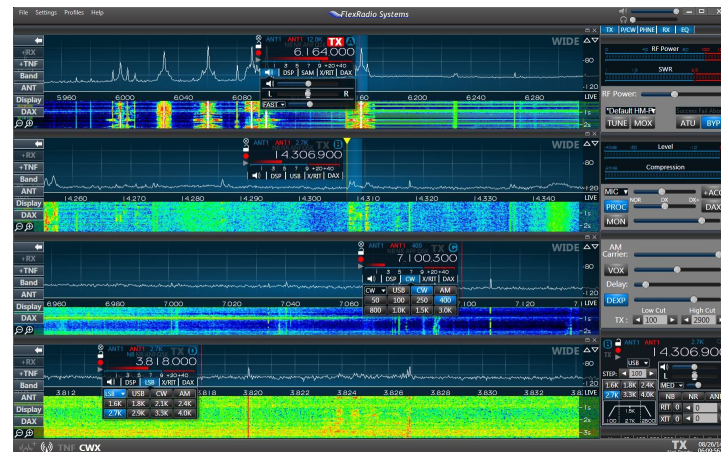




SDR & Flex Radio

SLSRC Meeting 10/27/17

Kyle Krieg (NØKTK)
www.nøktk.com
kylekrieg@gmail.com



What is a SDR?

SDR (Software Defined Radio) - is a radio where components that have been traditionally implemented in hardware (mixers, filters, amps, modulators/demodulators, detectors, etc), are instead implemented in software.



ICOM 7300



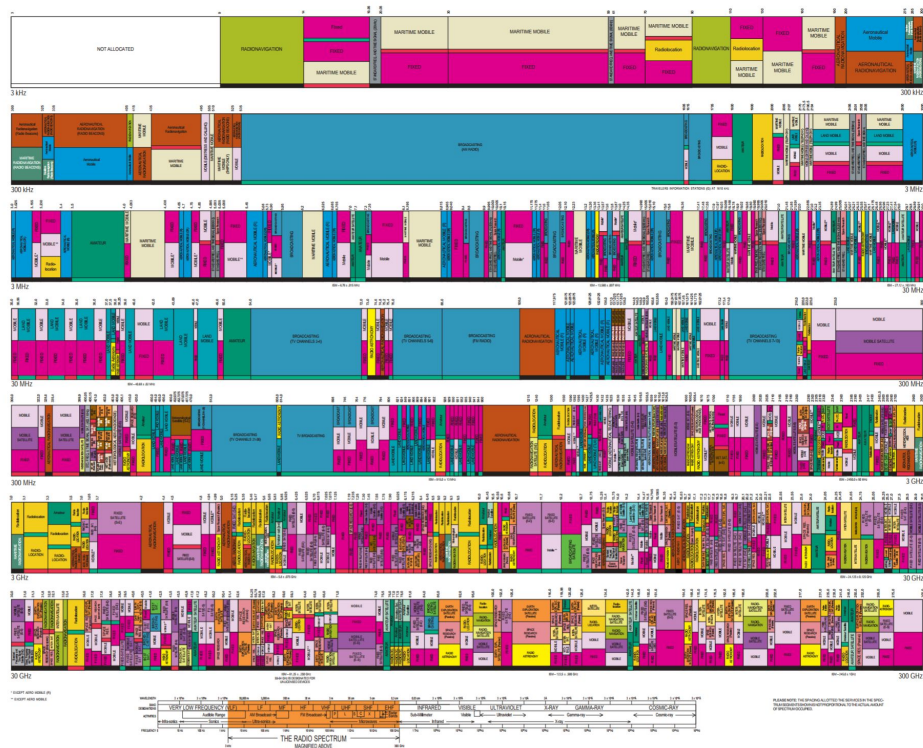
FlexRadio 6000 series



This chart is a graphic single-allocation portrayal of the Table of Frequency Allocations used to the FCC and NTIA. As such, it does not completely reflect all aspects, i.e., technical and related changes made to the Table of Frequency Allocations. Therefore, for complete information, users should consult the Table to determine the current status of U.S. allocations.

 **U.S. DEPARTMENT OF COMMERCE**
National Telecommunications and Information Administration
Office of Spectrum Management

October 2003





What makes an SDR a SDR?

Modulation using software & changeable? - YES

Digital Signal Processing in software? - YES

Control surface reconfigurable? - YES

Can add new features & new controls - YES

Radio controlled by software? - YES





Benefits of SDR's

Would your radio allow you to transmit a new mode? (FM, AM, SSB, CW). Most radios have fixed modes.

Does your radio allow you to define the button/knob settings? Most radios are vendor defined buttons & knobs.

Does your radio allow you to add a new feature or control?
Most radios have fixed features.



