

Performance and Feature differences among top OEMs.

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Great rigs but different individual designs
Examples of current rigs

Are you considering a new HF rig?

Subjects to emphasize today

Choosing a new rig is both subjective and complex.

Contesters and DXers have many options.

Each OEM* has chosen to emphasize different feature sets.

Consider improving your antenna, possibly limited by an HOA or the family desiring the antenna be invisible.

Order importance: Location, Antenna, Skill, Radio Model

* OEM = Original Equipment Manufacturer

Rig evaluations the past 18 years 50 miles east WWV

Do what you can, if not this much !



What has changed in 5 years?

- While receiver lab numbers for most current transceivers are excellent, the user interface is all over the map.
- If possible try out a potential new rig to see if it fits your operating style.
- Each OEM has chosen a niche for differentiation.

How old is your current rig?

- If older than 10 years it is a new experience.
- Major types today:
- Superhet, Hybrid Superhet, Direct Sampling & “IF Sampling”
- TS-890S = Hybrid 3 Yaesu models = IF Sampling
- Only Kenwood doesn't offer a sampling option.

Does the architecture matter?

- Most of the time it doesn't matter.
- A superhet has a roofing filter with a 5 to 70 MHz IF.
- Hybrid Superhet adds a direct sampling band scope.
- "IF Sampling" also has roofing filters, **ADC at IF**.
- Pure Direct Sampling has no roofing filters.
- If signals are S9+60 dB a roofing filter can help.

Architectures Dominating Today

- Superhet: TS-590SG, IC-7100
 - Hybrid Superhet: TS-890S
 - IF Sampling: FTdx-101D/MP, FTdx10
 - Direct Sampling: K4, IC-7610, Flex, Apache
Plus the new FT-710
-
- Either sampling method has ADC in RX path.
 - Only IF sampling has roofing filters at first IF.

