



EXPERIMENTING WITH AND USING SOFTWARE DEFINED RADIOS

OZARKCON, 2015

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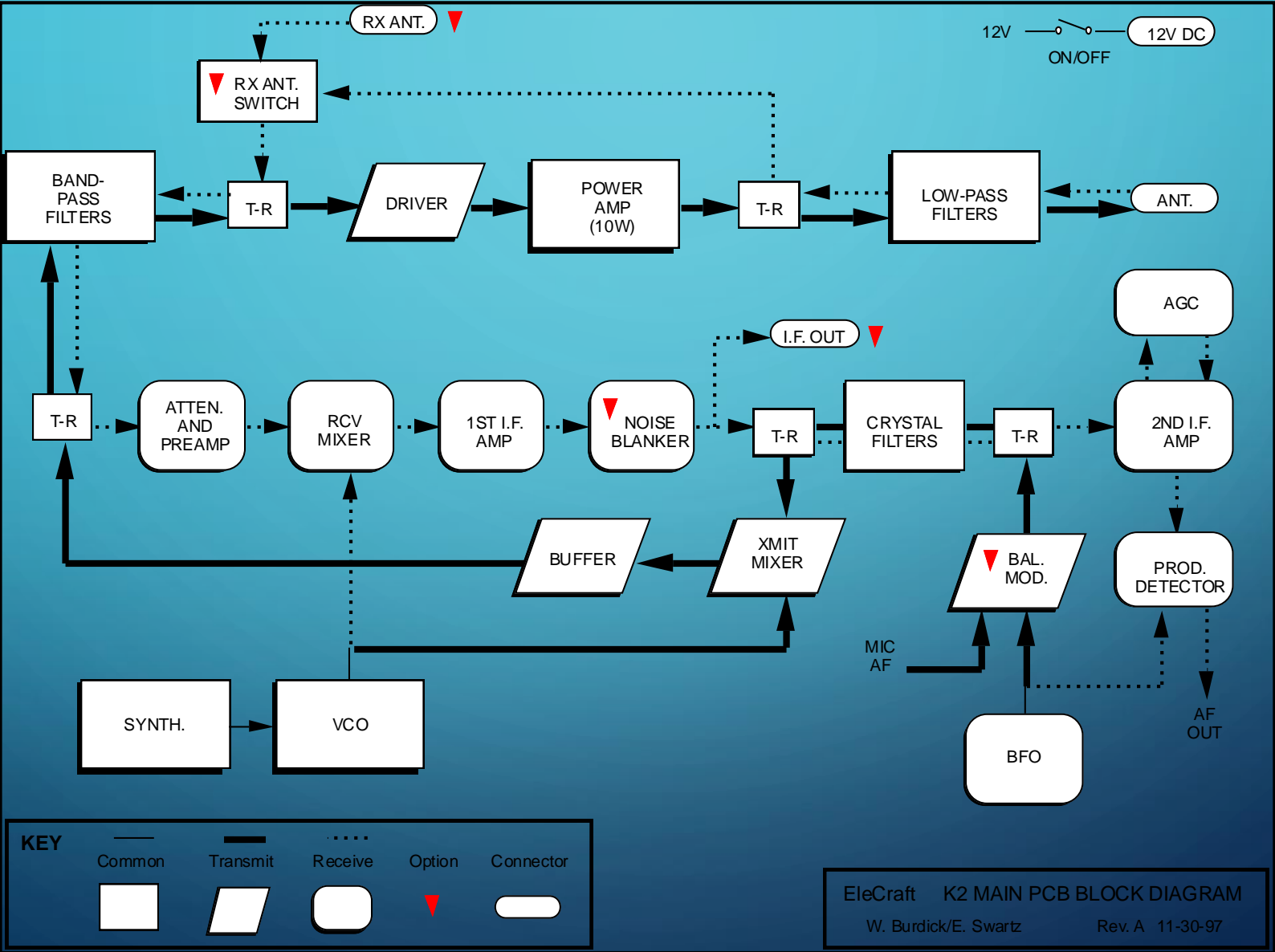
TOPICS:

- ***Introduction to Software Defined Radio (SDR)***
 - What is a SDR?
 - How are SDRs different than “conventional” radios?
 - Examples of SDRs
 - SDR Transmitter Example
- ***The FlexRadio Systems Flex-1500 SDR Demo (if we can get it to work)***
 - Features
 - Setup
 - Operation
 - Use with Third Party Applications
 - FLDIGI, Ham Radio Deluxe, etc.
 - ***Computing Resources Required***
- Alternative SDRs
- Flex-1500 and iSDR Demo (time permitting)

