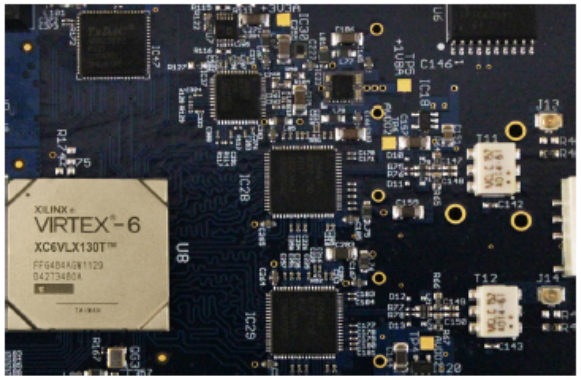
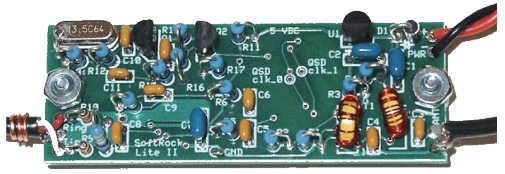




Contesting with the new SDR Radios

Stu Phillips K6TU

Contest Club California Peninsula

Today's presentation

- SDR – A brief introduction
- Different ways to include SDR in a station
- Contesting with a SDR
  - FLEX-6000 series radio
  - Station integration
  - Work flow management
  - The "visual" radio
  - Ease of S&P operation
  - Monitoring multiple bands
  - Real world experience with SDR
- Conclusion

SDR – BRIEF INTRODUCTION

Software Defined Radio – defined!

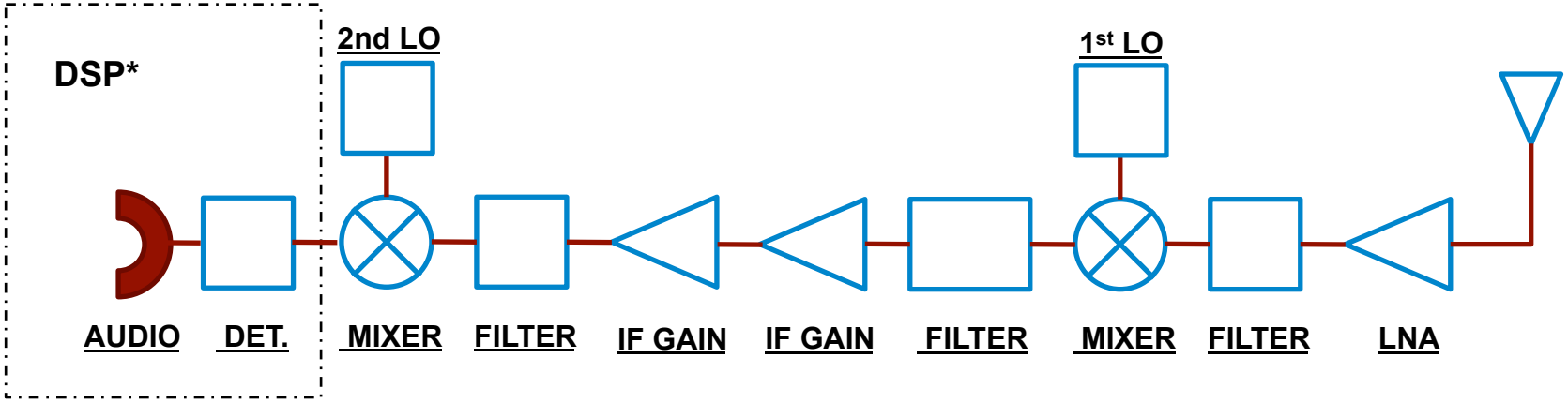
- A software-defined radio system, or SDR, is a radio communication system where components that have been **typically implemented in hardware** (e.g. mixers, filters, amplifiers, modulators/demodulators, detectors, etc.) **are instead implemented by means of software** on a personal computer or embedded system.[1]

[1] Software Defined Radio: Architectures, Systems and Functions (Markus Dillinger, Kambiz Madani, Nancy Alonistioti) Page xxxiii (Wiley & Sons, 2003, ISBN 0-470-85164-3)

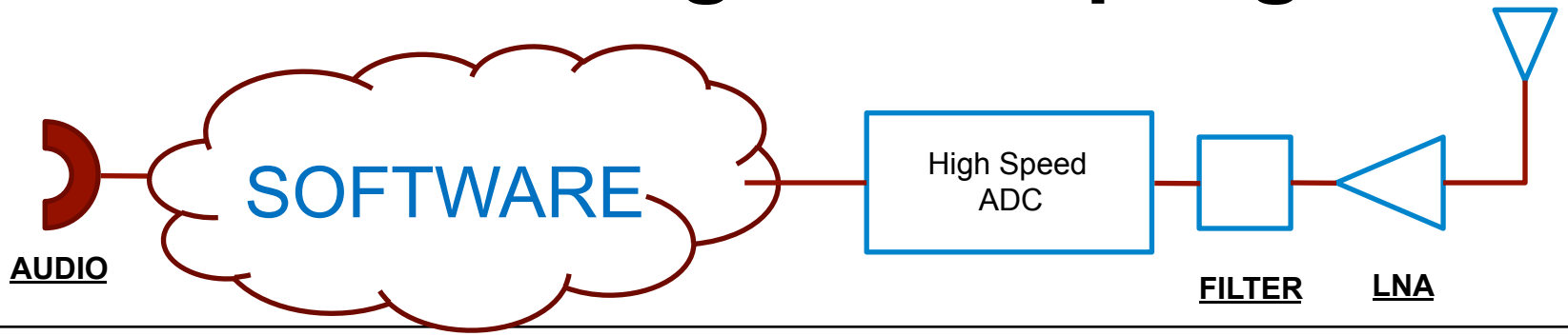
Source: http://en.wikipedia.org/wiki/Software-defined_radio

