
SDR Update

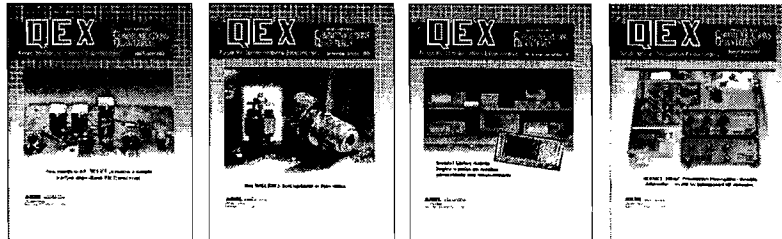
TAPR DCC 2003

By Gerald Youngblood, AC5OG

SDR-1000 Overview

- ◆ PC Based, Software Defined Radio
- ◆ Simple/Flexible External Hardware
- ◆ Open Software – GNU Public License
- ◆ Continuous enhancement

A Software Defined Radio For The Masses: Parts 1, 2, 3, & 4

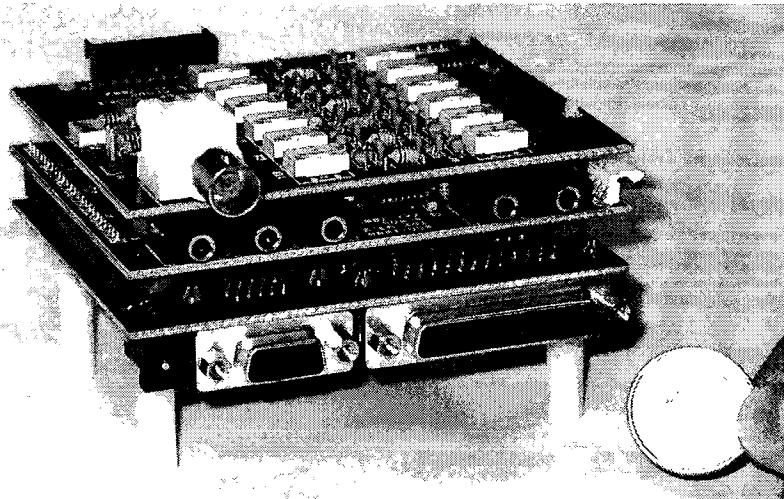


Reprints are may be found at www.flex-radio.com

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3

SDR-1000 Hardware

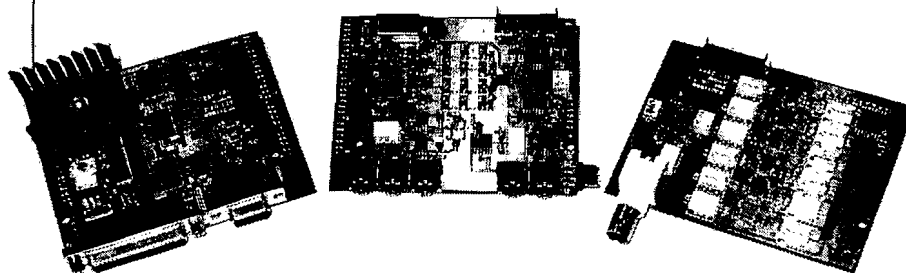


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4

Three Board Set

Some Assembly Required....



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5

SDR-1000 Specifications

Frequency Range	0-65MHz
Minimum Tuning Step	1uHz - 1Hz in SDR-Console Software
DDS Clock	200MHz, <1ps RMS jitter
1dB Compression	+8dBm
Max. Receive Bandwidth	40KHz (200KHz with proper sound card)
Transmit Power	2W PEP
Control Interface	PC Parallel Port (DB-25 connector)
Rear Panel Control Outputs	7 open collector Darlington, 1 TTL
Input Controls	PTT, Code Key
Sound Card Interface	Line In, Line Out, Microphone In
Power	13.8VDC
Price FOB Austin, TX	\$499.00 Plus S&H

