



IC-24AT Additional Features and Modifications

The Icom IC-24AT is truly a remarkable unit. Having its genesis in the IC-R1, Icom's extremely wide band Hand Held Receiver, it is capable of receiving a wide range of frequencies, as well as being able to transmit on short excursions, outside of the amateur two meter and 440 MHz. bands.

Cross-band repeater

The IC-24AT can also function as a Mini Repeater transmitting on the UHF band while simultaneously receiving on the VHF band, or vice versa. This procedure requires both a small hardware as well as a software modification, and is performed as follows;

1. Locate diode D14. It is located adjacent to the location for diode D13 (see above procedure). Clip or remove it.
 2. To enable Mini Repeater operation
 - a. Push and hold the "Function" key and then the "C" key.
 - b. Push and hold the "Function" key and then the "5" key and the "D" key.
 3. To cancel the Mini Repeater operation, push and hold the "Function" key and then push the "D" key.
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Out of band receive

The more current models can be modified to receive out of band, by a simple software (not necessary to physically open the transceiver) procedure as follows;

1. Turn the power switch off.
2. While simultaneously holding the "light" button, the "B" button, and the "#" button, turn the radio on.
3. All elements of the display will light up.
4. Continue holding the buttons until the display goes out. It may be helpful to have a buddy give you an extra hand during this procedure....
5. Your unit will now receive out of band.

The older models of this transceiver, require the removal of diode D13, before performing the above procedure. D13 is on the main logic board and is a discrete diode near the center of the board. It is the diode on the left of the two on the board when the radio is open and held with the controls away from you.

Keyboard entry of 100MHz and 10 MHz digit

The "stock" transceiver, was also not designed, to provide full direct keyboard entry of the operating frequency. This can also be modified by one or both of the two procedures below;

1. To directly key in the 10Mhz. frequency, simultaneously hold the "light" button and the "2" button, while turning the radio on.
2. To directly key in the 100Mhz. frequency, simultaneously hold the "light" button and the "3" button, while turning the radio on.

MARS / CAP transmit

The modification of the unit to enable it to transmit out of the amateur bands is a fairly simple procedure. It is however, complicated by the fact that the construction technique used in this transceiver is "Surface Mounted Technology." If you have no experience dealing with this technology, you may well be better advised to defer this procedure to someone who has. It is extremely small and delicate, and is best done with specialized equipment. Also, because the unit is not FCC type accepted for all the frequencies on which it can then transmit, it is not legal for you to use it, despite the fact you may be licensed to transmit on those frequencies. This information is provided only for those who are licensed for and want to use the unit on MARS and CAP frequencies, where there are no type acceptance restrictions. The procedure is as follows:

1. Order a couple of DA204u diodes from Icom or your Icom dealer. These are a special three terminal device with two diode in one package. They are very very small, about half the size of one of the key buttons on the touch tone pad.
2. Locate and remove the diode device in position D8.
3. Locate the vacant position of diode D7 and attach one of the DA204u diodes at that location.
4. Locate the vacant position of diode D12 and attach the other DA204u diode at that position.
5. If diode D13 (procedure above) has not been removed, remove it. The unit will now transmit out of the amateur bands.

FREQUENCY COVERAGE

RECEIVE

TRANSMIT

74.9 Mhz. - 127.9 Mhz	OFF
138.0 Mhz. - 168.0 MHz	138.0 Mhz. - 159.0 Mhz.
174.1 Mhz. - 189.69 Mhz	OFF
200.0 Mhz. - 287.22 Mhz	OFF
310.0 Mhz. - 349.0 Mhz	OFF
355.0 Mhz - 409.98 Mhz	OFF
412.37 Mhz. - 498.0 Mhz	410.5 Mhz. - 470.0 Mhz.
792.85 Mhz. - 966.66 Mhz	OFF

Expanded frequency receive performance

Following the frequency expansion modification (as specified by Icom), a sample IC-24 was tested for tuning range and input sensitivity for an S9 signal. While the sensitivity measurements should not be directly compared with the manufacturer's specifications (usually measured reference to a signal-to-noise quieting ratio), this "quick and dirty" data should give you a good idea of the sensitivity to a medium-strength signal.

Modified IC-24AT Receive Performance

Tuning Range	Mode	Band	Sensitivity for S9 Signal
74 - 107.995 MHz	(fm)	VHF range	approx 1 mV
108 - 136 MHz	(am)	VHF range	10 - 30 uV
138 - 240 MHz	(fm)	VHF range	1 uV - 1 mV ¹
250 - 302 MHz	(am)	VHF range	50 uV - 1 mV ²
310 - 354.995 MHz	(fm)	VHF range	50 uV - 3 uV ²
355 - 409 MHz	(fm)	UHF range	3 - 10 uV
417 - 490 MHz	(fm)	UHF range	1 uV - 100 uV ³
805 - 955 MHz	(fm)	UHF range	10 - 100 uV

1. The sensitivity from 138 - 150 MHz was 1 uV. From 150 - 240, the sensitivity decreased almost linearly from 1 uV to 1 mV (with input voltage plotted logarithmically).
2. The sensitivity increased almost linearly for both these ranges (with input voltage plotted logarithmically).
3. The sensitivity plot looked like a "U" with the bottom of the "U" corresponding to the range 440 - 450 MHz (1 uV). The sensitivity then got worse below 440 and above 450.

The image rejection for frequencies outside 135-165 MHz, 400-500 MHz, and 800-950 MHz is poor. Tuning ranges on VHF below 135 MHz and above 165 MHz actually receive image signals between 135 and 165 MHz stronger than signals on the indicated frequency.

Normally the VCO frequency is above the signal frequency:

- $f_o = f_{vco} - if$ (VHF < 200MHz, UHF < 800MHz)
- $f_o = (2 * f_{vco}) - if$ (VHF > 200MHz, UHF > 800MHz)

where:

f_o = actual frequency

f_{vco} = vco operating frequency

if = first if = 30.875 MHz.

The image frequency is:

- $f_o = f_{vco} + if$ (VHF < 200MHz, UHF < 800MHz)
- $f_o = (2 * f_{vco}) + if$ (VHF > 200MHz, UHF > 800MHz)

For example:

To receive on 162.550:

$$162.550 = f_{vco} - 30.875$$

$$f_{vco} = 193.425$$

The image will be $f_{vco} + if$:

$$162.550 = f_{vco} + 30.875$$

$$f_{vco} = 131.765$$

The actual display frequency will continue to be shown as if the vco was above the operating frequency:

- $f_{display} = f_{vco} - if$ (VHF < 200MHz, UHF < 800MHz)
- $f_{display} = (2 * f_{vco}) - if$ (VHF > 200MHz, UHF > 800MHz)

For the image case above:

$$f_{display} = 131.765 - 30.875$$

$$f_{display} = 100.8$$

Image frequency:

- $f_{image} = f_{display} + \text{or} - (2 * if)$
- $f_{image} = f_{display} + \text{or} - 61.75$

Average IC-24:

Displayed Freq	Actual Rx Freq
VHF VCO	
75 - 135	135 - 199 (Image)
135 - 199	135 - 199
200 - 250	145 - 170 (VHF VCO is not doubled)
UHF VCO	
400 - 500	400 - 500
800 - 950	800 - 950 (UHF VCO is doubled)

Compiled from Internet sources

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