Fox Hunt Attenuator

While ham radio operators normally are always trying to increase their ability to hear stations, those involved in Fox Hunting (hidden transmitter hunting) find strong signals to be a hindrance as they near their objective. Signal strength the meters on their radios show the hunters (Hounds) that they are getting close to the hidden transmitter (Fox), but as the Hounds get close to the transmitter, the strong signals make the signal strength meters (S-meter) on radios useless. The closer you get to the transmitter you're seeking, the tougher it is to find! Some means of reducing the amount of signal that the radio receives becomes necessary.

An attenuator placed in the feedline between your antenna and receiver will diminish (attenuate) the strength of the received signal. The S-meter can then be used to observe signal strength variations as you proceed closer to the hidden transmitter.

There are basically two types of attenuators.

Active Attenuators

Active attenuators make use of active components and thus require a source of power (e.g., a battery) in order to function. The offset attenuator is an example of an active attenuator.

Instead of directly attenuating the incoming signal, an offset attenuator works by adjusting the strength of an offset frequency signal. When using this type of attenuator, your receiver needs to be tuned to the offset frequency (usually 2 or 4 MHz either direction), instead of the frequency of the signal you are hunting. Since your receiver is tuned to a different frequency from that of the signal you're hunting means that your receiver will not be as affected by a strong hunt-frequency signal entering through the receiver's plastic case.

The small offset attenuator at right is available assembled and tested ($27.00) from K0OV. It is good for getting close (within a foot) to perhaps a watt or two. If you will be hunting higher power transmitters, then a shielded box might be necessary and possibly a switched 20 dB attenuator to keep the module from getting saturated with the unwanted signals. The offset is available in either 2 MHz or 4 MHz, and both seem to work just fine. The 4 MHz offset is probably preferable to reduce the possibility of in band interference. Generally, the 2 MHz is used for receivers that cannot tune out of band.

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Plans for other simple active attenuators can be found by searching the Internet.

One disadvantage of offset attenuators is that they require a battery to make them work, so you've got to remember to turn them on... and off! Another drawback to most offset attenuator designs is that their attenuation level is not calibrated; so you can never be certain just how much attenuation you're using. Also, since most designs use a potentiometer for adjusting attenuation level, it is difficult to return precisely to a previous attenuation setting. And because most offset attenuator designs include no filtering between the antenna and the mixer, the attenuator is potentially a very prodigious intermod producer. This can be a real problem when an offset attenuator is used in an area with strong out-of-band signals, such as neighborhoods near broadcast or paging towers.

Note: Avoid transmitting through an offset attenuator. Doing so could possibly destroy the attenuator or harm your radio. If it doesn't destroy the attenuator, it will almost certainly result in strong out-of-band signals being generated by the mixer in the attenuator.

Passive Attenuators

Passive attenuators contain no active components, but inherently impose an absorptive or reflective loss directly to any signal passing through them. The resistor network attenuator (or resistor step attenuator) is and example of a passive attenuators. Most attenuators of this type are operated using a series of switches that select a variety of resistor values. By configuring the switches appropriately, any attenuation level between 1 dB and 80 dB can be selected, in 1-dB steps.

For much of the hunt, a resistor-network attenuator will work quite well. Unlike most offset attenuators, resistor-network attenuators provide accurate, and very repeatable, attenuation settings. Also, most passive attenuators will not generate intermod signals that might interfere with your hunting efforts.

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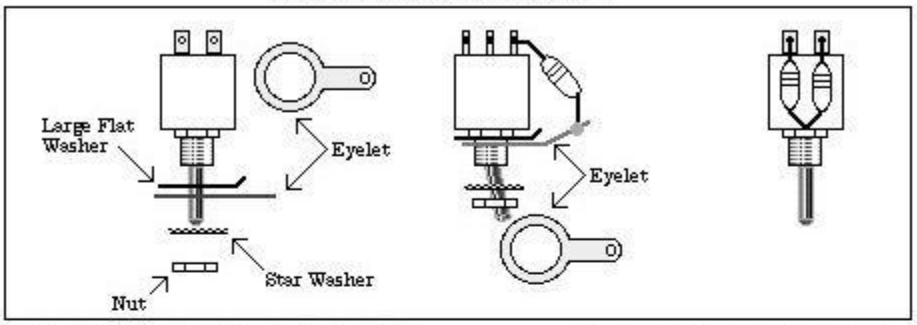
Shown at the right is the MFJ-792 Step Attenuator that provides up to 81 dB in signal attenuation. These units sell new for about $90.00, but they can sometimes be found on Ebay or other on-line Internet auctions for much less.

