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MESSENGER

202

BUSINESS/INDUSTRIAL
TWO-WAY RADIO 10 WATT

MODEL NO. 242-0326-xxx
MODEL NO. 242-0327-xxx
MODEL NO. 242-0328-xxx
MODEL NO. 242-0329-xxx
MODEL NO. 242-0338-xxx

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SECTION I
GENERAL INFORMATION

1.1 GENERAL

The Johnson Messenger 202 is a radio transceiver designed for two-way radio service in the 25-50 megahertz band. It comprises a crystal controlled superheterodyne receiver, a crystal controlled two-stage transmitter and power supply in a 5-5/8" x 7" x 11-3/8" enclosure. The antenna, power supply and some audio circuits are common to both the receiver and transmitter. Crystals for single channel operation are mounted within the cabinet. The transceiver provides plug-in operation of the Tone-Alert selective calling system, the Messenger Remote Control System, and the P/A 85 and P/A 30 power amplifiers. The Messenger 202 is supplied in the following models:

MODEL NO.	OPERATING VOLTAGE
242-326	117 VAC, 50-60 Hz
242-327	117 VAC, 50-60 Hz, 6 VDC
242-328	117 VAC, 50-60 Hz, 12 VDC
242-329	117 VAC, 50-60 Hz, 24 VDC
242-338	117 VAC, 230 VAC, 50-60 Hz, 12 VDC

The Universal Models (AC and DC) use a 6 volt vibrator for 6 VDC operation and a 12 volt vibrator for 12 VDC or 24 VDC operation.

The frequency ranges are indicated by the "dash number" for example:

MODEL	FREQUENCY RANGE
242-0328-001	25-30 MHz
242-0328-002	30-35 MHz
242-0328-003	35-40 MHz
242-0328-004	40-45 MHz
242-0328-005	45-50 MHz

A slight overlapping of ranges is normal.

1.2 RECEIVER TUBE AND SEMICONDUCTOR COMPLEMENT

TUBE	FUNCTION
V1 (6BJ6)	Tuned RF amplifier
V2 (12BE6)	Mixer and crystal oscillator
V3 (6BJ6)	IF amplifier (455 kHz)
V4 (6BJ6)	IF amplifier (455 kHz)
V10A (12AU7)	First audio amplifier
V5A (6AW8)	Squelch control amplifier
V5B (6AW8)	Second audio amplifier
V6 (12AB5)	Audio power output
V9 (12BW4)	Rectifier, high voltage
D2 (1N881)	Automatic noise limiter
D3 (1N294A)	Detector, AVC

1.3 TRANSMITTER TUBE AND SEMICONDUCTOR COMPLEMENT

TUBE	FUNCTION
V7 (7054)	Crystal oscillator

V8 (7061)	RF power amplifier, plate and screen modulated
V10B (12AU7)	First speech amplifier
V5B (6AW8)	Second speech amplifier
V6 (12AB5)	Modulator

1.4 ACCESSORIES

MODEL NO.	ACCESSORY
250-0810-001/018	Tone-Alert (6 VDC, 117 VAC)
250-0811-001/018	Tone-Alert (12 VDC, 117 VAC)
250-0833-001	Remote Control Console
250-0834-001	Remote Adapter
250-0157-301/305	P/A 85, 13.4 VDC
242-0159-301/305	P/A 85, 117 VAC
242-0181-301/305	P/A 30, 13.4 VDC
242-0182-301/305	P/A 30, 117 VAC
250-0839-001	Noise Cancelling Microphone

SECTION 2
SPECIFICATIONS

2.1 GENERAL

Frequency Range	25-50 MHz
Channels	one
Dimensions of Enclosure	5-5/8" high x 7" wide x 11-3/8" deep
Unit Weight	12 lb.
Microphone	ceramic element, Hi impedance
Frequency Control	±.002% crystal
Antenna Impedance	50 ohms, unbalanced
Compliance	Type accepted, FCC Rules Part 87, 89, 91, 93.

