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

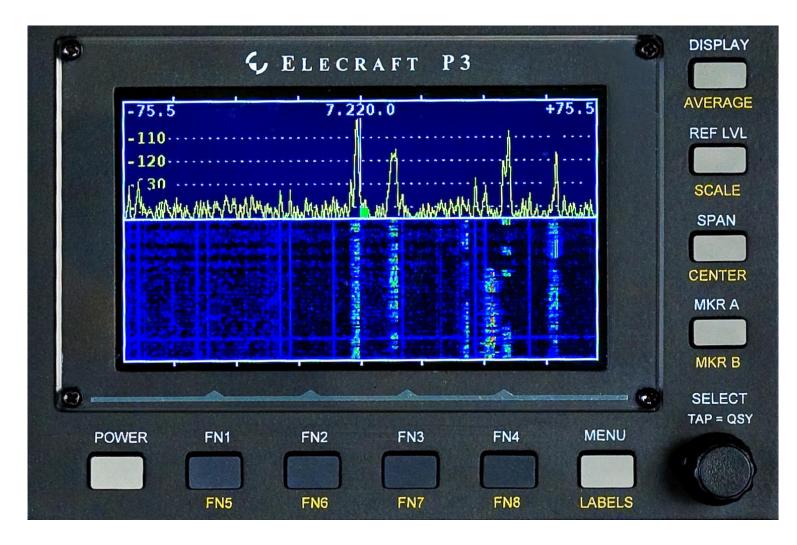
Icom IC-7600



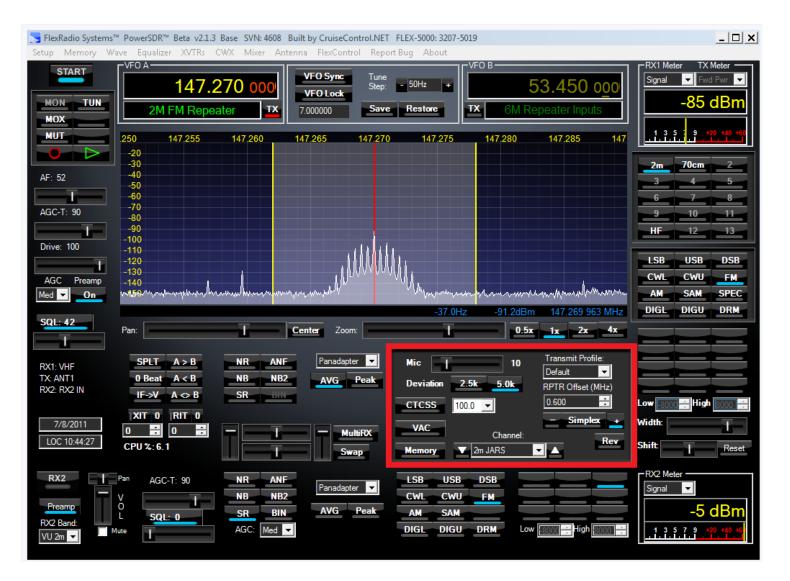
Yaesu FTDX-1200



Elecraft P3



FlexRadio PowerSDR Software



FlexRadio Maestro



Icom IC-7300



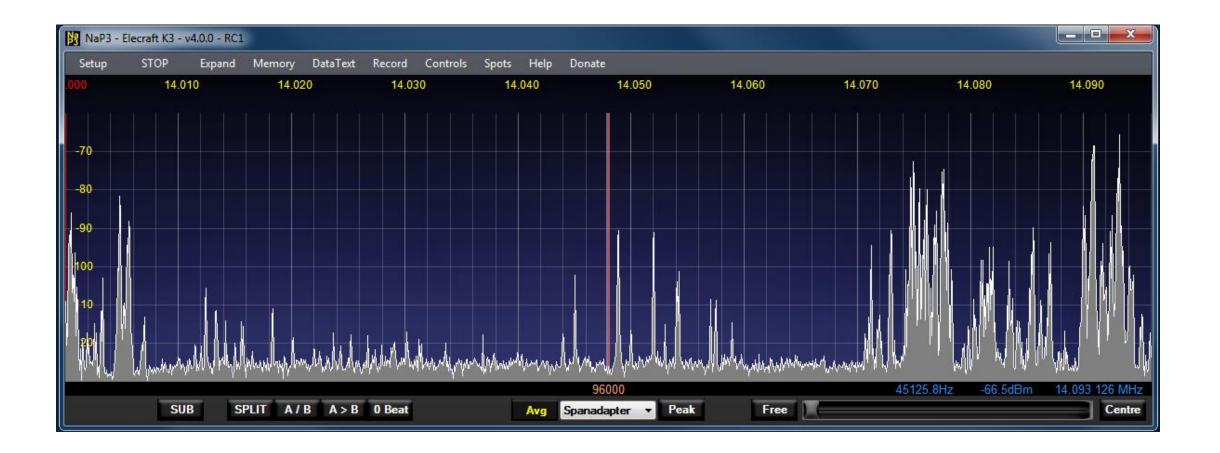
Platform-independent solutions

- 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, ...)

