Contest University 2024

A lot has changed in 10 years.

Are you considering a New Radio?

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NCØB

Let's demand cleaner transmitters.
Comments on popular rigs

Sherwood Engineering

Are you considering a new HF rig?

Subjects to emphasize today

Choosing a new rig is both subjective and complex.

What do you need for your typical on-air day?

Mainly operate SSB and FT8? You don't need a $4000 rig.

You may need a better antenna, possibly limited by an HOA or family desiring the antenna be invisible.

What has changed in 10 years?

- While receive-function lab numbers for many transceivers are excellent, the user interface is all over the map.
- I consider everything today an SDR.
- Computer operated or not, software runs all current rigs on the market.

How do we interface with a radio?

- Stand-alone or computer controlled?
- Large or small LCD screen
- Mostly knobs and buttons or touch screen & mouse?
- How complex and intuitive are the menus?
- Is a band scope and waterfall important to you?

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 Direct Sampling” * Coined by Dr. Ulrich Rohde
- TS-890S = Hybrid New Yaesus = IF Direct Sampling
- Only Kenwood doesn’t offer direct sampling.

Does the architecture matter?

- Most of the time it doesn't matter.
- A superhet has a roofing filter, 5 to 70 MHz IF.
- Hybrid Superhet adds a direct sampling band scope
- "IF Direct Sampling" also has roofing filters, ADC at IF.
- Direct Sampling does not have roofing filters.
- If signals are S9+60 dB a roofing filter helps.

A Few Examples per Type

Architectures Dominating Today

- Superhet: TS-590SG, IC-7100
- Hybrid Superhet: TS-890S
- IF Direct Sampling: FTdx-101D/MP, FTdx10
- Direct Sampling: K4D, IC-7610, Flex 6600

- Either direct sampling has ADC in RX path.
- Only IF direct sampling have roofing filters.
- All but superhet have ADC for the band scope.

What often limits reception?

- Receivers cannot eliminate key clicks in your passband or splatter from an adjacent signal.
- Transmit composite noise is mostly a line of sight issue with signals in excess of S9+60 dB
- Composite noise can be a Field Day problem.
- Field Day, very close by hams & MM contest stations are prime cases for a transceiver with a roofing filter.

The Challenge – Cleaner Transmitters

- Since we all share our bands we need to support OEMs who improve their transmitters.
- Competition drove massive RX improvements.
- Can competition do the same for TX?
- Does the typical ham care if his signal is wide?
- He should !

ARRL Clean Signal Initiative

- Reduce CW key clicks with software update
- Reduce SSB IMD splatter. (Pre-distortion?)
-
- Today that is Apache PureSignal & Icom DPD
- (Yaesu Class A no longer offered)

- Reduce TX Composite Noise
- (Usually an excessive AM noise issue)