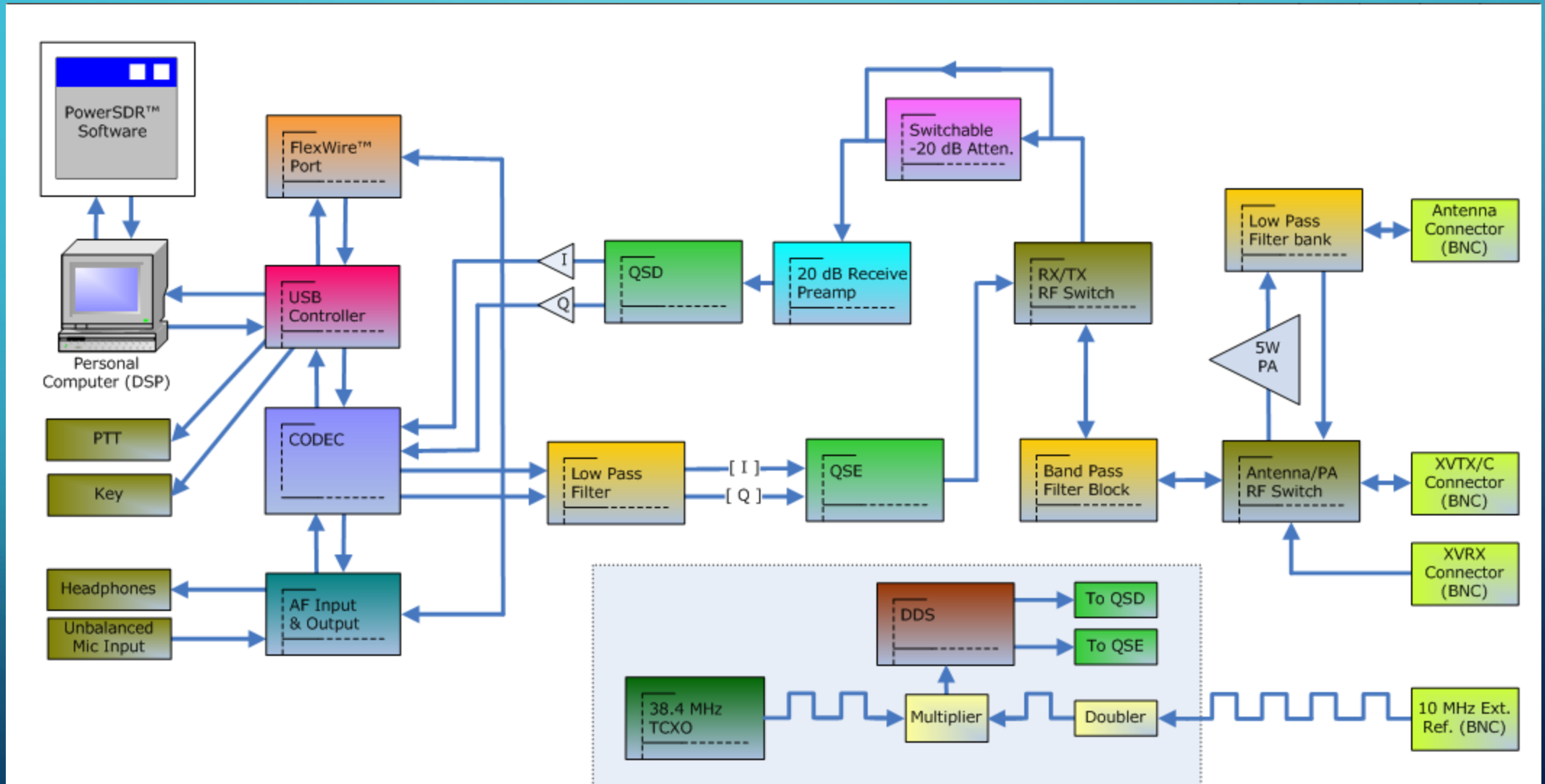
WHAT IS A SOFTWARE DEFINED RADIO?

