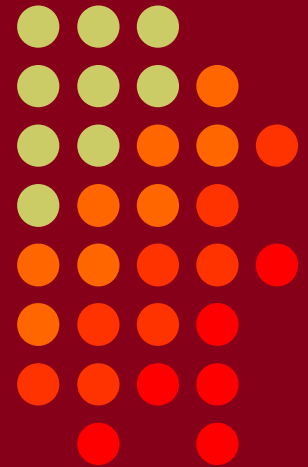


Optimizing the Use of Waterfall Displays for Contesting

Presented by N6TV

n6tv@arrl.net



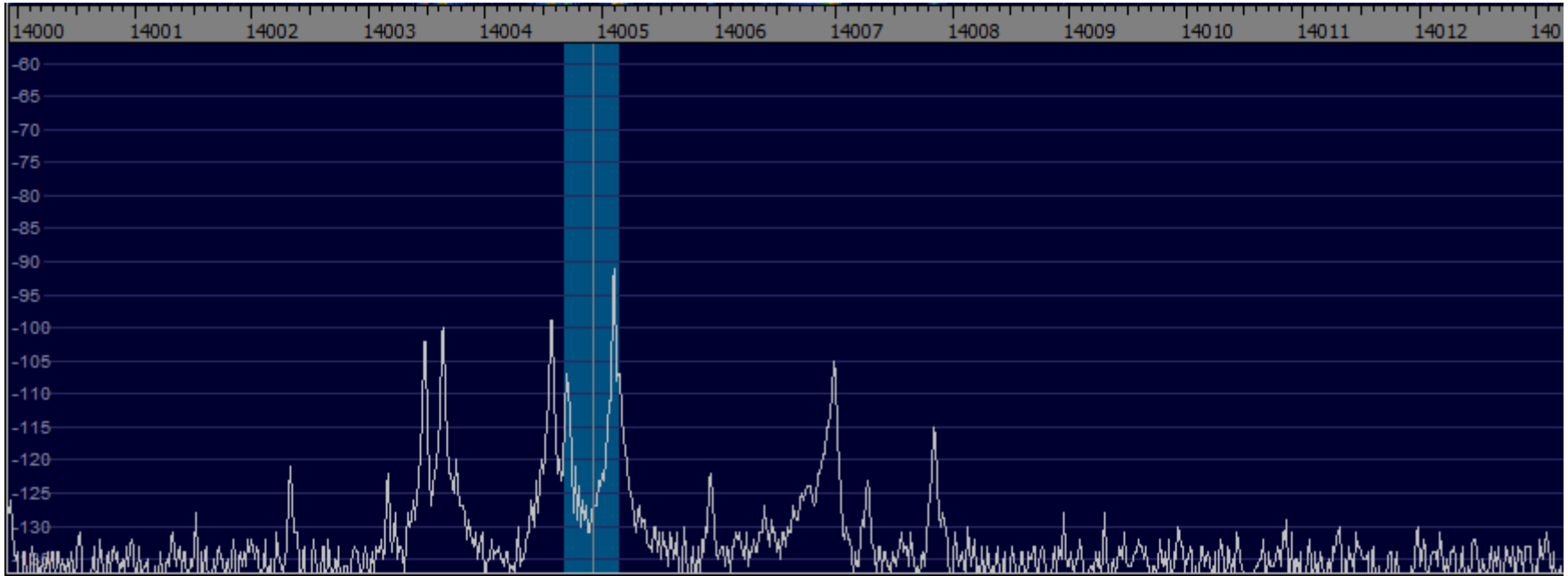
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Presentation Overview



- Spectrum display limitations
- Waterfall displays in Modern Rigs
- Waterfall display advantages & disadvantages
- Optimum waterfall settings and adjustments
- Q & A

Spectrum-Only Displays, aka “Panadapters”

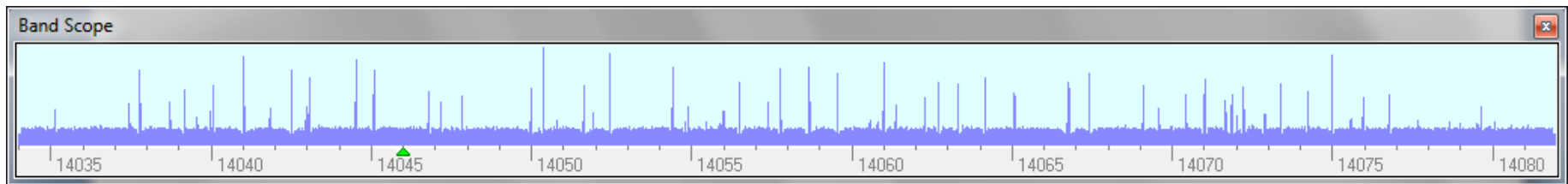


- No history – weak signals are covered up

CW Skimmer's Band Scope



- From the CW Skimmer menu, select View → Band Scope



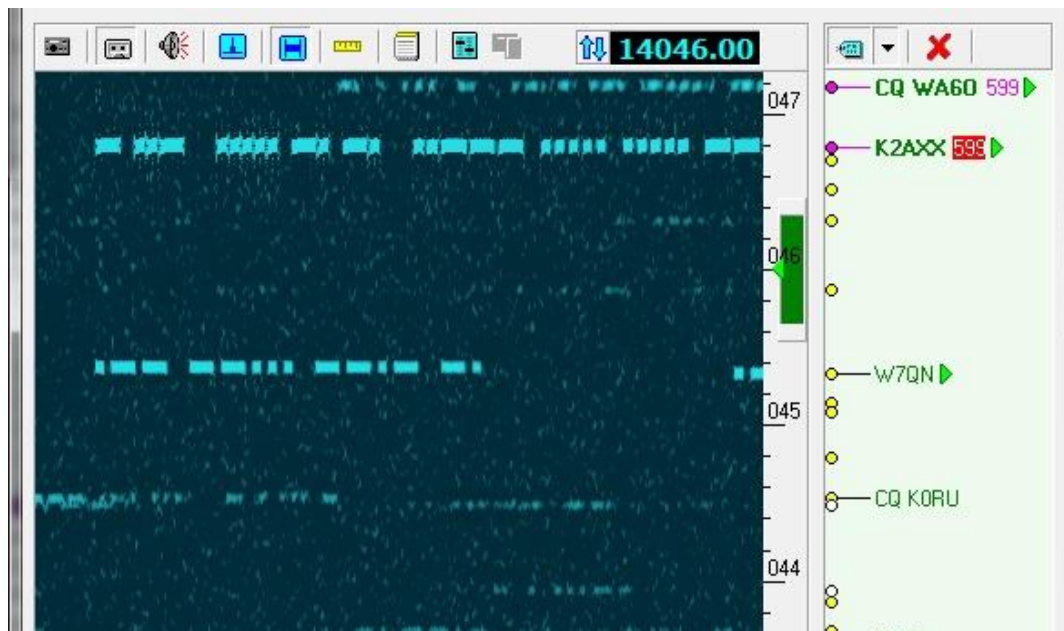
- Much better resolution, but display is very jumpy
- No history or “peak signal” memory
- Not useful on SSB

Legacy Panadapter Limitations



- Big signals dominate the display
- Weak signals very difficult to spot
- Signal peaks disappear, no history
- Difficult to find “clear spots” on a crowded band
- Display jumpy, distracting
 - Signal peak or averaging helps, but it also hides things

CW Skimmer Waterfall Limitations



- You only see 10 - 15 kHz of the band at most
- Scale is **fixed**, cannot “zoom” in or out, or tune smoothly
- Narrow 500 Hz CW filter – *not* usable on phone

Better Waterfall Displays



- The Elecraft P3 Panadapter



- Now seems obsolete

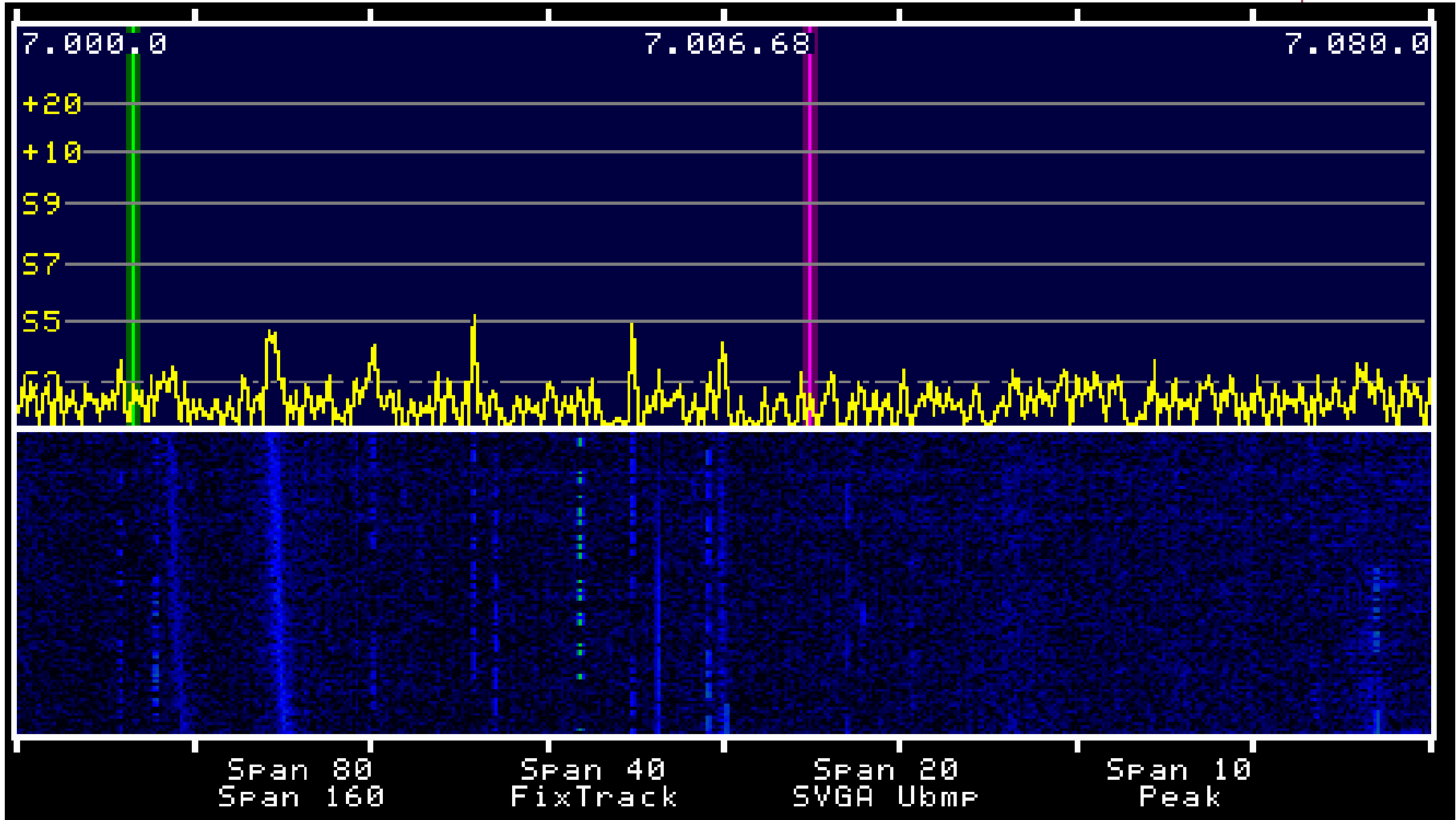
Elecraft P3 + P3SVGA Option



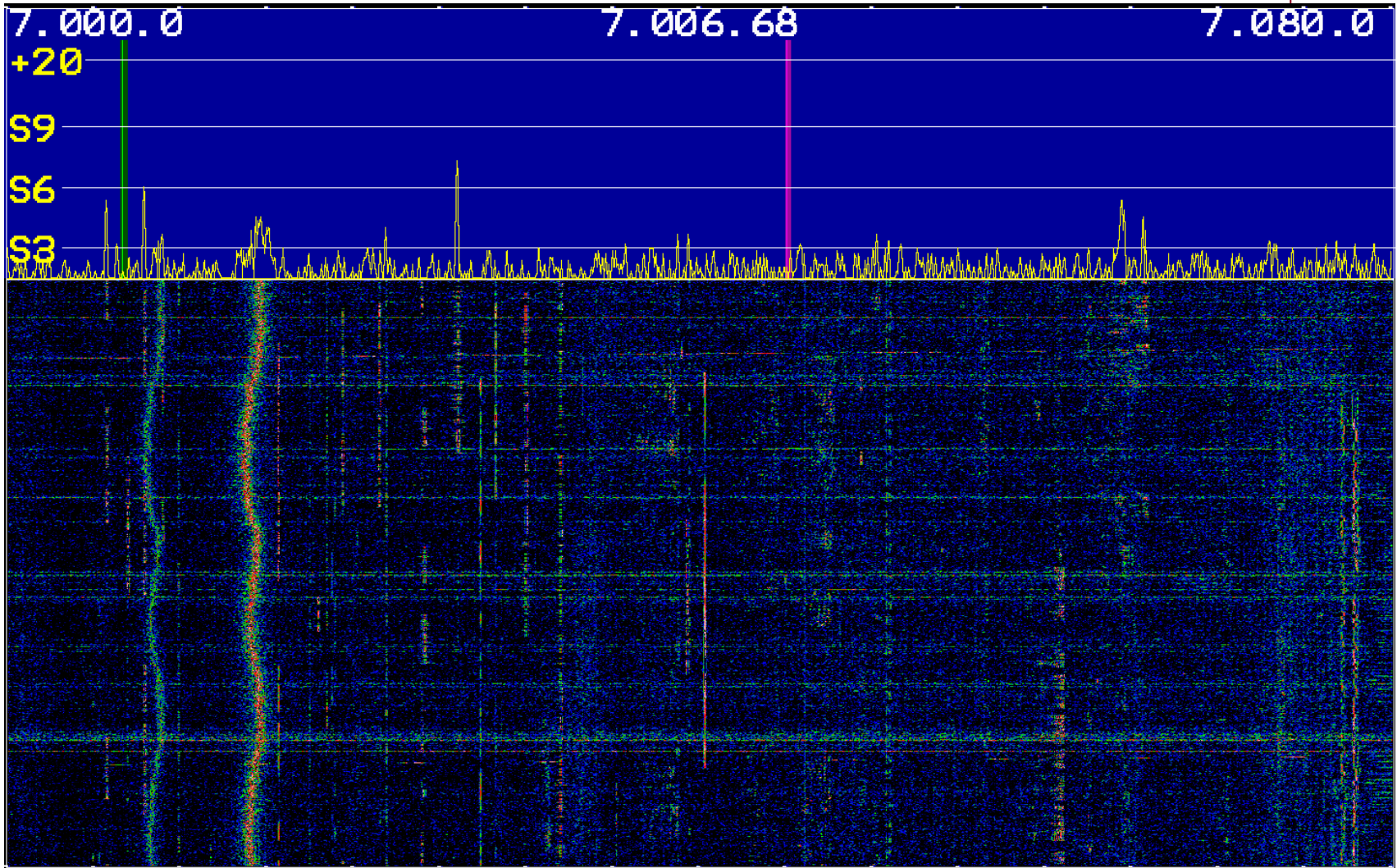
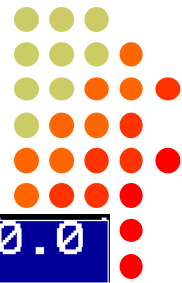
- P3 resolution only 480 x 272 pixels
- P3SVGA: internal SVGA Large Screen Adapter
 - 1024 x 768
 - 1280 x 1024
 - 1440 x 900
 - 1920 x 1080
- Displays far more signals



