

Elegant Software Radio Tools for a More Civilized Age



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Elegant Tools

- Enables you without getting in your way.
 - Keep easy things easy, make hard things possible.
 - Can focus on what matters.
 - Provides a delightful user experience.
-
- Use the best tool for the job.

Elegant Tools



Elegant Tools



Elegant Tools



Elegant Tools

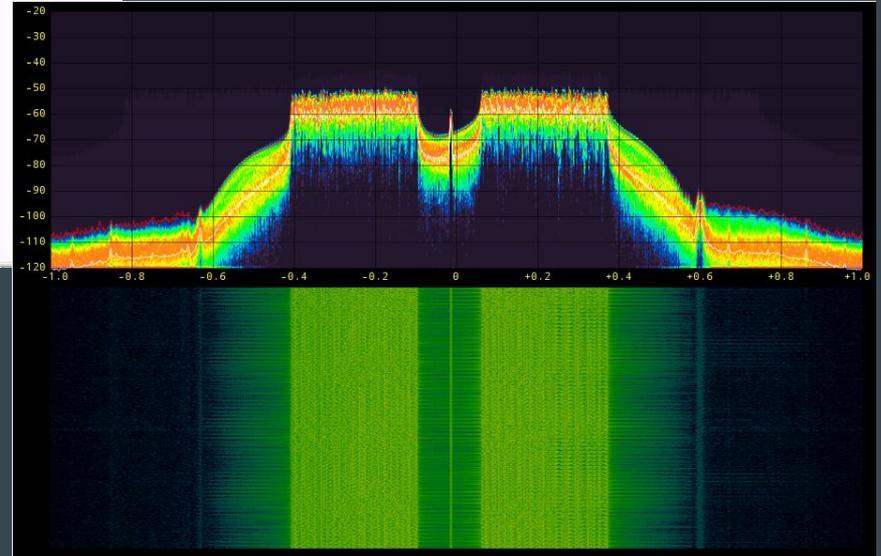
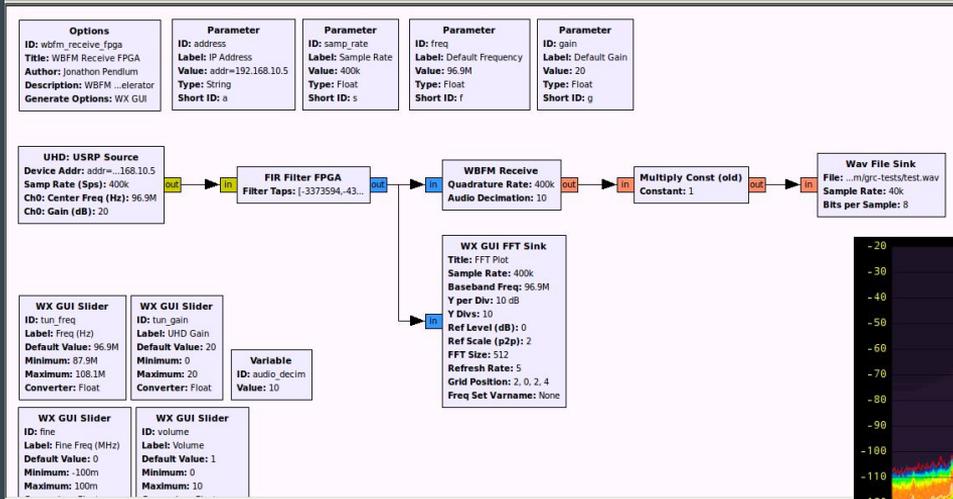


A Survey of Tools

- There are lots of tools out there!
- Can't cover them all in ~20 minutes.
- Will just cover the tools we see used most commonly.

