North Texas NTMS Microwave Society

Using the Soft Rocks as Microwave IF Spectrum Analyzers

By
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Central States VHF Society
San Antonio, Texas

Introduction

- The Soft Rocks got their start in the QRP community with the desire to introduce the amateur to very inexpensive Software Defined Radio
- I have used the Soft Rock 5s and 7s as IFs for my VHF and higher equipment
- Unfortunately the entire supply of 800 of the SR5s has been sold
- The SR6s are available presently but only go as high as the 30 meter band.
- However, I have heard from Tony Parks KB9YIG that a 10 meter version of the SR6 will be available late Summer – It will be called the RXTXv6.2 – keep an eye on the SoftRock 40 Yahoo Group website for latest information
- The slides to follow describe my use of the SR5 as a 10 meter IF and the basic use can be applied to the forth coming 10 meter version of the SR6.
- Since the circuit concepts are so simple, one could probably just homebrew their own!
- And the software is all Free!

Original Soft Rock 5 Designed by Tony Parks KB9YIG

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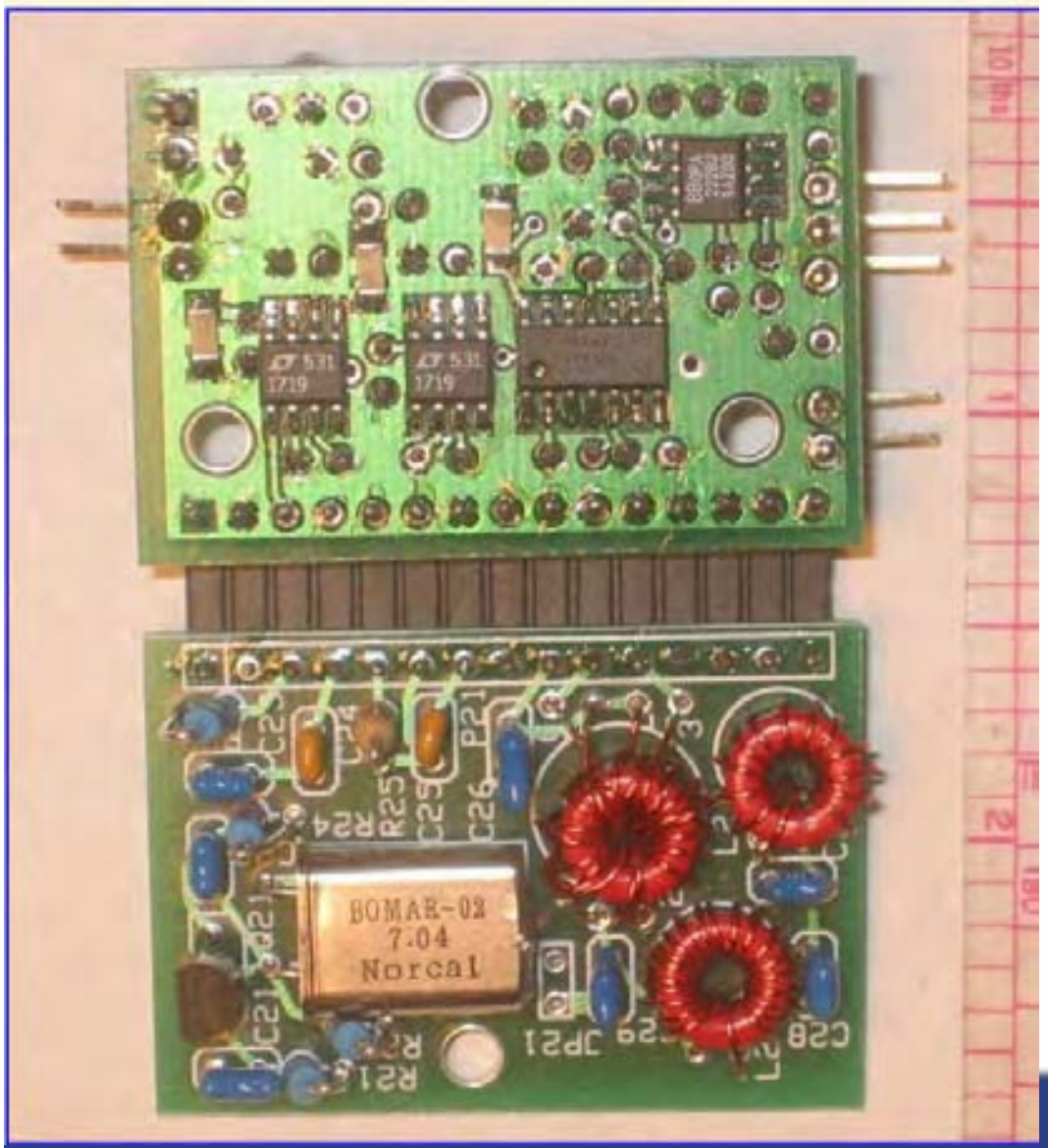

2 Board Approach

Top board has the LNAs, Comparators and QSD

Bottom board has the frequency sensitive components – LO , band pass filter and phase shift network

