



# Modern Radio's SDR-101

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Official Flex Radio Systems Elmer

(Unpaid)

# \*Topics

- \*History of Ham Radios
- \*6 Radio Architectures
- \*What is an SDR?
- \*How SDR's Work
- \*How SDR's Benefits YOU?
- \*Remote Operations Demo



\* Please **INTERRUPT** me  
with your **QUESTIONS**

\*SDR = Modern Radio

\*SOFTWARE

\*Defined

\*Radio

\*I will explain SDR in detail as we proceed

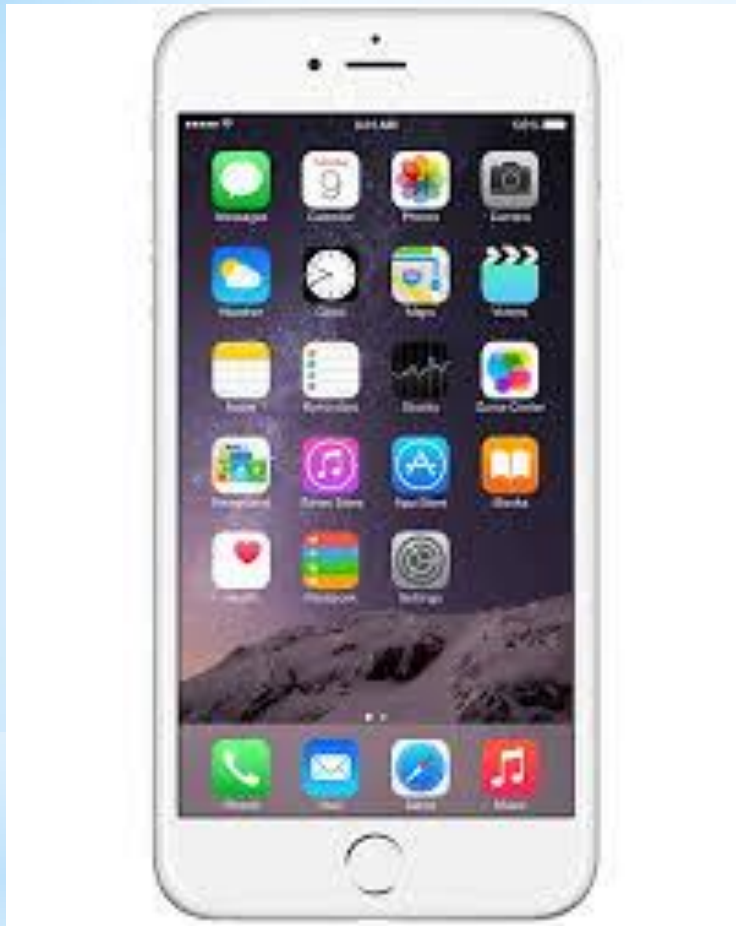
\*BUT First I Want To Ask You Questions?



# \* 1. Who Owns an SDR Now?



\*2. Anyone Own a Cell  
Phone With knobs?



\* This is an SDR  
Without Knobs

## \* Legacy Radios

- \* 1928 Technology... Superhetrodyne
- \* Use Analog Circuitry
- \* Almost every Ham Radio made by Icom, Yaesu, Kenwood, Elecraft, Hilberling
- \* End of Life Technology

## \* Modern Radios

- \* 21<sup>st</sup> Century Technology - Software Defined Radio (SDR)
- \* Talk will concentrate on Transceivers.
- \* There are Receive Only SDR's as inexpensive as \$18 that perform better than Legacy
- \* SDR use Digital Circuitry and Software to replace analog devices
- \* Software = **MATH**
- \* If you own a Cell Phone, you own a Modern Radio

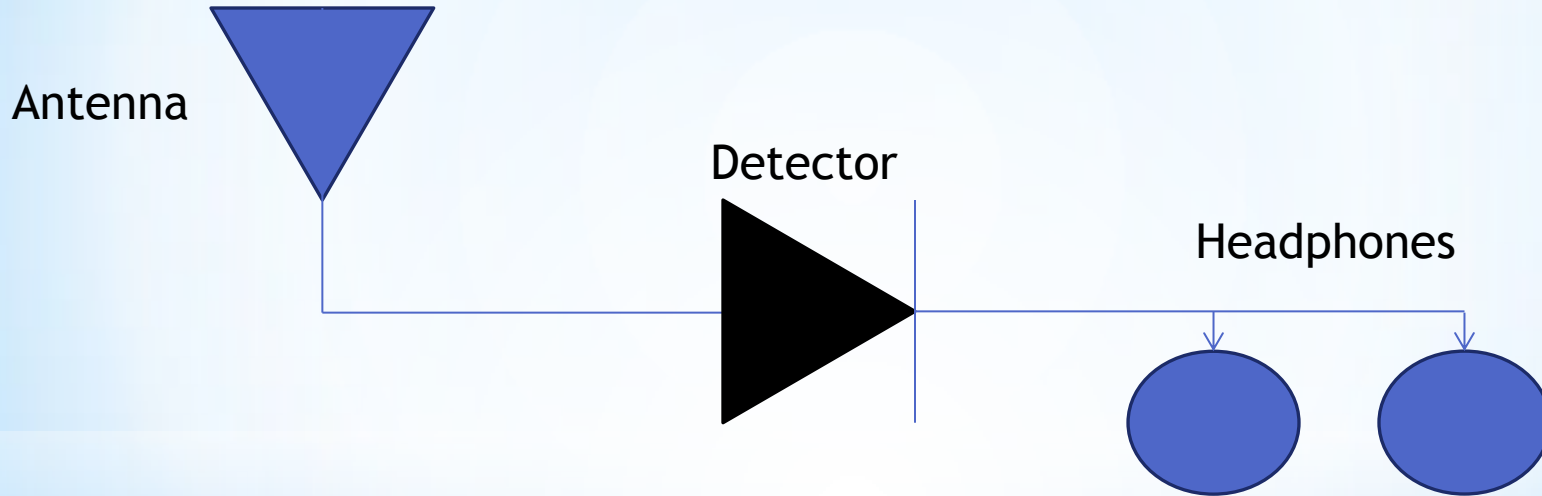
# \* Definitions



- \* Radio Architecture has come full circle
- \* Over the past 110+ years we have evolved about 6 major receiver architectures
- \* Multiple transmitter architectures which also have come full circle.
- \* Dates are historical best guesses

# \* History of Ham Radio

\* 1901 Antenna + Detector - Marconi



\* **1901-Architecture #1**



# \* Big Antenna's Help

- \* Hear the entire spectrum (Like Modern Radios)
- \* But Only One Signal to hear (Unlike Now)



1894 Coherer



1902 Magnetic Detector

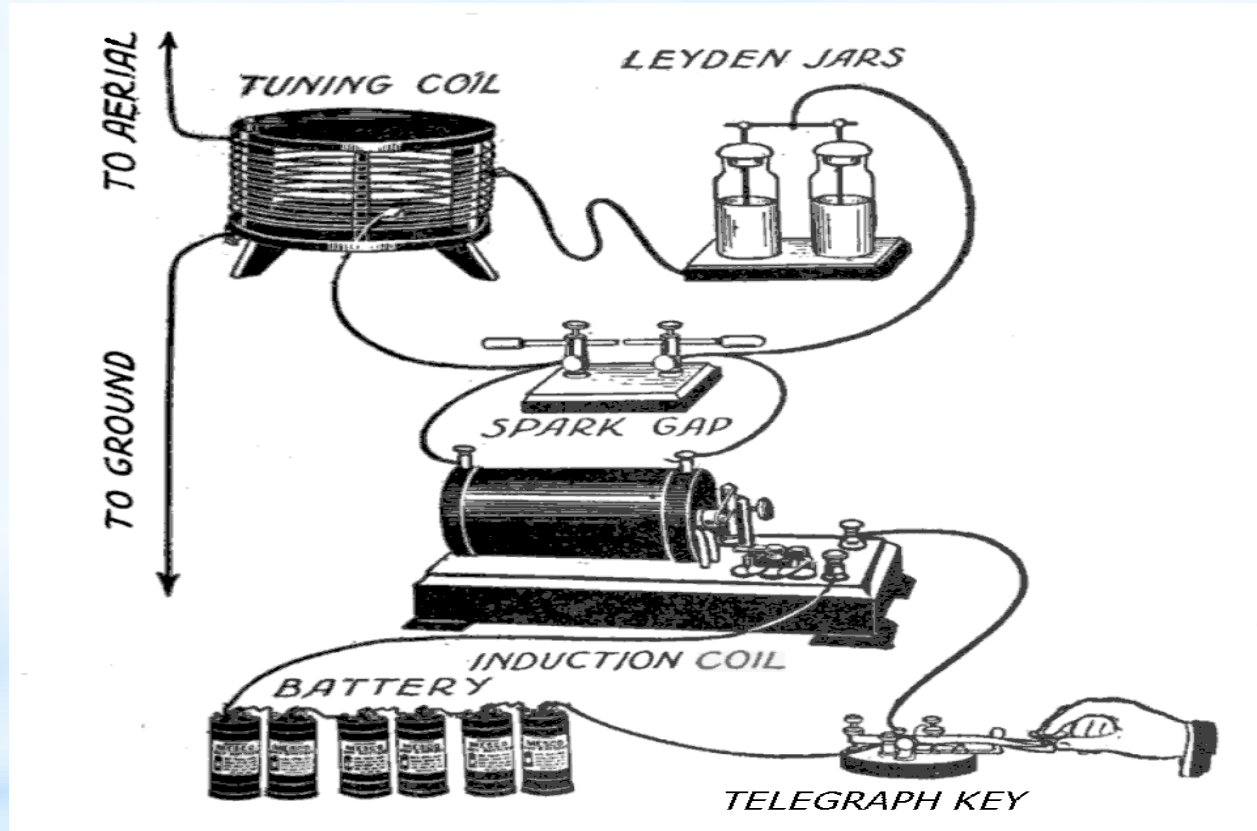


First Radio With a Knob

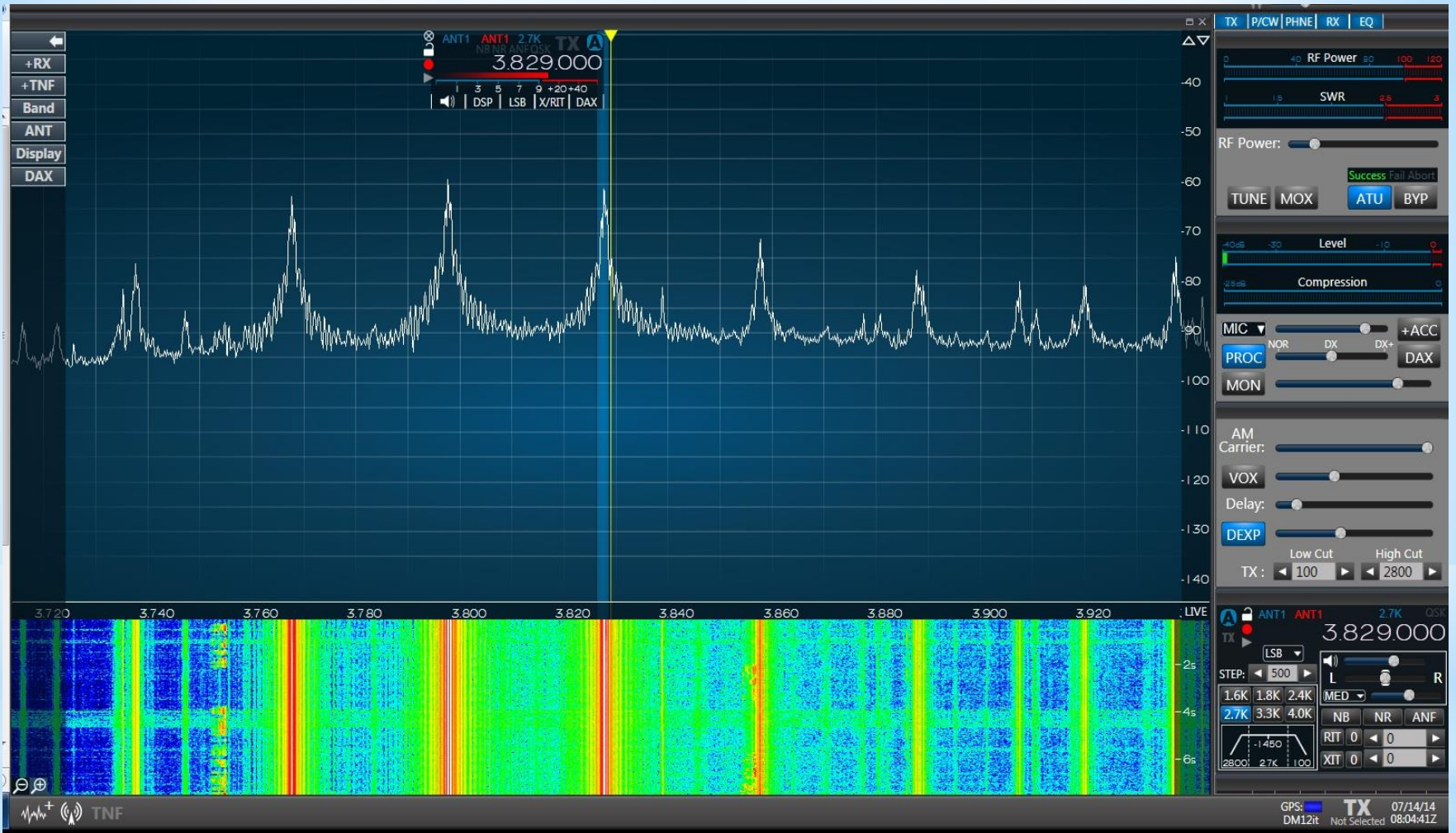
1906 Cat Whisker

# \* 1901-Architecture #1

## \*Spark Gap Transmitter



# \*Transmitters



# \* Spark Gap Noise

## \*The Good

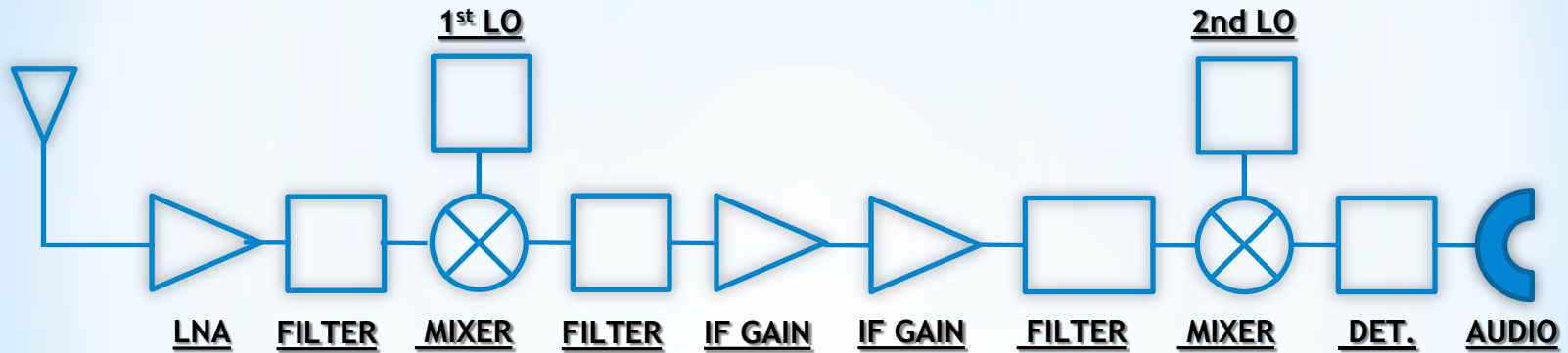
- \* Great Signal To Noise Ratio (Better than Superhet)
- \* Heard The Entire Spectrum

## \*The Bad

- \* Poor Selectivity
- \* Unable To Separate Stations
- \* Heard All The Images

# \* 1901 - Simple Detector

# Multi-Stage HW Receiver Chain - 1928



\* Circa 1928 - Architecture #2  
Superhetrodyne



\* Multi-conversion a.k.a. Superhetrodyne

\* Legacy Technology

\* Your OLD car radio, your OLD TV,

\* Any older scanner you have

\* Most every Hilberling, Kenwood, Icom, Ten-Tec, Elecraft and Yaesu on the market today

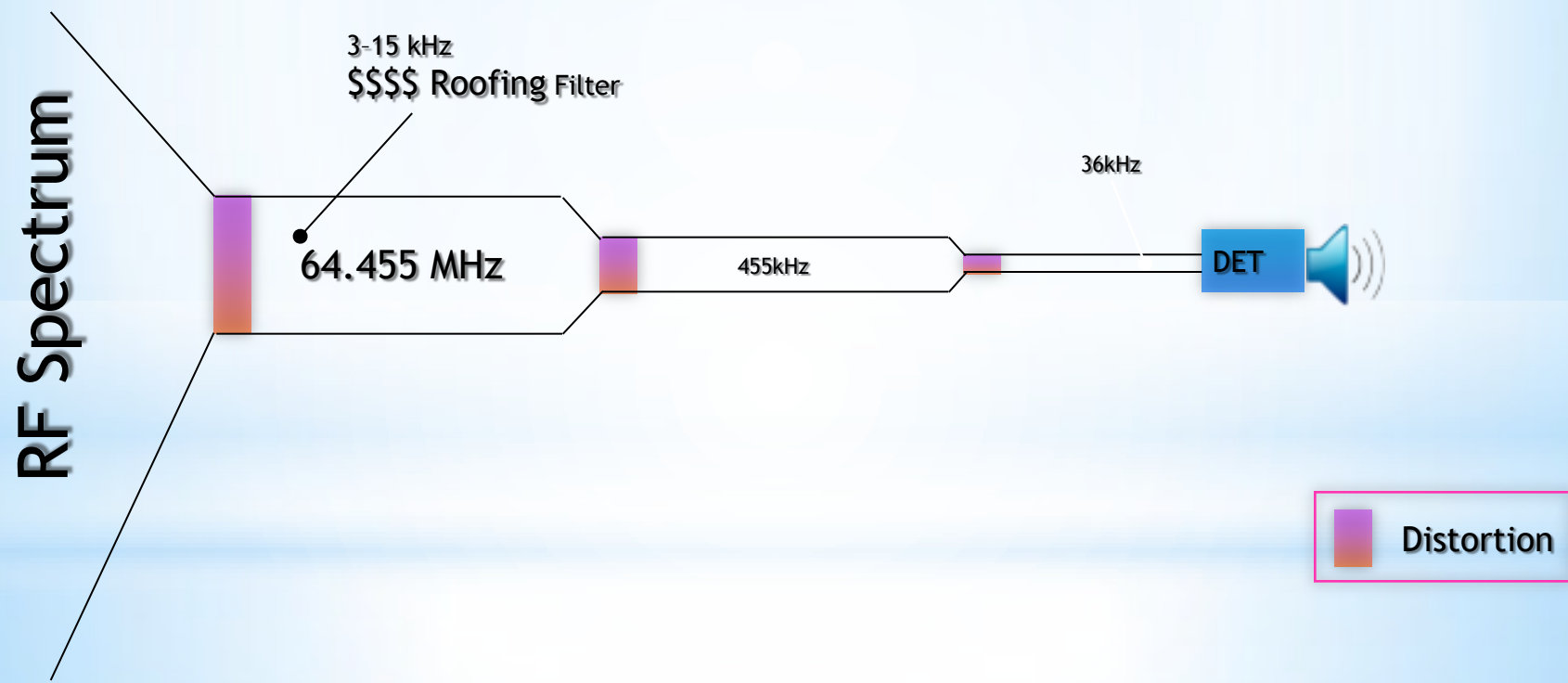
\* 1928 - Legacy



# Multi-Conversion



All Analog Domain



- \* WW2 - USA Using CW + AM
  
- \* USA Ham Radio Lead The World With Major Manufacturers Such As
  - \* Collins,
  - \* Hallicrafters,
  - \* Heathkit,
  - \* Swan,
  - \* Drake,
  - \* Gonset

\* 1928-1957 Era

\*Major Shock to US Technological Pride



\*1957 - Sputnik

# \* 1968 Disaster Struck Ham Radio

\* PROVING

\* There Is Nothing That A  
Government Can't Make

**Worse!**

- \* FCC Decided USA Needed More Technically Competent Hams
- \* Introduced Incentive Licensing
- \* FCC Decided USA Needed To Be Ready To fight WW2 Again
- \* So CW Speeds were Increased
- \* **Of Course, The Opposite Happened**