- A system where components that have typically been implemented in *hardware* are instead implemented using *software*.
 - Mixers
 - Filters
 - Modulators/Demodulators
 - Detectors
 - Controls
 - Etc
- Adding new mode or feature is a *software update!*

SOFTWARE DEFINED - CONVENTIONAL RADIO DIFFERENCES



SOFTWARE DEFINED - CONVENTIONAL RADIO DIFFERENCES

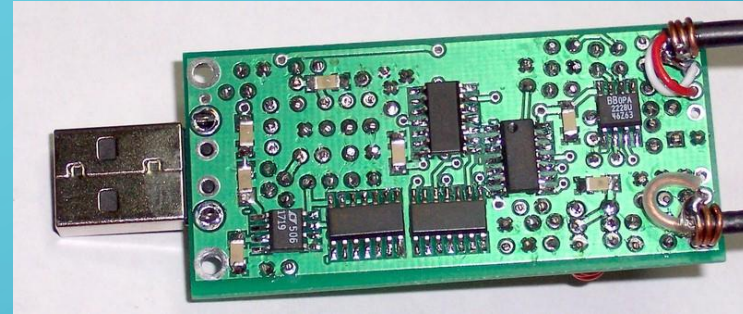


Flex-1500 Block Diagram

EXAMPLES OF SDRs

- SoftRock Series

- <http://www.amqrp.org/kits/softrock40/>



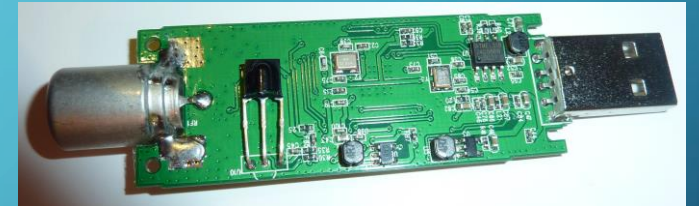
- SDR IQ

- <http://www.rfspace.com/RFSPACE/Home.html>



EXAMPLES OF SDRS

- RTL-SDR



EXAMPLES OF SDRS

FlexRadio Flex-5000

<http://www.flexradio.com/downloads/flex-5000-datasheet-pdf/>

No Longer Available



FlexRadio Flex-3000

<http://www.flexradio.com/downloads/flex-3000-datasheet-pdf/>

No Longer Available



- FlexRadio Flex-1500

- <http://www.flexradio.com/amateur-products/flex-series/flex-1500/>



EXAMPLES OF SDRS

FlexRadio Flex-6700

<http://www.flexradio.com/amateur-products/flex-6000-signature-series/flex-6700/>



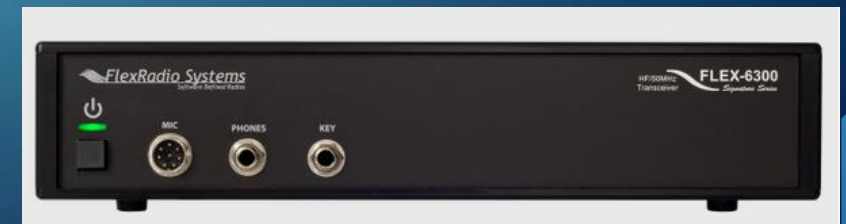
FlexRadio Flex-6500

<http://www.flexradio.com/downloads/flex-3000-datasheet-pdf/>



- FlexRadio Flex-6300

- <http://www.flexradio.com/amateur-products/flex-6000-signature-series/flex-6300/>



SOFTWARE DEFINED - CONVENTIONAL RADIO DIFFERENCES



Look Ma...

...No Knobs!



...But I gotta have my PC!



FlexRadio Systems™ PowerSDR™ v2.2.3 Demo

Setup Memory Wave Equalizer XVTRs CWX FlexControl ESC Report Bug About

START

MON TUN
MOX
MUT X2TR

AF: 14

AGC-T: 90

Drive: 50

AGC Preamp
Med High

SQL: -150

BCI Rejection

9/18/2011
LOC 18:44:16

VFO A: **14.067 748**

20M CW TX

VFO Sync VFO Lock 7.000000 Save Restore

Tune Step: - 50Hz +

VFO B: **7.000 000**

TX 40M Extra CW

14.050 14.055 14.060 14.065 14.070 14.075 14.080 14.085

-20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150

-3976.8Hz -94.0dBm 14.063 771 MHz

Pan: Center Zoom: 0.5x 1x 2x 4x

SPLIT A > B NR ANF Panadapter
0 Beat A < B NB NB2 AVG Peak
IF->V A <> B SR BIN TNF +TNF