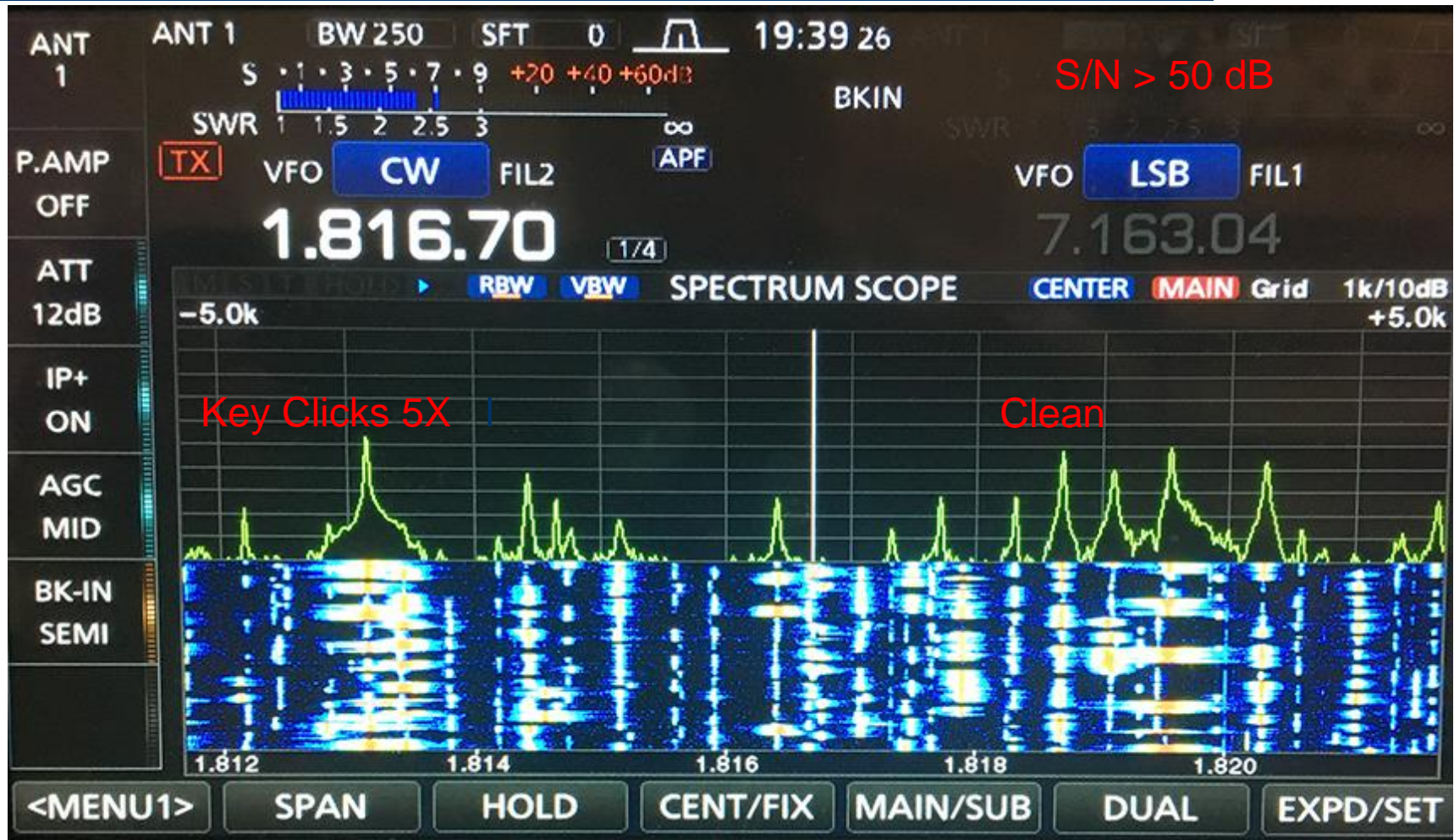
We can see transmit bandwidth problems

- You can learn a lot from band scope observations of on-air signals.
- What you see on a direct sampling band scope and waterfall is reality!
- You can see the wide signals causing QRM.
- Let's take a look at some examples.

