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<b>IMPORTANT MAINTENANCE/REPAIR INFORMATION</b>
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## Surface Mount Repair

RITRON surface mount products require special equipment and servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit boards and/or components, which is not covered by RITRON's warranty. If you are not completely familiar with surface mounted component repair techniques, RITRON recommends that you defer maintenance to qualified service personnel.

## Precautions for Handling CMOS Devices

This radio contains complementary metal-oxide semiconductor (CMOS) devices, which require special handling techniques. CMOS circuits are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, with no failure appearing until weeks or months later. For this reason, take special precautions any time you disassemble the radio. Follow the precautions below, which are even more critical in low humidity environments.

- 1) Storage/transport - CMOS devices that will be stored or transported must be placed in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for other semiconductors.
- 2) Grounding - All CMOS devices must be placed on a grounded bench surface. The technician that will work on the radio/CMOS circuit must be grounded before handling the radio. Normally, the technician wears a conductive wrist strap in series with a 100K Ohm resistor to ground.
- 3) Clothing - Do not wear nylon clothing while handling CMOS circuits.
- 4) Power off - Remove power before connecting, removing or soldering a PC board that contains CMOS devices.
- 5) Power/voltage transients - Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, making sure that no voltage transients are present.
- 6) Soldering - Use a grounded soldering iron for soldering CMOS circuitry.
- 7) Lead-straightening tools - When straightening CMOS leads, provide ground straps for the tool used.

## PC Board Removal - Special Tool

RITRON recommends using a knurled nut tool to remove the slotted knurled nuts that secure the charge and audio jacks on top of the radio. You will need two sizes of this tool, one for each jack size. Mouser Corporation ® is one source, stock number 382-0004 (2.5mm jack) and 382-0006 (3.5mm jack). You can reach Mouser sales and distribution center at 1-800-346-6873.

## Properly Attach the Synthesizer Shield

The synthesizer shield should not be removed, unless a component must be replaced. This shield is soldered to the main PC board.

## Re-assembly - Speaker Magnet, Battery Voltage on Connector Pin

The speaker magnet will pick up clipped leads and other small metal objects from your bench top. Even tiny objects on the diaphragm will cause the speaker to buzz. Make sure the speaker is free of foreign objects before reassembling the radio.

## Radio Transmitter Power Measurements

The JMX-441 was designed to produce a nominal output power of 1.5 watts at 7.5 volts. Measurements are made with the RITRON 441-SRVBD RF service module connected to the radio antenna terminal.

## JMX-441 SPECIFICATIONS

GENERAL
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<b>FCC ID:</b>	AIERIT14-441
<b>FCC Rule Parts:</b>	22, 74, 90, 95
<b>Frequency Range:</b>	450-470 MHz
<b>RF Channels:</b>	Conventional: 4 Channels, Independent TX/RX frequencies.
<b>Synthesizer Step Size:</b>	12.5 KHz
<b>Frequency Stability:</b>	+/-2.5 PPM (-30 to +60 C)
<b>Tone/Code Signaling:</b>	CTCSS (Quiet Call)
<b>Power Supply:</b>	+7.5 VDC, 700 mAH rechargeable NiCd battery pack standard +7.5 VDC, 1500 mAH rechargeable MiMH battery pack optional
<b>Battery Drain:</b>	
<i>Standby:</i>	65 mA
<i>Sleep:</i>	17 mA
<i>Avg. Standby with Power Saver:</i>	30 mA
<i>Receive:</i>	150 mA
<i>Transmit:</i>	600 mA @ 1.5 Watts with 7.5 VDC battery
<b>Battery Life:</b>	<b>Standard battery (700 mAH) @ 90/5/5 Duty Cycle</b> 9 Hrs, Battery Saver Always On <b>High capacity battery (1500 mAH) @ 90/5/5 Duty Cycle</b> 18 Hrs, Battery Saver Always On
<b>Dimensions:</b>	4.75"H x 2.2"W x 1.43"D
<b>Weight:</b>	11.5 oz. with battery pack
<b>Enclosure Material:</b>	Lexan Polycarbonate
<b>Environmental:</b>	Splash resistant and shock and vibration per RITRON Drop Test (6 ft. drop onto concrete on all six sides)
<b>Antenna Fitting:</b>	1/4" - 32 x 1/4" threaded
<b>External RF Test Jack:</b>	Antenna connector with RITRON 441-SRVBD test device

## JMX-441 SPECIFICATIONS

### GENERAL

<b>Earphone Jack:</b>	3.5 mm, disconnects the internal speaker for external earphone, speaker / microphone, or headset. Also provides cable connection for PC programming.
<b>Microphone/PTT/Chg Jack:</b>	2.5 mm, for external speaker/microphone, headset or RITRON model BC-A wall charger
<b>Push Button Controls:</b>	On/Volume Up Volume Down/Off PTT Channel
<b>Speaker Beep Indicators:</b>	
<i>On/Volume UP</i>	Multiple beeps indicating radio channel when radio is turned on, followed by increasing audio to adjust volume.
<i>Volume Down/Off</i>	Decreasing audio to adjust volume, with single tone when unit is turned off.
<i>Both Volume Buttons</i>	Alternates between Tone Squelch (single beep) and Carrier Squelch (two beeps). If both buttons are held down until the radio beeps repeatedly, squelch will be disabled.
<i>Channel</i>	Number of beeps indicates channel.

### RECEIVER Specifications

	<u>Wide band</u>	<u>Narrow band</u>
<b>Modulation Acceptance:</b>	+/- 7.0 kHz	+/- 3.75 kHz
<b>Sensitivity (12 dB SINAD):</b>	0.25 $\mu$ V	0.25 $\mu$ V
<b>Adjacent Channel (EIA):</b>	-65 dB	-55 dB
<b>Spurious Rejection:</b>	-50 dB	-50 dB
<b>Image Rejection (EIA):</b>	-50 dB	-50 dB
<b>Intermodulation (EIA):</b>	-60 dB	-60 dB
<b>Noise Squelch Sensitivity:</b>	Manually adjustable, factory set for 12 dB SINAD @ 3 kHz deviation	
<b>Frequency Response:</b>	300 - 3000 Hz, de-emphasized	
<b>Audio Output</b>	1 Watt into 8 $\Omega$ , with less than 5 % THD @ the earphone jack	
<b>Receiving System:</b>	Dual conversion superheterodyne	
<b>I.F. System:</b>	1st - 43.65 MHz	2nd - 450 KHz
<b>L.O. Injection:</b>	<b>High side</b>	

## JMX-441 SPECIFICATIONS

TRANSMITTER		
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RF Power Output:	1.3 Watts minimum @ +7.5 VDC 1.5 Watts typically	
	<u>Wide Mode</u>	<u>Narrow Mode</u>
Emission Designator:	20K0F3E	11K25F3E
Deviation:	+/- 5.00 KHz	+/- 2.50 KHz
FM Hum and Noise:	-43 dB	-37 dB
Audio Distortion:	< 5 %	< 5 %
Spurious and Harmonics:	-50 dBc	
Audio Response:	Meets FCC and EIA requirements	
Time-out Timer:	60 seconds	

## INTRODUCTION

### GENERAL

RITRON's JMX-441 handheld is a small programmable two-way radio designed to operate in the 450-470 MHz business band.

This handheld features push-button operating controls, with the Push-To-Talk and Channel buttons on one side of the radio. The On / Volume Up and Off/ Volume Down and monitor controls are on top.

Each radio can be "dealer or factory" programmed to contain a unique set of four operating frequencies and options. Separate RX and TX Quiet Call (CTCSS) tones can be programmed per channel. Transmitter wide or narrow deviation can be programmed on a per channel basis.

#### Inspection

Each radio package should include a radio, antenna, rechargeable battery pack, belt clip and any optional accessories ordered. Examine the equipment immediately after delivery and report any damages to your shipping company.

#### Model Identification

The JMX-441 model, serial number and FCC Identification are displayed on a label located on the back of the radio beneath the belt clip.

### FCC REGULATIONS

#### Licensing

The FCC requires the radio owner to obtain a station license for his radios before using them to transmit, but does not require an operating license or permit.

The station licensee is responsible for ensuring that transmitter power; frequency and deviation are within the limits specified by the station license. The station licensee is also responsible for proper operation and maintenance of the radio equipment. This includes checking the transmitter frequency and deviation periodically, using appropriate methods.

#### Safety Standards

The FCC (with its action in General Docket 79-144, March 13, 1985) has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment. RITRON follows these safety standards, and recommends that you observe the following guidelines:

- DO NOT hold the radio such that the antenna is very close to or touching exposed parts of the body, especially the face or eyes, while transmitting. Keep the radio vertical, four inches away while talking into the microphone.
- DO NOT press the Push-To-Talk except when you intend to transmit.
- DO NOT operate radio equipment near electrical blasting caps or in an explosive atmosphere.
- DO NOT allow children to play with any radio equipment that contains a transmitting device.
- Repair of RITRON products should be performed only by RITRON authorized personnel.

