Soft Rock and HPSDR – 21st Century Amateur Radio Experimentation

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Austin Summerfest - August 5, 2006

Who am I and why I'm talking about Software Defined Radio

- Bill Tracey – KD5TFD
- First Licensed in 2002
- Have an EE degree, work as a computer programmer
- Been having a ton of fun with SDR the last 3 years
- Think I should tell y'all 'bout it so you can have some fun too!

In the beginning – "SDR for the Masses"

- Gerald Youngblood's QEX articles – 2002
- Excellent set of articles – lots of interest from the experimenter community
- Shows how to do an SDR with a PC and some RF hardware
- Has evolved into a business for Gerald – Flex-Radio Systems
- $500 entry point for a 3 board stack radio
- GPL Licensed Software

The Soft Rock 40 – Truly SDR for the (cheap) masses

- Conceived and Designed by Tony Parks (KB9YIG) as an "SDR Sampler"
- Simple Crystal Controlled Receiver
  - Gives +/- 24 khz tuning with basic sound card
- Collaboratively developed on the Internet on the Flex Radio Friends VoIP server provided by Eric Ellison (AA4SW)
- My claim to fame: I came up with the name!
  - Also did PowerSDR mods for it, and built/tested quite a few prototypes
- $15 - $30 for a kit

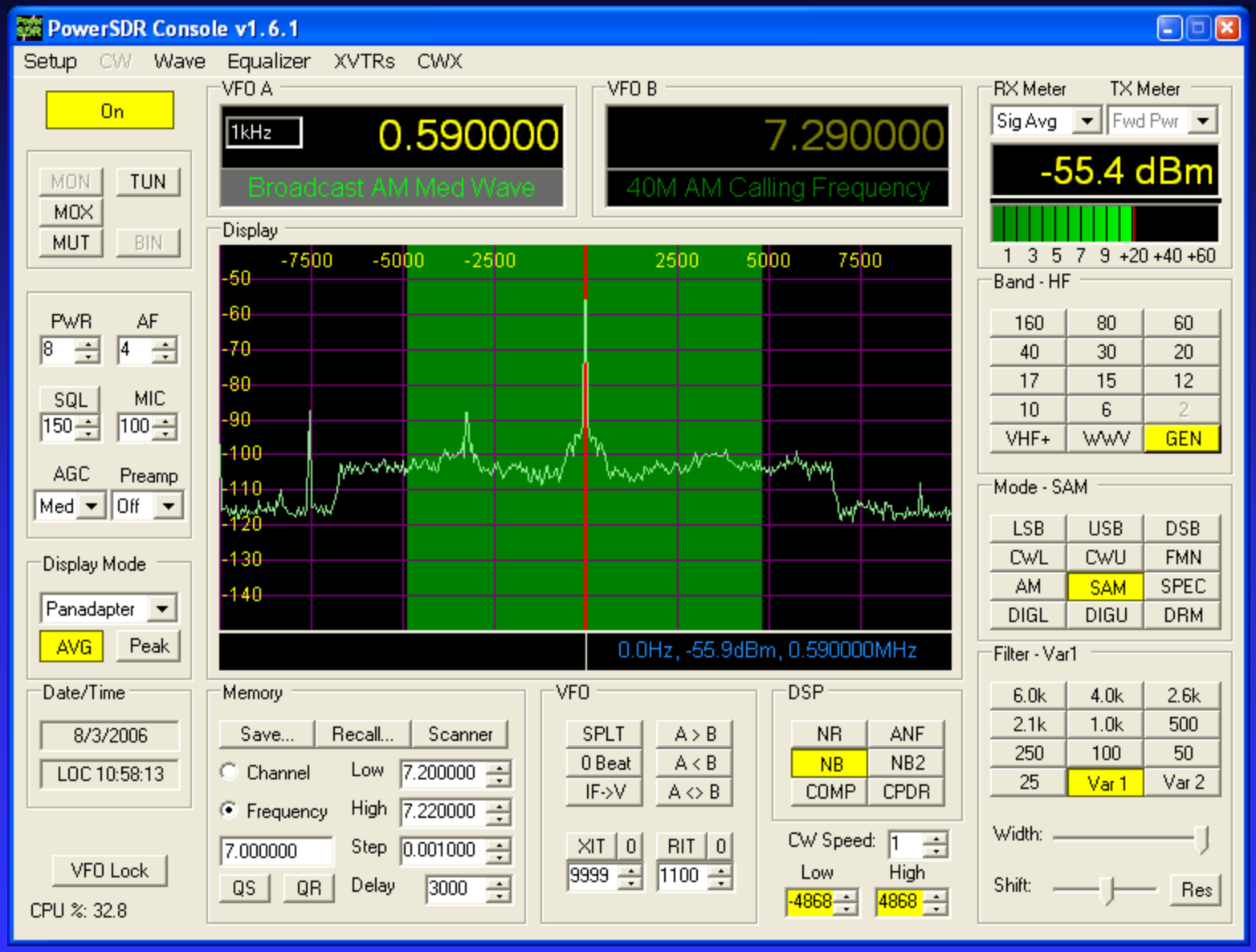
Soft Rock hits the Big Time

- AmQRP kitted Soft Rock 40 (V4) in 2005
  - A sell out!
- Tony now developing and selling Soft Rock Kits
  - V5 - 1x local osc – 2 boards bandpass/osc and QSD board, RC filter for LO Quadrature generation, no longer in production
  - V6 – back to 4x local osc - 40/80 meters, 160 meters
  - V7 – 10 meters, IF strip for VHF+ down converters, I7SWX/VK6APH mixer, 1x LO, RC filter for LO Quadrature generation
  - V6 and V7 are currently available
- Over 3000 Soft Rocks Out there now

Software for the Soft Rock

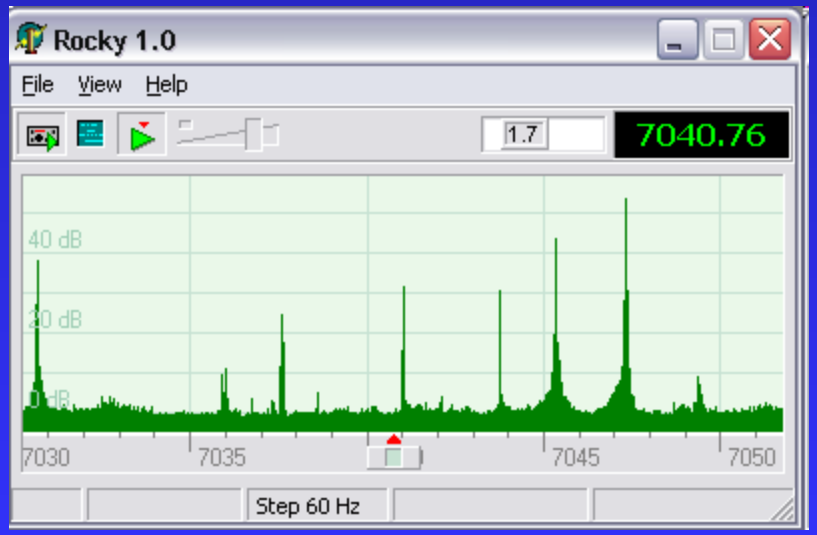
- PowerSDR – Flex's code adapated to the Soft Rock by KD5TFD – now part of Flex's distribution
- Rocky – by Alex Shovkoplyas, VE3NEA
- KGKSDR by Duncan Munro, M0KGK
- SDRadio and WinRad by Alberto Di Bene, I2PHD
- Linrad by Leif Asbrink, SM5BSZ
- GNURadio
- Anything that can handle I/Q should work