December 2018

Over 30 stations in 10 kHz IC-7610

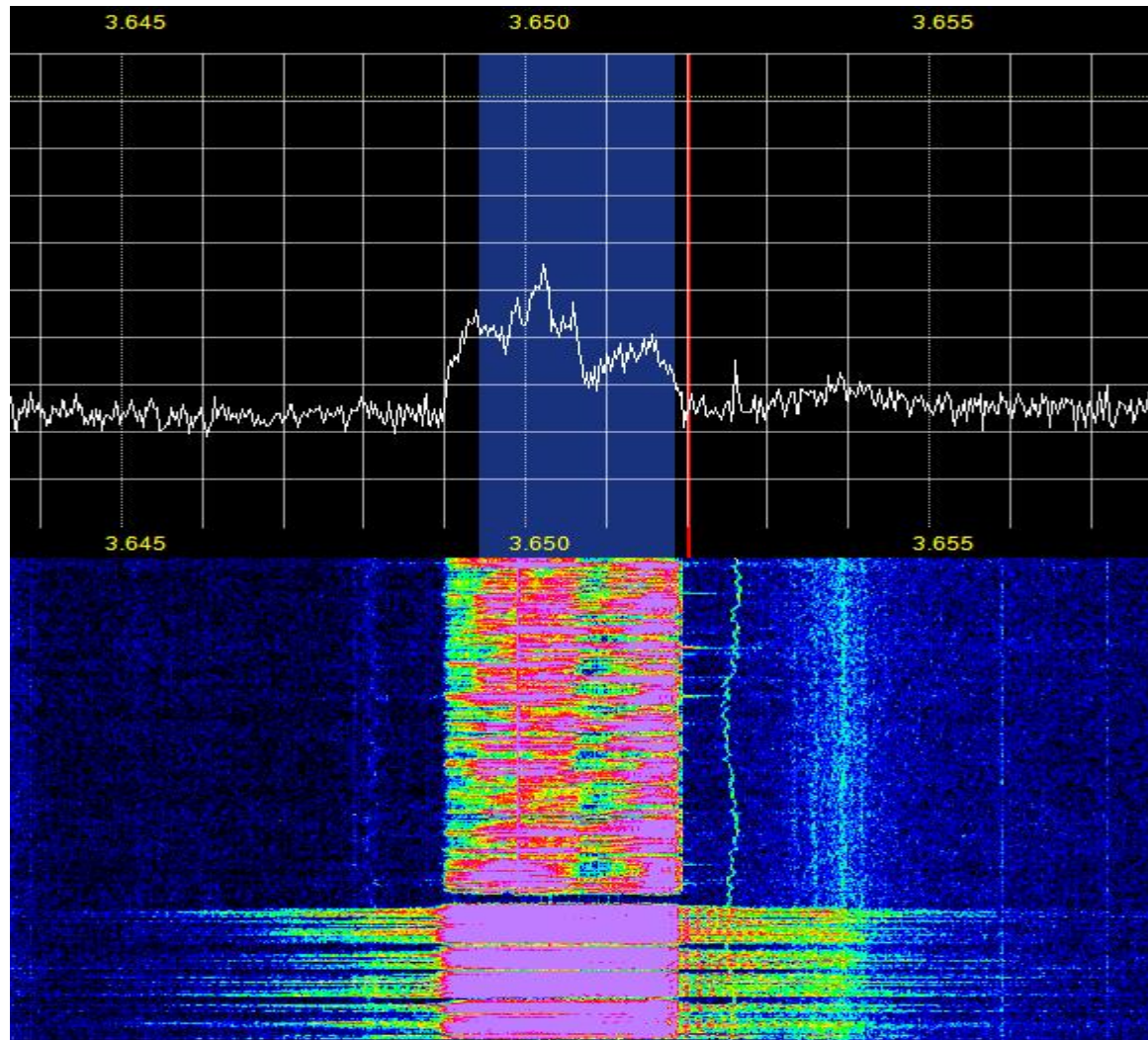
ARRL 160m CW Friday 7:40 PM



CW Key Click Improvements

- Flex & Elecraft have fixed rise & fall times, don't currently meet CSI.
- Bandwidths could meet CSI CW masks with new firmware.
- Apache G2 with latest firmware can likely meet the CSI CW mask.
- Icom, Kenwood & Yaesu have CW menu adjustable rise & fall times.
- None meet CSI key click mask at the default menu setting.
- Rise and Fall times menus should never have options of 1 or 2ms.
- Most but not all rigs have worse key clicks in full break-in.
- If menu adjustable, pick the slowest rise and fall time option.

