



SDR Forum Dayton 2010



Linux - HPSDR

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- Existing software to support HPSDR
 - PowerSDR – runs on Windows
 - Combination of C and C#
 - KISS Konsole – runs on Windows
 - C#





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- Goal
 - Write Linux software for HPSDR





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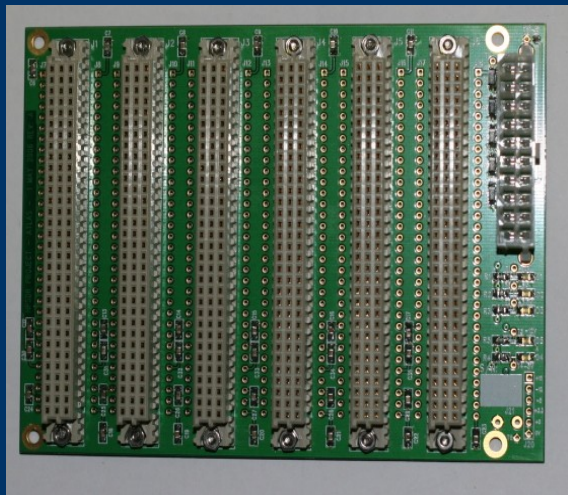
- HPSDR Hardware
 - Atlas Bus
 - Ozy/Magister USB I/O
 - Mercury receiver
 - Penelope transmitter
 - LPU Power Supply
 - Excalibur 10 MHz clock source
 - PennyWhistle RF Power Amplifier
 - Pandora Enclosure
 - Coming soon ...
 - Alex – RF Bandpass Filters
 - Ozy II – Ethernet I/O
 - Hermes – Single board HPSDR transceiver
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-



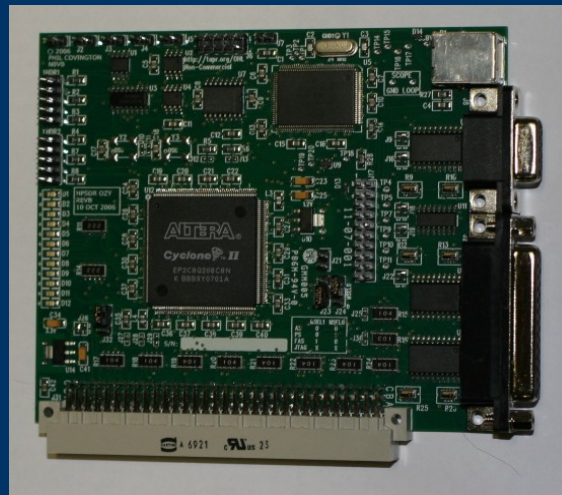
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- HPSDR Hardware



