Panoramic Spectrum Displays for Amateur Transceivers

VE3KI

West Carleton Amateur Radio Club

19 March 2018

Technological Basis

- Panoramic spectrum display: special-purpose spectrum analyzer, more or less closely integrated with a transceiver
- Analog: add a simple separate receiver swept-tuned across the band of interest, output displayed on a CRT or equivalent
- Digital:
 - Swept-tuned narrow-band detector within a conventional transceiver
 - Broad band direct-sampled SDR
 - Can be integrated with logging software

Some Platform-Dependent Displays

Analog





Heathkit SB-620

Kenwood SM-230

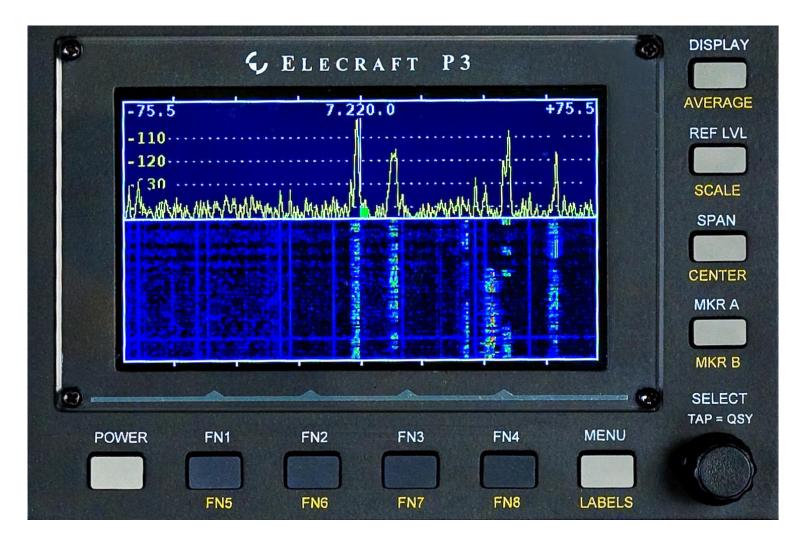
Icom IC-7600



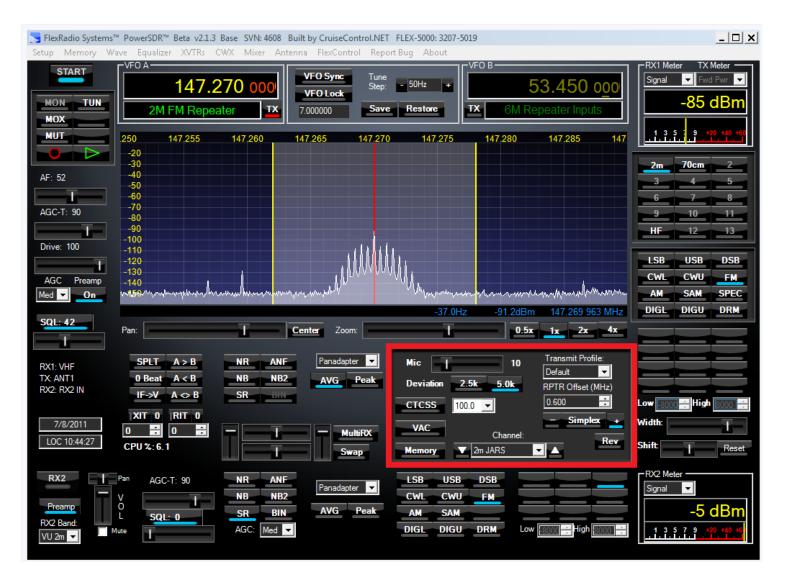
Yaesu FTDX-1200



Elecraft P3



FlexRadio PowerSDR Software



FlexRadio Maestro



Icom IC-7300



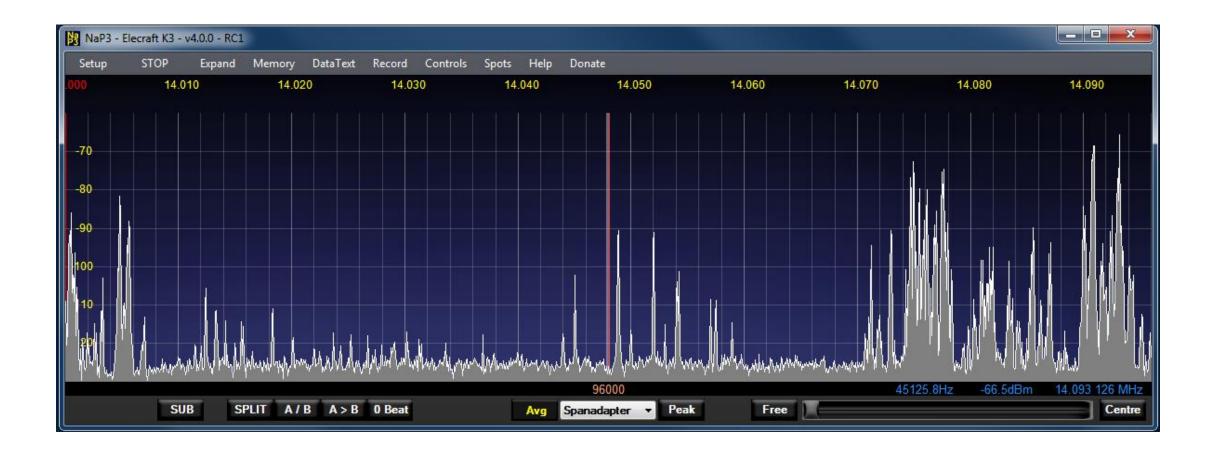
Platform-independent solutions

- Do you need to buy a particular Icom/Elecraft/Yaesu/FlexRadio transceiver in order to get a panoramic spectrum display?