PureSignal Adaptive Pre-Distortion vs. Typical SSB Splatter



Class A is gone with current rigs

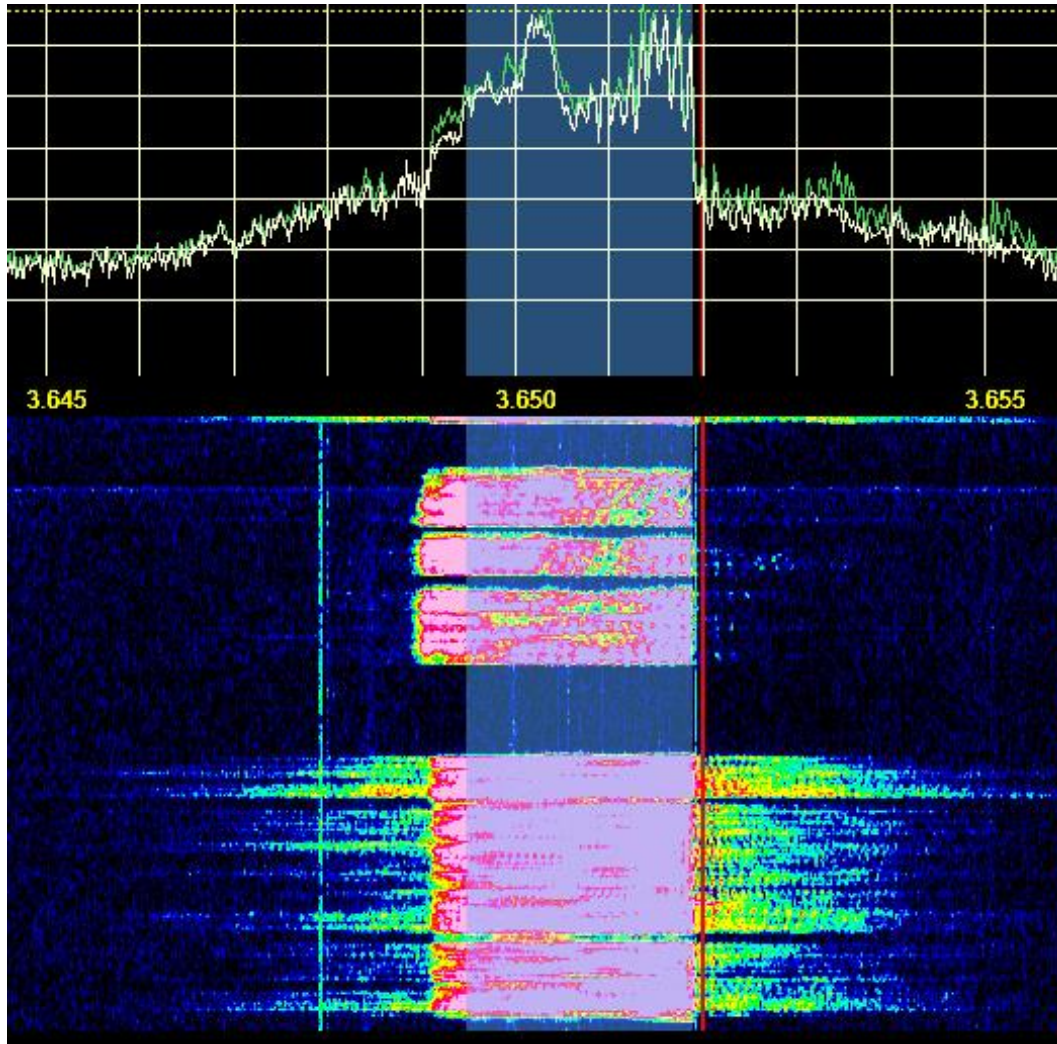
Icom now offers DPD predistortion

Flex & K4 ?

Apache 200D & PureSignal APD & Amp

Kenwood TS-890S & Alpha 89

Icom Digital Pre-Distortion (DPD) vs. Typical SSB Splatter



Display 10 kHz span
Apache 7000DLE RX

Blue shading is the
2.4 kHz RX bandwidth

Icom 7610 with DPD
driving an Acom 1000
Amp not in DPD loop
NC0B

Flex 6600M driving a
PowerGenius XL
W5AP

Great basic performance from all OEMs

- You can contest and DX with dozens of rigs.
- The magic “100 dB radio” is now common.
- Choices by brand, cost & size
- I operated multiple CW contests 4th quarter 2022 with \$1000 to \$1300 transceivers with no major performance complaints.

Dynamic Range of Top 25 HF Transceivers

• Yaesu FTdx-101D	110 dB
• Yaesu FTdx10	107 dB
• Yaesu FT-710	107 dB
• Elecraft K3S	106 dB
• Icom 7851	105 dB
• Kenwood TS-890S	105 dB
• Hilberling PT-8000A	105 dB
• Elecraft KX3	104 dB
• Apache 7000DLE	103 dB
• Elecraft K4	101 dB
• Yaesu FTdx-5000D	101 dB
• Flex 6400	100 dB
• Flex 6600	99 dB
• Flex 6700 (2017)	99 dB
• Icom 7760	99 dB
• Icom 7610	98 dB
• Icom 7300	97 dB
• Flex 5000	96 dB
• Ten-Tec Orion II	95 dB
• Ten-Tec Orion I	93 dB
• Kenwood TS-590SG	92 dB
• Ten-Tec Eagle	90 dB
• Flex 6300	89 dB
• Icom 705	88 dB
• TS-990S	87 dB

You can effectively work DX and Contests with any of these fine transceivers.