P3 Built-in Display at 480 x 272



P3SVGA at 1440 x 900

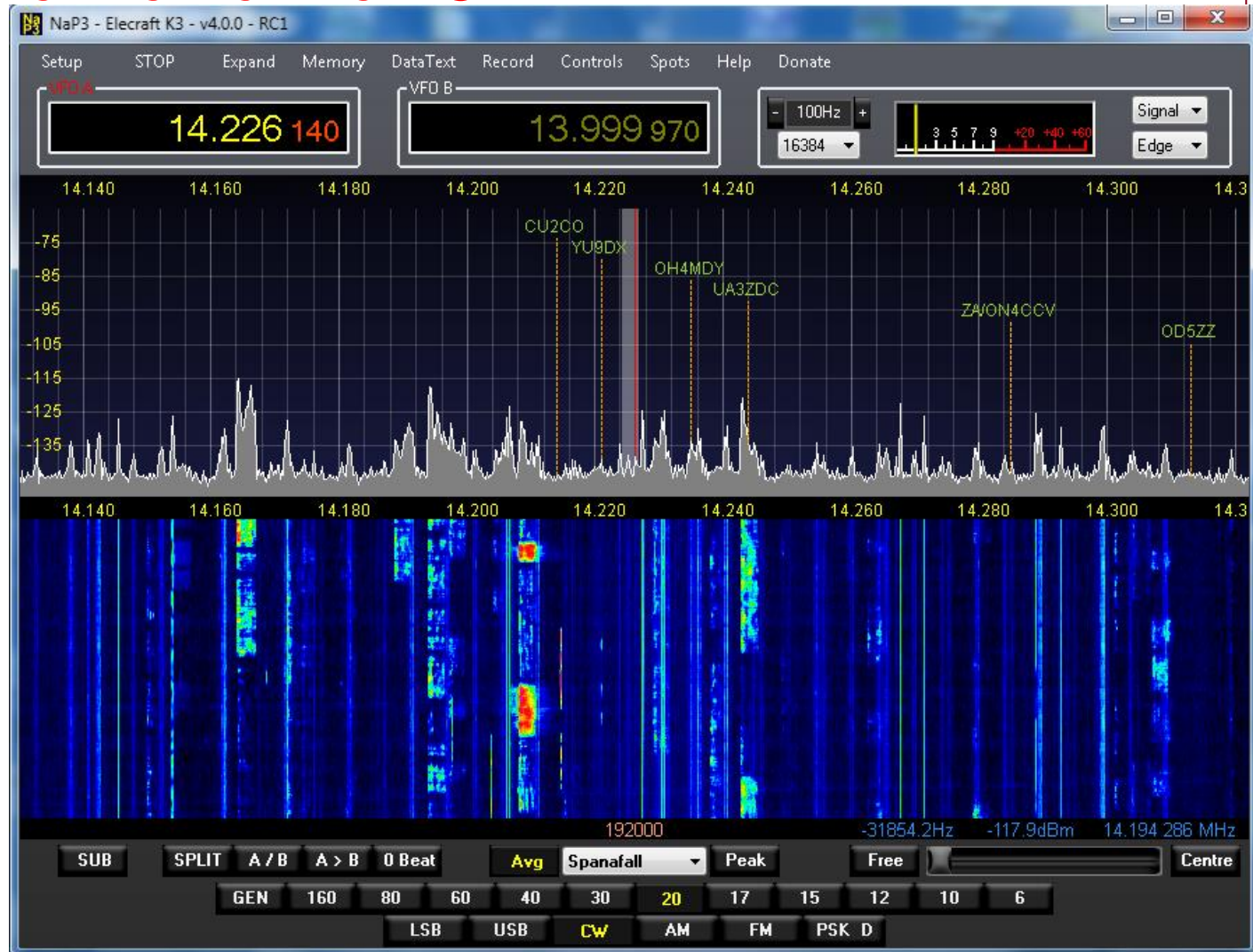


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ICOM® 10

LP-Pan and NaP3



Elecraft K4

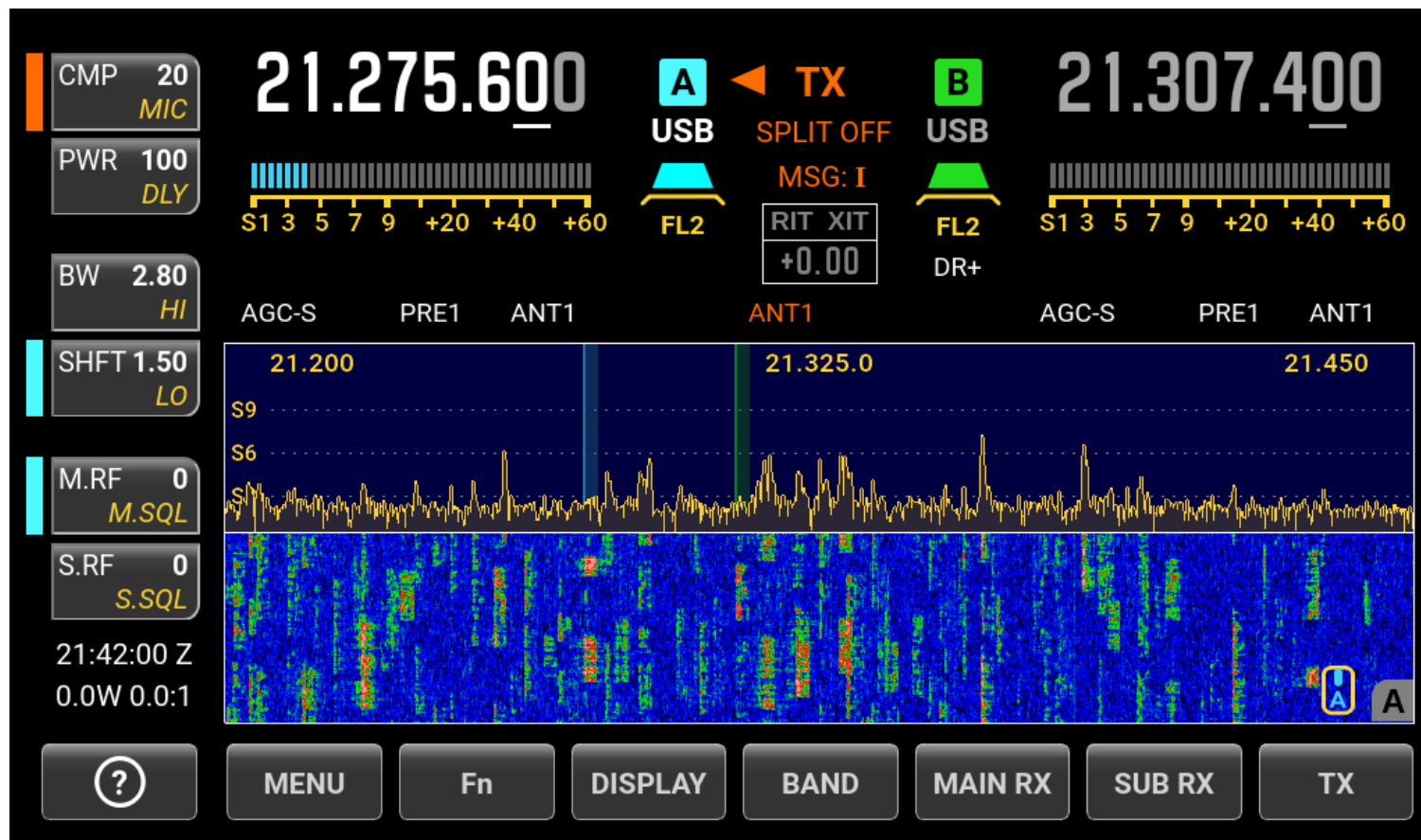


- Built-in LCD resolution 1024 x 600
- External HDMI Monitor Up to 4K
- Touch Screen
- Click to Tune with USB Mouse + Mouse Wheel fine tuning / RIT

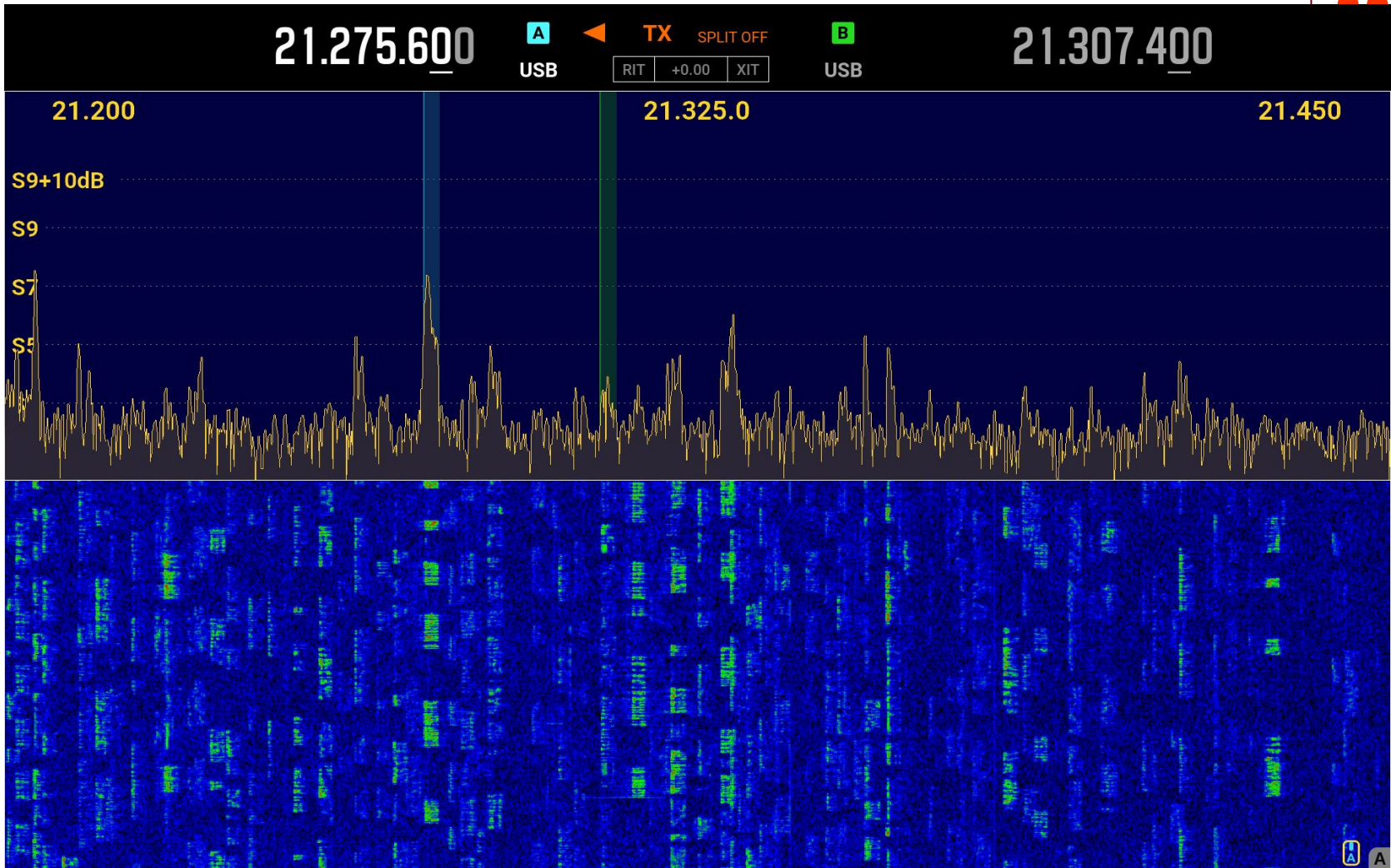
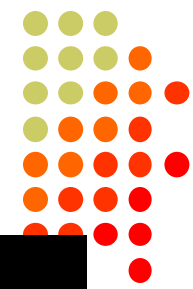




Elecraft K4 Built-in Display at 1024 x 600



Elecraft K4 Ext. Monitor at 1920 x 1200





IC-7850 / 7851

- 800 x 600, MAIN only, or MAIN + SUB
- Limited “Click to tune” with USB mouse



IC-7300 “Spectrum Scope”