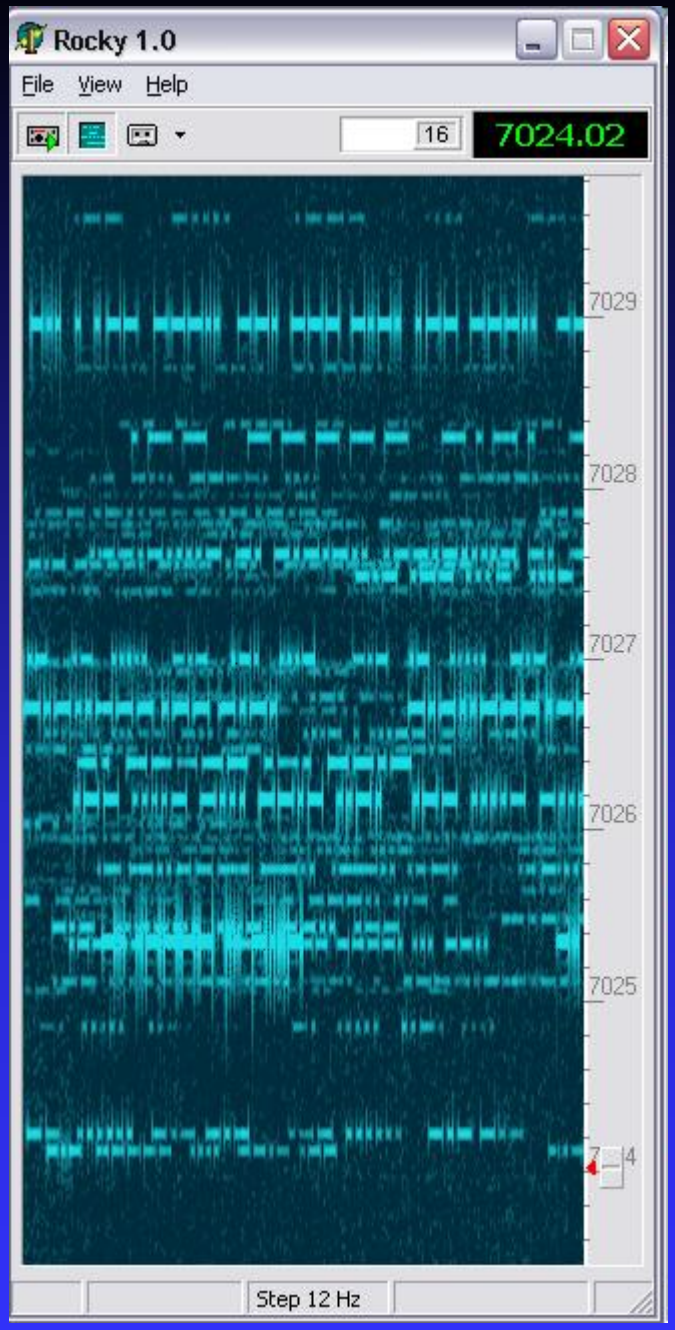
PowerSDR


PowerSDR Console v1.6.1
Setup
CW
Wave
Equalizer
XVTRs
CWX
On
MON
TUN
MOX
MUT
BIN
PWR
8
AF
4
SQL
150
MIC
100
AGC
Med
Preamp
Off
Display Mode
Panadapter
AVG
Peak
Date/Time
8/3/2006
LOC 10:58:13
VFO Lock
CPU %: 32.8
VFO A
1kHz
0.590000
Broadcast AM Med Wave
VFO B
7.290000
40M AM Calling Frequency
Display
-7500
-5000
-2500
2500
5000
7500
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
0.0Hz, -55.9dBm, 0.590000MHz
Memory
Save...
Recall...
Scanner
Channel
Frequency
Low
7.200000
High
7.220000
7.000000
Step
0.001000
QS
QR
Delay
3000
VFO
SPLT
0 Beat
IF->V
A > B
A < B
A <> B
XIT
0
9999
RIT
0
1100
DSP
NR
ANF
NB
NB2
COMP
CPDR
CW Speed:
1
Low
-4868
High
4868
RX Meter
TX Meter
Sig Avg
Fwd Pwr
-55.4 dBm
1 3 5 7 9 +20 +40 +60
Band - HF
160
80
60
40
30
20
17
15
12
10
6
2
VHF+
WWV
GEN
Mode - SAM
LSB
USB
DSB
CWL
CWU
FMN
AM
SAM
SPEC
DIGL
DIGU
DRM
Filter - Var1
6.0k
4.0k
2.6k
2.1k
1.0k
500
250
100
50
25
Var 1
Var 2
Width:
Shift:
Res

VE3NEA's Rocky

- Some great innovations
  - AutoIQ corrections, Polyphase FFT
  - Great bandscope
  - KeyClick Filter





Soft Rock Applications

- Top Band Dxing
- VHF/UHF Contesting
- Experimenting
- IF Strip – digitize your Boat Anchor (or K2, what have you)

Top Band DXing – VK6VZ

- Steve Ireland has been using a Soft Rock on 160 – a quote from the TopBand reflector