For those wishing to build their own step attenuator, Arrow Antennas has provided the information (left) about an attenuator they no long make. PWARC club member Paul, KB0JIT, used this idea as the basis of one of the prototype homebrew attenuators he built (below).

Fox Hunt Attenuator Instructions

Fox Hunt Attenuator

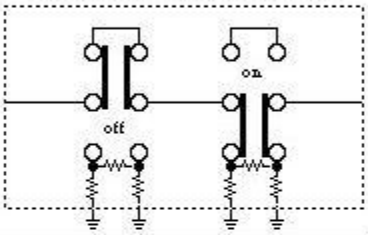


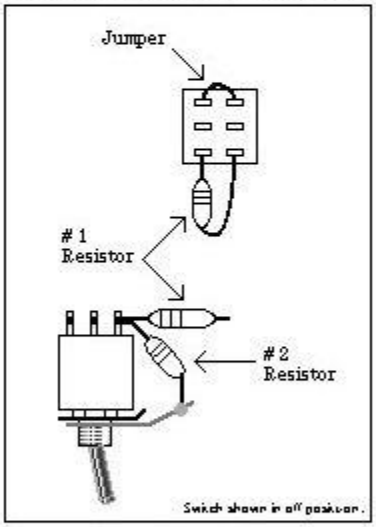
Study the all the drawings. This should give you all the information you need to assemble the Fox Hunt Attenuator.

Solder 3 resistors to each switch as shown.

1 resistor #1 and 2 resistors # 2 to each of the 5 switches, before installing them into the box.

Pi-Network Resistive Attenuator



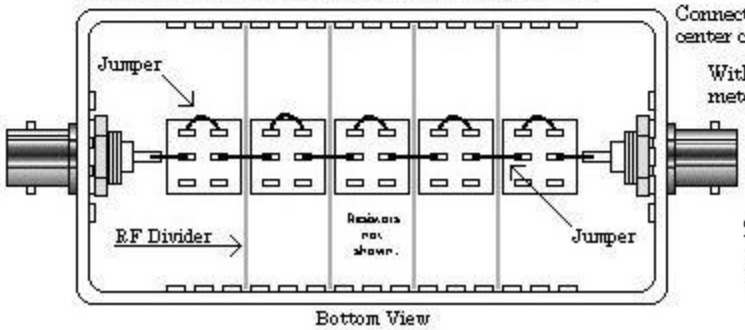


5 dB		
# 1 Resistor	33 ohm	Orange - Orange - Black
# 2 Resistors	200 ohm	Red - Black - Brown

10 dB		
# 1 Resistor	75 ohm	Violet - Green - Black
# 2 Resistors	100 ohm	Brown - Black - Brown

20 dB		
# 1 Resistor	270 ohm	Red - Violet - Brown
# 2 Resistors	68 ohm	Blue - Gray - Black

After installing the switches and connectors, then solder the copper wire to the connectors and the center contacts on all the switches. After soldering cut out the copper wire between the two contacts of each switch. As Shown below.
Be sure to install the RF Dividers between each switch.



Testing
Completed Unit

Connect Ohm Meter between the center conductor of each connector.

With all switches off, meter should show 0 - 3 ohms.

Turn each switch on, one at a time. Check reading.

20 dB = 92 ± 3 ohms
10 dB = 55 ± 3 ohms
5 dB = 32 ± 3 ohms

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Fortransmitter hunting, passive attenuators have several drawbacks. The most serious drawback results from the tendency of most receivers to pick up strong signals directly through their plastic cases, pinning the S-meter, regardless how well the attenuator reduces the signal arriving at the antenna jack. It is possible to address this problem by installing additional shielding (e.g., aluminum foil) to the case of your receiver, and using double-shielded feedline between the receiver and your antenna.

