KLAMATH BASIN AMATEUR RADIO ASSOCIATION

Know Your Knobs

HF radio controls — what each one does, and how it shapes your contact

K7AKT Charles J. Boening

ORIENTATION

Every knob does one job well

Modern rigs bury dozens of controls in menus, but almost all of them fall into five simple jobs. We'll take them one job at a time — what the control does, and how it changes the contact you're trying to make.

1. **Gain & levels** — how much signal gets in
2. **Shaping the passband** — deciding what to hear
3. **Fighting noise** — cleaning up what's left
4. **Tuning finesse** — landing exactly on frequency
5. **The transmit side** — sounding good going out

Same control, different name

Function	Yaesu	Icom	Kenwood
RX-offset tuning	Clarifier	RIT	RIT
Auto notch	DNF	ANF	Auto Notch
Noise reduction	DNR	NR	NR
Passband tuning	IF Shift	Twin PBT	Shift+Width
Preamp bypass	IPO	P.AMP Off	Preamp Off

The concepts are universal. Elecraft, Xiegu and others use their own labels — once you know the job, you'll find the knob.

A quick ham-radio decoder

A few terms we'll toss around today. New to HF? Keep this one handy.

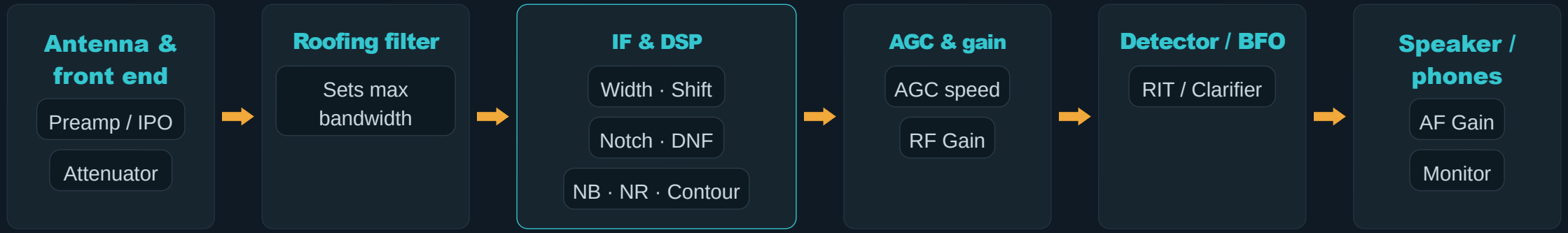
QRM — man-made interference
QRN — natural / atmospheric noise
QSB — signal fading
QSO — a contact / conversation
DX — a distant or rare station
Split — RX & TX on different frequencies
USB / **LSB** — upper / lower sideband (SSB)
CW — Morse code

ALC — automatic level control (transmit)
AGC — automatic gain control (receive)
DSP — digital signal processing
PBT — passband tuning (shift & width)
RIT — receiver incremental tuning
NB / **NR** — noise blanker / noise reduction
S-meter — received signal strength
73 — "best regards" (a friendly sign-off)

THE RECEIVE CHAIN

Where the controls live

Your signal travels a path from the antenna to the speaker. Each control acts at one point along that path — knowing *where* a knob acts explains *what* it can and can't fix.



TRANSMIT Mic → Mic Gain → Compression / Processor → ALC → Power amp → Antenna · watched by VOX/MOX & Monitor

ORIENTATION · YOUR SAFETY NET

Start from a known-good baseline

Set the radio here and every control does exactly what we're about to describe. Turned some knobs and now hear nothing? Don't panic — come back to this.

Receive

AF Gain — comfortable
AGC — on (Auto / Mid)
Attenuator — off
Shift / **PBT** — centered
Notch / **DNF** — off
RF Gain — fully up
Preamp / **IPO** — off on low bands
Width — wide (2.4–3.0 kHz)
NB / **NR** — off
RIT / **Clarifier** — zero / off

Transmit

Mode — LSB <10 MHz, USB above
Compression — off / low
VOX — off (use PTT)
Power — moderate
Mic Gain — peaks to ALC
TX EQ — flat
Monitor — off / phones
Split — off

> **Remember:** receive controls can't hurt anything. Experiment all you like — then return here and you're back to normal.

Preamp, IPO & Attenuator

Three ways to set how hard the antenna hits the front end. The goal is to land signals in the receiver's usable range — not so weak they're buried, not so strong they overload.