Atlas



Ozy/Magister



Mercury



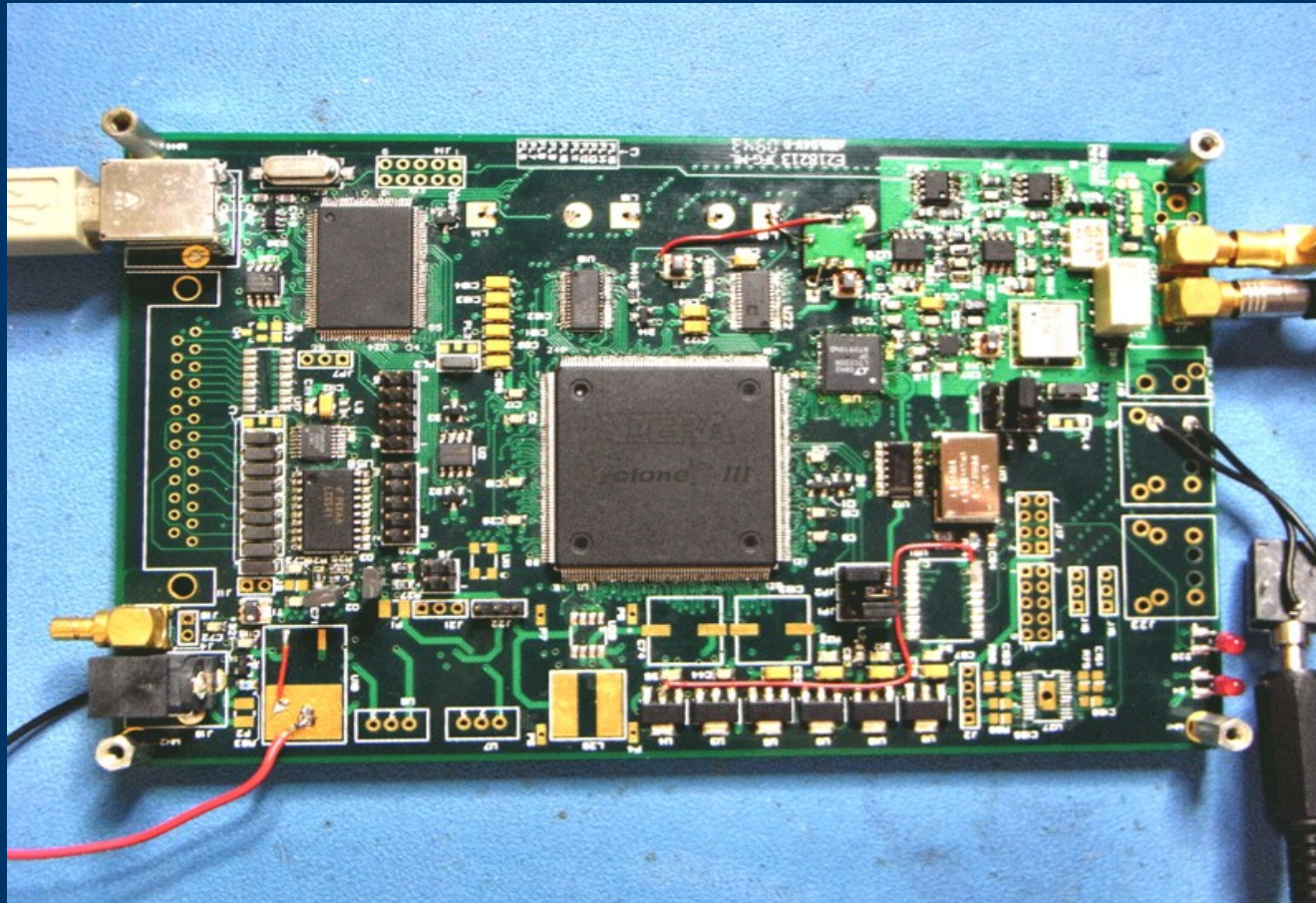
Penelope



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- HPSDR Hardware



Hermes



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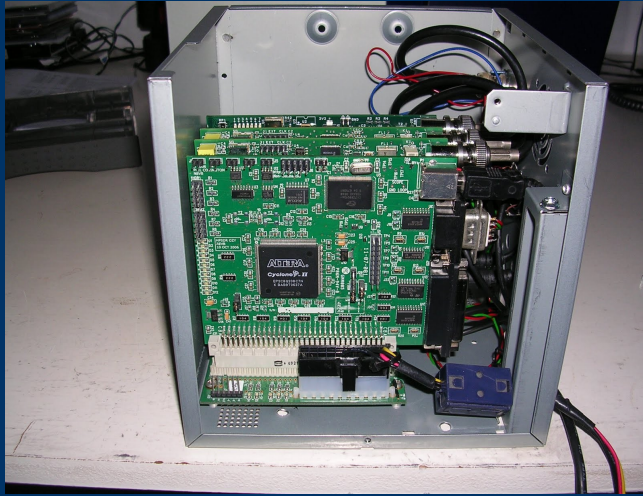


- HPSDR Hardware
 - FPGA on each card
 - Allows **reprogramming** of the hardware.
 - Original Mercury FPGA code implemented 1 receiver with either 48KHz, 96KHz or 192KHz bandwidth from anywhere within the 60MHz sampling range of the receiver.
 - New development to implement up to 8 receivers within a single Mercury card.





