For The New General Class Operator: HF Radio SSB Phone Receiver Functions

By Terry Lines, KD5RA

This month's article will focus your HF radio's controls and functions for receiving SSB Phone. I will offer my opinions on setting receive functions to maximize your ability to hear weak signals, which is usually necessary when trying to log that rare DX station.

First, and most important, is your antenna. Most of us will never have a full size multi-element yagi on a 90-foot tower. But as has been said millions of times, erect the best antenna you can. An entry level radio connected to that multi-element yagi on a 90 foot tower, is going to "hear better" than a top-of-the-line big dollar radio connected to 5 feet of wire mounted in an interior room on the ground floor of your house.

Squelch Control: Just like a VHF/UHF radio, your HF radio has a squelch control. The squelch on an HF radio is very much like the human appendix; nobody is 100% sure why it exists. The proper procedure for setting the squelch on an HF radio is a simple three-step process: 1) locate the squelch control, 2) rotate the control fully counter-clockwise, 3) forget where the squelch control is located.

IF Filters: Your radio has some type of SSB IF (Intermediate Frequency) filter. The filter's bandwidth is most likely between 2.3kHz and 2.8kHz; 2.5kHz is typical. The figure of merit most hams associate with this filter is the slope of the skirts. We don't have room here for an in-depth discussion of filters, but steeper skirts (faster roll-off), is generally considered desirable. My first HF radio was a Yaesu® FT847. This radio uses mechanical filters. The FT847 shipped from the factory with an inexpensive filter most likely built using ceramic resonators, a Collins® Mechanical Filter was an available user replaceable option (read more dollars). I opted to purchase the Collins filter, afterward, closely spaced signals, like during a contest, were slightly easier to copy. But don't expect be transported to some magical place where signals can be separated like channels on a television. My Icom® 756 ProIII uses DSP IF filtering, like many other newer midrange radios. Three basic filter widths can be selected, 1.8kHz, 2.5kHz and 3.0kHz, the filter shapes may also be adjusted. The 2.5kHz is most useful, but during contests like the NAQP, where signals are very closely spaced and generally strong, the 1.8kHz filter is useful. I don't do much rag chewing, but assuming the other station's signal is reasonably strong, the 3.0 kHz filter would be a good choice. If you have the option to install better filters, and finances permit, it's probably worthwhile, especially if the radio is of good quality and you plan to use it for a few years.

Passband Tuning: Your radio likely has a way to tune the audio passband. On my FT847 the tuning is done in the audio section and is referred to as Low and High Frequency Cut. On my Icom, because the IF filters are DSP implementations, the bandwidth adjustments were more easily done at the IF stage. Icom refers to the function as Dual-Passband-Tuning. While the names and implementations are different the function is the same, you may adjust the lower and upper audio frequencies limits presented to your speaker or headphones, effectively narrowing the passband. In my experience the single most effective adjustment you can make in order to hear weak signals is to raise the lower cutoff frequency of the passband. I can't be 100% sure what the unaltered lower cutoff frequency is for these two radios is, but I would guess it's around 100Hz. There is a lot of naturally occurring noise energy between 100 and 300Hz but not much energy from the human voice occupies these frequencies. If you listen to a moderately strong signal, S3 or a little higher, and begin to increase the lower frequency cutoff, you will quickly reach a point where a lot of low frequency rumble disappears and the other operator's signal seems to improve considerably. Hearing a weak signal is all about improving the signal to noise ratio presented to your ears. By eliminating the lowest frequencies of the passband, which are primarily noise and very little signal, you improve the ratio of signal to noise.

RF and AF Gain: Your radio has two gain adjustments, Radio Frequency gain and Audio Frequency gain. Both controls have the effect of increasing or decreasing the volume presented to the speaker. It may seem counterintuitive but decreasing the RF gain slightly can improve your ability to hear weak signals, again it's all about signal to noise ratio. Start with the RF gain control at its maximum gain setting. If you tune to a frequency with no signals, the S-meter on your radio will indicate the background noise level. As the noise level varies the meter will respond by moving up and down scale. If you begin to decrease the RF gain, at some point the S-meter will respond by moving up-scale. If the RF gain is decrease more, the S-meter will increase to a point where it no longer responds to noise peaks. For this noise level you have adjusted the RF amplifier stage of your radio close to its optimum signal to noise ratio. Adjust the volume using the AF gain control. Remember, as noise levels change this optimum setting will change slightly.

Notch Filters: Your radio may have a notch filter. On newer radios there are usually two settings, automatic and manual. The use of the notch filter applies to very specific situations. If there is a narrow, constant frequency tone interfering with a signal you are trying to copy, the notch filter can eliminate the tone. But keep in mind the same audio frequency of the signal you are trying to copy will be notched as well. You will notice a slight degradation to the quality of the desired signal but at least the annoying tone will be gone. I prefer to use the manual notch filter. Manual notch will eliminate only a single frequency, which you select with rotary control. Automatic notch, or adaptive notch will often try to notch multiple frequencies, after a few seconds the received signal can be severely degraded by the loss of the additional frequencies being notched.

Noise Blanker: The NB is used to eliminate impulse noise occurring at a relatively constant rate. Ignition noise is a classic example. The NB is usually not much needed at a base station. If needed in a mobile installation and your own vehicle is the source of the noise, you would be far better served fixing the ignition noise at its source rather than trying to mask it.

Noise Reduction: If your radio is of recent vintage, it has a DSP implemented noise reduction function. On the FT847 the noise reduction level is set in a menu, and then simply enable or disabled with a push button. On my Icom the NR is enabled/disabled with a push button but there is a Noise Reduction control, which allows the level of noise reduction to be adjusted without entering a menu. My experience with these two radios is the DSP noise reduction is of little value on truly weak signals but can be handy if noise levels are moderately high and you are in QSO with a moderately strong station.

RIT & Clarifier: Icom calls it RIT (Receiver Incremental Tuning), Yaesu calls it a Clarifier but the function is the same. It allows you to slightly offset your receive frequency relative to your transmit frequency. The function is of no real value in receiving weak signals and its true function would require more space than warranted here, refer to your radio's manual.

RF Preamplifier: Most radios have one or more RF preamps; my FT847 has one. My IC756 has two, one of which is a low noise design. Don't be mislead by the term low noise preamp; it doesn't reduce noise. A preamp amplifies both the incoming signal and noise equally. Low noise preamps simply add less noise to the incoming signal than other amplifier designs. The value of an RF preamp, low noise or otherwise, is limited on the HF bands. A preamp is of some value if noise levels on the band are incredibly low and the signal you are trying to log is very weak, but those conditions are rare. Your radio has an RF preamp so play with it once in a while, but under most conditions you will find it to be more of a hindrance than help.

Attenuator: Used to prevent receiver overload on extremely strong signals, definitely not applicable to weak signal reception.

Ambient Noise: What matters when trying to work weak signals is the signal to noise ratio presented to your ears not some arcane number on a spec sheet. Your radio room needs to be quite in order to maximize the signal to noise ratio presented to your ears. Try to work a weak station when your wife is running a vacuum cleaner in the same room, now that's a bad signal to noise ratio. The room should also be acoustically soft, replace that metal filing cabinet with a few stacks of old QSTs. Replace those framed family portraits glass covers and all, with some QSL cards attached to the wall with thumbtacks.

73
Terry