Some tips from contesting experience

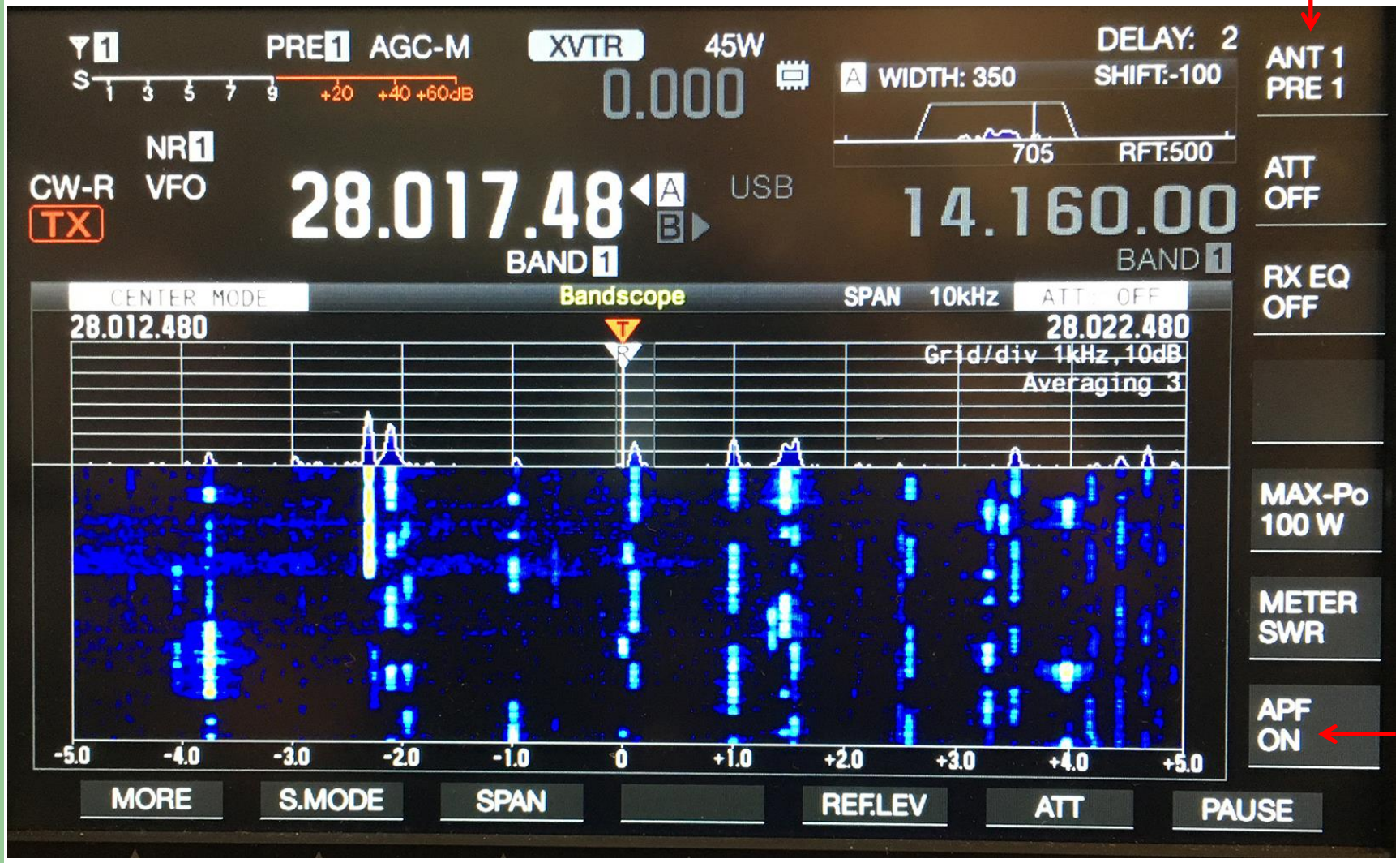
- You can learn a lot from proper receiver settings and band scope observations.
- Preamps and attenuation are tools to be used when appropriate, not on by default.
- Let’s take a look at 10m and 160m examples.