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- Software
 - USB interface to Ozy (packet rate for 48000 bps samples)
 - 512 byte packets
 - 8 byte header
 - Mox
 - Frequency (Rx or Tx or Both)
 - Full Duplex
 - Rx speed (48000,96000,192000)
 - Clock sources
 - Rx preamp
 - 63 Tx I/Q samples and audio samples
 - I and Q samples 16 bits each
 - Audio samples are 2 channels of 16 bits



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- Software
 - USB interface from Ozy (packet rate dependent on sample rate)
 - 512 byte packets
 - 8 byte header
 - PTT
 - Dash/Dot
 - ADC overflow
 - Software version of Ozy, Mercury, Penelope
 - Forward power
 - 63 I/Q and Microphone samples
 - I and Q samples 24 bits each
 - Microphone sample 16 bits





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- Software
 - USB bandscope interface from Ozy

4096 16 bit samples





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- Software
 - ghpsdr
 - Written in C
 - Uses DttSP for DSP functions
 - Uses GTK+ for GUI





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- Software
 - Multi threaded
 - thread to read USB I/Q and Microphone samples
 - thread to read USB bandscope samples
 - thread to process I/Q samples
 - thread to process bandscope samples
 - thread for spectrum/waterfall display update
 - thread for bandscope display update





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- Software

- Modular source code

agc.c	filter.c	ozy.c	spectrum_update.c
audio.c	frequency.c	ozy_ringbuffer.c	subrx.c
audiostream.c	hpsdr_setup.c	preamp.c	transmit.c
band.c		property.c	util.c
bandscope.c	libusbio.c	receiver.c	vfo.c
bandscope_control.c	main.c	setup.c	volume.c
bandscope_update.c	meter.c	sinewave.c	xvtr_setup.c
command.c	meter_update.c	soundcard.c	
display.c	mode.c	spectrum_buffers.c	
display_setup.c	ozy_buffers.c	spectrum.c	



