



FALCON DIRECT

Simple Solutions for Serious Situations!

TECH TOPIC - REPEATERS

Narrow banding of VHF and UHF 2-way radios has brought with it a whole new agenda of defining the purchase and installation of repeaters. In the past, the selection of a repeater was primarily based on **Price, Power, and Performance**. In other words, you choose a brand that you trusted at the lowest possible price, with the most power, and the lowest operating cost (i.e. long term warranty and perhaps a service contract to stabilize the cost of on-site maintenance). These are still good rules, but now there are some new considerations.

Now, the key issues are **Selectivity, Spurious, and Suppression** of Intermodulation interference. Without getting too technical, we will just say that narrow band radios are susceptible to interference we never considered just a few years ago!

I'll give you a few examples. Two public safety VHF radio users separated by almost 100 miles are both legally licensed - one for digital, the other for analog. They are on different frequencies, yet the digital user is causing severe interference to the analog user. The digital user, using the frequency of 151.2875 MHz is operating a trunked system (even though they don't have a license approved for trunking or approval from co-channel or adjacent channel users as required by FCC rules) transmits 500 watts ERP into the receiver of another public safety user on the frequency of 151.2800 MHz who was licensed BEFORE the digital user. So much for FCC rules and regulations...

For the moment, assume that both users are legally licensed, which they are (aside from the earlier comment). The problem is that there is only 7.5 kHz separation between the two frequencies and the bandwidth of the receivers is 11.25 kHz. This means that the analog users receiver is picking up the digital transmissions for a repeater a hundred miles away with a signal strength sufficient to blank out the use of local area portables, and even mobiles in marginal coverage areas.

So what is the solution? Two things you can depend on - the digital user isn't going to do anything and the FCC isn't going to do anything. That means the analog user needs to (a) purchase a radio with the best selectivity possible, or (b) add an optional device known as a preselector (maybe both).

We have prepared a comparison of some of the more popular repeaters at www.falcondirect.com/repeaters. You will note that we have the rated specifications for **Selectivity** for each model. The higher the number, the more capable the radio is for rejecting the type of interference previously described (i.e. -80 dB is better than -65dB or less). The Midland repeater is the best of the group at 80 dB, although it is a little pricey.....

For what it's worth, we had better repeaters in the 60's than we have today. It was not at all uncommon to have Selectivity, Spurious, and Intermodulation Suppression of -90 dB was common and even -100 dB was not all that unusual.

So why can't we do this today? It's the price we pay for instant gratification!

In the old days, radios were crystal controlled, specifically built to operate on a SINGLE frequency. Delivery was typically on the order of 6 to 8 weeks; sometimes as much as 6 MONTHS! The high tier radios had a crystal filter on the receiver and/or a ferrite isolator on the transmitter which gave the repeater broadcast quality performance.

Today, we don't use crystals. We use a thing called a synthesizer which allows radios to operate on up to a thousand frequencies or more. That's great! You can order a repeater today and have it tomorrow, but with the sacrifice of high spec suppression of unwanted signals.

The fact is that a synthesized radio is shipped from the factory to operate across an entire range of frequencies. In VHF this is typically 136-174 MHz or 400 to 470 MHz for UHF. Obviously, the performance can be optimized by fine tuning the repeater to the specific transmit and receive frequencies to be used, but this is rarely done. The reason is that the cost of doing a proper alignment can often exceed the total profit involved. As a result, virtually ALL dealers do nothing more than program the radio with no alignment to maximize suppression of unwanted interference. Some don't even know how to perform the task or have the equipment necessary to provide the service!

Sometimes we get lucky, but as more and more narrow band frequencies are assigned by the FCC, the problems will increase. Sometimes we get problems right out of the box. Case in point a recent installation we made in a rural area. Everything looked good. Both locations were on water tanks. At one site there was an existing UHF repeater. There were VHF repeaters at both sites. We put in a repeater with an unrated **Selectivity** spec.

Portables could talk through the repeater for more than a few miles (normally, we would expect 15 to 20 miles in this particular area with similar water tanks. The problem turned out to be that our receivers were being blanked out due to poor selectivity. We had three basic choices. We could switch to a radio with a better Selectivity rating or we could add a device known as a preselector, or we could abandon the sites.

At the end of the day, we lost over three thousand dollars in vehicle expense and labor time, ultimately electing to abandon both sites. Replacing the radio was out of the question. Adding a preselector represents nearly half the cost of the radio and we still had no guarantee of performance. We learned a lesson.

The lesson we learned is that we will never, ever again sell a VHF repeater without tuning and aligning for maximum performance, nor will we sell a repeater without either selling a premium radio, such as the Midland Base Tech II, or including a preselector with other radios if we are to be responsible for system operating capability. Those users who simply want to purchase the lowest priced repeater available may do so, but we have learned our lesson.

For what it's worth, the moderately priced radio that has tested best without shop alignment or a preselector is the Hytera RD-982AN. In actual side by side operation, it works when others don't. We've seen it first hand!

We hope this information saves some of the grief we have suffered along with others who have, and are, learning the hard way. If you can justify the cost of a top tier radio such as the Midland Base Tech II, your investment will pay off in the long run. As you will note in our repeater comparison price schedule, you can add the cost of shop tuning and alignment as well as a receiver preselector to any of the radios we offer. Do yourself a favor and include these options. They are well worth the cost!