New price range \$1000 to \$12,000+

Used market price even lower !

100 dB radios unheard of 20 years ago !

(16 dB preamp ON)

(Preamp OFF)

(IP+ ON)

(IP+ ON, S/N around 10,000 and up)

I have run contests with 20 of these 25

(No IP+ ADC linearization)

(RMDR limited close-in)

How do you select a new radio?

- Do you pick one of those top 25 models?
- That would be a good start.
- Married to one brand? **Pick price** that fits your budget.
- Price range for current **new** rigs today \$1000 to \$7,000+
- Size of the rig for DXpeditions, SOTA, POTA, etc.
- Let's look at niche features by brand in no particular order.

Brand Feature Differences

- Remote options hardware and software
- Reducing wide transmit signal bandwidth
- Architecture differences harsh RF environments
- DSP filter performance
- DSP noise mitigation

Comments on Flex

- Focused last several years on remote operation
- Maestro or tablets for remote
- Very few DSP improvements for years
- New 8000 series replaces the 6000 series but few new software features yet.
- Awaiting promised pre-distortion feature

Comments on Apache

- Leading noise mitigation (NB and NR)
- 1 of 2 brands with pre-distortion splatter reduction.
- (Apache PureSignal and Icom DPD)
- Don't consider an Apache "plug and play".
- Not recommended for your first HF transceiver.
- Buy a 100-watt standalone radio (no computer).

Comments on the Yaesu

- Offers IF sampling FTdx-101D/MP & FTdx10
- Roofing filters for super strong out of passband signals.
- A ham very close by, Field Day, Multi-Multi contests
- Yaesu's FT-710 direct sampling transceiver
- (No roofing filters by definition)
- Small size, price around \$1000

Small rig niche QRP (5 to 10 watts)

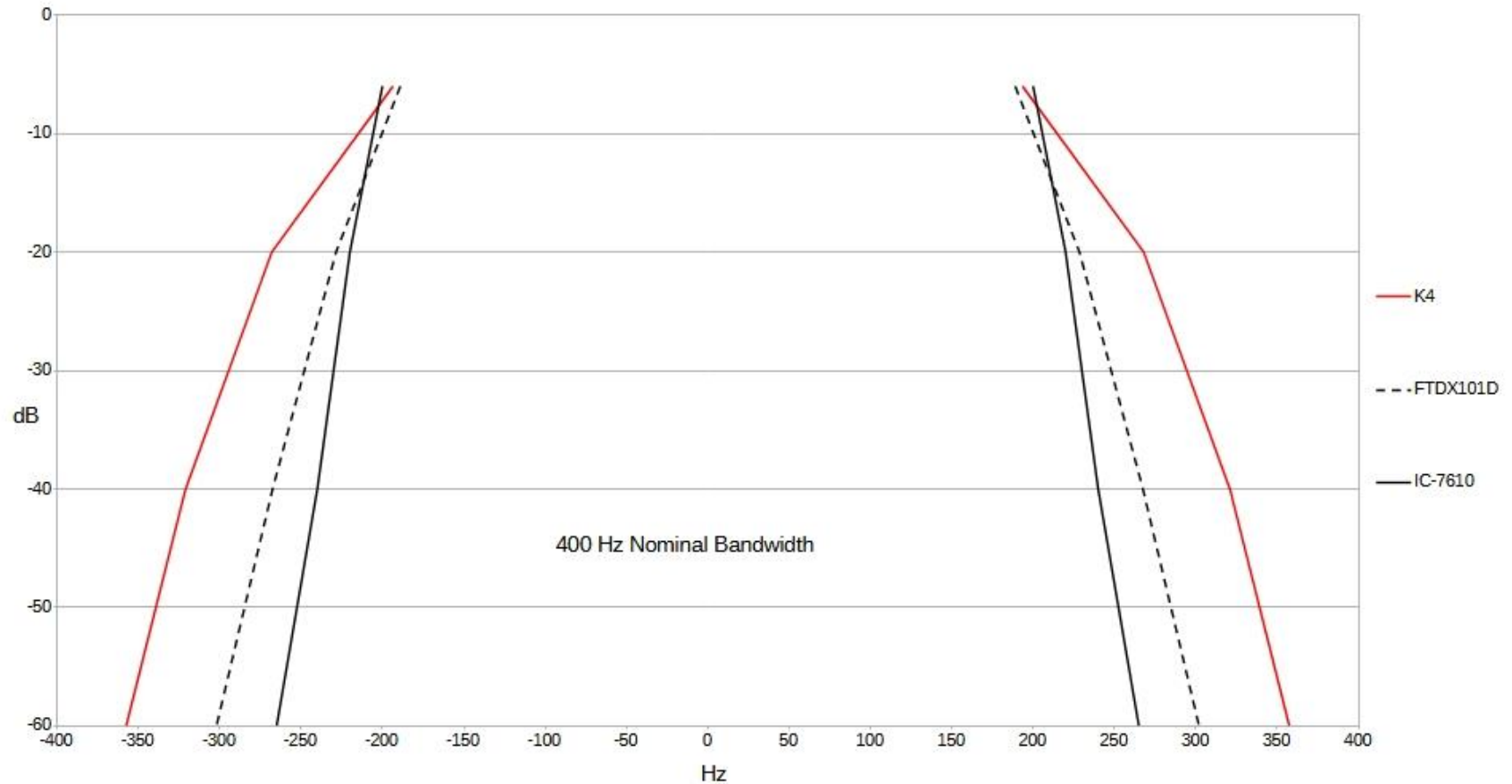
- Elecraft: KX3, KX2, KH1
- Yaesu FTX-1F (announced)
- (Replaces discontinued FT-817 & FT-818)
- Icom IC-705