Conventional Radio

Multi-Stage Receiver Chain



Direct Digital Sampling



DSP and Software Defined Radio

- Most modern high-end radios are SDR at some level
  - Conventional analog RF chain converts to low frequency IF
    - Multi-stage RF conversion
    - Roofing filters
    - Final IF 15-40 KHz
  - Digital Signal Processing for final IF to audio…
    - Modulation, Demodulation
    - Noise reduction, filtering
    - Equalization
  - Embedded computer allows external PC control of radio
    - CAT for logging interfaces, radio control etc.
  - DSP functions upgradeable by new firmware

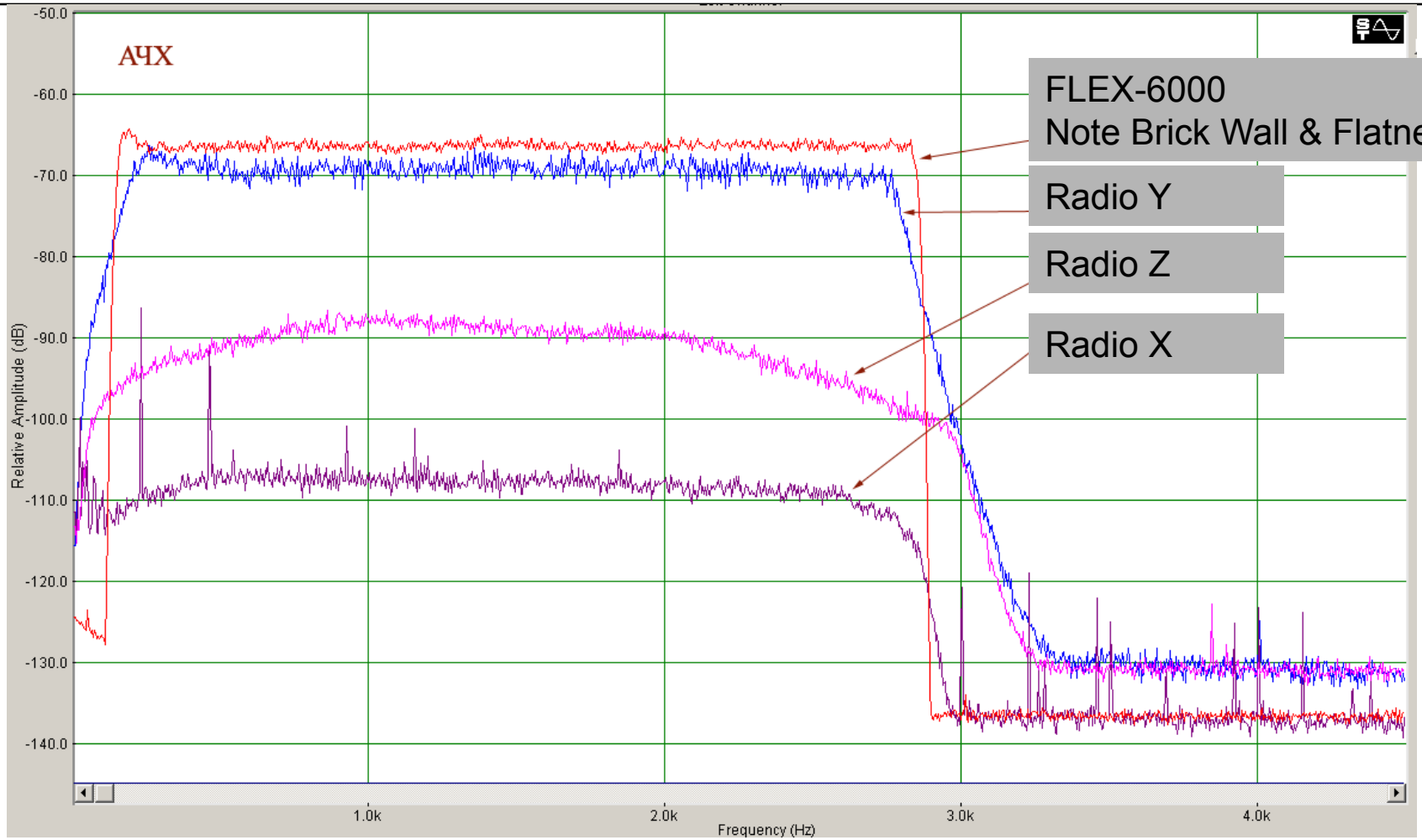
Software Defined Radio

- Direct digital sampling of RF to data
- Majority of RF chain is eliminated with exception of:
  - Band pass filters
  - Receiver pre-amplification

ADVANTAGES

- Less Analog => more linear
- Performance very expensive or not possible in analog
- Rig for each Mode or Style of Operation
- Continuous enhancement through software releases

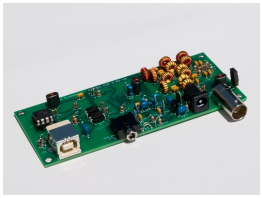
Brick wall filters



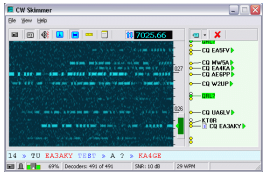
DIFFERENT WAYS TO INCLUDE SDR IN A STATION