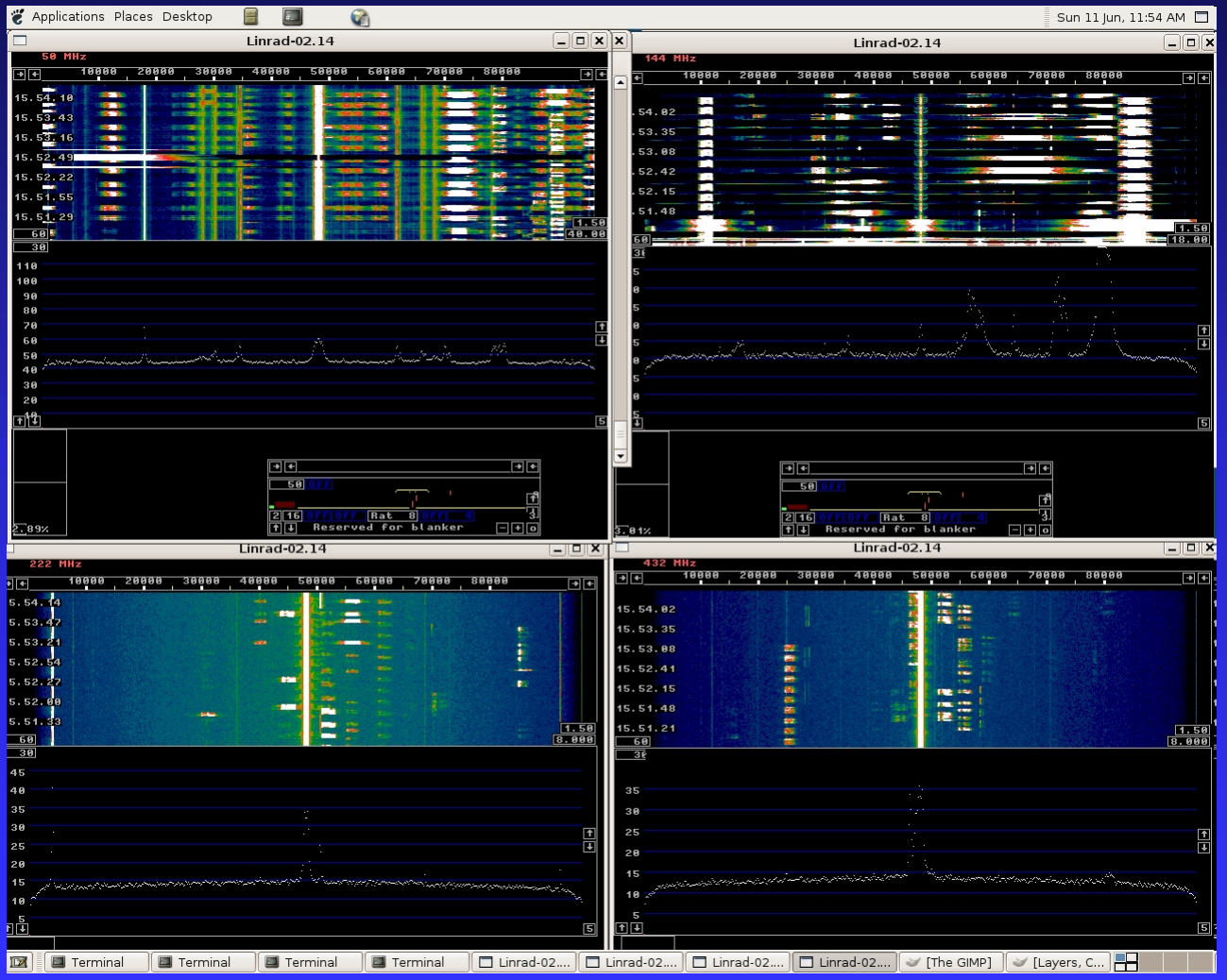
Instead of continually tuning up and down 1800 to 1835KHz, I simply watched the DX section of the band on my PC …(P4, 3.0ghz) screen and whenever a weak signal appeared, clicked on it, and, hey presto, quickly identified it. The signals I was listening to were between S2 and S5 maximum and often in slow and heavy QSB - I found the latter made it easy to tune over the top of them with my usual Yaesu FT1000, but I could easily see them on Rocky's bandscope and couldn't miss them. The Rocky/Softrock combination was far more effective than the FT1000 for this purpose, on the basis that I found at least five stations (weak USA and JAs mainly) in the same time it took me to find one on the FT1000.

Rocky is light years ahead of any other bandscope I have ever seen built into/tacked onto a radio - VE3NEA deserves a medal. The polyphase filtering and the solid trace are masterstrokes. The direct conversion Softrock 40 - modified for 160m with a front-end bandpass filter designed by Phil VK6APH - was much easier on the ear than the FT1000. Without the multiple IFs/mixers of the FT1000, the Softrock has that great 'connected direct to ether' sound to it - and the 600Hz digital filter made CW much nicer to listen to than the dual 500Hz lattice crystal filters in my FT1000.

I should emphasize that this is an experimenters (bleeding edge) product, but as far as I am concerned, the Rocky/Softrock SDR combo is in another league for weak signal DXing from the analog radios in my shack.