# \* 1968 Reaction To Sputnik

- \* Numbers Of Hams Plunged
- \* Bright Young Engineers No Longer Became Hams
- \* USA Ham Radio Innovation Stagnated
- \* All USA Ham Manufacturers Failed And/or Went Out Of The Ham Radio Business

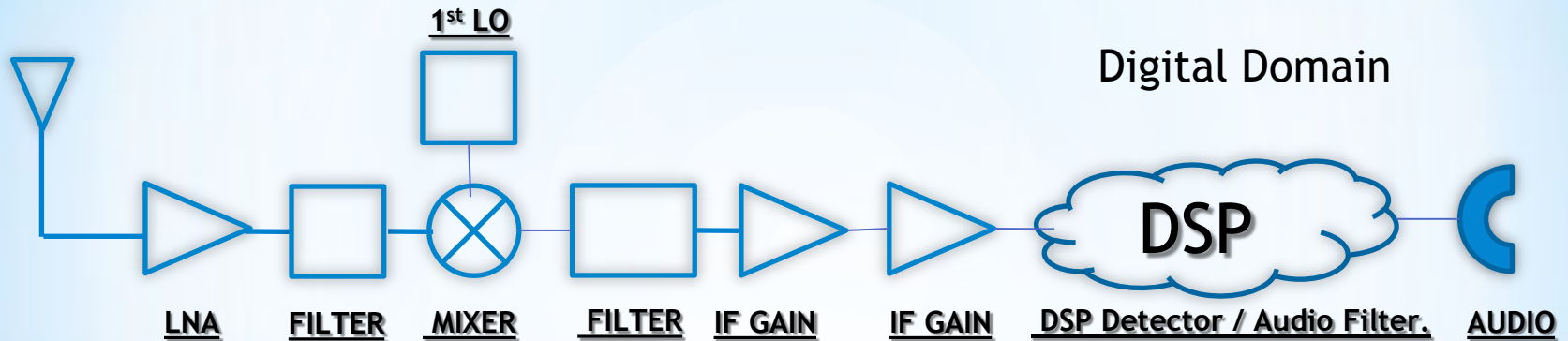
# \* Unintended Consequences

- \* Japan Learned The Lesson Of WW2
- \* Breaking CW Codes Cost Them The War
- \* Dropped CW As An Impediment For Ham Licenses
- \* Numbers Soared - Over 1,000,000 New Japanese Hams
- \* Bright Young Japanese Engineers Became Hams
- \* Icom Yaesu And Kenwood Became the Dominant Ham Manufacturers Worldwide
- \* No New Technology But Improved On The 1928 Superheterodyne at Much Better Prices

## \* Circa-1973 Japan



# Legacy HW/DSP Receiver Chain - 1980



- \* US Digital Signal Processing Chips
- \* Convert to Digital Domain To Become Detectors And Improve Audio And Noise Characteristics
- \* Japanese Radios Continued To Dominate

\* 1980 - Architecture #3



# Multi-Conversion

On the IC-7600:

“When compared to a typical triple-conversion system, the double conversion system is more difficult to implement but it dramatically reduces signal distortion and provides a high-fidelity RF signal to the DSP processor.”

– Icom America website



- \* Legacy Radios add:
  - \* Distortion to the received signals (Harder to Hear)
  - \* 5 to 15 dBm of Crud to the received signals (Harder to hear)
  - \* Or 1 -2 S Units of Noise+Distortion to the received signals
  - \* Worse Audio Signal to Noise Ratios Compared to Architecture #1

## \* Architecture #3 Legacy Receivers

- + Adjacent band signal rejection: operate in harsh signal conditions
- + Common, well-accepted old design: works well
- Distortion introduced in each stage of filtering and mixing
- Noise (CRUD) amplified at each stage
- Only signals in the final IF can be tuned
- Limited view of spectrum
- For best filtering, requires expensive crystal filters (multiple)

## \* Architecture #3 Multi-Conversion The good and bad

- \* CW Speed Reduced To 5wpm
- \* CW Eliminated For Techs
- \* American Ham Radio Numbers Started To Increase
- \* Bright Young USA Engineers Started To Become Hams
- \* New USA Ham Radio Manufacturers Started To Re-appear

## \* 1999 Reprieve

- \* Legacy Analog Technology had reached its practical limits
- \* Expensive Filters to Improve Selectivity
- \* Expensive Technology to Improve Dynamic Range
- \* Each Stage increased internal noise
- \* Each Stage increased internal distortion
- \* Harder to Hear More Due to Internal Noise and Distortion
- \* Miniscule Visual Displays
- \* Lots of \$\$\$\$\$ for a minor improvement

## \* Legacy Limits

# A Lot Of Money For A Little Bit Better Hilberling PT-8000A



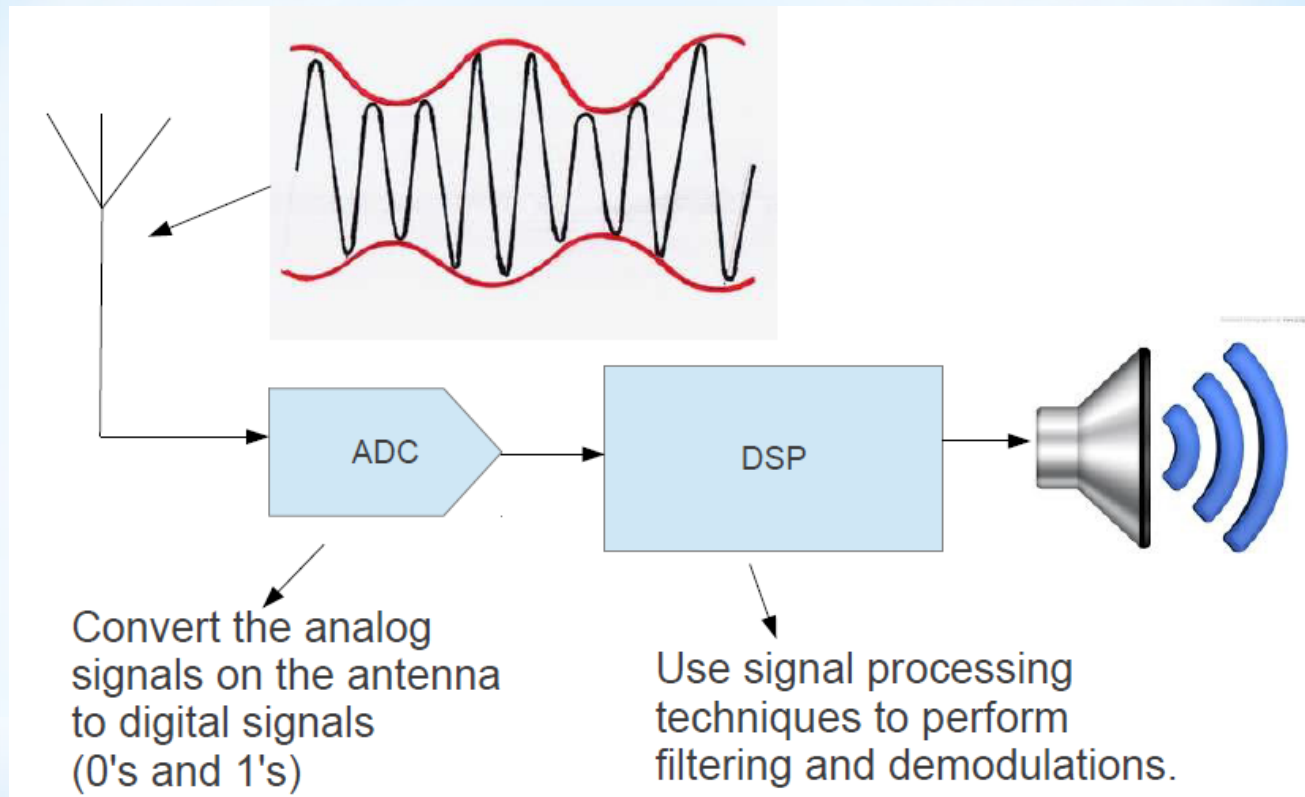
No Panafall  
Display

\* \$18,000 Ultimate  
Legacy Radio

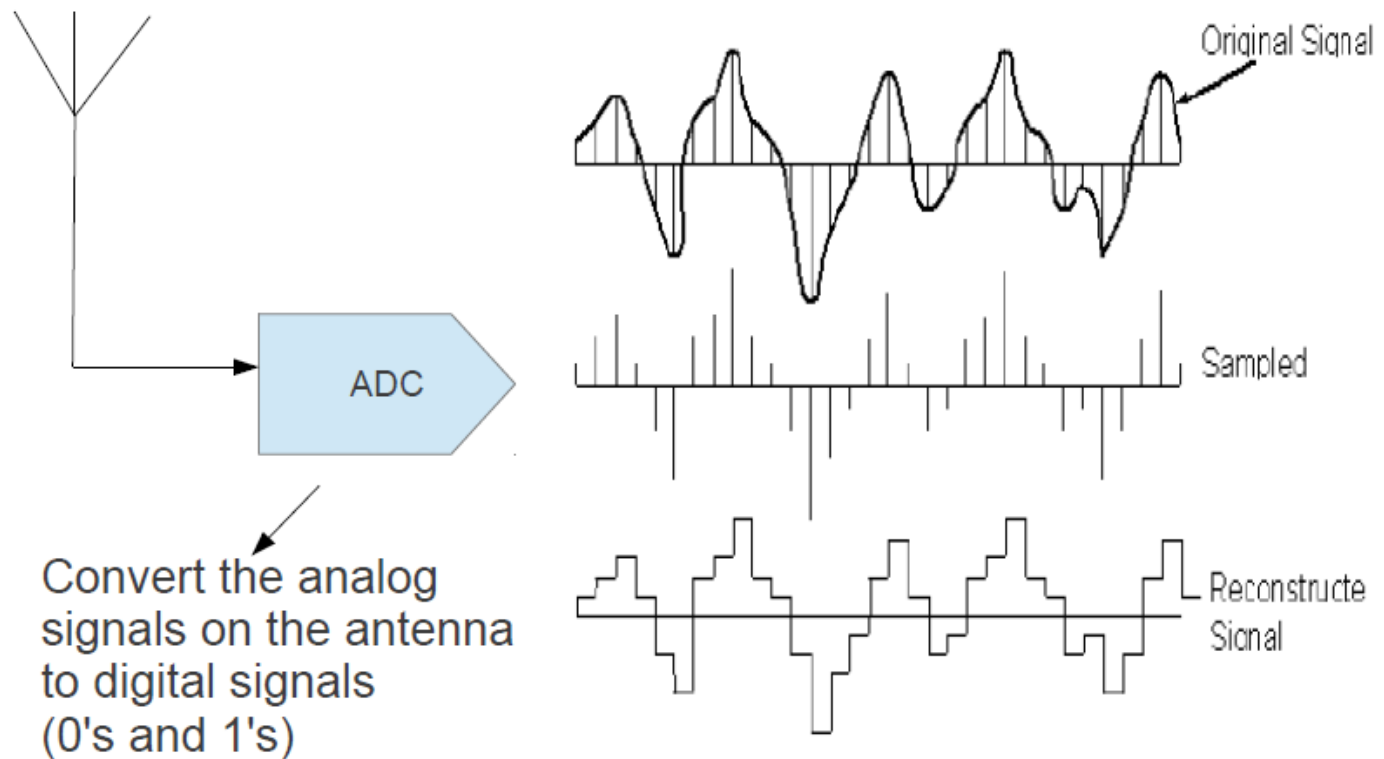


# \*SDR to the Rescue



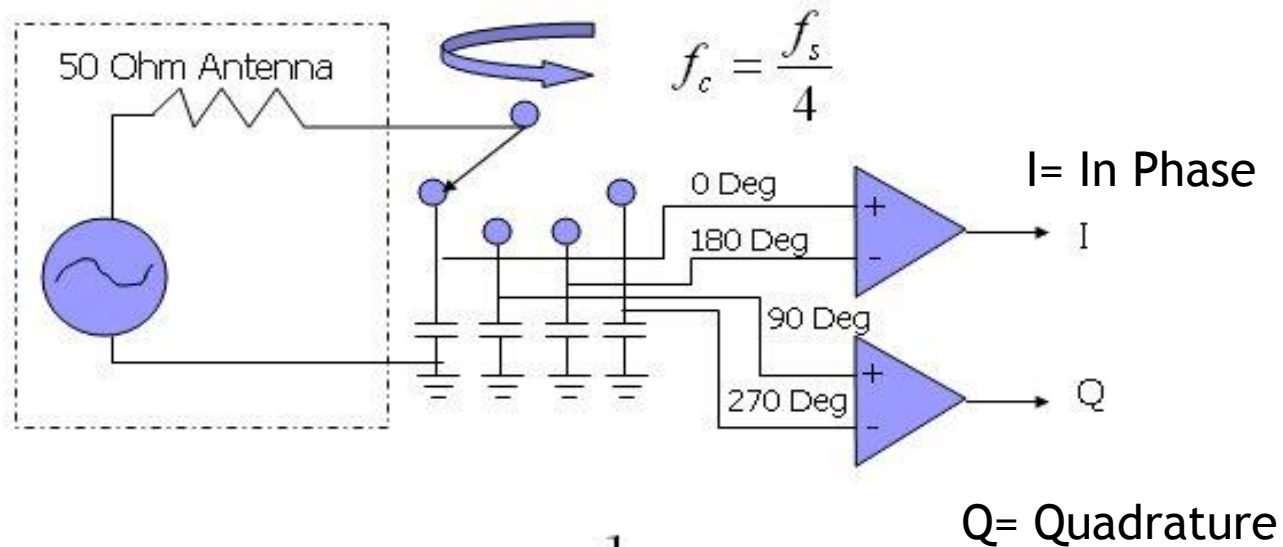


# \*How SDR's Work



# \*How SDR's Work

# Quadrature Sampling Detector



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

\* Quadrature Sampling Detector

## \* MATH

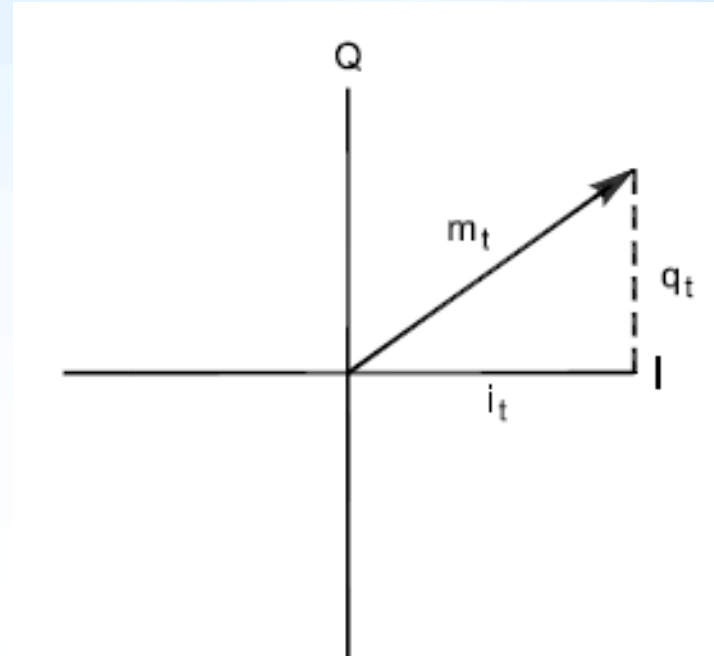
\* ---- ON THE EXAM

$$m_t = \sqrt{I_t^2 + Q_t^2}$$

Magnitude

$$\phi_t = \tan^{-1}\left(\frac{Q_t}{I_t}\right)$$

Phase



## \* How SDR's Work

# \* Dirty Little Secret



Don't tell N6KI

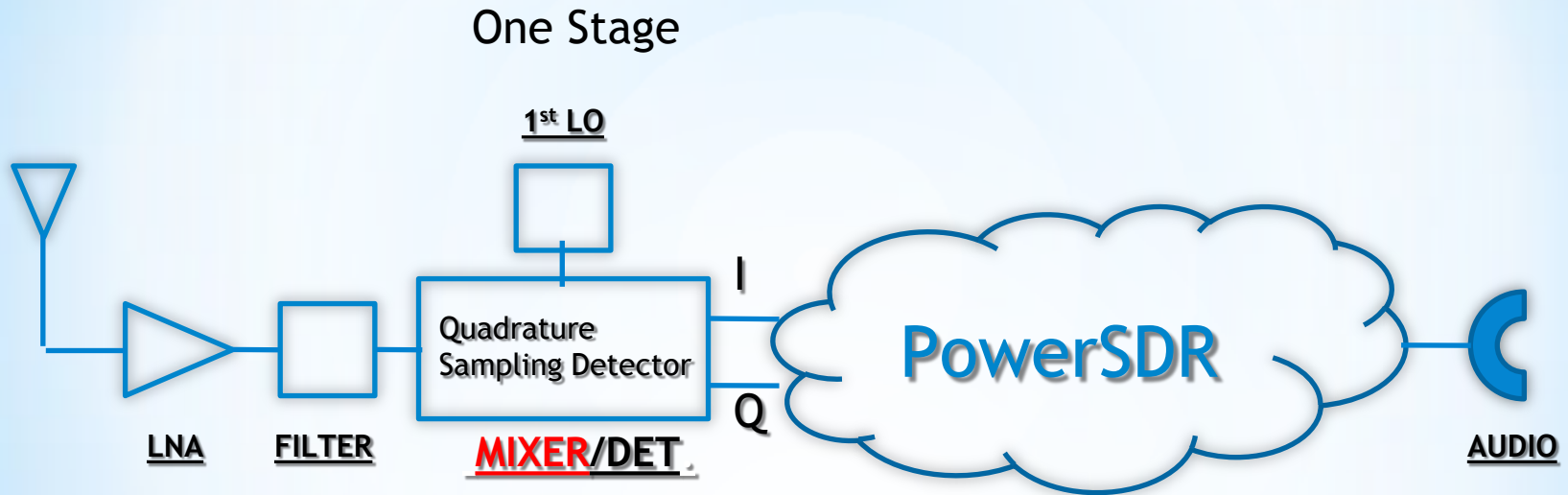
# \* All Future Radios will be SDR's

## \* 1<sup>st</sup> Generation SDR

- \* ADC Too Expensive to Direct Sample RF
- \* Convert To Digital Baseband - Fast ADC
- \* Direct Conversion SDR
- \* Invented in USA
- \* US Military - Prime Mover
- \* Cell Phones SDR
- \* Ham Radio - Software Defined Radio

# \* 2000 - Architecture #4 Direct Conversion SDR

# MODERN RADIO - 2000 TECHNOLOGY - 1st Generation SDR



\*“QSD” Direct Conversion Chain

\* FLEX-5000



FLEX-3000



\* Elecraft KX3



Elad FDM-DUO



\* Some SDR's still have Knobs

\* 1<sup>ST</sup> Generation SDR





# Direct Conversion SDR



# \* 1<sup>ST</sup> Generation SDR

FlexRadio Systems™ PowerSDR™ Beta v2.0.15 Demo

Setup Memory Wave Equalizer XVTRs CWX Report Bug

**START**

**MON** **TUN**  
**MDX**  
**MUT** **X2TR**

AF: 55  
AGC-T: 90  
Drive: 50  
AGC Preamp  
Med High  
SQL: -150  
BCI Reject

VFO A: 14.052 456  
20M CW TX  
VFO Sync VFO Lock 7.000000  
Tune Step: - 1kHz +  
Save Restore

VFO B: 14.070 000  
TX 20M RTTY

RX1 Meter TX Meter  
Signal Fwd Pwr  
**-77 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 FMN  
AM SAM SPEC  
DIGL DIGU DRM

1.0k 800 750  
600 500 400  
250 100 50  
25 Var 1 Var 2  
Low 661 High 4226  
Width: Shift: Reset

14.000 14.010 14.020 14.030 14.040 14.050 14.060 14.070 14.080 14.090  
-40  
-60  
-80  
-100  
-120