December 2018

Over 20 stations in 10 kHz TS-890S

ARRL 10m Saturday afternoon

Note preamp



Bottom of the sun spot cycle 2018

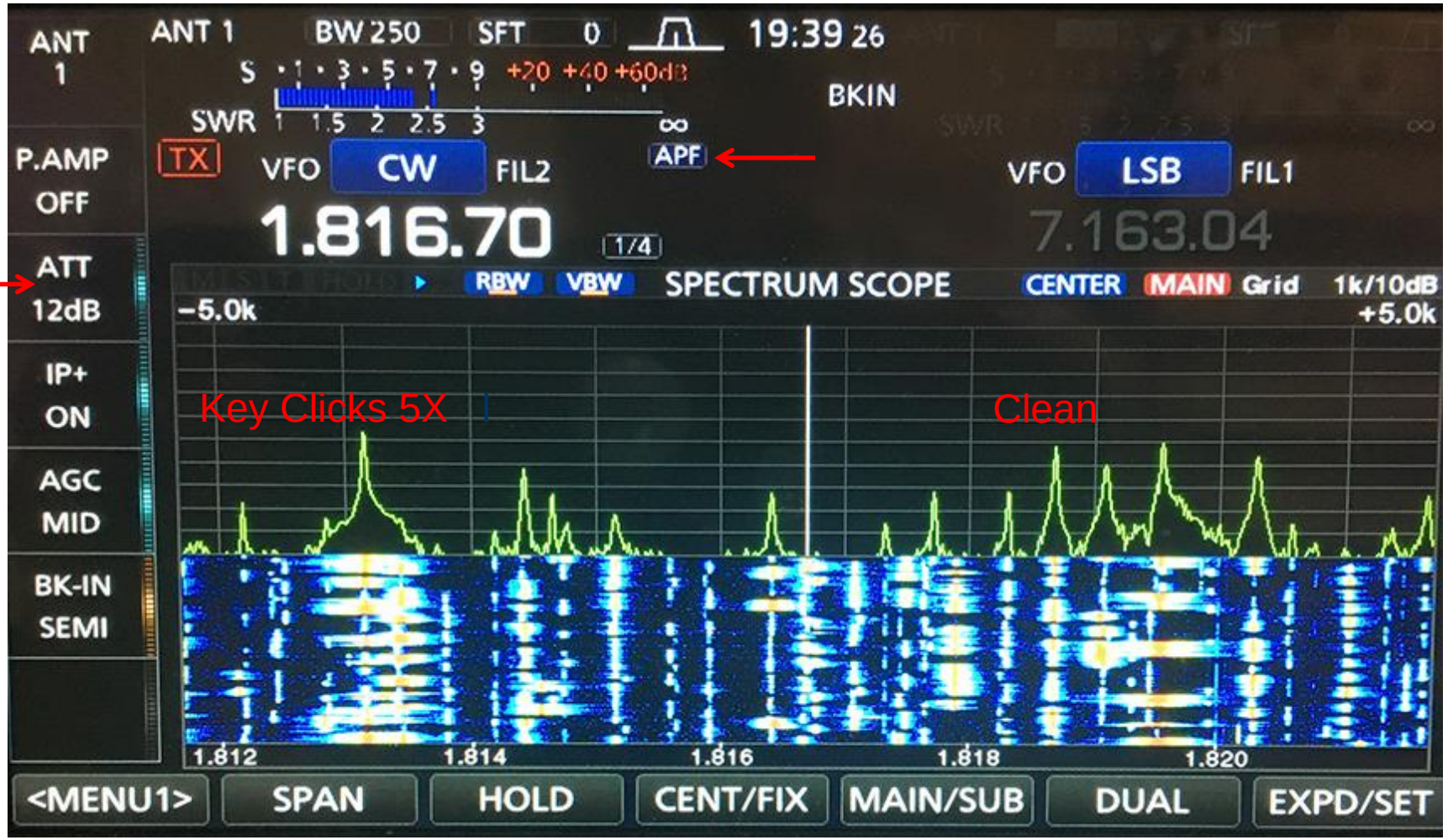
December 2018

Over 30 stations in 10 kHz IC-7610

ARRL 160m CW Friday 7:40 PM

Note

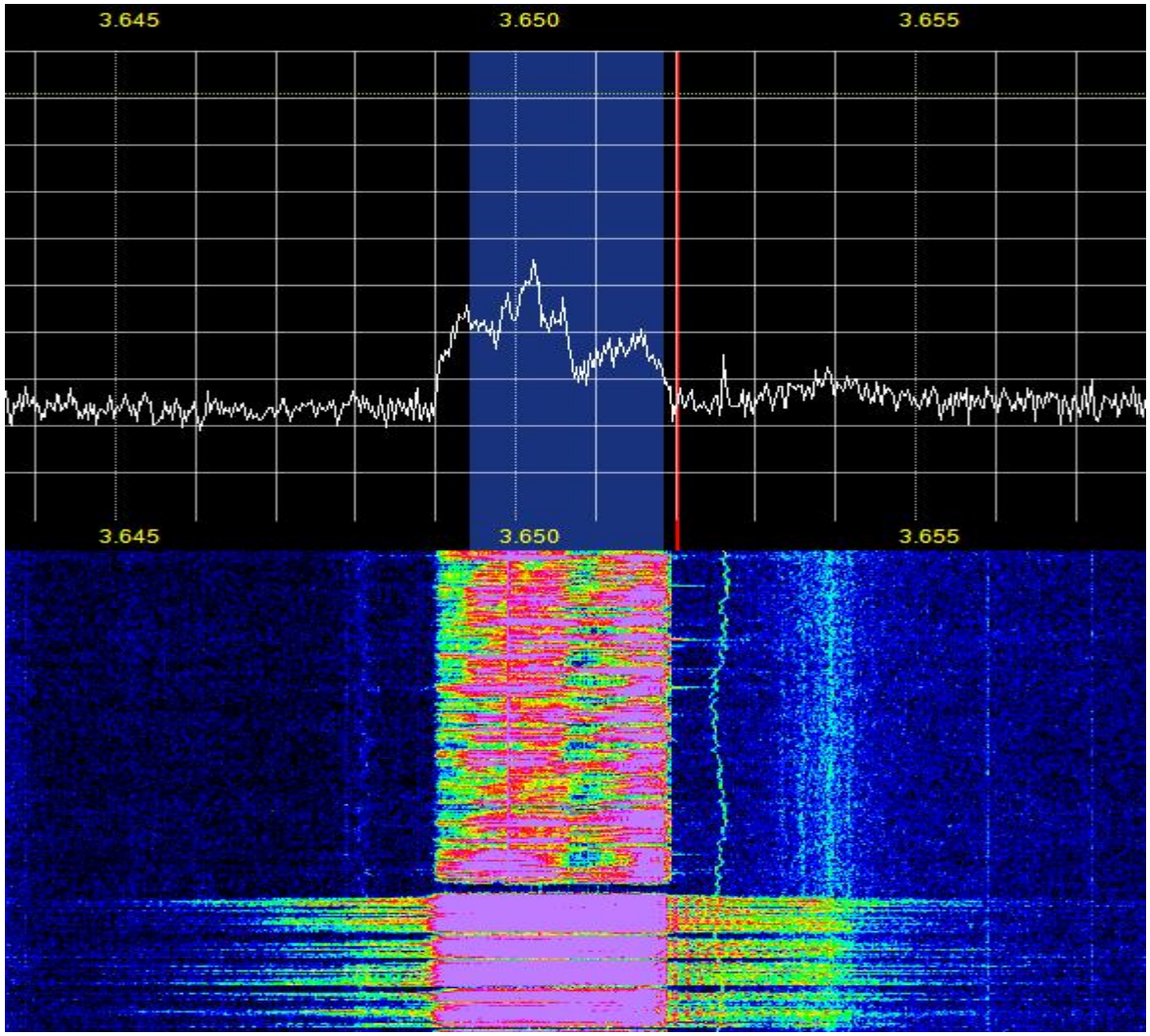