SDR hybrid with Conventional Radio

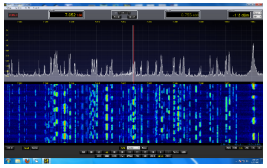
IF



Softrock RX



CW Skimmer

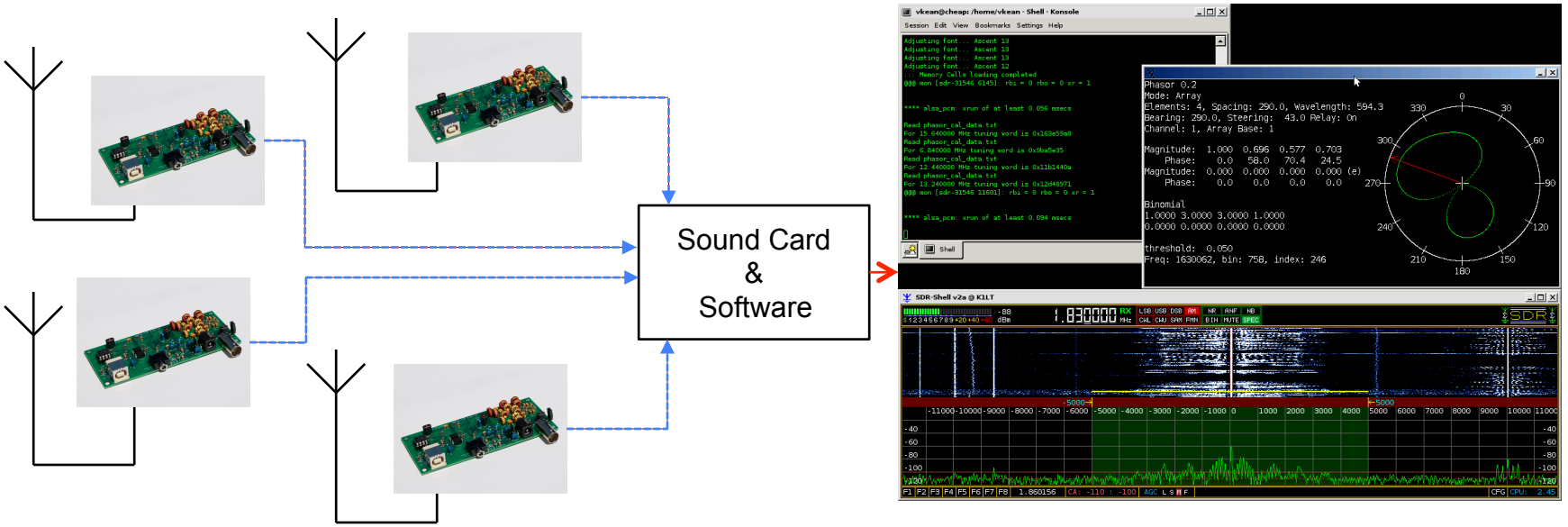


Band Scope

- Add SDR to monitor the IF output
- Many modern transceivers already have an IF output
- Use inexpensive SDR RX like SoftRock (~ $25)
- Use for wideband CW Skimmer operation
- 96 KHz wide band scope

Electronic beam steering

- K1LT presentation at Dayton 2008 on 160m beam steering using multiple SDR
- Softrock receiver on each antenna – short verticals
- Beam steering in software with baseband signals
- http://www.k1lt.com/Beam Steering on 160 Meters.ppt



Use SDR as the primary radio

- FlexRadio Systems offers a range of SDR transceivers
- All use a computer for the UI
- Flex 1500, 3000, 5000 use computer for DSP
  - Connect to radio via USB or Firewire
- Flex 6000 has embedded computer
  - Handles all real time processing
  - Connects to radio via LAN
- All have excellent performance
  - Great contest or DX radios
- Like having a new radio every release
- Great support!

CONTESTING WITH A FLEX-6000 SERIES SDR

FLEX-6000 Series

- FLEX-6000 series is unique
  - FIRST LAN controlled radio SERVER
  - Radio samples at 245.76 Msps – Direct Digital Sampling
  - CPU, DSP and FPGA for all real time operations & DSP
- 100 watt radio with Automatic ATU – 160m – 6m*
- Antenna ports
  - Two TX
  - Separate transverter and RX antenna ports
- GPSDO frequency standard as option
- 1 or 2 spectrum capture units*
- 4 or 8 pan adaptors*
- 4 or 8 independent slice receivers*
- Clean transmitter
- Ultra High Performance receivers