Disadvantages of SDR's

Must have a computer or interface to control the radio.

Analog to digital conversion and CPU clock cycles comes at a price.

Software reliability instead of a hardware based solution.

User adaption, I NEED KNOBS!





Getting Started - What do I need?



Computer - any computer made in the past 5 years can run almost any of the SDR software packages

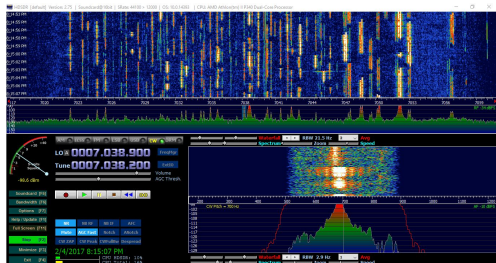


SDR Software - downloaded from the internet, typically a free open source package

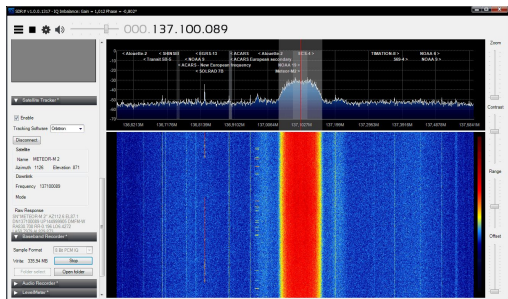


SDR Dongle - typically a USB hardware device with small antenna attached

SDR Software



HDSDR - www.hdsdr.de. Free SDR software, most popular, has built in drivers for most of the RTL-SDR dongles and IF output.



SDR# - www.sdrplay.com. Free SDR software. Designed to work with Airplay SDR, but will work with almost any RTL-SDR hardware.

For Mac and Linux try the following SDR packages : Linrad & GQRX

SDR Hardware

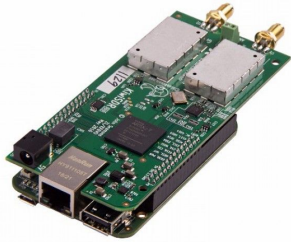


RTL-SDR - www.rtl-sdr.com. Amazon \$25 bucks, can be used with almost any SDR software package. Good cheap entry level dongle.



SDRPlay- www.sdrplay.com \$200, can be used with almost any SDR software package. Really good reviews with SDR community.

SDR Hardware (cont')



Kiwi SDR - www.kiwisdr.com. \$299, software is open source and very configurable. Can stream signals to the web via sdr.hu account. Hardware is a Beagle board + SDR add on.



Hack RF - www.greatscottgadgets.com. \$350, open source. One of the original SDRs in the hacker community. Has very minimal TX (50mA) capabilities.

Amateur Radio SDR's (RX/TX)



ELAD FM Duo

<http://shop.elad-usa.com/>

HF + 6m

QRP

Cost \$1200



ICOM IC7300

<http://shop.elad-usa.com/>

HF + 6m

100W

#15 on Sherwood

Engineering Receiver Test

Cost \$1400



FlexRadio 6000 Series

<http://www.flexradio.com>

HF + 6m

100W

#1 on Sherwood

Engineering Receiver Test

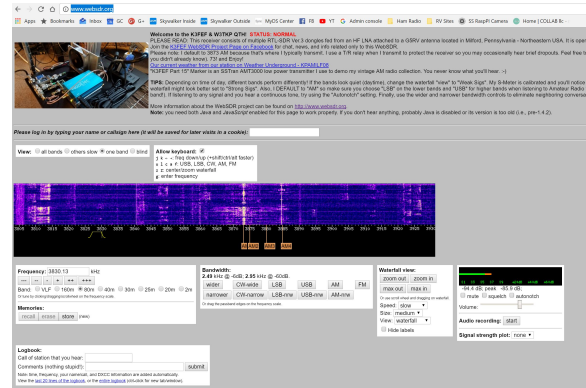
Cost \$2000 to \$7000



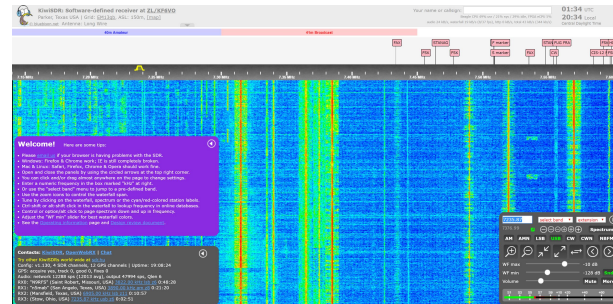
SDR Resources (Web Listening)