## BATTERY CARE

The handheld is powered by a rechargeable battery, which fits into the radio case (see FIG-1).

### CHARGING

The battery pack can lose its charge during storage and shipment, and should be fully charged before the radio is used. Thereafter, the battery should be charged overnight after each day of use, to ensure peak radio performance for the next day. Using the cube charger (model BC-A), the battery should charge completely in 12 hours.

**Note:** A new battery must be cycled (charged and discharged) several times before it will reach its maximum charge capacity.

To charge the battery using a RITRON cube charger - plug the charger cord into the smaller of the two jacks on top of the radio. Then plug the cube into a 110 VAC outlet. The green lamp lights while the battery is charging, and should go off only when the cube is unplugged.

Two charger contacts, visible through the bottom of the radio case, allow the battery to be charged using an optional RITRON drop-in charger (model BCPS-FS). The battery pack may be charged inside or outside of the radio case.

To charge the battery using a drop-in charger (model BCPS-FS) - plug the drop-in charger into a 110 VAC outlet. Set the portable or battery into the charger. Each battery contact must rest on a charger contact pin.

Typically, a battery pack's service life is one year. To ensure maximum service life, follow these guidelines:

- Do not discharge a battery that is already "run down." If the battery cannot power your radio, recharge the battery.
- Do not overcharge a battery. The standard battery should not be left to charge continuously.
- Before storing a battery, charge it for 16 hours. Thereafter, charge the battery for 16 hours once every 30 days.

With daily use and recharging, a battery's service life is about one year. It is time to purchase a new battery:

- 1) When the radio's transmitter coverage decreases or does not work at all.
- 2) When the radio quits working after just a few hours of use, even with a full overnight charge.
- 3) When the battery is more than two years old. The date of manufacture is stamped on every battery. The first two digits indicate the year, the last two digits the week.

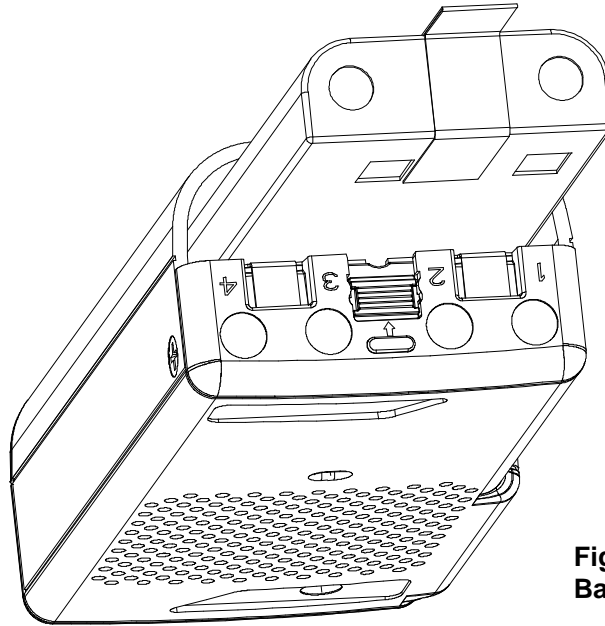


## BATTERY CARE

### BATTERY REPLACEMENT

To take the battery out of the radio, remove the battery door pictured in FIG-1. Use the pull-tab to remove the battery.

Slide the replacement battery into the radio case. Make sure the spring contacts are inserted between the battery and paper insulator. The contacts must not touch the radio PC board.



**Fig. 1**  
**Battery Replacement**

### PRECAUTIONS

- Use only RITRON-supplied chargers; other chargers might cause fire, explosion, or other damage to the radio.
- Do not "fast-charge" a brand new battery pack. Otherwise, the battery might be damaged.
- Once the battery has been charged fully using the normal rate, the fast rate may be used thereafter.
- Do not fast-charge a battery pack that is fully charged. This can shorten battery life.
- Do not charge or replace a battery in an explosive atmosphere. Contact sparking can ignite an explosion.
- Do not dispose of a battery in fire. An explosion might result.
- Do not charge the battery in temperatures colder than about 45°F. Electrolyte leakage can occur and ruin the battery.
- Charging in temperatures above approximately 95°F will not harm the battery, but can reduce its charge capacity.

## DESCRIPTION OF CONTROLS AND CONNECTORS

### **Antenna**

The flexible antenna radiates and receives radio signals. Before using the radio, be sure the antenna base is threaded fully into the radio's antenna bushing.

VHF and UHF antennas are not interchangeable. Use only the antenna type packaged with the radio. A VHF antenna is pictured in FIG-2. (The UHF antenna is smaller in diameter.)

### **On/Volume Up**

This button switches on the radio, then increases the volume if you continue to press.

### **Off/Volume Down**

This button decreases the volume, then shuts off the radio if you continue to press.

### **Channel Select**

Pressing this button selects the next channel. When the maximum number of channels is reached and you press this button, the radio resets to channel 1.

### **Speaker**

The speaker allows you to hear calls on your channel.

### **Push-To-Talk Button**

The PTT activates the transmitter, and must be held down while you talk into the microphone. Release the PTT button to receive.

### **Microphone**

The microphone converts your voice into electrical impulses, which are carried with your broadcast to receiving radios. Hold the radio about four inches away and talk into the microphone while transmitting. Shouting does not improve the listener's reception.

### **Audio Accessory Jack**

This jack connects speaker audio to optional accessories, such as a remote speaker/microphone or an earphone. For accessories that have a two-plug connector, the smaller plug is inserted into the charge jack.

This jack is also used to program the radio using the optional PC programming kit.

### **Charge Jack**

The battery may be charged through this jack using a standard RITRON wall socket charger cube.

This jack also connects microphone audio to the optional remote speaker/microphone.

### **Battery Access (Case Bottom)**

The battery door on the case bottom may be removed to access the battery. (Refer to the battery section of this manual.)

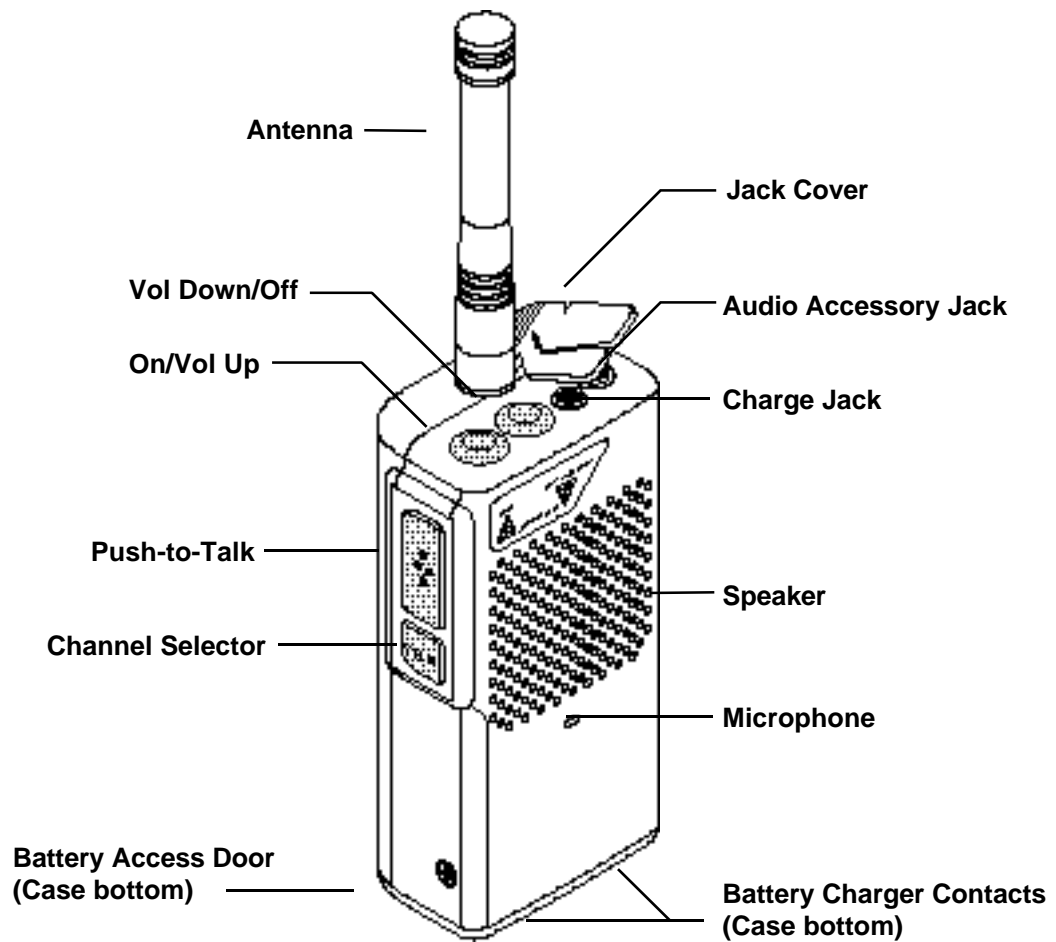
### **Drop-in Charger Contacts**

Two charger contacts in the bottom of the JMX-441 radio case allow the battery pack to be charged using an optional RITRON drop-in charger (model BCPS-FS).