http://ewjt.com/kd5tfd/sdr1k-notebook/sr40/v5-1stlook/index.html

http://amqrp.org/kits/softrock40/version5.html

http://www.hamsdr.com/Home.aspx

raparks@ctcisp.com

Block Diagram of the Soft Rock 5

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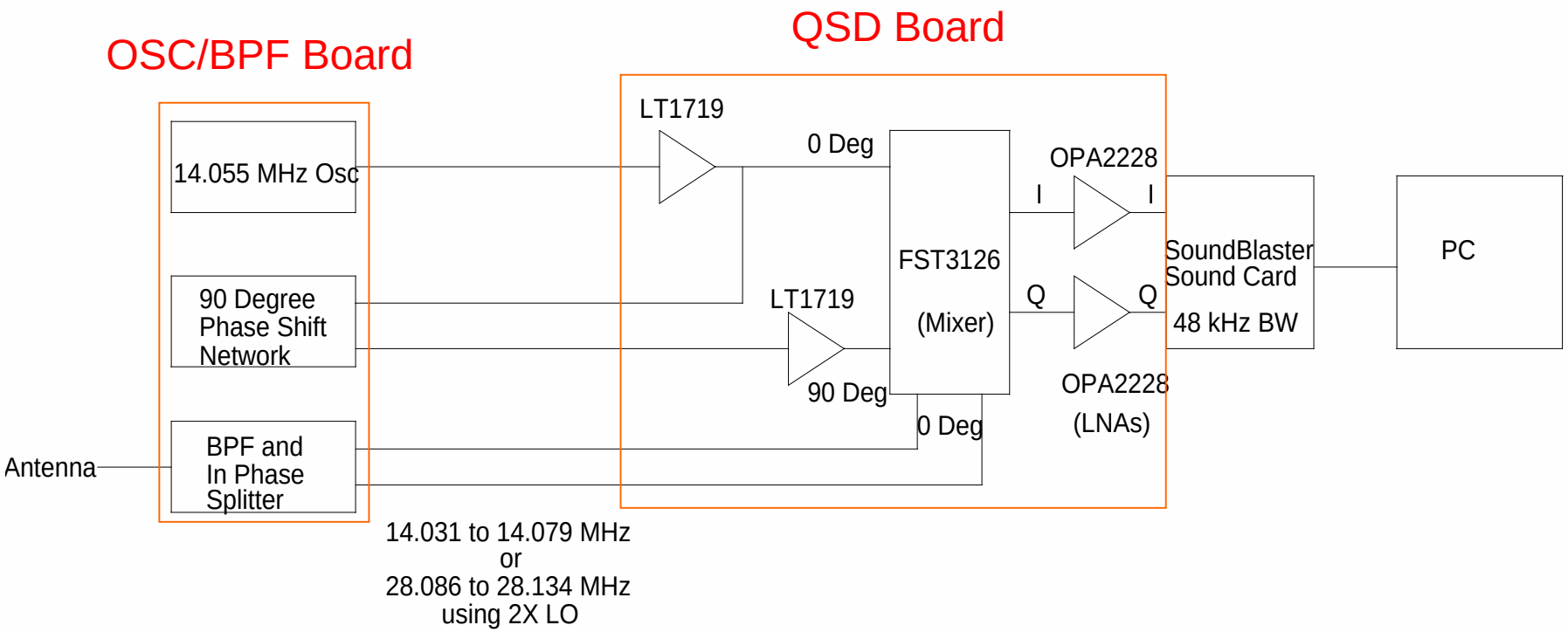
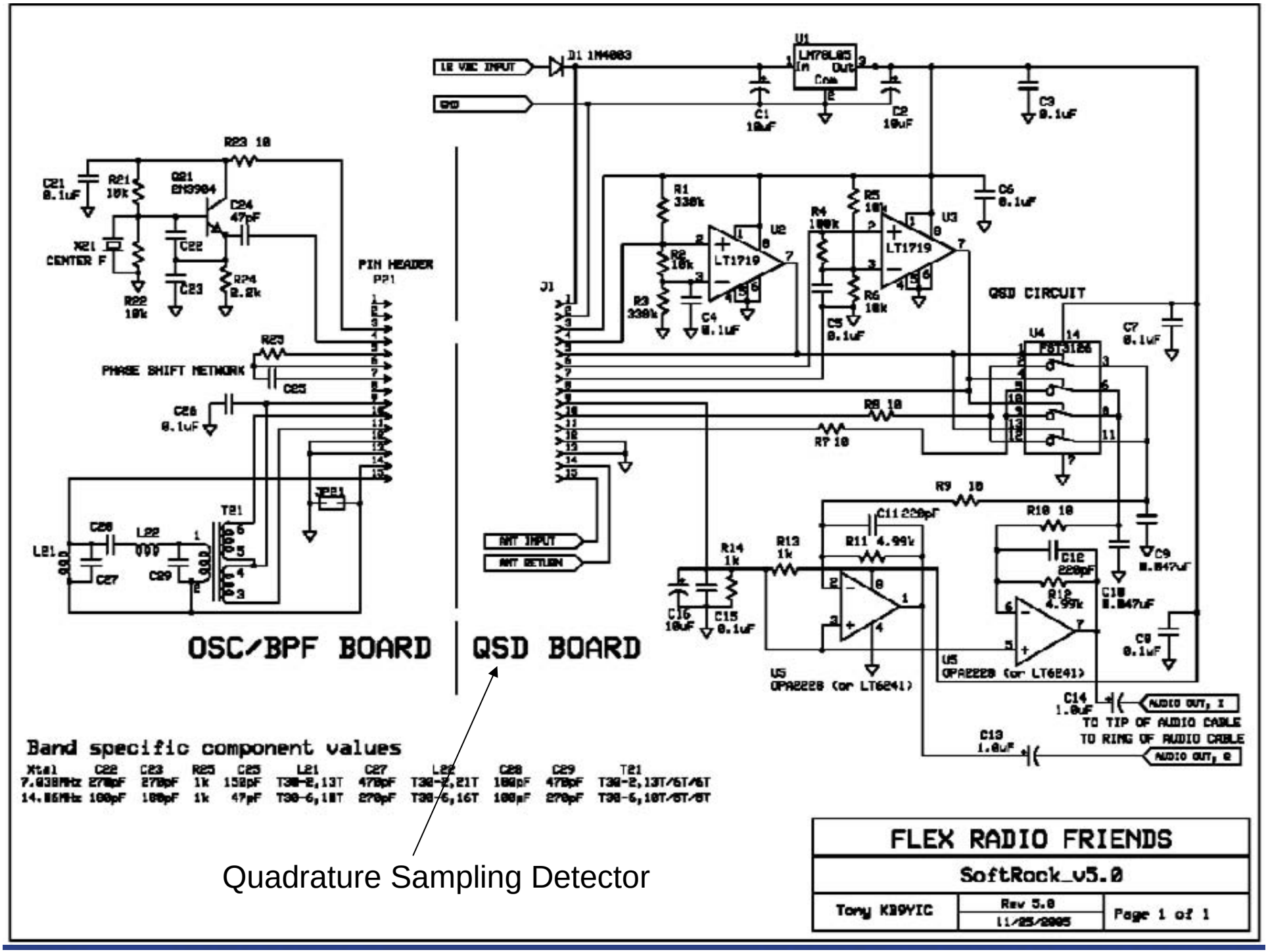


Quadrature Sampling Detector with in-phase feed of the RF and quadrature feed of the LO and 2 low noise IF amplifiers that provide I&Q for the sound card.



Quadrature Sampling Detector

SoftRock v5.0 Band Specific Component Values

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Band (MHz)	C22 (pF)	C23 (pF)	C24 (pF)	C25 (pF)	C27 (pF)	C28 (pF)	C29 (pF)	L21 (uH)	L21 wind/core	L22 (uH)	L22 wind/core	T21 core	T21 primary	T21 secondaries
1.800	470	470	220	620	6800	470	6800	1.1	16T #30 on T30-2	14	57T #30 on T30-2	T30-2	16T #30	7T/7T #30 bifilar
3.500	470	470	220	330	1000	360	1000	1.4	18T #30 on T30-2	3.9	30T #30 on T30-2	T30-2	18T #30	8T/8T #30 bifilar
7.000	270	270	47	150	470	180	470	0.73	13T #26 on T30-2	1.9	21T #26 on T30-2	T30-2	13T #26	6T/6T #26 bifilar
10.100	270	270	47	100	330	120	330	0.52	11T #26 on T30-2	1.2	17T #26 on T30-2	T30-2	11T #26	5T/5T #26 bifilar
14.000	180	180	47	47	270	100	270	0.36	10T #26 on T30-6	0.92	16T #26 on T30-6	T30-6	10T #26	5T/5T #26 bifilar
18.068	150	150	47	47	180	69	180	0.36	10T #26 on T30-6	0.71	14T #26 on T30-6	T30-6	10T #26	5T/5T #26 bifilar
21.000	150	150	47	47	150	62	150	0.29	9T #26 on T30-6	0.61	13T #26 on T30-6	T30-6	9T #26	4T/4T #26 bifilar
24.890	120	120	47	47	120	47	120	0.24	8T #26 on T30-6	0.52	12T #26 on T30-6	T30-6	8T #26	4T/4T #26 bifilar
28.000	100	100	47	33	120	47	120	0.18	7T #26 on T30-6	0.44	11T #26 on T30-6	T30-6	7T #26	3T/3T #26 bifilar

From Tony WA8RJF

Band (MHz)	R24 (k)	C22 (pF)	C23 (pF)	C24 (pF)	C25 (pF)	C27 (pF)	C28 (pF)	C29 (pF)	L21 (uH)	L21 wind/core	L22 (uH)	L22 wind/core	T21 core	T21 primary	T21 secondaries
1.800	3.3	470	470	220	680	6800	470	6800	1.1	16T #30 on T30-2	14	57T #30 on T30-2	T30-2	16T #30	7T/7T #30 bifilar
3.500	2.2	470	470	220	330	1000	390	1000	1.4	18T #30 on T30-2	3.9	30T #30 on T30-2	T30-2	18T #30	8T/8T #30 bifilar
7.000	2.2	270	270	47	150	470	180	470	0.73	13T #26 on T30-2	1.9	21T #26 on T30-2	T30-2	13T #26	6T/6T #26 bifilar
10.100	2.2	270	270	47	100	330	150	330	0.52	11T #26 on T30-2	1.2	17T #26 on T30-2	T30-2	11T #26	5T/5T #26 bifilar
14.000	2.2	180	180	47	47	270	100	270	0.36	10T #26 on T30-6	0.92	16T #26 on T30-6	T30-6	10T #26	5T/5T #26 bifilar
18.068-21.000	2.2	150	150	47	47	180	100	180	0.36	10T #26 on T30-6	0.71	14T #26 on T30-6	T30-6	10T #26	5T/5T #26 bifilar
24.890-28.000	2.2	100	100	47	47	120	56	120	0.24	8T #26 on T30-6	0.52	12T #26 on T30-6	T30-6	8T #26	4T/4T #26 bifilar