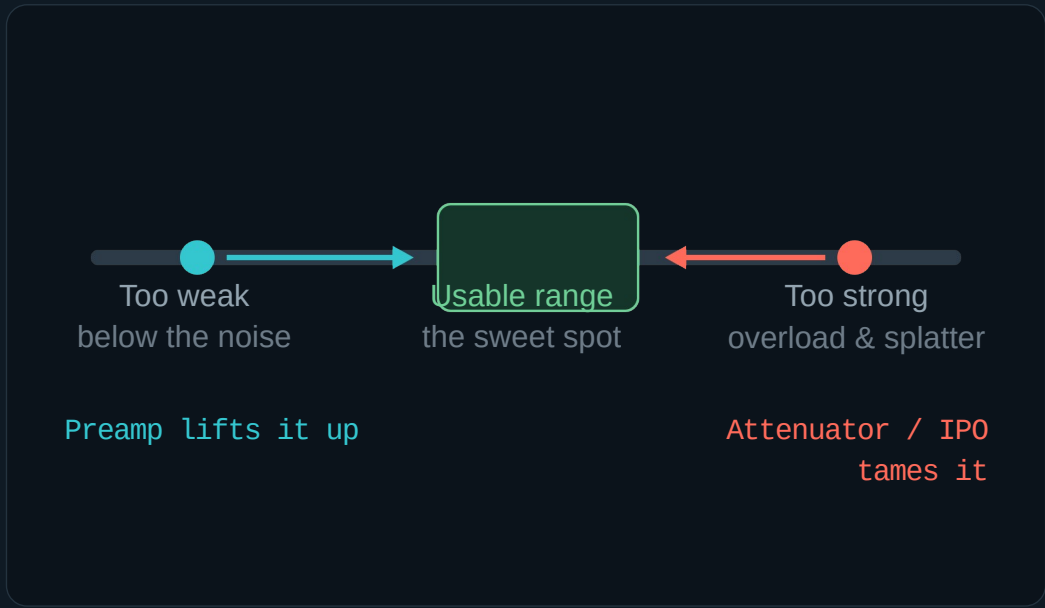
Preamp / IPO

Preamp adds gain for weak signals on quiet, higher bands (10 / 12 / 6 m). IPO (preamp **off**) bypasses it so strong signals and low-band noise don't overload the front end — better dynamic range.

Attenuator

Knocks everything down a fixed amount (often 6–18 dB). Use it when signals are crushingly strong or the band noise itself is overloading the receiver.

> **On the air:** quiet 20 m morning → preamp helps you hear the weak ones. Loud 40 m night → IPO or attenuator keeps a booming signal from wiping out the band.



RF Gain vs. AF Gain

Two very different knobs that both feel like "volume." One sets how loud the speaker is; the other sets how much receiver you're using.

AF Gain (Volume)

Sets speaker or headphone loudness only. It does **not** change what you can pull out of the noise — turning it up just makes everything louder.

RF Gain

Sets the receiver's overall gain — and with it the AGC threshold. Back it off and the noise floor drops and AGC stops pumping; go too far and weak signals disappear.

> **On the air:** on a hissy, crowded evening, reduce RF gain until the noise eases but signals still copy — far easier on the ears than riding the volume.

RF Gain moves the **whole** receiver — noise floor and signals together.

AF Gain moves loudness **only** — the signal-to-noise stays the same.

AGC — Automatic Gain Control

The receiver's automatic volume rider. It keeps a whisper-weak station and a booming local at roughly the same comfortable level, so you're not lunging for the knob.

What it does

Above a threshold, it turns receiver gain **down** as signals get stronger — flattening a huge range of input into a steady, listenable output.

AGC speed

Slow — smooth for SSB ragchews · **Fast** — CW, digital & pileups · **Mid** — a good default · **Off** — you ride RF gain by hand

> **Watch out:** on a noisy band, fast AGC can make the hiss "pump." A strong nearby signal can also pull gain down on the weak one you want — narrower filtering helps.

Width & Shift (Passband Tuning)

Your single most powerful tools against a crowded band. Think of a window you listen through: **Width** sets how wide it is, **Shift** slides it left or right.

Width (bandwidth)

How wide a slice you hear. Wide (2.7–3.0 kHz) for full SSB audio; narrow (1.8 kHz SSB, 500–250 Hz CW) to carve out crowding neighbors.

Shift / PBT

Slides the window up or down **without** changing your pitch or tuned frequency. Icom's "Twin PBT" squeezes both edges at once.

> **On the air:** narrow the width and nudge the shift, and a station buried under a neighbor suddenly stands out clean.

AS THE FILTER LOOKS ON YOUR DISPLAY

Width — squeeze the skirts inward and the neighbor drops out of the window

Shift — slide the whole window sideways to dodge the interference

Width & Shift as a tone control

These aren't just for beating QRM — together they shape the *sound* of a voice. Choose which slice of the audio you hear, and a hard-to-copy signal can turn warm and clear.