14.000 14.010 14.020 14.030 14.040 14.050 14.060 14.070 14.080 14.090

3545.5Hz -82.6dBm 14.055 401 MHz

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

SPLT A > B  
0 Beat A < B  
IF->V A <> B

NR ANF  
NB NB2  
**SR** BIN  
AVG Peak

Panafall

Speed: 25 WPM Pitch Freq (Hz): 600 VAC

Iambic  
 Disable Monitor  
 Show TX CW Frequency

Break In  
 Enabled Delay (ms): 300

XIT 0 RIT 0  
0 0  
CPU %: 0.0

MultiRX Swap

\* 1<sup>st</sup> Generation  
Direct Conversion

- + Distortion minimized with only one mixer:  
clear signal -- sounds better, less fatigue (less in-band distortion)
  - Noise amplified by only 1 stage
- + Can show 192kHz of realtime spectrum:  
wide panadapter view
- + Low power, high dynamic range:  
interference mitigation
- Image rejection difficult (balanced IQ mixer, WBIR)
- Better, but still limited view of spectrum (192Khz)

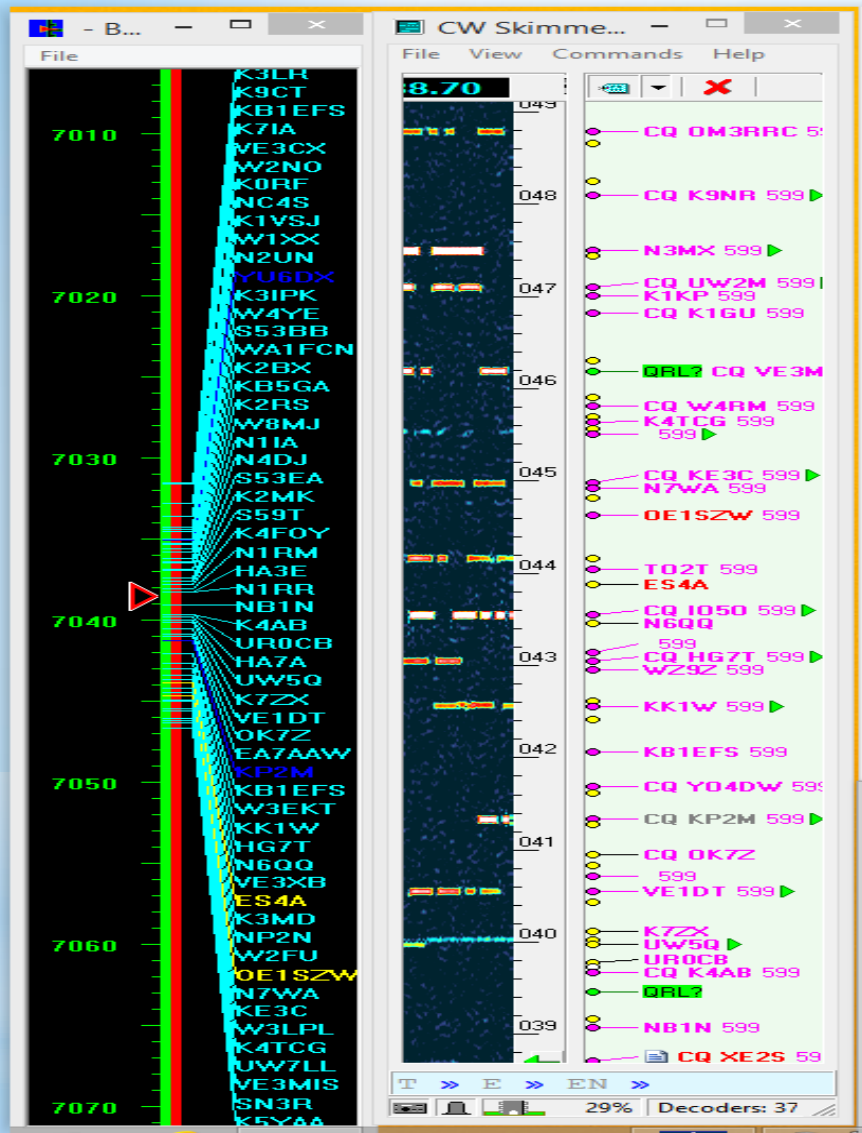
## \* Direct Conversion

The good and  
not-so-good

# \* 1<sup>ST</sup> Generation SDR

- \* CW Eliminated
- \* USA Ham Radio Numbers Soars
- \* Bright Young Engineers Became Hams
- \* USA Now The Home Of The Top Ham Manufacturers
  - \* Elecraft
  - \* Ten Tech
  - \* Flex Radio

\* 2007 Freedom Reigns



\* CW More Popular Now Than When It Was FORCED Upon Us.

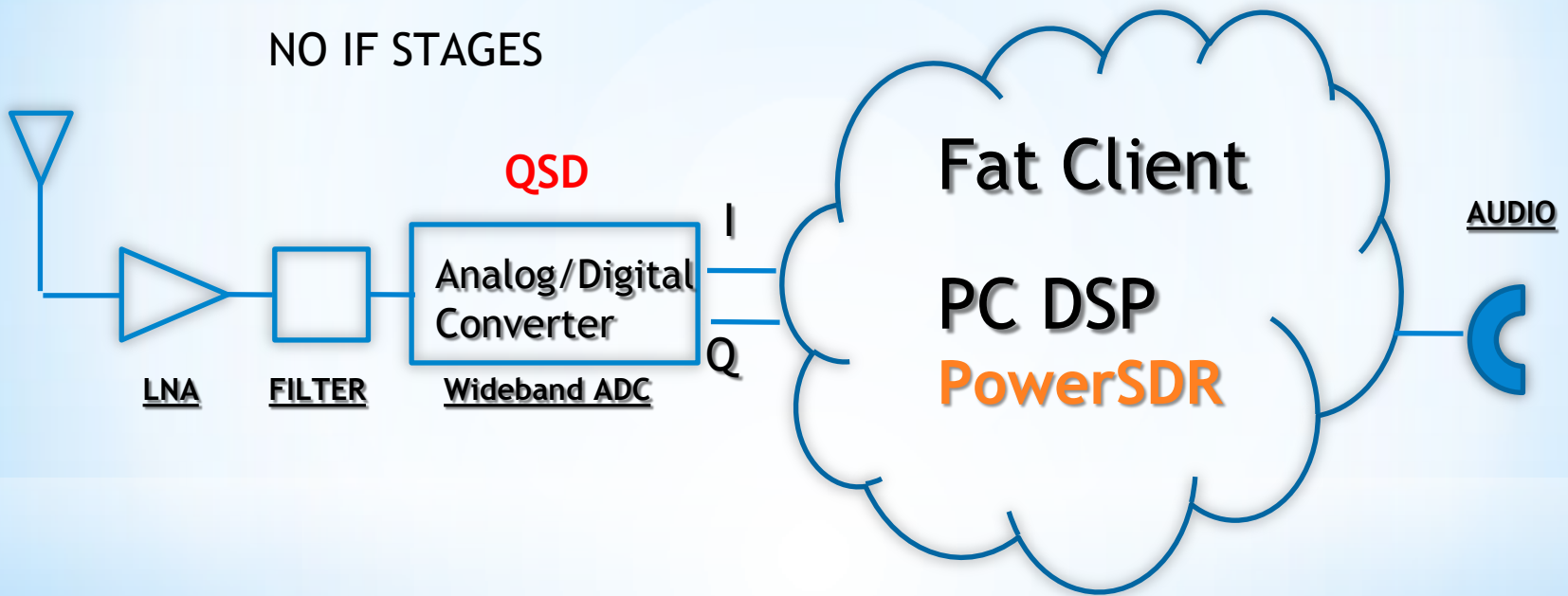
\* Unintended Consequences

## \* 2<sup>nd</sup> Generation SDR

- \* ADC got faster and cheaper
- \* Direct Sampling at RF
- \* Processing was complicated
- \* External DSP Processing
- \* Fat Client - HPSDR
- \* VERY FAST PC for DSP

# \* 2009 Architecture #5 Fat Client Direct Sampling SDR

MODERN RADIO - 2009+ TECHNOLOGY - 2<sup>nd</sup> Generation SDR  
Wide Band - EXTERNAL Processing



\* **Direct Sampling Converter Chain**  
**2009 Architecture #5**

- + Distortion minimized (ADC @ antenna):  
**best signal clarity**
- + n-Receivers, n-Panadapters and varying widths see more bands, more receivers
- + Extremely high dynamic range: operate in worst conditions - **IP3 +50db +125db Dynamic Range or better**
- + Extreme flexibility through reprogrammability (*ultimate* SDR): future benefits
- **Very Fast PC to Process Data**
- **Huge Bandwidth between Radio and PC**

**2<sup>nd</sup> Generation SDR**  
**Wide Band - EXTERNAL Processing**

# **Direct Sampling Benefits**



## 2<sup>nd</sup> Generation SDR - Wide Band - EXTERNAL Processing

\* HPSDR



ANAN-100D



\* 2009 Architecture #5

# Fat Client Direct Sampling SDR

# Yes Dennis, N6KI



\* Modern Radio's  
2<sup>nd</sup> Generation SDR can have Knobs

# By 2012 FPGA Prices Cost Effective For Internal Processing

## Brand A

Texas Instruments TMS320VC33

0.120 GFLOPS

## Brand B

Texas Instruments TMS320C6713 x3 + TMS320C6711

4.95 GFLOPS

1.35 GMAC

## Brand C

Texas Instruments TMS320C6727B x2

4.2 GFLOPS

1.40 GMAC

## FLEX-6500

Texas Instruments TMS320C6A8167 + XC6VLX75T

78 GFLOPS

191 GMAC

## FLEX-6700 / FLEX-6700R

Texas Instruments TMS320C6A8167 + XC6VLX130T

121 GFLOPS

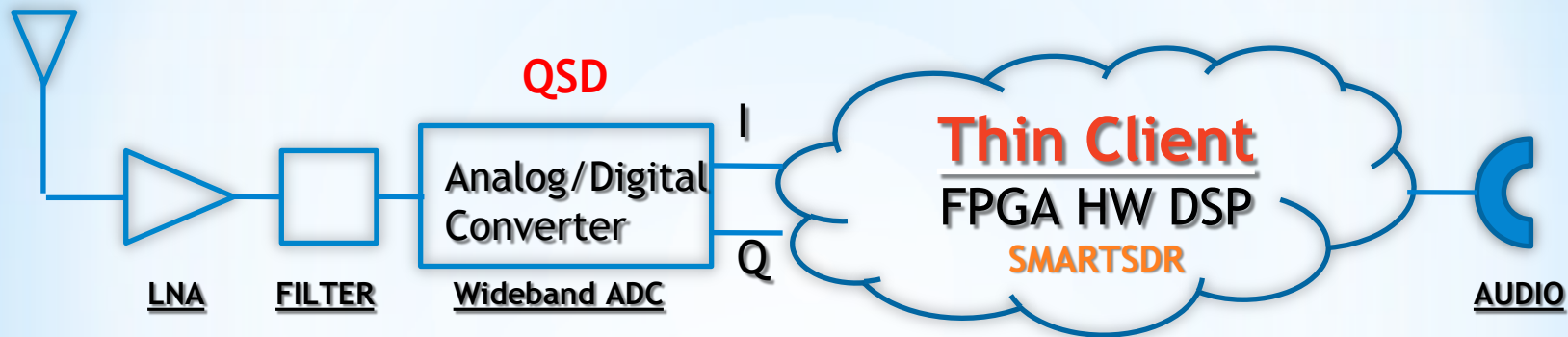
317 GMAC



## Transceiver DSP Performance Comparison

\* **Compute Power for Internal Processing**

MODERN RADIO - 2012+ TECHNOLOGY - 3<sup>rd</sup> Generation SDR  
**Wide Band - INTERNAL Processing**



**\* Direct Sampling Converter Chain**

**\* 2012 Architecture #6**

**Thin Client Direct Sampling SDR**

- + Distortion minimized (ADC @ antenna): **best signal clarity**
- + n-Receivers, n-Panadapters and varying widths see more bands, more receivers
- + Extremely high dynamic range: operate in worst conditions - **IP3 +50db +125db Dynamic Range or better**
- + Extreme flexibility through reprogrammability  
(*ultimate* SDR): future benefits
- + Regular PC to Display Video Only
- + Acceptable Bandwidth between PC and Radio.
- Technically challenging to design and write software

**3rd Generation SDR**  
**Wide Band - INTERNAL Processing**

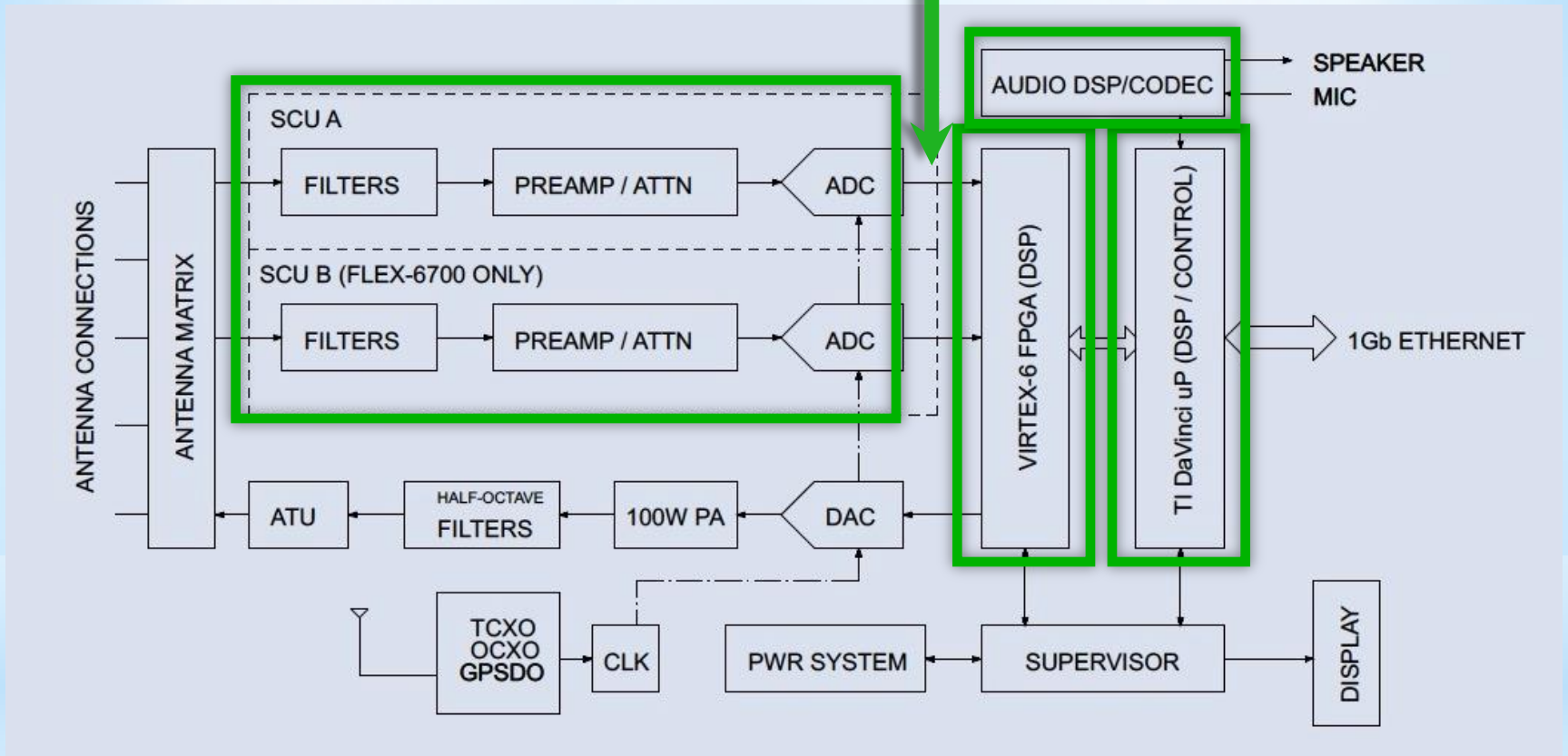
# **Direct Sampling Benefits**

# Direct Sampling

## FLEX-6000



7.9Gbps + 1Gbps



55



# 3<sup>rd</sup> Generation SDR Architecture



FLEX-6000 Series



ANAN-200

\* 3<sup>rd</sup> Generation Direct Sampled  
Thin Client SDR



# Sherwood Engineering Inc.

1268 South Ogden Street Denver, Colorado 80210 USA

**email** Phone: **303-722-2257** FAX: **303-744-8876**

9 a.m. - 5 p.m. MST Monday - Friday

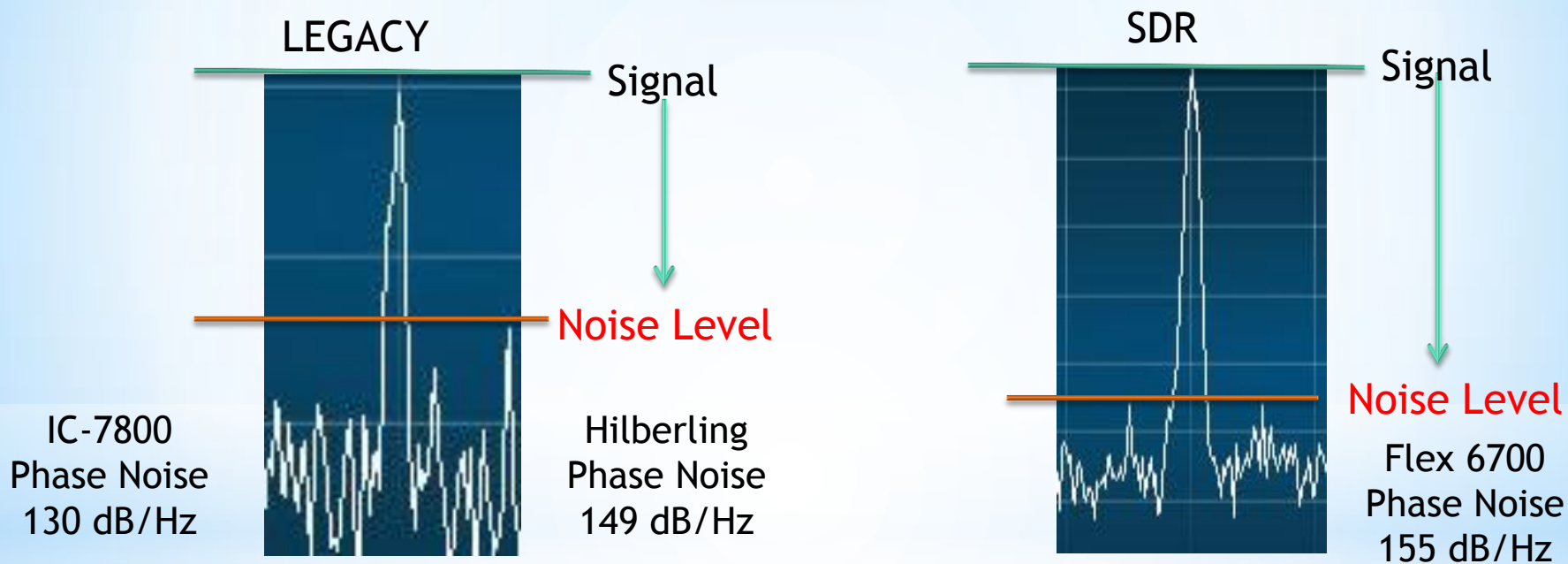
## Receiver Test Data

*Sorted by Third-Order Dynamic Range Narrow Spaced - or- ARRL RMDR (Reciprocal Mixing Dynamic Range) if Phase Noise Limited*