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6

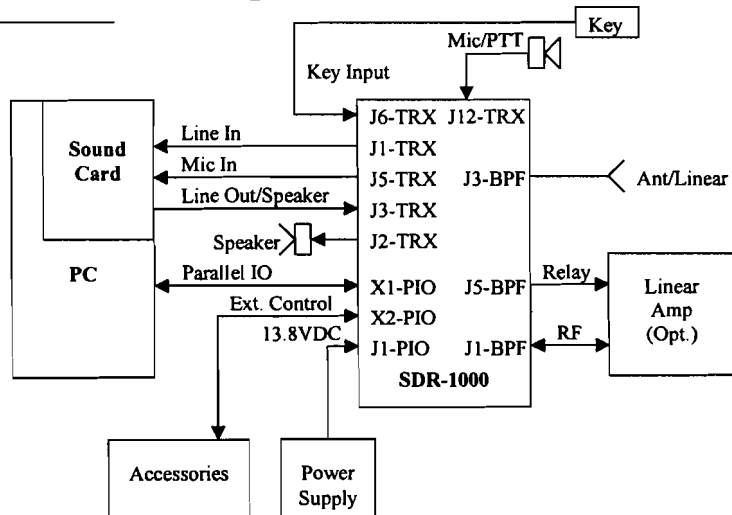
Coming Soon

- ◆ 144MHz Undersampling Converter
- ◆ QSD Low Noise Preamp
- ◆ Enclosure
- ◆ 20W Linear Amplifier & Filters

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7

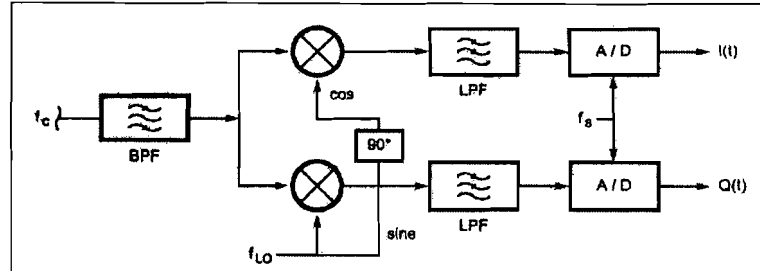
SDR-1000 Connections



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8

Quadrature Sampling Architecture



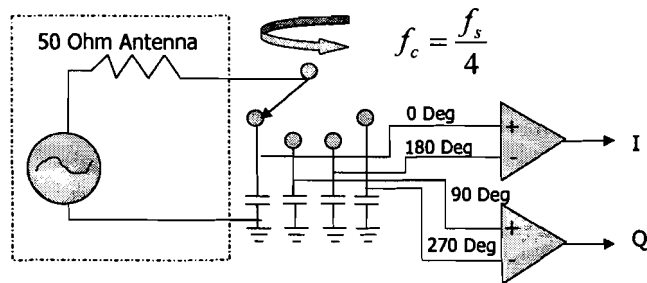
$$BW = 2 * \frac{f_s}{2} = f_s$$

Quadrature Sampling Doubles Bandwidth

Why Direct Quadrature Sampling

- ◆ Doubles BW for Sampling Rate
- ◆ Simple/Low Cost Hardware
- ◆ I & Q – Any Modulation
- ◆ DSP Overcomes Analog Imbalances
- ◆ Low Cost/High Resolution ADCs
- ◆ Amazing Audio!