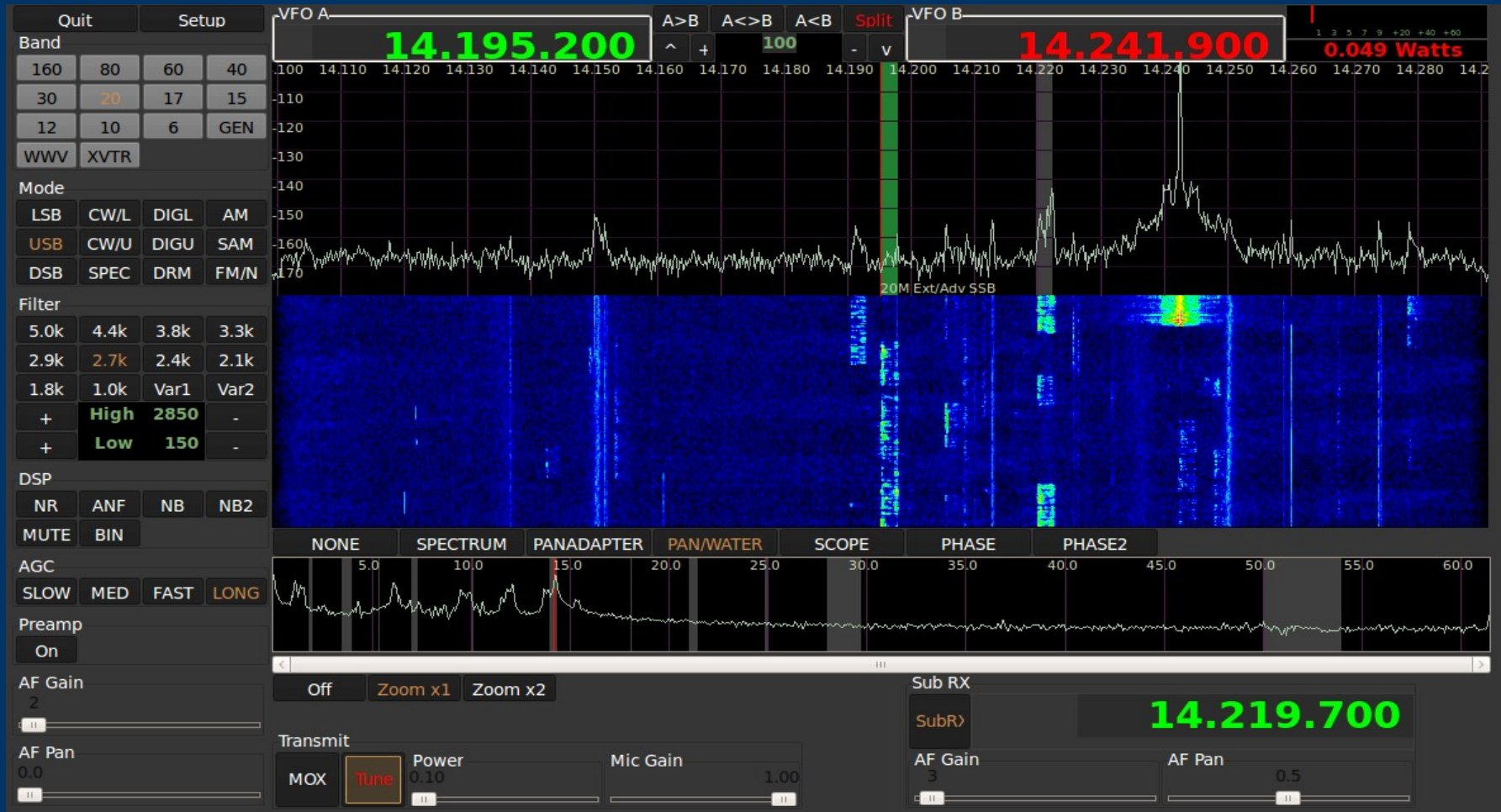


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- Software

ghpsdr





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- Software

ghpsdr





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- Software

ghpsdr





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- Software

But what about Mercury supporting multiple receivers?





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- Software

USB I/Q Data Stream

USB data is transferred in 512 byte packets.

8 bytes of header data.



Receiver I/Q data and Mic sample.



I and Q samples are 24 bits (3 bytes).

Microphone samples are 16 bits (2 bytes).

Number of samples per packet varies depending on number of receivers.