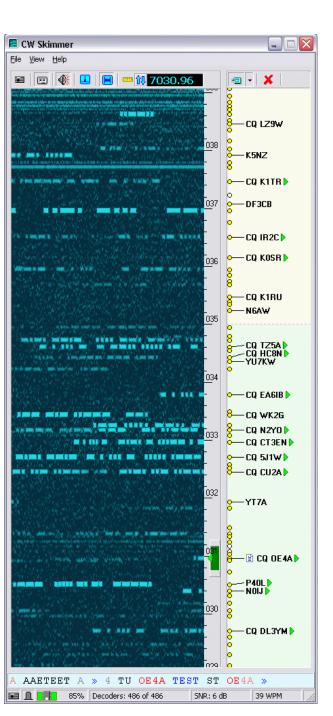
NaP3 Example



NaP3 with DX Cluster spots



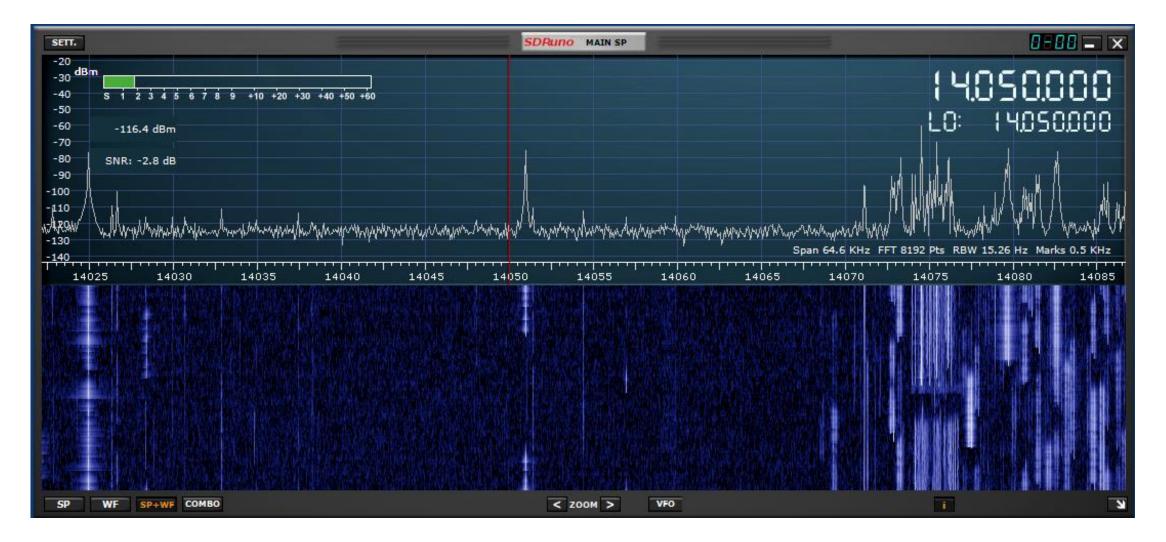
CW Skimmer



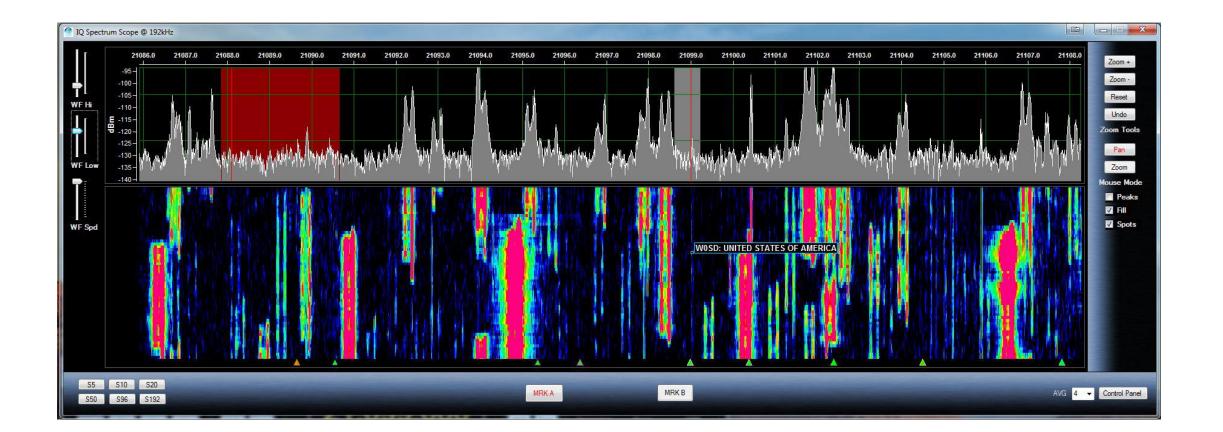
RF-based

- 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



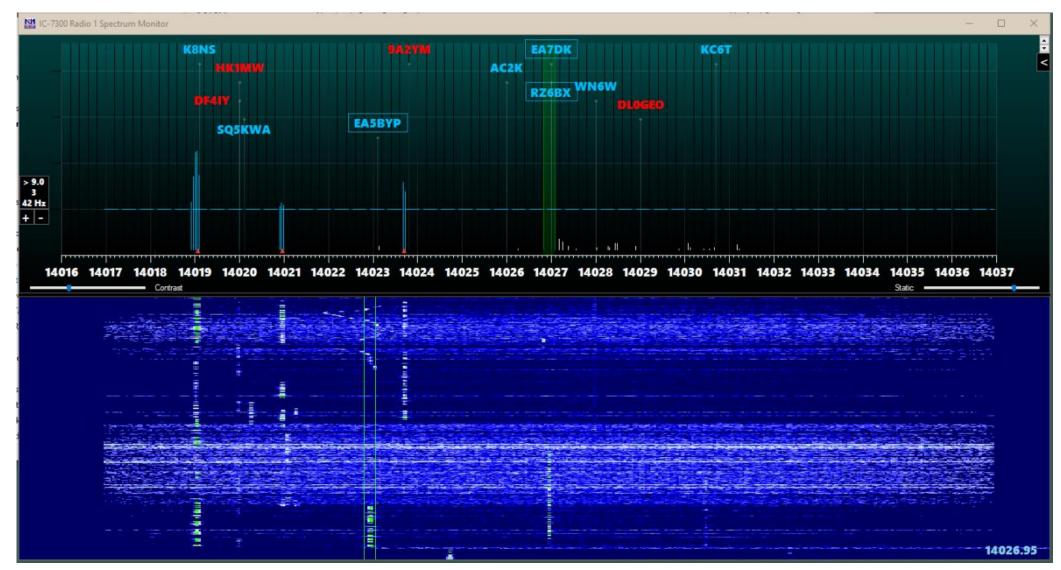
Integration with Logging Software

- 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

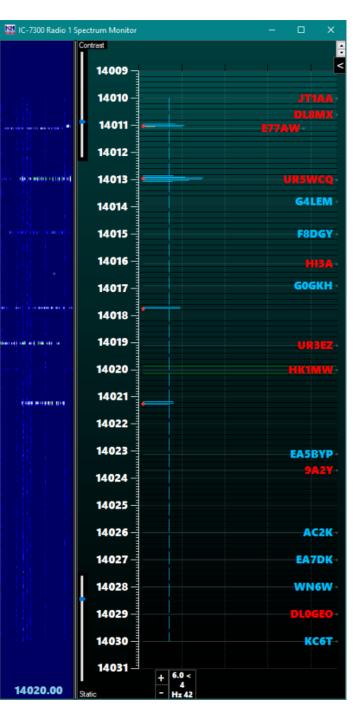
N2IC's Waterfall Bandmap

Water	fall Bandmap	- • ×
Stop	Sound card based SDR	Configure
W7F 1957 (75V) (75V) (7		Zoom
R OZBA K REL WJ9B		Contrast
ABGMAX K1DW N3RD	해 가지 : : : : : : : : : : : : : : : : : :	- Speed
FEJOE	na za al na aj (122) 12493 jeste leste inter a di 14931	
<mark>JAGHZ</mark> (4RO	AUCENTRALIA REPORT OF A CONTRAL AND A CONTRA	
AA3B RM2D K9MA	ning and a subset of the second s 14036 14	
KMOD	······································	
SM5CCE RK25E	4000	
F5IN T9MUO F997T9P	de held of held Sector of the sector of the Sector of the sector of the	
*91VX	14041	
VE 3MGY N9MM DF100FL DL5YM	rang ang ming ming ming ming ming ming ming mi	
1 T (ал он сөм өм ж солун 40 ман нуу ₄₀₄₃ ал он хал	

N1MM+ with IC-7300