Narrow to trim the edges

Bring width in to ~2.2 kHz to cut harsh highs and low rumble. Often a voice gets easier to copy and less tiring, even with no interference.

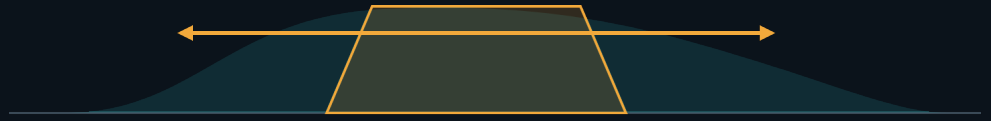
Shift to set the tone

Slide the window **lower** for more warmth and bass, or **higher** for more treble and clarity — matched to the incoming voice.

On the air: a boomy, muddy signal? Narrow a bit and shift up — the words snap into focus. A thin, tinny one? Shift down for body.

PICKING A SLICE OF THE VOICE · LOW → HIGH

Narrow to ~2200 Hz — trims harsh highs and low rumble



Shift low for warmth & bass, high for clarity & treble

Roofing Filters

The receiver's *outer* gate — a hardware filter early in the IF, before the AGC and DSP. It decides which signals even get a chance to reach the rest of the radio.

What it is

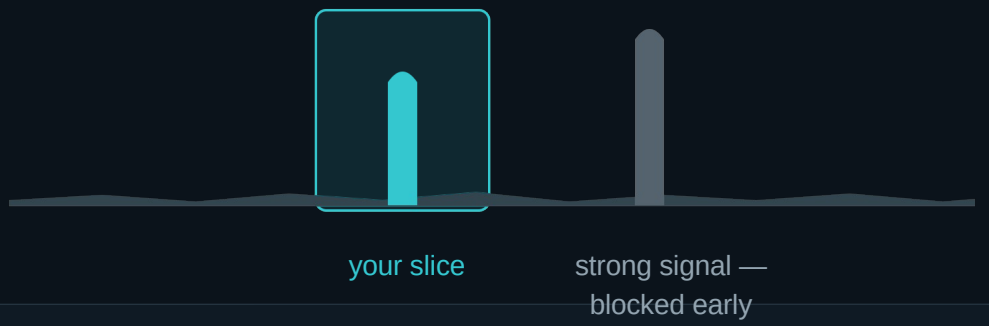
A fixed hardware filter near the front of the IF. It sets the widest range of signals that can reach the AGC and the DSP filters.

Why it matters

A strong signal a few kHz away can pump your AGC even with a narrow DSP filter. A **narrow roofing filter** removes it earlier — cleaner copy in pileups and contests.

On the air: many rigs offer 3 kHz / 600 Hz / 300 Hz options — roomy for SSB, tight for CW in a crowd. Entry rigs may have just one.

ORDER IN THE RECEIVER



Notch & Auto-Notch (DNF)

A surgical tool for a single steady tone — a tuner-upper's whistle, an RTTY carrier, a heterodyne. It removes the offending tone and leaves the voice untouched.

Manual Notch

You place a narrow, deep null by hand right on one steady tone. Kills the whistle, leaves the audio.

Auto-Notch / DNF (DSP)

The radio finds steady tones automatically, removes several at once, and tracks them as they drift. **Turn it off for CW** — it can erase the very tone you're copying.

On the air: that maddening squeal from someone tuning up? One notch and it's gone while the station keeps coming through.

RECEIVE · SHAPING THE PASSBAND

Contour & APF

Where Notch cuts one sharp tone, these reshape the tone of the whole passband — one gently, one very sharply.

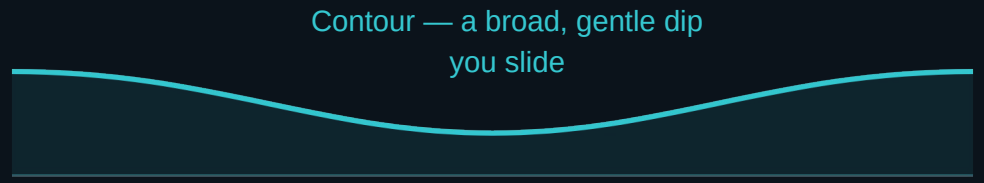
Contour

A soft, wide hill or valley you slide across the passband to gently boost or cut a **range** of audio frequencies — tame harshness, dip a band of noise, add warmth. Not a sharp cut.

APF — Audio Peak Filter

A very narrow audio peak locked on your CW pitch (~500–700 Hz). It makes a weak CW note jump out of the noise. **CW only.**

> **On the air:** Contour is about comfort and clarity on SSB; APF is about digging a weak CW signal out of the mud.



