

Five “MUST-HAVES” to consider when buying a two-way radio repeater

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There are many two-way radio repeaters on the market. It's important to pick the right one for your application and budget. You definitely want to be happy with the result of your repeater buying decision. The following information is a brief guide of what I believe is five “**MUST HAVES**” to consider.

1. **Receiver** – The repeater you purchase **MUST** have a good receiver. This requirement should be at the top of the list. If your repeater cannot ‘hear’ very well, then it's not very good and range will be limited.

There are three key parameters to look for when considering a receiver: Receiver sensitivity, Receiver selectivity, and Intermodulation rejection:

- A. **Sensitivity** - Is a measure of the minimum signal level required to produce a specified output signal of a specified signal to noise ratio (SINAD). In repeater systems, this measurement is often given in microvolts or uV at 12 dB SINAD. **The smaller the number in microvolt the more sensitive the receiver. For example: 0.25 uV at 12 dB SINAD is a very good receiver.**
- B. **Selectivity** – Is a measure of the how well the receiver ‘hears’ only the wanted signal and rejects all other signals nearby in frequency. Selectivity is measured as a ratio in dB comparing the signal strength received against that of a similar signal on another frequency. **The higher the number, the more selective the receiver.**
- C. **Intermodulation Rejection** – Is a measure of how well the receiver handles the various unwanted harmonics created by the receiver itself. When a receiver is doing its job, it creates unwanted signals that can interfere with the received signal. Intermodulation Rejection indicates how well the receiver rejects these unwanted products. **The higher the number in dB, the better. When this number is 70 dB or higher, it indicates quality parts are being used in the receiver construction.**

One more important fact: **The repeater's antenna should be mounted as high in the air as possible to make the system work optimally.**

2. **Transmit Power** – This specification, measured in Watts, is probably the one Repeater specification that all of the attention. Having as much RF Power as possible has merit, however, many things must be considered when buying a repeater. The goal is to consistently get as much transmit power out of the repeater without destroying it or reducing its life. It's important to consider how often the repeater will be transmitting and for how long. For example, if a repeater spec states it produces 50 Watts, the question to ask is: How long can it deliver 50 Watts without interruption? If not very long, it might only be good at 25 Watts. Therefore it's important to consider the manufacturers' **duty rating and cooling process and how it meets your application.**

- A. **Systems Example:** As transmit power is considered, power loss through the duplexer, power loss through the antenna feed line, and power gain at the antenna must also be considered. A simple example illustrates this point: If you have a 50 Watt repeater, duplexer, 100 FT of LMR-400 feed line, and a 6 dB gain antenna. The loss through a duplexer is typically 1.5 dB. This brings the output down to 37.5 Watts to the feed line. The loss through the feed line brings the power down to 26 Watts. The antenna adds 6 dB of gain and now your effective radiated power (ERP) is 104 Watts.
- B. **Adjustable Transmit Power:** The repeater you consider must have the ability to adjust the transmit output power. Can it be dialed from 0 Watts to Max? Adjustable output power provides for a lot of flexibility if you consider using the repeater as an exciter for an external RF Power Amplifier. External RF Power Amps are often specified as 10 Watts INPUT 100 Watts OUTPUT or 30 Watts IN, 100 Watts OUT. If you can dial your repeater back to 5 or 10 watts, it extends the life of your repeater and lets the external RF power amp do much of the work.
- C. **Cooling:** The next 'must have' for a repeater transmitter is sufficient cooling. You need to make sure your repeater transmitter is kept cool. This will increase the lifespan of the repeater as it will not have to work as hard in delivering power. Cooling is very important. Forced air is the best. At least one fan is required and two is even better. If the repeater is doing 5 Watts or more on a 50% duty cycle rating or higher, it is advisable to have forced air cooling your transmitter and power supply.

3. **Power Supply with built-in battery charger:** For ease of use and install, the repeater you purchase must have a built-in power supply. Having a built-in power supply will alleviate a lot of aggravation because you won't have to obtain the correct power supply to run your repeater. The manufacturer has already done this for you! The repeater should also have the ability to be connected to an external DC source like a battery or external power supply. In addition, if there's a built-in battery charger, then the internal power supply can trickle charge the battery.

4. **Built-in Controller:** Your repeater must have a controller and the repeater you purchase should have a basic built-in repeater controller. This will save you the task of connecting the repeater to an after-market controller. The ideal controller features that should be built in are:
 1. Decode / encode CTCSS tones and DCS codes.
 2. CW station ID.
 3. Courtesy Tone.
 4. TX Timer Timeout and TX Hang Timer.
 5. DTMF remote management capability.
 6. Narrow (12.5 kHz) and Wide band Capable.
 7. Ease of programming.

5. **Accessory Port/Expansion** - This feature is a **BIG** 'must have.' The accessory port is where the magic can happen and can make a repeater very versatile and flexible. For example, do you want to connect an external controller that allows for voice updates? Do you want to connect a digital modem and turn your repeater into a digital repeater? If so, are the proper connections available?

Here are the 5 signal input / outputs the repeater accessory must have:

1. **Receiver Discriminator Output** – Unsquelled, unfiltered based band flat audio.
2. **COS Output / COR Output** - Received a carrier or decoded a CTCSS or DCS code.
3. **PTT Input** – External PTT Input line to cause repeater to transmit.
4. **TX Audio Input** – Audio to be transmitted by the repeater.
5. **TX BASEBAND Audio Input** – Unfiltered TX DATA or AUDIO.

While this list is not exhaustive, it does bring to mind five key **MUST-HAVES** when considering purchasing a new repeater. Warranty and customer service / support is also of strong consideration. You want make sure you have somebody to call in the event there's a problem.

MUST-HAVE SUMMARY:

- 1. Good Receiver – less that 0.25 uV at 12 dB SINAD**
- 2. Solid, consistent transmit Power with adequate cooling**
- 3. Built-in Power Supply with built-in battery charger**
- 4. Built-in Controller**
- 5. Accessory Port/Expansion**