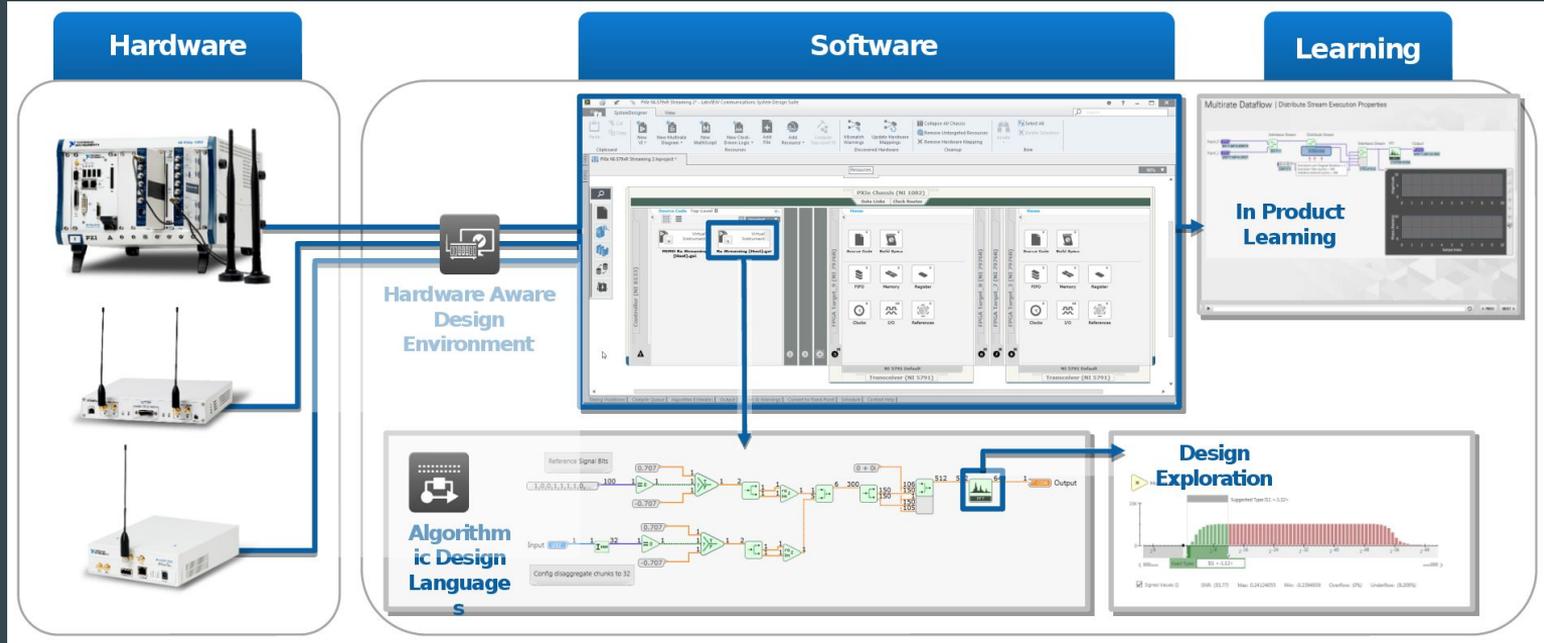
Design Tools

GNU Radio



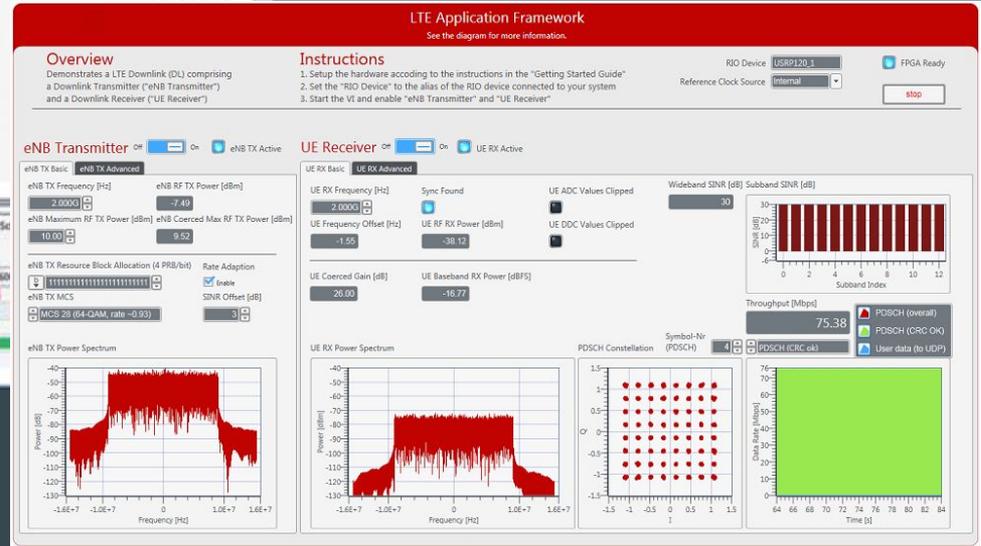
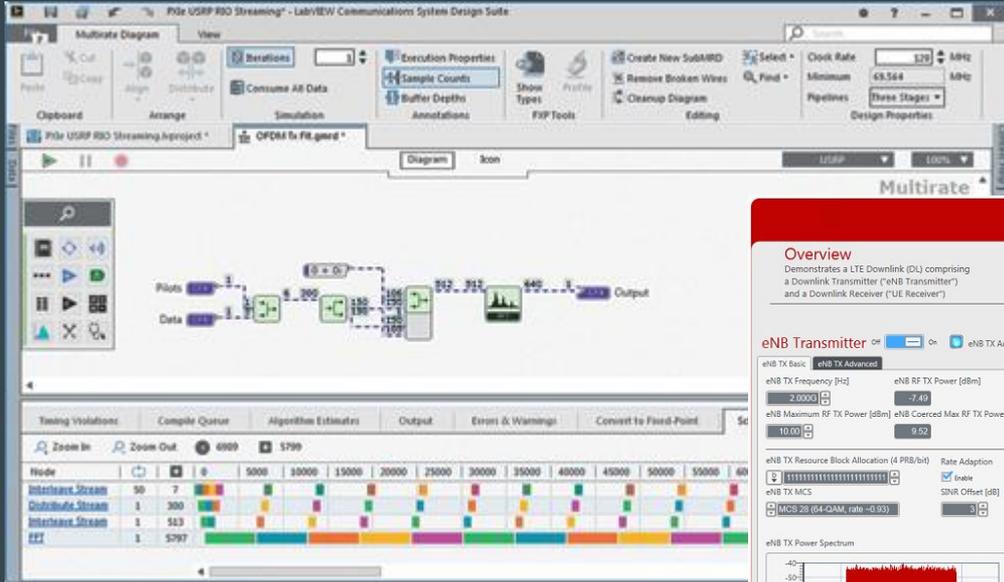
- Very popular, active community
- Lots of blocks ready-to-use
- GPL

LabVIEW Communications



- From Design to Test
- Reference Designs, Examples, Support
- Commercial Product

LabVIEW FPGA



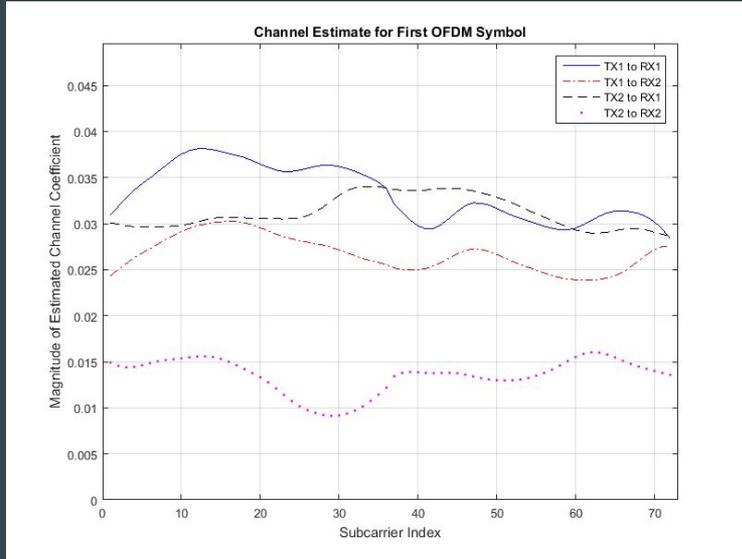
- Graphical FPGA Design
- LTE, 802.11 App Frameworks
- Commercial Product

Matlab

```
radioFound = false;
radiolist = findsdru;
for i = 1:length(radiolist)
    if strcmp(radiolist(i).Status, 'Success')
        if strcmp(radiolist(i).Platform, 'B210')
            radio = comm.SDRUReceiver('Platform','B210', ...
                'SerialNum', radiolist(i).SerialNum);
            radio.MasterClockRate = 1.92e6 * 4; % Need to exceed 5 MHz minimum
            radio.DecimationFactor = 4;         % Sampling rate is 1.92e6
            radioFound = true;
            break;
        end
        if (strcmp(radiolist(i).Platform, 'X300') || ...
            strcmp(radiolist(i).Platform, 'X310'))
            radio = comm.SDRUReceiver('Platform',radiolist(i).Platform, ...
                'IPAddress', radiolist(i).IPAddress);
            radio.MasterClockRate = 184.32e6;
            radio.DecimationFactor = 96;         % Sampling rate is 1.92e6
            radioFound = true;
        end
    end
end
end
```

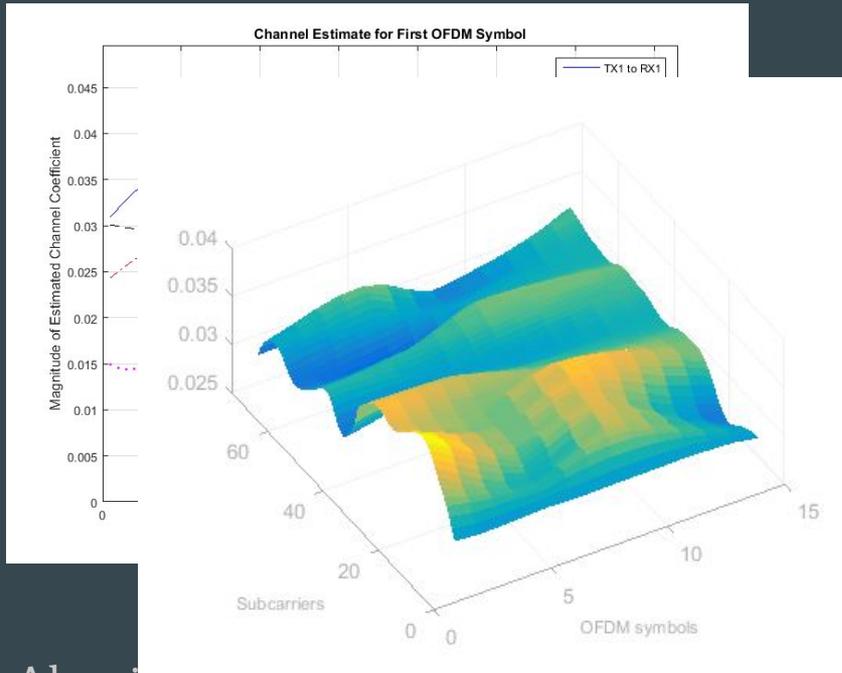
- Algorithm Design
- Great support for USRPs!
- Commercial Product