From Tony Parks KB9YIG

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http://www.amqrp.org/kits/dds60/index.html

This is an inexpensive kit that allows you to pick an LO of 28.1 MHz

AMERICAN QRP CLUB

DDS-60 Kit

A 0-60 MHz coverage VFO with built-in amplifier and variable output level from 0 to 4V p-p, manually adjusted with a trimpot or software controlled with a digipot.

| Overview | Schematic | Ordering | Availability | Ways to Use |

| Assembly & User Manual | Quick Assy Guide | Builder's Notes |

Article: "Working with Surface Mount Technology (SMT) Parts"

Tech Topic: DDS-60 Spectral Purity Study

Kit Status: In stock.

Overview

Some three years ago we introduced the original **DDS Daughtercard** (www.nqrp.org/dds) to the QRP community, providing a low cost and modular way to add a precisely-adjustable 0-30 MHz signal generator to one's project. All you had to do was add an AD9850 DDS chip (available as a free sample from the good people at Analog Devices) and +12V, and then any number of popular microcontrollers could control the DDS Daughtercard to have it serve as a rock-solid VFO. Over 1,000 of these little cards were sold!

Well, there is still a demand for this inexpensive little kit and an ever-growing list of uses for it so we updated the basic design and are now ready to provide the *new_and_improved* **DDS-60 daughtercard**. This self-contained functional module generates a good-quality RF signal from **1-60 MHz** by using a small pc board to contain just the bare DDS essentials – an Analog Devices AD9851 DDS chip, a clock oscillator, a 5th-order elliptic filter and an adjustable-level RF amplifier. Additionally, an onboard 5V regulator is provided so you only need provide a battery or power supply ranging anywhere from 8-16V DC. The three digital control lines, the power supply, and the output signal are all available on a pin header at the board edge, and the DDS-60 is pin-compatible with the original DDS Daughtercard. The schematic is shown below on this page.

The 8-position pin header at the board edge serves to allow DDS-60 to be plugged into and used in any project you might have on your bench, regardless of which microcontroller is employed. Just provide a single strip socket (e.g., a 16-pin IC socket split lengthwise) on the project board and plug in the DDS Daughtercard. Heck, you don't even need a dedicated microcontroller – use a cable connected to the parallel printer port of your PC and use public domain PC software to control the DDS board! See the Ways to Use section for a number of custom solutions for you to easily control your DDS-60 daughtercard.

Once your controller-of-choice serially loads the 40-bit control word into the DDS, the raw waveform is presented to an elliptic filter that removes unwanted high-end frequency components, resulting in a signal of sufficient quality to serve as a local oscillator for a transceiver. We regularly see great signal quality, with harmonic content of –40 dB.

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DDS-60 using the AD9851

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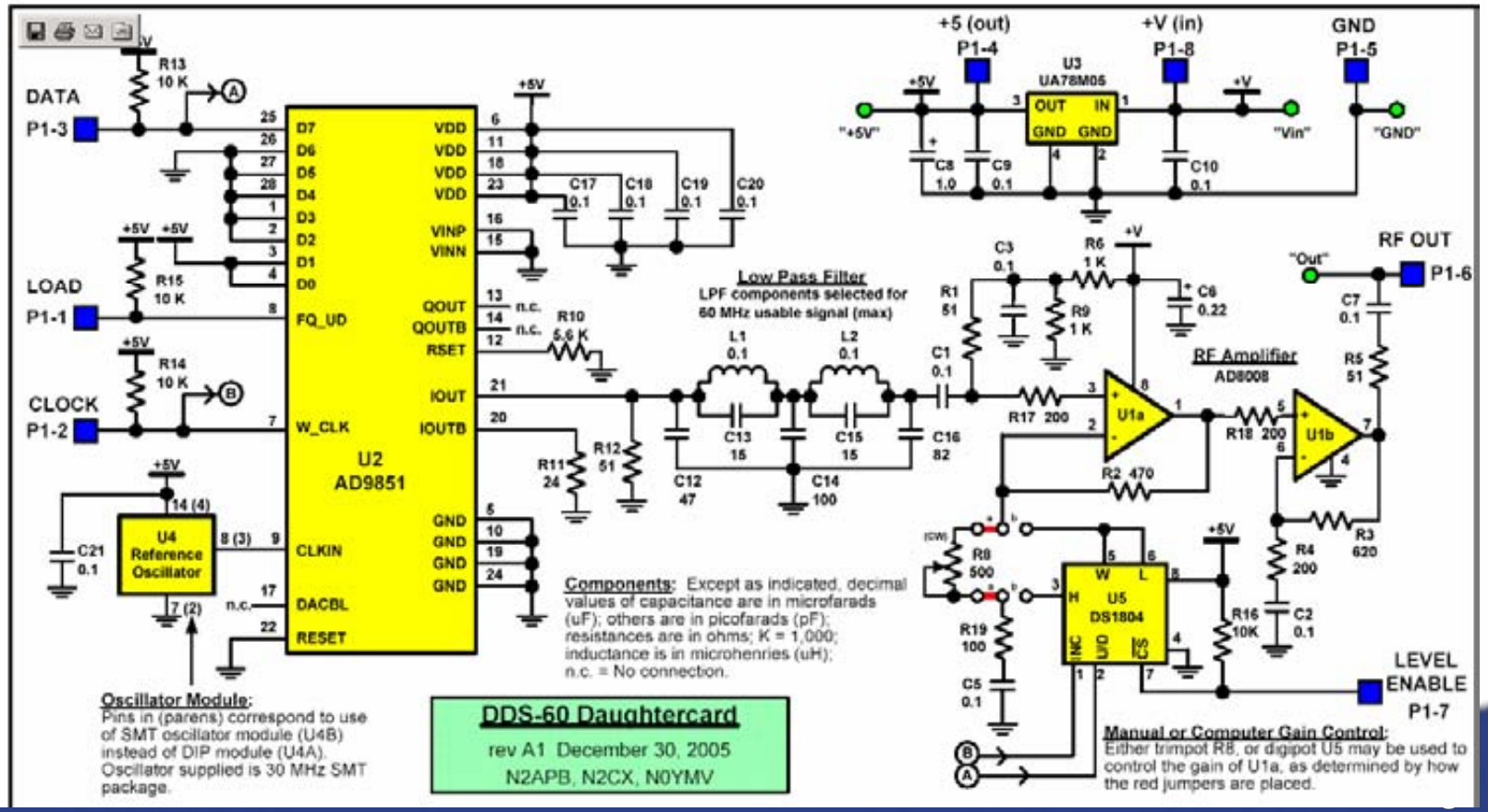
Specifications

- Power requirements: 8-16V DC at 130 ma (typical).
- RF Output – fully adjustable to +16 dBm, or about 4V p-p.
- Output signal not affected by varying +V supply voltage – great for battery operation.
- Near-constant output level from 1-60 MHz.
- Good signal purity – harmonics down approximately 40 dB from the fundamental.
- Pin-compatible with the original DDS Daughtercard module
- Only few changes needed in existing AD9850 software drivers