N1MM+ Vertical Orientation



3 Bandmaps

Centre = traditional bandmap (call signs from Cluster)

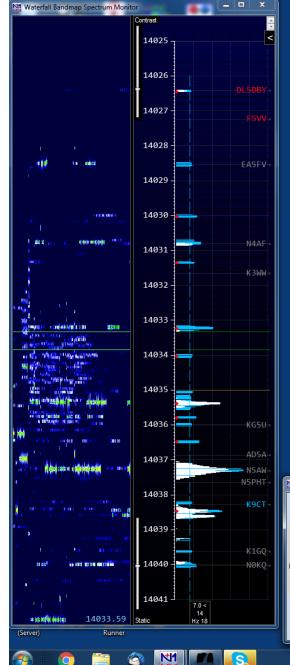
Left = N2IC's Waterfall Bandmap (spectrum data from an external SDR)

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

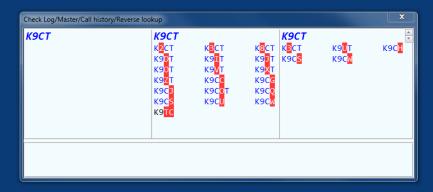
In addition to point and click with a mouse, you can also use keyboard hotkeys to jump to the next currently-active trace on the waterfall.

😻 Waterfall Bandmap 📃 🗖 🗙	Elecraft K3 VFO A	Waterfall Bandmap Spectrum Monitor	
Stop Sound card based SDR	14088.00 SH/DX Wide CQ	Contrast	
Clear All Spots Centered	RIT 0.00 XIT AFSK	14083	CM4FDM SD6t
KD6TR CT7AJL 14084 Zoom	14084 — CT7AJL 71° #		A1GT/QRP MØIHT M OK1KSL
NG11 N410	NG1I 130° New #	n n n n n n n n n n n n n n n n n n n	КОСТВ
	K5TXM 237° New # N4IQ 210° # G4FKA 53° New #		CT7AJL NG1I
	14085 UR2Y 43° # New # EA3HKA 69° #	6 4	FKA FKA
	G0JSP 53° # DJ4WS 51° ¤ New #		TD 557K DJ4WS
OK70 Contrast	S57K 54° ¤ New # I4IID 58° # IK2SAI 58° New #		UA2CZ A2CZ
	14086	ACC ANCE AN A REAL AND	
7Z1AL Strengther starting to 1000 1000 10	A2CZ 99° New # UA2CZ 43° ¤ New #	14086	ND8L ED1MK