- The answer is no. You can add a spectrum display to any amateur transceiver with the help of an HF-capable SDR (e.g. Airspy-HF+, SDRPlay RSP, SoftRock/LP-PAN + sound card), some free software, and depending on the transceiver, possibly some additional hardware for T/R sequencing
- The spectrum source can be either your transceiver's IF, or RF directly from the antenna

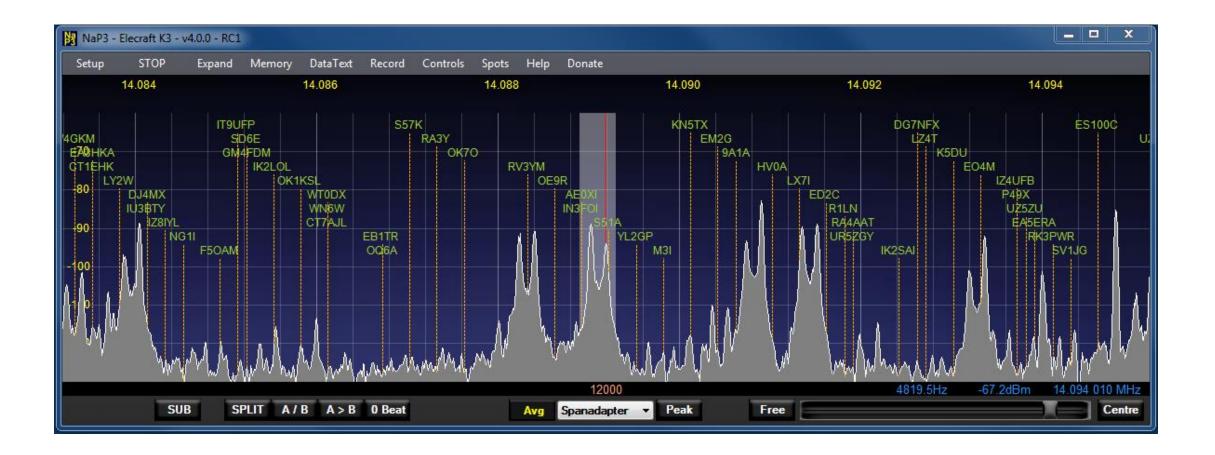
IF-based

- If your transceiver has an IF output, or if you can modify it to provide one (after the first mixer but ahead of roofing filters or other selectivity-determining circuits), you can feed this into an SDR tuned to the IF
- Use SDR panadapter software that uses CAT control from the transceiver to label the display with the transceiver's RF instead of the SDR's frequency (transceiver's IF)
 - If you are already using CAT control with a logging program, you may need some kind of port-sharing software (com0com, VSPE, LP-Bridge, ...)