Matlab



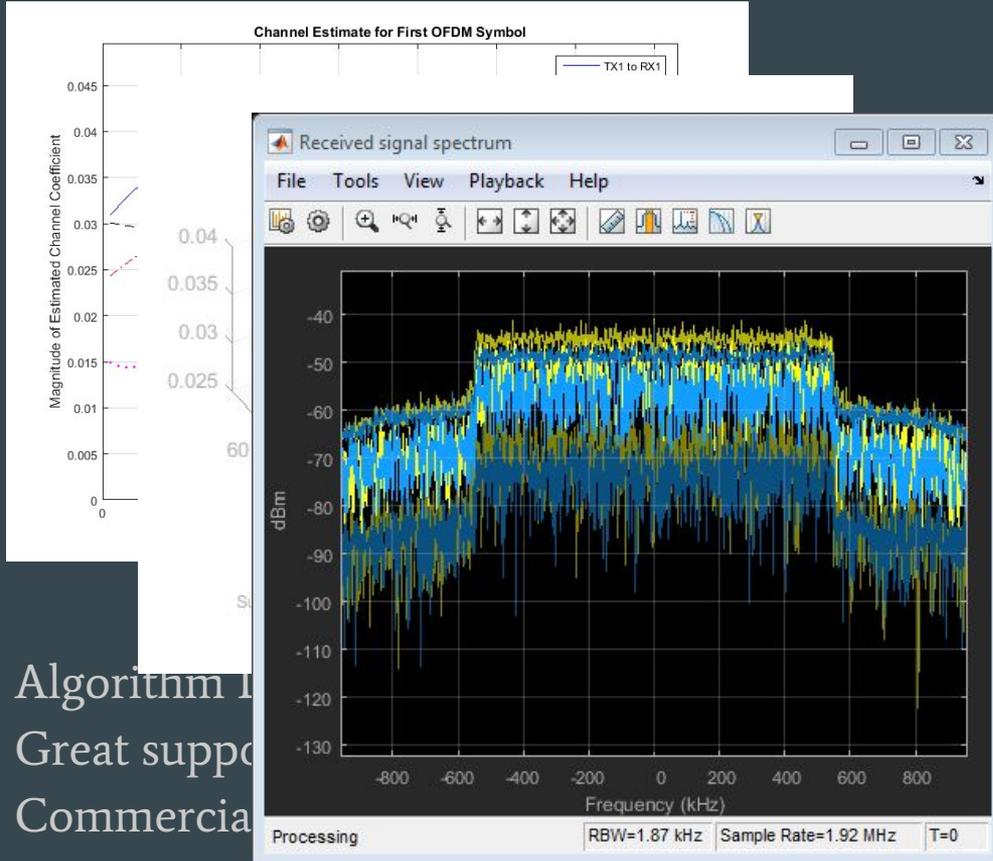
- Algorithm Design
- Great support for USRPs!
- Commercial Product

Matlab



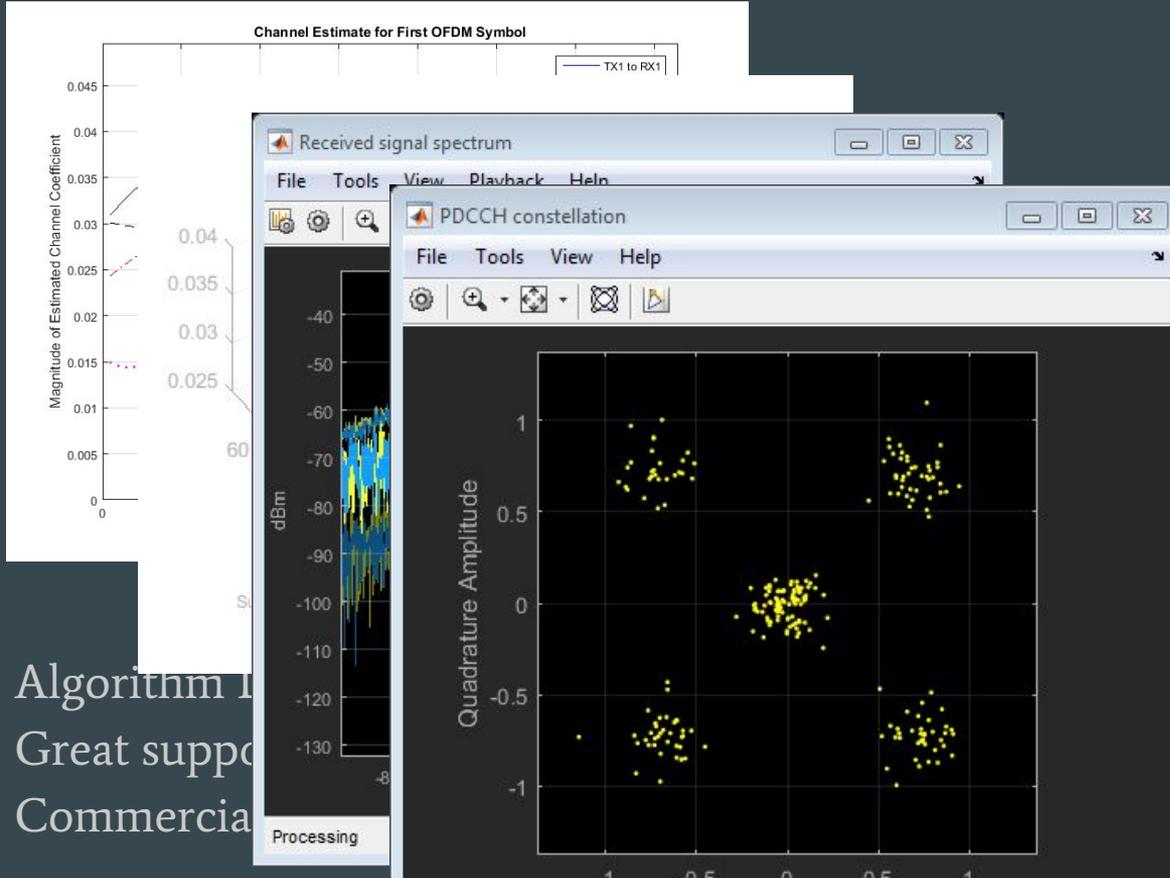
- Algorithm Design
- Great support for USRPs!
- Commercial Product