WebSDR - <http://www.websdr.org/>



Kiwi SDR - WebSDR - <http://http://kiwisdr.com/>





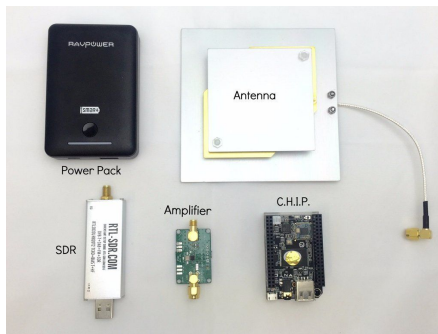
SDR Projects (Non Amateur Radio)



Flight Aware

www.flightaware.com

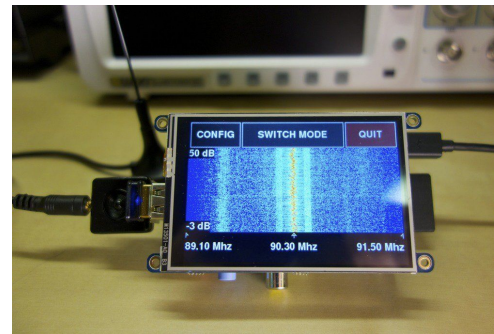
Ground station airplane tracking. Total investment is around \$100 bucks.



Outernet

www.outernet.com

Free satellite downlink (20m a day) for internet access to remote locations.



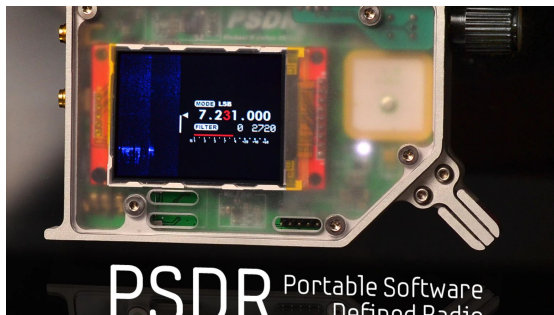
Portable SDR

<https://www.rtl-sdr.com/a-portable-sdr-project/>

Cheap portable scanner with a Raspberry Pi and display



SDR Projects (Amateur Radio)



Pocket SDR

www.kickstarter.com

Kickstarter project for
QRP portable operation



[larger image](#)

- 15m/12m/10m

Built SoftRock RXTX Ensemble Transceiver **\$124.00**

The SoftRock RXTX Ensemble is a 1 watt SDR transceiver, built for oper.

- 160m
- 80m/40m
- 40m/30m/20m
- 30m/20m/17m

Softrock Transceiver

www.fivedash.com

Transceiver kits with
board and components.



SDR Resources (More Info)

RTL-SDR.COM

RTL-SDR (RTL2832U) and software defined radio news and projects. Also featuring Airspy, HackRF, FCD, SDRplay and more.



List of software-defined radios

From Wikipedia, the free encyclopedia

This article provides a list of commercially available **software-defined radio** receivers.

Name	Type	Frequency range	Max bandwidth	<div><div></div><div></div></div> <div>TX capable</div>	<div><div></div><div></div></div> <div>Sampling rate</div>	<div><div></div><div></div></div> <div>Panadapters / Receivers</div>	<div><div></div><div></div></div> <div>Host Interface</div>	<div><div></div><div></div></div> <div>Windows</div>	<div><div></div><div></div></div> <div>Linux</div>	<div><div></div><div></div></div> <div>Mac</div>	<div><div></div><div></div></div> <div>FPGA</div>	<div><div></div><div></div></div> <div>Base price</div>
ADAT ADT-200A ^[1]	Pre-built	10 kHz – 30 MHz (planned modules for 50–54 MHz, 70.0–70.5 MHz, and 144–148 MHz)	0.5–100 kHz		?	1/3	Embedded system (no computer needed), USB, Internet remote	Yes, with option R-1 & ADAT Commander	?	?		CHF 5,220
AD-FMCOMMS2-EBZ ^[2]	Pre-built	2400 – 2500 MHz		Yes	61.44 MSPS	2/2	FMC (to Xilinx board) then USB 2.0 or Gigabit Ethernet.	Yes	Yes	Yes		US\$750

https://en.wikipedia.org/wiki/List_of_software-defined_radios



SDR Resources (More Info)

Software Defined Radio (SDR) for Amateur Radio – An Overview



Steve Dick, K1RF

February 11, 2015

Comm Center
100 Fairfield Ave
Norwalk, CT





SDR's on Sherwood Engineering

<http://www.sherweng.com/table.html> - out of the top 25 receiving radios on the list, 12 are SDR's