### **Jack Cover**

This rubber cover seals out dust and moisture, etc. Snap the cover into the audio accessory and charge jack openings when the jacks are not being used.

## DESCRIPTION OF CONTROLS AND CONNECTORS



**Fig. 2 Controls and Accessory Connectors**

### **Belt Clip Installation**

If you are going to attach the belt clip to the handheld, follow these instructions:

- 1) The belt clip is fastened to the radio case back with the Philips head screw provided. Use the screw included, since a longer screw might damage the radio's electronics.

Do not use petroleum solvents of any kind on the radio. These can corrode the case.

- 2) Place the belt clip on top of the radio case back, with the screw hole in the aligned with the hole in the radio case.
- 3) Using the screw that came with this accessory, attach the clip to the radio.

### **OPERATION**

## **On-off/Volume**

To switch on the radio - press the on/volume up button.

To adjust the volume - press the volume up button until you reach the desired level. You should hear noise and any broadcasts on the channel.

To turn off the radio - press and hold the off/volume down button until a beep sounds. For quick turn off press the PTT button after first pressing the off / volume down button.

To determine whether the radio is on - press the volume down button. If the radio is on, noise or activity on the channel is heard.

## **Receive**

To hear calls from other users - adjust the volume as desired. The radio can receive broadcasts while the Push-To-Talk button is not being pressed. Whether or not you hear these broadcasts depends upon the squelch settings.

There are two types of squelch used in the JMX-441 portable. First is carrier squelch. This lets you hear all broadcasts on your channel strong enough for the radio to detect, and silences noise. Second is one of the selective signaling or "tone squelch" formats available on the JMX-441. This allows you to screen out "on-channel" broadcasts that do not carry the correct code programmed for the radio.

Note: It is possible that the beginning of a call might be missed while the radio is in battery saver mode. If this happens, ask the caller to repeat his message.

## **Monitor**

To monitor the channel - press one of the volume control buttons. When you press the volume up or the volume down button, squelch turns off and all radio traffic on the channel (and noise) sounds in the speaker.

## **Selective Signaling Squelch**

To deactivate tone squelch and operate in simple carrier squelch mode simultaneously press both of the volume buttons. Hold until a double beep is heard then release both buttons. To activate tone squelch again hold both volume buttons down until a single beep is heard. You are now in tone squelch mode.

Note: If you continue to hold down the volume buttons after the beep (or double beep), the radio will start beeping repeatedly. This means that squelch is turned off. Release the buttons. To restore squelch, press and hold both of the volume buttons until the radio sounds a beep or double beep.

## **Battery Saver**

The handheld has a "battery saver" feature that conserves battery power. After 10 seconds with no transmitter or receiver activity the radio goes into 25% duty cycle operation. While in the battery saver mode the radio constantly checks the transmitter, receiver and controls for activity. During this "off-time," any activity restores full power. After 750 msec in low power the battery saver applies power to the receiver, checking for broadcasts. It is possible that the first part of an incoming call might go unheard before activity is detected and power restored. If this happens, the caller can repeat his message. Once "radio contact" is made power save mode is entered only after 10 seconds of either transmitter or receiver inactivity.

## **OPERATION**

### **Transmit**

To transmit - hold down the Push-To-Talk button and, with the radio four inches away, talk into the microphone. Speak in a normal voice since talking louder will not improve the listener's reception.

### **Channel Selection**

To read out present channel - press and release the channel button. The radio will beep a number of times equal to the present channel number.

To change channels - press and release the channel button within one second after a previous press. The radio will beep a number of times equal to the new channel number. If the highest channel number is selected and you press the channel button, the radio will reset to channel 1. A one-channel radio will beep only once when you press the channel button.

<b>WHAT THE RADIO TONES MEAN</b>
----------------------------------

The handheld responds to certain instructions by sounding a beep or series of tones. These tones can tell you whether the radio is working as you expect.

### **Error Tones in Receive Mode**

Synthesizer Unlock – A continual beep indicates the radio frequency synthesizer is malfunctioning. Increment channels until you arrive back on channel. If beeping persists the synthesizer is faulty or the frequency is outside of authorized range.

Low battery - If a beep occurs every 20 seconds the battery is low. Recharge or replace the battery. The radio will receive with a low battery but may shut down during transmit.

Shut down – The radio will shut down when the battery voltage drops below a predetermined "dead battery" level to ensure specified radio operation.

### **Error Tones in Transmit Mode**

Synthesizer Unlock – A beep continual beep while PTT is pressed indicates the radio frequency synthesizer is malfunctioning. If beeping persists the synthesizer is faulty or the frequency is outside of the authorized range.

Time-out-Timer alert – A rapid beeping occurs when 1 minute of transmission has elapsed. Transmission is terminated. Beeping will stop and the radio will return to receive mode when PTT is released.

Shut down – The radio will shut down when the battery voltage drops below a predetermined "dead battery" level.

### **Channel Select**

When the channel button is pressed, the radio beeps a number of times equal to the channel number selected.

### **Tone Squelch**

When you press and hold both Volume buttons at the same time, a single beep will sound to indicate that the radio is now set to tone squelch mode. A "double beep" means that carrier squelch is on.

## OPERATIONOPERATION

### TROUBLESHOOTING

If you have trouble operating the handheld, review the radio controls and operation sections. If you think the radio is malfunctioning, check the table below.

#### Problem

#### Possible Solutions

#### **GENERAL**

The radio does not work at all.

Make sure that the battery is installed correctly, as shown in FIG-1.

Recharge or replace the battery. (See note 1.)

Operating features do not work exactly as expected.

The radio has been factory or dealer programmed for customized operation.

Reception is poor.

Move to a different location. (Note 2.)

Confirm that the proper antenna is connected to the radio. (See p. 11, "Antenna.")

You cannot hear calls from other radios.

Turn off tone squelch. (See Note 3.)

Be certain your radio receives on the same as the caller transmits. (Note 4.)

Recharge the battery. (Note 1.)

Your calls cannot be heard in other radios.

Make sure that your radio transmits on the receive frequency of the radio(s) you want to call. (Note 4.)

Recharge the battery. (Note 1.)

#### **Battery**

The battery loses its charge sooner than expected.

Review the battery charging instructions.

Conserve the battery. (Note 5.)

If the radio is used in extreme cold, warm the radio under your coat. (Note 6.)

Replace the battery. (Note 1.)

#### **Error Tones**

An error tone sounds when the radio is first switched on.

See "Error Tones" in the Operation section.

An error tone sounds while you are talking (and the transmitter shuts off).

Refer to "Error Tones"

## OPERATION

### TROUBLESHOOTING

#### Problem

#### Possible Solutions

#### **Tone Coded Squelch**

You cannot screen out calls from users outside of your tone group.

Make sure the channel is programmed with tone squelch.

Activate Tone (coded) squelch. (Note 7.)

You cannot hear Tone coded messages while in Tone (coded) squelch.

Confirm that the channel is programmed to detect the same code as the calling radio(s) transmits. (Note 7.)

Others in your tone group cannot hear your tone coded messages.

Verify that you transmit the same code as the radio(s) you call are programmed to detect. (Note 7.)

#### **Notes**

- 1) Try a battery pack from a working radio. If the radio in question works with that pack, the original battery is suspect. Charge the suspect battery as recommended in this manual. Then, if the charged original battery cannot power the handheld, try charging again with another charger. If the battery still doesn't hold a charge, the pack should probably be replaced. However, if the battery appears to be good after you try the second charger, the first charger might be faulty. If you think that an accessory is not operating properly, contact your dealer or RITRON. (Radio accessories come with a 90-day limited warranty.)
- 2) Reception can often be improved by moving a short distance. This effect is more noticeable inside of buildings. The range of these portables equipped with a standard battery pack is about two miles (line-of-sight).
- 3) If your radio does not detect calls from other radios on the channel, turn off tone squelch. (Press both Volume buttons at the same time - a double beep means that tone squelch is off.)
- 4) If you want to hear a call, you must select a channel that is programmed to receive the caller's transmit frequency. If you want to call another unit, you must select a channel that is programmed to transmit the other radio's receive frequency. However, if you use a repeater, your channel must be programmed to work with the repeater's transmit and receive frequencies. (A radio channel can hold two separate operating frequencies, one for Receive, the other for Transmit.)
- 5) Maximum power drain occurs while the radio transmits, so don't hold down the Push-To-Talk button more than necessary. Battery power is used while the handheld is left on to receive calls. If practical, switch off the unit.
- 6) In extreme cold, a battery's charge capacity is greatly reduced. If you use the radio in very cold weather, periodically warm the portable underneath your coat if possible. An optional remote speaker/microphone would allow you to keep the radio under your coat while transmitting and receiving.
- 7) In order for radios to communicate using Quiet Call, they must be programmed with the same tone code. Each code is unique, and your radio will respond only to the code programmed.