Matlab



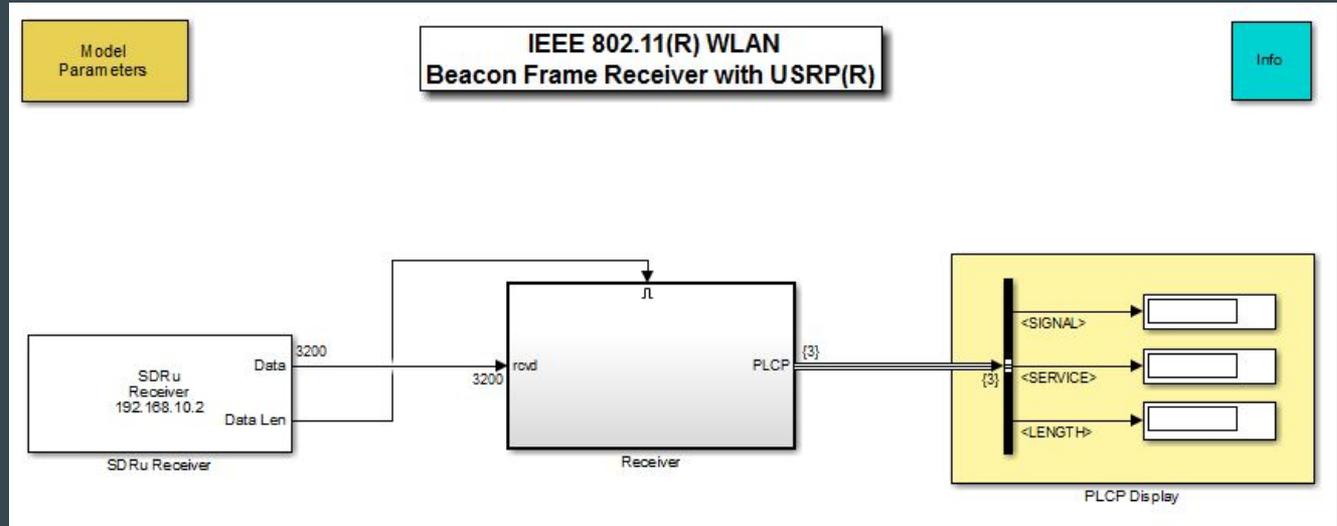
- Algorithm I
- Great support
- Commercial

Matlab



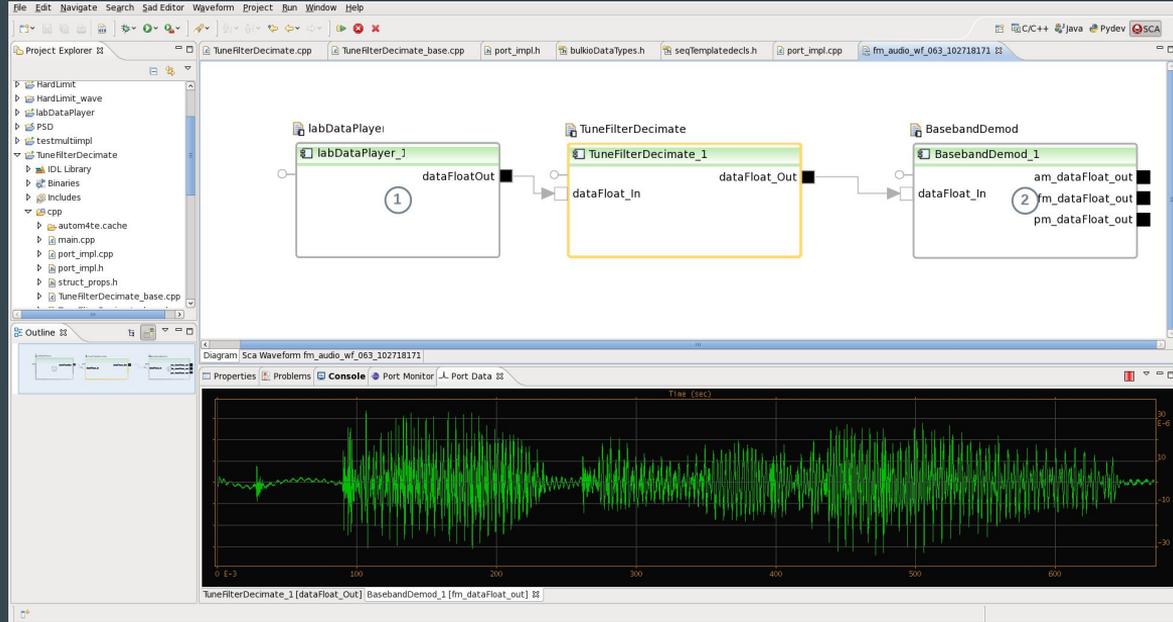
- Algorithm 1
- Great support
- Commercial

Simulink



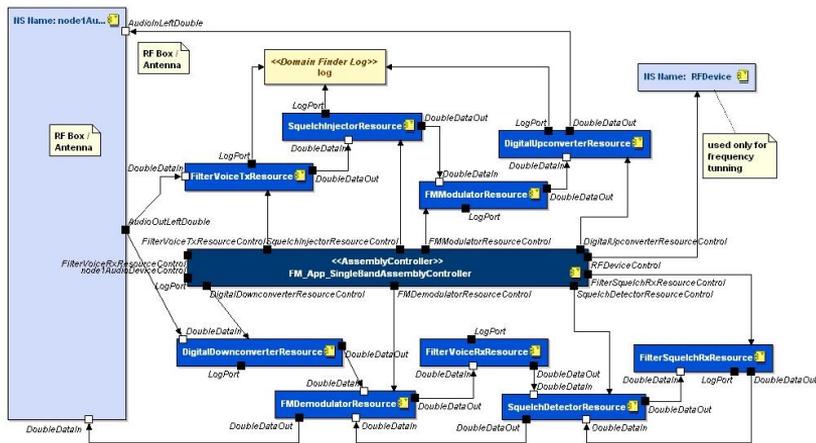
- Model-Based Design
- Generate HDL from Block Diagrams
- Commercial Product

REDHAWK



- Eclipse-based Design Tool
- SCA Framework
- LGPL

NordiaSoft SCARI



NordiaSoft Radio Manager

File View Application Tools Window Help

Radio Hierarchy

- Radio
 - SCARI/DomainManager
 - LinuxAudioNodeDeviceManager
 - USRP_UHD_Device
 - SCARI/USRP_UHD_AM_Transceiver/ExecutableDevice
 - SCARI/USRP_UHD_AM_Transceiver/Filter
 - SCARI/USRP_UHD_AM_Transceiver/AM
 - SCARI/USRP_UHD_AM_Transceiver/Sig
 - LinuxAudioNodeAudioDevice
 - LinuxAudioNodeLogger
 - USRP_UHD_AM_Transceiver
 - USRP_UHD_FM_Transceiver
 - USRP_UHD_Wideband_FM_Receiver

Radio Topology

Log

LinuxAudioNodeLogger

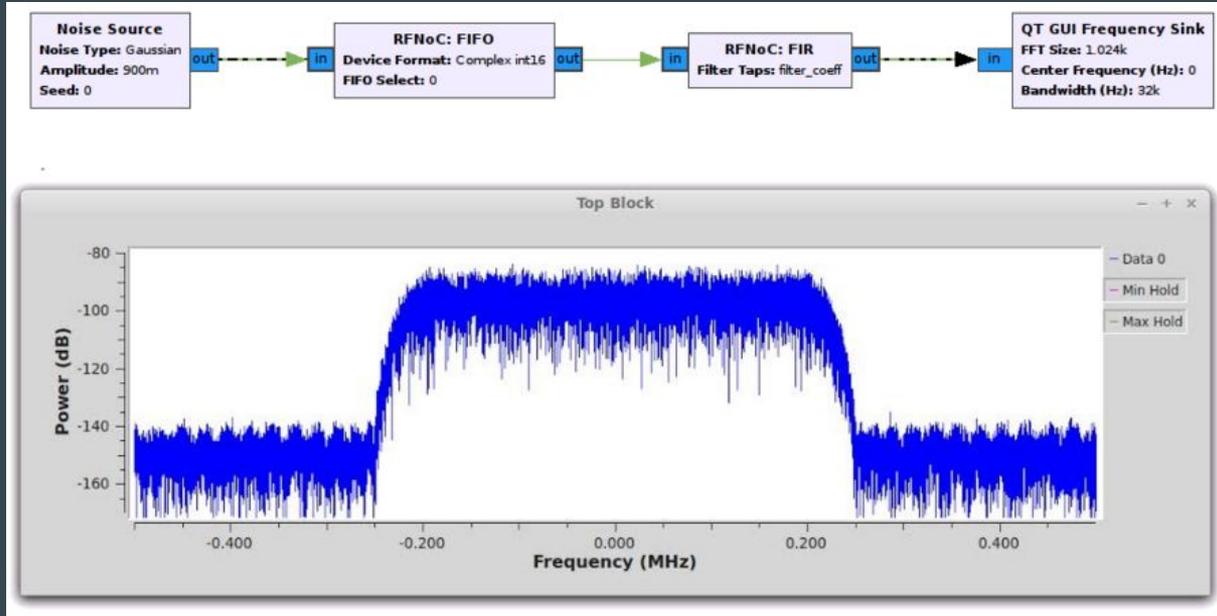
Log Level... RegEx Filter... Refresh Clear Max message count: 200 Auto refresh 1