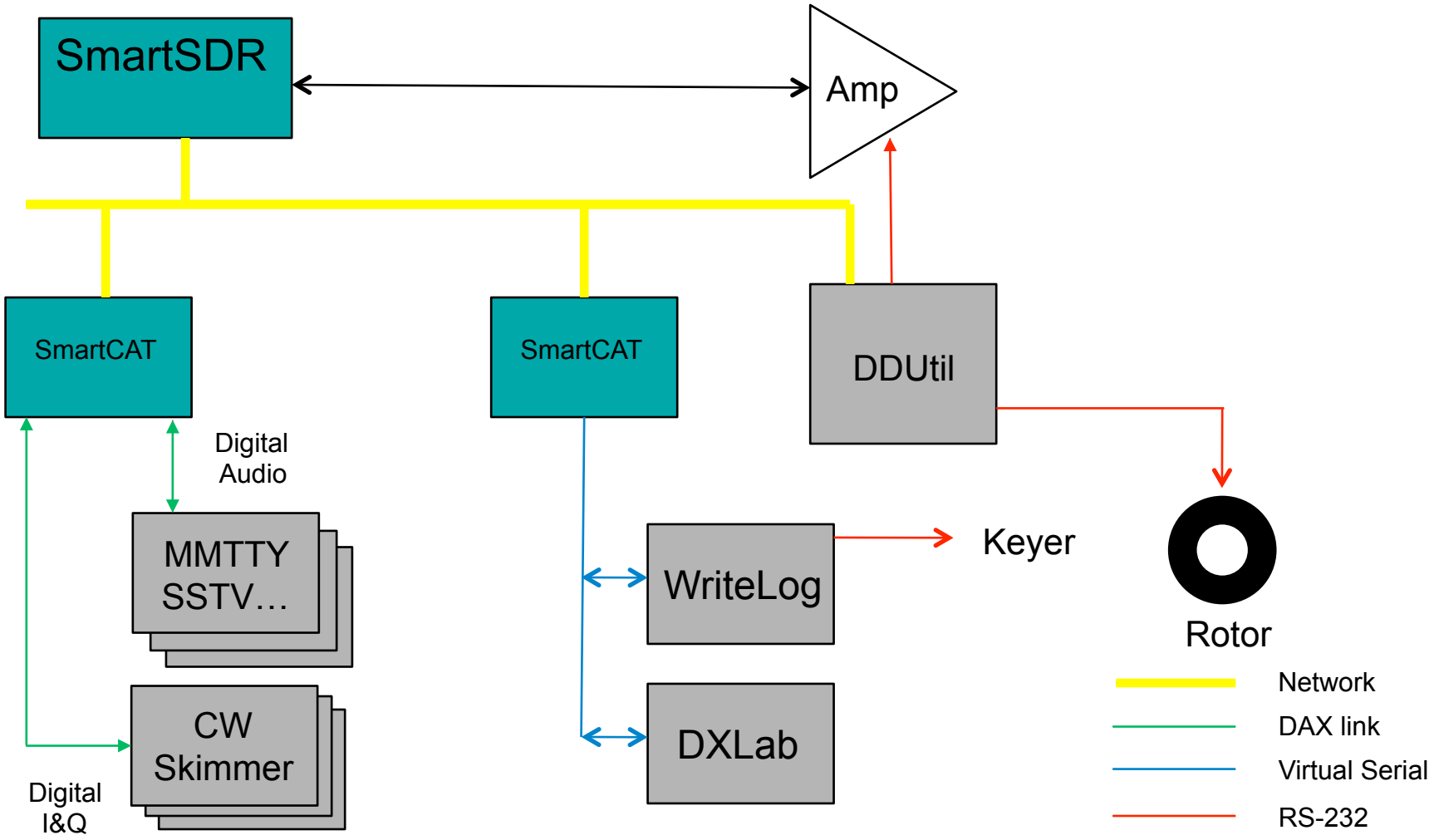
Station Integration - 1

- Access the radio from anywhere on the local network – cabled or WiFi
- Multiple clients [CAT, DAX, Control…] on same or multiple different computers
  - Windows based software
  - Lot of flexibility… imagine 4 different CW Skimmers from one radio… while you operate it!
- Clients for other platforms available - iPad
- Full remote control… coming!

Station Integration – 2

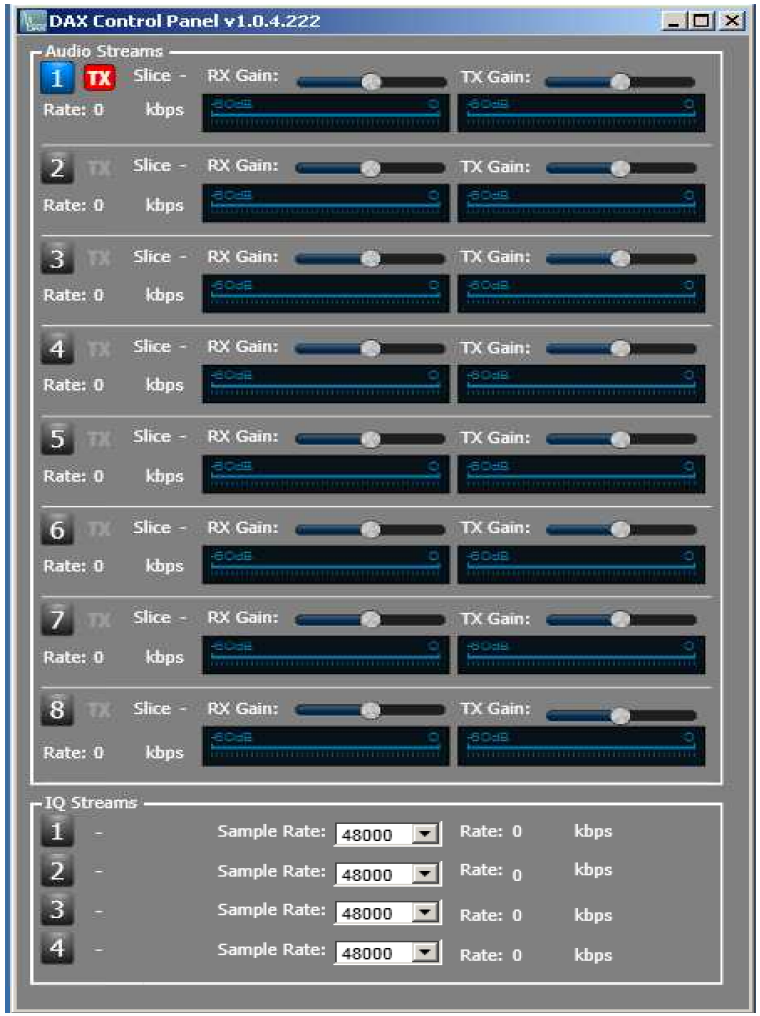
- Components
  - SmartSDR
    - Graphical client – pan adaptors, controls
  - SmartCAT
    - CAT client
      - Can run on multiple computers at once
      - Provides multiple virtual serial ports
  - SmartDAX
    - Digital data client (Digital Audio eXchange)
      - Can run on multiple computers at once
      - Provides multiple sound devices for other software
      - Audio streams or Digital Data (IQ) for Skimmer, etc.