*Updated 9 December 2014 with Kenwood TS-590SG*

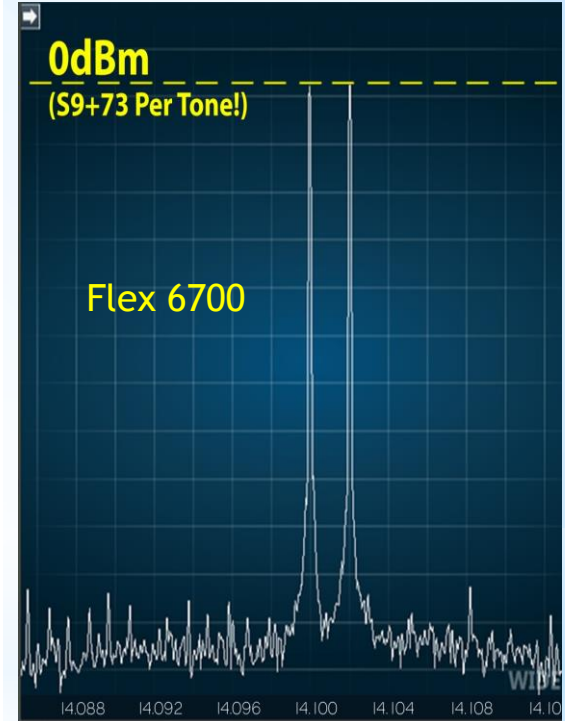
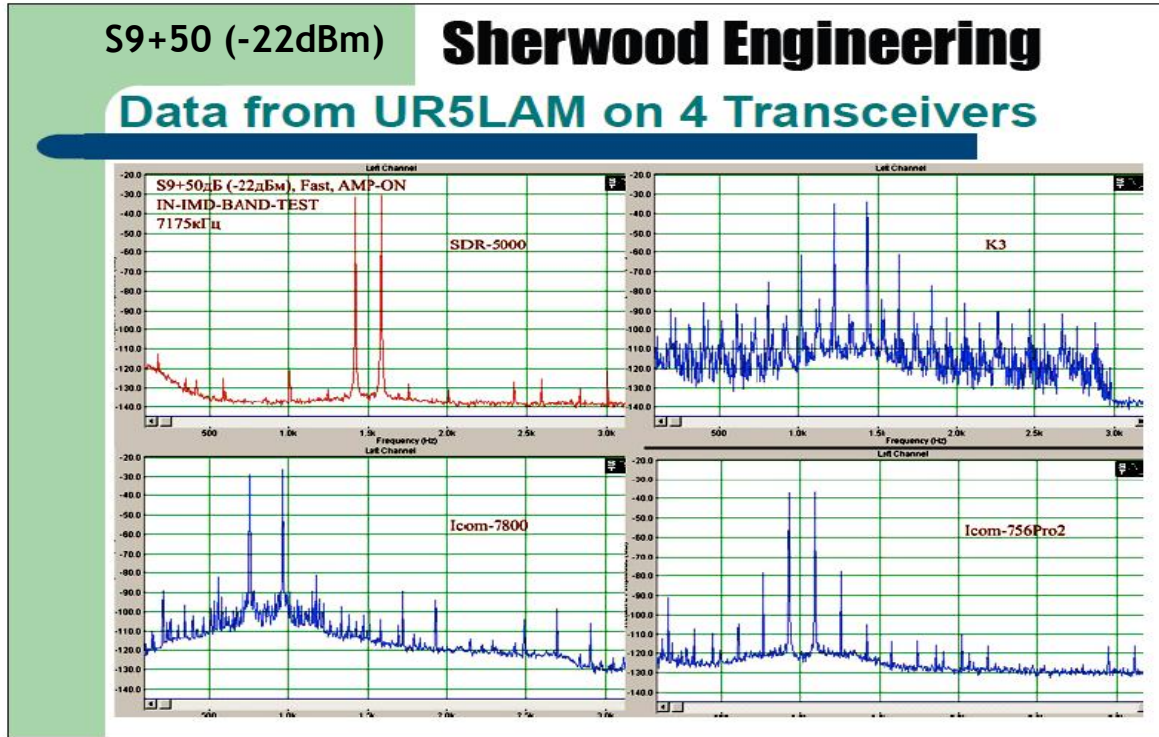
Device Under Test	Noise Floor (dBm)	AGC Thrshld (uV)	dB	100kHz Blocking (dB)	Sensitivity (uV)	LO Noise (dBc/Hz)	Spacing kHz	Front End Selectivity	Filter Ultimate (dB)	Dynamic Range Wide Spaced (dB)	kHz	Dynamic Range Narrow Spaced (dB)	kHz
<i>Added 9/29/14</i> FlexRadio Systems 6700 Hardware Updated	-118 -135 <sup>b2</sup>	3.0 1.0 <sup>b2</sup>	Var	A/D Limit	2.0 0.25 <sup>b2</sup>	145 155	10 50	B Band Pass	115	99	20&2	108 <sup>y</sup>	20&2
<i>Added 10/02/12</i> Hilberling PT-8000A Hardware Rev 2.00	-128 -141 <sup>b</sup>	5.4 1.0 <sup>b</sup>	3	142	0.45 0.11 <sup>b</sup>	144 149	10 50	A Trk Presel	100	105	20	105 <sup>w</sup>	2
<i>Added 08/10/12</i> Elecraft KX3	-123 -138 <sup>b2</sup>	12 1.3 <sup>b2</sup>	3	138	0.9 0.09 <sup>b2</sup>	144	10	B Band Pass	110	105	20	104 <sup>t</sup> 96 <sup>u</sup> 65 <sup>v</sup>	2
<i>Added 12/01/10</i> Yaesu FTdx-5000D	-123 -135 <sup>b</sup> -141 <sup>b1</sup>	4.6 1.2 <sup>b</sup> 0.33 <sup>b1</sup>	3	127 <sup>s</sup>	1.1 0.27 <sup>b</sup> 0.13 <sup>b1</sup>	135	10	B Band Pass	90 <sup>f</sup>	104	20	101 <sup>f</sup>	2
<i>Added 2/15/08</i> Elecraft K3	-130 -138 <sup>b</sup>	2.1 0.6 <sup>b</sup>	3	140 <sup>s</sup>	0.33 0.19 <sup>b</sup>	138	10	B Band Pass	105	104	20	101 <sup>pf</sup> 96 <sup>qf</sup> 95 <sup>r</sup>	2
<i>Updated 7/2/09</i> Perseus	-123 -125 <sup>b</sup>	0.15 0.1 <sup>b</sup>	3	125	0.8 0.6 <sup>b</sup>	147	10	B Band Pass	109 <sup>f</sup>	99	20	99	2
<i>Added 2/15/08</i> FlexRadio Systems FLEX-5000A	-123 -135 <sup>b</sup>	2.0 0.5 <sup>b</sup>	3	123 <sup>s</sup>	1.3 0.3 <sup>b</sup>	123	10	B Band Pass	98	96	20	96	2

\* 1. Best Received Signal to Noise Ratio- SDR Hears Best



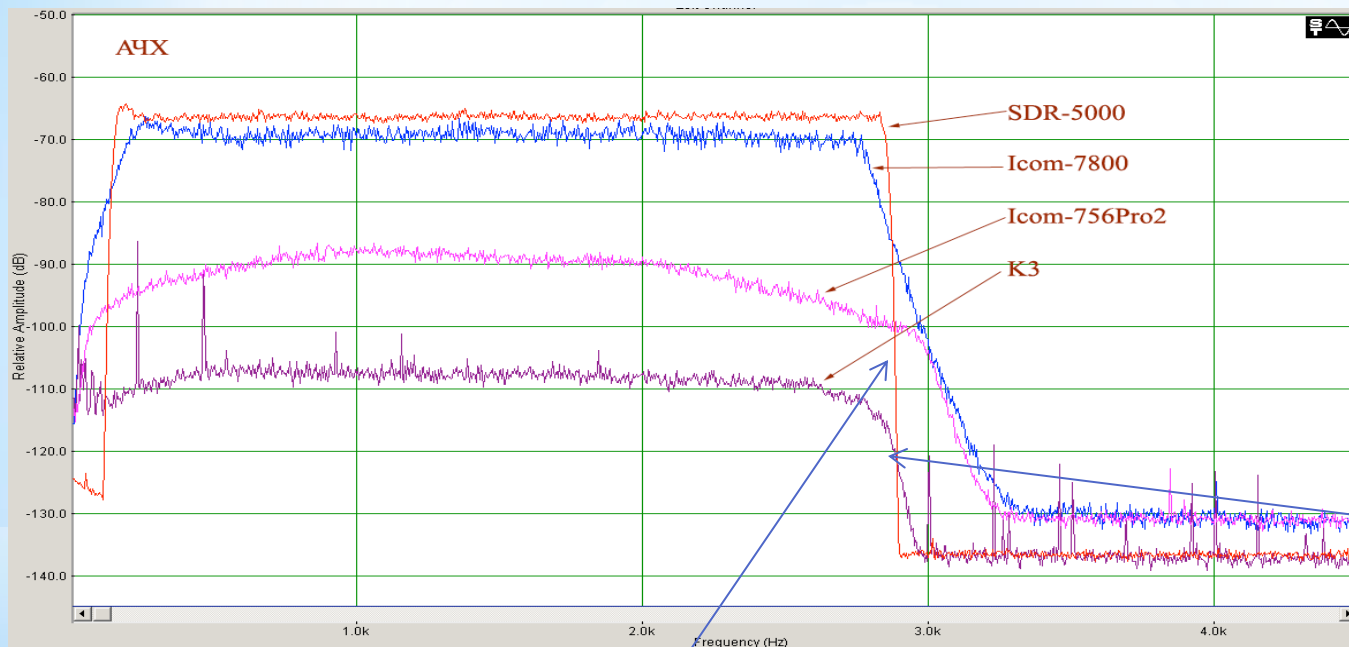
\* SDR Benefits for you

## \* 2. Least Distortion - SDR Hears Best



# \* SDR Benefits for you

### \* 3. Best Filter Selectivity - Brick Wall Filters



Ultimate Filter	
Flex 6700	115 dB
KX3	110dB
K3	105dB
Hilberling	100dB
IC-7800	100dB

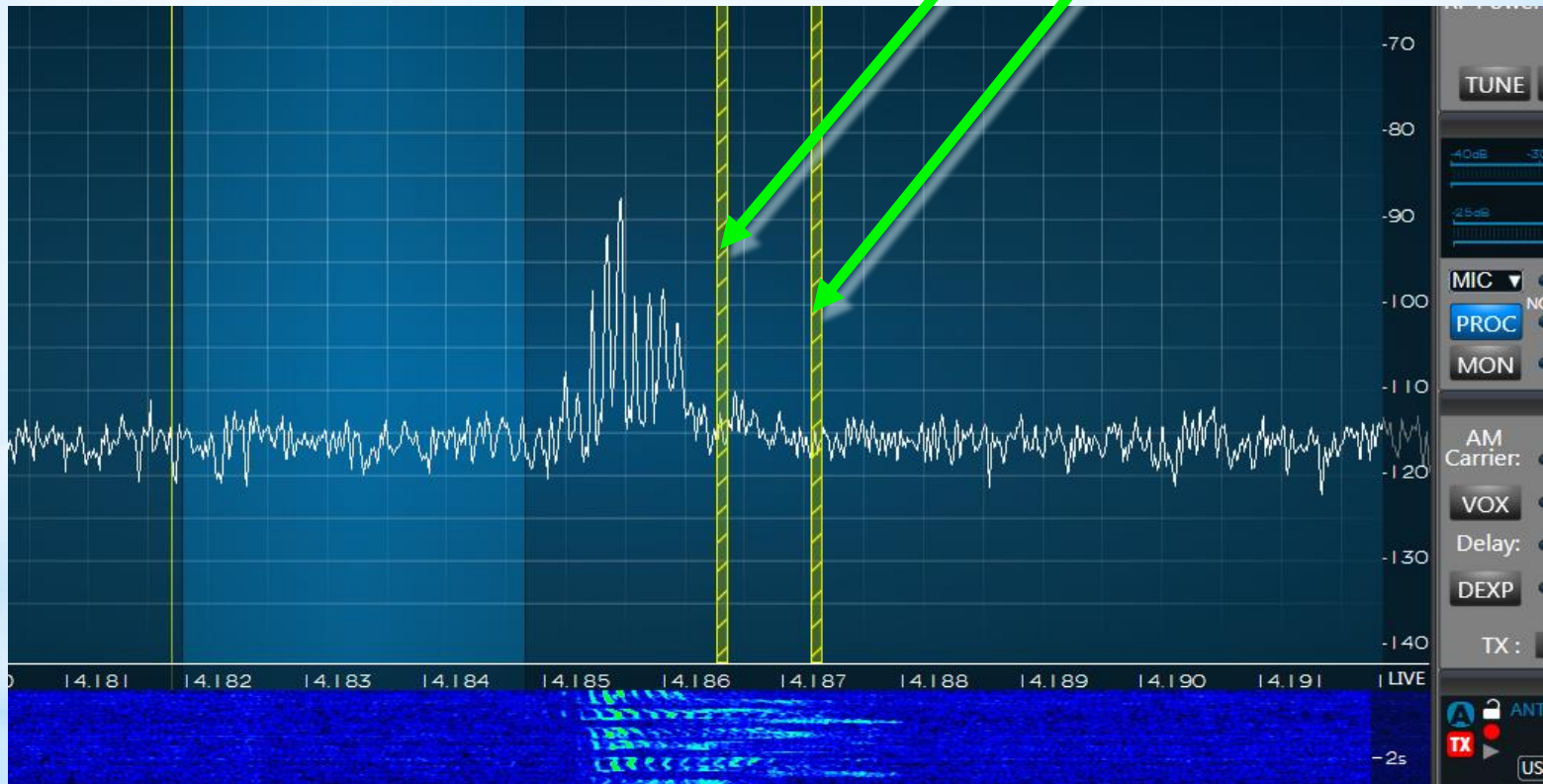
1.05 Shape Factor

Don't do the math for signals you don't want to hear

# \* SDR Benefits for you

## \* 4. Infinite Number Tracking Notch Filters

As you tune, the TNF follows *RF*, not *IF/Audio*

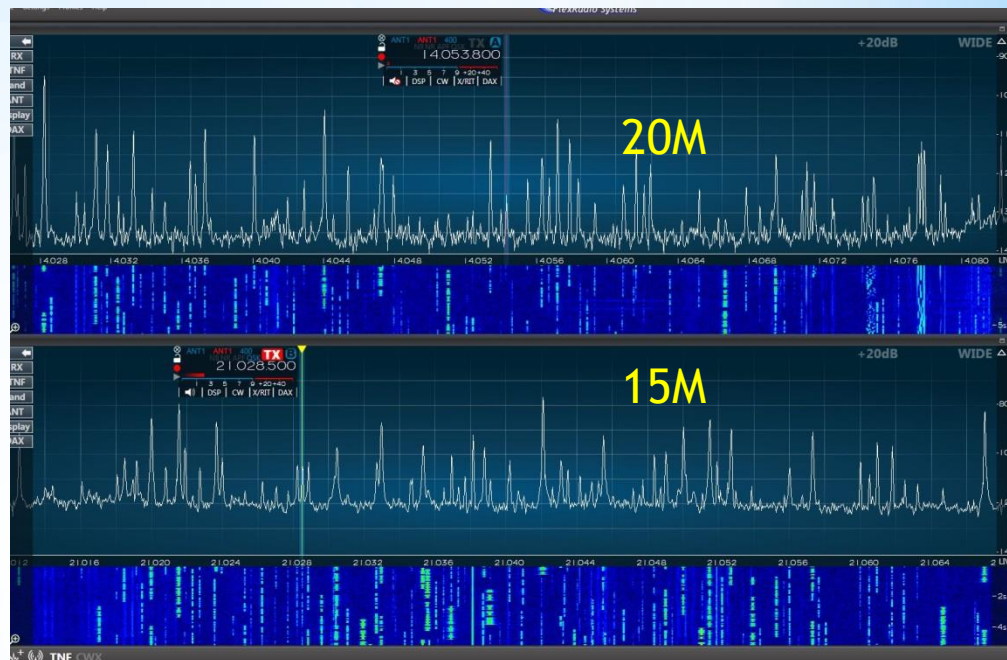


# \* SDR Benefits for you

## \* 5. Sees Every Signal - No More BLIND RADIOS

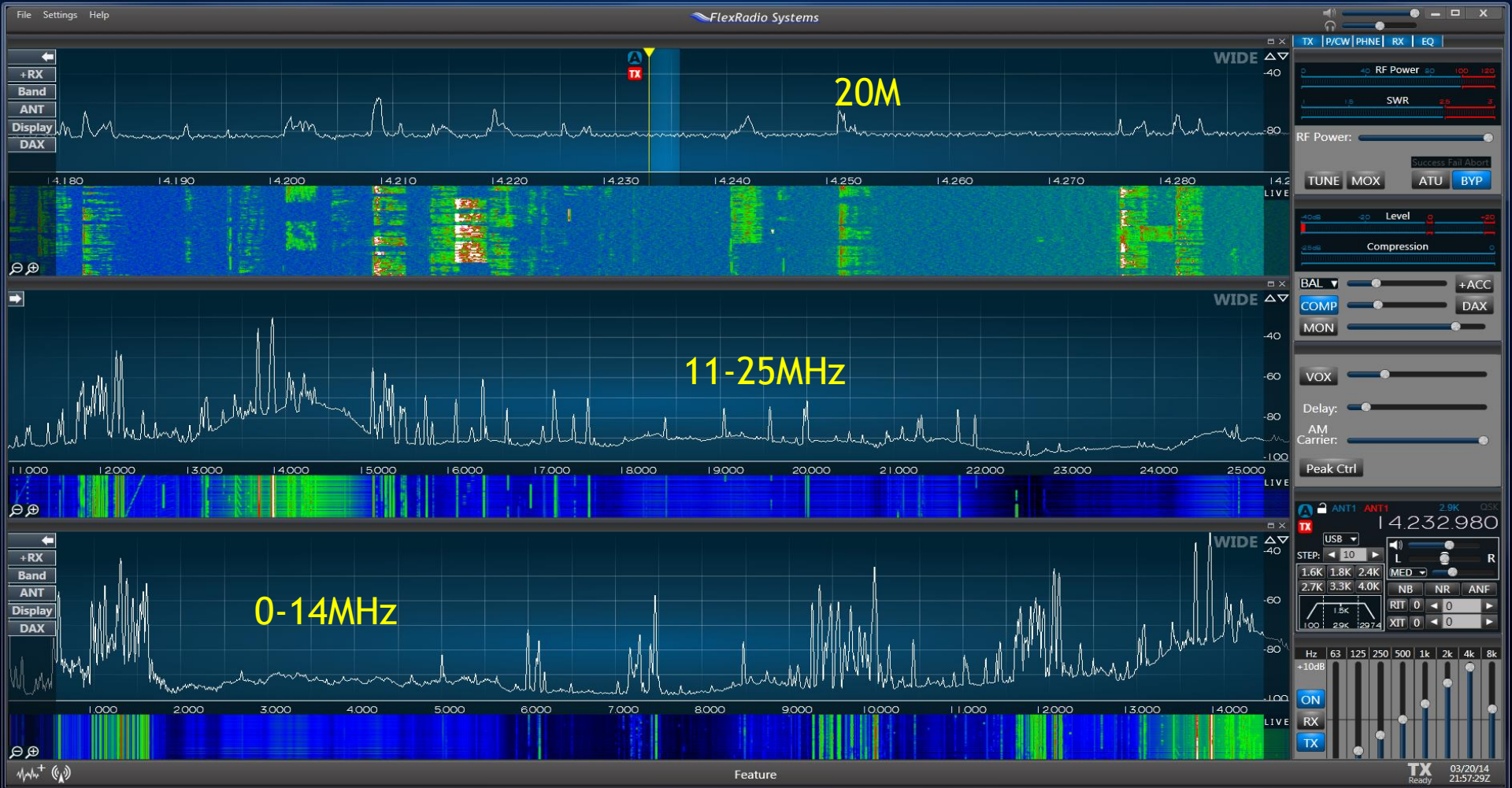


Blind Legacy Radio



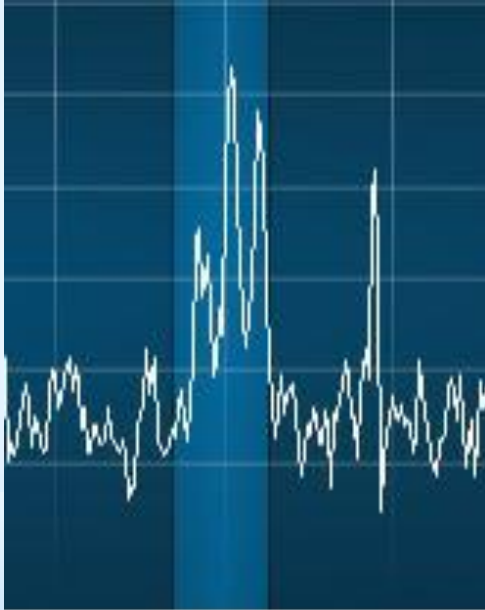
SDR Sees Entire Band

# \* SDR Benefits for you



\* 20M as well as  
0 MHz-25MHz

## \*6. Best Dynamic Range - Block Adjacent Signals



Flex 6700	108dB
Hilberling	105dB
KX-3	104dB
K-3	101dB
FTdx-5000D	101dB
IC-7800	80dB