Press and hold both volume buttons at the same time. A single beep means that tone squelch is on. A double beep means that tone squelch is off.

## PROGRAMMING THE RADIO

Each JMX-441 may be programmed to operate on up to 4 channels. The JMX-441 may be programmed using its Push-to-Talk switch or an optional RITRON programming kit.

PTT (PUSH-TO-TALK) PROGRAMMING allows you to program any channel to one of the radio frequencies listed in Table 1 and any Quiet Call code listed in Table 2. The radio will transmit and receive on the programmed table frequency and QC code.

PC PROGRAMMING allows you to program any frequency within the band and channel spacing of the radio model. This method also lets you customize the handheld with optional operating features.

<b>PTT (PUSH-TO-TALK) PROGRAMMING</b>
---------------------------------------

### Placing the Radio in PTT Programming Mode

1. Turn off the radio by pressing the Volume Down button until the “radio off” prompt sounds.
2. Press and hold the PTT button.
3. While holding the PTT button, press and hold the Volume On button until a rapid beeping is heard in the speaker.
4. Release the On/Volume button. A series of five beeps will sound in the speaker indicating that the radio is in PTT program mode at which time release the PTT button

### How to Find Out What Is Already Programmed

1. Place the radio in PTT programming mode as described above.
2. Press the Channel button to select the radio channel you would like to read out.
3. Press and release the Volume Up button.
4. The radio will sound a series of beeps, pause, and then begin another series. Four series of beeps will be heard, with each series representing a digit. The number of beeps in a series is equal to the digit. (10 beeps = the digit 0)
5. Write down each digit while the radio pauses. List the digits in the order that you hear them.
6. The first two digits represent the frequency as shown in Table 1.
7. The second two digits represent the QC (CTCSS) tone frequency as shown in Table 2.

Note: If you are unable to read out a channel, it has probably been programmed using the PC programming kit to a frequency not contained in Table 1.



## PROGRAMMING THE RADIO

### PTT Programming the Radio

Four valid digits must be entered for the radio to accept PTT programming. The first two digits entered is the frequency code from Table 1, followed by the two digits for the QC code from Table 2.

1. Place the radio in PTT programming mode as described above.
2. Press the Channel button to select the radio channel you would like to program.
3. Enter the first digit by pressing the PTT button the number of times equal to the digit's value. (To enter the digit 0, press the PTT ten times.)
4. Pause after the digit is entered, a tone will sound indicating that the digit has been accepted.
5. Enter the second, third and fourth digits using the same method as the first digit.
6. Press the Volume Up button to enter the new channel programming. The radio will sound a confirmation tone to indicate that programming has been accepted.

### PTT Programming Mistakes

Invalid Entries	An error tone means that you tried to save an invalid entry. No programming changes are made in this case. A triple tone will sound next indicating that the radio is still in programming mode, and ready for an entry.
PTT Entry Mistakes	If you press the PTT five times when you intended four, for example, or if you just lose count, do not press the Volume Up button to store the entry. Instead, start over by turning the radio off and placing the radio in programming mode again.

### Return To Normal Operation

After you finish programming, turn the radio off and then on again. The radio will beep when it is ready for normal operation.

## PROGRAMMING THE RADIO

**Table 1 – PTT Programming Frequency Table**

<u>Code</u>	<u>Frequency</u>	<u>Description</u>	<u>Code</u>	<u>Frequency</u>	<u>Description</u>
01	467.7625	J	11	462.6250	black dot
02	467.8125	K	12	462.6750	orange dot
03	464.5500	yellow dot	13	464.3250	
04	464.5000	brown dot	14	464.8250	
05	467.8500	silver star	15	469.5000	
06	467.8750	gold star	16	469.5500	
07	467.9000	red star	17	463.2625	
08	467.9250	blue star	18	464.9125	
09	469.2625		19	464.6000	
10	462.5750	white dot	20	464.7000	
			21	462.7250	

**Table 2 – Quiet Call Codes and Frequencies**

<u>QC Code</u>	<u>Freq (Hz)</u>	<u>QC Code</u>	<u>Freq (Hz)</u>	<u>QC Code</u>	<u>Freq (Hz)</u>	<u>QC Code</u>	<u>Freq (Hz)</u>
01	67.0	16	114.8	31	192.8	46	189.9
02	71.9	17	118.8	32	203.5	47	196.6
03	74.4	18	123.0	33	210.7	48	199.5
04	77.0	19	127.3	34	218.1	49	206.5
05	79.7	20	131.8	35	225.7	50	229.1
06	82.5	21	136.5	36	233.6	51	254.1
07	85.4	22	141.3	37	241.8		
08	88.5	23	146.2	38	250.3		
09	91.5	24	151.4	39	69.4		
10	94.8	25	156.7	40	159.8		
11	97.4	26	162.2	41	165.5		
12	100.0	27	167.9	42	171.3		
13	103.5	28	173.8	43	177.3		
14	107.2	29	179.9	44	No Tone		
15	110.9	30	186.2	45	183.5		

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## PROGRAMMING THE RADIO

### PROGRAMMING THE RADIO USING A PC COMPUTER

RITRON's programming kit allows programming of the JMX-441 model radios using a PC compatible computer. An adapter cable connects the radio to a computer's serial communications port. Once the cable is hooked up, the user inserts the diskette provided into his computer's floppy disk drive and loads a software program.

This program transfers data between radio and computer memory, and includes on-screen instructions and help. Radio data may be saved to the computer's hard disk in order to program other radios.

#### The PC Programming Kit Includes:

- 1) Ritron Transceiver programming software, which is contained on 3.5" diskettes.
- 2) Installation instructions and a registration form.
- 3) Ritron PC to radio adapter cable, which is terminated at one end with a DB-25F connector, at the other end with a modular plug. The DB-25 plugs into the computer's serial port, the modular plug into the 441-SRVBD modular jack.
- 4) An adapter for use with JMX-441 portables. This adapter mates the modular plug to a 3.5 mm plug, for connection to the handheld audio jack.

#### The PC Programming Kit Requires:

A PC compatible computer with Windows 95 or later. The computer must have an RS-232 serial port available. A hard disk drive is recommended.

#### **PC Programmable Features**

Channel features can be programmed differently on each channel. One channel can have wide band deviation (+/- 5 khz) on the transmitter and the next narrow band (+/- 2.5 khz). Transmit and receive frequencies and tones on a channel can be different. A channel can also be deleted. Up to a 32 character ID string can be entered to allow PC programmers to identify radios.

## JMX-441 THEORY OF OPERATION

### INTRODUCTION

The JMX-441 is a four-channel handheld transceiver built on a double sided circuit board. Both sides of the main printed circuit board are populated with components, with the bottom side containing only surface mounted components.

The JMX-441 is frequency synthesized, with all functions of the radio controlled by a microcontroller.

### POWER SUPPLY AND VOLTAGE DISTRIBUTION

The JMX-441 is powered by an internal 6-cell rechargeable battery pack. The battery pack supplies power to the radio via two contact terminals that are connected to the PCB through P301. F301 is a 3A fuse in series with P301 for short circuit protection. The battery pack may be charged through 2.5 mm charge jack J301 via CR302 and F301. Diode CR302 prevents the batteries from discharging through the charger accessory and stops a reverse voltage from being applied to the battery pack through J301. Zener diode CR301 prevents a high voltage from being applied to the radio circuitry.

SW304 ON/VOL UP switched is pressed to switch on the JMX-441, turning on voltage pass transistor Q302. Q302 supplies power to IC301, a +5 VDC regulator used to power microcontroller IC302. Pin 23 of IC302 turns on Q303, which keeps Q302 turned on after SW302 has been released. Power is removed from the JMX-441 by pressing the VOL DN/OFF switch SW304 until a beep is heard from the speaker, at which time Q303 is turned off.

+5 VDC regulator IC301 supplies power directly to microcontroller IC302, audio circuits IC201 & IC102, reference oscillator Y301, synthesizer IC401, and PTT detect transistor Q301.

The RXEN output at Pin 11 of IC302 lets Q104 & Q105 switch the regulated +5 VDC to the receiver. Pin 11 of IC302 will also turn on Q402 & Q407 enabling the receive VCO.

#### **Power Strobe**

The JMX-441 handheld includes a power strobe feature, which reduces battery current drain by periodically removing voltage from part of the radio. The strobe off cycle time is about 700 msec. The RX+V power strobe output of the Q104 collector switches the regulated +5 VDC to the receiver RF and IF circuitry. Pin 11 of IC302 will also turn on Q402 & Q407 enabling the receive VCO.