XIT 0 RIT 0

CPU %: 0.8 MultiRX Swap

VAC RX Gain: 0 TX Gain: 0

Sample Rate: 48000 Mono/Stereo: Stereo

TX Profile: Default

RX1 Meter TX Meter

Signal Fwd Pwr

-76 dBm

1 3 5 7 9 +20 +40 +60

160	80	60
40	30	20
17	15	12
10	6	2
VHF+	WWV	GEN

LSB	USB	DSB
CWL	CWU	FM
AM	SAM	SPEC
DIGL	DIGU	DRM

3.0k	2.5k	2.0k
1.5k	1.0k	800
600	300	150
75	Var 1	Var 2

Low 1000 High 2000

Width: Shift: Reset

EXAMPLES OF SDRs

- Elecraft K3

- <http://www.elecraft.com/K3/K3.htm>



- Elecraft KX3

- <http://www.elecraft.com/KX3/kx3.htm>



SOFTWARE DEFINED - CONVENTIONAL RADIO DIFFERENCES

IC-706 "GO" Kit

1. IC-706
2. Tuner
3. Microphone
4. Key
5. Power cables
6. Signalink Box
7. Sound card cables to computer
8. Rig control cable
9. CW keying cable
10. Laptop computer
11. Power supply

Flex-3000 "GO" Kit

1. Flex-3000
2. Microphone
3. Key
4. Power cable
5. Firewire Cable
6. Laptop computer
7. Power supply

**Which would you rather carry
on Field Day?**

OPERATION – DIGITAL

- PowerSDR supports CW keyboard, CW memories for general use or contesting directly.
- Digital Mode operation, automatic contesting & automatic logging requires 3rd party applications:
 - Writelog
 - MMTTY
 - FLDIGI
 - Logger32
 - *MixW*
 - *Ham Radio Deluxe*
 - *JT65 variants*

INTERFACING POWERSDR WITH 3RD PARTY APPLICATIONS

- Most 3rd party applications require:
 - Serial ports for:
 - RIG CAT control
 - CW Keying
 - Push To Talk (PTT)
 - Audio cables for connecting rig audio to PC Soundcard.
 - All Flex SDRs contain built-in soundcard
 - Flex-1500 connects via USB
- PowerSDR supports hardware cabling.
- Enter *Virtual Cables*

INTERFACING POWERSDR WITH 3RD PARTY APPLICATIONS

- Virtual Serial Ports
 - Created by VspMgr (Virtual Serial Port Manager)
 - Look like real serial ports to PowerSDR and 3rd party apps such as Writelog or MMTTY
 - Setup in pairs (COM10/COM30, COM11/COM31, COM12/COM32, etc)
 - One end of the pair used in PowerSDR (COM30), the other in the 3rd Party app (COM10).
 - Data the apps sends on COM10 is received by PowerSDR on COM30 and vice-versa.

INTERFACING POWERSDR WITH 3RD PARTY APPLICATIONS

- Virtual Audio Cables

- Created by *Virtual Audio Cable*
- Look like real audio sources to PowerSDR and 3rd party apps such as Writelog or MMTTY
- Setup in pairs (Vcable1, Vcable2)
- One cable (Vcable1) of the pair used to source audio from PowerSDR to the 3rd Party app.
- One cable (Vcable2) of the pair used to source audio to PowerSDR from the 3rd Party app.

POWERSDR COMPUTER RESOURCES

- *Opinion:* Most bad experiences with SDRs are caused by attempting to use an underpowered or poorly configured PC to run PowerSDR
- Underpowered PC will cause:
 - Choppy audio
 - Choppy CW
 - Excessive audio latency
 - Distorted audio
- Excessive Deferred Procedure Call (DPC) latencies will cause the same thing

MY POWERSDR COMPUTER

- Dell XPS1530
 - Intel Core2 Duo CPU T8300 @ 2.40 GHz
 - 4 GB RAM
 - Windows 7 32-bit / Service Pack 1
 - 1 Firewire (IEEE1394) port
 - 3 USB ports
- *FlexRadio* has good information on PC resources required to run PowerSDR
 - <http://kc.flexradio.com/KnowledgebaseArticle50063.aspx?Keywords=powersdr+computer>