| Source | Level | Data | Time |
|---------------------|-------|--|---------------------------|
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:fileMgr:777] FileManager obtained by a client | 20150923 04:26:43:799.667 |
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:fileMgr:777] FileManager obtained by a client | 20150923 04:26:43:825.74 |
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:fileMgr:777] FileManager obtained by a client | 20150923 04:26:43:850.193 |
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:deviceManagers:668] DeviceManager list obtained by a | 20150923 04:26:51:343.688 |
| SCARI/DomainManager | 8 | [ApplicationFactoryManager.cc:getApplicationFactories:1200] ApplicationFactory | 20150923 04:26:51:345.593 |
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:applications:730] Application list obtained by a client | 20150923 04:26:51:346.041 |
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:fileMgr:777] FileManager obtained by a client | 20150923 04:26:51:359.842 |
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:fileMgr:777] FileManager obtained by a client | 20150923 04:26:51:376.602 |
| SCARI/DomainManager | 8 | [DomainManagerImpl.cc:fileMgr:777] FileManager obtained by a client | 20150923 04:26:51:393.887 |

App USRP_UHD_AM_Transceiver: DCE:b319e441-e9a9-4c31-b517-a491b6c6f66e:USRP_UHD_AM_Transceiver

- SCA CF & Design Tools
- SCA Compliant!!
- Commercial Product

RFNoC



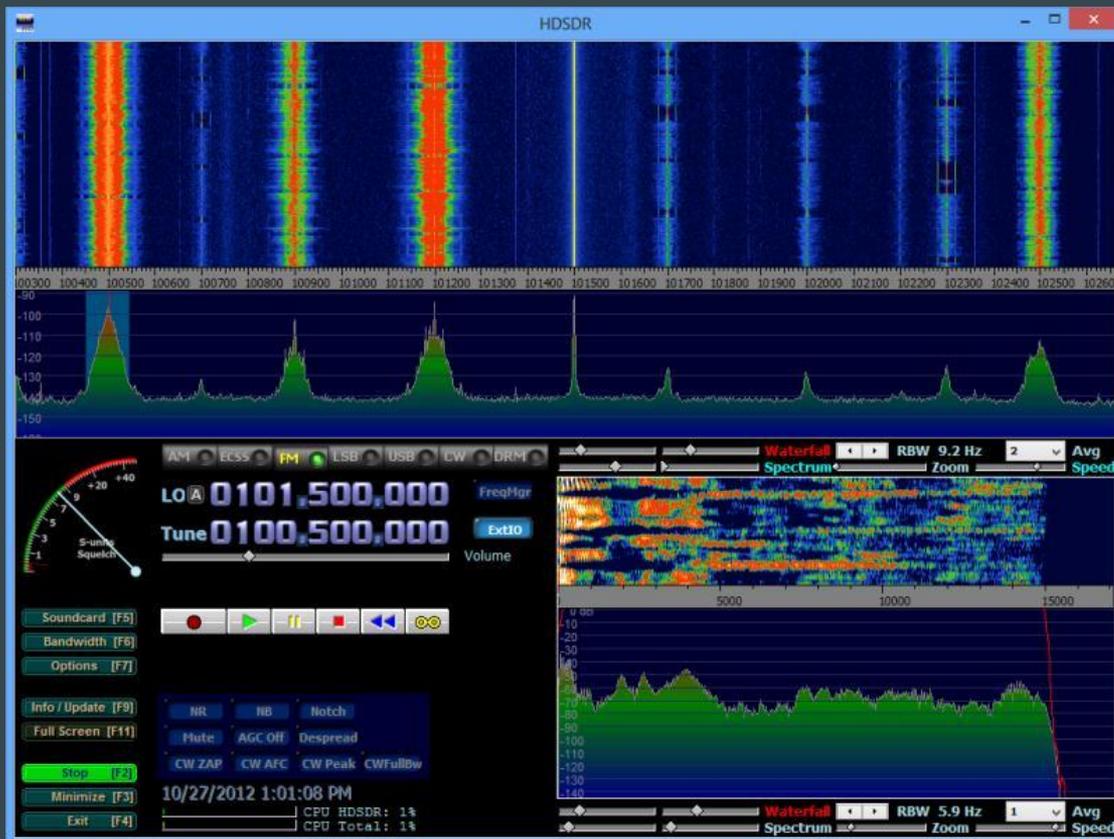
- Heterogenous Processing (focused on FPGA right now)
- Built on GNU Radio
- GPL

User Front-Ends

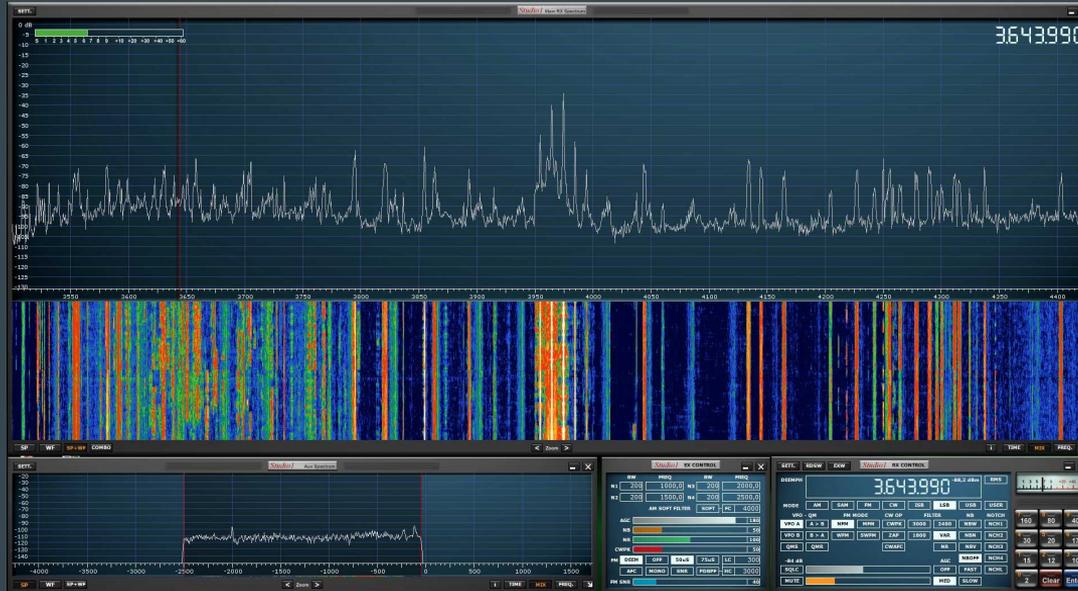
HSDR

- Spectrum Analysis
- Click-to-Tune!
- Send to Audio
- Windows Only
- Proprietary