Station Integration - 2



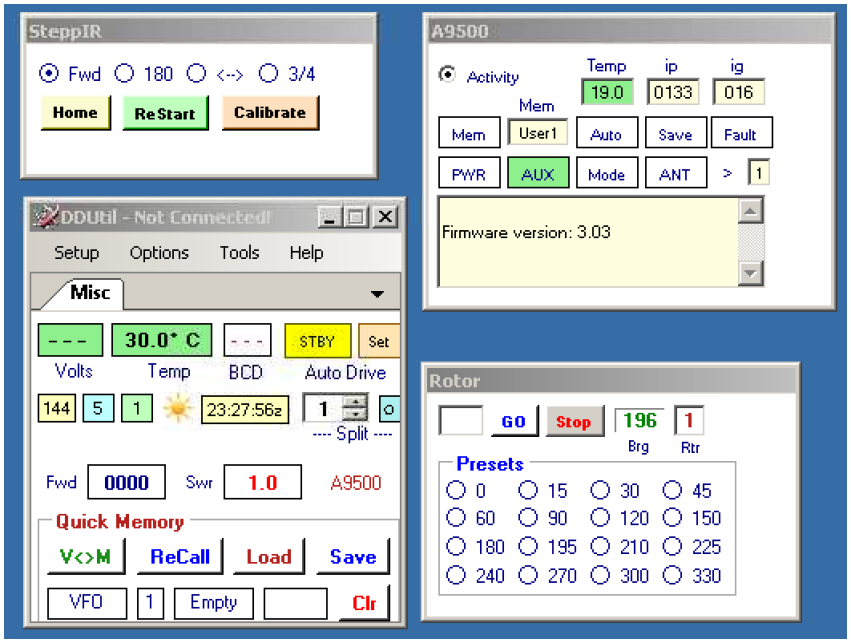
Station Integration - 4

- Connect to radio via network
- FDX audio channel per slice
- Appears as Audio Devices
- 8 audio channels
- 4 Digital IQ streams
  - Skimmer etc
  - 48 – 192 Ksps



Station Integration - 5

- DDUTIL
- Written by Steve K5FR
- Integrates station control
  - Power meter
  - Amplifier
  - SteppIR control
  - Filter selection
  - Rotor control
- Awesome support
- Free



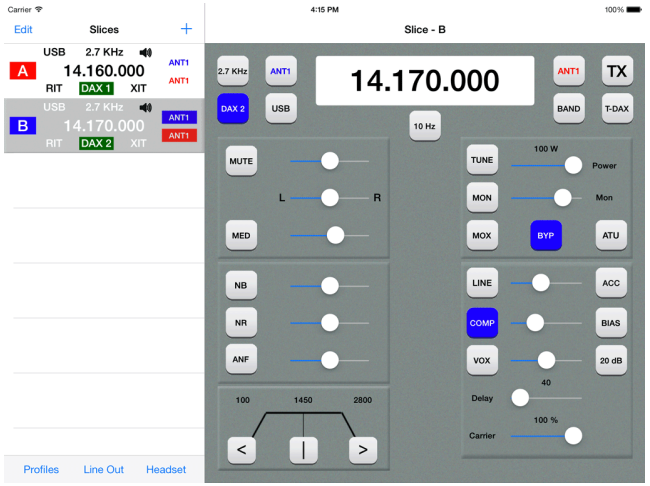
Workflow Management - 1

- Doing well in a contest DEMANDS optimized workflow…
  - Cut down the number of key strokes
  - Minimize the extraneous information you send (e.g. cut out "please copy", repeating what you were just sent, eliminate unwanted characters in CW or RTTY like DE... over the course of a contest these add up to HOURS of additional time).
  - Not having to think about controlling the radio - just do it!
- Computer control of ANY radio requires careful thought to optimize workflow
  - MUST have independent way to control the radio without having to move focus from the logging software