EXAMPLES OF SDRs

- Elecraft K3

- <http://www.elecraft.com/K3/K3.htm>



- Elecraft KX3

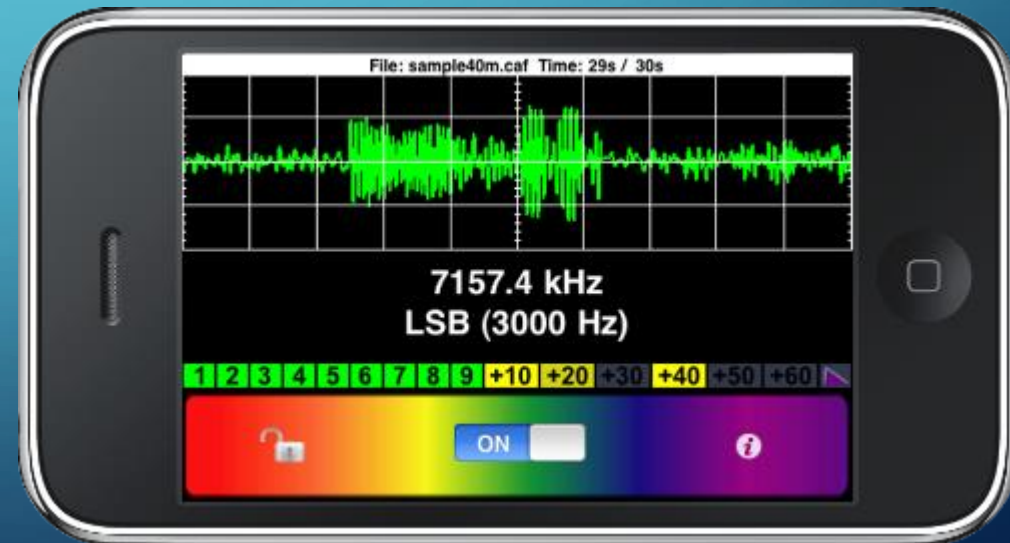
- <http://www.elecraft.com/KX3/kx3.htm>



EXAMPLES OF SDRs

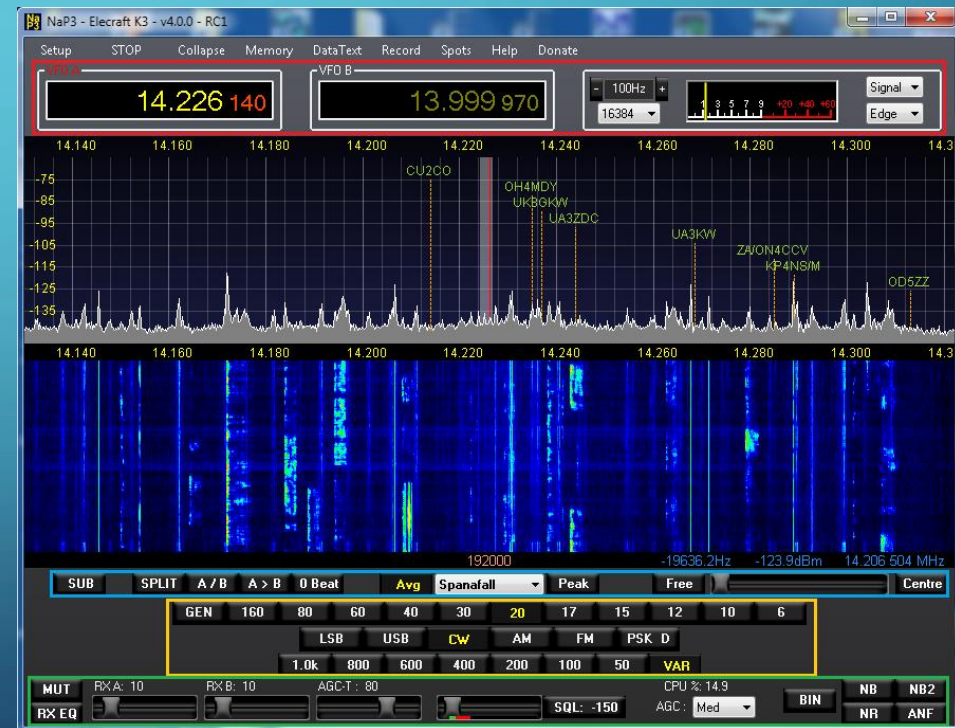
- iSDR and the KX3

- Runs on iOS
- Can control the KX3
- http://apps.digitalconfections.com/?page_id=28



EXAMPLES OF SDRS

- NaP3 and the KX3 (or K3)
 - Runs on Windows
 - Very nice panadater display with point / click rig control
 - Complicated to setup
 - Does everything a Flex-1500 does
 - Full break-in CW
 - 10W output
 - No longer being actively developed.



SDR DEVELOPMENTS

- The HT of the Future
 - SDR that looks more like a Smart Phone than a radio
 - Being developed as open source (hardware and software)
 - Developers: Chris Testa, **KD2BMH** and Bruce Parens, K6BP

The image features a blue gradient background with white circuit-like lines in the corners. The word "QUESTIONS?" is centered in white. The lines are composed of straight segments and small circles, resembling a network or data flow diagram.

QUESTIONS?