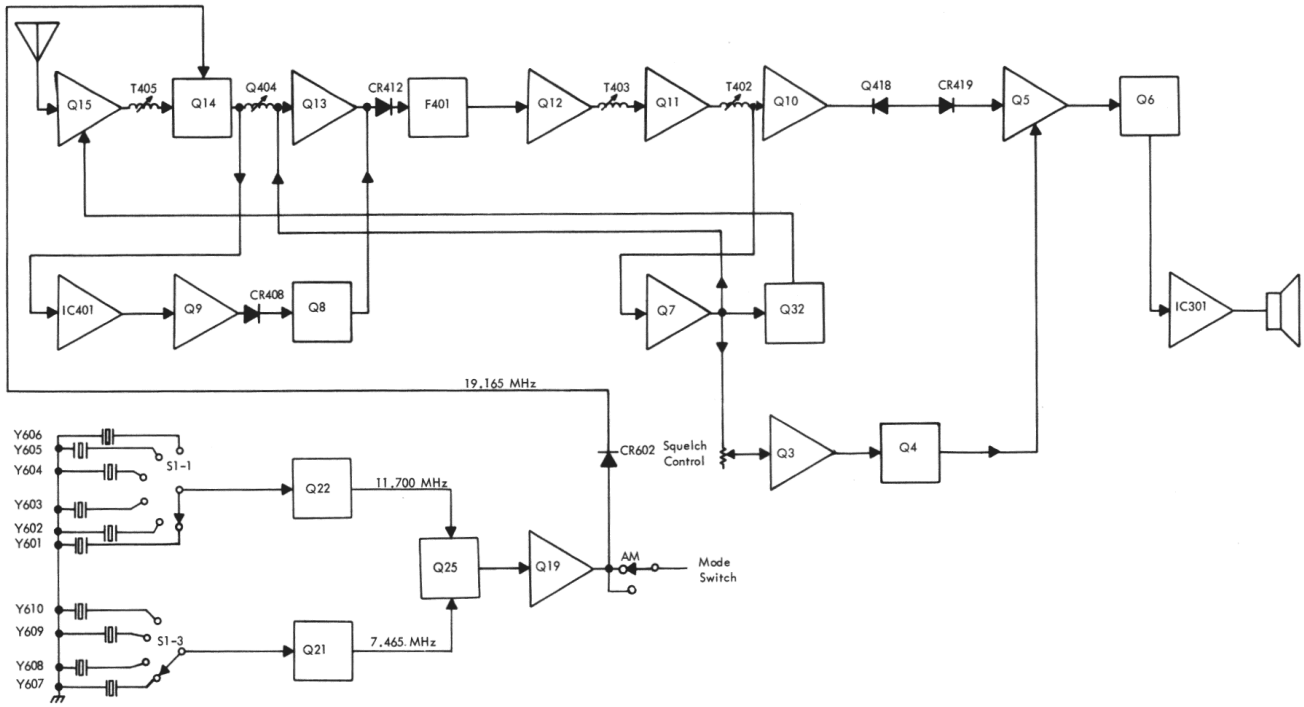
FREQUENCY SYNTHESIZER TABLE

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.