#### **Low Battery Voltage Detection**

Battery voltage is measured at A/D input Pin 28 of IC302 through voltage divider R308/R309. The radio will emit a beep every 20 seconds if a low battery voltage is detected and will turn the radio off if the battery voltage drops below about 6 VDC. The battery voltage need only drop below this level once for the periodic 20 second beep commence. Typically, hitting the PTT with a weak battery will trigger this.

## JMX-441 THEORY OF OPERATION

### REFERENCE OSCILLATOR

Reference oscillator Y301 is a 1.5 ppm temperature controlled, voltage controlled oscillator (TCVCXO) operating at 14.4 MHz. The Pin 4 output of the TCVCXO provides a reference for the frequency synthesizer IC401 at Pin 20. IC401 is programmed to provide an output at Pin 1 that is  $\frac{1}{4}$  of the reference (3.6 MHz), which is applied as a reference oscillator to Pin 7 of IC302 microcontroller. The Y301 pin 4 output is also multiplied (tripled) up to 43.2 MHz by Q106 and its associated circuitry to provide a receiver second local oscillator signal.

### SYNTHESIZER

The JMX-441 radio is built around a common phase-locked loop (PLL) that consists of a voltage-controlled oscillator (VCO) and a frequency synthesizer. The PLL generates both the receiver 1st local oscillator and transmitter carrier signals. Control signals from microcontroller IC302 and Reference oscillator Y301 are routed to frequency synthesizer IC401 per the following chart:

#### Pin Numbers

	<u>Clock</u>	<u>Data</u>	<u>Latch</u>	<u>LD</u>	<u>REF IN</u>	<u>REF OUT</u>	<u>+5SW</u>	<u>+5V</u>
IC302	17	15	23	28	-	7	5	-
Y301	-	-	-	-	4	-	-	2
IC401	18	19	17	2	20	1	12	5, 14

Q409 and Q410 function as a 5.8 volt regulator to isolate the VCO from the noisy supply. Q403, C408 and associated components provide a filtered supply for the VCO oscillator and buffer amplifiers.

#### Prescaler Divider / Synthesizer Controller

IC401 contains both a prescaler and synthesizer controller. The prescaler squares and divides the VCO output present at pin 11 by either 64 or 65, determined by a synthesizer controller logic signal. The exact number of times the prescaler is instructed to change divisors is determined by the channel frequency.

IC401 contains a digital phase detector that works as follows: when an operating channel is changed or the receive/transmit mode switched, a new synthesizer operating frequency is selected. Microcontroller IC302 clocks new data into IC401 internal buffer in synchronization with clock pulses. The channel information is stored in EE memory of IC302 and is loaded into RAM when the channel is selected.

Once new data is loaded into the buffer, a single pulse from IC302 appears at IC401 to instruct the synthesizer controller to latch and execute the new data. IC401 utilizes internal circuitry to determine whether the present VCO output frequency is correct by comparing the phase and frequency of the VCO signal at Pin 11 to the 14.4 MHz reference oscillator at Pin 20. IC401 produces an output signal at Pin 6, a single-ended phase/frequency detector output, proportional to the phase difference between the two input signals.

The loop filter C421, C422, R413, R412 and C420 transform the Pin 6 output signal to a DC voltage for application to the VCO tuning varactors CR403 through CR406. The synthesizer system is "locked" when the phase and frequency of both the reference and the divided VCO signal are the same.

The maximum amount of current this output can sink or source is determined by the value of R415 tied to Pin 8 of IC401, with the output current programmable to 25, 50 or 100% of maximum.

## JMX-441 THEORY OF OPERATION

### VCO / Buffer Amplifiers

Q406, L404, CR405 & CR406 and associated components form the receive VCO (Voltage Controlled Oscillator), a resonant circuit that oscillates at frequencies from 416.35 MHz (460-43.65 MHz) to 426.35 MHz. Varying the voltage at CR405 & CR406 changes the varactor capacitance, which in turn alters the VCO output frequency. Q404, L402, CR403 & CR404 and associated components form the transmit VCO a resonant circuit that oscillates at frequencies from 460 MHz to 470 MHz. Varying the voltage at CR403 and CR404 changes the varactor capacitance, which in turn alters the VCO output frequency. Audio from the modulating circuitry modulates CR401's capacitance which in turn FM modulates the VCO. Varactor CR402 is biased by the tuning voltage to keep FM deviation flat across the transmit band.

Q401 is a buffer amplifier feeding the input of the synthesizer at Pin 11, the receiver 1st local oscillator and the transmitter pre-amplifier.

## JMX-441 THEORY OF OPERATION

<b>RECEIVER</b>
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As mentioned before, Q104 switches the regulated +5 VDC to the receiver. The RX+V receiver voltage is switched at the power saver duty cycle of about 25%.

### RF Amplifier

A received signal from the antenna passes through matching L208 and C104 to the receiver front end. L101 and L102 and the associated capacitors form a bandpass filter ahead of low-noise RF amplifier Q101. L103 and L104 form a band pass filter and match to the Q102 mixer.

### 1st Mixer

The amplified received input signal is applied to the base of mixer Q102. The 1st local oscillator signal from the synthesizer module is buffered by filtered by band pass amplifier Q109 and then applied to the emitter of Q102. L105, C120 and C121 tune the drain output of Q102 to 43.65 MHz and apply it to YF101, a 43.65 MHz two-pole crystal filter. Q103 and associated components amplify the 43.65 MHz IF signal and apply it to the input of the 2nd mixer at Pin 16 of IC101.

### FM Receiver Subsystem

A multi-function integrated circuit, IC101 and associated components for the FM-receiver subsystem. The subsystem performs the following functions: 1) 2nd mixer, 2) 2nd IF amplifier, 3) FM detector, and 4) noise amplifier.

The Pin 4 output of 14.4 MHz reference oscillator Y301 is multiplied by three to 43.2 MHz by Q106 and associated components. This signal is applied to the 2nd local oscillator input at Pin 1 of IC101. The 43.65 MHz signal at Pin 16 and the 2nd local oscillator are mixed, with the resulting 450 KHz output signal appearing at Pin 3. This signal is filtered by a 450 kHz 6-pole ceramic filter YF102 and applied to the input of the limiting IF amplifier at Pin 5. IC101 pin 6 and pin 7 de-couples the IF amplifier. An internal quadrature detector, whose center frequency is determined by the 450 kHz quadrature coil T101, detects the FM IF signal. One input of the quadrature detector is connected internally to the IF signal from pin 7 while the other input is the phase-shifted signal from T101 at Pin 8.

Demodulated audio appears at Pin 9, where a low-pass filter (R127, C136) removes spurious quadrature output prior to application to the voice or tone conditioning audio circuitry. Demodulated audio from Pin

9 is applied to the Pin 10 input of a noise filter/amplifier consisting of R122, R123, R122, R135 C136 and C137. The Pin 11 output of the noise amplifier is applied to a biased noise detector CR101, with the output connected to pin 12 of IC101. The squelch hysteresis is about 3 dB.

### **Voice and Tone Conditioning in Receive Mode**

After R127 and C140 remove the 450 kHz element from the demodulated audio output at Pin 9 of IC101, C139 couples the audio signal to IC102a for subaudible tone 250 Hz low pass filtering and C147 couples to IC102 b & c for voice 300 Hz high pass filtering.

### **Voice Band**

IC102b & c along with its associated components form a high-pass filter circuit that attenuates audio signals below 300 Hz. IC102d and IC103 form a variable gain amplifier controlled by IC302. De-emphasis is realized in R150, R152 and C152. Alert tones are added via R151, R160 and C150 from IC302 pin 13.

### **Sub-Audible**

After being filtered by a 250 Hz third order low pass filter the CTCSS signal is read by IC302 pin 27 A/D port. An internal discrete Fourier transform looks for the wanted tone. Decode bandwidth is about  $\pm 2$  Hz.

### **Audio Amplifier**

Receive audio from volume control IC102d is applied to the Pin 2 input IC104, a 1 watt audio amplifier. C154 couples the Pin 5 output to the internal  $8\Omega$  speaker SP301 via audio jack J302.

Microcontroller IC302 Pin 14 switches DC power to the audio amplifier by turning on Q108, which then turns on pass transistor Q107 to apply battery voltage to Pin 6 of the audio amp. CR102 prevents an inadvertent DC voltage at J302 from damaging the audio amplifier.

<b>ANTENNA SWITCHING / LOW PASS FILTER</b>
--

A low-pass filter comprised of filter L209, L210, C216, C217, C218 and C220 removes harmonics from the transmitter output before applying the RF signal to the antenna. Two PIN diodes CR201 and CR202 along with associated components form the antenna switching circuit. With the JMX-441 in receive mode no voltage is applied to the PIN diodes and they do not conduct. This opens CR202 to prevent the transmitter amplifier from affecting the receiver tuning. Incoming signals from the antenna pass through L208 and C104 to the receiver front end.