ATT



IC-7300 & TS-990S 18 dB attenuation example 2019

Both stations running legal limit amplifiers

Typical SSB Splatter vs. PureSignal Adaptive Pre-distortion



Class A is gone with current rigs

Icom now offers DPD predistortion

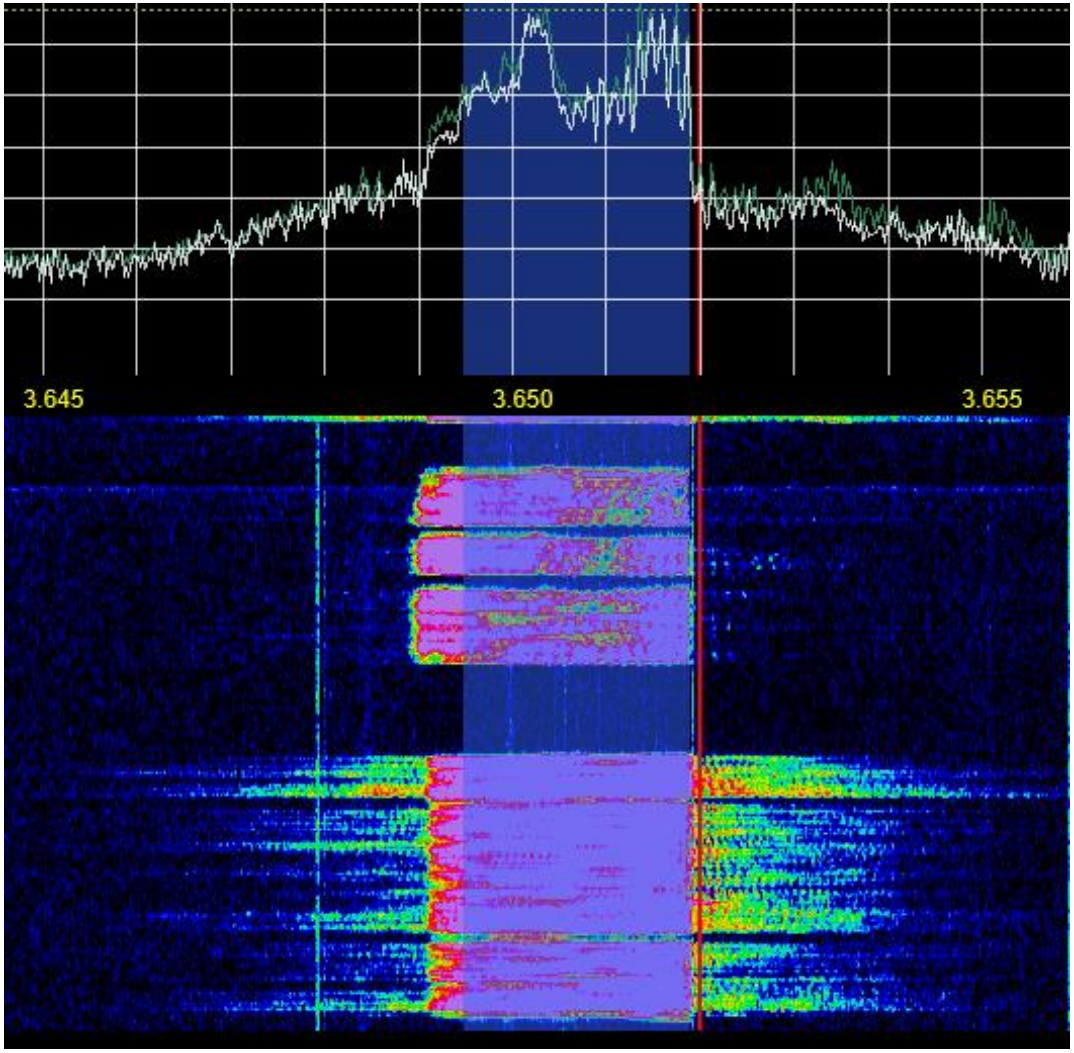
Flex & K4 maybe someday ?