Operating Voltages	Nominal Power Supply Voltage	Standard Test Voltage
	6 VDC	6.5 VDC
	12 VDC	13.8 VDC
	24 VDC	26.4 VDC
	110-120 VAC	117 VAC
	220-240 VAC	234 VAC

Power Demand with Standard Test Voltages at Input to Power Cable.	
	6.5 VDC Rec. 9.8 amps
	Trans. 11.6 amps
	13.8 VDC Rec. 4.9 amps
	Trans. 5.8 amps
	26.4 VDC Rec. 2.5 amps
	Trans. 2.95 amps
	117 VAC Rec. 70 watts
	Trans. 85 watts
	234 VAC Rec. 70 watts
	Trans. 85 watts

2.2 RECEIVER

Receiver input is given in microvolts at the signal generator into a 6 dB 50 ohm pad. Signal at transceiver antenna terminals will nominally be 1/2 of this value. Input modulated 30% at 1000 Hz. Standard Test Voltage, per Section 2.1, applied to input of power cable.

Audio Output Power	1.2 watts minimum at 1 μV 3 watts minimum at 10% distortion at 1000 μV,
Speaker Impedance	3.2 ohms nominal
Sensitivity	10 dB minimum S+N/N ratio at 1 μV, 25-40 MHz; 8 dB minimum S+N/N ratio at 1 μV, 40-50 MHz
Selectivity	7 kHz bandwidth at -6 dB, 21 kHz bandwidth at -60 dB
Spurious Rejection	Image: nominal 30 dB; others 45 dB or better
Squelch Sensitivity	6 dB or less signal change for 40 dB of quieting at 2 μV
Squelch Range	Typical 0.3 to 300 μV Squelch opens with 1 μV or less. Tight squelch requires 50 μV or more to open.
Intermediate Frequency	455 kHz
Noise Limiting	Series type, automatic threshold adjustment
AGC Characteristics	Nominally flat ±12 dB 10 to 100,000 μV with 12 dB roll-off from 10 to 1 μV
Circuitry	Single conversion superheterodyne; electron tubes

2.3 TRANSMITTER

Standard Test Voltage, per Section 2.1, applied to input of power cable.

Emission	8A3
DC Power Input	10 watts at Standard Test Voltage
RF Power Output	4.5 watts minimum at Standard Test Voltage
RF Spurious and Harmonic Attenuation	Better than FCC requirement
Audio Input Impedance	High
Audio Frequency Response	+1 -4 dB, 400-2500 Hz
Modulation	High level AM, plate and screen; class AB1 modulator, audio peak clipping and audio filtering
Circuitry	Electron tubes

SECTION 3
INSTALLATION

3.1 UNPACKING

Messenger transceivers are shipped in single cartons, adequately reinforced to protect the unit during transportation. A microphone and an AC power cable are included, but are detached. The universal models also include a DC power cable. The carton also includes an accessory package containing an operating manual, microphone holder, warranty card, log book order form, transmitter identification card. Use caution when unpacking to avoid loss of these items.

Inspect the unit for possible damage during shipment - report any discrepancies immediately to the transportation company or your local E. F. Johnson Company distributor.

3.2 VEHICULAR MOUNTING

The Messenger transceiver is easily installed in a vehicle by using the DC power cable which is supplied with all universal Messenger transceivers. The power cables may be purchased separately. Installation of power cables and antennas would allow most convenient transfer of the transceiver from vehicle to vehicle. Check SWR whenever the transceiver is connected to an untried antenna. (See Section 4.3.)

When installing the Messenger transceiver in a vehicle, position the unit where the operator can easily reach the controls. The Messenger Dash Mounting Kit (E. F. Johnson Part No. 251-0828-001) is recommended for mobile installations, and includes the hardware and instructions necessary for a quick and rugged mounting.

CAUTION: Do not install the transceiver in the direct air stream from the vehicle's heater as temperatures in this area can measure up to 150°F, which can result in component failure.

After you have selected a satisfactory transceiver location, but before mounting the transceiver, install the transceiver antenna and route the antenna lead to the transceiver location. Routing the antenna lead before transceiver mounting allows more working room under the vehicle dashboard. Mount the transceiver following the directions supplied with the mobile mounting bracket.

3.3 POWER CABLES

DC power cables for the Messenger are coded: black for the ground lead, blue for the "hot" lead with 6 VDC models, red for the "hot" lead with 12 VDC models, yellow for the "hot" lead with 24 VDC models. The black lead is to be connected to the grounded side of the battery with either negative ground or positive ground battery systems. Connect the black lead to the vehicle frame, body or engine using any convenient bolt. Clean the point of connection to remove all dirt, paint or grease. Connect the blue or red or yellow lead to the accessory terminal of the vehicle ignition switch. The "hot" lead is provided with an in-line fuseholder and fuse.