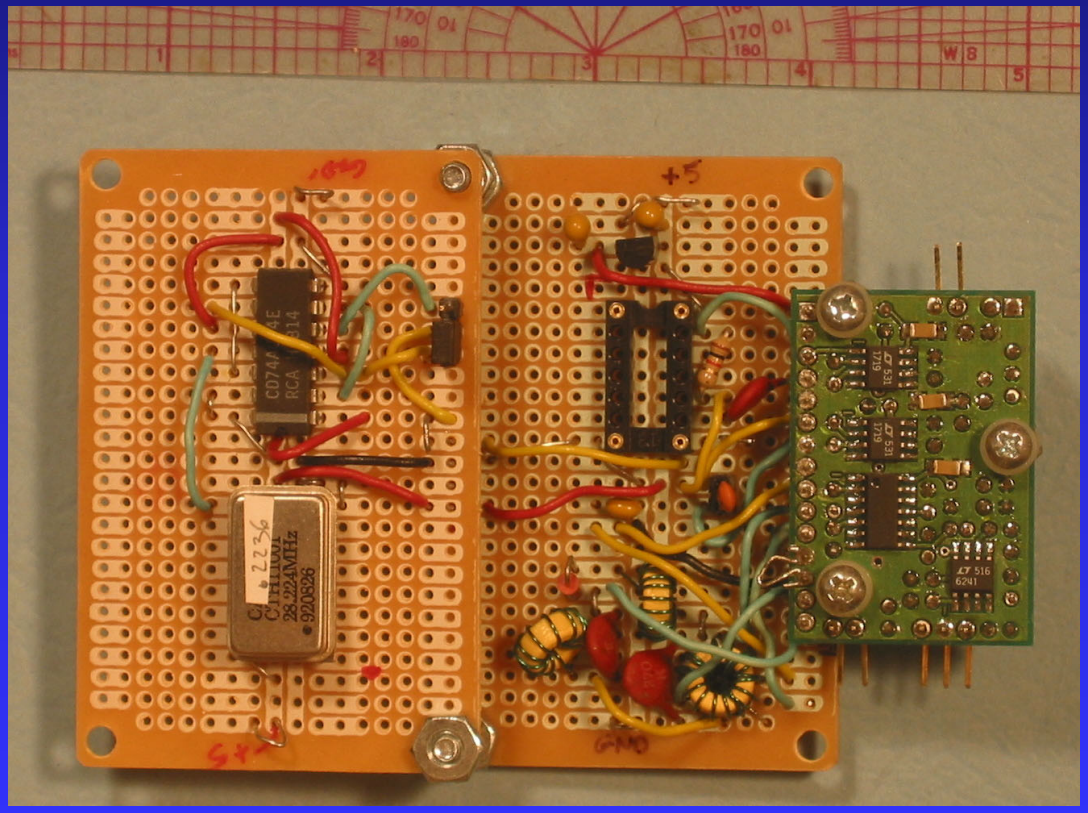
VHF Contest – 4 SR 7s & Linrad

Roger Rehr, W3SZ used 4 SR7's and Linrad for bandscopes in a recent VHF/UHF Contest – Situational Awareness!



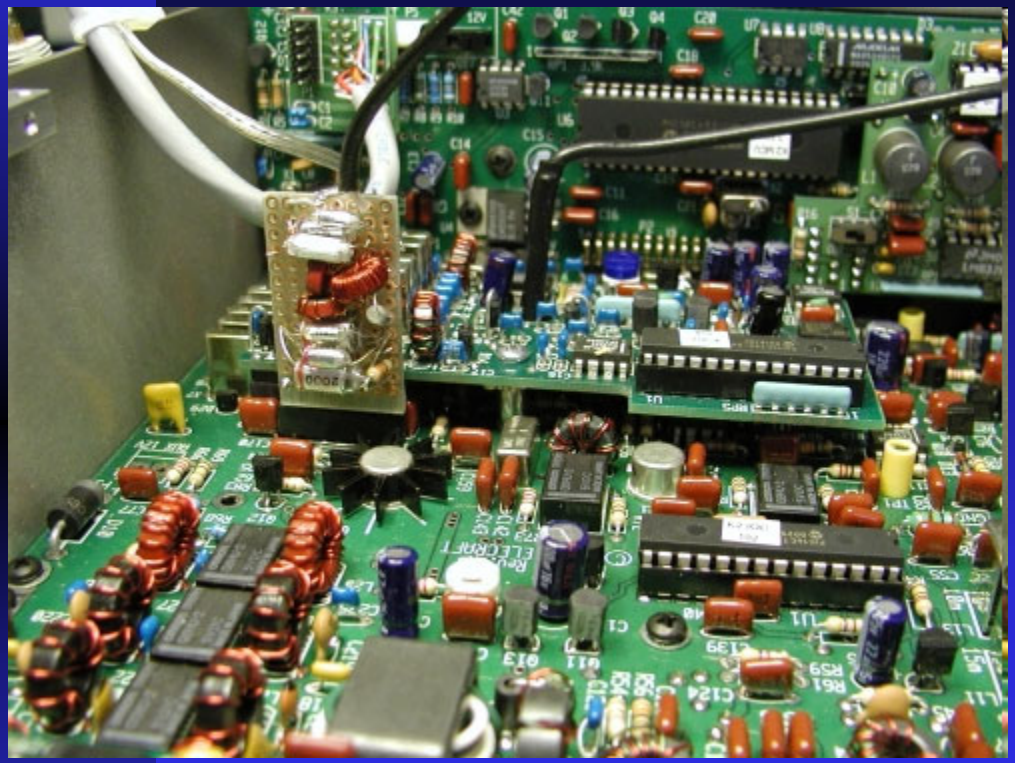
Experimenting

- An IARU Beacon Monitor for VE3NEA's Faros
- Also can be an 20 meter SSTVcam receiver