Apache PureSignal for 10 years

Kenwood TS-890S

Both stations 75 meters S9+30 dB

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



Display 10 kHz span
Apache 7000DLE RX

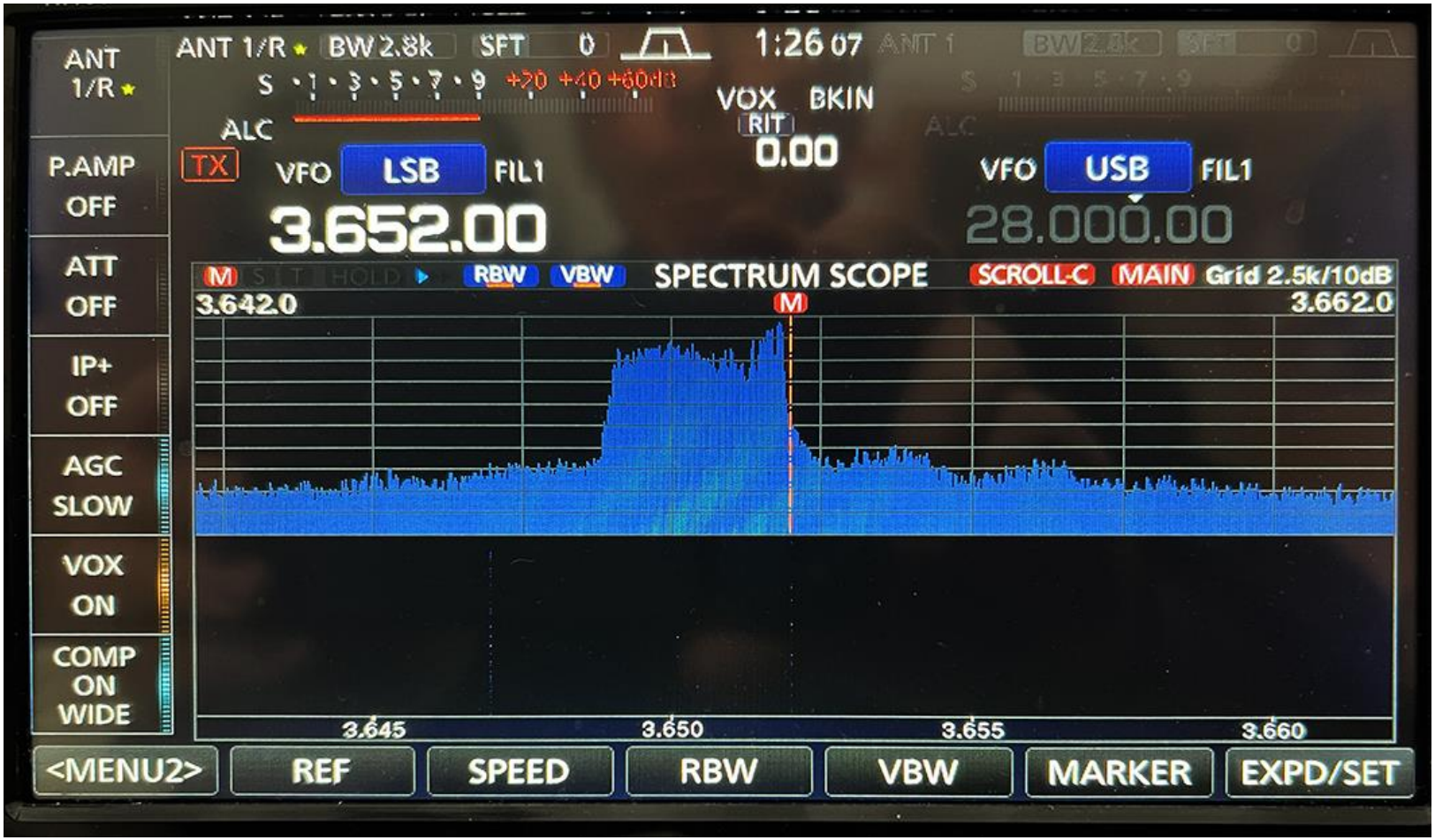
Blue shading is the
2.4 kHz RX bandwidth