<http://www.hsdn.de/index.html>



Studio1

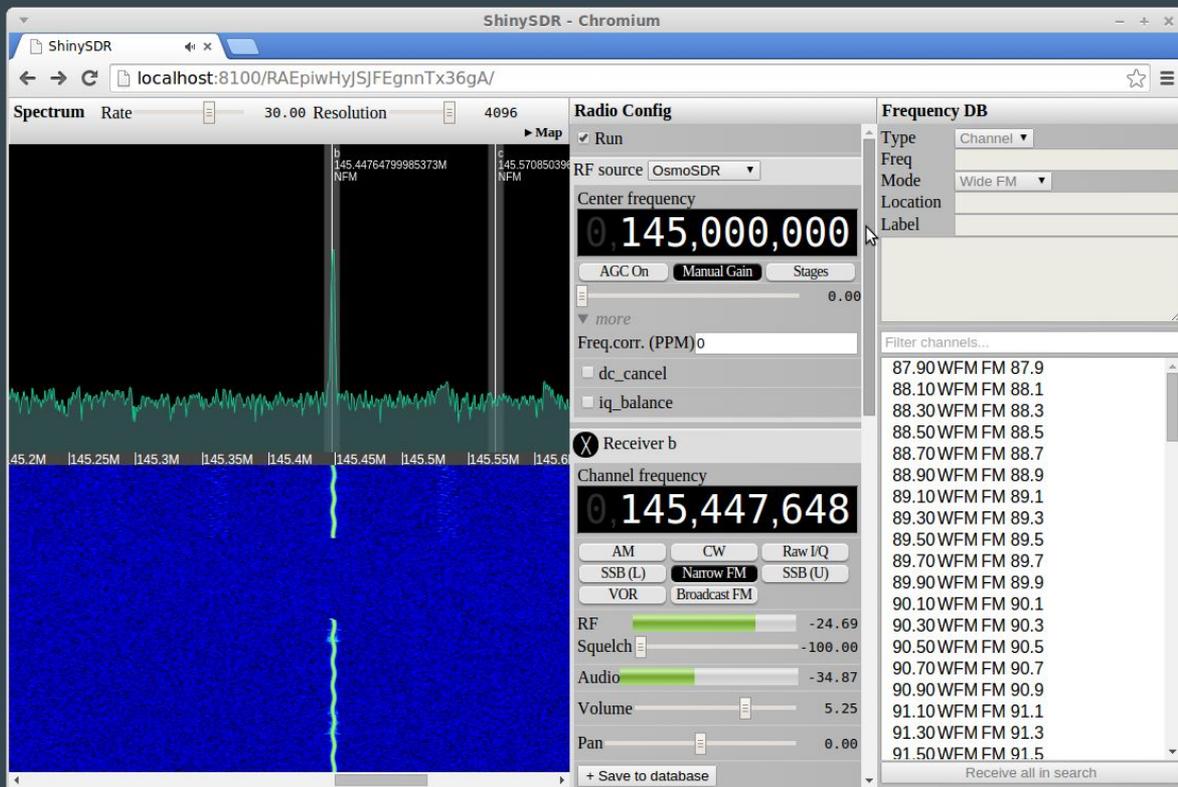


- HAM
- Includes Demod
- Windows Only
- Proprietary

<http://www.woodboxradio.com/studio1.html>

ShinySDR

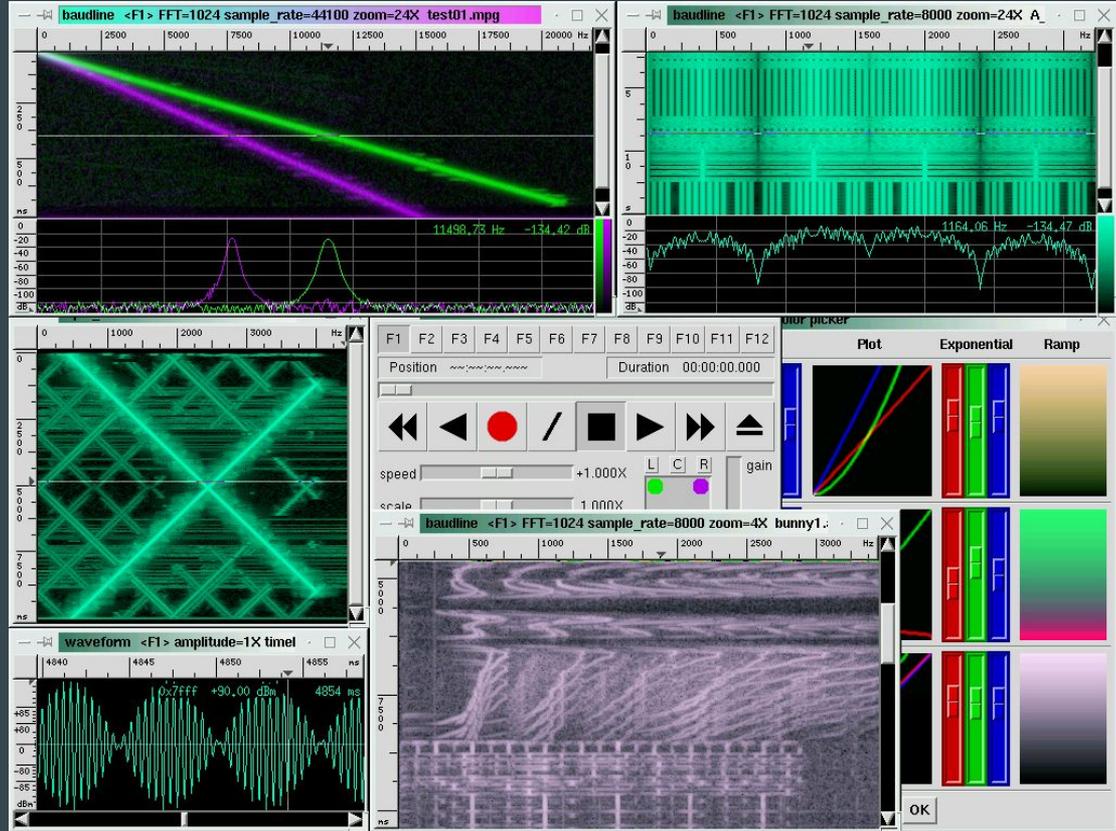
- Web Based
- Remote Access
- Includes Demods
- Uses GNU Radio
 - Custom Blocks
- GPL