RECEIVE · FIGHTING NOISE

Noise Blanker (NB)

For sharp, pulsing noise — the tick-tick-tick of a bad power pole, ignition, or an electric fence. It removes pulses in time, not by frequency.

What it does

Watches for short, sharp impulses and briefly mutes — "blanks" — the receiver during each one, so the pulse never reaches your ears.

Best for — and not for

Great on **impulse** noise: ignition, arcing insulators, some radar. It does **not** help with steady hiss or atmospheric noise — that's the next slide's job.

NB level: use just enough to kill the pulses. Too much distorts strong SSB and adds artifacts. Some rigs let you match the blanking width to the pulse.

RECEIVE · FIGHTING NOISE

Noise Reduction (NR / DNR)

For the *steady* stuff the blanker can't touch — band hiss, atmospheric noise, static. DSP pulls the random noise down so a weak signal rises out of the background.

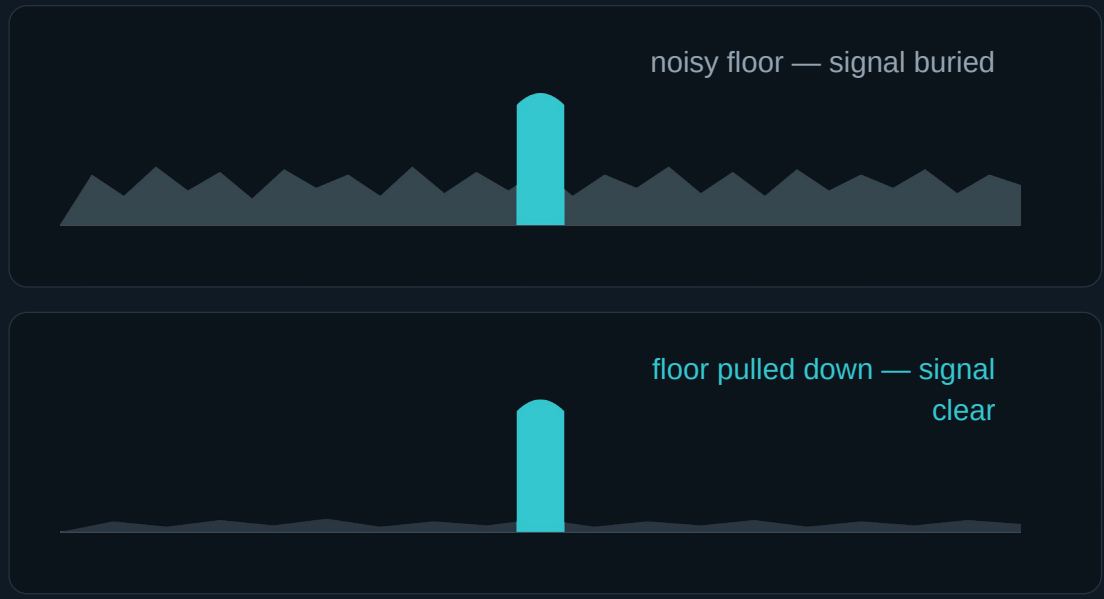
What it does

DSP sorts random noise from real signal and pulls the hiss down — lifting a weak voice or CW note out of the background.

Blanker vs. reduction

NB kills sharp **pulses**; NR/DNR lowers steady **hiss**. Different problems, different tools — often used together.

Watch out: push it too far and audio turns "watery" and hollow — you can lose the signal you're chasing. Use the lowest setting that helps.



RECEIVE · TUNING FINESSE

RIT & Clarifier

Fine-tune who you *hear* without moving where you *transmit*. A small nudge that keeps you on the other station's frequency while you clean up their pitch.

What it does

RIT (Receiver Incremental Tuning) shifts only your **receive** frequency a little — a few kHz — while your **transmit** stays put. XIT does the same for transmit only.

Why you'd use it

Tune in a station who's slightly off, or correct SSB pitch so a voice sounds natural — without dragging your transmit off their frequency.

Clarifier is Yaesu's name for the same thing — it can offset RX and, as the TX Clarifier, transmit. Same idea, different label.

YOUR DIAL: 14.250 MHZ

14.250.00 Transmit — stays exactly here

14.250.30 Receive — nudged by RIT (+300 Hz)

RECEIVE · TUNING FINESSE

Split Operation

Receive on one frequency, transmit on another. The key to breaking a DX pileup — and the source of a lot of on-air confusion until it clicks.

What it does

Uses two VFOs at once — VFO A to receive, VFO B to transmit — so you listen on one frequency and call on another.

Why — the pileup

A rare station gets buried if everyone calls on his exact frequency. So he transmits on his, and "listens up" 5–10 kHz. Split lets you call there while hearing him clearly.

On the air: "Listening 5 up." Set split +5, place your transmit in his window — and you're heard instead of lost in the wall of callers.