When the JMX-441 is switched into transmit mode, transmitter supply voltage is switched on by Q304 and Q305. Buffer amplifier Q204 is immediately turned on. Q305 only turns the driver stage Q202 and the pin diode switch on after about 40 msec. R317 and C323 formed an RC time delay to allow the synthesizer to come on frequency before power is transmitted. Current flows through R214, R213, CR202, L208 and then CR201 to ground forward biasing the PIN diodes. CR202 passes transmitter RF power to the antenna while CR201 shunts the receiver RF amplifier input to ground.

## JMX-441 THEORY OF OPERATION

### TRANSMITTER

#### Keying

The JMX-441 transmitter is keyed when PTT switch SW301 is depressed. Electret condenser microphone M301 is connected in series to ground with the PTT switch, which when depressed draws current through M301, SW301, CR303 and R303 to turn on pull up transistor Q301. Q301 then pulls pin 1 input of microcontroller IC302 high. The microcontroller transmit enable output at Pin 12 (TXEN) then goes high to turn on Q304, which turns on pass transistor Q305 to apply +7VDC to the transmitter as described previously. The transmitter can also be keyed through J301 with an audio accessory that inserts a microphone and PTT switch in series to ground, drawing current through CR303.

The Pin 12 TXEN output of microcontroller IC302 can hold the transmitter on after the PTT switch has been released to allow for squelch tail elimination.

#### Power Amplifier

Q202, Q203 and Q204 with associated components amplify the VCO signal and apply it to the input of RF Final amplifier Q205. The output of Q205 is matched to the antenna switching circuitry and applied to the antenna through the low-pass filter.

#### Voice and CTCSS processing

Microphone voice goes through PTT switch SW301 and CR303 before being amplified by IC201a. R222 and C224 form a pre-emphasis network. Limiting occurs in the output of IC201b. IC201c & d form a fifth order low pass filter with corner frequency of 3 kHz. Sub-audible tones enter from IC302 pin 13 (TONEOUT). CTCSS tones are generated by the pulse width modulated (PWM) output pin 13 of the microcontroller. The 8 bit PWM output operates at 7.2 kHz. A simple RC filter consisting of R329, R242 and C239 are sufficient to suppress higher order frequency components. The fifth order 3kHz low pass filter further attenuates the 7.2 kHz components. The FM deviation is set by potentiometer R237. Two point modulation of the VCO is used. The transmit loop bandwidth of the synthesizer is about 100 Hz. The CTCSS deviation from 67 to 254 Hz lies between 650 and 850 Hz in wide band mode.



## JMX-441 THEORY OF OPERATION

<b>MICROCONTROLLER</b>
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The JMX-441 handheld transceiver is electronically controlled by IC302, an 8-bit flash programmable microcontroller. IC302 has A/D inputs and PWM outputs for processing analog signals. Radio characteristics are stored in internal EE memory. It's RS232 port is used in programming the radio's personal characteristics such as frequencies and tones.

<u>PIN</u>	<u>DESCRIPTION</u>
1	PTT input is pulled HIGH when either the internal or external PTT switch is pressed to initiate transmitter operation.
2	CHANNEL SELECT gets pulled low when activated.
3	NC
4	+5 VDC $V_{CC}$ supply voltage.
5	GROUND
6	NC
7	XTAL1 is 3.6 MHz reference input from IC401.
8	NC
9	VOLUP gets pulled low when activated.
10	VOLDN gets pulled low when activated.
11	RXEN goes high to enable receiver.
12	TXEN goes high to enable transmitter.
13	TONE OUT generates the QC (CTCSS) waveforms via an 8 bit PWM prior to modulating the VCO in transmit mode. Also generates alert tones heard on the speaker.
14	SQUELCH output goes high to apply power to audio amp IC104 for receiver speaker audio or radio alert tones.
15	DATA output sends serial data to frequency synthesizer IC401 to program frequency information. Also used for flash programming (MOSI)
16	VOL1 is the LSB in receiver audio gain. Also used in flash programming (MISO).
17	SCK output sends serial data clock pulses to frequency synthesizer.
18	AVCC supplies +5VDC.
19	NC
20	AREF supplies the reference level for the A/D and is connected to the regulated +5 VDC.
21	AGND supplies A/D ground.
22	NC
23	ON ENABLE/ ENB output is HIGH when the radio is turned on, keeping pass transistor Q302 turned on via Q303 to supply power to the radio. Also used to latch data into IC401 when driven low momentarily.
24, 25, 26	AUDIO GAIN BITS control an analog switch IC103 to set audio gain on received audio.
27	CTCSS IN is an A/D input sampling the CTCSS waveform at 1000 to 1700 Hz. A discrete Fourier transform is subsequently performed on the desired frequency.
28	LOCKDET is an A/D input used to measure the battery voltage for low and dead battery detection. When the input falls below about 2.1 volts the battery is dead. This input also serves as the synthesizer lock detect. Unlock occurs when pulled to +5VDC by Q406.
29	/RESET is held low to start the radio in a known state on power up.
30, 31	SERIAL DATA PORT links the microcontroller to communications from an external data terminal via J302 RING connection. This allows programming of the JMX-441 EE memory used to store channel frequency and configuration information.
32	CARDET gets pulled low when a RF carrier is detected by the IC101.

## JMX-441 ALIGNMENT PROCEDURE

An authorized RF service technician must perform test and alignment of the JMX-441. Do not attempt service of the JMX-441 if not completely familiar with frequency synthesized radio operation. The JMX-441 can operate in either Narrow Band (2.5 KHz deviation) or Wide Band (5 KHz deviation) systems. No transmitter alignment is necessary.

### RECOMMENDED TEST EQUIPMENT

- |   |  |
|---|--|
| 1) 0 to +15 VDC, 1A current-limited power supply  | 3) Oscilloscope (to 20 MHz)            |
| 2) RF Communications Test Set (to 174 MHz) with: <ul style="list-style-type: none"><li>- FM Deviation Meter</li><li>- RF Wattmeter</li><li>- Frequency Counter</li><li>- SINAD Measuring Device</li></ul> | 4) VTVM or DMM                         |
|   | 5) RITRON PC Programming Kit           |
|   | 6) <b>RITRON 441-SRVBD Test Module</b> |

### RADIO PREPARATION

- 1) Remove the JMX-441 from the case. See assembly diagram for assistance.
- 2) Install the RITRON **441-SRVBD** test assembly by plugging the **441-SRVBD** into the 2.5 mm and 3.5 mm jacks on top of the radio.
- 3) Connect the FM communications test set to the BNC connector on the **441-SRVBD** test assembly.
- 4) Apply power (7.5 VDC) and turn on the radio to place it in operating mode.

## JMX-441 ALIGNMENT PROCEDURE

### REFERENCE FREQUENCY

- 1) Make sure that the unit has been switched on and is at room temperature (approximately +25° C)
- 2) Set the RF communications test set to the transmit mode.
- 3) Press the PTT button to transmit
- 4) Transmitter frequency error should be less than +/- 500 Hz.
- 5) Adjust the trimmer cap in the rectangular reference frequency oscillator YF301 if not within 4.

### TRANSMITTER POWER

Transmitter power should be set by the factory. If a slight adjustment is needed coil L210 can be “spiked” or compressed to adjust power output.

## JMX-441 ALIGNMENT PROCEDURE

### TRANSMITTER VOICE DEVIATION

If the transmitter voice deviation needs adjustment perform the following.

- 1) Set the RF communications test set to the transmit mode.
- 2) Set audio filtering from <20 Hz to 3kHz.
- 3) Set to FM demod with +/- peak deviation.
- 4) Select channel with no CTCSS tone programmed.
- 5) Connect audio source to 2.5 mm microphone input set to 1 kHz and 100 mV RMS .
- 6) The JMX-441 should start transmitting when a 2.5 mm microphone cable plug is connected to the audio generator with a DC path to ground. An attenuator pad can be inserted if a DC path to ground is not present in the generator. Adjust generator accordingly.
- 7) Adjust R237 for peak deviation of 2050+/-50 Hz on narrow band channels or +/-4200+/-100 Hz on wide band.
- 8) Stop transmitting by disconnecting cable.
- 9) Check other channels as needed.

NOTE: CTCSS tone deviation is automatically set to be within 650 to 850 Hz after this adjustment on wide band tone enabled channels. Maximum voice and tone deviation on CTCSS wide band channels will then be 4850 to 5050 Hz. Narrow band tone deviation will be 350 to 500 Hz with overall deviation of 2350 to 2550 Hz.