Note: Avoid transmitting through a resistor-network attenuator. Doing so could destroy the attenuator if it is not designed to handle the transmitter's output power level.

Fixed Value Passive Attenuators

Being able to control the amount of attenuation used is a great feature, but as an alternative, one of more fixed value attenuators can be used if needed. If you have a radio with an SMA or a BNC antenna connector, you might be able to find a variety of fixed value attenuators on Ebay that will connect directly to your radio.

Note: Avoid transmitting through a fixed value attenuator. Doing so could destroy the attenuator and harm your radio if the attenuator is not designed to handle the transmitter's output power level.

Attenuator Alternatives

Ok, so what are your options if you want to go on a Fox Hunt this weekend and have no attenuator? You might want to try these techniques.

Tune Off Frequency

Try tuning your receiver 5 kHz or more above or below the transmitter's frequency. This effectively uses the skirts of the IF passband to attenuate the signal and keep you in the hunt. Since you are no longer tuned atop the signal's carrier, you'll probably notice that any modulation of the signal will cause the signal strength to appear to jump around. So this is a less-than-ideal substitute for a "real" attenuator.

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Rotate Your Antenna

You can attenuate the signal you're hunting by orienting your antenna so that its angle of polarization is not aligned with the signal's polarization. For instance: if you hold a yagi antenna so that its elements are aligned vertically, the antenna will be less efficient for hunting a signal that is horizontally polarized. The yagi antenna will pick up the signal more weakly when it is misaligned in that manner, which is just what you want.

Note: *the previous three suggestions will help knock the signal strength down so that you can continue to use your receiver and VHF beam antenna. The remaining suggestions will require that you reconfigure your hunting equipment and hunting style.*

Tune to a Harmonic

If you have a receiver capable of tuning to a multiple of the transmitter's frequency, try listening to the second or third harmonic. (That's two times, or three times the transmitter's frequency.) If you can hear one of the harmonics, you're getting close. Once you can hear a harmonic, you might switch over to an antenna designed for the harmonic frequency. If you are using a tape measure yagi, shorten the elements by tucking them inside the "X" connectors.

Body Fading

Body fading (or body shielding) is a technique that can be used when you're stuck without better hunting equipment. The technique involves holding the receiver close to your abdomen, and then rotating your body slowly while observing the signal strength indicated by the receiver. First start by using a rubber duck antenna. If the signal is still too strong, disconnect the antenna. When you observe minimum signal strength, the direction to the transmitter is most likely behind you. This technique works best when you can ensure that the receiver is picking up only line-of-sight signals from the transmitter. Most reflected signals will not be strong enough for your receiver to pick them up without an antenna. Which means you will be most successful with the body fade technique when you are close enough to the transmitter that you can perform body fade with no antenna connected to the receiver.

Remove the Antenna

Do you think you might be right on top of the transmitter, but you're not sure? Try this test: disconnect the antenna from your receiver. Do you still hear the signal? If yes, you are getting close to the transmitter. If the signal is still full scale with the antenna

disconnected, you may be very close! But be careful. Most handy talkies today have plastic cases, and may pick up the signal without an antenna when you are still some distance from the transmitter.

Aluminum Foil

Is the signal too strong even with no antenna attached to the receiver? Try wrapping some aluminum foil around your receiver. (CAREFUL: Place some electrical tape over any exposed metal charging pads on your receiver or battery pack. You don't want to short out the battery!) The aluminum foil should help shield the receiver, and knock the signal strength down again (still no antenna attached). Instead of wrapping your receiver with foil, you can put foil around a cardboard box or tube, and then place the receiver inside the foil-covered container. In either case you'll need to cut a hole in the foil (and box) so that you can see the signal strength indicator. Once you've done that, try the "body fade" technique, this time with the foil shielding in place and no antenna attached.

Try several of the alternative methods as you practice hunting for hidden transmitters, and be prepared to use them as needed.