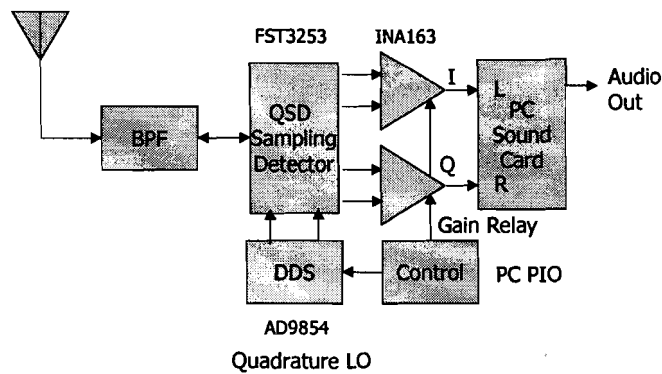
Quadrature Sampling Detector



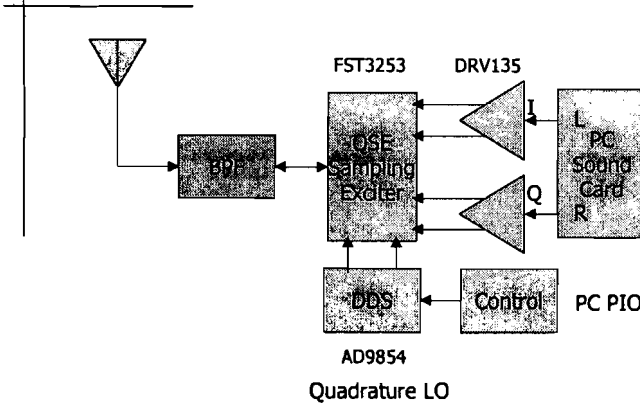
$$BW = \frac{1}{\pi R_{ant} C_s}$$

Bandwidth Determined by Source Impedance and Sampling Capacitors

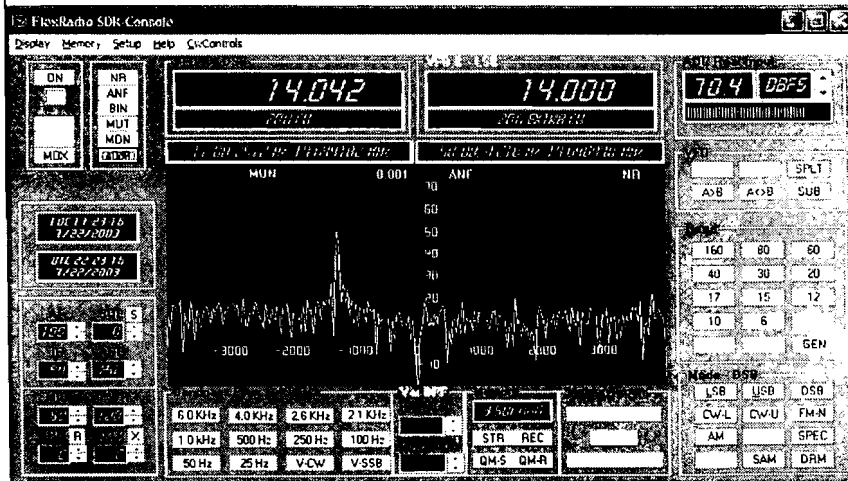
SDR Receiver Hardware



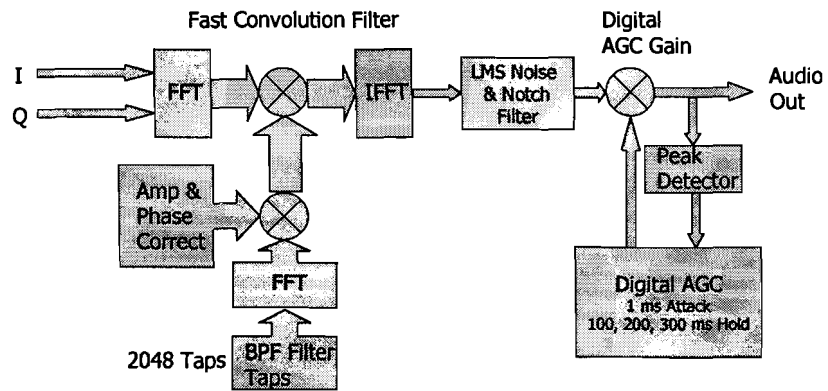
SDR Exciter Hardware



SDR-Console User Interface



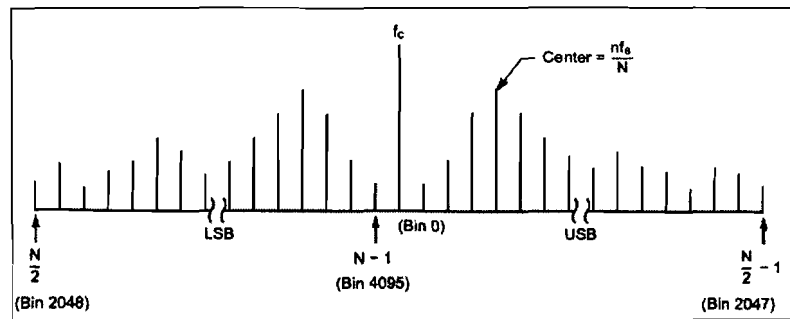
SDR Receiver Software



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15

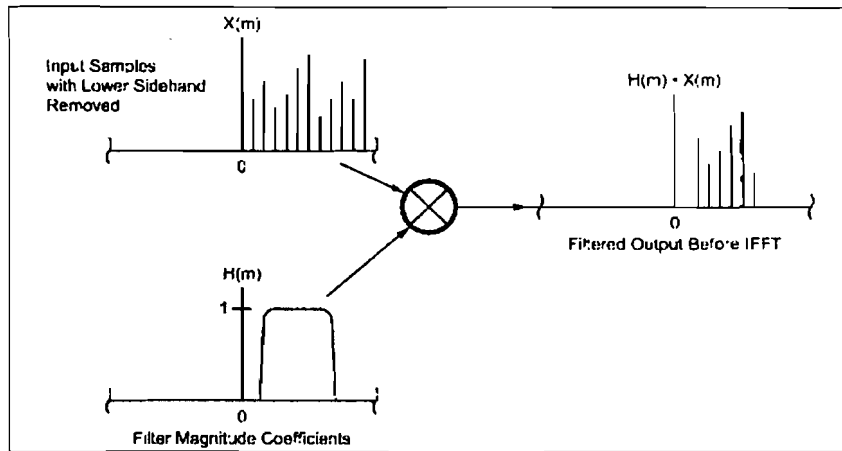
FFT Output Bins



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16

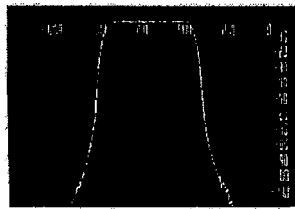
FFT Convolution Spectrum



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17

500 Hz Filter SF= ~ 1.05 !

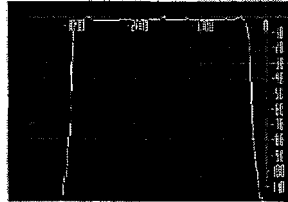


$F_h = 950$ Hz, $F_l = 450$ Hz, 60 dB down @ 1 KHz, Shape Factor ~ 1.05

4096 Bin FFT and 2048 Tap Filter
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18

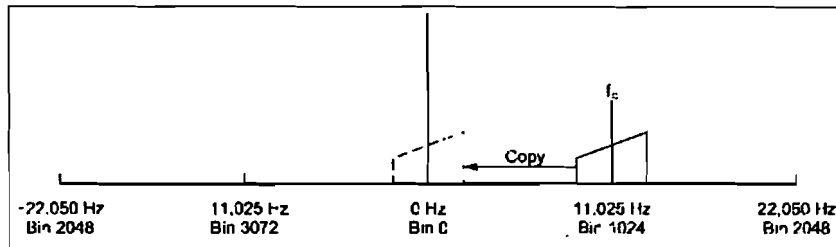
2.8KHz Filter Spectrum



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19

Offset Baseband IF Shift

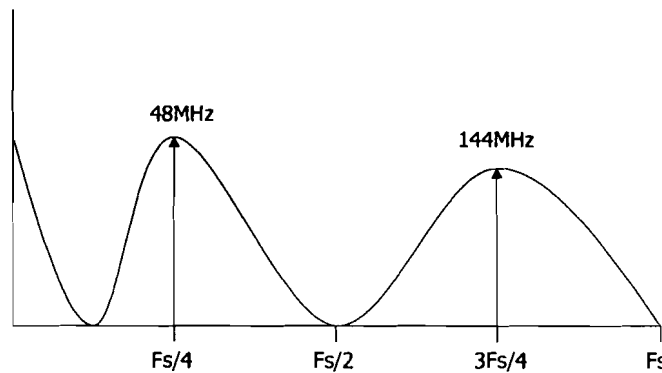