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

Flex 6700 driving a
PowerGenius XL

IMD down more than 45 dB max hold 15 seconds

Icom Digital Pre-Distortion for cleaner SSB



On-air bandwidth screen capture 10 dB per division 25 kHz span

Is it time for a new rig in you shack?

- There are lots of great choices today if you operate contests or DX pile-ups.
- In general if all you do is rag chew and operate FT8 your current rig is likely fine.
- Current rigs with built-in sound cards make WSJT X or other digital software setup much easier than years ago.

Top 25 out of 150 radios nc0b.com

Lab data from my web site

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	(16 dB preamp ON)
Flex 6700 (2017)	99 dB	(Preamp OFF)
Icom 7610	98 dB	(IP+ ON)
Icom 7300	97 dB	(IP+ ON, S/N around 10,000 and up)
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	(No IP+ ADC linearization)
TS-990S	87 dB	(RMDR limited close-in)
Elecraft KX2	86 dB	

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

New price range $900 to $12,560+

Used market price even lower !

100 dB radios unheard of 20 years ago !

I have run contests with 20 of these 25

How do you select a new radio?

- Do you pick one of those top 25 models?
- Married to one brand? Pick $ that fits your budget.
- Price range for new rigs $900 to $12,000+
- Ergonomics and User Interface (UI) are important
- Quality of Noise Mitigation – NB and NR
- Antennas are more important than the rig model.
- Location, Antennas, Operator Skill, Radio Model

You need to know your radio

Model	Noise floor no preamp	Dynamic Range
Flex 6600	-111 dBm	99 dB
Flex 6400	-112 dBm	100 dB
Elecraft K4	-121 dBm	101 dB
Yaesu FT-710	-127 dBm	106 dB
Apache 7000	-131 dBm	103 dB
Icom 7610	-132 dBm	98 dB
Icom 7300	-133 dBm	97 dB

Up to 22 dB gain differences with no preamp or attenuation.

With the Flex you likely need preamp gain 20m and up.
With the Icom you likely need attenuation on 40m and down.

None of the designs are right or wrong, but they are VERY different.

Current Rig Offerings

- Subjective comments to follow on several different current transceivers.
- Observations from operating all the following transceivers in major CW and SSB contests.

User Interfaces all over the map

Main Architecture Types Today

- Hybrid Superhet, Direct Sampling or IF Direct Sampling
- Most common UI today: Internal LCD or computer screen
- Flex runs on Windows or Apple OS
- Apache Windows only, except new G2 Raspberry pi 4 piHPSDR
- Windows updates can “break” things !

- Complication – Computer OS not real-time operating system

- All others are stand-alone embedded operating system

- How you interface with your radio is very personal.

- Let’s look at some examples.

Prices as of January 3, 2024

Some Rig Price Comparisons

Model	Price	New since 2020
Elecraft K4D	$6480 (tuner included)	Yes
Yaesu FTdx10	$1400	Yes
Icom IC-705	$1350	Yes
Yaesu FT-710 AESS	$1000	Yes
Yaesu FT-710 Field	$900	Yes
Icom IC-7300	$1000	For comparison
Icom IC-7610	$3250	
FTdx-101D	$3250	
FTdx-101MP	$4550	
TS-890S	$4000	
Flex 6600	$4600	

Comments on Flex

- Preoccupied with a military contracts several years
- Focused last 5 years on remote and contesting
- Very few DSP improvements for years
- Some CW bugs have been around for a very long time.

- Very loyal customer base
- No schematics or documentation published

- Non-M models are currently shipping. M models will ship this summer. Maestros scheduled to ship 2/19/2024. A few months to fill backlog.