OE9R	RN5AA 35° # OK7O 49° ¤ New #	Dis Units Againes	R A A A A A A A A A A A A A A A A A A A
UR52GY S51A Speed	14087		UR5ZGY
100 Experience of the second se	7Z1AL 52° ¤ # 0E9R 53° ¤ New #	Distriction of the second seco	
	UR5ZGY 43° ⊭ # S51A 54° ⊭ New #	Contraction of the Contraction o	R EW8DX CR5V
KN5TX	14088 NE3F 187° New # CR5V 71° New # EW8DX 40° # New #	14088	KN5TX
IK3TPP	XE1IB 228° New # M3I 53° #		CS7AA UNCE
	KN5TX 237° New # IK3TPP 58° New #	e = (p) (p) (1)	WTODX UWBE HVOA
ACTIVITY AND A CONTRACT AND A CONTRA	14089- 9A1A 54° ¤ New # CS7AA 71° New UW6E 43° ¤ #		U <mark>FRE LX7</mark> I
	WTODX 254° # HV0A 59° New #		KS7AA
KS7AA	LX7I 53° New # IZ4UFB 58° #		W. NSVYS EF9R
EF9B	* KS7AA 273° New # EF9R 74° New #		S53X VE5MX
	N5VYS 237° New # N5VY 237° # OG90AA 32° New #		WIBALLE ED3D
	VE5MX 300° New # 14091 — S53X 54° ⊭ #		EO4M ON5JT
ED3D 9HTAE K5DU	V31TF 205° New # ED3D 69° #		NU1C IW9FDD
INTERNATION CONTRACTOR OF A CONTRACT OF A CO	VM3RIE 269° New # 9H1AE 63° New # K5DU 237° New #		EV1R EIR A61M
	14092		KK3PWR-
	NK6A 269° ¤ # NV9FDD 58° New #		ES100C
A61M N4ER RK3PwH	NU1G 130° # CO2WL 190° # L 76K 51° # New #		DK2AMS EASERA
	14093		15 z 10

