Adventures in Ham Radio with K8DV

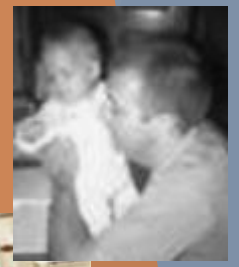
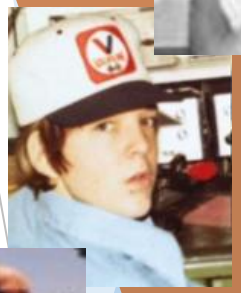
Getting The Most Out of Your HF Radio

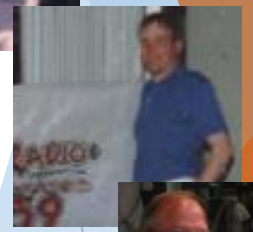
A Look At HF Radio Receiver Controls

By Dave Vest, K8DV

Who is K8DV?

- First licensed at 14
- DX'ing and contesting over 40 years
- DXCC, WAS, WAC, VUCC Card Checker for ARRL
- 9 Band DXCC 160 – 10
- 9 Band WAS 160 – 10
- WAZ (mixed) 5 Band WAZ
- ARRL TPA #63 (Triple Play Award LoTW)
- DXCC Totals Mixed 336 CW 326 Phone 299 Digital 313
- DXCC Challenge (Band Slots) 2401
- 5 time M/M winner Ohio QSO Party (K8DV)




- What we are not going to cover
- Disclaimer
- Where does it start
- Noise
- Most non-useful HF control
- AF and RF Gain controls
- Preamps and Attenuators
- AGC – Automatic Gain Control
- IF filtering CW and SSB (Crystal and DSP) and Slope (Shape)
- PBT, IF Shift, Notch, NR, XIT, RIT, Split,
- Final word about the importance of ambient noise
- Word about Menus
- References
- Questions

What is not going to be covered

- Power On/Off
- VFO
- Band Switch
- AM or FM modes
- SDR Radios
- Transmitter settings
- Unique features particular to manufacturer
- One last thing before diving in, Disclaimers

Disclaimers

- What works on one model/brand of radio may not work the same or as well on another
- CW (Narrow Bandwidth) and SSB (Wider Bandwidth) require different adjustments by the operator
- As noise level changes, so does the need to change receiver settings
- What follows is based on my operating style and in no way meant to be implying the only way or the best way, just my way – methods shown here can be used on vintage through modern day radios
- At the end of the day it comes down to personal preferences and what you like to hear
- This is only meant to be a high level look at basic functions and not a replacement for your own experimentation on your own radio or manufacturer's user manual

Where does the signal start?

- The ANTENNA
- Your antenna is far more important than the number of receiver controls on your radio or category of radio you have, PERIOD
- There are great receivers in QRP kit radios that have bare minimum number of controls, VFO, AF Gain and RF Gain
- For you vintage or entry level radio owners, don’t be concerned if your rig does not have all the features discussed

All I hear is noise?

"if you can't hear 'em, you can't work 'em"

- Think of a conversation in a noisy room
- To have a conversation you must hear the person you are trying to talk to:

  (Think of being in a crowded room)

  - He or she must talk louder (increased signal strength) than the noise and/or
  - Lower the noise by moving to a corner, cup you hand to your ear, etc. (reduce receiver noise)
- Let's look at some common receiver controls found on most radios

You're 5-9, Please REPEAT

Squelch control

- Very useful on FM VHF and UHF

- Steps for adjusting “Squelch Control” for SSB and CW HF operating:
  - Locate the “Squelch Control”
  - Place “Squelch Control” in full open position
  - APPLY super glue (OKAY, Just Kidding)

Most non-useful control on your HF radio

AF and RF gain control adjustments

- Most hams are prone to turn the RF Gain to maximum after all, more gain must be better, right? Then they use the AF Gain as a conventional volume control
- Try reducing the RF Gain and turn the AF Gain up and use the RF Gain as the “volume control” this helps reduce or lower the noise floor
- Lets now take a look at how to utilize the above method

Two most useful controls on your HF radio

RF gain control adjustment

- Over the next few slides are a few methods with reduced RF Gain, results in a

  Better Signal to Noise Ratio

- All seem to work

- Again, simply think in terms of turning up the AF Gain and using the RF Gain as the volume control – (Old School, learned this from my dad using a 1960s Drake 2B)

- Very useful when using BA receiver with poor or no AGC

RF gain control adjustment

Method number 1

- Adjusting RF Gain to the “SWEET SPOT”
  - Turn RF and AF Gain all the way down
  - Turn off AGC (optional, I tend to always run AGC in slow)
  - PROTECT HEARING, avoid headphones when AGC is OFF
  - Turn AF Gain about midway then slowly turn up RF Gain listening for signal clarity
  - Turn AGC back on if desired or if using headphones