Schematic



Softmark USB HF Generator

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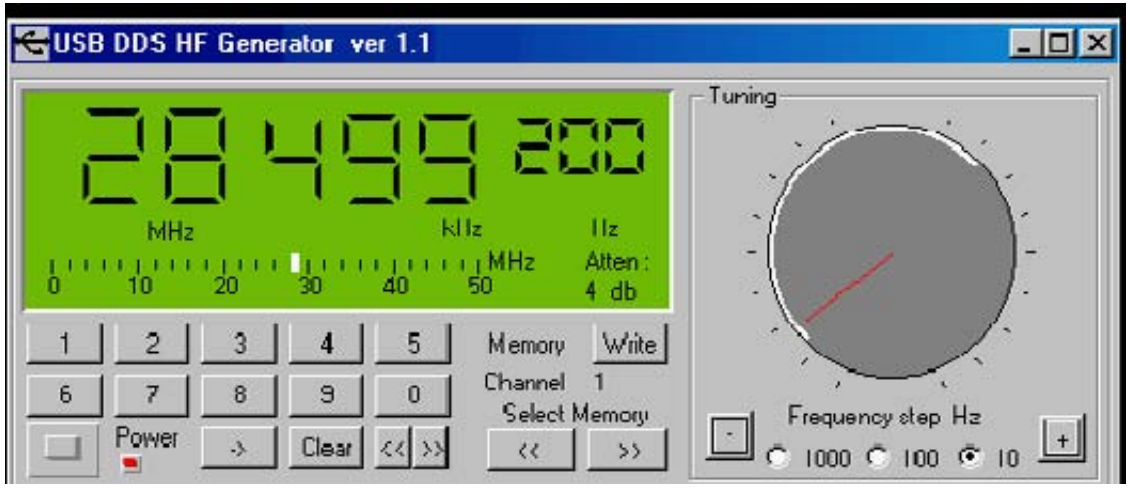
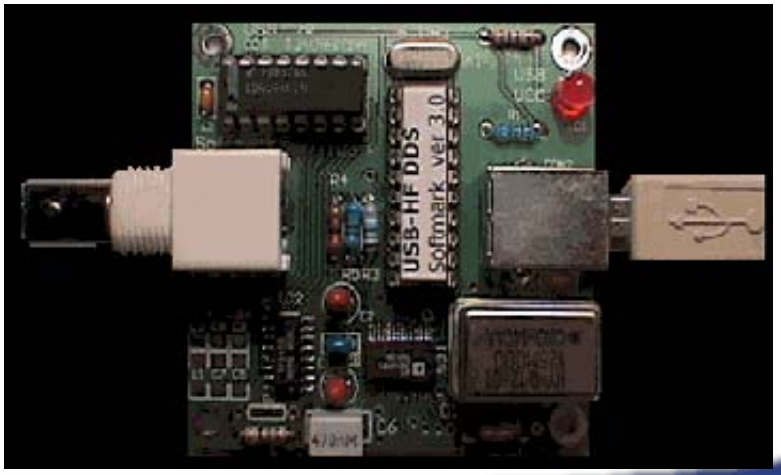


http://www.ar.com.au/~softmark/



G4JNT AD9852 DDS

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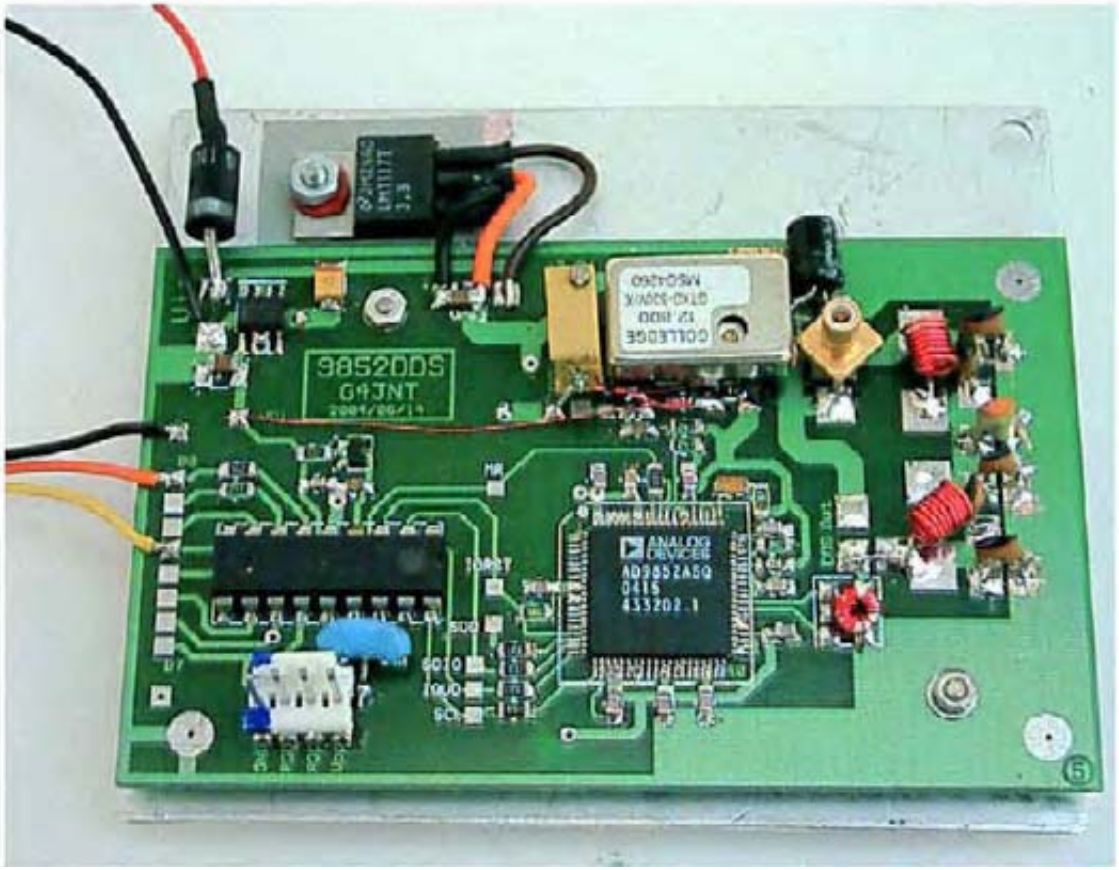
http://www.scrbg.org/g4jnt/AD9852module.pdf



Can be programmed up to .35 X Clock frequency
Clock frequency can be 4 to 20 X reference frequency
So for a 10 MHz reference frequency then max frequency is .35 X 200 = 70 MHz
Very nice for Soft Rock