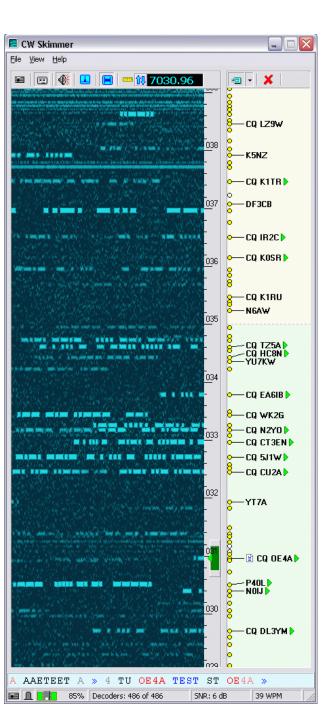
NaP3 Example



NaP3 with DX Cluster spots



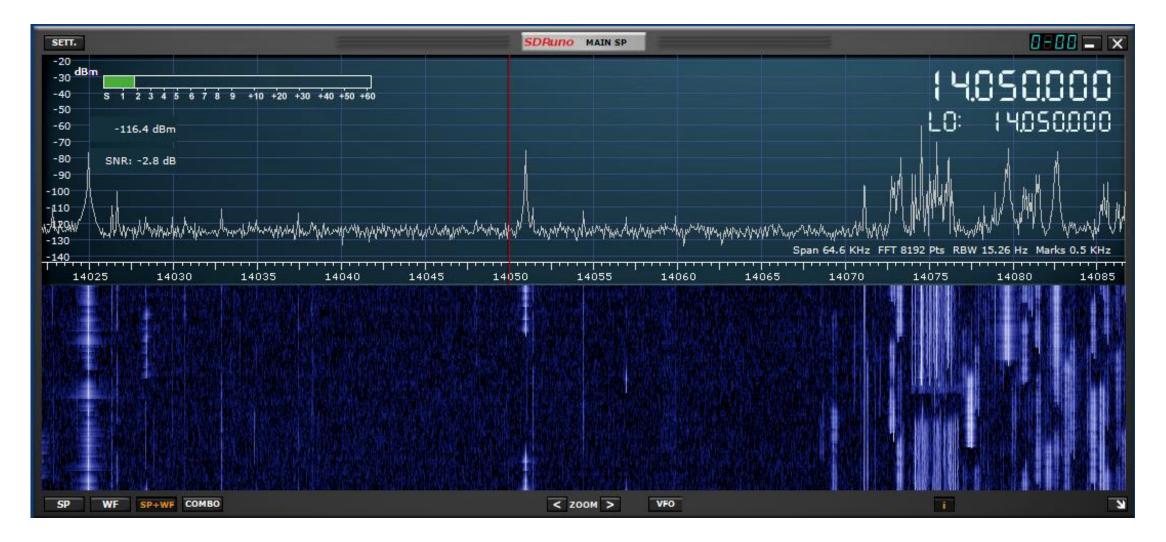
CW Skimmer



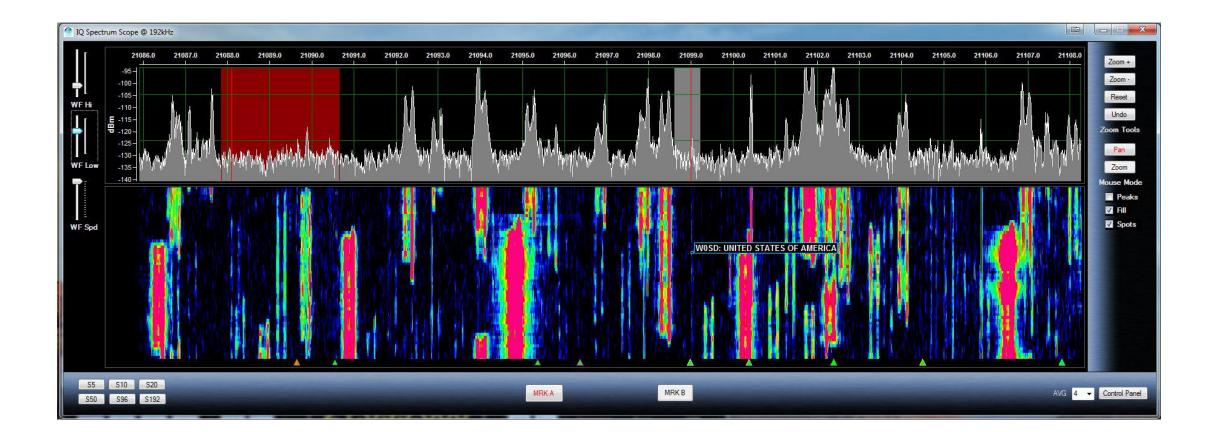
RF-based

- Some transceivers provide a pair of jacks for RX Antenna output and input (originally intended for accessories like filters, noise-cancellers, etc.)
 - The output is behind the T/R switch but ahead of the first mixer
 - Connect a jumper between the RX Ant output and input with a splitter to tap off a signal to the SDR
 - Use radio control software to tune the SDR to the transceiver's frequency
- If your transceiver does not have an RX Ant Output/Input pair, use a T/R sequencer plus a splitter to route received signals to both receivers while isolating the SDR from the transmitter's output