- With touch screen



IC-7610 with dual band waterfall



Kenwood TS-890S



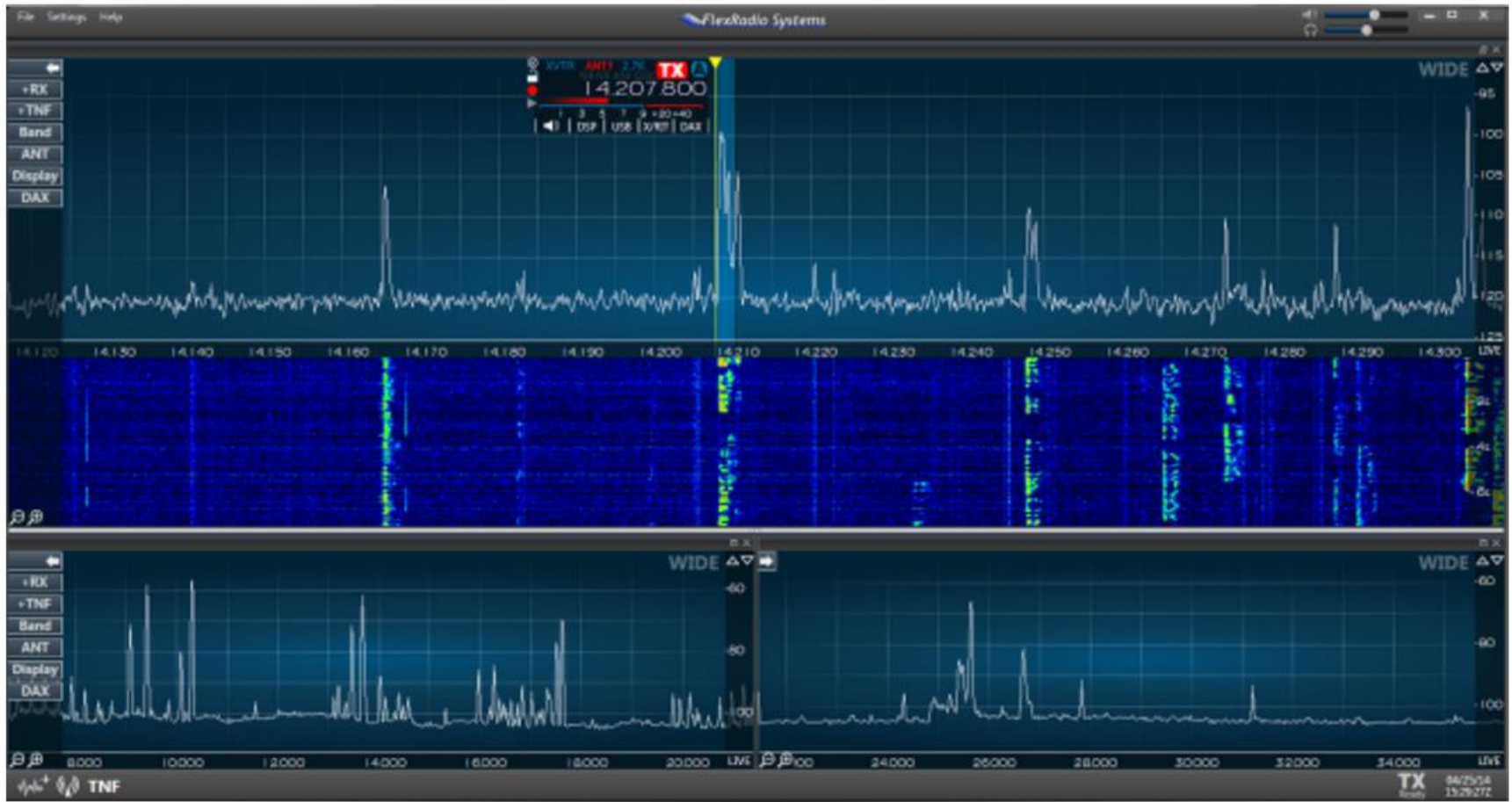
Yaesu FTdx101D



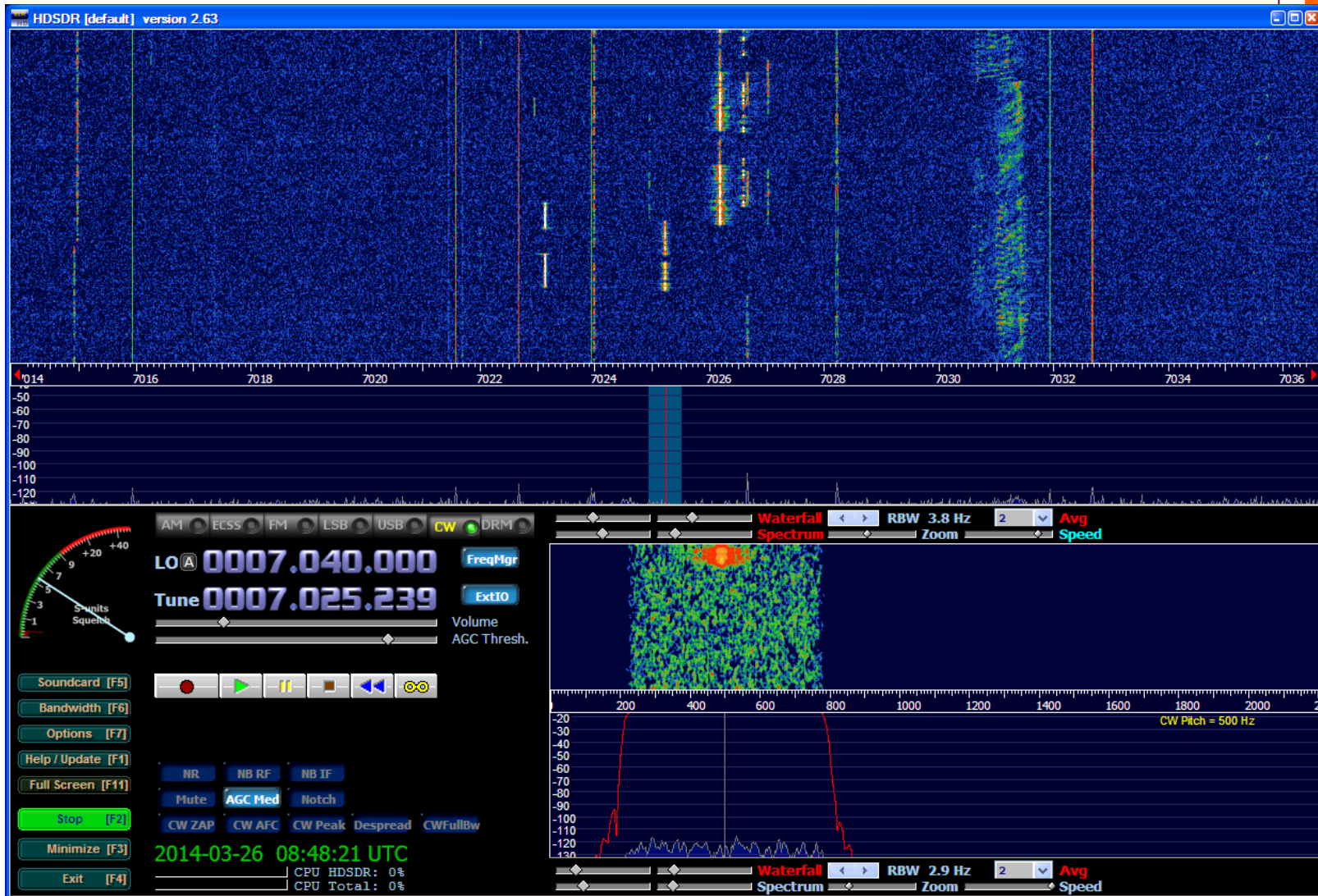
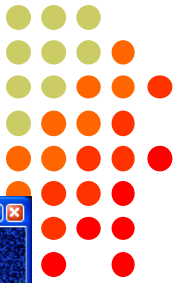
FlexRadio FLEX-6700™



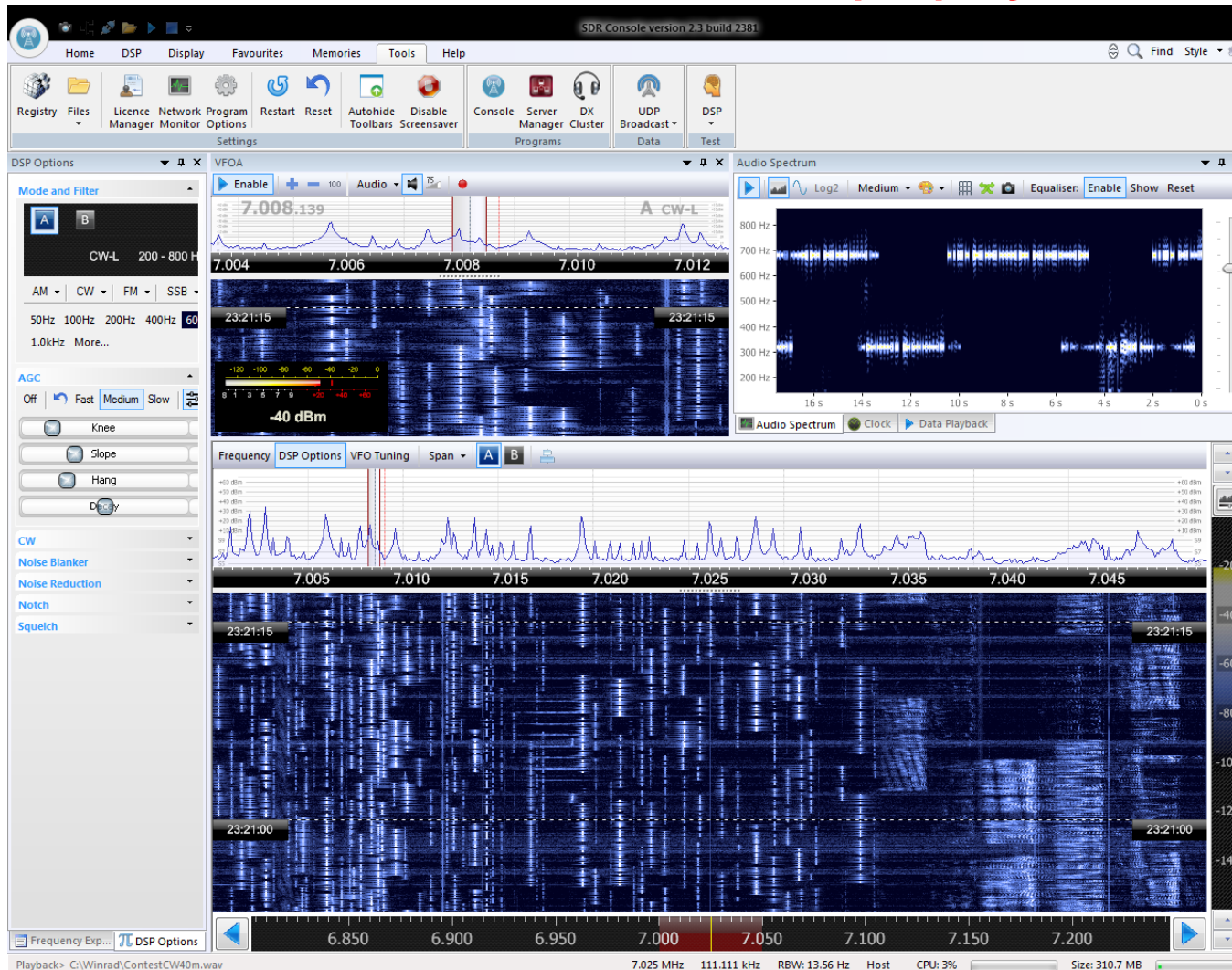
FlexRadio Systems® SmartSDR



HSDR Software



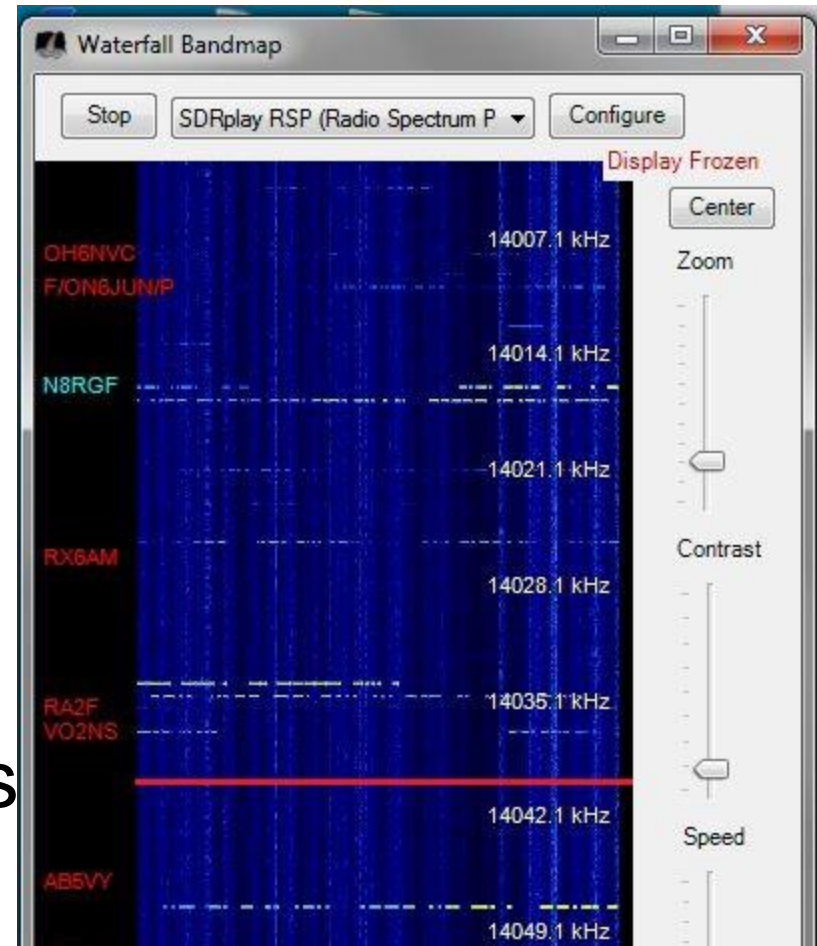
SDR-Radio.com SDRConsole (V2) by HB9DRV



Waterfall Bandmap by N2IC (for N1MM+)