Workflow Management - 1

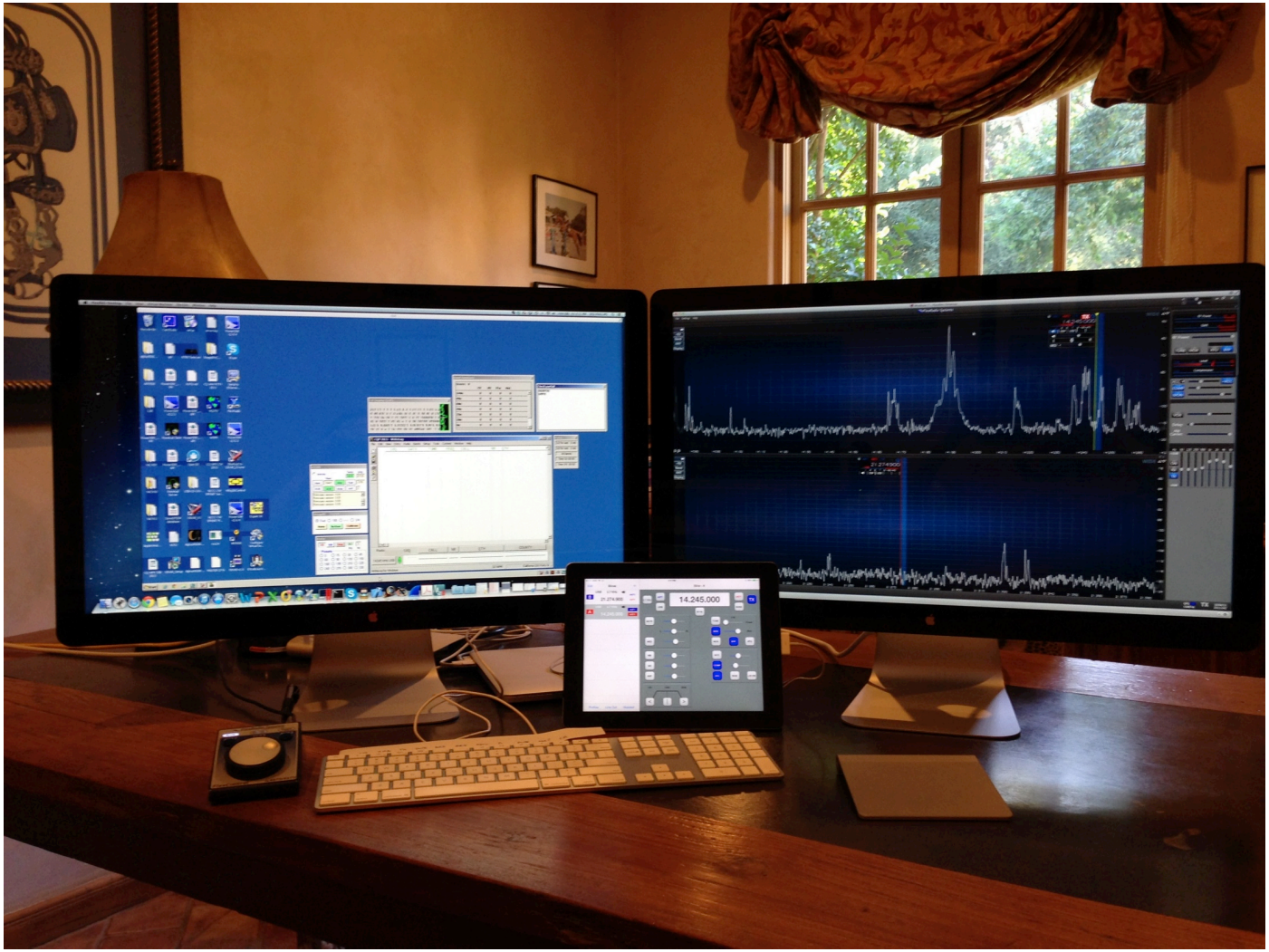
- For high rate in a contest, workflow management is critical
- Operator focus need to be on the logging program
- But the radio interface is now Software…
- Some external control is mandatory…