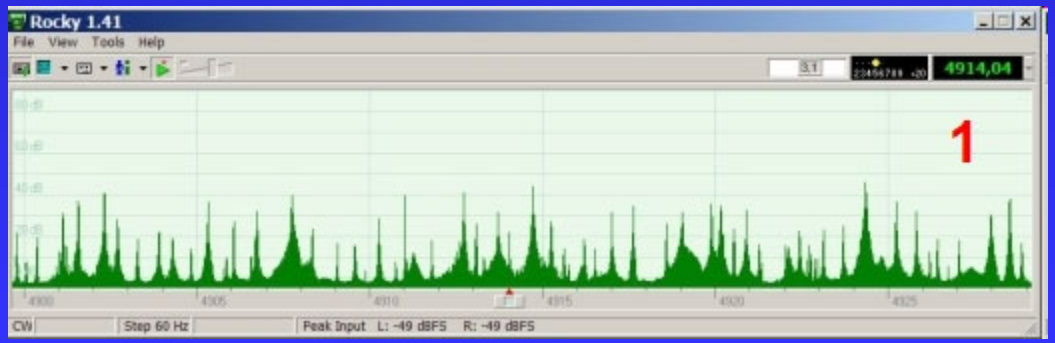


- Based on an SR v5
- 28.224 clock osc divided/2
- 14.224 osc used for SSTV

Bodo Scholz's DJ9CS K2 Panadapter



- Tapped 4.915 MHz IF at Noise Blanker Slot
- Bandpass filter & SR 5 with Appropriate Xtal



Soft Rock Future

- Tony's doing a new 1000 kit run of the V6
- Harmonic Sampling for 20 and 15 meters
  - ¾ LO frequency (eg. ¾ * 18.724 = 14.043)
  - -114 dbm MDS (500 hz, 3db, Exitgy, 20 meters)
  - 43 db attenuation of primary frequency
- An exciter?
- SoftRock info: http://groups.yahoo.com/group/softrock40/

HPSDR.org

- High Performance Software Defined Radio
- By Design Soft Rock is a minimalist SDR
- HPSDR aimed towards high performance
  - Build a better Sound Card for SDR 1000
  - Evolved to can we build a Radio
  - Modular approach
- A System for Experimenters and Enthusiasts
- Open – Hardware, Firmware, & Software