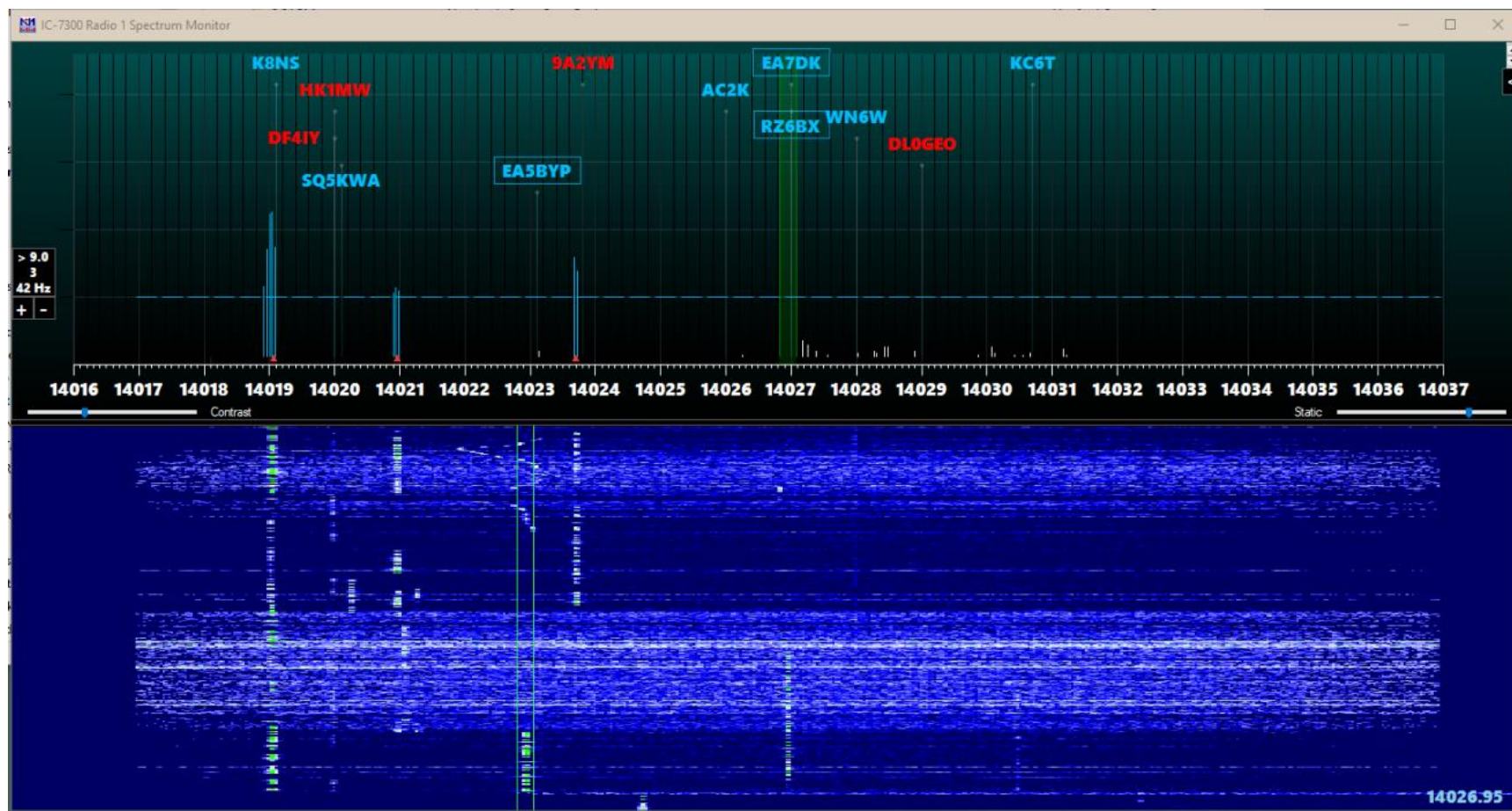


- Combines **cluster spots** from Internet or Skimmer with waterfall from local SDR
- Zoom Feature
- Click to tune feature
- Potential to support other logging programs

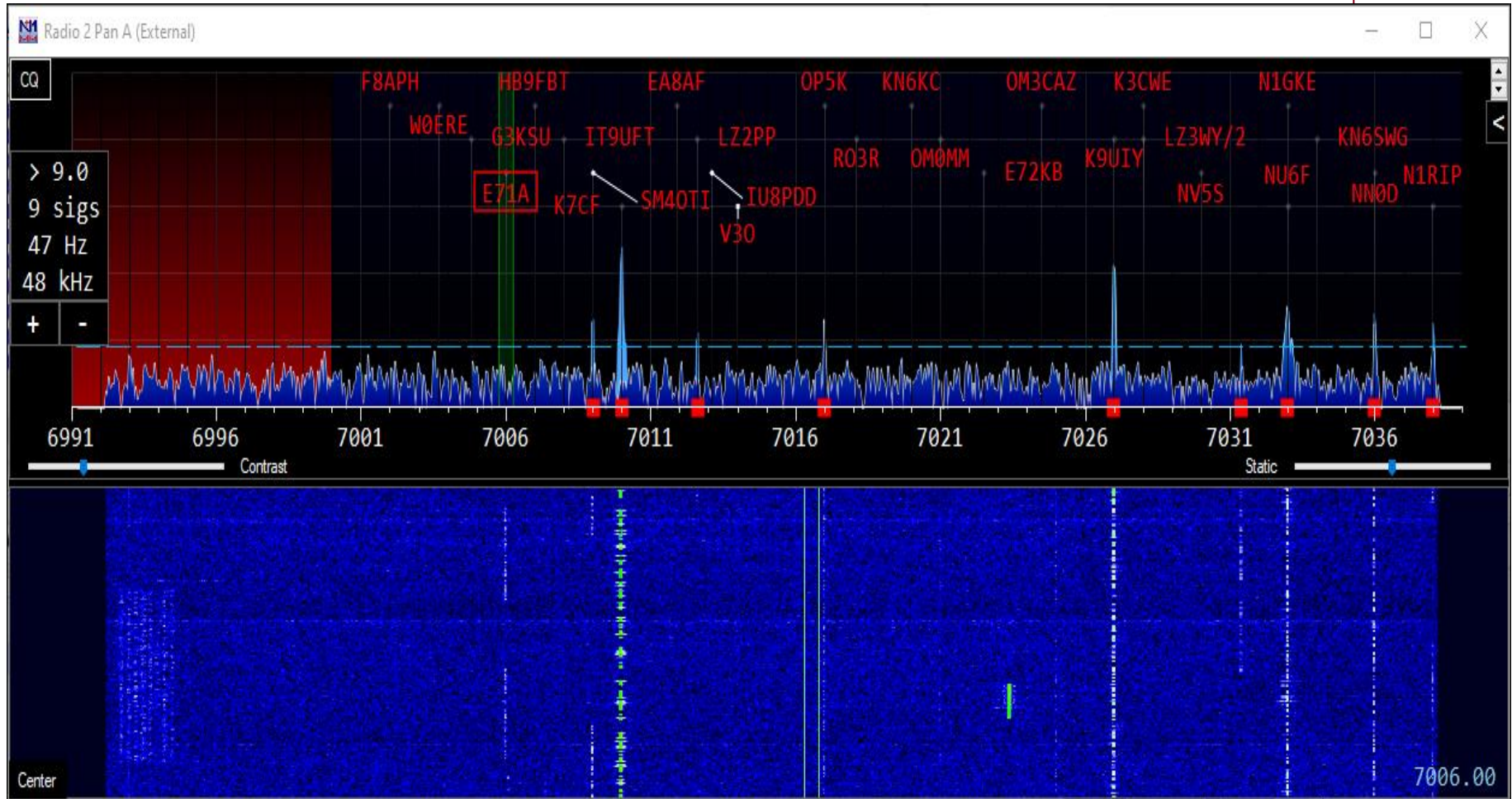




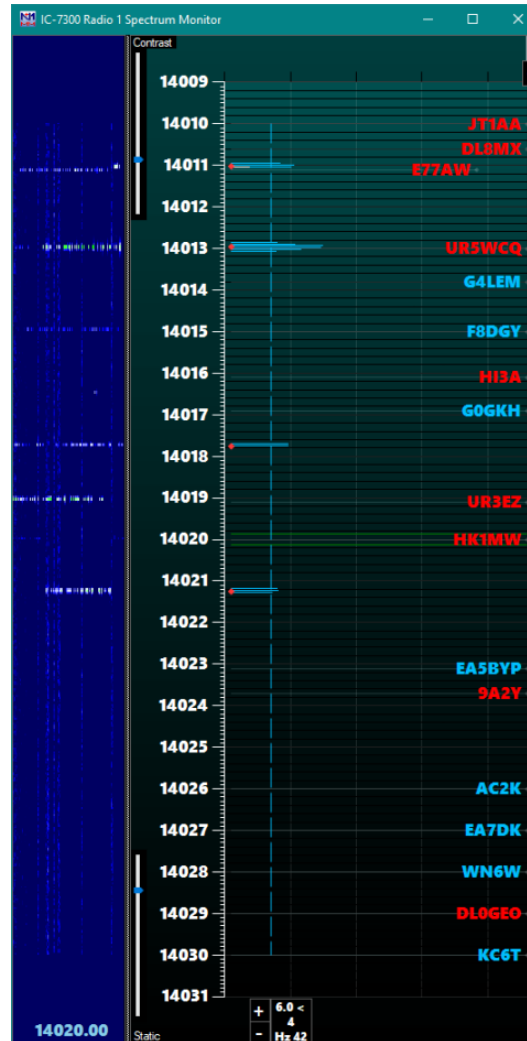
N1MM+ Spectrum Display Window



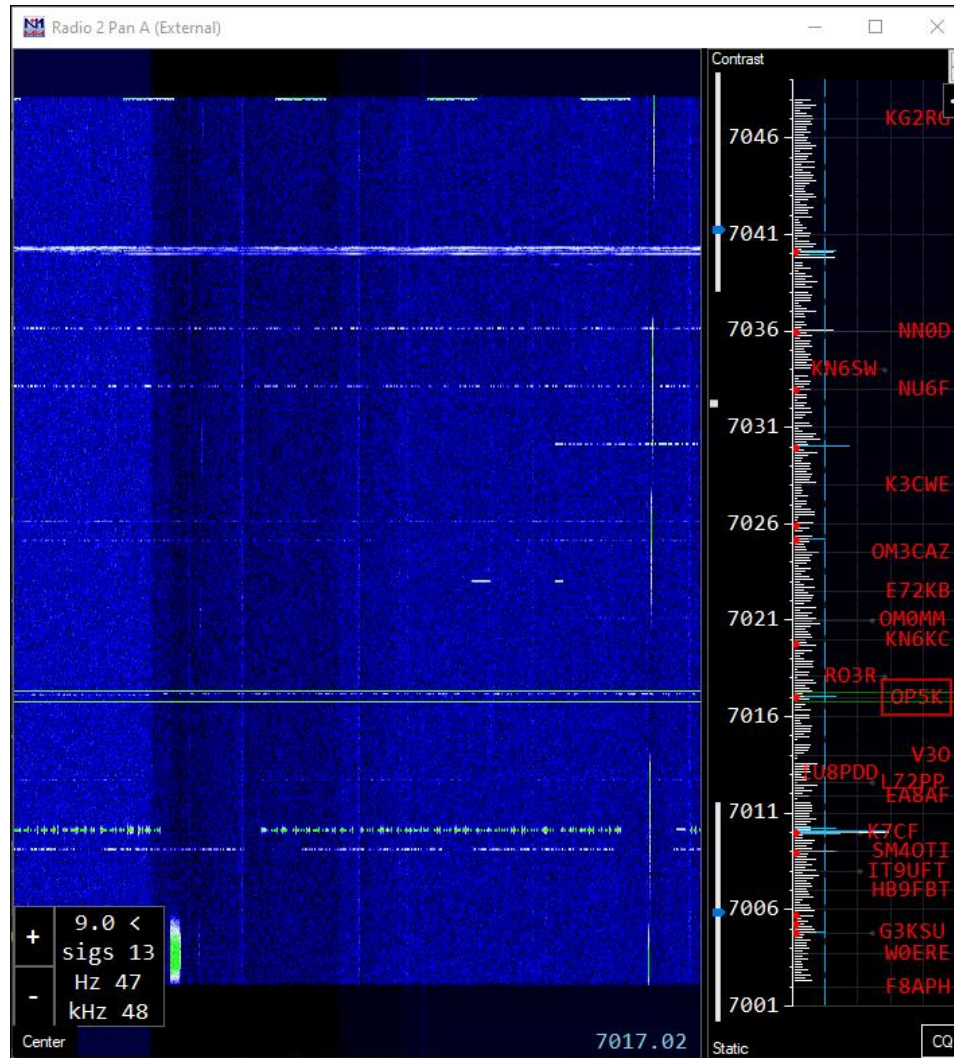
N1MM+ Spectrum Display Window



N1MM+ Vertical Spectrum Display Window



N1MM+ Vertical Spectrum Display Window





N1MM+ Spectrum Display Options

- For Elecraft K4, connect via to K4 via TCP
- Click Window > Spectrum Display
- Click “<” Arrow, top right corner

Spectrum Setup for Radio 2 Pan A (External)

Spectrum Source	Source Options	General Options
<input type="radio"/> N1MM SDR Server <input checked="" type="radio"/> External (WB, Flex, etc) <input type="radio"/> Airspy HF+ SpyServer <input type="radio"/> IC-7610 I/Q via FTDI dll <input type="radio"/> Icom Level Data - Radio 1 <input type="radio"/> Icom Level Data - Radio 2	External Source Name (or blank) Radio 2 Pan A	Display Bins: 512 Show frequencies based on: <input type="radio"/> Radio 1 <input checked="" type="radio"/> Radio 2 Spectrum Orientation: Bar Show these spots: All <input type="checkbox"/> Show only spots you can hear Show Red Signal Markers: All OK Cancel