Comments on the Elecraft K4

- Major firmware improvements in the last 3 years.
- Remote K4 to K4 firmware released before Hamvention 2024
- K4/O prototype shown at Hamcation Orlando Florida February 2025
- Price range around \$2000
- IF sampling K4HD superhet upgrade prototype also at Hamcation 2025
- Price range around \$1000 or so. Optional roofing filters \$???
- Promised Pre-Distortion timeline unknown.
- CW DSP filters surprisingly not as sharp as a other current brands.
- (Or the K3S with optional roofing filters)

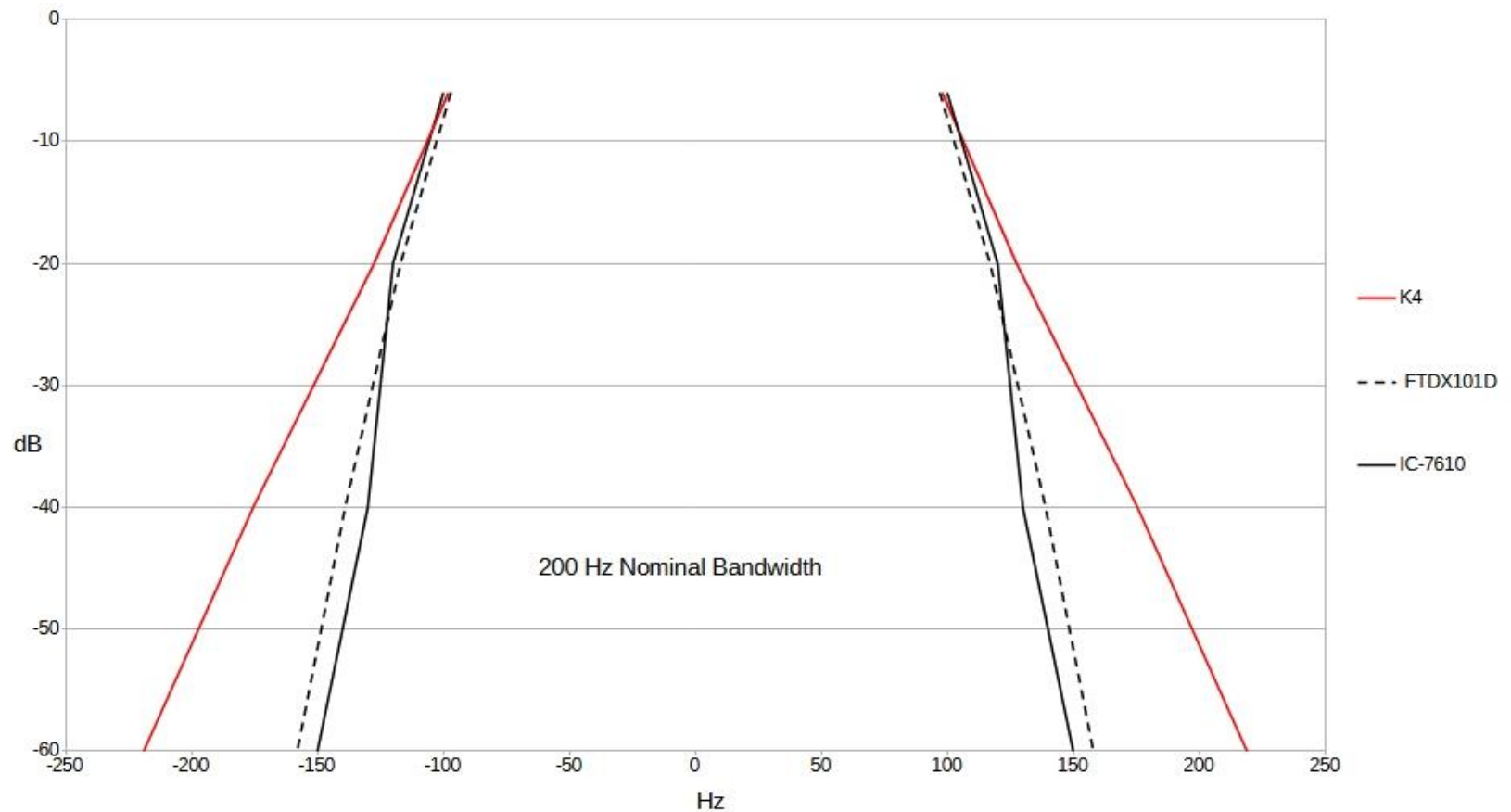
Graphs courtesy K9MA, K4, 101D & 7610

400 Hz DSP filter shape (FIR)



K4 in red is the widest with 7610 the sharpest

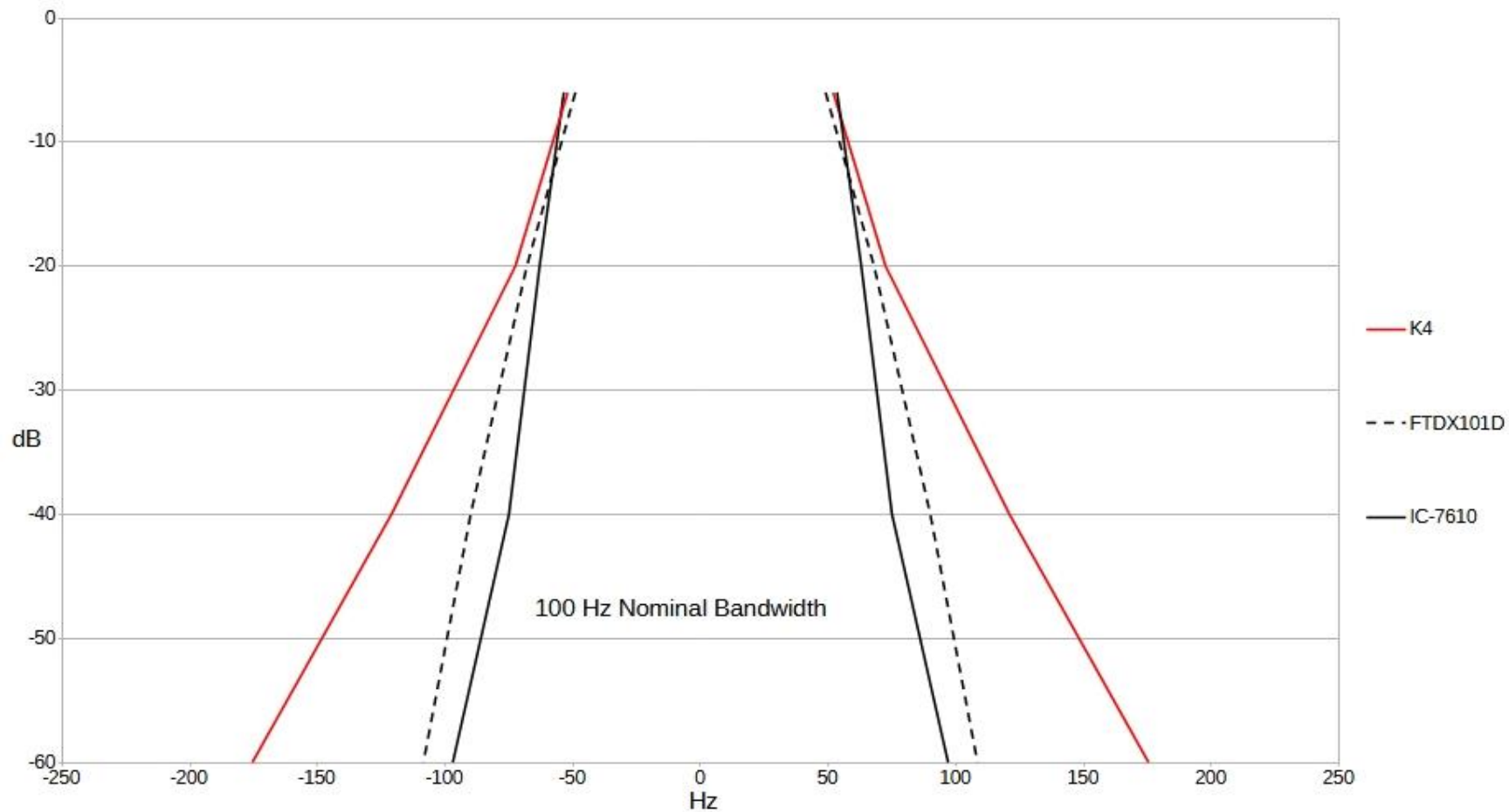