RF gain control adjustment

Method number 2

- Set AGC to FAST
- Tune your radio to an unoccupied frequency
- Check S-meter reading of the noise
- If the meter is moving at all, reduce RF Gain until meter just stops moving
- On many radios reducing the RF Gain will cause the S-Meter reading to rise which is from the RF Gain circuit rather than actual signal strength. This is fine because we are looking for is the point where the S-Meter movement stops.
- For example, if you have S4 noise, reduce RF Gain such that the S-Meter only deflects on signals greater than S-4

RF gain control adjustment

In Method number 3 as detailed in next slide

- Set audio noise floor
- Set receiver noise floor
- Connect Antenna
- Determine if pre-amp is needed
- Determine if attenuator (ATT) is needed (ATT very good tool on lower bands)

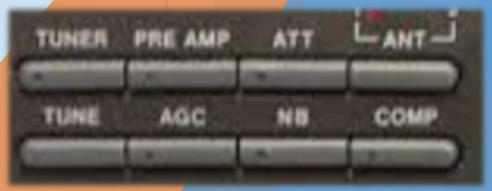
RF gain control adjustment

Method number 3 and more precise

- Turn OFF ACG, Pre-Amp and attenuator (ATT) and disconnect antenna
- Set AF Gain and RF gain to minimum (full counterclockwise)
- Advance AF Gain until you just hear noise (audio noise floor)
- Turn ON Pre-Amp
- Advance RF Gain until you hear receiver noise this is just above the audio noise
- Connect antenna and tune to unoccupied frequency, you should now hear band noise
- Switch off Pre-Amp, if still hear band noise, Pre-Amp not needed and go to next step. If no longer hear band noise, turn Pre-Amp back on and adjustment is complete
- If Pre-Amp not required, add in ATT in steps until you do not hear band noise, decrease on ATT step, adjustment complete. Some rigs only have one step of ATT.

Pre-amp and attenuator (ATT)

- Pre-Amp is typically needed only on higher frequencies where noise tends to be less of an issue. Personally, I rarely use a Pre-Amp below 14 MHz
- Attenuators (ATT) most commonly used to reduce overload from very strong signals
- Attenuators (ATT) may actually improve the S/N ratio on bands with lots of noise 40, 80 or 160, I use ATT often on these bands especially during the summer months with noise is at its worst
- This is a similar concept to reducing RF Gain but in a fix amount and on some radios multiple steps of attenuation
- Let me show you what it looks like and difference in S/N



Attenuator (ATT) example

Attenuator OFF

S5 Noise
Unoccupied Frequency

Nearby SSB Signal
S/N ratio in S units about 9 to 5

Attenuator ON

< S1 Noise (ATT ON)
Unoccupied Frequency

Nearby SSB Signal
S/N ratio in S units about 6 to 1

What did You just see?

- SSB signal on 40 meters
- Note the drop in S-Meter with attenuator (ATT) on
- Despite the drop in S-Meter reading, the signal is easier to copy with the attenuator (ATT) on because of the reduced noise level

AGC – Automatic Gain Control

- Closed-loop feedback regulating circuit which provides an controlled output signal of amplitude, in spite of variation of the amplitude of the input signal
- AGC limits variation in volume between signals of differing strength (So an S5 signal has same volume as 10 over S9 signal)
- Most ham receivers/transceivers typically allow for AGC adjustments of Slow, Fast or Off as seen in the picture to the right. (Collins 75S-3B)

AGC – Slow, Fast or Off

- Fast AGC – Can work against you with fluttering signals such as polar path for example
- Slow AGC – Since Fast AGC May cause AGC “PUMP” on SSB, Slow AGC is usually preferred for a more gradual fall off on RX recovery
- Fast AGC – Can help with weak CW signals as the RX recovers faster
- Off AGC – Consider turning off AGC for weak signals and adjusting RF Gain – works as a manual AGC if you would

IF Filters for SSB

- SSB filters are typically in the range of 1.8KHz to 3.0KHz
- 3.0KHz more noise and more audio fidelity
- 1.8KHz less noise and less audio fidelity
- Most common for SSB is 2.1KHz (default in most BAs) to 3.0KHz
- In modern radio using DSP filtering one can set the width and shape to “soft” or “sharp” this is a person preference for what you like to hear, I tend to use “sharp” for everyday hamming and contesting, YMMV