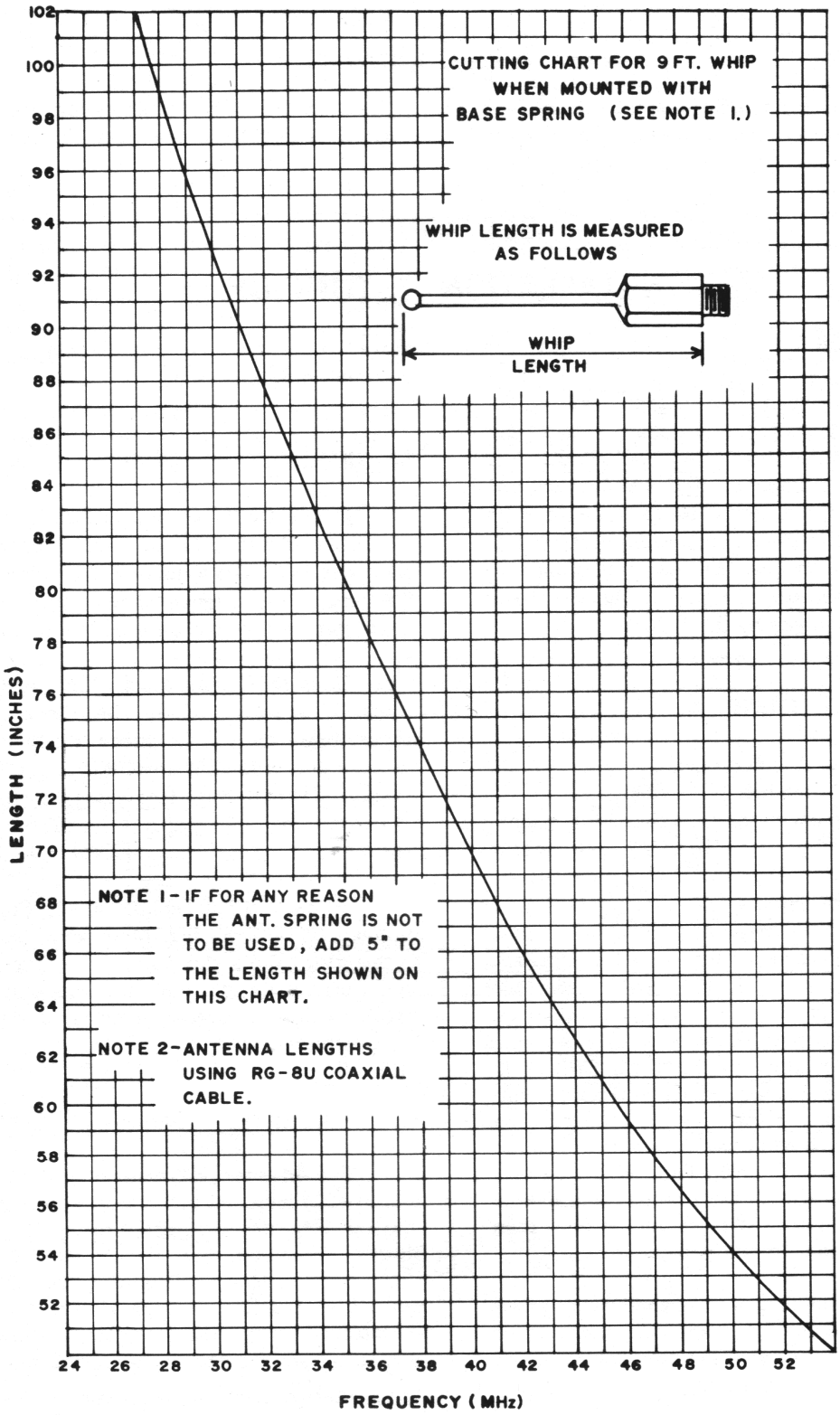
The AC power cable is equipped with a double fused power plug. Insert the power plug into any 117 VAC, 50-60 Hz outlet. (117-234 VAC models are supplied with a cable for 234 VAC. An accessory power cable for 117 VAC operation is available.)

The combination (AC-DC) models of the Messenger transceivers can be operated from the appropriate AC or DC source without switching. Simply insert the appropriate power cable into the transceiver power jack. Refer to the accompanying fuse chart for fuses used on each model of the transceiver.

