

RECEIVER SPURIOUS RESPONSES

Or: Why am I hearing the 2-Meter Repeater in the Federal Government portion of the Spectrum !!!!

Hopefully, this little article will shed some light on this question, which has been asked many times over the years. Although it is possible for a REAL spurious signal to be generated by our transmitter, due to a malfunction, it is not very likely. Our repeater employs a significant amount of extra filtering, which will limit any to well within the 2-meter band and not be radiated else where or very far.

There are several ways in which receivers can have spurious responses hearing a signal that is really not on that channel. The one of interest to us here is a strong, single, signals typically in excess of -50 dBm, on frequencies other than the one showing on the dial. Examples of this type, include but not limited to, the **1st IF (Intermediate Frequency) image** response and the **2nd IF image** response, as well as any harmonics of the local oscillator mixing with any harmonics of the undesired signal.

Using the typical receiver in Figure 11, if the IF frequency is 10.7 MHz, and the desired signal is 167.485 MHz, the Local Oscillator can be either 10.7 MHz **above** or **below** the desired frequency to cause a 10.7 MHz signal to be generated in the mixer. If the LO (Local Oscillator) is below, it will be 156.785 MHz (in our example) for proper operation to occur. With a wider **preselector**, like the ones in your typical scanner and older ham radios that can hear more than the Ham band of interest, the image frequency can easily fall within the pass band of the preselector. The pre-selector (front-end filter) determines the basic receiver operating range, i.e. 144 –174 Mhz.

Due to manufacturing costs, most radios will use high-side injection for the lower half of the band and low-side injection for the high half of the band. This makes it possible to use the same circuitry for the LO over a wider tuning range, reducing the cost, but at the expense of image rejection and receiver performance.

To reduce the possibility of this occurring, the IF frequency should be greater than the pre-selector bandwidth. 174 minus 144 = 30 Mhz. So in this example, the 1st. IF should have a center frequency of greater then 30 Mhz. The dashed line in Figure 11 shows how the pre-selector bandwidth must be less than the IF frequency. Modern wide bandwidth receivers use very high IF frequencies to be able to achieve the desired operational bandwidth without these spurious responses.

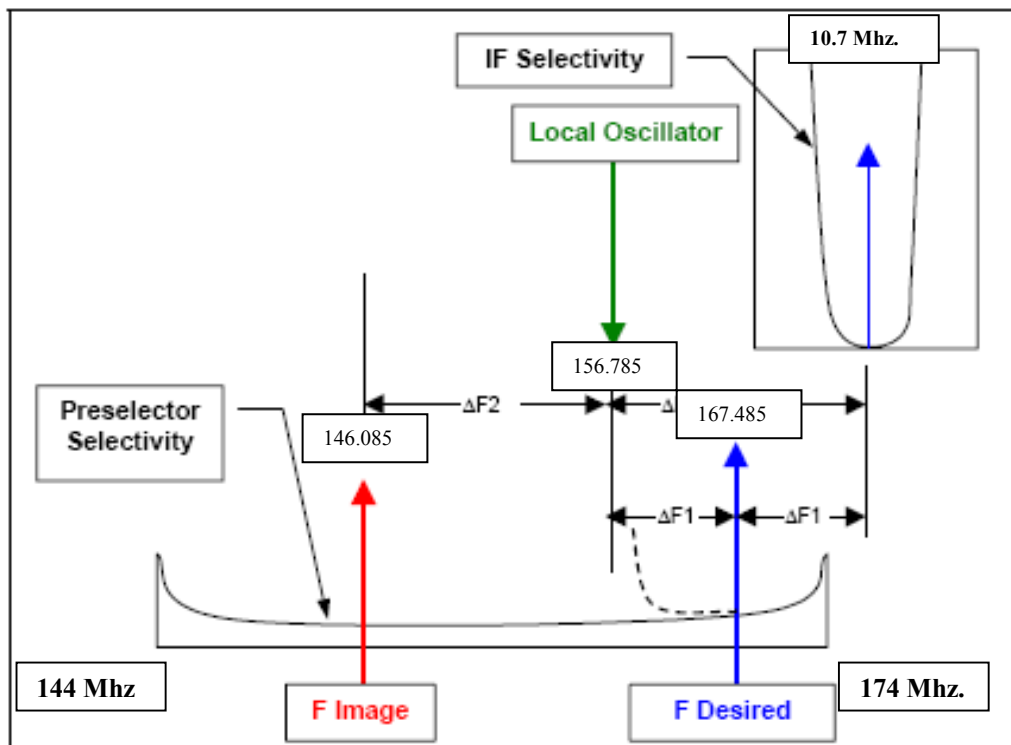


Figure 11 - Typical Receiver With A Wide Preselector Passband

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$f = F - (2 * IF)$ for low-side injection or $f = F + (2 * IF)$ for high-side injection

f = the frequency of the image

F = the Desired frequency

$2 * IF$ = the actual IF center frequency (i.e. 10.7 Mhz), multiplied times 2

In our example with low-side injection:

$f = 167.485 \text{ Mhz.} - (2 * 10.7 \text{ Mhz.})$

$f = 167.485 \text{ Mhz.} - 21.4 \text{ Mhz}$

$f = 146.085 \text{ Mhz.}$

The example above shows the **Desired** Frequency as being higher than the **Image**, but the **Desired** can just as well be lower than the **Image**.

You can determine which LO your receiver is using by adding or subtracting the IF frequency from the frequency showing on the dial. Then take a scanner with a short piece of coax and the end striped back about 2 or 3 inches for a probe, dial up the frequencies calculated above. Take the short probe and place it next to your radio's case or place it inside the antenna connector of the rig. At one of the 2 frequencies, you should be able to head a carrier with no modulation on it.

There are a number of newer model radios that are using different IF's like 30.56 Mhz (ICOM). Some of the more expensive units will even employ automatically diode-tuned front-ends to keep the bandwidth narrow at any given frequency. The IF frequencies used in your radio can be found in the Specifications section of your user manual along with the information on the equipments ability to reject different types of spurious responses. Basically, the bigger the **db** number, the better. But, if your radio will receive outside of an Amateur band, the book will state that the specs do not apply to out-of-band operation. So what you hear is what you get, whether you want it or not.

Hope this helps. If you have any questions, feel free to E-mail me at dgg53@hotmail.com or catch me on the air.

73's

Dave Gartner

WD6AXM