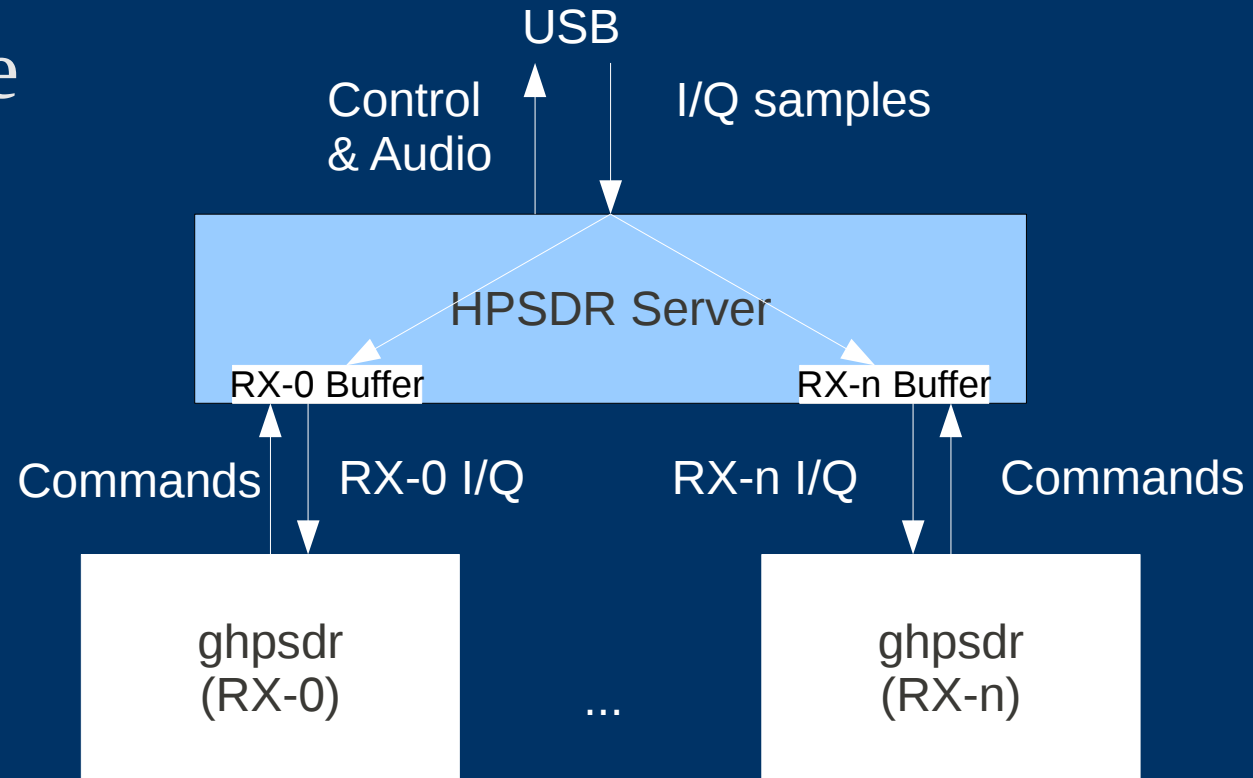




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- Software



TCP connection for Commands
I/Q data sent over UDP



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- Software





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- Software

The screenshot displays the gHPSDR software interface. The main window shows a spectrum analyzer with a frequency range from 7.010 to 7.100 MHz. The VFO A is set to 7.056.000 MHz and VFO B is set to 7.100.000 MHz. The signal level is -67 dBm. The interface includes various control panels for Band, Mode, Filter, DSP, AGC, Preamp, AF Gain, AF Pan, Transmit, Power, Mic Gain, and AF Pan. The right side of the interface features three receiver windows: HPSDR: RX1 7.008 to 7.104 MHz, HPSDR: RX2 3.652 to 3.748 MHz, and HPSDR: RX3 14.008 to 14.104 MHz. The bottom status bar shows the system tray with various icons and the taskbar with several open applications.



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- Software

Bandwidth Requirements

24 bit I samples
24 bit Q samples

48000 samples per second = **2304000** bits per second
96000 samples per second = **4608000** bits per second
192000 samples per second = **9216000** bits per second

For just 1 receiver!