FUSE CHART

NOTE - ONLY SPECIFIED FUSES SHOULD BE USED

Cat. No.	Operating Voltages	Fuse Type
242-0326-xxx	117 V 50-60 Hz	2 AMP, 1/4 x 1-1/4 Type AGC2
242-0327-xxx	117 V 50-60 Hz	2 AMP, 1/4 x 1-1/4 Type AGC2
	6 VDC	20 AMP, 1/4 x 1-1/4 Type SFE-20
242-0328-xxx	117 V 50-60 Hz	2 AMP, 1/4 x 1-1/4 Type AGC2
	12 VDC	9 AMP, 1/4 x 7/8 Type SFE-9
242-0329-xxx	117 V 50-60 Hz	2 AMP, 1/4 x 1-1/4 Type AGC2
	24 VDC	4 AMP, 1/4 x 5/8 Type SFE-4
242-0338-xxx	117 VAC, 50-60 Hz	2 AMP, 1/4 x 1-1/4 Type AGC2
	234 VAC, 50-60 Hz	1 AMP, 1/4 x 1-1/4 Type AGC1
	24 VDC	4 AMP, 1/4 x 5/8 Type SFE-4



WHIP CUTTING CHART
FIGURE 1

SECTION 4
INSTALLATION TUNE-UP

4.1 INTRODUCTION

After installing the Messenger, connect the unit to a properly mounted 50 ohm antenna cut somewhat longer than the length indicated on the whip cutting chart, Figure 1. For best transceiver operation, adjust the antenna length for minimum Standing Wave Ratio (SWR), following Section 4.2, next tune the transmitter following Section 4.3, then make the transmitter frequency check outlined in Section 4.4 (required by the FCC).

4.2 ANTENNA ADJUSTMENT

Best transceiver performance can only be obtained when the antenna is properly resonated (tuned to minimum SWR) for the particular transceiver operating frequency. To check SWR, insert an SWR bridge (such as the E. F. Johnson Directional Coupler and Indicator, Catalog Numbers 250-0037 and 250-0038 respectively) in the antenna feedline, following the manufacturer's instructions. Key the transceiver. Read the SWR. Tune the antenna for minimum SWR. To tune an unloaded, "whip" type antenna, trim the whip at its base - not the top - in small increments, checking SWR after each increment is removed - be careful not to trim off too much. A set screw located in the antenna base allows 1/4 inch vertical antenna movement for fine antenna adjustment. To tune a "loaded" or other non-whip type antenna, follow the manufacturer's instructions. SWR should be less than 1.5 to 1 for best transceiver performance.

SWR measurements of base antenna systems with long transmission lines are best made at or near the antenna. Otherwise the attenuation of the transmission line makes the SWR appear better than it really is.

After antenna adjustment, remove the SWR bridge and connect the transceiver directly to the antenna feedline. If the SWR measured 1.3:1 or more, adjust the transceiver output network, as outlined in Section 4.3.

4.3 TRANSMITTER TUNING

Connect a DC voltmeter across R46 (positive to junction of R46, R72) to monitor power amplifier plate current. C49 adjusts P/A loading, L9 adjusts P/A tuning. (See Figure 11 for component location.) Each volt read represents 10 mA plate current.

Turn the transceiver "ON" and allow a 20 second warm-up period. Key the transmitter by depressing the microphone push-to-talk bar. Quickly adjust L9 for a dip in P/A plate current as measured across R46 Increase transmitter loading by decreasing C49 capacity, and simultaneously re-dipping the plate current with L9.

Adjust C49 in small steps, each time re-dipping L9 until 32 mA plate current is obtained at the dip. Make the final adjustment in mobile installations with the engine revved up so that the battery voltage approaches the value of the Standard Test Voltage.