<https://github.com/kpreid/shinysdr>

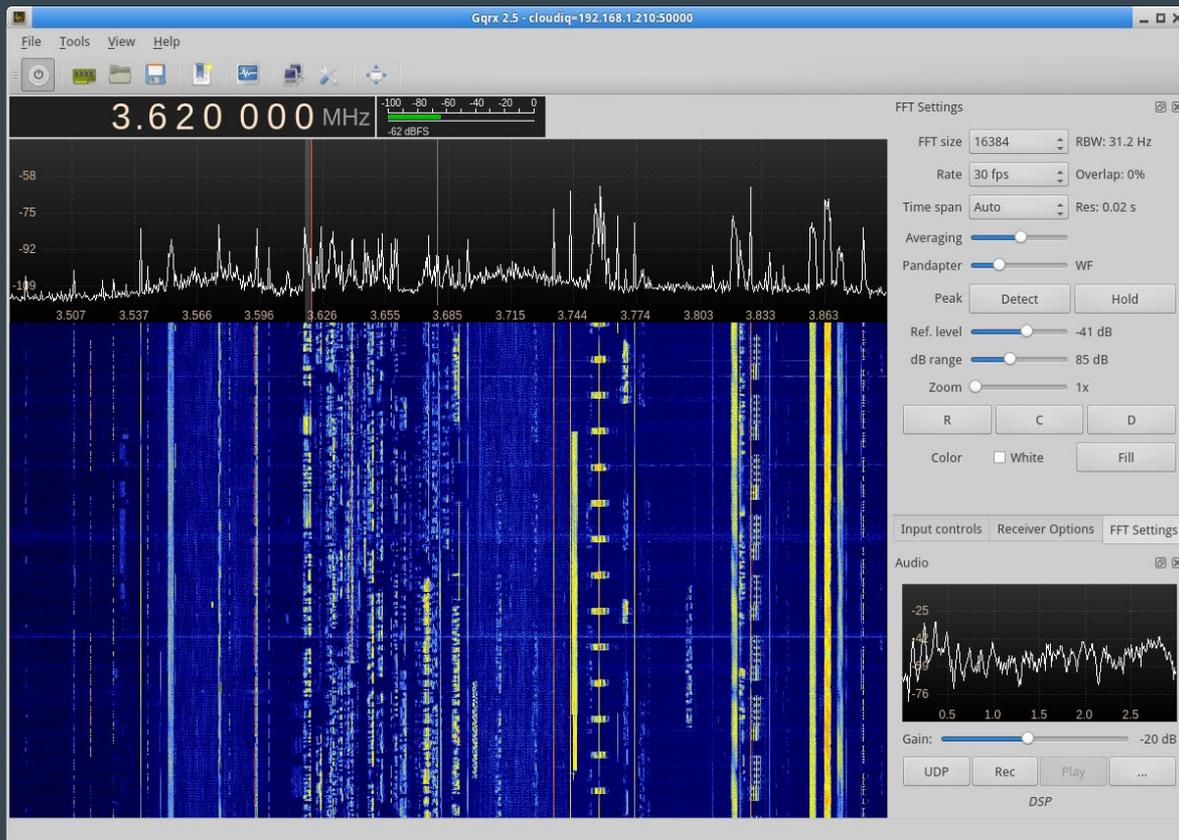
Baudline

- Signals Analysis
- Post Processing
- Proprietary



<http://www.baudline.com/>

Gqrx



- Spectrum Analysis
- Includes Demods
- AGC, Squelch, etc.,
- Uses GNU Radio
- GPL

<http://gqrx.dk/>

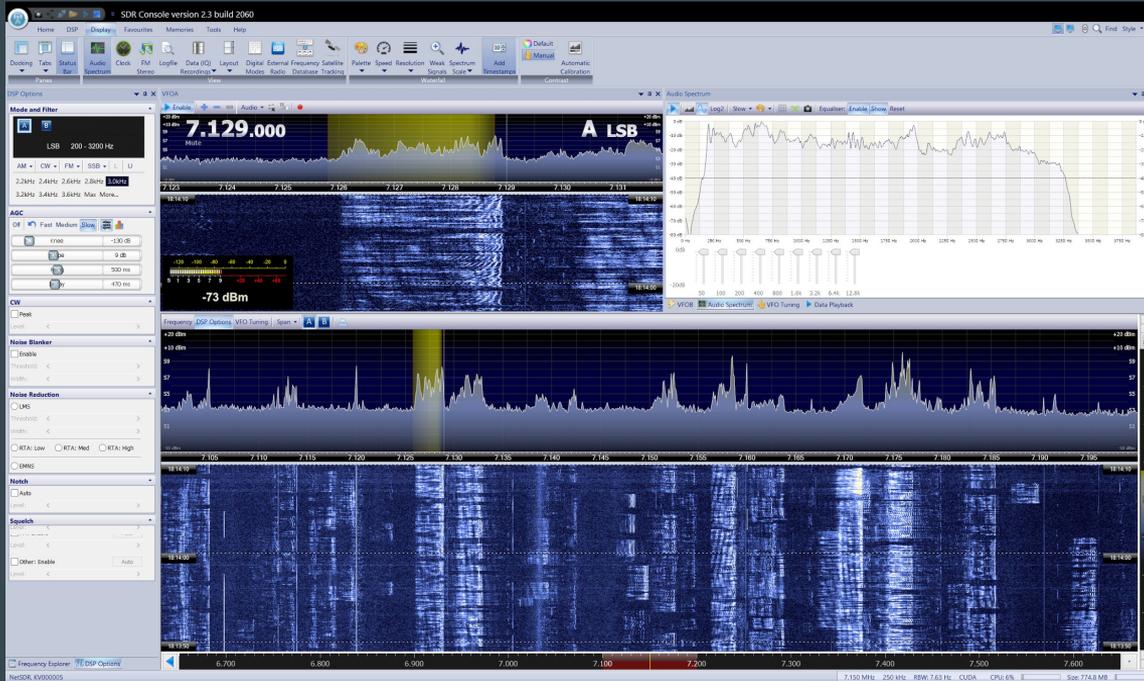
SoDaRadio

- HAM Front-End
- Direct Text Entry
- BSD

The screenshot displays the SoDa Radio software interface. At the top, there is a menu bar with 'File', 'Configure', 'QSO Actions', and 'Help'. Below the menu is a tabbed interface with 'Waterfall' and 'Periodogram' tabs. The main display area is a waterfall plot showing frequency in MHz/kHz on the x-axis (ranging from -12.5 to 12.5) and amplitude on the y-axis. A vertical blue line is visible in the center of the plot. To the right of the plot are several control panels: 'Band Spread' (set to 25 kHz), 'Center Frequency' (set to 10368125), 'RX->CFreq', 'Y Rng (dB/box)' (set to 5dB), and 'Y RefLevel (dB)' (set to -5). Below the plot are controls for 'Mode' (set to CW_U), 'AF Bandwidth' (set to 2000 Hz), 'AF Gain', 'RF Gain', 'TX Frequency' (set to 10,368.118 111), and 'RX Frequency' (set to 10,368.118 111). There is a 'TX=RX Lock' checkbox checked. Below these are fields for 'From Grid' (FN41ee), 'Bearing' (331 T), 'To Grid' (fn33kd), 'Rev. Bearing' (150 T), 'To Call' (kw2t), and 'Range' (250 km). A 'Transmit CW Text' field contains the text: 'VVVVVVVVVVVVV', 'kw2t kw2t kw2t de kb1vc kb1vc kb1vc FN41ee FN41ee FN41ee _bk', and 'RRR QSL QSL QSLde kb1vc _bk'. Below this is a 'CW Control' section with buttons for 'Exchange', 'My Info', 'My Call', 'My Grid', 'QSL', 'BK', '73', 'V', and 'Carrier'. There is also a 'Repeat' control set to 3 and a 'Clear CW Buffer' button. At the bottom left, there is a 'Log Comment' field and a 'Log Contact' button. At the bottom right, there is a 'TX PTT' indicator showing 'TX OFF' and a table with columns 'TIME (UTC)', 'LAT', 'Grid', and 'LON'. The table contains the following data: TIME (UTC) 15:47:54, LAT 41.176, Grid FN41ee, LON -71.591. At the very bottom, there is a status bar with keyboard shortcuts: '^C Set To Call', '^G Set To Grid', '^L Enter Log Comment', '^X Enter CW Text', and the filename 'SoDa.soda_log'.