FlexControl



K6TU Control

Workflow Management - 2

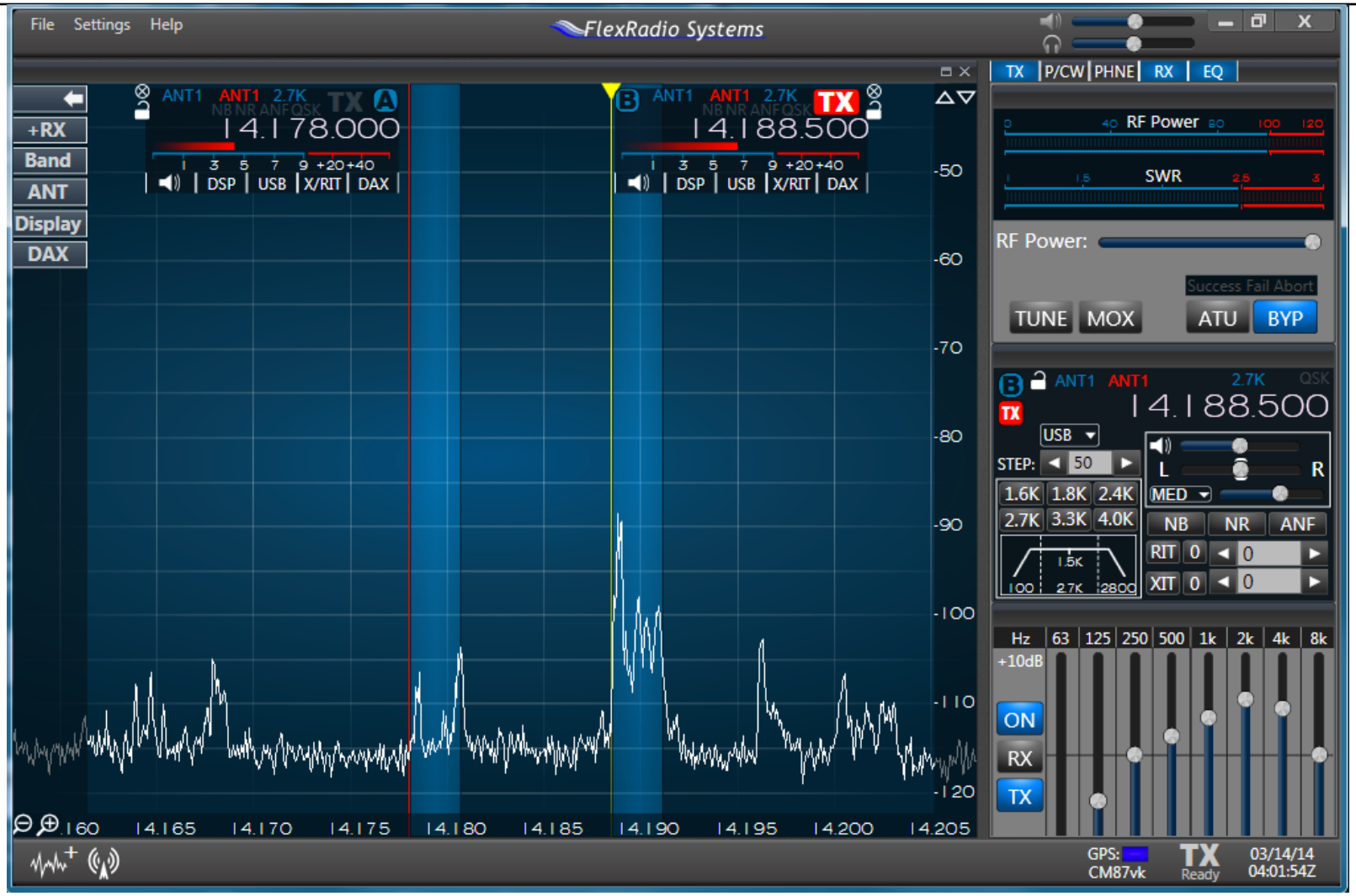


The Visual Radio - 1

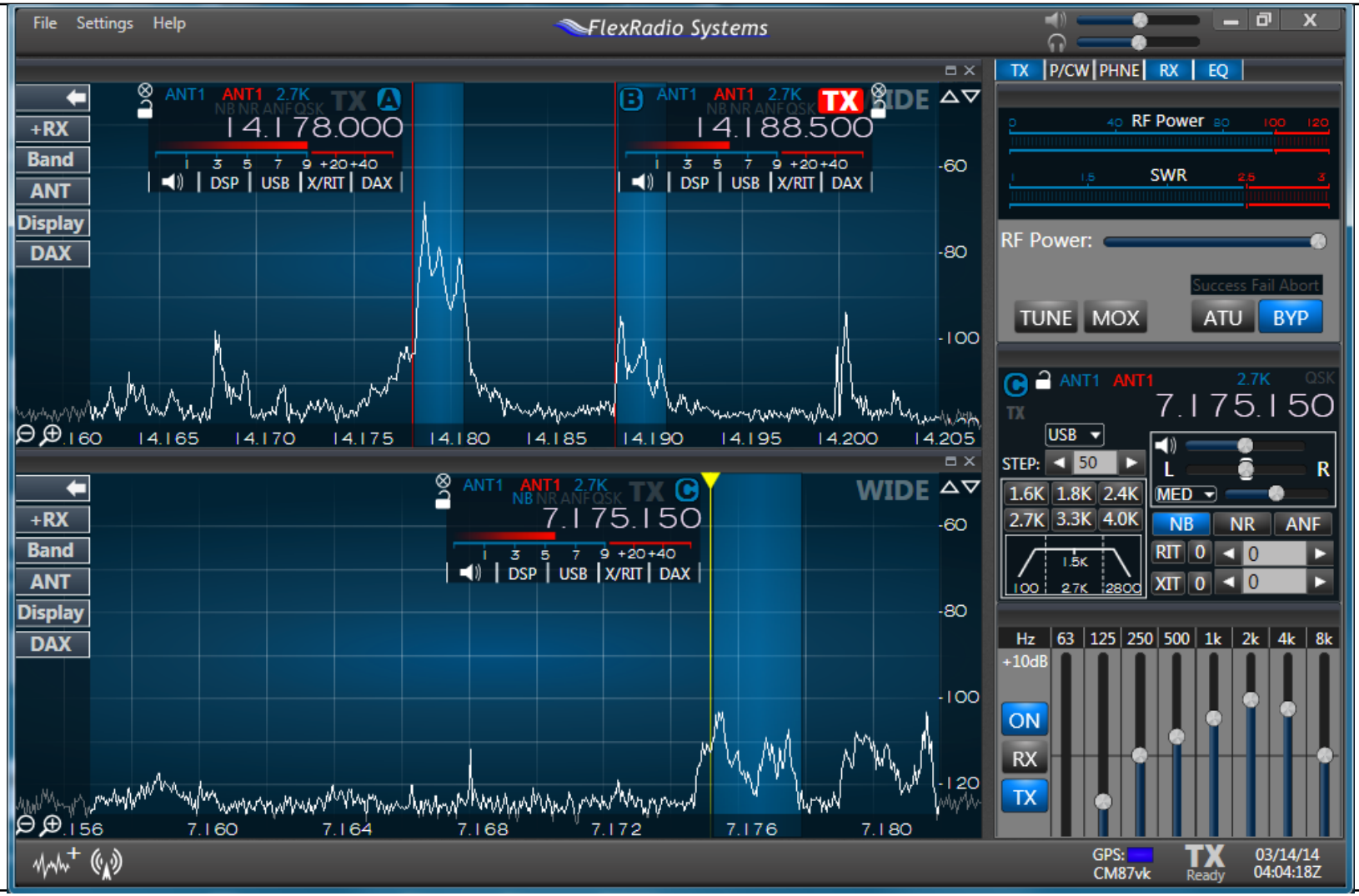
- Having multiple panadaptors changes your life as it adds another sense (sight) to radio control
  - Real time display of MULTIPLE bands
  - Ability to zoom in
  - Spot pile ups…
  - See the weak ones
  - Find “quiet spots” for CQ frequencies