14.200.00 — **VFO A · RX**
you listen to the DX

14.205.00 — **VFO B · TX**
you transmit up 5 kHz

TRANSMIT · SOUNDING GOOD

Mic Gain

How hard your voice drives the transmitter. It sets modulation, not raw power — and getting it right is the difference between clean audio and a signal that splatters across the band.

What it does

Sets how much of your voice reaches the transmitter — the modulation level. It does not add power; it fills out the signal you already have.

Set it by the ALC meter

Speak normally and adjust so voice peaks bring ALC into the maker's recommended range — full, clean audio without pinning the meter.

On the air: too low and you're thin and hard to copy; too high and you distort, splatter, and widen your signal. When in doubt, back off a touch.

Too low — thin & weak

Just right — full, clean audio

Too high — clipped, splatter

Speech Compression / Processor

Speech has big peaks and low averages. Compression evens that out — raising your *average* power for more punch, so you get through when the band is rough.

What it does

Raises average power relative to peaks — more "talk power" and readability, especially in weak or noisy conditions.

The trade-off

Overdo it and you get distortion, listening fatigue, and a wider signal. A little goes a long way — watch the compression / ALC meter.

On the air: in a marginal opening, a moderate amount can turn "you're 2-by-1" into a solid contact. Use the Monitor to hear what you're sending.

VOX, MOX & Monitor

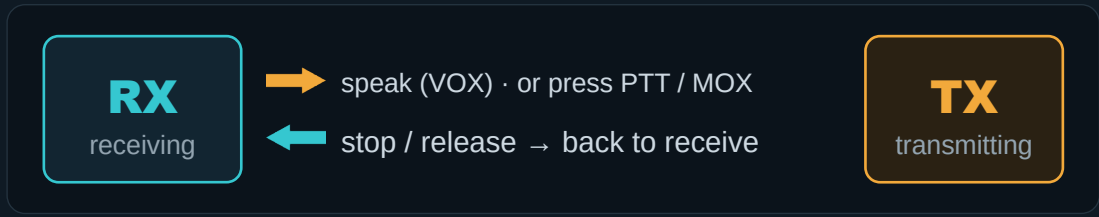
How you switch between receive and transmit — hands-free or by hand — and how you keep an ear on what you're actually sending.

VOX — Voice-Operated Transmit

The rig keys up when you speak and drops back when you stop — no PTT. Tune it with **VOX gain** (sensitivity), **anti-VOX** (so speaker audio won't key you), and **delay** (hang time).

MOX / PTT

MOX manually switches to transmit and holds it — handy for tuning or data. PTT keys while you hold it. Both are you telling the radio "transmit now."



Monitor (MONI)

Lets you hear your own transmitted audio through the DSP in real time — check mic gain, compression, and EQ as you talk. Use headphones to avoid feedback. It doesn't change what you send; it just lets you listen.

Break-in & QSK (CW)

On CW, break-in decides whether you can hear *between* your own keystrokes — a small thing that changes how you work a busy band.

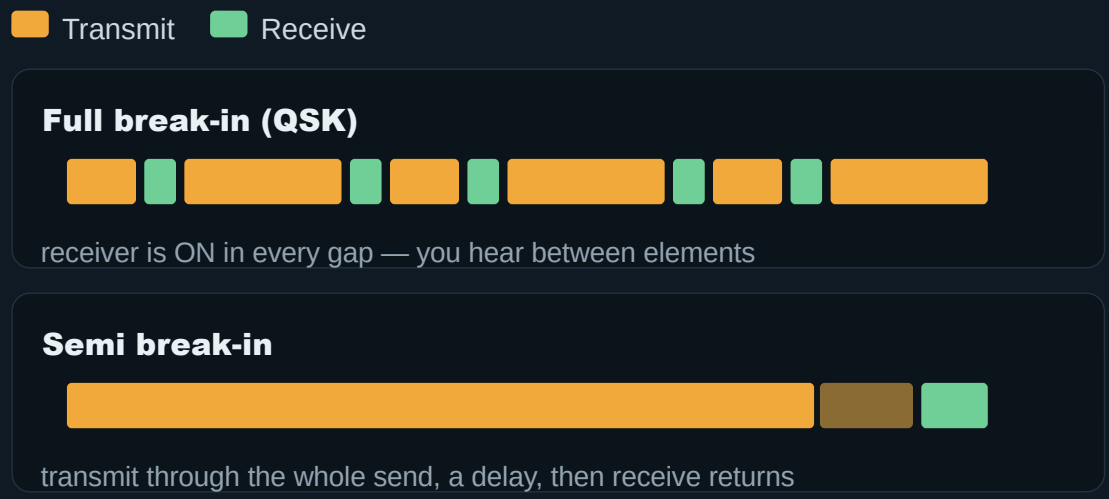
Full break-in (QSK)

The receiver comes alive in the tiny gaps between dits and dahs — you hear the other station or interference **while** you're sending, and can be stopped mid-stream. Needs fast T/R switching.