N1MM+ with Spectrum Display

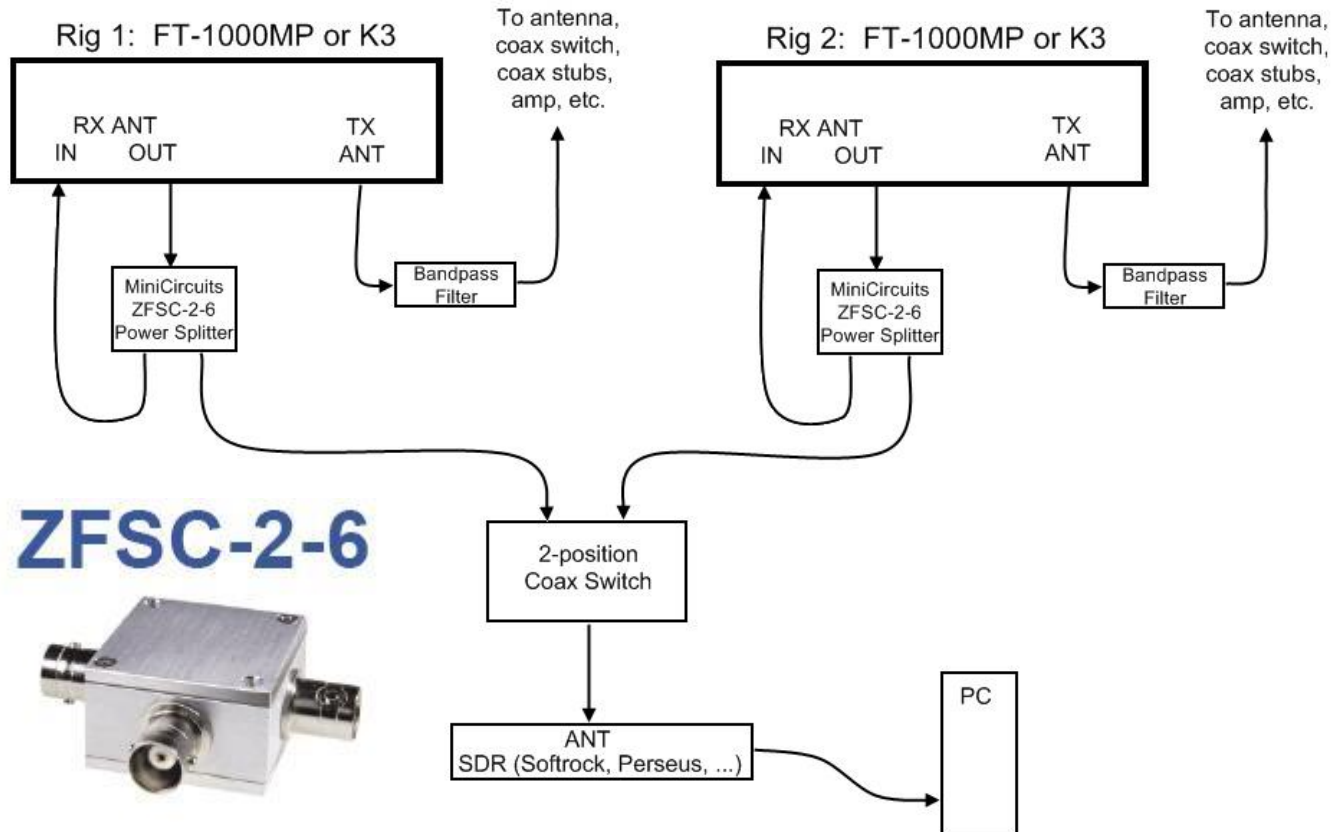


The screenshot displays the N1MM+ software interface. At the top is the 'Airsy Spectrum Monitor' window showing a spectrum plot with various call signs labeled, including SP9RV, CN1WW, K83VQU, S09MDK, K4SXT, EA1FCL, XX9D, DL5YAD, DK8VD, N4QR, N3FL, K1YAN, N8MD, W0JZ, K3GH, HAGFQ, VE1JYY, JE3BUD, F5NZY, DL6UKW, K4GM, KE7L, DL6UKW, K4GM, KE7L, KK4GFR, N5XE, N0BC, MBSVC, N1IX, DF9ZY, SP2HKA, and K13HL. The plot shows signal strength in dBm (0 to 15) across a frequency range from 3500 to 3580 kHz. Below the spectrum are several windows: 'Check Log/Master/Telnet/Call history/Reverse lookup' with columns for Log #, Master, Telnet, and Call hist; 'Dupesheet - IC-7800 Radio 13.5 MHz' showing a table of call logs; 'Score - 0 Points' showing a table with columns for Band, Mode, QSOs, Pts, Mlt, and Pt/Q; 'Manual Radio 2' showing a list of call signs like VU2MV, JA7BSF, K1G, K1GHL, E71A, K9T, YV5DRN, YV5NIN, SS1KD, UJQJZ, UA0CKD, UJQJZ, EA80M, EF80, and PY2LOG; and '7010.93 CW Manual Radio 2' showing a control panel with buttons for F1-F6, F7-F12, and various functions like Esc, Stop, Wipe, Log It, Edit, Mark, Store, Spot It, and QRZ. The main interface shows the call sign 'F5NZY' and various radio control options.

Click-To-Tune with a “Legacy” Transceiver + SDR



Adding a Software Defined Radio (SDR)
to an SO2R Station



Drawing by N6TV@arrl.net 31 May 2008

Use OmniRig support in HDSDR to sync freq. with any transceiver



The screenshot displays the HDSDR software interface. On the left, a 'Peak' meter shows a reading of -139.0 dBm. Below the meter is a list of function keys: SDR-Device [F8], Soundcard [F5], Bandwidth [F6], Options [F7], Full Screen [F11], Start [F2], Minimize [F3], and Exit [F4]. The main menu is open, showing options like Select Input, Visualization, Input Channel Mode for RX, Output Channel Mode for RX, RF Front-End Configuration, Calibration Settings, Recording Settings+Scheduler, DigiMode Settings, Misc Options, Mouse Wheel, DDE to HDSDR, CAT to Radio (OmniRig), CAT to HDSDR, TX, and About HDSDR / Help / Update. The 'CAT to Radio (OmniRig)' option is selected, opening a sub-menu with the following items: 'Whats this?', 'Use v1 instead of v2' (checked), 'Setup', 'sync Rig1 (Elecraft K4 => On-line)', 'sync Rig2 (Elecraft K4 => On-line)' (checked), 'sync to Rig' (checked and highlighted), 'sync from Rig' (checked), 'sync Tune frequency' (radio button), 'sync LO frequency', 'sync Modulation', 'set Converter Offset', and 'Swap CW and CW-R' (checked). A frequency display at the bottom right shows -140 and 150.

Waterfall Display Advantages



- Many zoom levels: 5, 10, 30, 60, ..., 800 KHz+
 - Monitor an entire band, or a small slice
- Jump to Next Signal (N1MM+ Spectrum Display)
- Find “fresh meat” (unlabeled signals)
- Weak signals easy to spot (faint traces)
- Find new run frequencies *fast*
- Spot big pileups, or gaps in “Listening Up” DX pileups
- Find who the DX just worked, *fast*
- “Click to Tune” – direct access using a mouse or tap
 - IC-7300, IC-7610, IC-7800 V3.0, IC-7851, Flex/SmartSDR, HDSDR, SDRConsole, Elecraft K4 (but *not* Elecraft P3)

More Waterfall Advantages



- Find “good spots to call” in a CW pileup
- Find clear spots to call CQ
- QRM? You can *see* where to move your VFO to minimize it
- During S&P, find the “next” signal *fast* (no more slow and careful tuning)
- Position VFO B or 2nd receiver without having to *listen* to it
 - S&P while CQing, “SO2V” (single-op, two VFOs)
- Monitor overall band activity
- Keep an eye on the local competition

Waterfall Display *Disadvantages*



- Most radios don't automatically tune from signal-to-signal like CW Skimmer or the N1MM+ Spectrum Display
- Clicking on a signal with the mouse not as precise as tuning with VFO, must still fine tune (mouse wheel in K4 works great)
- Contest software loses focus when you click on waterfall in separate program
- Some find it visually distracting
- Cumbersome to adjust scope width and band edges
- **But, if you're *not* using a waterfall display in a contest, you're really operating "blind"**
- **A waterfall display is really the "killer app"**

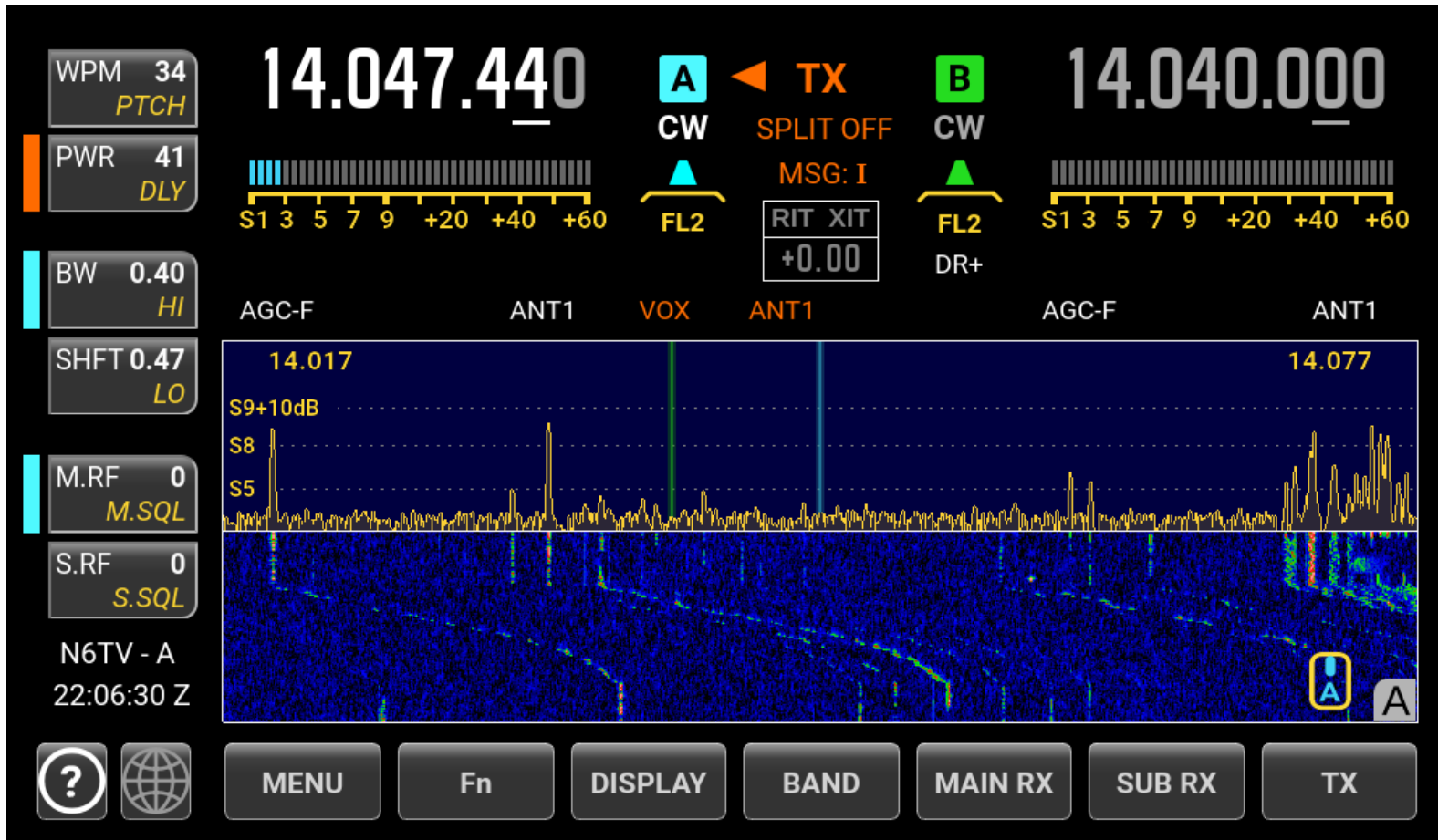
Recommendations While Contesting



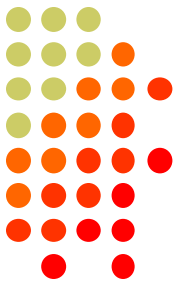
- Always enable the waterfall, and adjust properly
- **Use Fixed Mode** (never “Center” or “Track” mode)
 - You want the VFO cursor to move, not the scope
- Use narrow 5 - 20 kHz span for CW, or running
- Use wider 40 -100 kHz span for Phone
- Logging software can and should automate this:
 - In Win-Test, type **SPAN20** [Enter] to set a 20 kHz scope span, limited to band edges
 - See <https://bit.ly/wtscripts> - Win-Test Scripts
P3scripts.zip, IcomScripts.zip, includes source code



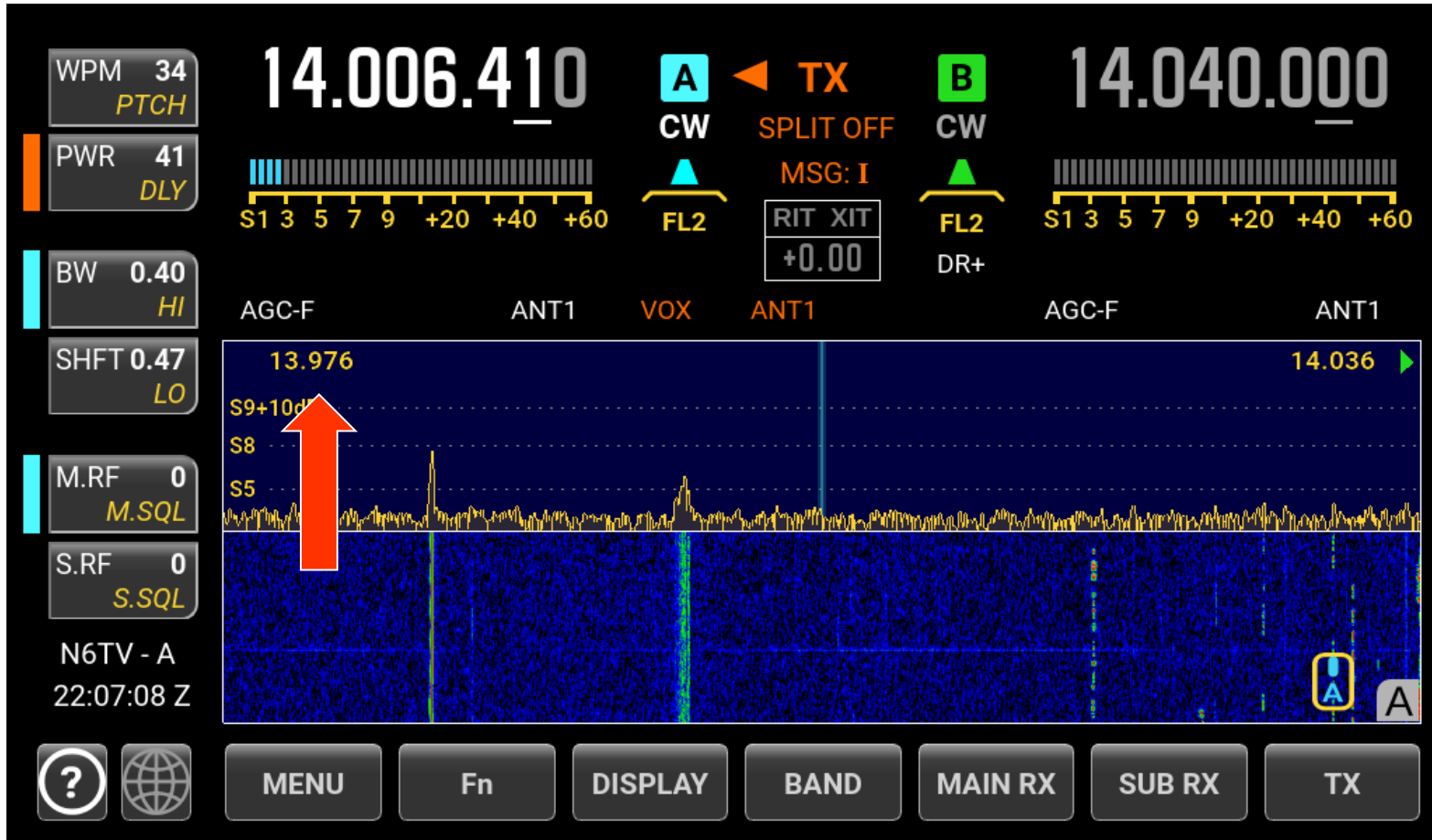
What's Wrong with this picture?