Other Options for the LO

- Signal generator
- Clock oscillator

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CW Signal on 1296.100 MHz

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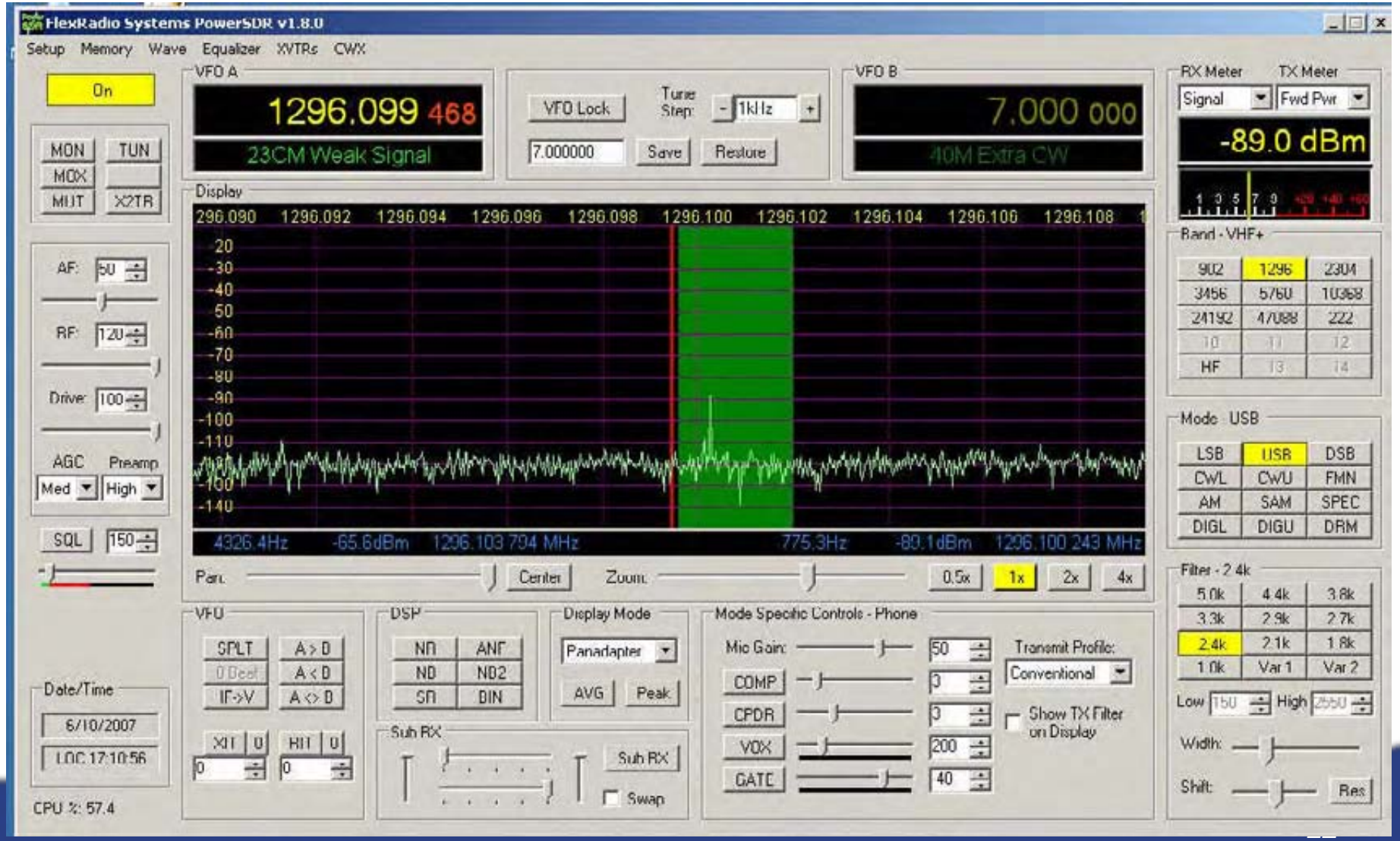

KM5PO on 1296.1 MHz SSB

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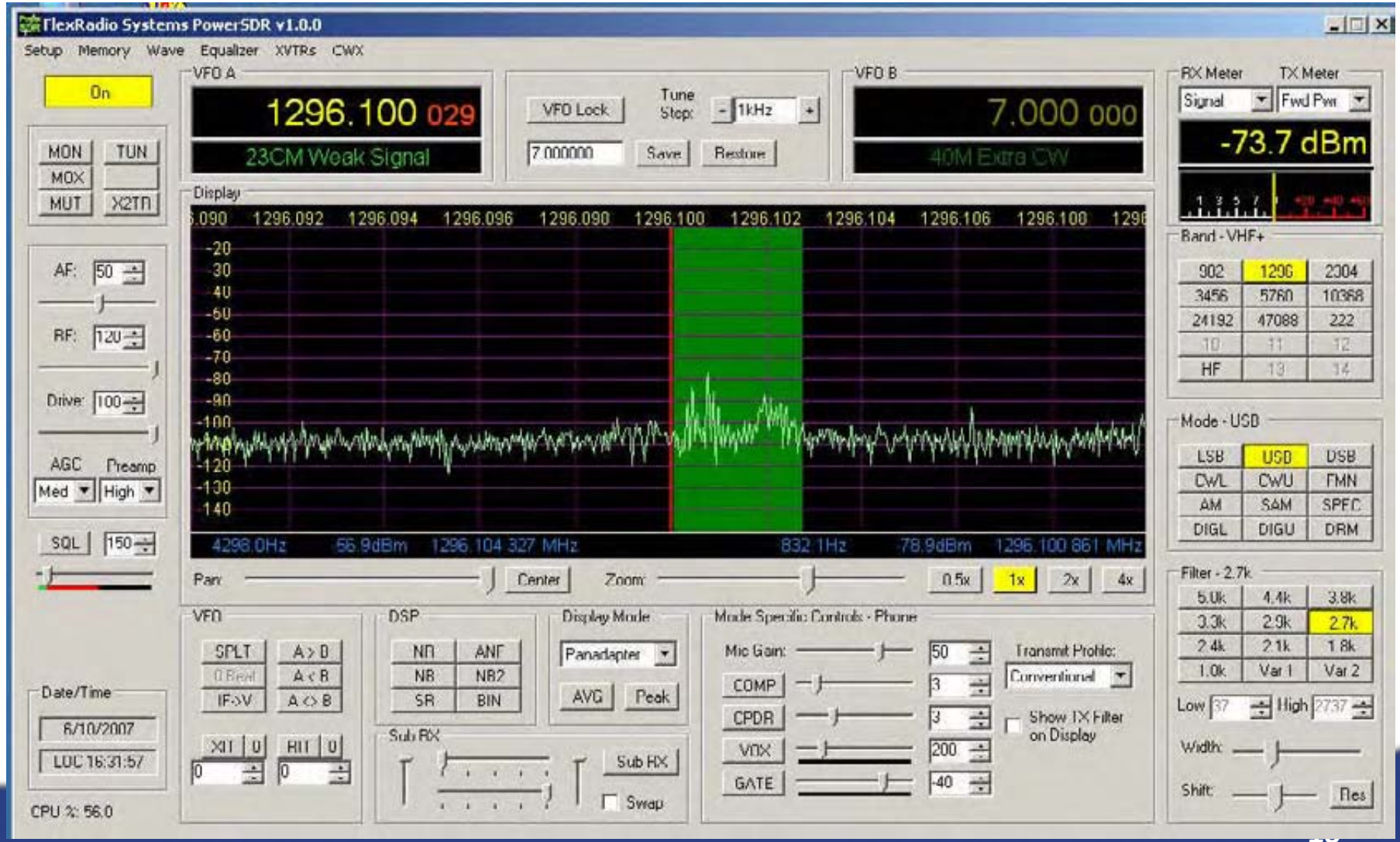