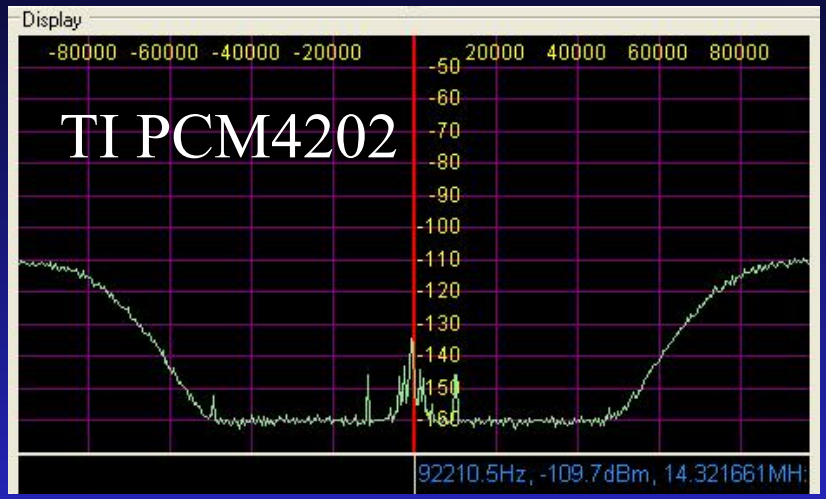
HPSDR.org Community

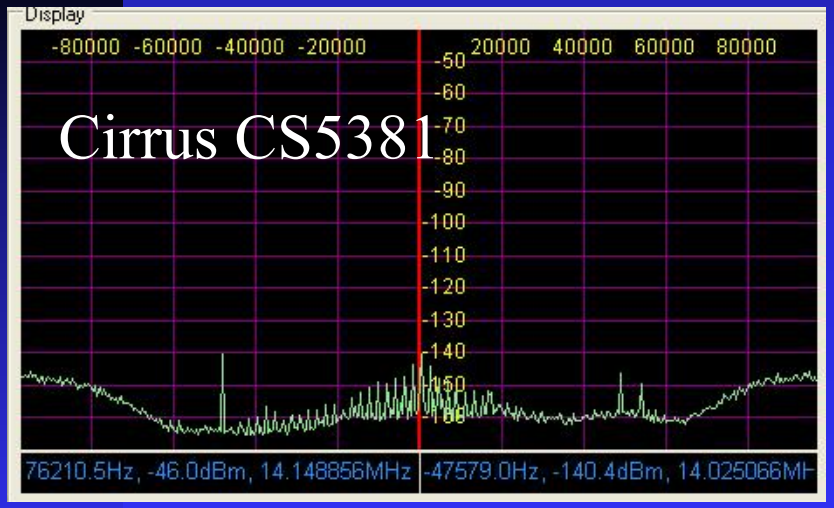
- Very Skilled set of People coming together
- Doing it for the love of it
- Loose Confederation of Experimenters
- World Wide Collaboration
- Trying to Advance the Amateur Radio Art
- Open – GPL for Software
  - John Ackerman (N8UR) from TAPR working on TAPR Open Hardware License
- AMSAT and TAPR lending support
  - TAPR kitting Atlas, others when ready
  - AMSAT getting designers access to commercial tools

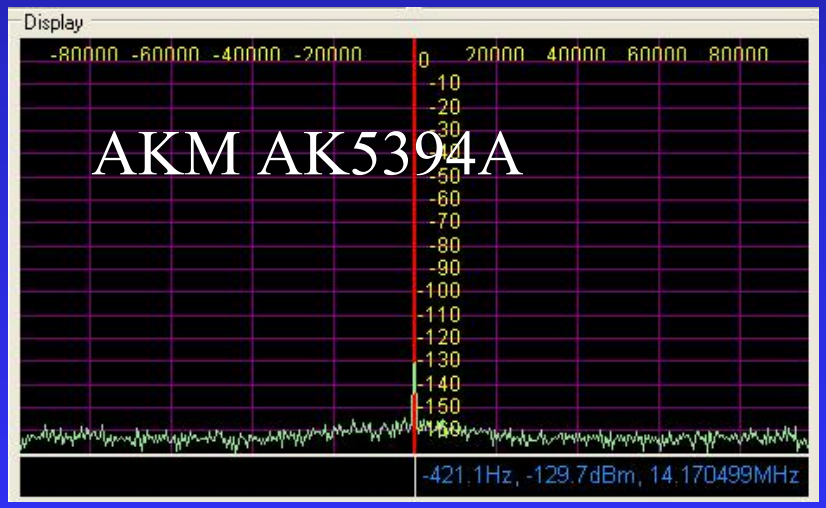