- **TRACK or CENTER mode causes waterfall smearing**



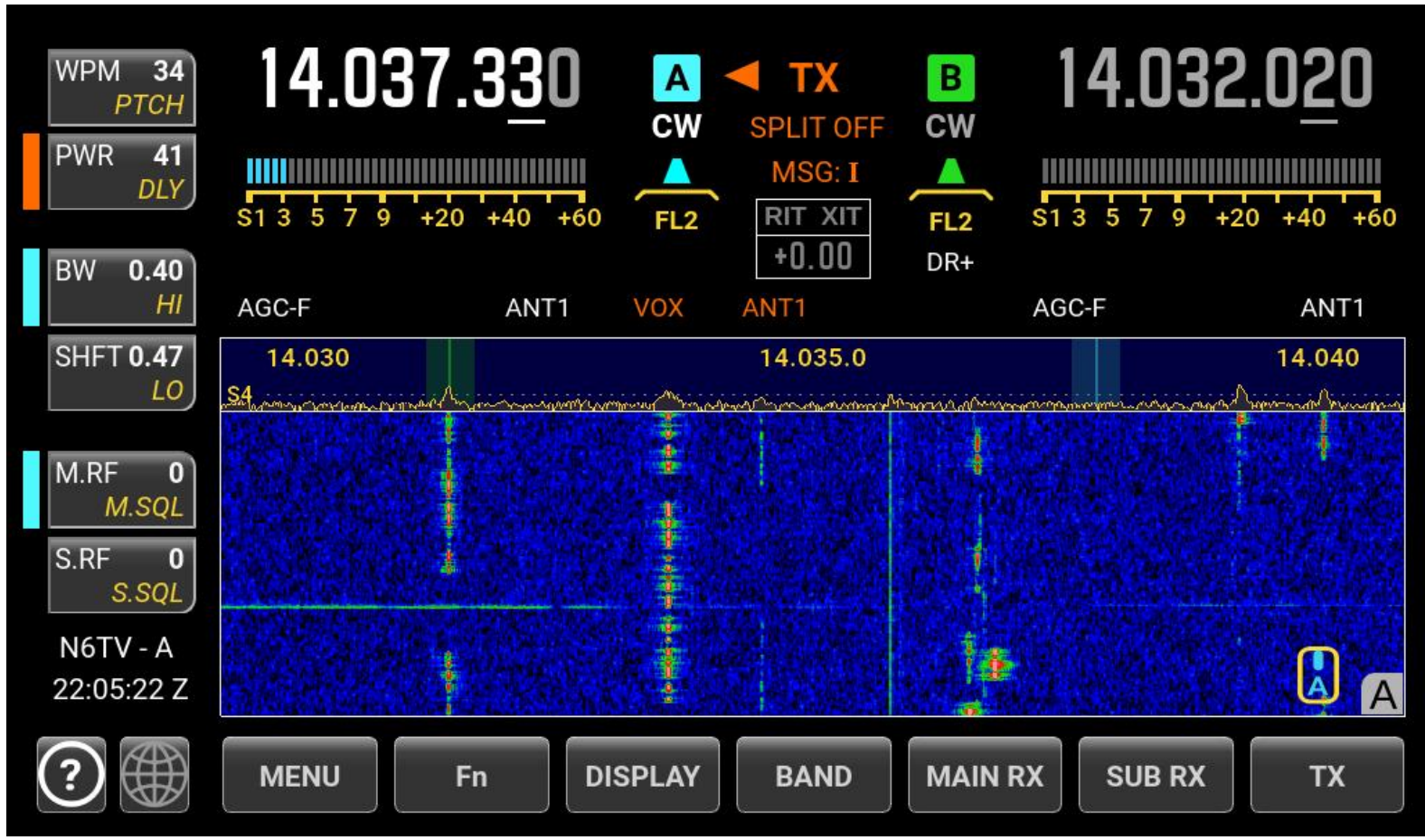
What's Wrong with this picture?



- **CENTER mode causes wasted space “Out of Band”**



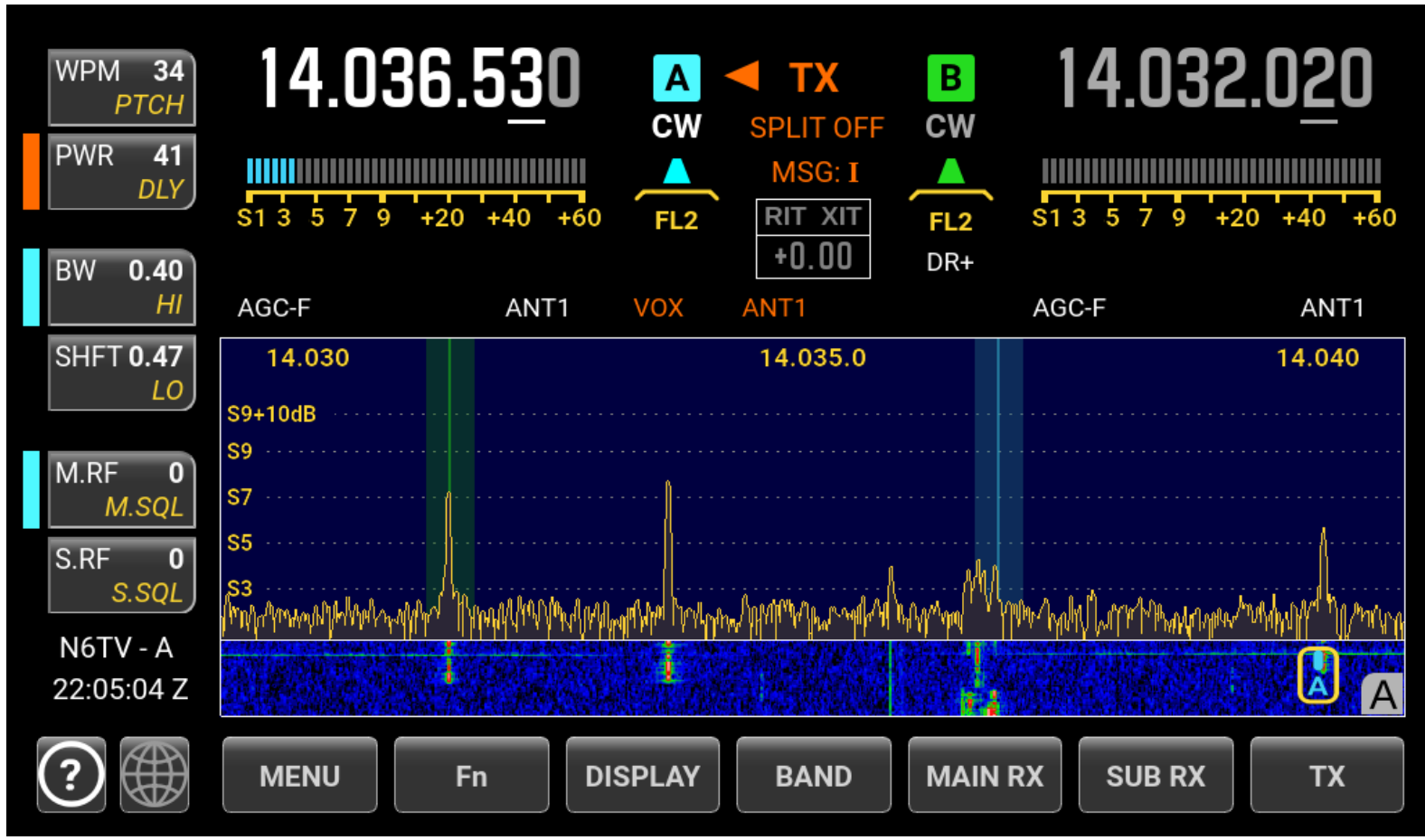
What's Wrong with this picture?



- **Waterfall Height is set too high**



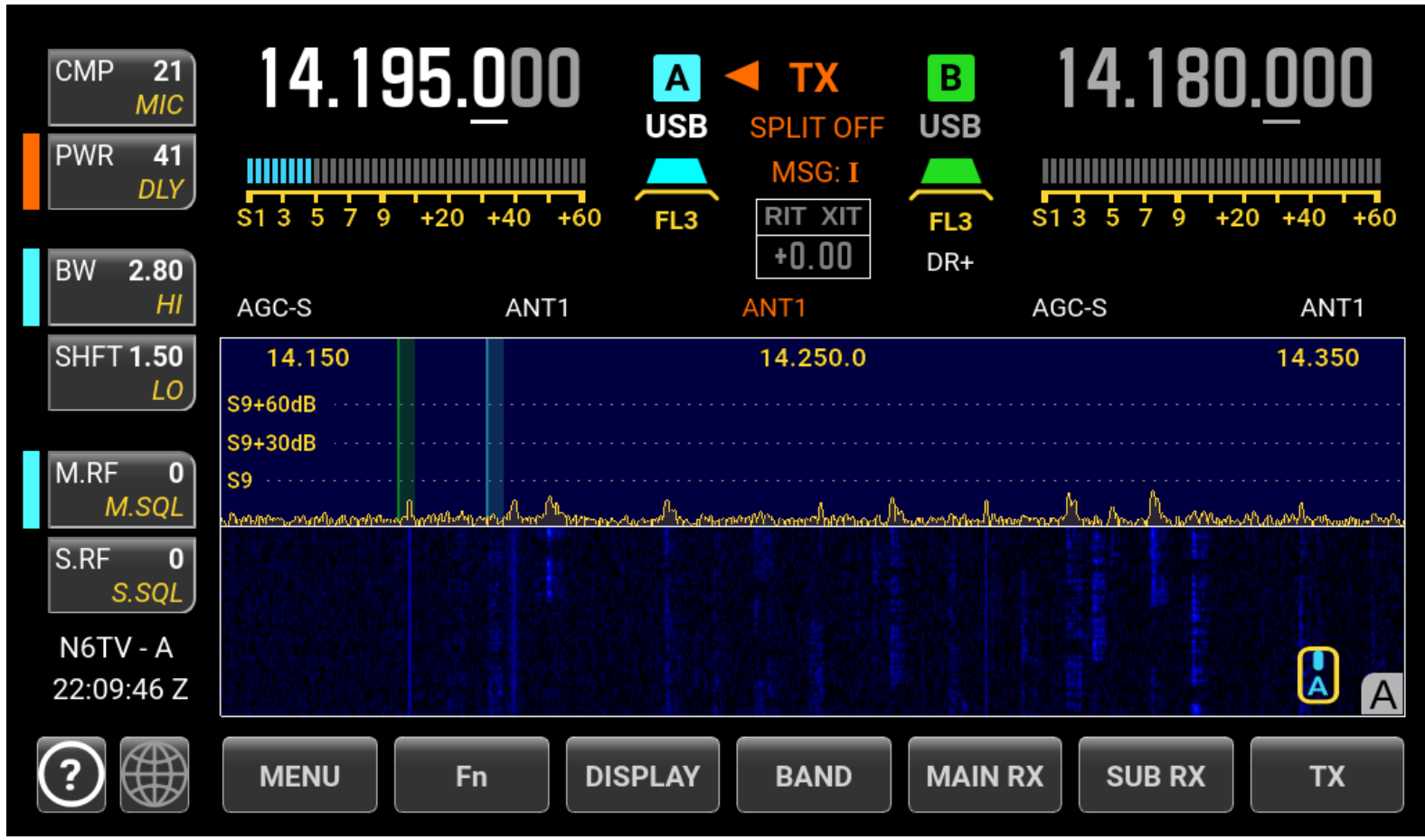
What's Wrong with this picture?



- **Waterfall Height set too low**



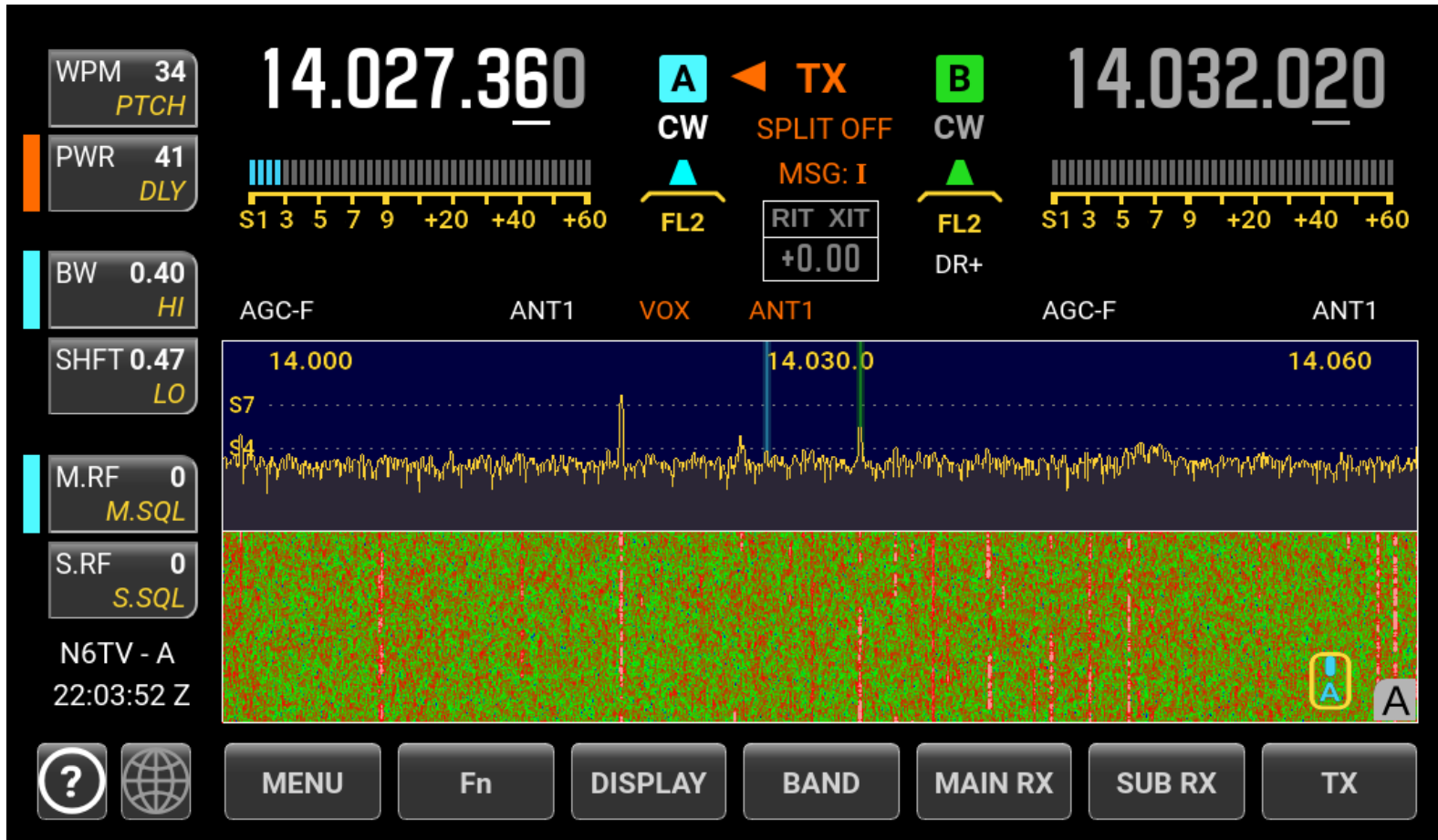
What's Wrong with this picture?