Semi break-in

Keys on your first element and stays in transmit through a short delay after you stop, then returns to receive. Easier on the relays; you hear only after you finish.

> **On the air:** QSK is prized in pileups — you know instantly if you're being covered or if the DX came back to someone else, without waiting to finish.



TRANSMIT · SOUNDING GOOD

Dialing in your transmit audio

Good SSB audio is built in order — set the basics first, then add polish. Change one thing at a time and let the meters (and an honest signal report) guide you.

1. **Start clean.** Processor/compression off, TX EQ flat. Set **mic gain** so normal voice peaks just reach the recommended ALC range.
2. **Fix your mic technique.** A steady 2–4 inches, speak across the mic (not into it), consistent level. This matters more than any menu.
3. **Add compression gradually.** Bring it up while watching the COMP/ALC meter; back off at the first sign of distortion.
4. **Listen & verify.** Use **Monitor** on headphones, then get an on-air report. Shape TX EQ / bandwidth to taste.

Watch the ALC meter

Peaks should land in the **target zone** — not slammed into the **red**. Pinning ALC hard means you're overdriving.

Match it to the QSO

Ragchew: wider bandwidth, flatter EQ, light compression — natural and easy to listen to.

DX / contest: narrower, a little bass cut, more compression — punch that cuts through.

TX EQ — shaping your transmit audio

The transmit mirror of Width & Shift: instead of shaping what you *hear*, you shape what you *send* — boosting or cutting bass, mids, and treble to fit your voice and the conditions.

What it is

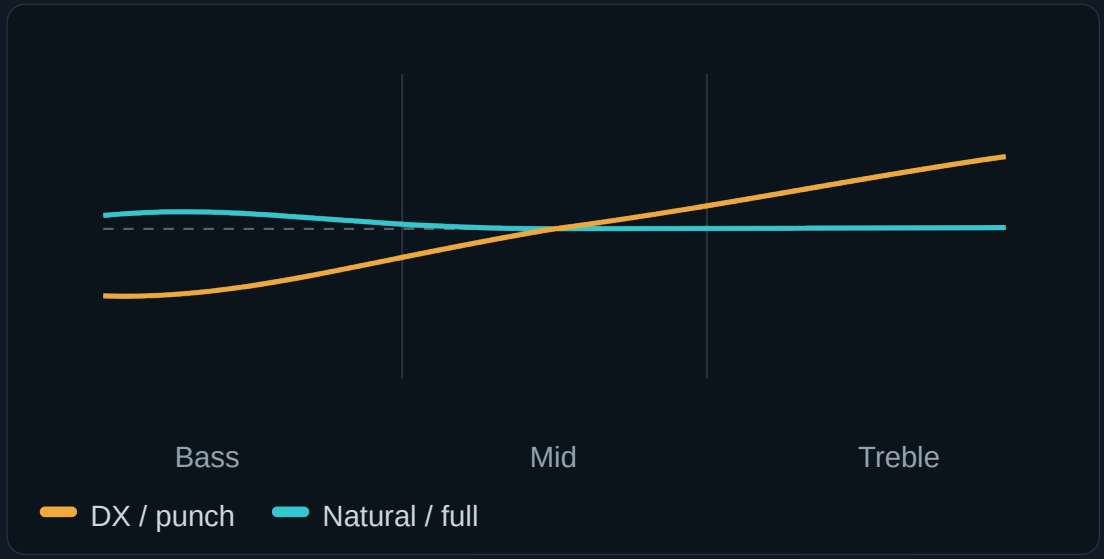
An equalizer for your outgoing audio. Simple rigs give bass and treble; others have multi-band **parametric** EQ — separate low/mid/high with adjustable center and level — sometimes with different SSB and data presets.

Shape it to the goal

DX / punch: ease the bass, lift presence (~2–3 kHz) to cut through. **Natural / ragchew:** flatter, with a little low-end warmth.

Match & verify: deep voice → less bass, more highs; thin voice → add low-mid warmth. Small moves, checked on Monitor and by honest reports. Too much bass is muddy and wasteful; too much treble is harsh.

TX EQ RESPONSE · BOOST ABOVE THE LINE, CUT BELOW



TRANSMIT · DIGITAL MODES

What changes for FT8, RTTY & PSK

In a data mode the software and the sound card do most of the work — so many front-panel controls step aside, and the goal on both ends becomes **clean, linear, untouched** audio.