Comments on Apache

- Leading noise mitigation (NB and NR)
- 1 of 2 brands with pre-distortion splatter reduction.
- A fiddlers delight
- Don’t consider it “plug and play”.
- Not recommended for your first HF transceiver.
- Buy a 100-watt standalone radio (no computer).
- Incomplete documentation on dozens of settings
- OEM makes the radio
- Open Source software runs the radio
- Consider a separate computer for just the radio.

Comments on the IC-7300

- A game changer that came out 8 years ago.
- First direct sampling transceiver with knobs
- More than 50,000 sold in just the USA and Canada !
- Good Dynamic Range
- 7300 operates much like more expensive IC-7610
- Excellent ergonomics and scope display
- Common user interface for all the Icom direct sampling transceivers: 7300, 7610, 9700 & 705
- Added scrolling & re-center feature for these Icom rigs.
- Very stable firmware. No Audio Peak Filter (APF)
- Latest firmware 1.42 updated 11/2023, wait for now.

Comments on the Yaesu FT-710

- Yaesu's first direct sampling transceiver
- Similar to IC-7300 but better lab numbers 7 years later

- Price FT-710 AESS: $1000 (with external speaker)
- Price FT-710 Field: $900 (no external speaker)
- Price 7300: $1000
- Price FTdx10: $1400

- User Interface and band scope could be improved.
- Multiple contest evaluations 4th quarter 2022.
  (CQ WW CW, ARRL 160 & 10m)

Comments on the Yaesu FTdx10

- Excellent Lab numbers
- Ergonomics different than the FT-710
- User Interface & band scope could be improved.
- “IF direct sampling” superhet with roofing filters
- Both 710 and 10 have an Audio Peak Filter for CW.
- Multiple contest evaluations 4th quarter 2022.
  (ARRL 160 & 10m plus Stew Perry Top Band CW)

Yaesu FTdx10 vs. FT-710

- Sitting in front of both it is as if they were designed by different companies.
- Adjusting filter bandwidth & IF shift easy on the 10 and not very flexible on the 710.
- The 10 has the volume control on the left side of the VFO while the 710 has it on the right side of VFO.
- The 710 has less crowded button placement
- Neither of the band scopes and waterfall displays automatically re-center when tuning, a major limitation for me as an S&P contester.

Kenwood TS-590 series

- TS-590SG shipped late 2014
- Excellent overall performer
- Lacks a band scope that is now typical.
- Can be added with an SDR dongle or Elecraft P3
- TS-590S goes back to late 2010
- Reasonable used price option
- Easy User Interface
- I operated both S and SG 160m CW contests several years ago along with T-T Eagle.

Will Kenwood bring out a new rig in 2024?

- The TS-590SG came out in late 2014.
- The TS-890S came out in late 2018.
- TS-890S has the best waterfall in my opinion.
- The HF to UHF TS-2000 discontinued with no replacement.
- Hamvention 2023 only announced a new TH-D75A handheld.
- Planned competitors to 7300 & 9700 have never materialized.
- Every new radio in last 7 years has a band scope and waterfall.