IF Filters for CW

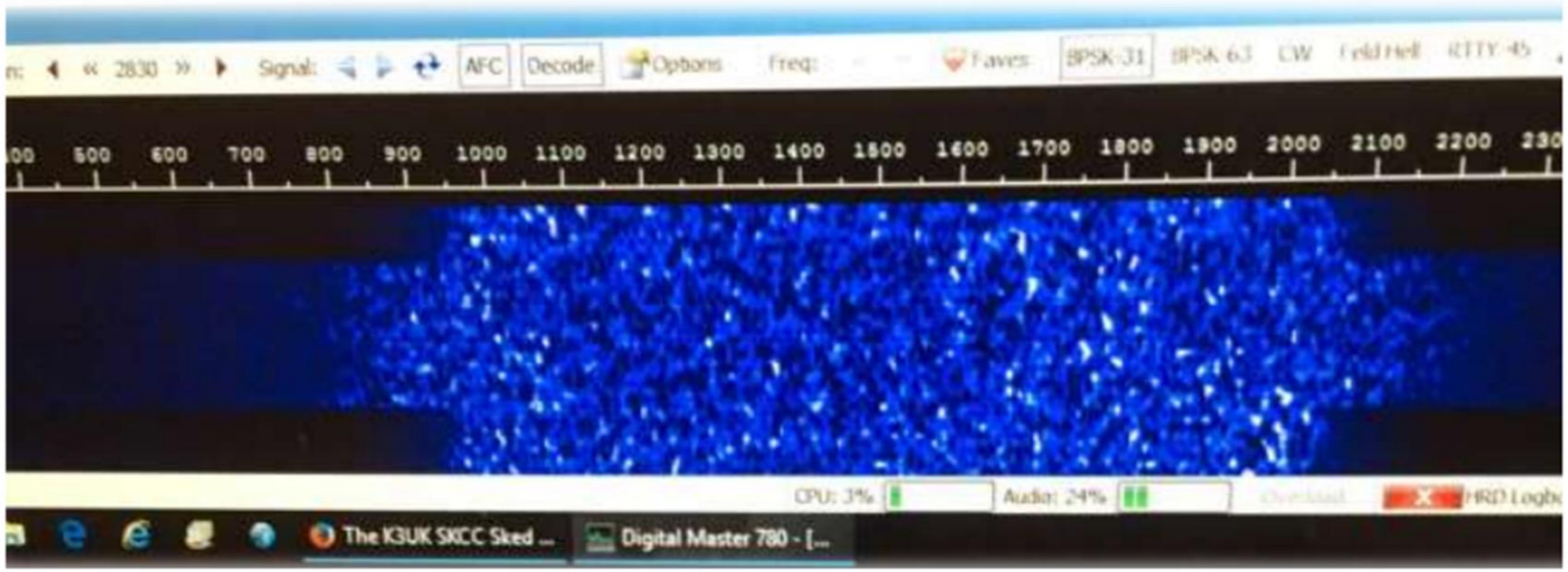
- CW filters are typically in the range of 100Hz to 1000Hz or wider
- In old BA radios typically you would find mechanical crystal filters options if available for 200Hz, 400Hz or 500Hz
- With old mechanical filters the more narrow the more “RINGING” you would experience, less so with modern DSP filtering
- Normally tune the band with the rig on wide setting and once you establish a QSO would engage narrow filter
- If calling CQ, I have the filter set to wide and set to narrow after QSO has started

So What is Filter “Slope”

- Slope or by some known as shape, some rigs with DSP configurable filters allow you to adjust for either a “soft” or “sharp” fall off
- Most prefer the “sharp” setting (rapid role off) and is the shape of most filters found in BA equipment (Collins, Drake, Heathkit, etc.)
- This is a personal preference and you will have to experiment to determine what you like, you may prefer a sharp slope on a wide filter and a soft slope on a narrow filter
- There is no right or wrong just what is pleasing to your ears
- This is what is great about DSP to be able to make these configuration changes right from the front panel

Getting a Sense of Filters “Sharp vs Soft”

Using digital software such as DM780 you can get an idea of what different filters, “Look Like”



Sharp Slope

Soft Slope

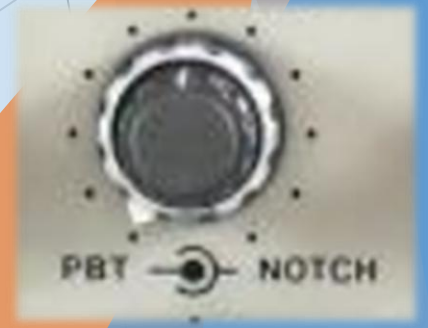
Sharp Slope

40 Meter SSB noise with a 1Khz DSP filter configured

Using Icom IC-756 PRO III “Sharp” and “Soft” slope alternated

Pass Band Filter

- Used to adjust the low and high frequency cutoff
- Typically has center 0 and plus and minus, on most radios CW will reduce bandwidth on the high side and CCW will reduce bandwidth on the low side
- This can be really helpful on SSB since it permits adjusting the passband to reject adjacent channel interference on either the high or low side
- This adjustment has no effect on the transmitter
- Some times labeled as PBT (Pass Band Tuning) as on Ten Tec Omni VI