8 receivers at 192000 = **73728000** bits per second

My broadband uplink speed is 360 Kbps

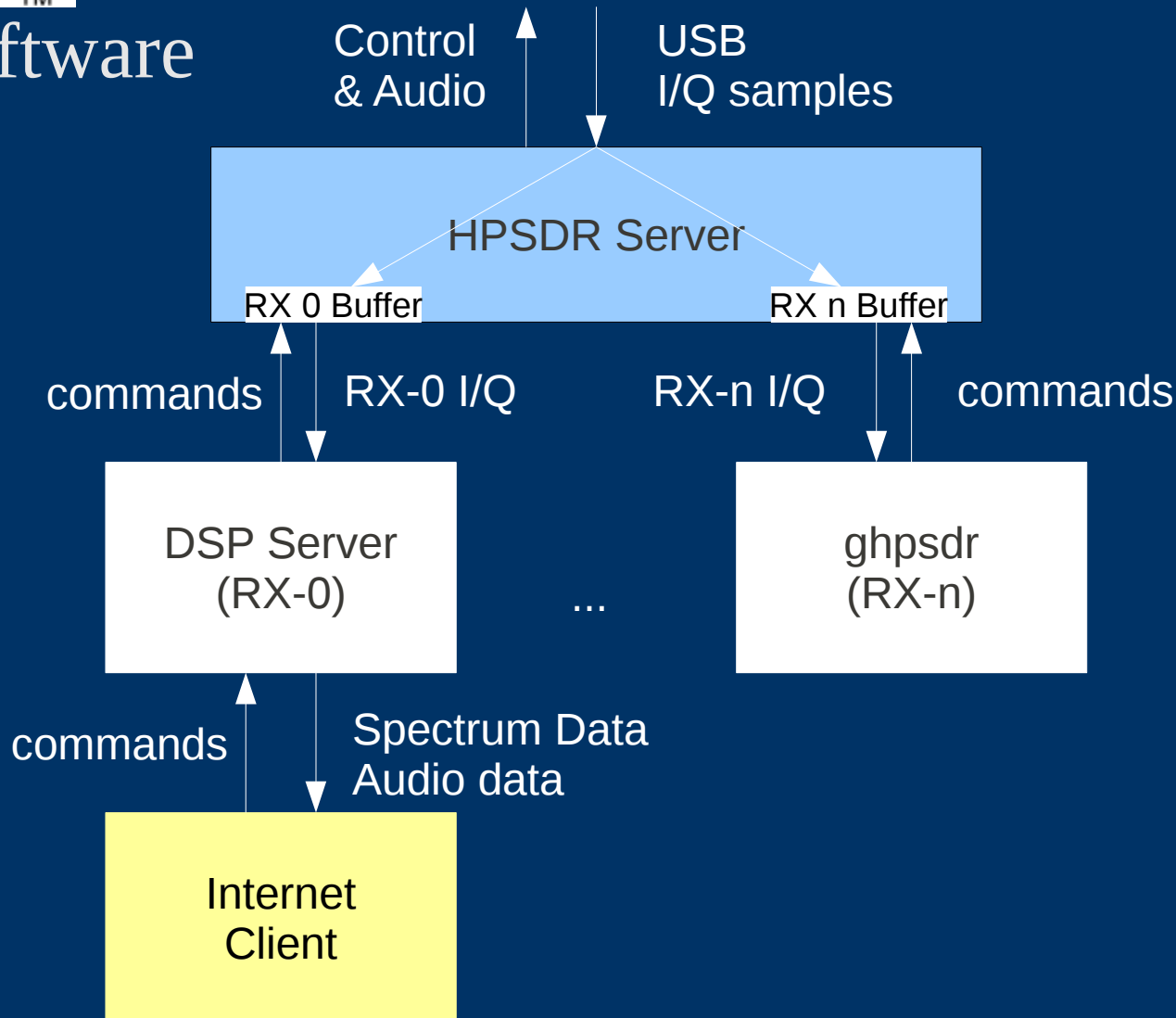




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- Software





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- Software
 - Bandwidth requirements per internet receiver
 - Spectrum data sent as 8 bit values
 - Client requests number of samples - currently 480 at 10 requests per second.
 - Audio data sent as 8-bit aLaw at 8000 samples per second.
 - Spectrum data = $480 * 10 * 8 = 34800$ bits per second
 - Audio data = $8000 * 8 = 64000$ bits per second
 - 98800 bits per second per receiver