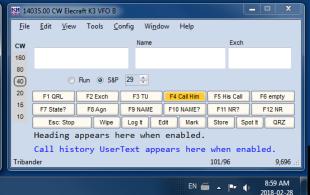
In action



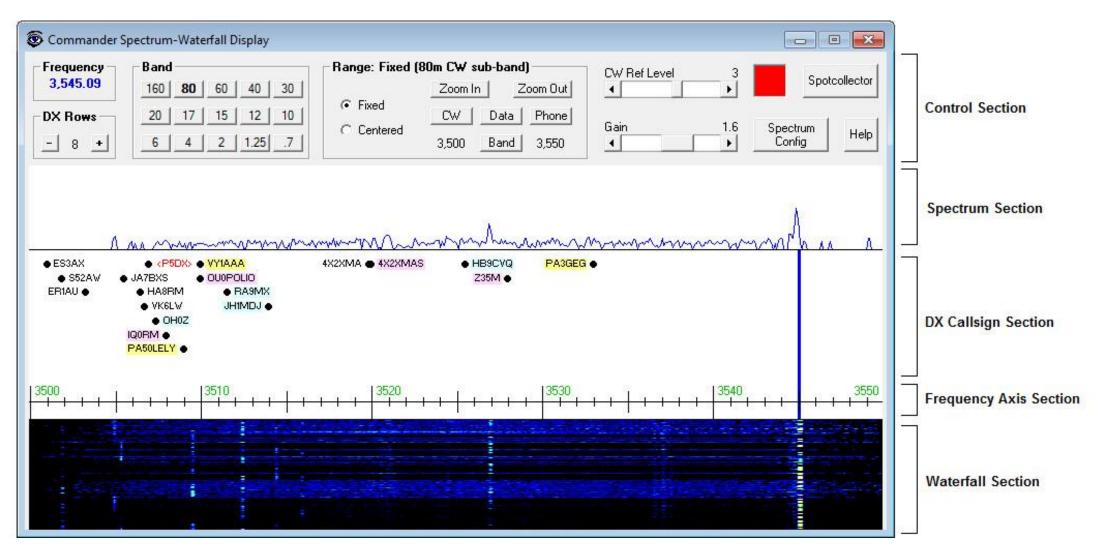
2018-0	2-28 13:59:382	CWops Mini-CWT	Contest - VE3KI_	2018.s3db						×
MM-DD	HH:MM 🔺	Call	Freq	Mode	Name	Exch	M1	Pts		<u> </u>
02-28	13:53	EA5FV	14028.54	CW	DANI	EA	 Image: A second s	1		
02-28	13:53	N5PHT	14037.65	CW	GARY	1489		1		
02-28	13:54	K1GQ	14039.62	CW	BILL	NH		1		
02-28	13:55	NØKQ	14040.03	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>