# \*SDR Benefits for you



# \*7. Digital - No Costly External Interfaces or Cables

## Legacy Radio Arrangement



## SDR Radio Arrangement

Every in Digital Domain  
Inside computer



# \*SDR Benefits for you

# \* 8. Best Digital Decoding

## Legacy Radio Arrangement



Flex 6700 decodes  
No Legacy decodes below

-27db S/N  
-20 dB S/N

## WA3IHV JT65 Real World Example

Legacy Icom 7700 -19dB S/N  
Modern Flex 6700 -26dB S/N

Modern – 7dB Gain Advantage

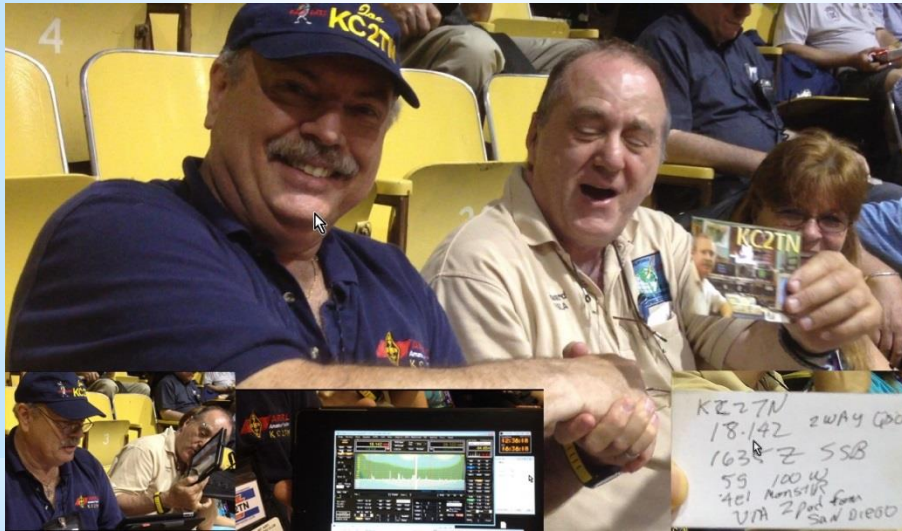
## SDR Radio Arrangement



# \* SDR Benefits for you

## \*9. Easiest Remote Operations

DAYTON 2012



Friedrichshafen 2014



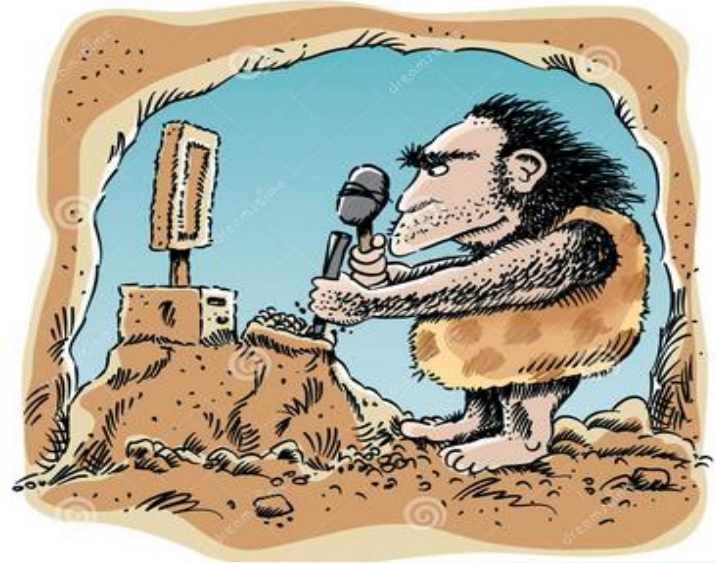
iPad Remote via Flex 6700 through KY6LA in La Jolla, CA  
from 22 Different Countries  
Maybe today too

# \*SDR Benefits for you

## \* 10. SDR Software Continually Improves



Legacy Radios Fixed in Stone  
Rarely improve with age



SDR - New Features/Modes added all the time  
Like a new radio every few months

# \* SDR Benefits for you

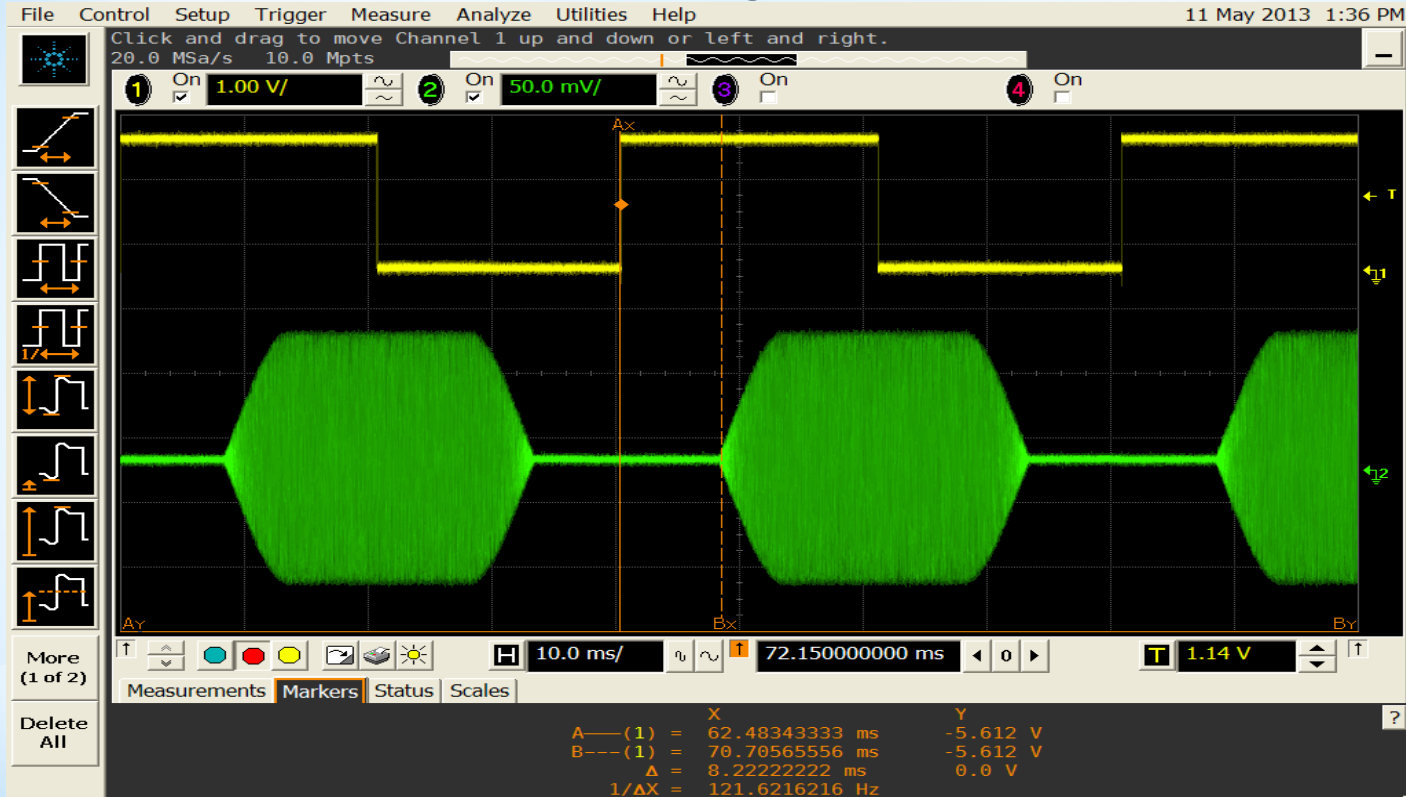
## \* 11. Open Applications Programming Interfaces



Lots Of Hams Writing New Software To Make SDR's Better  
On Windows, MAC, Linux, iOS and Android

# \* SDR Benefits for you

## \* 12. Cleanest Transmit Signals

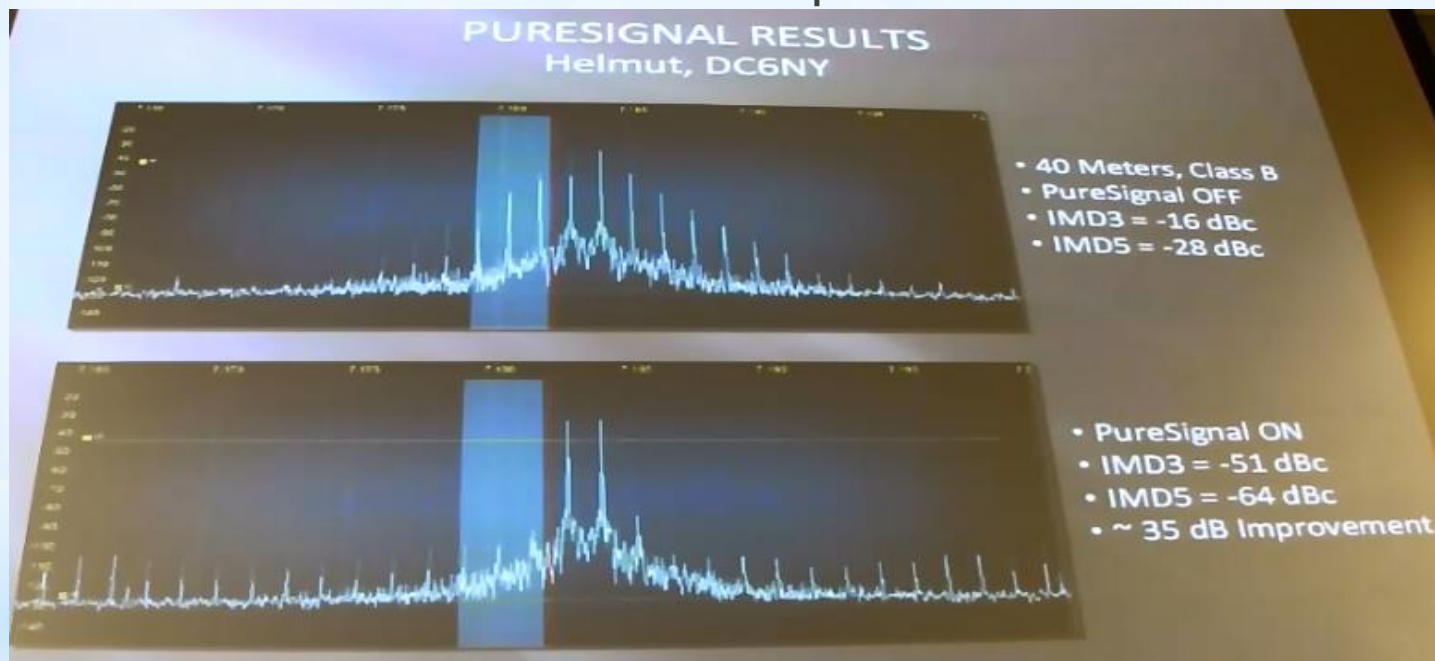


Modern Radios - Perfect CW Signal Shaping  
Modern Radios - Lowest Transmit Audio Distortion

# \* SDR Benefits for you

## \* 12. Cleanest Transmit Signals

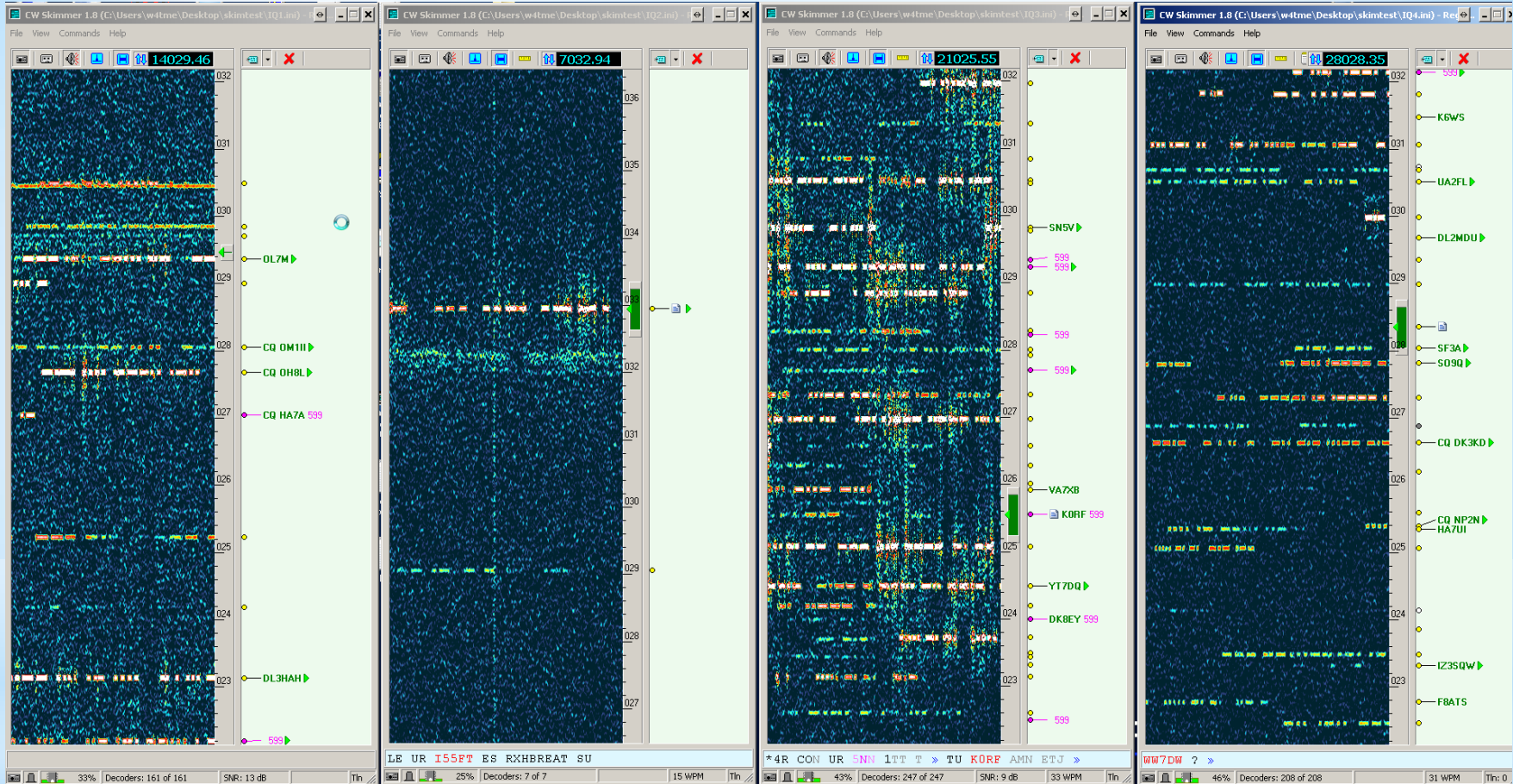
\* Even 35dB Cleaner with Adaptive Pre-Distortion



Source Dr Warren Pratt NR0V  
Friedrichshafen, June 2014

# \* SDR Benefits for you

# \* 13. 4 CWSkimmers - Each Decoding 192KHz



20M

40M

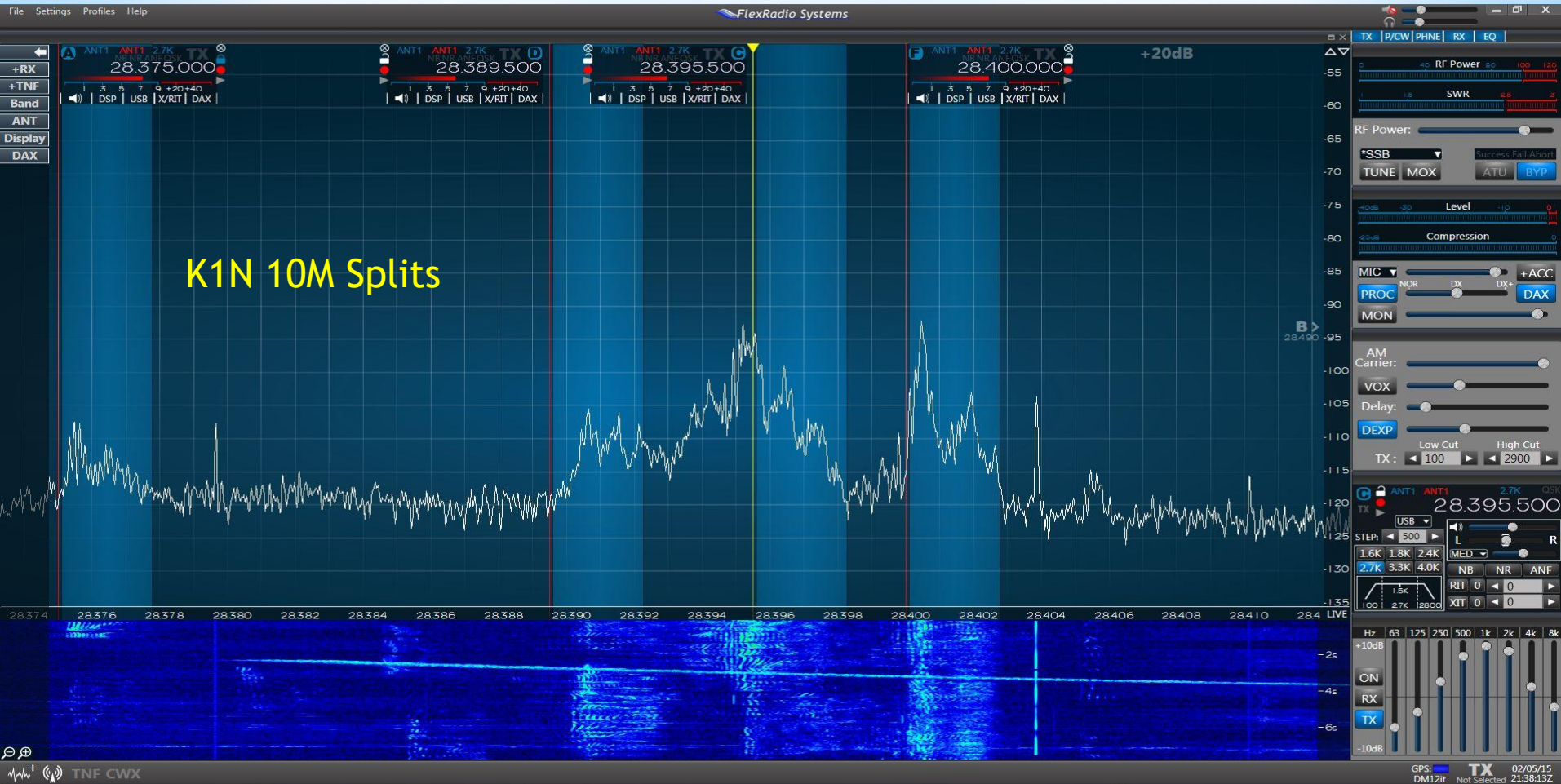
15M

10M

# \* SDR Benefits for you

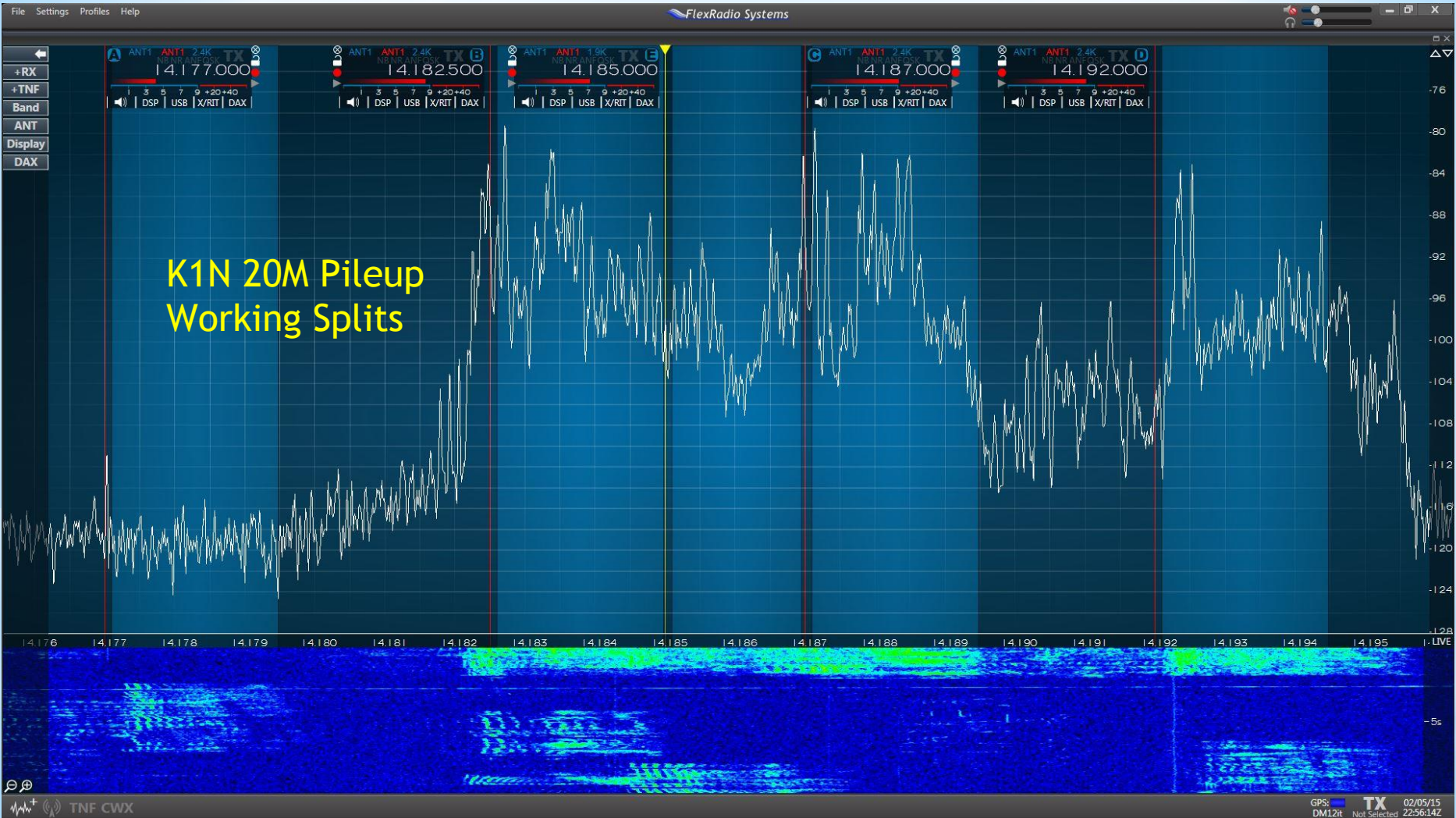


# \* 14. 4 Receivers at the Same Time



# \* SDR Benefits for you

# \* 15. 8 Receivers at the Same Time



# \* SDR Benefits for you

## \* 16. SDR - Easy to Use Human Interface

- \* Late 20<sup>th</sup> Century - C130 - Complex Buttons, Dials and Knobs



\* SDR Benefits for you

- \* 16. SDR Easy to Use Human Interface
  - \* Late 20<sup>th</sup> Century Legacy Radio - FTdx5000
  - \* Blind Radio -Complex Buttons, Dials, Knobs