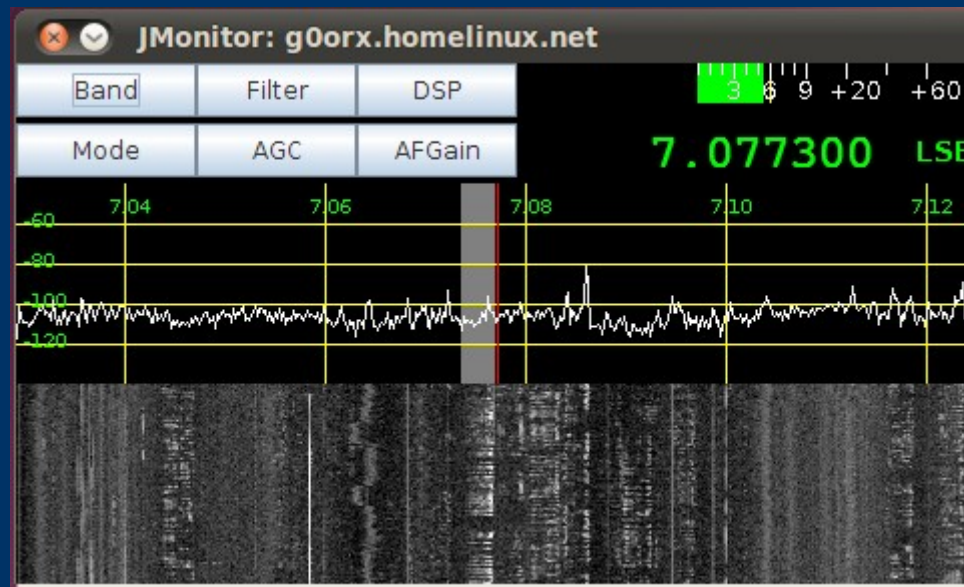




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- Software
 - Java Applet Client
 - Runs in any browser window.
 - Can be run as a standalone application.