Optimizing I & Q Amplitude and Phase for Best Image Rejection

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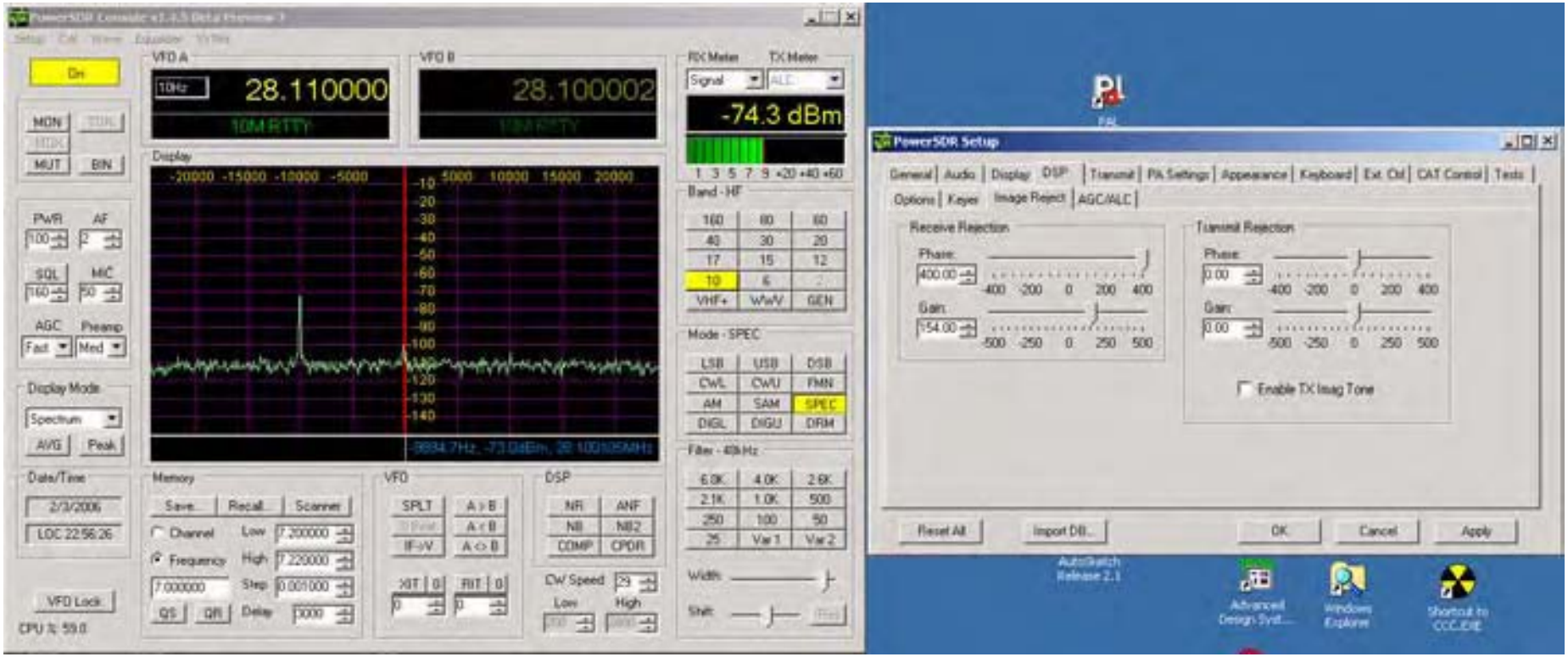

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http://www.dxatlas.com/Rocky/