IF Shift

- Used to reduce interference from adjacent frequency
- Useful on CW and SSB, on most rigs no effect on AM or FM
- Can help boost audio frequencies on both the low and high end, useful on radios with or without DSP
- Like PBT typically has center 0 and plus and minus, but instead of reducing bandwidth it moves the center frequency of the filter, plus or minus
- On both the PBT and IF Shift when using a narrow filter you can use these controls to improve the audio quality through the filter
- This adjustment has no effect on the transmitter
- Labeled as IF Shift as seen on many Kenwood models from the mid-eighties forward as on the TS-820S

Notch Filters

- Manual Notch filters have been available on receivers going back to the sixties, Collins called it “Rejection Tuning”
- Auto Notch Filters (ANF) came into their own in the late eighties
- ANF eliminate a constant frequency tone, heterodyne or multiple heterodynes from a SSB signal
- Audio quality may be degraded, this is common if the ANF is trying to eliminate too many tones at once
- Manual notch filters eliminate a single tone, heterodyne by turning the knob, considered by many to be superior to the ANF
- On some radios the manual notch filter width can be adjusted
- I may be lazy, but the ANF has always worked good for me and no manual adjustment
- This adjustment has no effect on the transmitter

NB and DSP NR

- NB Noise Blankers work well to control short bursts of energy like auto ignition, door bell buzzers, light dimmers or other electrical noise
- DSP Digital Signal Processing NR noise reduction is often helpful in dealing with noise
- How DSP and NR function, High Level
  - Step 1 A/D conversion
  - Step 2 Signal processing in the form of computer performing complex mathematical operations on the digital signal (7 to 10 dB noise reduction is typical per ARRL lab testing)
  - Step 3 D/A conversion
  - Depending on your radio, there may be more than one NR protocol available and have the ability to adjust the amount of DSP NR you desire (Elecraft has many levels and configurations for DSP NR for example)

RIT, XIT, VFO A/B, A=B and Split

- RIT – Receiver Incremental Tuning (AKA clarifier) allows you to move the receive frequency without moving the TX frequency
- XIT – Transmitter Incremental Tuning allows you to move the transmit frequency without moving the RX frequency
- A/B – allows you to select which VFO you want to use, both control the radio's frequency
- A=B – allows you to set both VFOs to same frequency quickly, by pressing both will be set to the frequency of the A VFO
- Split – allows you to receive on one frequency and transmit on another usually receive on A VFO and transmit on B VFO
- If covering just a few Khz/s you can use RIT or XIT to work split
- Most rare DX uses split operation thus keeping their transmit frequency fairly clear
- Most entry level radios, such as the Icom IC-718 offers all the above

Importance of Ambient Noise and why all we have talked about, matters

- Our hearing has about 100 dB range
- A typical library type room has a noise level of about 40 dB leaving us only 60 dB to play with
- Encapsulating headphones reduce noise by approximately 15-25 dB
- Quality in ear monitors reduce noise approximately 25 dB
- In ear monitor and external ear muffs reduce noise approximately 40 dB
- Once you use headphones or headset regularly, you are likely to be looking to sell your external speaker, one of the best investments you can make for dealing with noise

A Word About Menus
Reset Is Your Friend

- Elecraft K3 has too many menus to remember not counting the multi-function knobs on the front panel
- Even if each menu item only had two possible options (most have several) there is easily over 1000s of combinations
- Whether we like it or not, STUFF HAPPENS
- Keep a record of changes you make, in the case of the K3 it allows you to backup menu settings to a configuration file on your computer, YMMV
- In the event of MALFUNCTION, **RESET!**
- If there is an advantage of BA rigs it would be NO MENUS

Video References

- https://www.youtube.com/watch?v=W0tnt8MXYwE

(You Tube Amateur Extra lesson 6.4 on Filters and Impedance Matching)

- https://www.youtube.com/watch?v=1sX0VsINGu8f

(Bob Heil,K9EID, on ACG and RF gain adjustment from Ham Nation episode 130)

- https://www.youtube.com/watch?v=hM_ID-tivsA

(Radio Terminology explained AGC Automatic Gain Control)

- https://www.youtube.com/watch?v=9_uYHwAQcQ0

(Setting "split“)

- https://www.youtube.com/watch?v=26oCCEZRANk

(Notch Filter Demo)

QUESTIONS

73 de K8DV