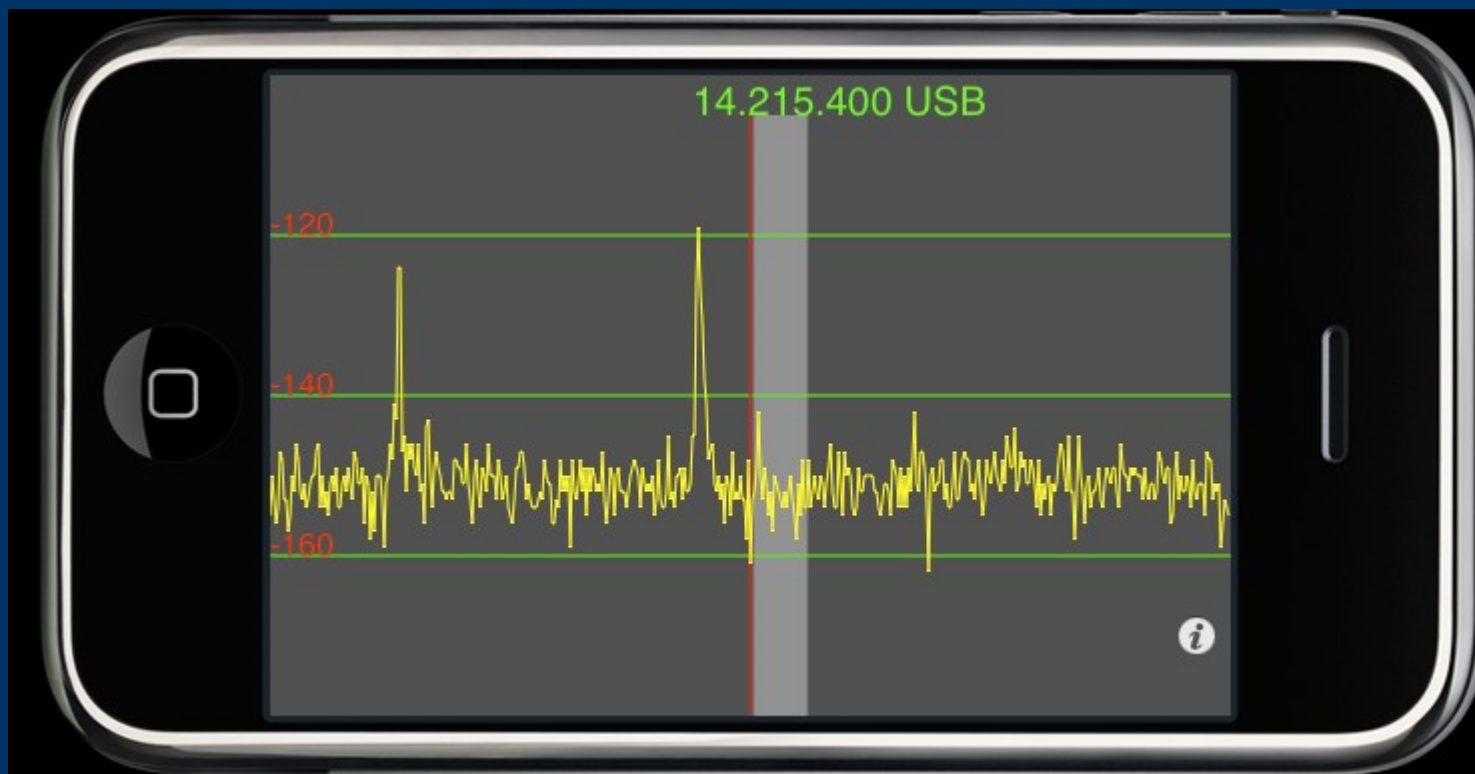




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- Software
 - iPhone client

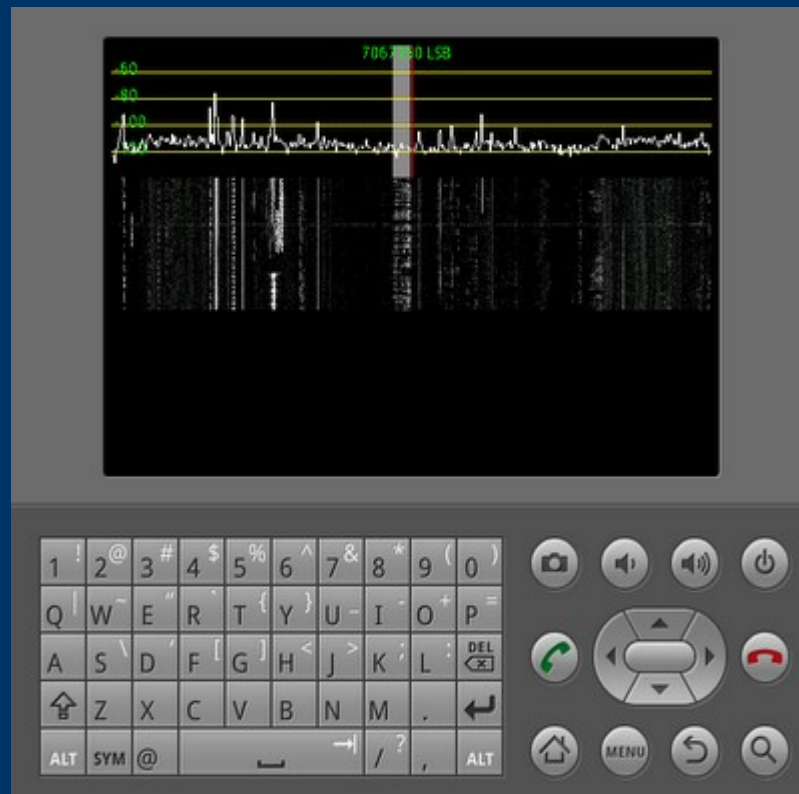




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- Software
 - Android Client





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- Software

Ongoing development to support other hardware

SDR1000 server

Softrock server (both fixed Xtal and Si570)

UHFSDR server





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Thanks

- HPSDR Group
 - TAPR Group
 - Phil Harman VK6APH
 - Bob McGwier N4HY
 - Frank Brickle AB2KT
 - Ken Hopper N9VV
 - Kirk Weedman KD7IRS
 - Bruce Walker W1BW
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- References

- Source code in HPSDR svn repository:

- `svn://64.245.179.219/svn/repos_sdr_hpsdr/trunk/N6LYT`