200 Hz DSP filter shape (IIR)



Ringings is not a problem with any of these three rigs.

K4 in red, 101D dashed line, 7610 in black

100 Hz DSP Filter Shape (IIR)



Comments on IC-7610 & IC-7760

- Both rigs offer pre-distortion (DPD) barefoot.
- Only PW2 offers DPD with the amp in the correction loop.
- (Neither PW1 nor 3rd party amps supported with DPD)
- Could a 3rd party software / hardware hack fix this?
- 7760 200 watts as with other flagship offerings.
(FTdx-101MP, TS-990S, Apache 8000)
- 7760 can have wired control head up to 100 meters away.
- New firmware allows remote via wireless LAN or Internet.
- Requires user supplied wireless access point.

Important factors to consider

- Operator fatigue is made worse by poor receive audio and poor AGC operation.
- NB and NR very important for urban QTHs.
- You might select a radio mainly due to its ability to do noise mitigation.
- Flex may currently be the best for remote operation.
- Apache has PureSignal and great NR & NB.
- Icom DPD barefoot or with PW2 1 KW amp.
- Barefoot + tube type linear = big IMD improvement.

More factors to consider

- Bad ergonomics are frustrating.
- Is speech processor adequate?
- Standalone or Computer Operated?
- Is firmware regularly updated?
- Is warranty service done well and quickly?
- Is the radio supported with parts and service after it is out of production? **K3?**
- Bottom Line: Do you enjoy using your radio?



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