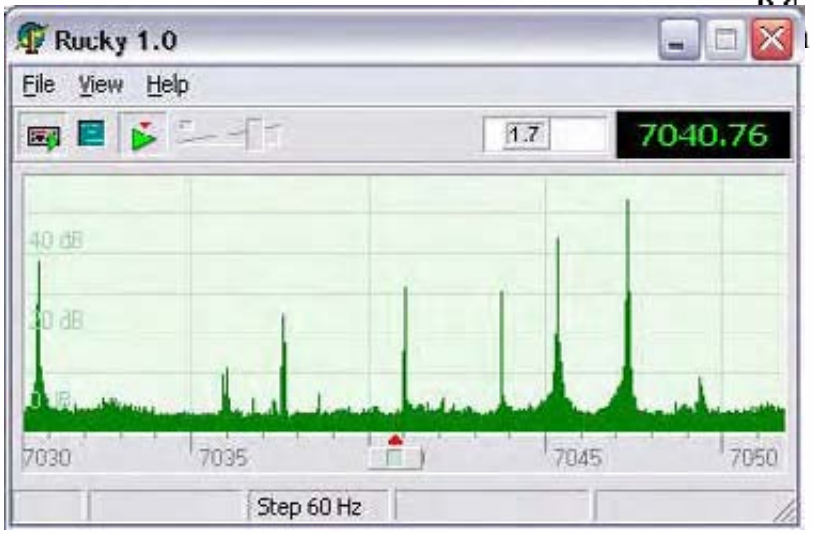
Rocky 3.2

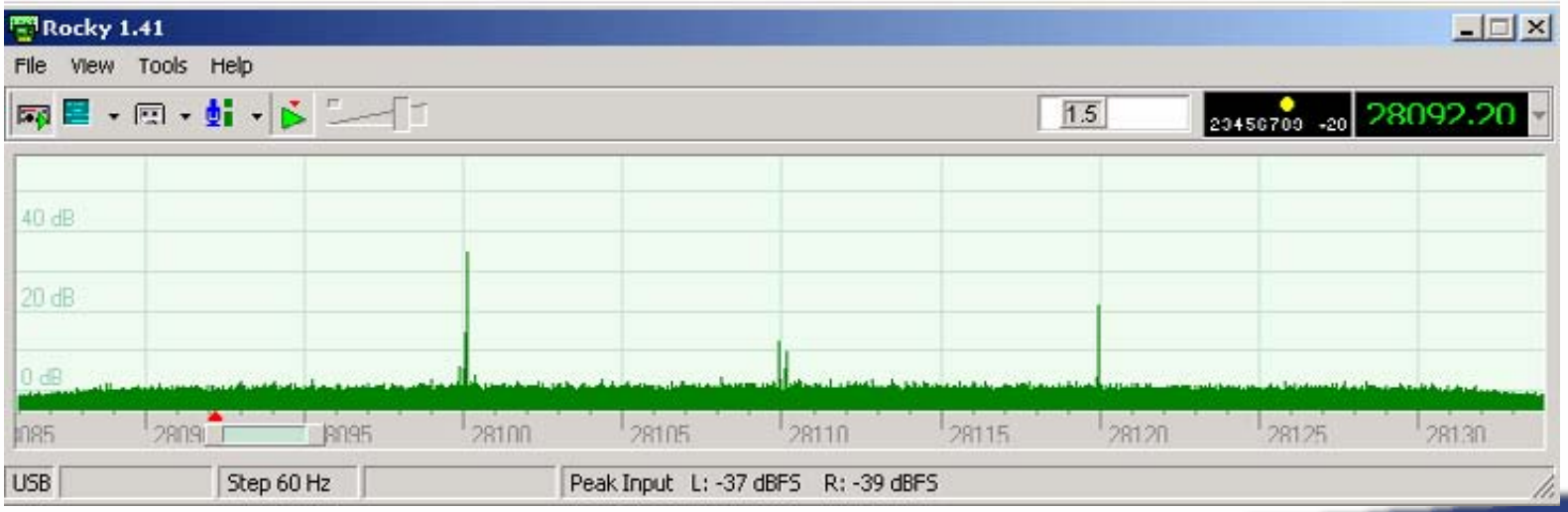
FREEWARE

by Alex VE3NEA

ve3nea@dxatlas.com

SDR software for **SoftRock40**





WINRAD by I2PHD

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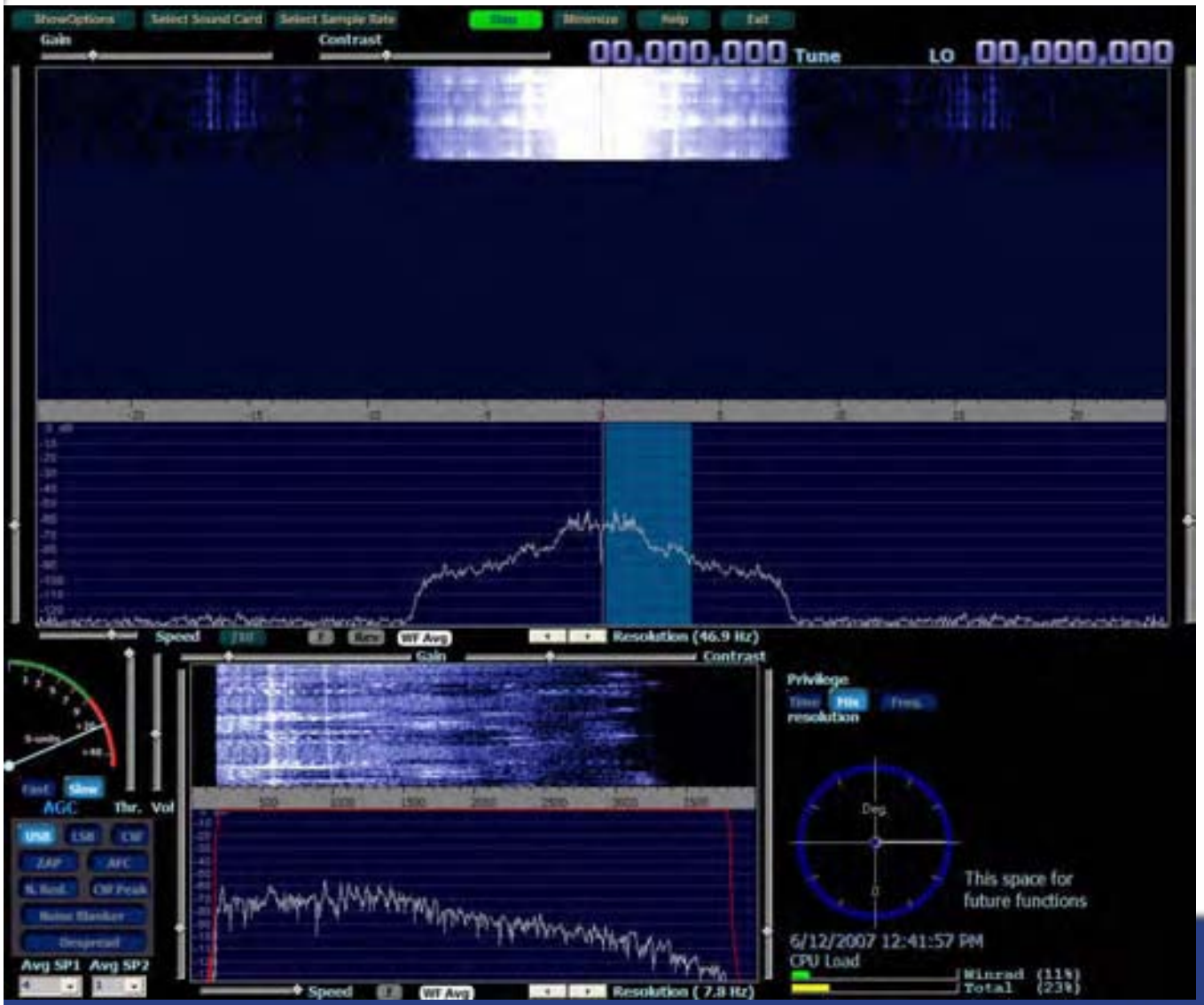

Uses outputs from any sound card

Can supply up to 192 kHz of passband display
Excellent program & support from Alberto

http://www.winrad.org/winrad/index.html

SDR-1000 Microwave Radio w/ K3TUF UCB

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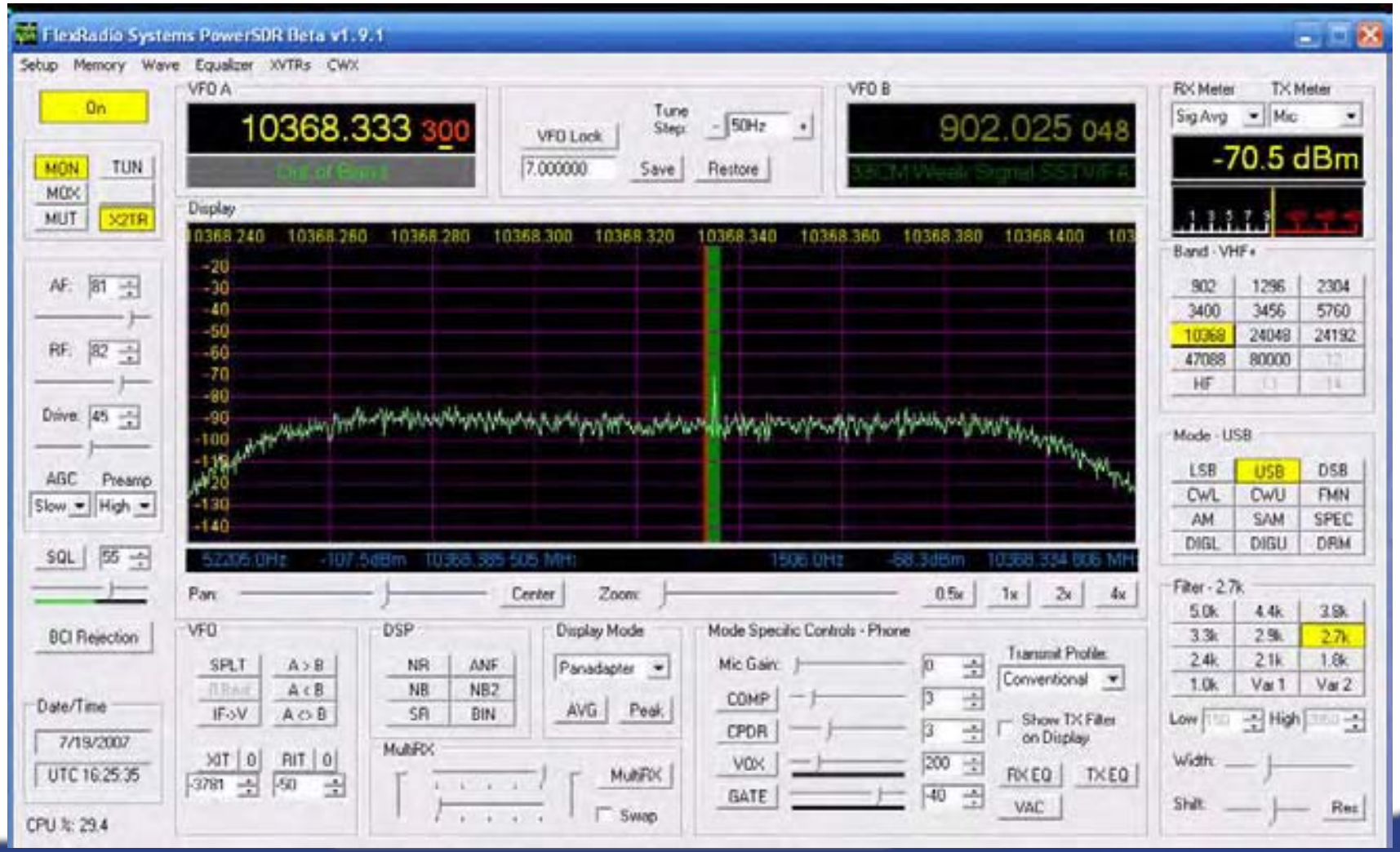