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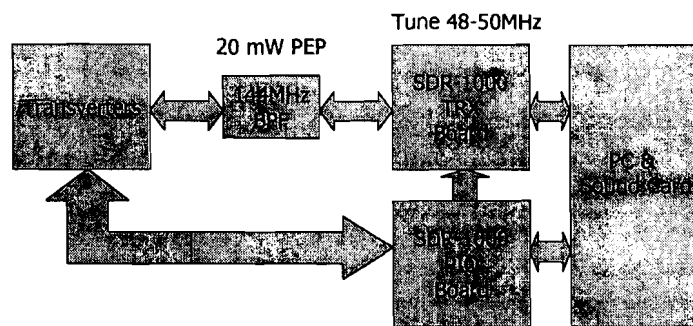
20

Undersampling Uses The Alias

Two Capacitor Sampling Responds to Odd Harmonic Frequencies - $\sin(x)/x$



2M Under Sampling IF For Transverters



Open Source Contributions

- ◆ N4HY – AM, FM, DRM, Complex Filters, Noise and Spur Reduction
- ◆ W5SXD – CW Keyer and modulation, Spectrum Frequency/Amplitude readout
- ◆ VK6APH – Feed Forward Speech Processor, Graphic Equalizer
- ◆ Others Contributing Enhancements

Modes Supported

- | | |
|--|--|
| <ul style="list-style-type: none">◆ Current<ul style="list-style-type: none">■ SSB & DSB TX/RX■ CW TX/RX■ AM TX/RX■ SAM RX■ FMN TX/RX■ DRM RX | <ul style="list-style-type: none">◆ Future<ul style="list-style-type: none">■ PSK31■ RTTY■ Slowscan TV■ WSJT■ Digital Voice■ Your add it! |
|--|--|

SDR Applications

- ◆ 28 MHz or 144MHz IF Radio
- ◆ Contest Grade HF Transceiver
- ◆ Integrated Analog & Digital Modes
- ◆ Long Integration "Lowfer" Receiver
- ◆ New Digital Modes
- ◆ Digital Voice Modes
- ◆ Full Internet Remote Operation
- ◆ Dream It and Code It

The SDR-1000

The radio that be what you want it to be!