Transmit side

Do — use the data mode (DATA / USB-D / PSK). It takes audio from the USB interface and usually bypasses the mic, EQ and processor for you.

Do — set drive with the **USB / data level**, not mic gain, for just a touch of ALC (per your rig's spec).

Avoid — compression / processor. It wrecks the linearity these modes need and splatters across the band. Keep it flat.

Receive side

Turn off Auto-Notch / DNF — it eats the very tones the decoder is listening for.

Go easy on NR / NB — heavy DSP can distort the waveform the software relies on. Let the **waterfall** do the filtering.

Often better — a wider filter (keep signals in the passband) and, for FT8, fast or off AGC.

> **Bottom line:** in a data mode with a USB sound interface, the mic-side controls — mic gain, EQ, VOX, processor — mostly don't apply. The work is in your software and one clean drive level.

WRAP-UP · WORKED EXAMPLE

Putting it all together

One weak SSB station, a crowded and noisy 40 m evening. No single knob does it — the *order* does. Here's the sequence.

PULL HIM OUT OF THE NOISE

1. Start at the **baseline** — known-good.
2. Tune him in — a touch of **RIT** if he's slightly off.
3. Narrow **Width** to ~2.2 kHz to cut the crowd.
4. **Shift** to slide a neighbor out of the window.
5. **Notch** a steady whistle · **NR** for hiss (**NB** for crackle).

DIAL IT IN, THEN ANSWER

6. Back off **RF gain** until the hiss eases but he still copies.
7. Set tone with **Shift** — down for warmth, up for clarity.
8. Transmit: **mic gain** to ALC on your peaks.
9. Add a little **compression** if he's weak · check on **Monitor**.

> **Result:** a readable contact pulled out of the noise — the sequence did it, not any one knob.

WRAP-UP

Quick reference

RECEIVE

Control	Reach for it to…
Preamp / IPO	add gain up front, or bypass it
Attenuator	tame crushingly strong signals
RF Gain	calm a noisy band by hand
AF Gain	set speaker volume
AGC	auto-ride volume (speed to mode)
Width & Shift	carve a station out of QRM
Roofing filter	block strong neighbors (contests)
Notch / DNF	kill a steady whistle or carrier
Contour / APF	shape tone; peak a weak CW note
Noise Blanker	blank sharp, pulsing noise
NR / DNR	lower steady hiss & static
RIT / Split	offset RX; work a pileup

TRANSMIT

Control	Reach for it to…
Mic Gain	set modulation to ALC
Compression	add average talk power
VOX / MOX	key hands-free or by hand
Monitor	hear your own audio
Break-in / QSK	hear between CW elements

Rules of thumb

Change one thing at a time. Width & Shift beat everything else for crowding. If your audio sounds bad, suspect **too much** — mic gain, compression, or NR.

WRAP-UP

Common mistakes & myths

The same lessons from the other direction — the habits that quietly make things worse.

Preamp on everywhere

On low, noisy bands it just boosts noise and invites overload. IPO / preamp-off is often better.

Drowning it in NR

Too much sounds watery and hollow and buries the signal. Use the least that helps.

Riding the volume on a noisy band

Reduce **RF gain** instead — it lowers the noise, not just the loudness.

Maxing mic gain & compression

Distortion and splatter make you *harder* to copy, not easier. Watch the ALC.

Forgetting RIT / XIT is on

You'll end up off frequency. Zero the clarifier when you're done with it.

Calling on the DX's frequency

When he's working split, call in his listening window — not on top of him.

WRAP-UP

Troubleshooting — symptom → fix

When something sounds wrong, start from what you hear and work back to the knob.

RECEIVING

You hear…	Check…
Nothing / very weak	RF Gain up · ATT off · RIT off · band & antenna
Blasting loud	RF Gain down · Attenuator · AGC on
Steady whistle	Notch / DNF
Crackle / popping	Noise Blanker
Constant hiss	NR / DNR
Muddy / boomy	narrow Width · Shift up
Thin / tinny	Shift down · wider Width

TRANSMITTING

They say…	Check…
Can't hear you	Mic Gain · PTT / VOX · power · right freq & split
You're distorted	Mic Gain down · Compression down
You're weak / thin	Mic Gain up · add compression · TX EQ
Splattering / too wide	Mic Gain & Compression down · check ALC
CW: can't hear between	Break-in / QSK

> Still stuck? Return to the **baseline** and change one thing at a time.