Updated 24 July 2017 added Elecraft KX2 & more FT 817															
Device Under Test	Price (USD)	ADC Value (V)	dB	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value	Min/Max Value
Added 12/09/12 FirstRadio Systems 6100 Hardware Updated	-118 -120M	3.0 1.0M	N/A	130 preamp OFF	2.0 0.1M	145 131	10 10	D Band Pass	115	99	208.2	100%	208.2		
Added 12/01/17 Elecraft K1 2nd Sample	-120 -120M	1.5 0.1M	3	130	0.2M 0.1M	144 146	10 10	D Band Pass	110	107%	20	100%	208%	2	
Added 12/17/17 Elecraft K1 2nd Sample	-120 -120M	1.5 0.1M	3	130	0.2M 0.1M	144 146	10 10	D Band Pass	110	100%	20	100%	208%	2	
Added 12/19/17 Elecraft K1 (K1.5 Core Rev4) New Hardware	-120 -120M	1.5 0.1M	3	141	0.2M 0.1M	145 147	10 10	D Band Pass	108	100%	20	100%	208%	2	
Added 01/05/18 Soni K1.5 Rev4	-120 -120M	1.5 0.1M	3	140	0.2M 0.1M	148 153	10 10	A 7th Pass	100	100%	20	100%	208%	2	
Added 01/06/18 Elecraft FT 817 Rev4 Hardware Rev 7.100	-120 -120M	1.5 0.1M	3	142	0.2M 0.1M	144 149	10 10	A 7th Pass	100	100	20	100%	208%	2	
Added 01/08/18 Elecraft KX2	-120 -120M	1.5 0.1M	3	138	0.2M 0.1M	144 145	10 10	D Band Pass	100	100	20	100%	208%	2	
Added 12/01/18 Elecraft K1	-120 -120M	1.5 0.1M	3	127	0.2M 0.1M	133	10	D Band Pass	95	104	20	100%	208%	2	
Added 12/01/18 Elecraft K1	-120 -120M	1.5 0.1M	3	140	0.2M 0.1M	138	10	D Band Pass	105	104	20	100%	208%	2	
Added 01/11/18 Rohde ANAL-SDR Tuned 12/17/2017	-120 -120M	1.5 0.1M	3	123	0.1M 0.1M	131 137	10 10	D Band Pass	95	99	20	99%	208%	2	
Updated 12/09 Powers	-120 -120M	1.5 0.1M	3	125	0.1M 0.1M	147	10	D Band Pass	100	99	20	99	208%	2	
Added 12/17/17 FirstRadio Systems 6100 2nd Sample (1 sample)	-120 -120M	3.0 1.0M	N/A	130 preamp OFF	2.0 0.2M	145 131	10 10	D Band Pass	115	99	208.2	100%	208.2		
Added 12/19/17 FirstRadio Systems FLX3-5000A	-120 -120M	3.0 0.1M	3	120	0.1M 0.1M	123	10	D Band Pass	98	99	20	99	208%	2	
Added 12/19/17 Elecraft K1	-120 -120M	1.5 0.1M	3	130	0.2M 0.1M	128	10	D Band Pass	100	97	20	97	208%	2	
Added 01/05/18 Soni K1.5 Rev4	-120 -120M	1.5 0.1M	3	123	0.2M 0.1M	123 147	10 10	D Band Pass	85	100%	20	100%	208%	2	
Updated 01/19/18 Ten Tec Omni	-120 -120M	1.5 0.1M	3	137	0.2M 0.1M	130	10	D Band Pass	100	96	20	96	208%	2	
Added 12/09/17 Elecraft FT 817 Rev4 Drive Conversion Mode	-120 -120M	1.5 0.1M	3	137	0.2M 0.1M	139 141	10 10	D Band Pass	100	104	20	97	208%	2	
Added 01/02/18 Ten Tec Argonaut V1	-120 -120M	1.5 0.1M	3	127	0.1M 0.2M	127 134	10 10	D Band Pass	97	95	20	97	208%	2	
Added 12/19/18 Ten Tec Eagle	-120 -120M	1.5 0.1M	3	128	0.1M 0.1M	143	10	D Band Pass	97	93	20	97	208%	2	
Added 12/19/18 FirstRadio Systems FLX3-5000	-120 -120M	3.0 0.1M	3	110	0.1M 0.1M	120	10	D Band Pass	97	97	20	97	208%	2	
Updated 12/17/17 FirstRadio Systems 6100 Privacy Updated	-120 -120M	3.0 1.0M	N/A	130 preamp OFF	2.0 0.2M	143 148	10 10	D High & Low Pass	110	89	208.2	89%	208.2		
Added 12/19/18 Elecraft FT 817 Rev4 (1 sample) Drive Conversion Mode For 13-Conversion and 13-18 Rev4 at 18 dB	-120 -120M	1.5 0.1M	3	144	0.2M 0.1M	140	10	D Band Pass	97	100	20	97	208%	2	



Flex Radio Demo