4.4 TRANSMITTER FREQUENCY CHECK

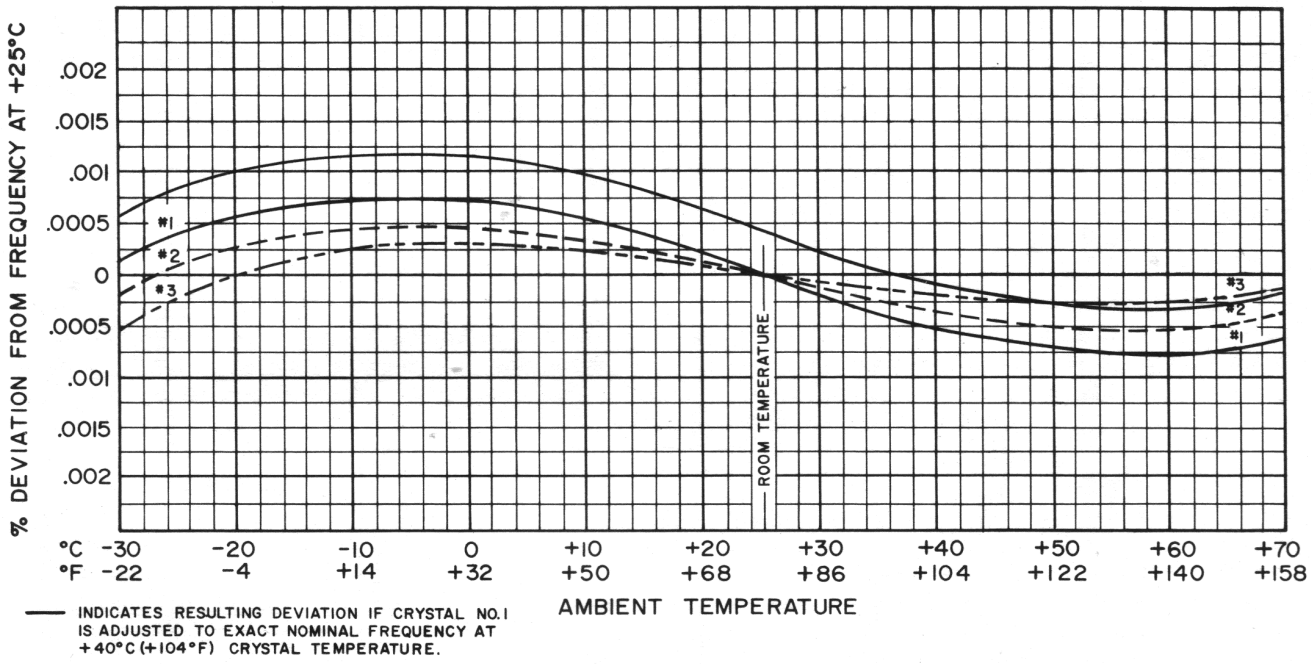
The Messenger transceiver is thoroughly tested and inspected at the factory before shipment, and the frequency calibrated to within the specified limits. However, FCC Rules, Part 91.105 state that: the licensee shall employ suitable means to determine that the carrier of each transmitter is maintained within the specified tolerance. This determination shall be made and the results entered in the station records. Frequency checks shall be made when, "the transmitter is initially installed; when any change is made in the transmitter which may effect the carrier frequency or stability; and at intervals not to exceed one year for crystal-controlled transmitters." Crystal frequencies are

dependent upon temperature; see Figure 2 for a typical crystal frequency vs. temperature curve.

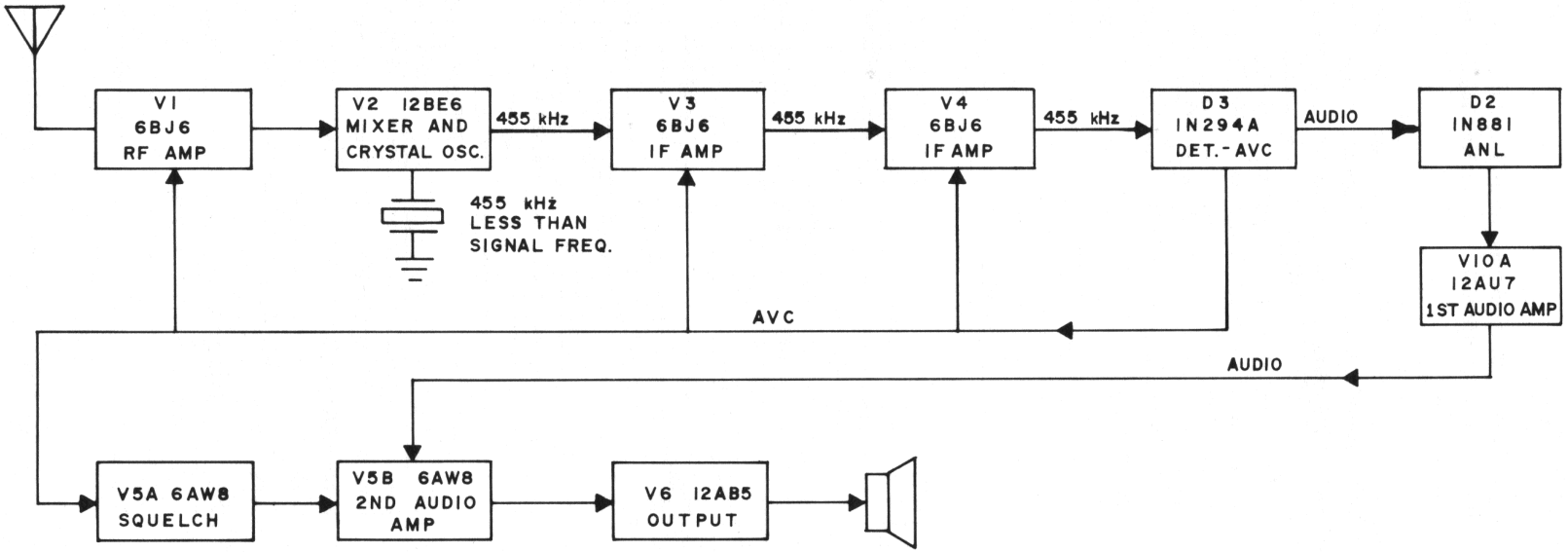
The frequency of a quartz crystal varies with temperature. Figure 2 shows the relationship between frequency and temperature for three typical crystals. These crystals have been adjusted in the transceiver to the exact nominal frequency with the transceiver operating at room temperature (+77° Fahrenheit or +25° Centigrade).