- Reference Level (bottom edge) is set too high (S-8)



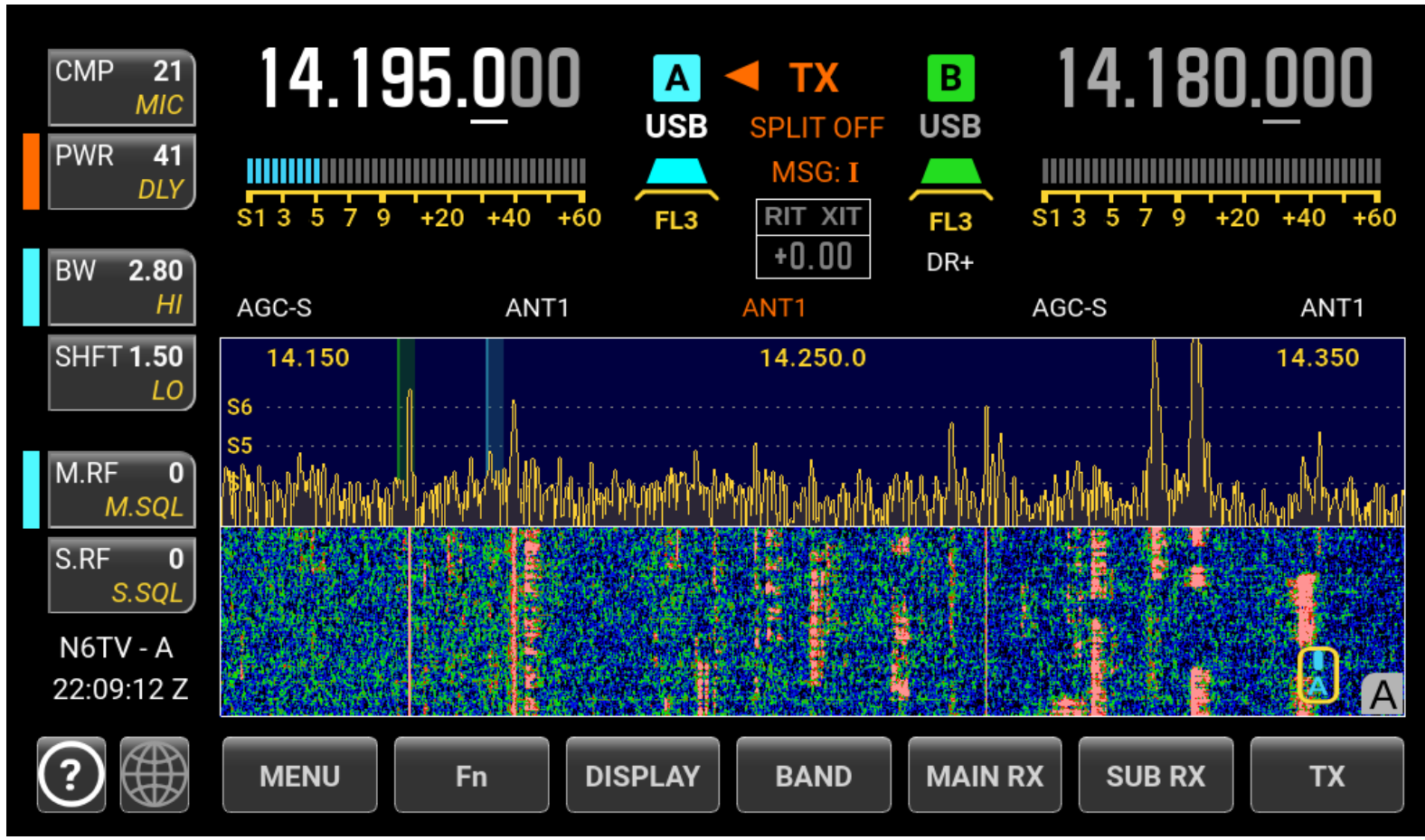
What's Wrong with this picture?



- Reference Level (bottom edge) is set too low



What's Wrong with this picture?



- **Vertical SCALE is set too low**

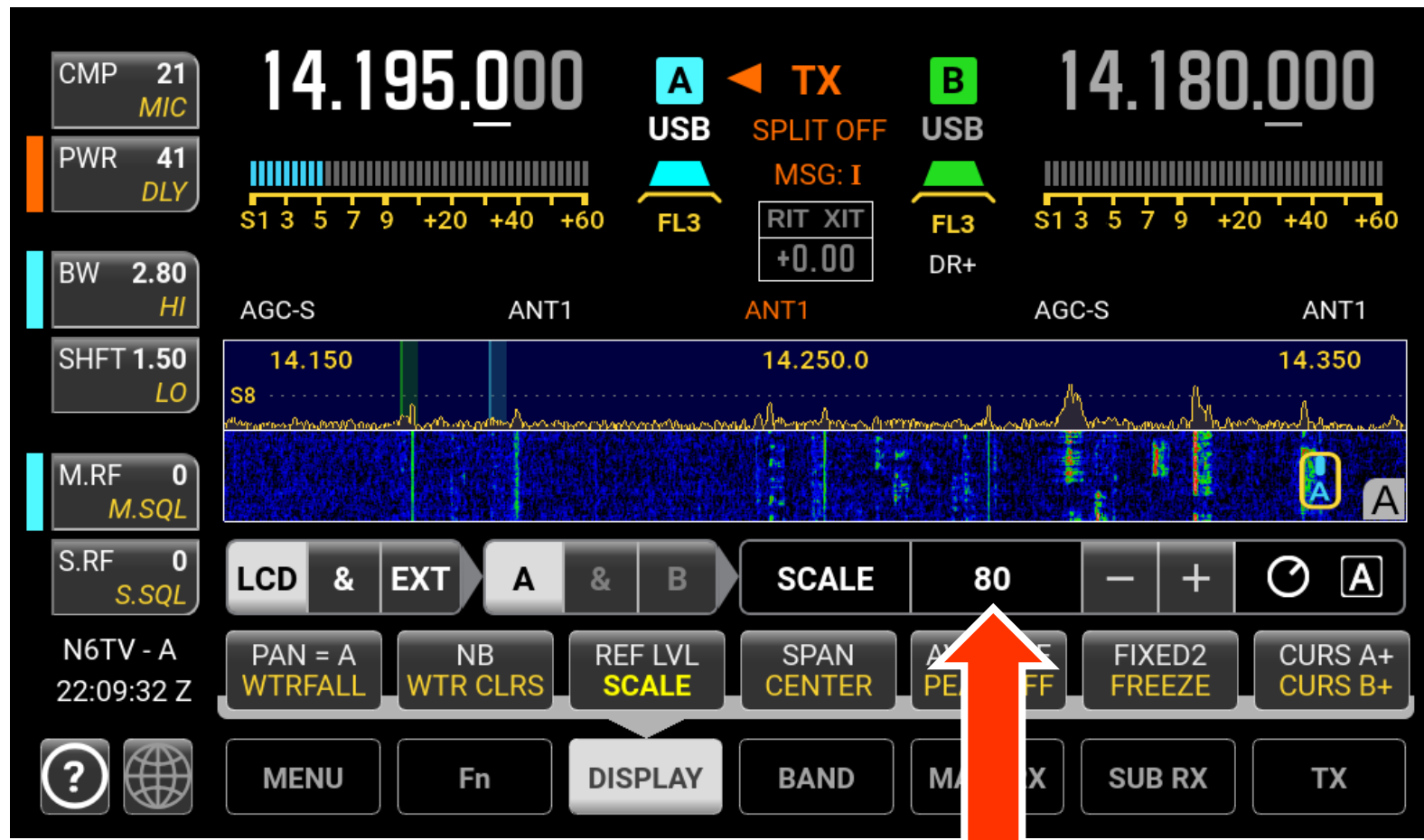


SCALE (height) is too low (only 30 dB)

The screenshot shows the ICOM 44 radio's interface. At the top, the frequency is 14.195.000 on the left and 14.180.000 on the right. The center display shows a spectrum plot with a scale of 30 dB. A red arrow points to the 'SCALE 30' button on the keypad. The keypad also features buttons for 'SCALE', '30', '+', '-', 'A', 'PAN = A WTRFALL', 'NB WTR CLRS', 'REF LVL SCALE', 'SPAN CENTER', 'PEP OFF', 'FIXED2 FREEZE', 'CURS A+ CURS B+', 'MENU', 'Fn', 'DISPLAY', 'BAND', 'M', 'X', 'SUB RX', and 'TX'. The interface also displays various status indicators such as 'CMP 21 MIC', 'PWR 41 DLY', 'BW 2.80 HI', 'SHFT 1.50 LO', 'M.RF 0 M.SQ', and 'S.RF 0 S.SQ'.