The Visual Radio – some examples

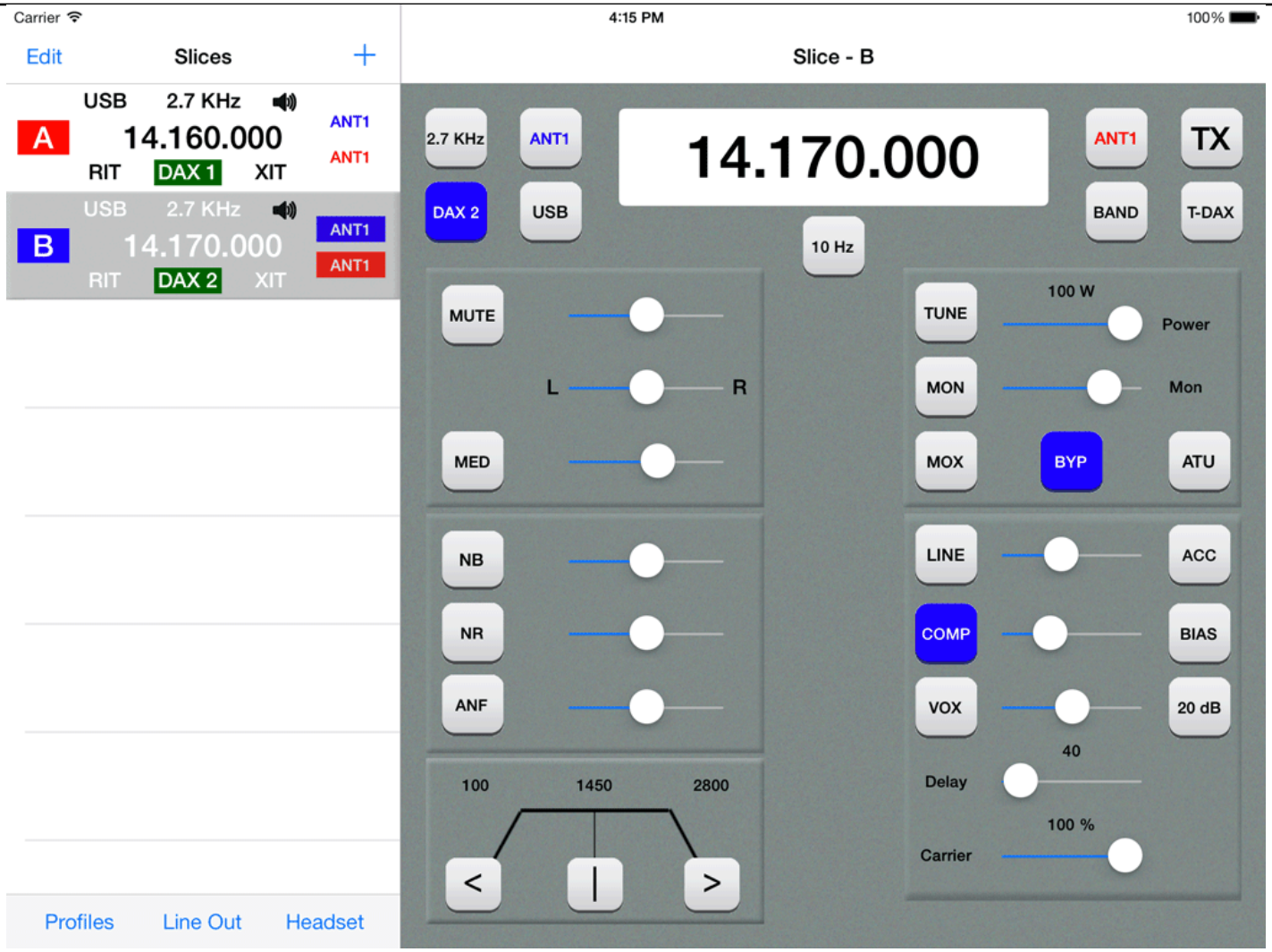
Ease of S&P or Split operation



Monitor multiple bands at once



iPad Client user interface



Real world experience with SDR

- Awesome contest radio!
  - Receiver performance is spectacular
  - Brick wall filters with custom configurations means you can work very close to strong stations
- DX operating is a dream
- Ultimate ease of integration with other software
- Having a legal limit transceiver with fully automatic band change (transfer in < 0.25 seconds) is a riot
- SSB, CW or RTTY – very flexible
- Learnt early on you have to have…
  - At least ONE KNOB!

Conclusions

- The FlexRadio SDR family provides
  - Great flexibility
  - World class performance
  - Ease of computer integration & control
- Make the core of a great station
- Is a dream to operate!
- Computer independent control of the radio is a MUST
  - FlexControl makes all the difference in the world

QUESTIONS ?

THANK YOU!