\* SDR Benefits for you

## \* 16. Easy to Use Human Interface

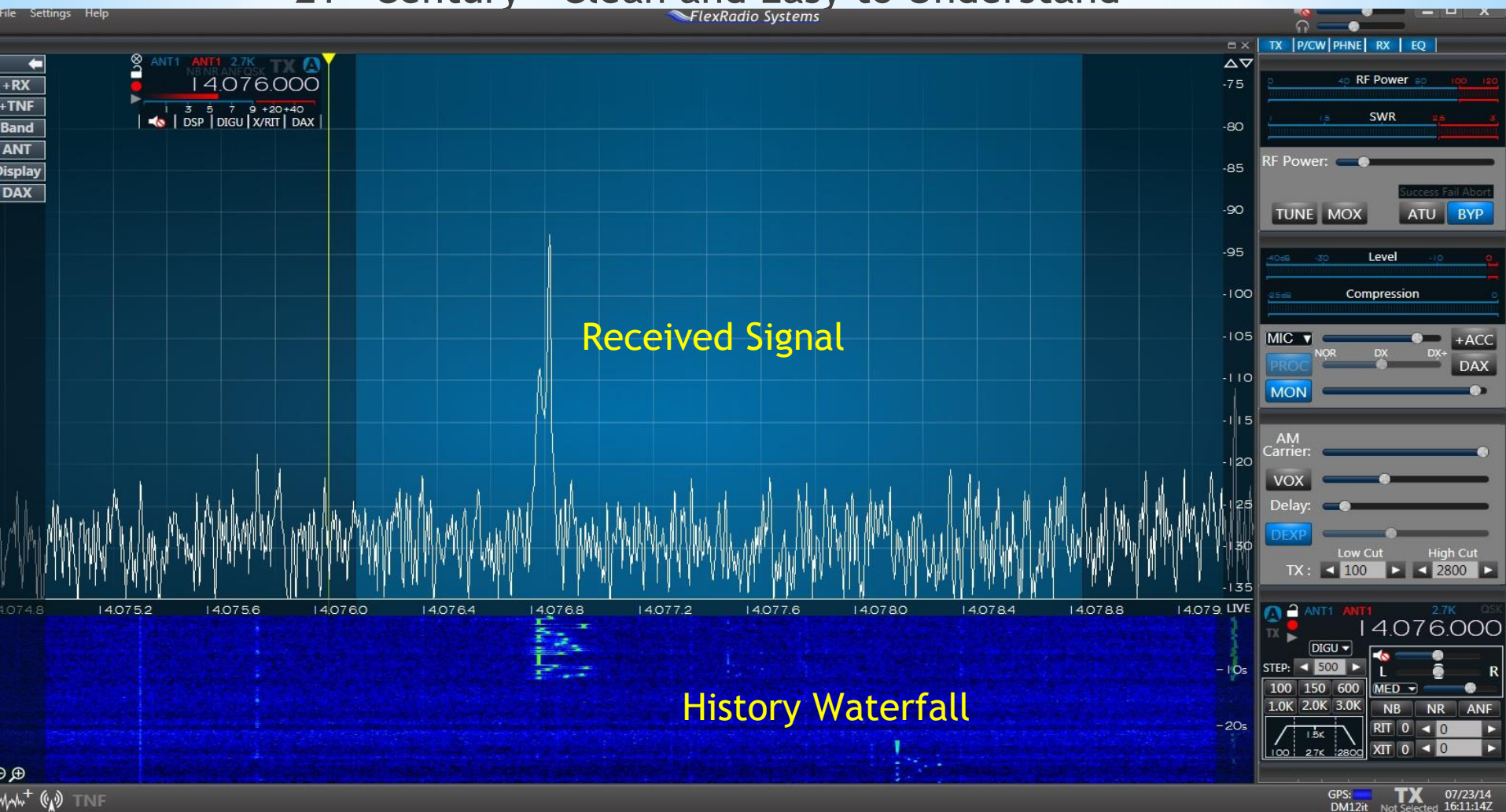
\* 21<sup>st</sup> Century - Modern 787 Cockpit



\* **SDR Benefits for you**

# \* 16. SDR Easy to Use Human Interface

## \* 21<sup>st</sup> Century - Clean and Easy to Understand



# \* SDR Benefits for you

## \* 16. SDR Easy to Use Human Interface

- \* Legacy - Hours of reading manual
- \* Legacy - Hours to Setup Correctly
- \* Legacy - Easy to screw up by pushing wrong button or twisting the wrong knob
  
- \* SDR - Easiest Learning Curve for Newbies
- \* SDR - Operational with visual interface in a Few Minutes
  - Without Reading The Manual

\* SDR Benefits for you

# \* 17. Easy Auto Control of Amps, Rotors, Meters, etc

The screenshot displays a multi-window software interface for an SDR station. The top window, titled 'Term\_2K\_USB - Rel. 120512\_A', shows a digital display with 'SWR' and 'Standby' indicators, along with various status parameters like 'IN 1', 'BAND 20 m', 'ANT 1t', 'CAT KENWD', 'OUT MAX', 'SWR ---', and 'TEMP 88°F'. To its right is a 'Term\_2K\_USB: Keypad' window with virtual buttons for 'INPUT', 'ANT', 'L', 'L', 'DISPLAY', 'ON', 'BAND', 'BAND', 'C', 'C', 'POWER', 'CAT', 'SET', 'OFF', 'AL', 'TUNE', 'SET', 'TUNE', 'OPERATE', 'ON', 'OP', and 'TX'.

Below these are three main control windows. On the left is 'The Flex Meter Experiment', which features a large digital display showing '1.00 SWR' and a semi-circular scale from 201 to 999. Below the meter is a table of sources and names, with 'SWR' selected. In the center is 'DDUtil 3.0.9.03 - 14.182.000 USB', which shows a detailed setup page with fields for 'Volts', 'Temp', 'BCD', 'Auto Drive', 'Fwd', 'Swr', 'LP100', and 'Presets'. It also includes a 'Rotor' section with 'GO', 'Stop', and '098 1' buttons. On the right is a 'Heading' window showing 'DX Data' for 'Palmyra & Jarvis Is' and 'Location Data' for 'Palmyra Island', including coordinates and time zone. A 'Rotor' label is placed next to the 'Rotor 1' field in this window.

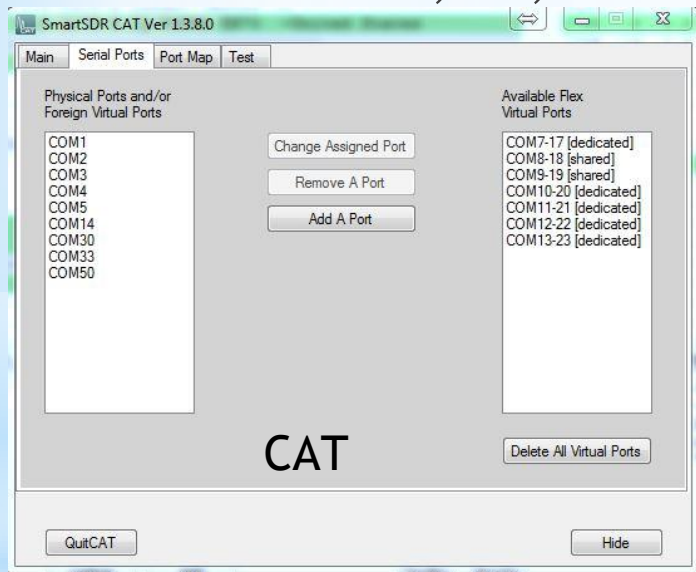
At the bottom right is a 'MacBtms' window containing a grid of 12x8 buttons for various functions like 'F1', 'F2', 'F3', 'F4', 'F5', 'F6', 'F7', 'F8', 'F9', 'F10', 'F11', 'F12', 'SSB', 'CW', 'DIGL', 'DIGH', 'SO2R', 'Exit', 'TxSw1', 'TxSw2', 'TxSw3', 'TxSw4', 'TxSw5', 'TxSw6', 'TxSw7', 'TxSw8', 'TxSw9', 'PSDR', 'Startup', 'Tune On', 'Tune Off', 'Quadra', 'Empty', 'Empty', 'Empty', 'RX2 100', and 'Rx2 50'. A 'Macro's' label is placed to the right of this window.

At the bottom left, the text 'Already Digital' is written in a large, bold font.

# \* SDR Benefits for you

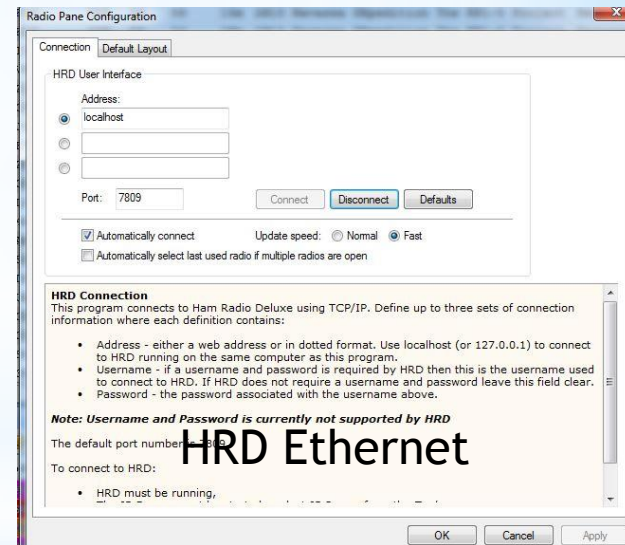


- \* 18. Easy CAT Interface to Logging and Digital Software
- \* CAT = Computer Aided Transceiver
- \* Virtual Serial Port Pairs (New Concept)
- \* CAT - already digital inside the computer
- \* CAT (max 115kb/s) and SDR Ethernet (1Gb/S) connections
- \* Ethernet - 9,000,000 x faster connection than CAT



COM 1 Rotor  
 COM 2 Spare  
 COM 3 SteppIR MonstIR  
 COM 4 LP-100A WattMeter  
 COM 5 Passive 2K-FA  
 COM 6-16 MixW Dedicated  
 COM 7-17 Writelog Dedicated  
 COM 8-18 Rotor Writelog  
 COM 9-19 Rotor MixW  
 COM 10-20 WSJT-XA Dedicated  
 COM 11-21 WSJT-XB Dedicated  
 COM 12-22 VoiceKeyer  
 COM 13-23 S-Meter  
 COM 14 Genovation  
 COM 30 WaveNode WN-2d  
 COM 31 WaveNode 2 VHF  
 COM 33 Expert 2K-FA  
 COM 50 FlexControl

CAT



\* SDR Benefits for you

## \* 19. Easy Audio Connections WITHOUT Cables/Interfaces

- \* Connect to All Digital (PSK, RTTY, WSJT) Programs inside computer
- \* 8 Virtual Audio Cables - Digital Audio Xchange



Up to 8 Sound Channels

Up to 4 - 192KHz Channels

\* SDR Benefits for you

## \*20. HAVING FUN!!!!

- \* SDR - CAN DO MORE THINGS THAN ANY OTHER RADIO
  - \* SDR - BUILT IN LAB GRADE TEST EQUIPMENT
  - \* SDR - ALWAYS SOMETHING NEW TO TRY
- 
- \* MOST FUN OF ANY RADIO I HAVE EVER OWNED

\*SDR Benefits for you

## \* LEGACY RADIOS

- \* 1. 1901 - Simple Detector
- \* 2. 1928 - Multi-conversion a.k.a. Superhetrodyne- Legacy
- \* 3. 1980 - Superhetrodyne with DSP
  - \* Your car radio, your TV, any older scanner you have
  - \* Most every Hilberling, Kenwood, Icom, Ten-Tec, Elecraft and Yaesu on the market today

## \* MODERN RADIOS

- \* 4. 2000- 1<sup>st</sup> Generation SDR - Direct Conversion  
FLEX-5000, FLEX-3000, FLEX1500, Elecraft KX3, Elad FDM-Duo
- \* 5. 2009 2<sup>nd</sup> Generation SDR - Direct Sampling External Processing  
HPSDR, ANAN-100, SUNSDR-2
- \* 6. 2012 3<sup>rd</sup> Generation SDR - Direct Sampling INTERNAL Processing  
FLEX-6000, ANAN-200D

# \* Summary of Architectures

\* Unless You Trying To Start A Collection  
Of Antique Radios

\* It Is A Total Waste Of \$\$ To Buy A  
Legacy Radio In The 21<sup>st</sup> Century

\* **My Opinion**

- \* Let's Look At My Station And
- \* Try To Connect Via KY6LA in LA JOLLA

# \* Remoting

# \* MY STATION LAYOUT



85' SteppIR MonstIR (Nested @27')

\* KY6LA



# \* KY6LA VHF Stack



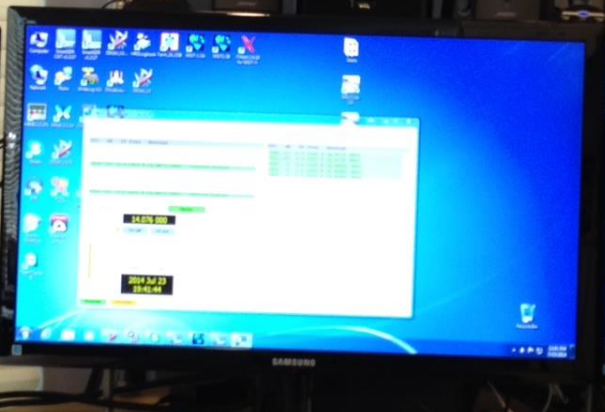
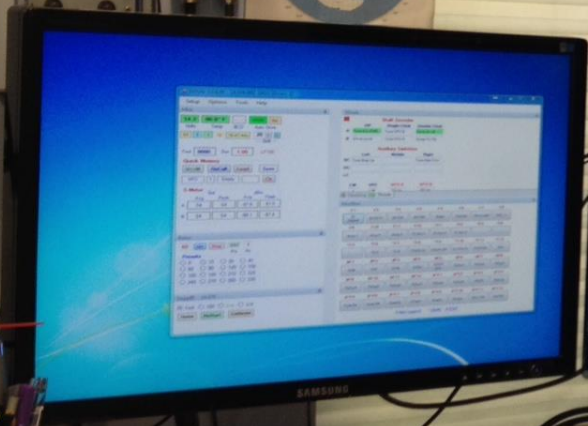


# \* KY6LA Antenna Control Stack

19:41  
-GMT-

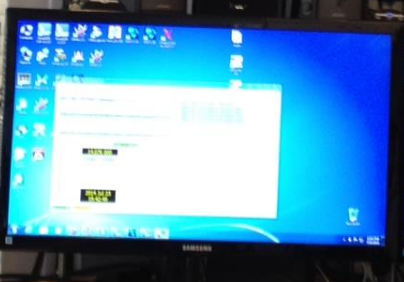
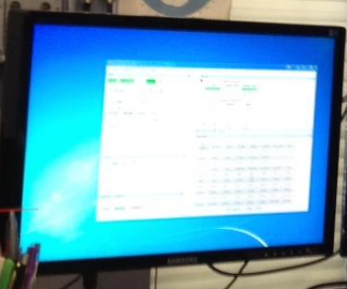
U.S. Amateur Bands  
Phone Bands

160	1,800	2,000
80	3,000	4,000
40	7,125	7,300
30		
20	14,100	14,300
17	18,110	18,160
15	21,200	21,400
12	24,930	24,990
10	28,300	29,700
8	50,100	54,000
7	144,100	148,000
6	222,000	223,000
5	420,000	450,000





U.S. Standard Time	UTC
00:00	05:00
01:00	06:00
02:00	07:00
03:00	08:00
04:00	09:00
05:00	10:00
06:00	11:00
07:00	12:00
08:00	13:00
09:00	14:00
10:00	15:00
11:00	16:00
12:00	17:00
13:00	18:00
14:00	19:00
15:00	20:00
16:00	21:00
17:00	22:00
18:00	23:00
19:00	00:00
20:00	01:00
21:00	02:00
22:00	03:00
23:00	04:00



RADIO STATION  
VE3GFW/K6



- \* [sites.google.com/site/thesdrinstitute/A-Software-Defined-Radio-for-the-Masses](http://sites.google.com/site/thesdrinstitute/A-Software-Defined-Radio-for-the-Masses)
- \* [w9oy-sdr.blogspot.com](http://w9oy-sdr.blogspot.com)
- \* [www.flexradio.com](http://www.flexradio.com)
- \* [apache-labs.com/index.php](http://apache-labs.com/index.php)
- \* [www.ab9il.net/software-defined-radio/rtl2832-sdr.htm](http://www.ab9il.net/software-defined-radio/rtl2832-sdr.htm)
- \* [www.hamsdr.com/StartHere.htm](http://www.hamsdr.com/StartHere.htm)
- \* [www.hamsdr.com/WA2DFI/Hands\\_On\\_SDR\\_%20Dayton\\_2008\\_v0\\_9.ppt](http://www.hamsdr.com/WA2DFI/Hands_On_SDR_%20Dayton_2008_v0_9.ppt)
- \* [wb5rvz.com/sdr/](http://wb5rvz.com/sdr/)
- \* [sdrsharp.com/](http://sdrsharp.com/)
- \* [www.baycom.org/~tom/ham/soundmodem/](http://www.baycom.org/~tom/ham/soundmodem/)
- \* [www.insomnihack.ch/images/insomnihack-mar13-bk-sdr.pdf#page=10&zoom=auto,0,458](http://www.insomnihack.ch/images/insomnihack-mar13-bk-sdr.pdf#page=10&zoom=auto,0,458)
- \* [www.pe0sat.vgnet.nl/tag/sdrsharp/](http://www.pe0sat.vgnet.nl/tag/sdrsharp/)
- \* [2600.wrepp.com/2600/Links/29/3/superkuh.com/gnuradio.html](http://2600.wrepp.com/2600/Links/29/3/superkuh.com/gnuradio.html)
- \* [wb6dhw.com/For\\_Sale.html#UHFSDR](http://wb6dhw.com/For_Sale.html#UHFSDR)
- \* [www.davegardner.org/Ham/PDF/EasySDR.pdf](http://www.davegardner.org/Ham/PDF/EasySDR.pdf)
- \* [zr6aic.blogspot.com/2013/02/setting-up-my-raspberry-pi-as-sdr-server.html](http://zr6aic.blogspot.com/2013/02/setting-up-my-raspberry-pi-as-sdr-server.html)
- \* [www.oz9aec.net/index.php/gnu-radio/gnu-radio-blog/477-noaa-apt-reception-with-gqrx-and-rtlsdr](http://www.oz9aec.net/index.php/gnu-radio/gnu-radio-blog/477-noaa-apt-reception-with-gqrx-and-rtlsdr)
- \* [v2.sdr-radio.com/Download.aspx](http://v2.sdr-radio.com/Download.aspx)