10 watts and a battery

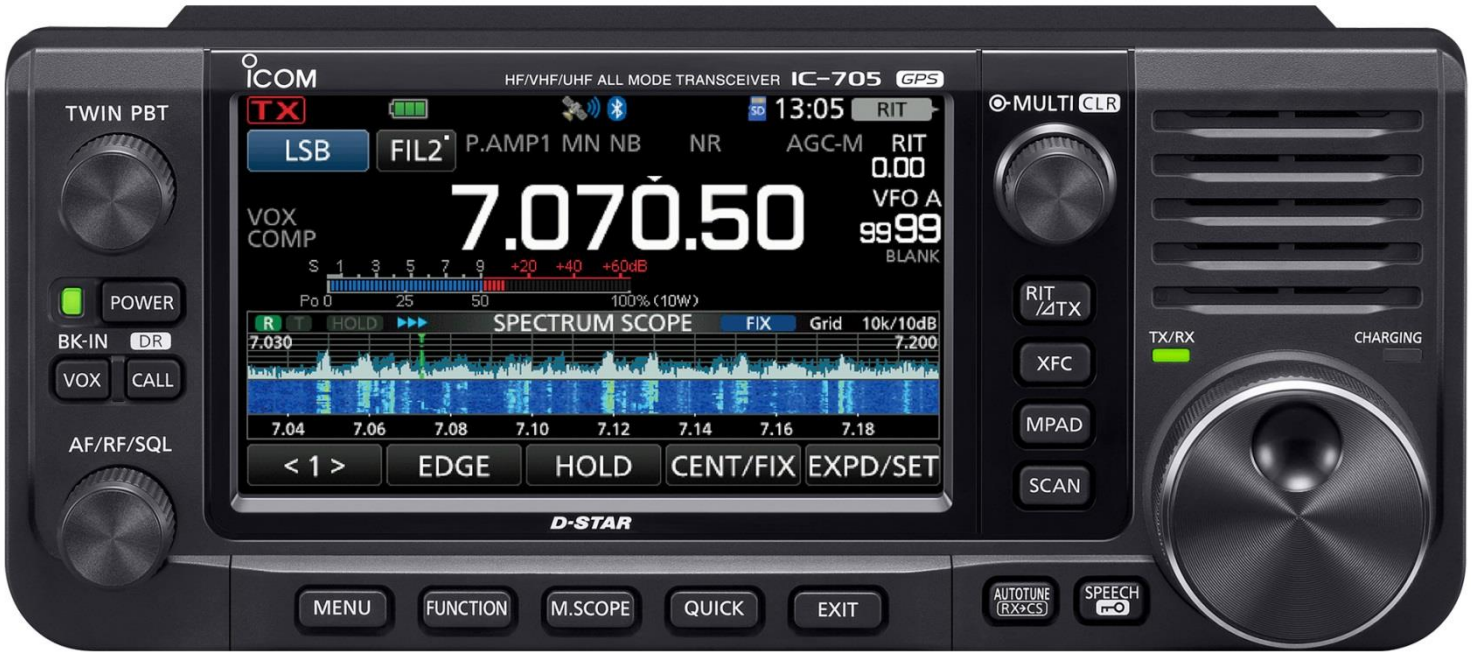
Summits and Parks on the air

- Does operating outdoors interests you?
- Consider the Icom IC-705
- 160 m through 70cm
- SSB, CW, FM, Digital FT8 (with laptop) $1350
- Companion AH-705 single wire tuner $360
- 23 foot single wire plus a radial 40m – 6m

- I worked an IC-705 POTA on new year's day 2023 S9 2m SSB signal on a mountain 100 miles away.

Much smaller than 9.3 pound IC-7300

2.4 pound Icom IC-705



Comments on the IC-705

- For HF, operates much like an IC-7300
- Lots of VHF features
- Excellent ergonomics and scope display
- Common user interface for all the Icom direct sampling transceivers: 7300, 7610, 9700 & now the 705
- Display re-centers when tuning as with the other three.
- Operated ARRL 160m & 10m contests December 2020

Comments on the Elecraft K4

- Much of the K3 firmware was ported to the K4.
- Major firmware improvements in the last two years.

- Firmware and features still under development.
- New Beta releases often have new bugs.
- AGC threshold & AF level issues still unresolved.

- The most expensive current mainstream rig. $6480 with tuner
- Price increased 9% April 20, 2023. (Some discounts at festivals)
- HD model, pre-distortion, transverters & remote still in development.

- Customer base is likely past K3 owners.
- Lots of brand loyalty and reflector support.
- Note: With a single multi-band antenna Sub RX cannot be on a higher band than the main RX due to TX low pass filter in the circuit.

Digital Pre-Distortion (DPD) arrived November

Comments on IC-7610 compared to IC-7300

- No noisy relays for T/R or amp key line
- Audio Peak Filter (APF) for CW
- Identical dual receivers, DXpedition split or other band
- More physical buttons and larger LCD screen
- Buttons for each band
- Two transmit antenna ports
- One RX antenna port (Beverage?)
- DVI-D port for external LCD monitor
- Quieter fan
- RC-28 tuning knob for Sub RX $300 as with other brands
- New firmware 1.40 added pre-distortion (DPD) barefoot.
- If you only operate SSB and FT8, IC-7300 is just fine.

DPD = Digital Pre-Distortion

Don’t select a new radio by one single number !

Important factors to consider

- Operator fatigue is made worse by poor receive audio and poor AGC performance.

- NB and NR very important for urban QTHs.
- You might select a radio mainly due to its ability to do noise mitigation.

- Flex may be best for remote operation.
- Apache has PureSignal and great NR & NB.
- Both require an internal or external computer.

- Icom DPD, awaiting PW2 & 3rd party amp hack

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?

Sherwood Engineering

Q&A on any subject at the close of CTU

Ask for a PDF of this presentation via email.

Email: rob@nc0b.com

Feel free to email questions !