### RECEIVER FRONT END TUNNING

The JMX-441 receiver is factory tuned for a frequency range of 460-470 MHz. If receiver appears to be less sensitive on one of the band edges the front end tuning coils may need readjustment. Press and hold vol/up and vol/dn until continual beeping occurs then release to defeat squelch. Set generator to highest frequency programmed at -122 dbm with +/- 3 khz deviation. Adjust coil cores L101,L102, L103 and L104 out until SINAD starts to drop. Back off slightly to maintain best SINAD. Now, set generator to the lowest frequency programmed at -122 dbm. Similar SINAD readings to the high end frequency should be obtained. If not, turn coils in slightly. Recheck high end again.

### RECEIVER SQUELCH LEVEL

The JMX-441 receiver is factory tuned for a frequency range of 460-470 MHz. The JMX-441 receiver is configured from the factory for narrow band and wide band operation. The 43.650 MHz first IF has a +/-6.0 kHz bandwidth. The 450 kHz second IF has a minimum +/- 4.5 kHz 6 dB bandwidth. With a +/-2.5 ppm reference oscillator the first LO frequency error will be less than 1100 Hz. Acceptable wideband deviation (+/-5 kHz) demodulation occurs provided the transmitter has a comparable stability. When a channel is set to narrow band the hardware in the receiver stays the same but the CTCSS decode algorithm compensates for the lower deviation.

- 1) Select a channel.
- 2) Adjust squelch pot R131 fully counter clockwise.
- 3) Set communications test set generator to output -122 dbm with +/- 3 kHz deviation with a 1 kHz tone on desired frequency.
- 4) Adjust squelch pot R131 clockwise until squelch opens.
- 5) Reduce generator level until radio squelches.
- 6) Increase generator level until audio opens. Confirm squelch hysteresis is 2- 5 dB.

NOTE: Under +/-1.5 kHz deviation the squelch opening level will be around 1 dB lower. The squelch will open at lower levels in very cold temperatures. If squelch opens with no signal under extremely cold temperatures place JMX-441 inside your coat and warm it up a bit. If continued use in very cold temperatures will be happening adjust squelch level slightly higher.

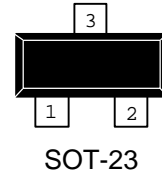
## JMX-441 VOLTAGE CHART

### Measurement Conditions

Supply voltage at 7.5 VDC, radio in operating mode, volume control at minimum.

KEY: All measurements are in VDC unless indicated otherwise.

NC = No connection  
 GND = Ground  
 \* = Voltage is strobed in Power Saver mode  
 → = See note in right column



### JMX-441 VOLTAGES

DEVICE	PIN	Transmit	Receive	Standby	DESCRIPTION
CR101	1	0.1	0.9	0.6	squelch noise rectifier
	2	GND	GND	GND	
	3	0.18	0.45	0.3	
CR102	C	7.5	7.5	7.5	Voltage clamp
	A	0.0	0.0	0.0	
CR301	C	7.5	7.5	7.5	Over voltage protection
	A	GND	GND	GND	
CR302	C	7.5	7.5	7.5	Charging rectification
	A	.55	4.65	4.65	
CR303	1	0.9	4.65	4.65	PTT switching
	2	.4	5	5	
	3	0.79	4.9	4.9	
CR304	1	NC	NC	NC	VolUp voltage clamp
	2	6.7	6.7	6.7	
	3	4.9	4.9	4.9	
CR305	1	0	0	0	Serial port Voltage clamp
	2	5.0	5.0	5.0	
	3	0.25	0.25	0.25	

## JMX-441 VOLTAGE CHART

DEVICE	PIN	Transmit	Receive	Standby	DESCRIPTION
CR401	C	2.5	2.5	2.5	Mod Biasing
	A	GND	GND	GND	
CR402	C	5.5	5.5	5.5	Mod compensation biasing → 1.0 – 4.5 VDC TX VCO tuning voltage
	A	→	→	→	
CR403	C	→	→	→	→ 1.0 – 4.5 VDC TX VCO tuning voltage
	A	0	0	0	
CR404	C	→	→	→	→ 1.0 – 4.5 VDC TX VCO tuning voltage
	A	GND	GND	GND	
CR405	C	→	→	→	→ 1.0 – 4.5 VDC RX VCO tuning voltage
	A	0	0	0	
CR406	C	→	→	→	→ 1.0 – 4.5 VDC RX VCO tuning voltage
	A	GND	GND	GND	
IC101	1	0.0	4.7	*	RX FM-IF subsystem
	2	NC	4.2	NC	
	3	0.0	4.4	*	
	4	0.0	4.7	*	
	5	0.0	4.3	*	
	6	0.0	4.3	*	
	7	0.0	4.3	*	
	8	0.0	4.7	*	
	9	0.0	2.1	*	
	10	0.0	0.75	*	
	11	0.0	1.0	*	
	12	0.0	0.9	*	
	13	NC	0	*	
	14	0.0	4.9	*	
	15	GND	GND	GND	
	16	0.0	1.7	*	
IC102	1	*	2	*	RX audio filter
	2	*	2	*	
	3	*	1.9	*	
	4	*	4.75	*	
	5	*	2	*	
	6	*	2	*	
	7	*	2	*	
	8	*	2	*	
	9	*	2	*	
	10	*	2	*	
	11	GND	GND	GND	
	12	*	2	*	
	13	*	2	*	
	14	*	2	*	
IC103	1	*	2	*	audio gain controller
	2	*	2	*	
	3	*	2	*	
	4	*	2	*	
	5	*	→	*	
	6	*	→	*	
	7	*	2	*	
	8	GND	GND	GND	
	9	*	2	*	

	10	*	2	*	
	11	*	2	*	
	12	*	→	*	→ 0 to set gain weight, 5=off
	13	*	→	*	→ 0 to set gain weight, 5=off
	14	*	2	*	
	15	*	2	*	
	16	*	4.8	*	
IC104	1	*	1.3	*	audio power amp
	2	*	0	*	
	3	*	0	*	
	4	*	GND	*	
	5	*	3.7	*	
	6	*	7.5	*	
	7	*	3.7	*	
	8	*	1.3	*	
IC201	1	2	2	*	TX audio filter
	2	2	2	*	
	3	2	2	*	
	4	4.9	4.9	*	
	5	2	2	*	
	6	2	2	*	
	7	2	2	*	
	8	2	2	*	
	9	2	2	*	
	10	2	2	*	
	11	GND	GND	GND	
	12	2	2	*	
	13	2	2	*	
	14	2	2	*	
IC301	1	7.5	7.5	*	5 V regulator
	2	GND	GND	*	
	3	7.5	7.5	*	
	4	NC	NC	*	
	5	5.0	5.0	*	
IC302	1	5.0	0.0	0.0	Microcontroller
	2	5.0	5.0	5.0	
	3	NC	NC	NC	
	4	5.0	5.0	5.0	
	5	GND	GND	GND	
	6	NC	NC	NC	
	7	2.1	2.2	2.1	
	8	NC	NC	NC	
	9	5	5	5	
	10	5	5	5	
	11	0	5	*	
	12	5	0	0	
	13	*	*	*	
	14	0	5	0	
	15	*	*	*	
	16	→	→	→	
	17	*	*	*	
	18	5	5	5	
	19	NC	NC	NC	
	20	5.0	5.0	5.0	
	21	GND	GND	GND	
	22	NC	NC	NC	
	23	5	5	5	
	24	→	→	→	
	25	→	→	→	

	26	→	→	→	→ 0 when gain bit is set, 5=off
	27	2	2	2	
	28	→	→	→	→ 3v nominal, 40% of VBATT
	29	5	5	5	
	30	0.2	0.2	0.2	
	31	0.2	0.2	0.2	
	32	4.6	0	*	
IC401	1	→	→	→	→ 3.6 MHz clock signal
	2	5.0	5.0	*	Frequency synthesizer
	3	NC	NC	NC	
	4	NC	NC	NC	
	5	5.0	5.0	5.0	
	6	→	→	*	→ 1.0 – 4.5 VDC VCO tuning voltage
	7	GND	GND	GND	
	8	2.2	2.2	*	
	9	NC	NC	NC	
	10	2.4	2.4	*	
	11	2.4	2.4	*	
	12	5.0	5.0	*	
	13	NC	NC	NC	
	14	5.0	5.0	5.0	
	15	0.0	0.0	*	
	16	NC	NC	NC	
	17	5.0	5.0	5.0	
	18	*	*	*	
	19	*	*	*	
	20	2.2 →	2.2 →	*	→ 14.4 MHz reference signal