## \* References

# \*Panafall - DX Secrets

Like Shooting DX Fish in  
a Barrel

Working TX6G

DX Summit | Equipment & Antennas | Bracket | NCAA.com | TX6G - Callsign Lookup by

www.dxsummit.fi/Search.aspx

# DXSUMMIT BY RADIO X ARCALA

NEWS | DX SPOTS | BAND SPOTS | ANNOUNCEMENTS | SEND SPOT | **SEARCH** | FORUM | DONATE | RADIO ARCALA

» SPOT DATABASE SEARCH

Search string:  Search:  DX Call  Any column

Year:  Band:

Mode:  Number of spots:

W6TA	24908.0	TX6G	UP 3	1756	24 Mar	Not Found
WOROB-@	18146.0	TX6G	5/7 IN MN QSL G3TXF	1750	24 Mar	Not Found
UA5IKI-@	18146.0	TX6G	fnx for qso 73!	1749	24 Mar	Not Found
W3LPL	24908.1	TX6G	Heard in MD	1749	24 Mar	Not Found
UA5IKI-@	18146.0	TX6G	fnx for qso 73!	1748	24 Mar	Not Found
UA5IKI-@	18146.0	TX6G	fnx for qso 73!	1747	24 Mar	Not Found
W0ZK	18146.0	TX6G	fnx for qso 73!	1746	24 Mar	Not Found
R8DX-@	18146.0	TX6G	TNX!	1739	24 Mar	Not Found
ES4IN-@	18146.0	TX6G	UP 5-10	1738	24 Mar	Not Found
W8LR-@	24908.0	TX6G	1sn up	1733	24 Mar	Not Found
RN4DJS-@	18146.0	TX6G	tnx 153	1727	24 Mar	Not Found
KB6KI-@	18146.0	TX6G	Always 5/9++ FB up 5-10	1725	24 Mar	Not Found
I2SEJB	18146.0	TX6G	5/8 IOTA OC-114	1725	24 Mar	Not Found
KD4POJ-@	21035.0	TX6G	QRX 30 Minutes	1715	24 Mar	Not Found
K4WMS	24909.5	TX6G	up 1.5 579 in VA	1713	24 Mar	Not Found
Y0SOU-@	21035.2	TX6G	tu , up38,95	1708	24 Mar	Not Found
RA6ARI	21035.1	TX6G	up1.8, tnx qso	1704	24 Mar	Not Found
UTSJAJ-@	24908.0	TX6G	up	1701	24 Mar	Not Found
KJ9C/7	24908.0	TX6G	Q5X 24911.15 UP STRONG IN MT	1701	24 Mar	Not Found
KL2YV	18146.0	TX6G	5/9 in Alaska	1656	24 Mar	Not Found
I2ZIFF	14182.0	TX6G	up 5/10 - pse	1655	24 Mar	Not Found
RO1B	21035.1	TX6G	Q5X 21036.38 cq up1	1652	24 Mar	Not Found
R4AZ-@	14182.0	TX6G	tnx QSO up 14.210 FB!	1643	24 Mar	Not Found
AC5RK-@	18146.0	TX6G	5-10 up	1639	24 Mar	Not Found
A6SCA	10121.0	TX6G	OC-114 tnx! up 1	1638	24 Mar	Not Found

camtasiaup (1).exe


Sign In/Register

**Solar-Terrestrial Data**  
 24 Mar 2014 1753 GMT  
 SFI: 158 SN: 159  
 A-Index: 6  
 K-Index: 1  
 X-Ray: B7.7  
 304A: 176.0 @ SEM

**Calculated Conditions**

Band	Day	Night
80m-40m:	Poor	Good
30m-20m:	Fair	Good
17m-15m:	Good	Good
12m-10m:	Good	Poor
Signal Noise:	30-31	

Click to Install Solar Data On your Web Site  
<http://www.n0nbn.com>  
 Copyright Paul L. Herriman 2010



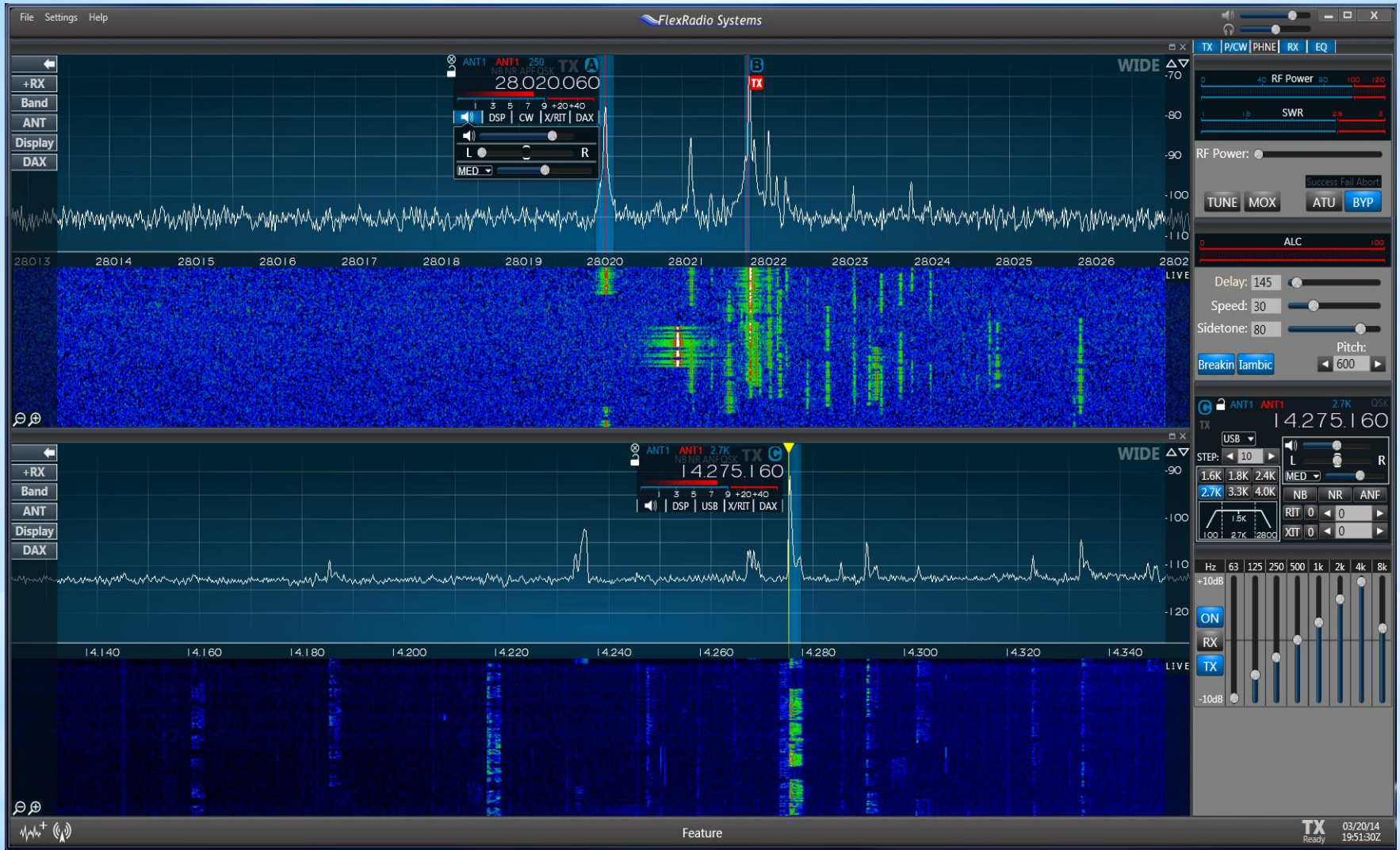
**DX ENGINEERING**

The World's Most Popular 43-Foot Vertical Antenna!

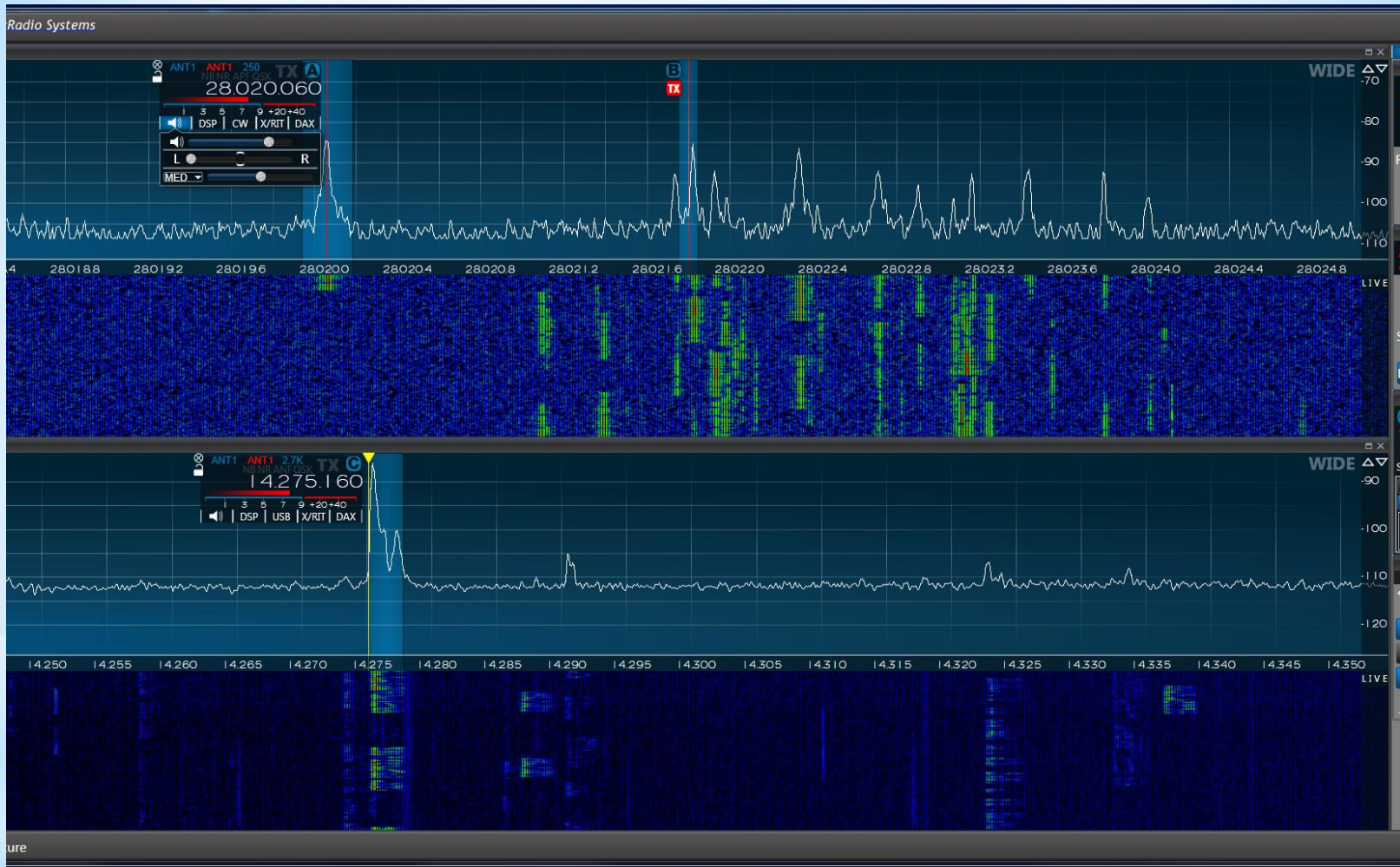
- High Quality
- Superior Performance
- Low Price

Thousands Sold!