SDR-1000 Controlled K3TUF UCB for Microwave Band Switching

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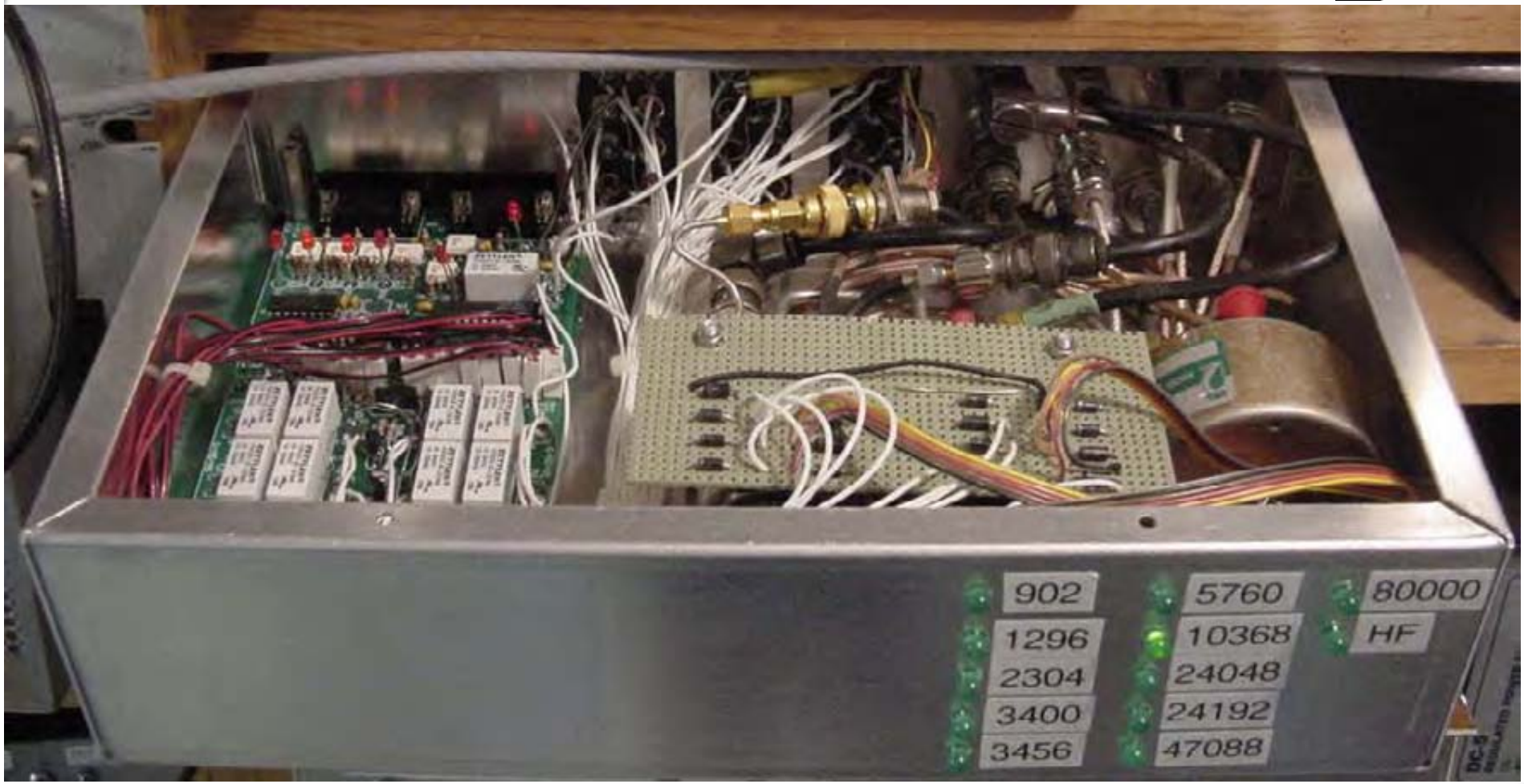

No more bandswitching knob!

SDR-1000 XVTR Setup

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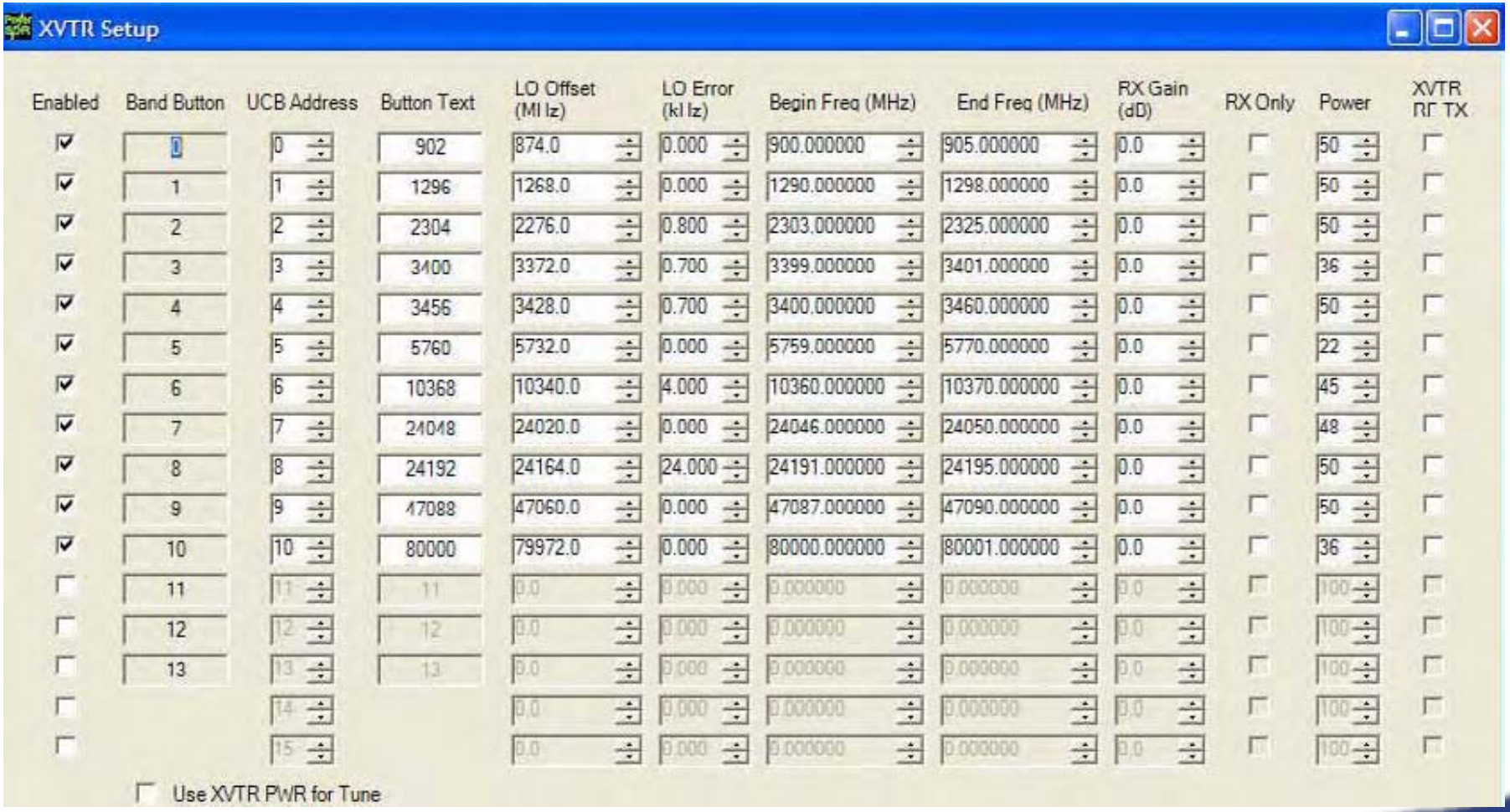
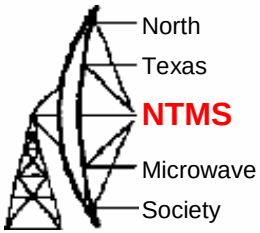


Summary



- Great for a microwave IF spectrum analyzer – Frequency coverage is crystal frequency plus and minus 24 kHz for a 48 kHz sampling rate sound card
- Software is free!
- Receiver can become a well calibrated small signal power meter for the lab
- With the DDS-60, the combination can provide receive coverage from 1 to 60 MHz – only need to provide front-end BPF if connected to antenna
- Can also be set up as a spectrum analyzer at the first IF frequency of your favorite “rice-box” radio at a fraction of the cost of an IC-756pro, IC7800 and IC-9000
- Hard to imagine all the neat stuff they can do in software today and to think our soundcards are at least 48 kHz wide receivers!
- Any questions?