The above adjustment eliminates the crystal's calibration error at room temperature. Before adjustment, the curves would have the same typical "S" shape, but would be shifted up or down in frequency and would not necessarily intersect at the same point.

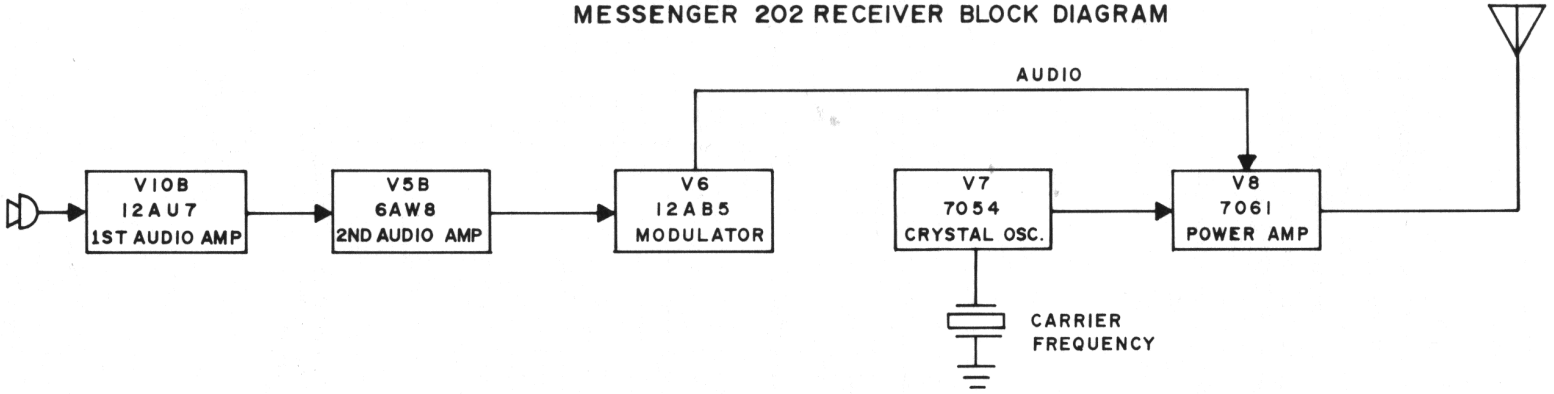
Notice that the frequency at room temperature is essentially at the midpoint of the frequency excursion over the temperature range, hence for a mobile unit or any unit which operates over a wide temperature range, the crystal should be set on frequency with the equipment operating at room temperature. This may be done with the cabinet off and without a long warm-up. This will allow the least frequency error over the entire temperature range.



CRYSTAL FREQUENCY DEVIATION
WITH TEMPERATURE CHANGES
FIGURE 2



MESSENGER 202 RECEIVER BLOCK DIAGRAM



MESSENGER 202 TRANSMITTER BLOCK DIAGRAM

FIGURE 3