### JMX-441 VOLTAGE CHART

DEVICE	PIN	Transmit	Receive	Standby	DESCRIPTION
Q 101	1	0	.7	*	RX RF amplifier
	2	GND	GND	GND	
	3	0.0	3.4	*	
Q 102	1	0.0	1.2	*	RX mixer
	2	0.0	0.5	*	
	3	0.0	4.75	*	
Q 103	1	0.0	0.7	*	RX IF amplifier
	2	0.0	0.0	*	
	3	0.0	3.9	*	
Q 104	1	5	4.2	*	RX pass switch
	2	5	5.0	*	
	3	2	4.8	*	
Q 105	1	0.0	5	*	RX switch
	2	GND	GND	GND	
	3	5	0	*	
Q 106	1	0.0	1.4	*	RX 2 <sup>nd</sup> LO multiplier/amp
	2	0	1.1	*	
	3	2	4.3	*	
Q 107	1	0	6.8	*	audio amp pass switch
	2	0	7.5	*	
	3	0	7.5	*	
Q 108	1	0.0	5	*	audio amp switch
	2	GND	GND	GND	
	3	0	0	*	
Q 109	1	0	4.2	*	1 <sup>st</sup> LO buffer amp
	2	0	1.3	*	
	3	0	0	*	
Q 201	1	6.7	0	0	TX buffer 1 enable
	2	7.36	GND	0	
	3	7.2	0	0	
Q 202	1	0.7	0	0	TX buffer 1
	2	GND	GND	0	
	3	5.6	0	0	
Q 203	1	0.75	0.0	0.0	TX buffer 2
	2	.4	0.0	0.0	
	3	7.1	0	0	
Q 205	E	0.0	0.0	0.0	TX RF final amplifier
	B	GND	GND	GND	
	C	7.4	7.5	7.5	



### SST-444 VOLTAGE CHART

DEVICE	PIN	Transmit	Receive	Standby	DESCRIPTION
Q 301	1	4.3	5.0	5.0	PTT buffer
	2	5	5	5	
	3	5	0	0	
Q 302	1	6.8	6.8	6.8	ON pass amp
	2	7.5	7.5	7.5	
	3	7.4	7.4	7.4	
Q 303	1	4.6	4.6	4.6	ON buffer switch
	2	4.0	4.0	4.0	
	3	6.8	6.8	6.8	
Q 304	1	5.0	0	0	TX ON buffer amp
	2	GND	GND	GND	
	3	0	7.5	7.5	
Q 305	1	6.8	7.5	7.5	TX strobe
	2	7.5	7.5	7.5	
	3	7.3	0	0	
Q 401	1	1	1	*	VCO buffer amplifier
	2	0.25	0.25	*	
	3	4.5	4.5	*	
Q 402	1	0.7	0.7	*	VCO buffer amplifier switch
	2	GND	GND	GND	
	3	0.1	0.1	*	
Q 403	1	5.5	5.5	5.5	super filter
	2	4.7	4.7	4.7	
	3	5.6	5.6	5.6	
Q 404	1	4.7	4.7	*	TX oscillator
	2	1.3	3.3	*	
	3	GND	GND	GND	
Q 405	1	0.7	0	*	TX oscillator ON
	2	GND	GND	GND	
	3	0.1	3.2	*	
Q 406	1	4.7	4.7	*	RX oscillator
	2	3.3	1.3	*	
	3	GND	GND	GND	
Q 407	1	0	0.7	*	RX oscillator ON
	2	GND	GND	GND	
	3	3.2	0.1	*	
Q 408	1	5	5	*	Lock Detect
	2	5	5	*	
	3	→	→	*	
Q 409	1	6.8	6.8	6.8	VCO pass regulator
	2	7.5	7.5	7.5	
	3	5.6	5.6	5.6	
Q 410	1	5	5	5	VCO ON regulator
	2	4.3	4.3	4.3	
	3	6.8	6.8	6.8	

### JMX-441 SCHEMATIC REFERENCE PARTS LIST

NOTE: This parts list reflects the most current component values. If a component value given in the schematic differs from this list, the parts list should be considered the most current.

Last Update: July 27, 2000

<u>Ref</u>	<u>Ritron PN</u>	<u>Description</u>	<u>X</u>	<u>Y</u>	<u>Theta</u>	<u>Loc</u>
SPEAKER:						
SP301	5500045	SPEAKER, 45MM, 1W, LOW PROFILE SST/RTX	1191	-551	3.371	Top
SWITCHES:						
SW301	5100046	SWITCH, TACT LO PROFILE RT ANGLE 160gf	97	-784	270	Top
SW302	5100042	SWITCH SPST MOMENTARY MINI PC 260GM	280	-142	180	Top
SW303	5100046	SWITCH, TACT LO PROFILE RT ANGLE 160gf	97	-163	270	Top
SW304	5100042	SWITCH SPST MOMENTARY MINI PC 260GM	800	-140	180	Top
TRANSFORMER:						
T101	5600018	455KHZ IF TRANSFORMER (5MM)	370	-304	0	Top
OSCILLATOR & FILTERS:						
Y301	23050003	TCVCXO, 14.400 MHz, 1.5 PPM, VC=30 PPM/V	498	-361	270	Top
YF101	2301403	43.650 MHz Crystal Filter +/-6.0KHz UM-1	84	-120	270	Top
YF102	2301022	FILTER,CERAMIC, 450KHz,+/-4.5KHz,6 POLE	237	-334	180	Top
FERRITE BEADS:						
Z201	18360001	BEAD; FERRITE SURFACE MOUNT	1067	-108	180	Top
Z202	18360001	BEAD; FERRITE SURFACE MOUNT	1472	-654	180	Top

#### **HARDWARE**

1350380D	PCB, DFSR4, 5UPM, .060 MIX, JMX-441
25602500	CRYSTAL SUPPORT, RUBBER PAD, SMALL/UM-1
06001021	#28 AWG STRANDED WIRE; RED (INCHES)
06001023	#28 AWG STRANDED WIRE;GREEN INCHES
06001026	#28 AWG STRANDED WIRE; BLACK INCHES
06001029	#28 AWG STRANDED WIRE; BLUE INCHES
25105500	SHIELD, JMX-441 SYNTHESIZER
25603000	FOAM, MOUNTING, SPEAKER
25603900	SPACER, MIC FOAM
25605700	MICROPHONE HOLDER
25900700	ADHESIVE, MTG, MIC HOLDER
2811H401	SCREW #4-40 X .25 LG TRIM HEAD PHILLIPS

## JMX-441 CASE ASSEMBLY PARTS LIST

<u>Ref</u>	<u>Ritron PN</u>	<u>Description</u>
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### MAIN CASE ASSEMBLY

13250000	CASE W/INSERT, PLASTIC, SST BLACK
13578000	DOOR, BATTERY, PLASTIC, SST 2-PC
13588000	LATCH, BATTERY DOOR, PLASTIC SST 2-PC
25106400	BATTERY DOOR HINGE RETAINER
25201500	RETAINER, PLASTIC, PTT, SST
25400600	BUSHING, THREADED, PLATED, ANTENNA SS
25603300	GRILLE CLOTH, SPEAKER, SST
25603400	DUAL JACK PLUG, RUBBER,SST
25606200	HINGE, BATTERY DOOR, SST
25800500	ACTUATOR, RUBBER,PTT,SST
25800600	ACTUATOR, RUBBER, TACT, SST
02802026	NUT; KNURLED; M4PO.5;/2.5MM JACK
02802027	NUT; KNURLED; M6PO.5/3.5MM JACK
28112401	SCREW 4-40 X 1/4" PHFLST
28233G03	KNURLED NUT, ANTENNA, JMX

### CASE BOTTOM ASSEMBLY

13564000	CASE, BOTTOM, PLASTIC, SST 2-PC
2142D021	CONNECTOR, CABLE ASSEMBLY, 2-POS, SST+
25400800	SPRING CONTACT, BATTERY, SST W/O TABSC
25400900	CONTACT BATTERY SST-PLUS (POLARIZED)
25604800	SPACER, PCB, FOAM, SST 2-PC

### CASE LABELS

14220001	LABEL, CONTROLS, SST
14222029	LABEL, NAMEPLATE, SST
14290002	BLANK LABEL, .75" X .25" GLOSSY WHITE +
14200037	LABEL SST/JMX MFG DATE CODE
14200095	LABEL FCC SERIAL JMX-441

### BELT CLIP

25201600	BELT CLIP, PLASTIC, SST BLACK
2811B600	SCREW 6-32 X 1/4" PHTRST

### BATTERY PACK AND INSULATOR

BPJS-6N	BATTERY, RECHG, 7.2V NiCd, YELLOW , SST
14230088	LABEL, BATTERY, BPS-6N-SC, SST
25300600	INSULATOR, BATTERY, FIBRE, SST
25606000	FOAM SUPPORT, BATTERY JMX SERIES
25601600	BATTERY SHIM; ASSEMBLY ~X~ SERIES

### ANTENNA

AFS-150	ANTENNA VHF MOLDED, 150-160 REG LEN SST
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### PACKING MATERIALS

14210004	LOW BATTERY NOTICE LABEL
14312006	SHIPPING CARTON, CARDBOARD,SST
14321002	FOAM INSERT, PACKING, SST/MINI
14500008	MANUAL, OWNERS, JMX/SST

14500016 USER MANUAL JMX-441  
14540006 WARRANTY REGISTRATION CARD