HPSDR - What's being built now

- Atlas Backplane – passive
  - Completed, 2nd run going out now
- Janus Sound Board (A/D and D/A converters)
  - AK5394A (192khz, 24bit A/D) for IQ in
  - TLV320AIC23B for Mic and Audio Out
  - PWM implemented in FPGA for IQ out
  - Hi Performance (better the Delta 44)
- OzyMandias – Cypress FX2 USB2 Link to the Computer, Cyclone II FPGA for local logic
- Currently working on Integrating Ozy, Janus and PowerSDR

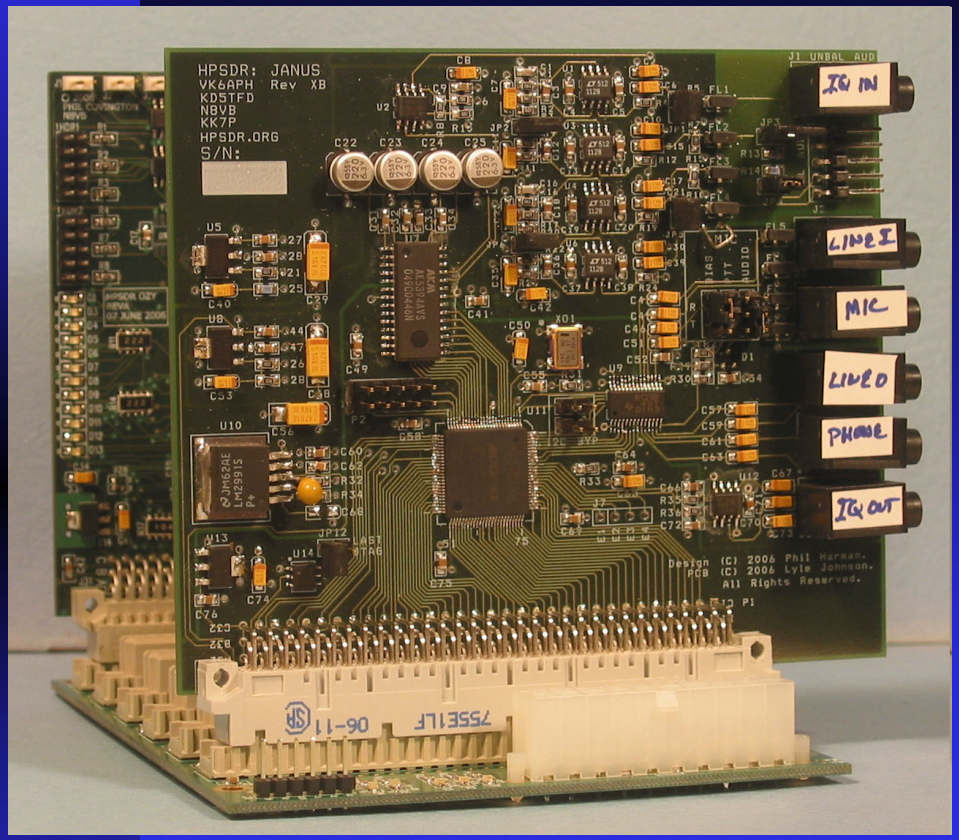
Side note: Why the AK5394A?