SDRuno/SDRPlay



Win4K3Suite



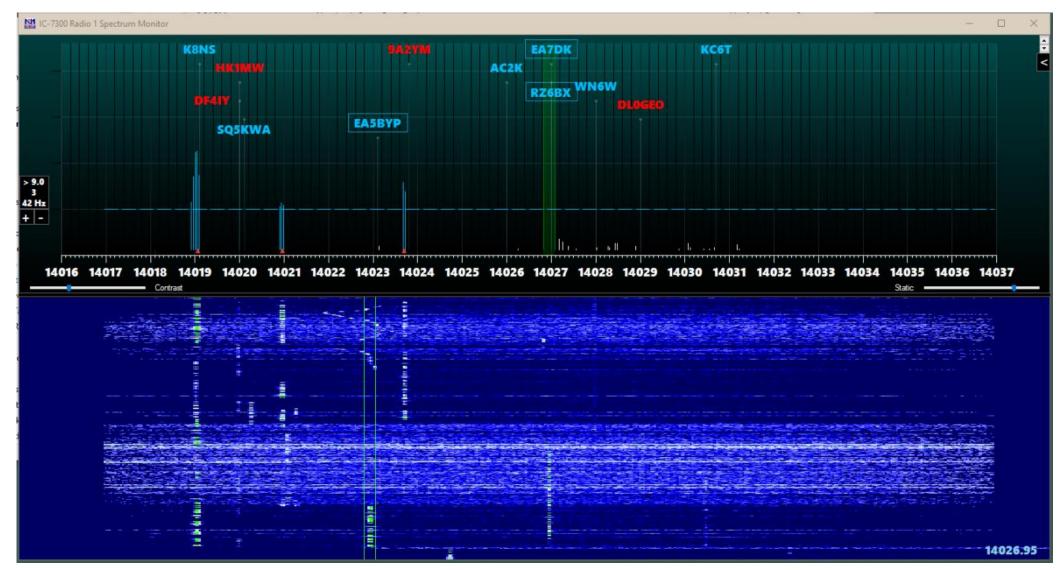
Integration with Logging Software

- The examples so far are integrated with the radio, but not with the logging software
- Next step is to integrate with logging software
 - Provides instant dupe vs. new contact vs. new multiplier status display for contests, or DXCC needed status and LotW/eQSL info for DXers
 - Replaces the logging software's bandmap display with a spectrum display
 - Can integrate with some transceivers directly (IC-7300, FlexRadio), or with external SDR-based displays

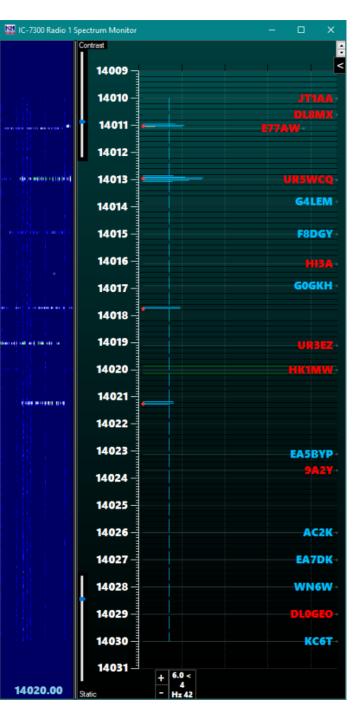
N2IC's Waterfall Bandmap

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N1MM+ with IC-7300



N1MM+ Vertical Orientation



3 Bandmaps

Centre = traditional bandmap (call signs from Cluster)

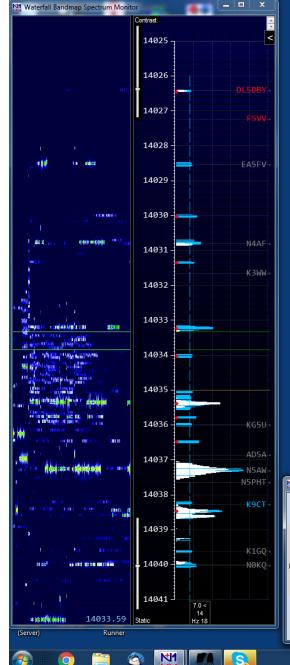
Left = N2IC's Waterfall Bandmap (spectrum data from an external SDR)

Right = N1MM+ spectrum display (fed by Waterfall Bandmap program)

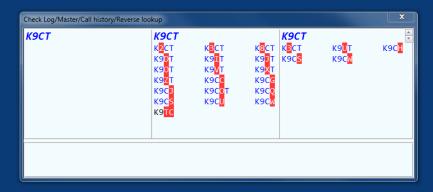
In addition to point and click with a mouse, you can also use keyboard hotkeys to jump to the next currently-active trace on the waterfall.