WHERE IS IT ON YOUR RADIO · 1 OF 3

Icom IC-7300

FIND THESE

Preamp / Atten — P.AMP/ATT button

Noise Blanker — NB button

Noise Reduction — NR button

Notch / auto-notch — NOTCH (hold for auto)

Width / Shift — TWIN PBT knob (top left)

AF / RF Gain — AF·RF/SQL knob

RIT · Split — RIT · SPLIT buttons (top right)

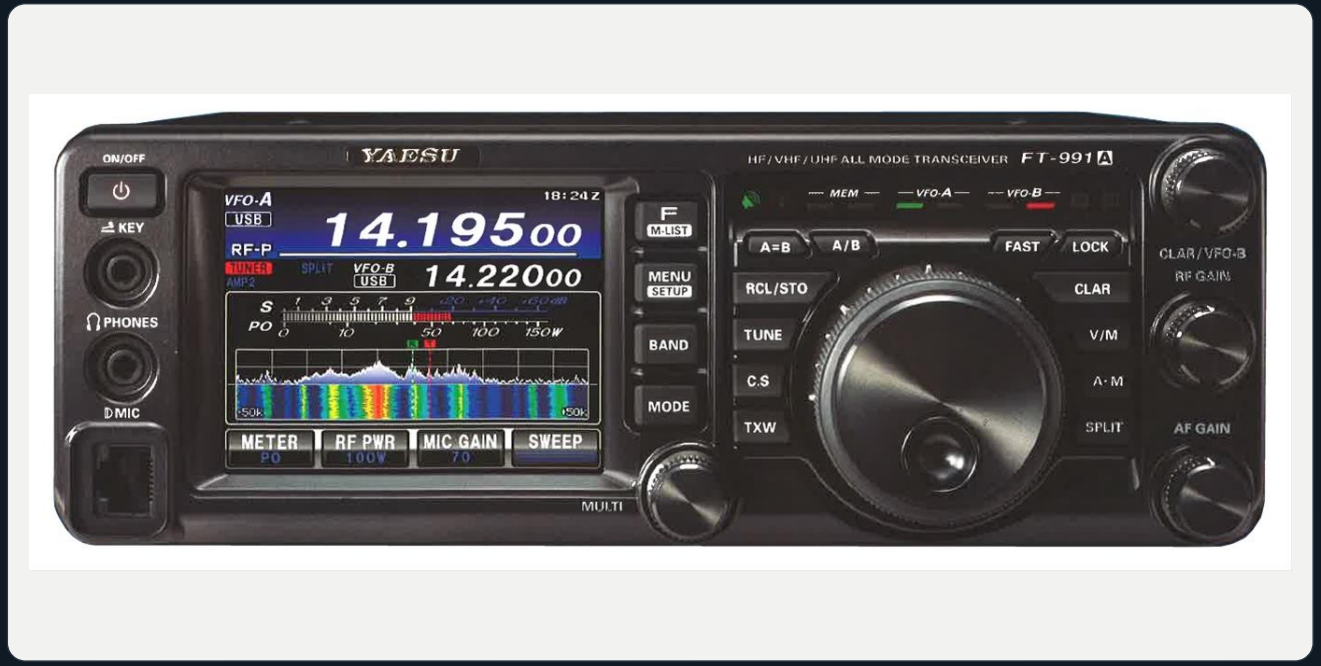
VOX / Break-in — VOX/BK-IN button

Mic gain · Comp · EQ · DNF — MENU / FUNCTION

Touchscreen + a knob per job — most controls are one or two taps away.

WHERE IS IT ON YOUR RADIO · 2 OF 3

Yaesu FT-991A



FIND THESE

AF Gain — AF GAIN knob (lower right)

RF Gain — RF GAIN knob (upper right)

Clarifier (RIT) · Split — CLAR · SPLIT

Mic Gain — MIC GAIN soft-key (under screen)

RF Power — RF PWR soft-key

Mode · Band — MODE · BAND buttons

NB · NR · Notch · Contour — F(M-LIST) menu

Width / Shift — Function / DSP menu

VOX · Comp · TX EQ — MENU (SETUP)

Fewer dedicated buttons — most DSP controls live in the menu, so learn the F and MENU keys.

Yaesu FTDX10

FIND THESE

Width / Shift — SHIFT/WIDTH knob (top right)

Notch — NOTCH knob (right)

Contour / APF — CONT/APF knob (right)

Noise Blanker · Noise Reduction — NB · DNR

AF / RF Gain — AF·RF/SQL knob (bottom)

VOX / MOX — VOX/MOX button (left)

Clarifier (RIT) · Split — CLAR RX/TX · SPLIT

Preamp (IPO) · Atten · AGC · Roofing — on the display; set via FUNC

The most dedicated knobs of the three — Width, Shift, Notch and Contour all have their own controls.

THANK YOU · KBARA

Questions?

The fastest way to master these is to tune around and try them. Your **receive** controls can't hurt a thing — so experiment freely, and listen to what each one changes.

K7AKT Charles J. Boening **73!**