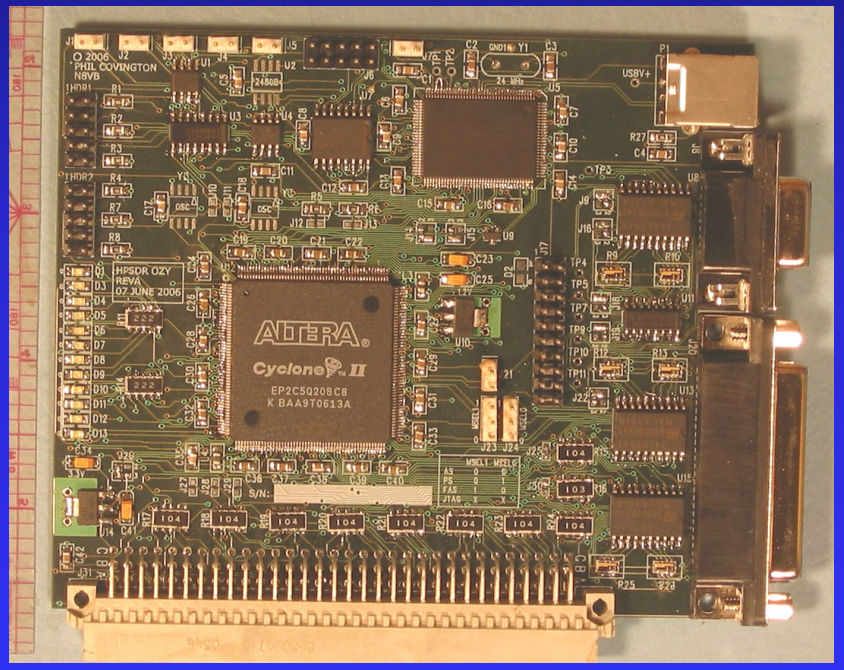






Atlas, Janus, and Ozy





Mercury, Gibraltar, Sasquatch, …

- Mercury – Hi Rate A/D card – N8VB & VK6APH
  - LTC2208 based – 130Msps, 16 bit
  - VK6APH up and experimenting on Ref board
  - Digitize whole HF band in one swoop
  - Digital Down Conversion in FPGA on board
- Gibraltar – Locked Frequency Standard – W2GPS & N7HPR
  - Lock all the osc's in an HPSDR to one clock
- Sasquatch: A DSP Board – KK7P
  - "Look Ma, no PC"
- Phoenix – A QSD/QSE board
- Others being discussed

Wrap Up

- Exciting Stuff to Experiment With
- Accessible – if you're interested in SDR, try a Soft Rock
  - Also a good 1st surface mount project
- HPSDR.org – building blocks for experimenters
- Join in, have some fun!
  - Hardware, Firmware and Software Opportunities are plentiful
- Questions?

The End

Backup Charts

Some Other SDR work

- GNURadio and the USRP
  - HPSDR borrowing heavily from USRP architecture
- AMSAT's SDX
  - Sasquatch based on DSP AMSAT is using
- uWSDR
  - SDR for Microwaves, HW and SW from a European group
- Flex Radio
  - Showed early version of their new SDX in development at Dayton this year

Experimenting

- A DDS tuned SoftRock 5 for 20 meters
- Using AmQRP DDS card, homebrew USB control
- Others have done similar with better DDS chips