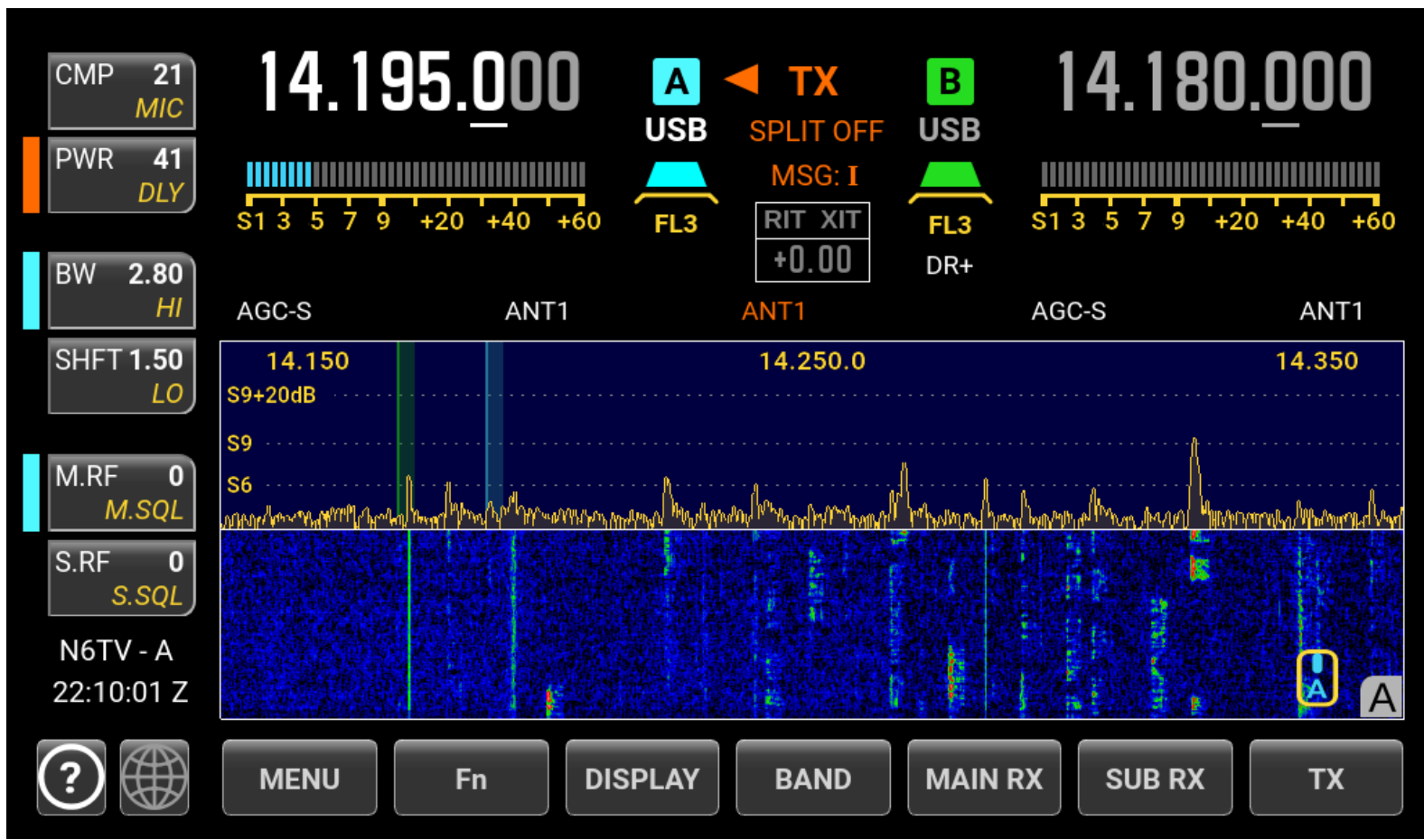


Corrected to 80 dB of vertical scale



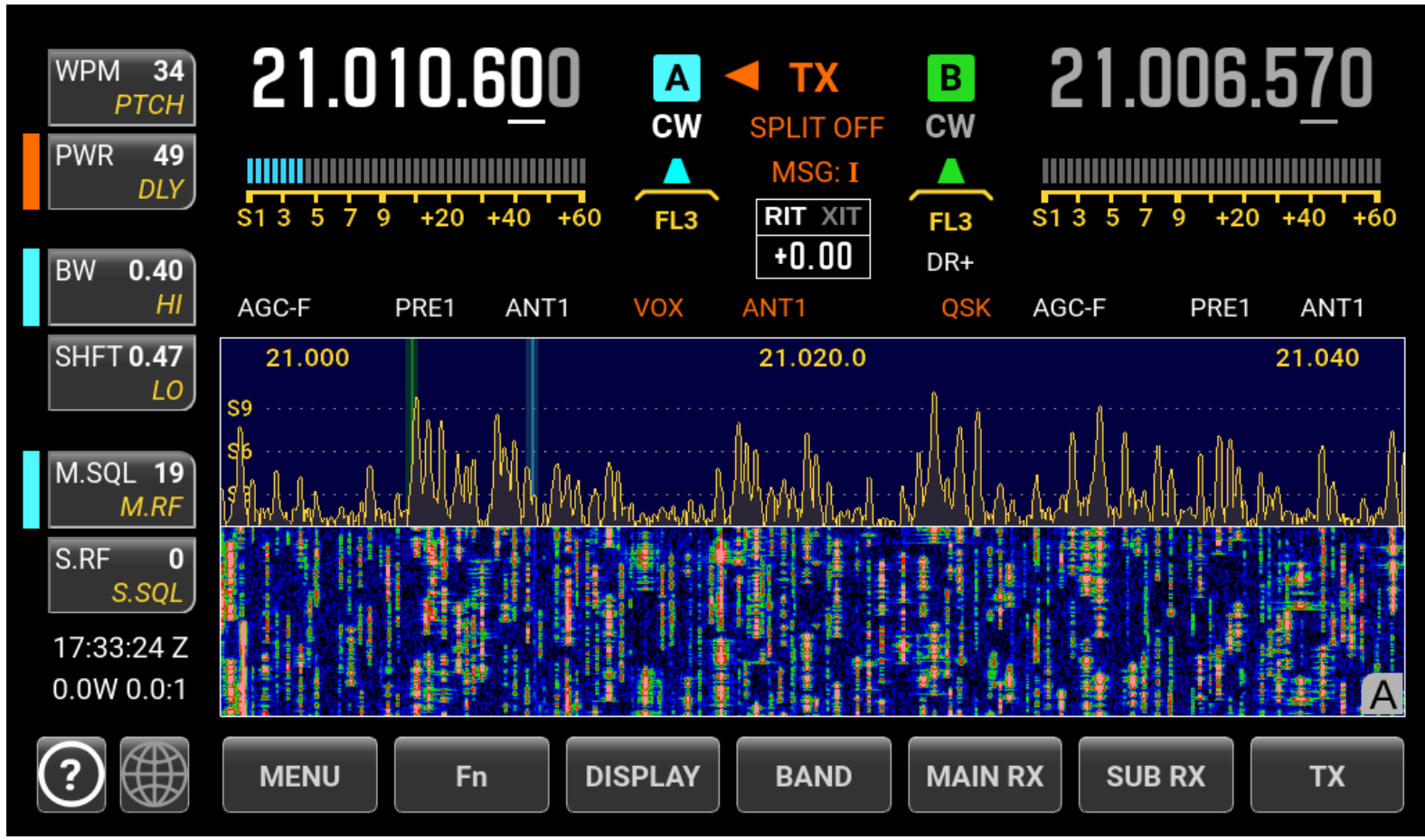


Proper Scale, Reference Level, Height





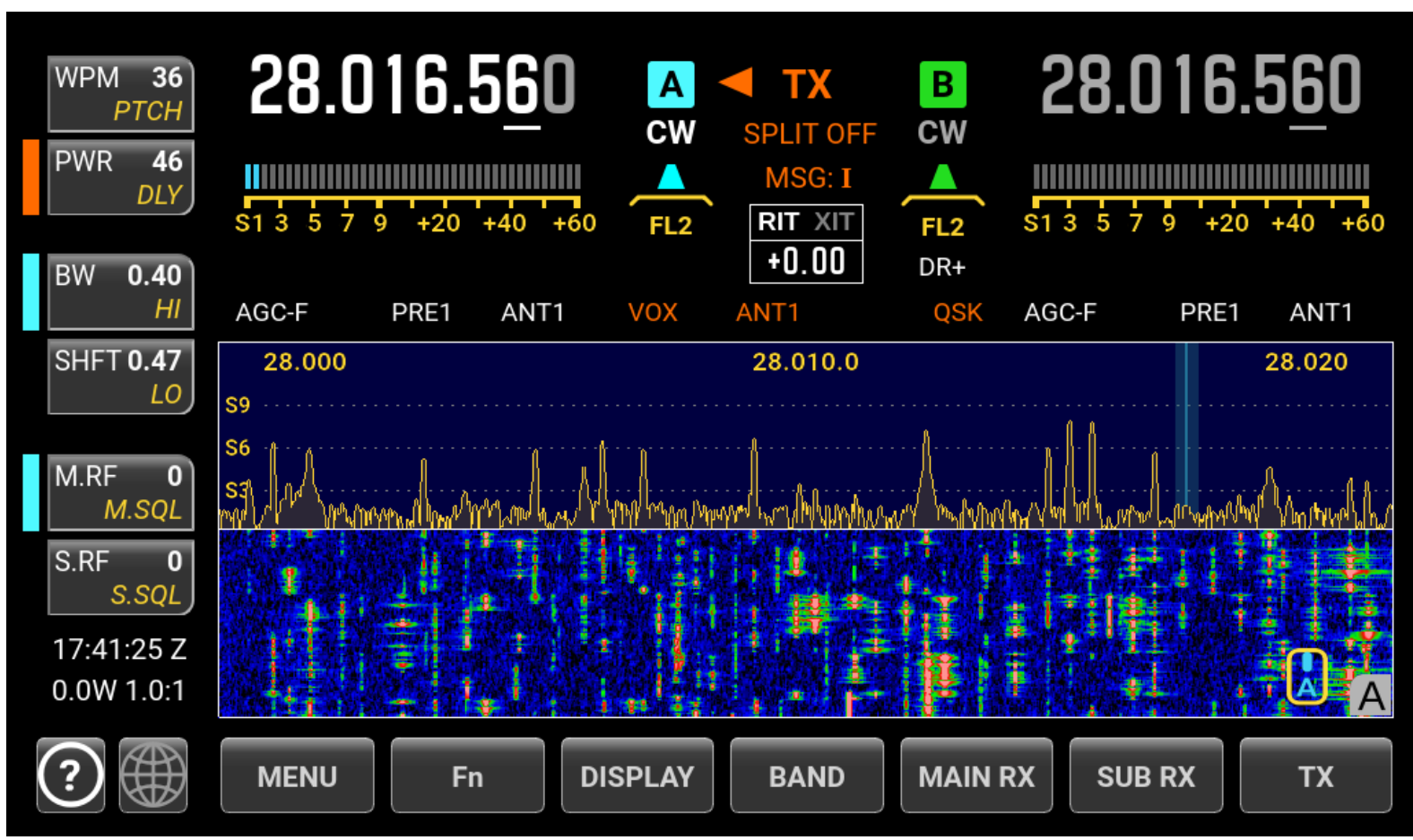
What's Wrong with this picture?



- Too many signals, SPAN too wide (40 kHz)

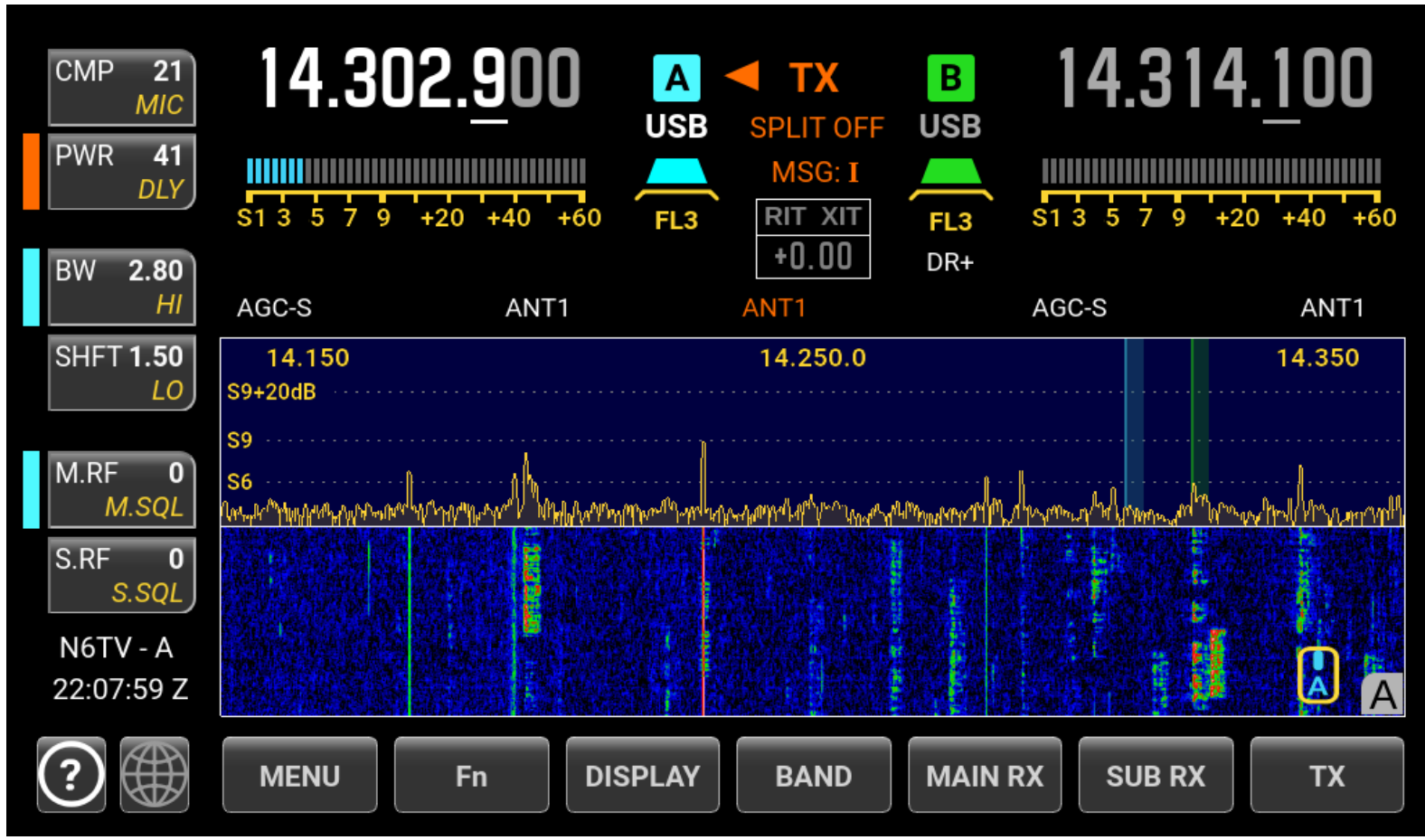


Try 20 kHz SPAN for Crowded CW Bands





What's Wrong with this picture?



- **200 kHz SPAN too wide for Phone contests**



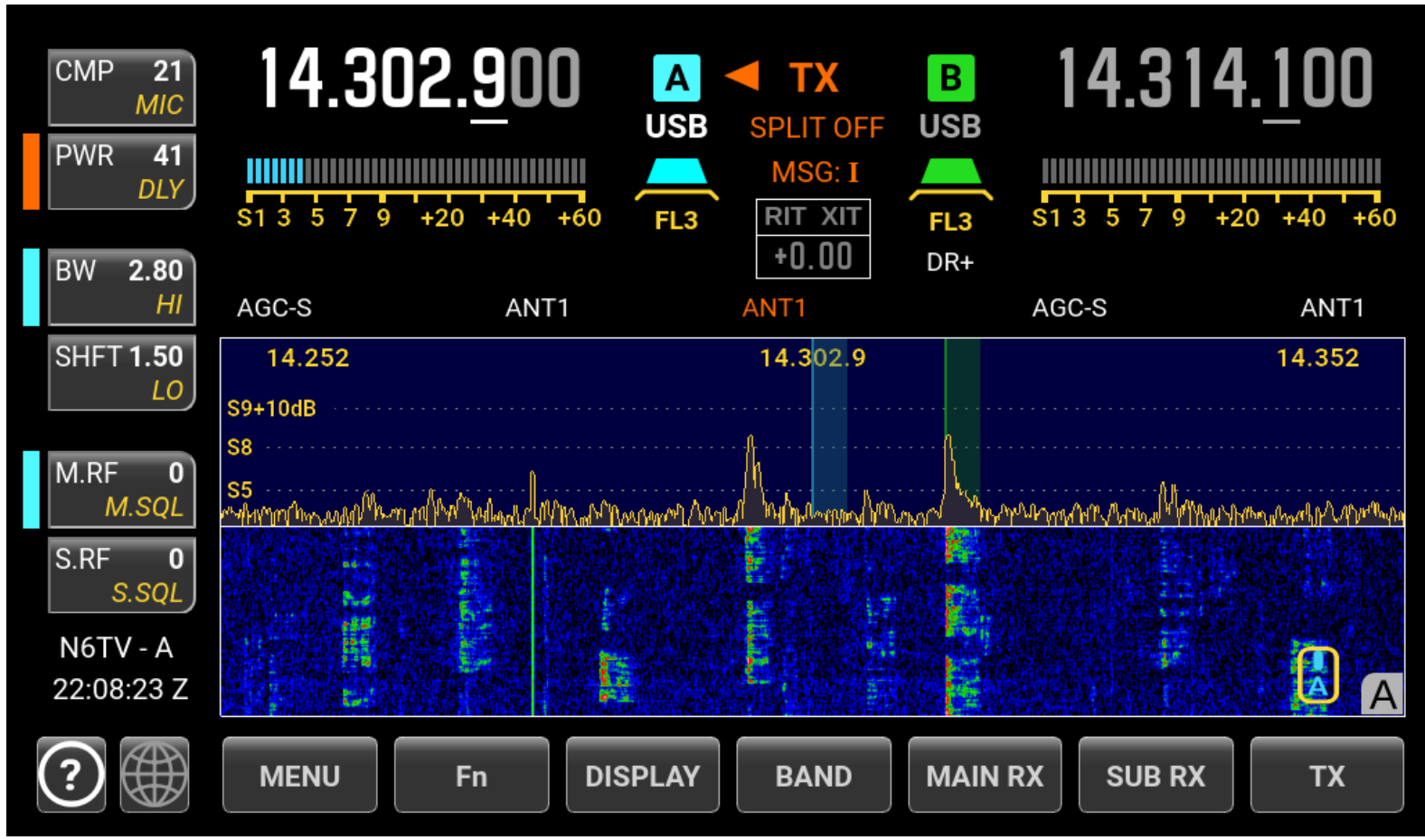
Try 100 kHz SPAN for Phone Bands

The screenshot displays the ICOM 50 radio's interface with the following settings and data:

- Left Frequency Window:** 14.302.900
- Right Frequency Window:** 14.314.100
- Mode:** TX (Transmit)
- USB Mode:** SPLIT OFF
- Message:** MSG: I
- RIT/XIT:** +0.00
- Filters:** FL3 (Left), DR+ (Right)
- AGC-S:** ANT1 (Left), ANT1 (Right)
- Span:** 100.0 kHz
- Frequency Markers:** 14.252, 14.302.9, 14.352
- Control Panel:** SPAN 100.0, SPAN CENTER, AVERAGE, FIXED2 FREEZE, CURS A+ CURS B+, MENU, Fn, DISPLAY, BAND, MA X, SUB RX, TX



A 100 kHz SPAN is good for Phone Contests



Summary of Recommendations



- Always enable a waterfall display when contesting
- Set up the waterfall scope for good visibility of weak signals, but low visual noise
- Adjust horizontal SPAN throughout contest
- Avoid CENTER or TRACK mode to avoid smearing and wasted space on “out of band” frequencies
- Try the N1MM Spectrum Display with DX Cluster spots

Questions?



- <http://www.qrz.com/db/n6tv> - Links to this and other presentations
- <https://n1mmwp.hamdocs.com/n1mm-manual/windows/#16-the-spectrum-display-window> – N1MM+ Spectrum Display Setup
- <http://http://www.hdsdr.de/> - HDSDR software
- <http://sdr-radio.com/Software> - SDRConsole
- <https://n1mmwp.hamdocs.com/n1mm-manual/windows/#16-the-spectrum-display-window> – N1MM+ Spectrum Display