<http://sodaradio.sourceforge.net/Site/SoDaRadio.html>

SDR-Console

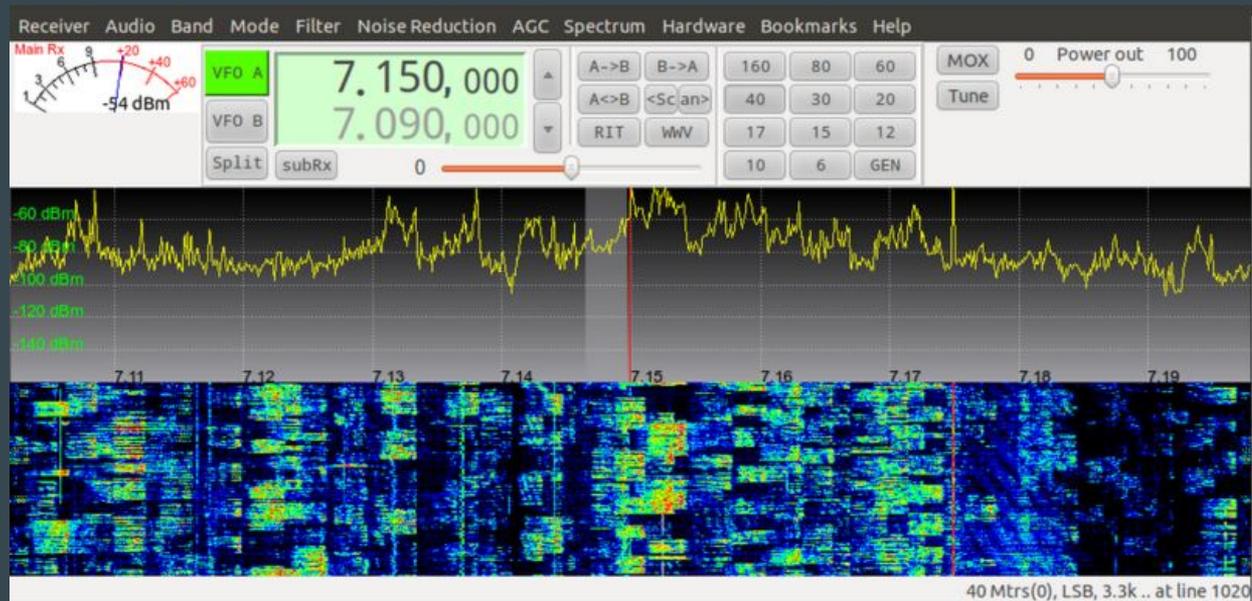


- HAM Focus
- Includes Demods
- Signal to Audio
- Proprietary

<http://sdr-radio.com/Software>

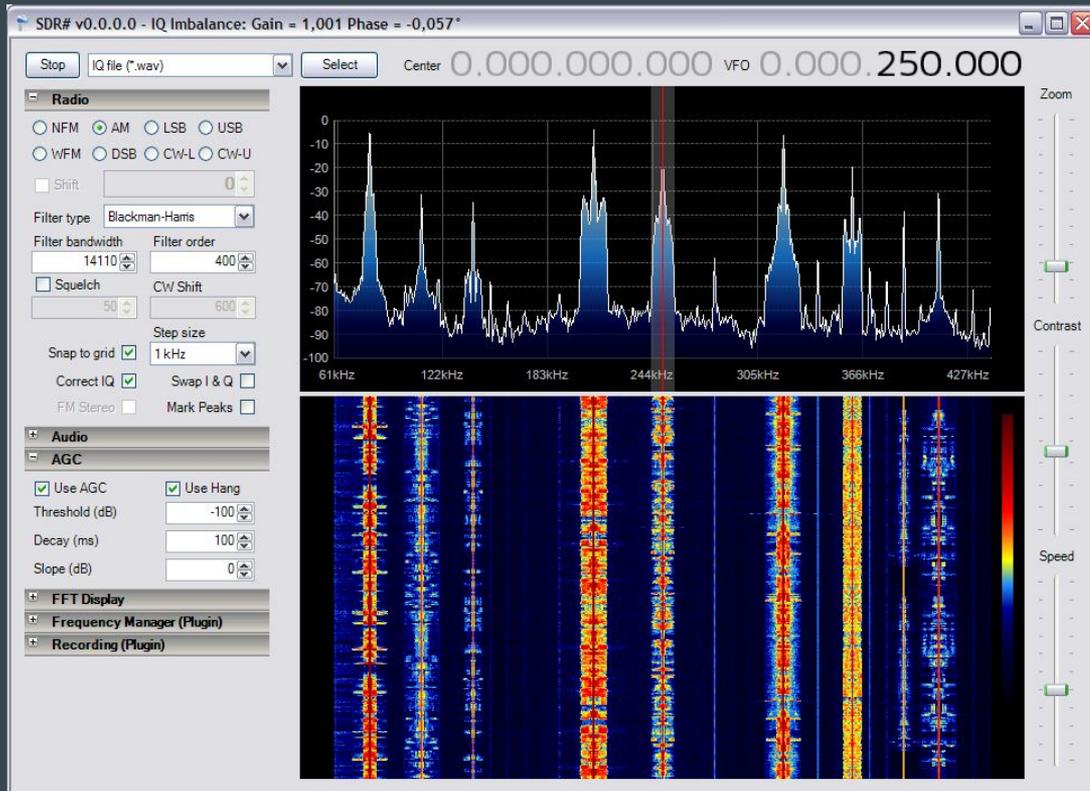
QtRadio / ghpsdr3-alex

- Server / Client
- Remote Access
- Map of Servers
- GPL



http://napan.ca/ghpsdr3/index.php/Main_Page

SDR#



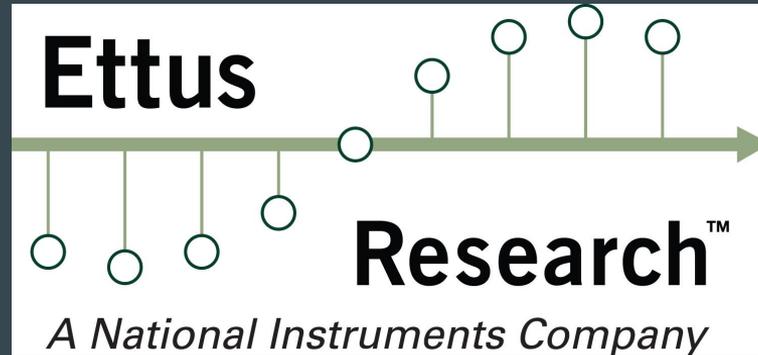
- Monitoring
- Windows Only
- Proprietary

<http://airspy.com/download/>

**Through the magic of software
abstraction...**

USRP Hardware Driver (UHD)

- Every tool in this presentation uses UHD to talk to USRPs
- C or C++ Interfaces
- Compile into dynamic or static library
 - Easy to package with your own application that uses USRPs!
- GPL or Proprietary Licenses Available



USRP