😻 Waterfall Bandmap 📃 🗖 🗙	Elecraft K3 VFO A	Waterfall Bandmap Spectrum Monitor	
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	14085 UR2Y 43° # New # EA3HKA 69° #	6 4	FKA FKA
	G0JSP 53° # DJ4WS 51° ¤ New #		TD 557K DJ4WS
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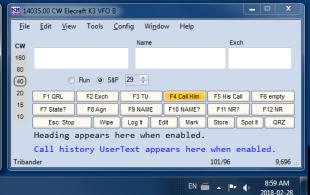
In action



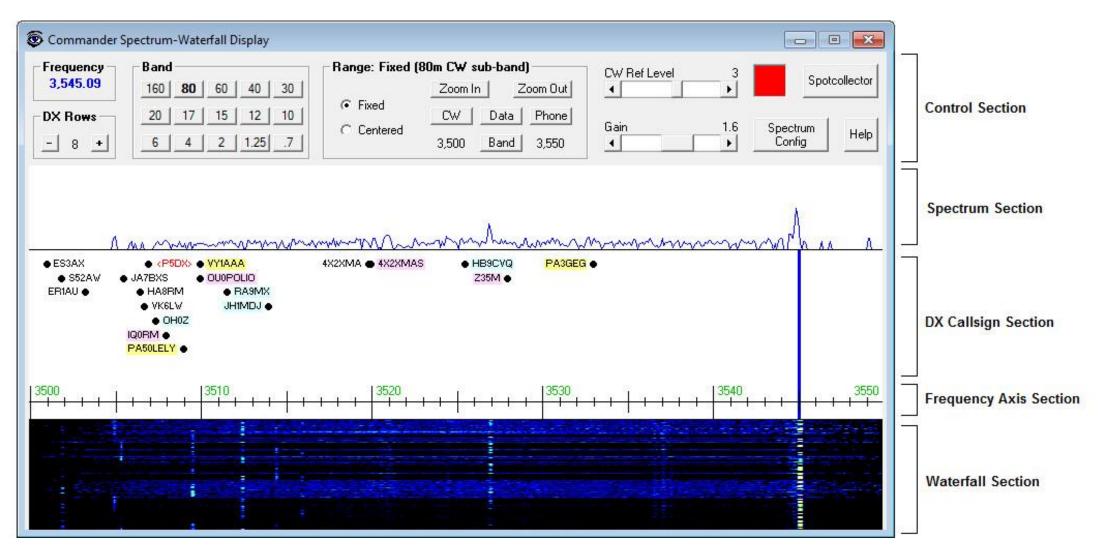
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02-28	13:55	NØKQ	14040.03	CW	BILL	1463		1		
02-28	13:55	HB9ARF	14041.61	CW	PHIL	1354	 Image: A second s	1		
02-28	13:55	N5AW	14037.31	CW	MARV	157	 Image: A second s	1		
02-28	13:56	AD5A	14036.86	CW	MIKE	1415	 Image: A second s	1		
02-28	13:56	KG5U	14036.00	CW	DALE	1241	 Image: A second s	1		
02-28	13:58	N4AF	14030.81	CW	HOWIE	132		1		-
02-28	13:43	К9СТ	7031.20	CW	CRAIG	276	~	1		







DXLab Suite – IC7300/7610/7851



Software Resources

- N1MM+ Spectrum Display: <u>https://n1mm.hamdocs.com/tiki-</u> <u>index.php?page=Spectrum+Display+Window&structure=N1MM+Logger+Documentation</u> (go to the N1MM+ on-line manual and search for Spectrum Display)
- N2IC's Waterfall Bandmap: <u>https://groups.io/g/waterfallbandmap</u>
- DXLab Suite Interoperation with SDRs: <u>http://www.dxlabsuite.com/dxlabwiki/SDRInteroperation</u> - Icom Spectrum Display: <u>http://www.dxlabsuite.com/dxlabwiki/SpectrumWaterfallIcom</u>
- Win4K3Suite, Win4Yaesu Suite: <u>https://va2fsq.com/</u>, <u>http://yaesu.va2fsq.com/</u>
- NaP3: <u>http://www.telepostinc.com/NaP3.html</u>
- CW Skimmer: <u>http://www.dxatlas.com/cwskimmer/</u>