# \* TX6G Spots

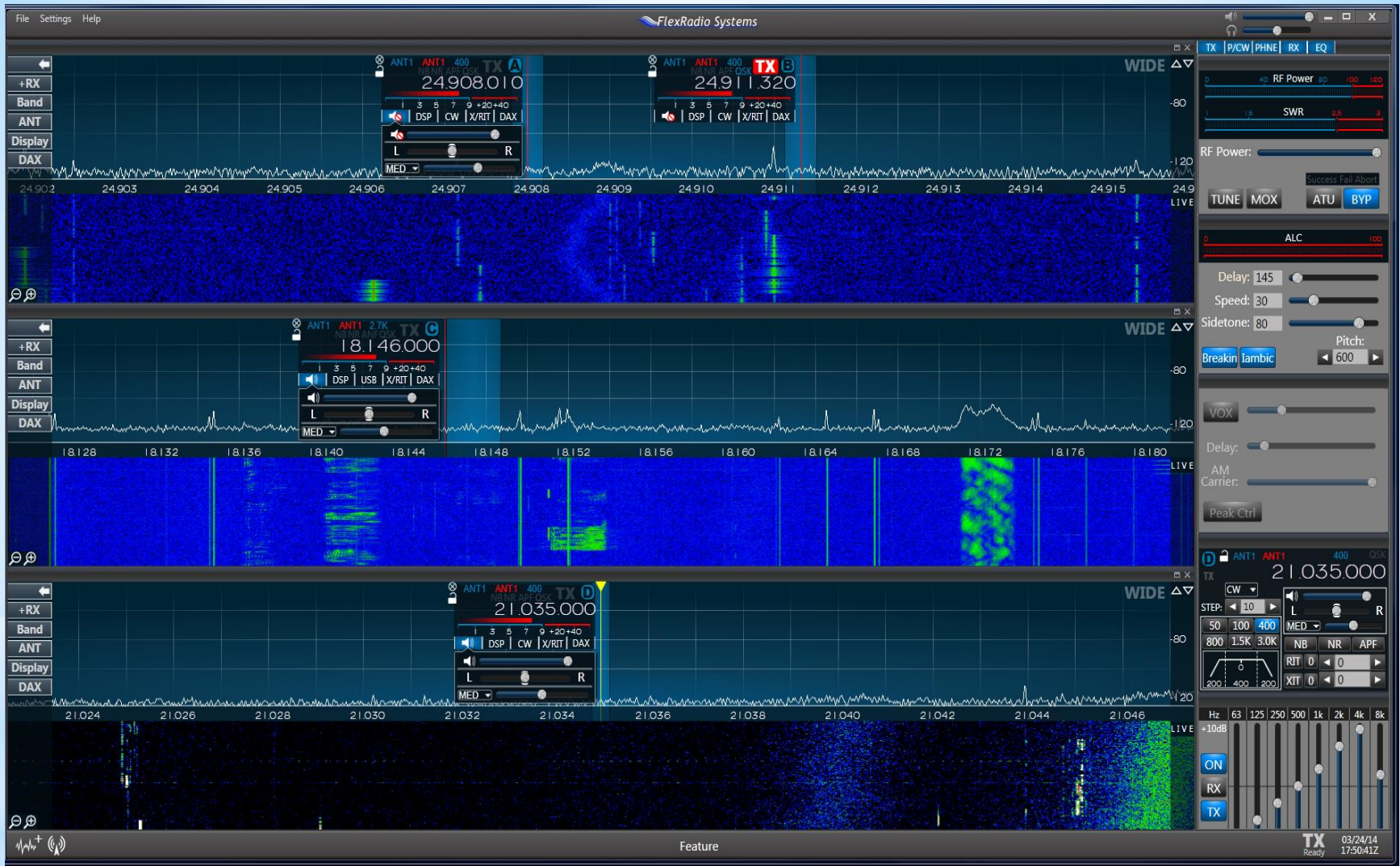


**\*TX6G**

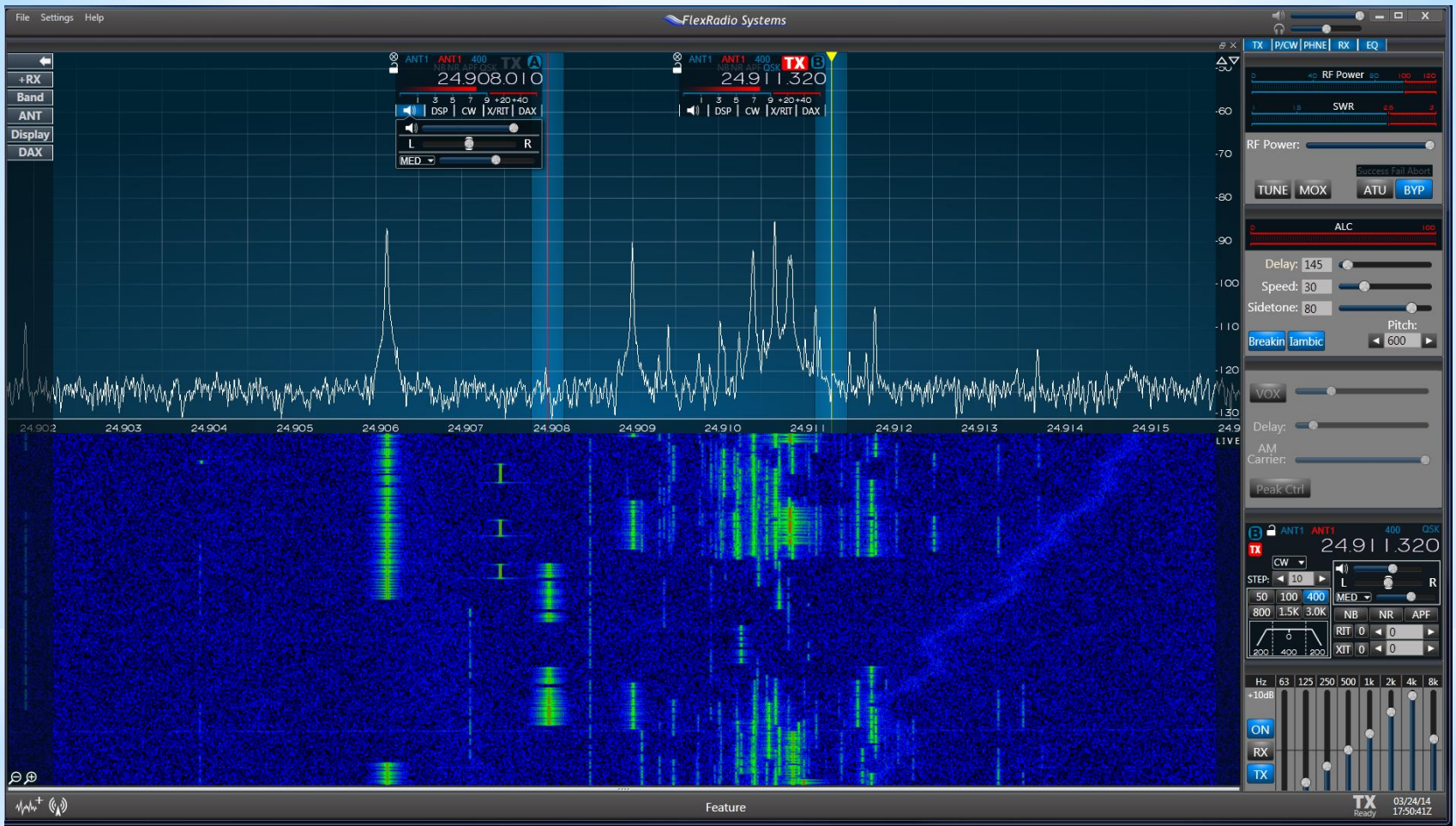


# \*TX6G Split (zoom)

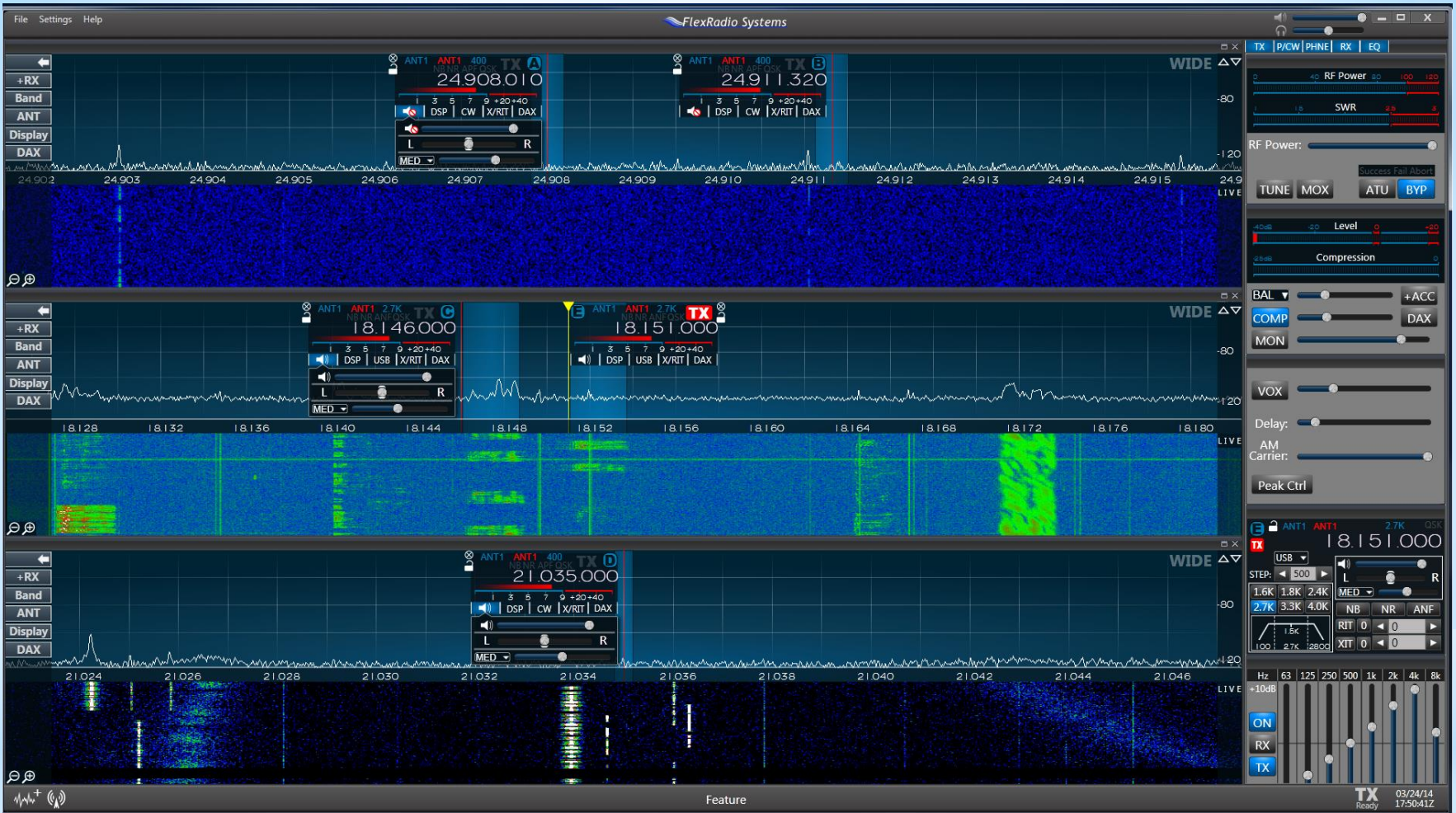




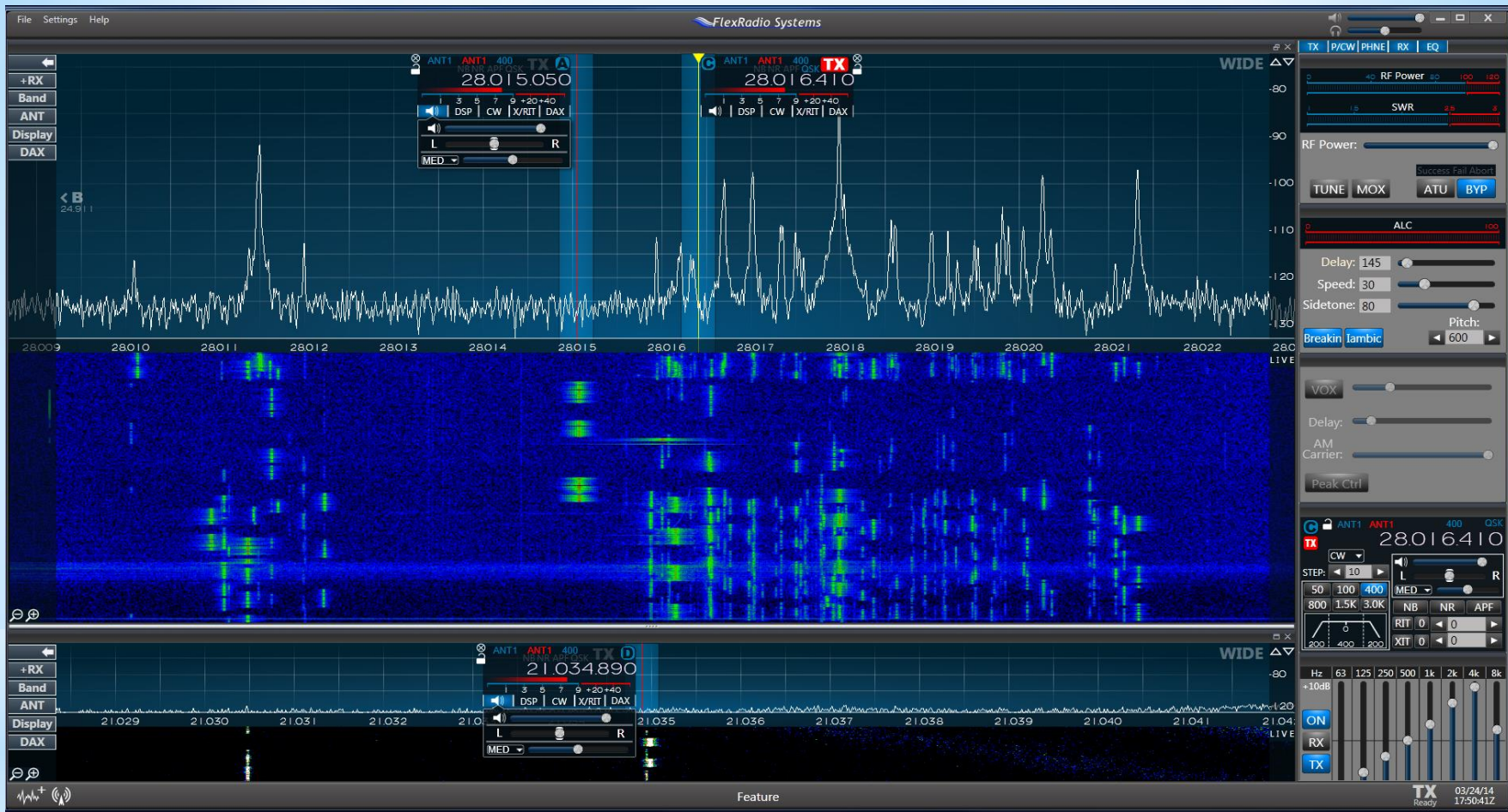
# \*TX6G 3-Band Panafall



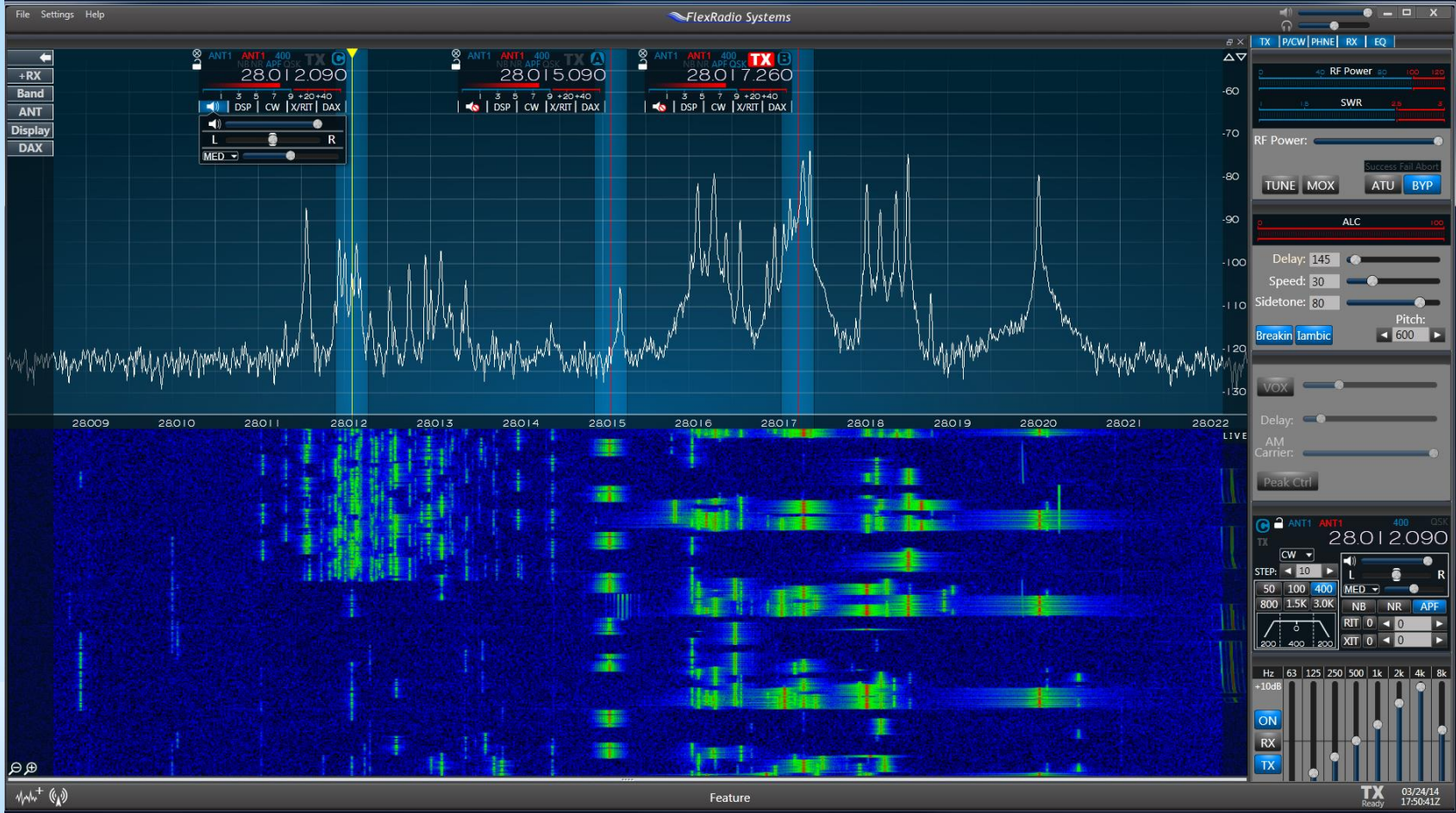
# \*TX6G - 12m Zoom



# \*TX6G-17m SSB

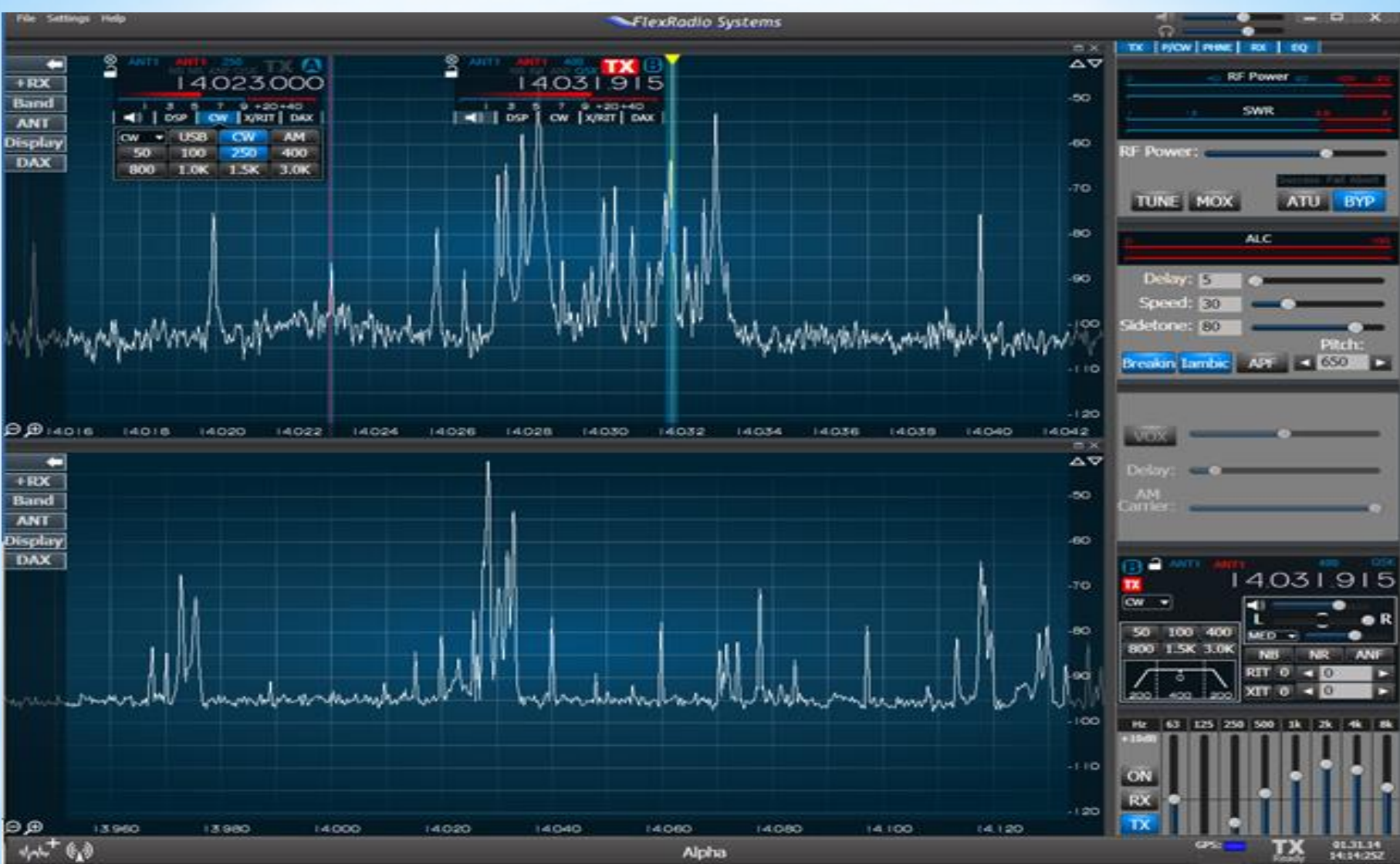


\*TX6G- 10m UP UP EU EU!

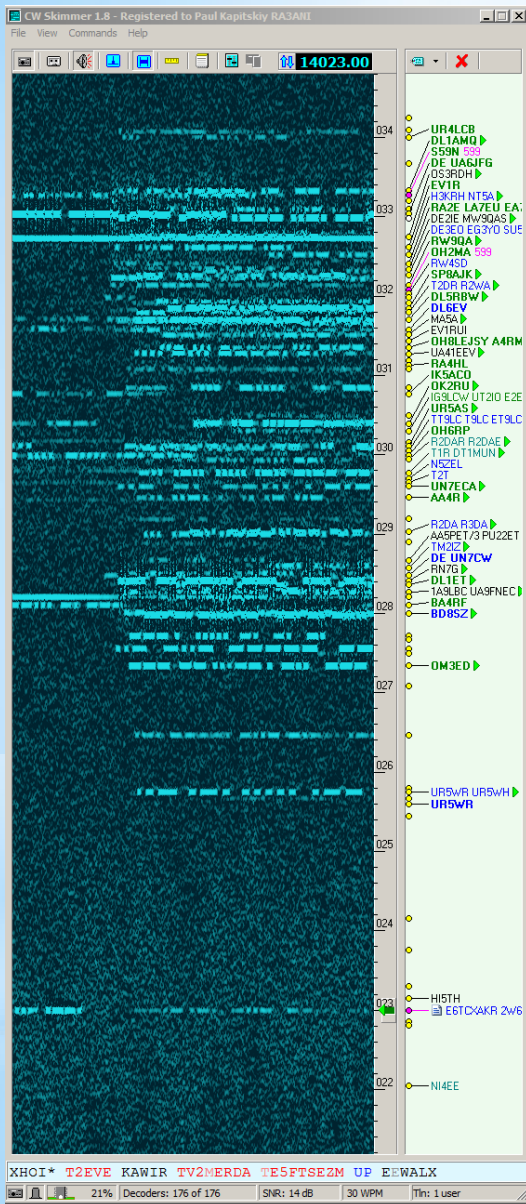


\*TX6G - 10m

# \* DX Secrets Working FT5ZM



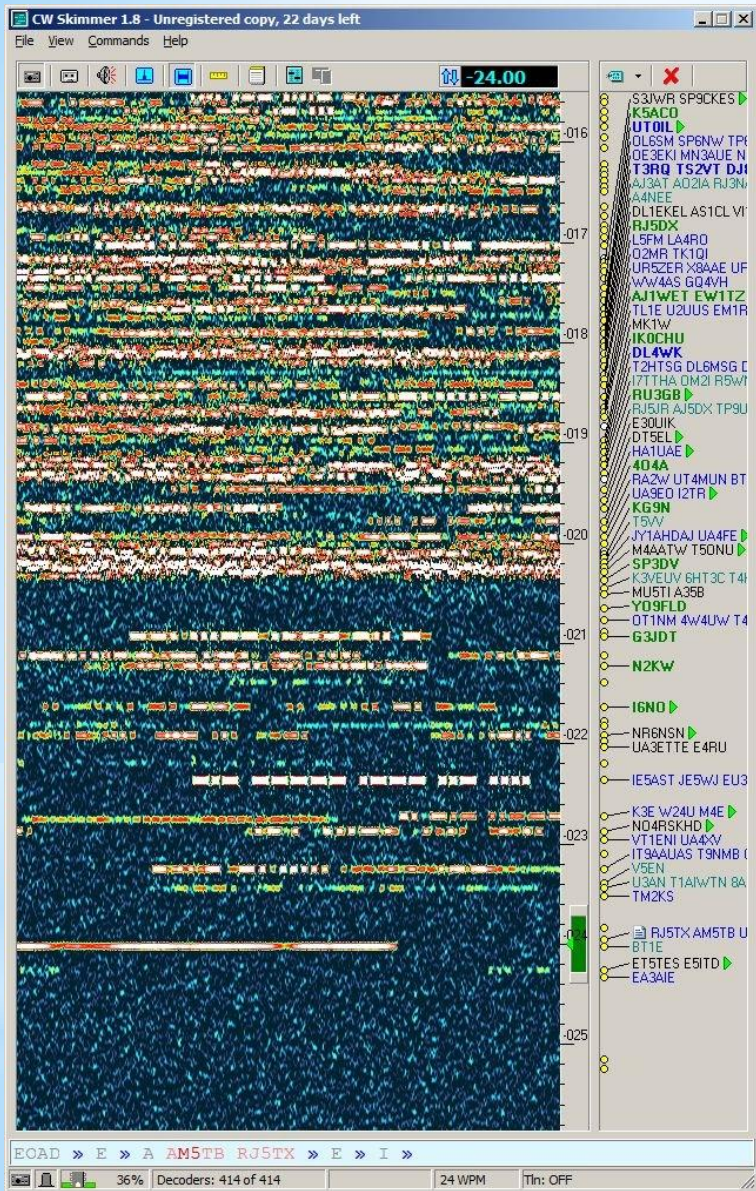
\* ET5ZM



\* Antenna Pointed at FT5ZM

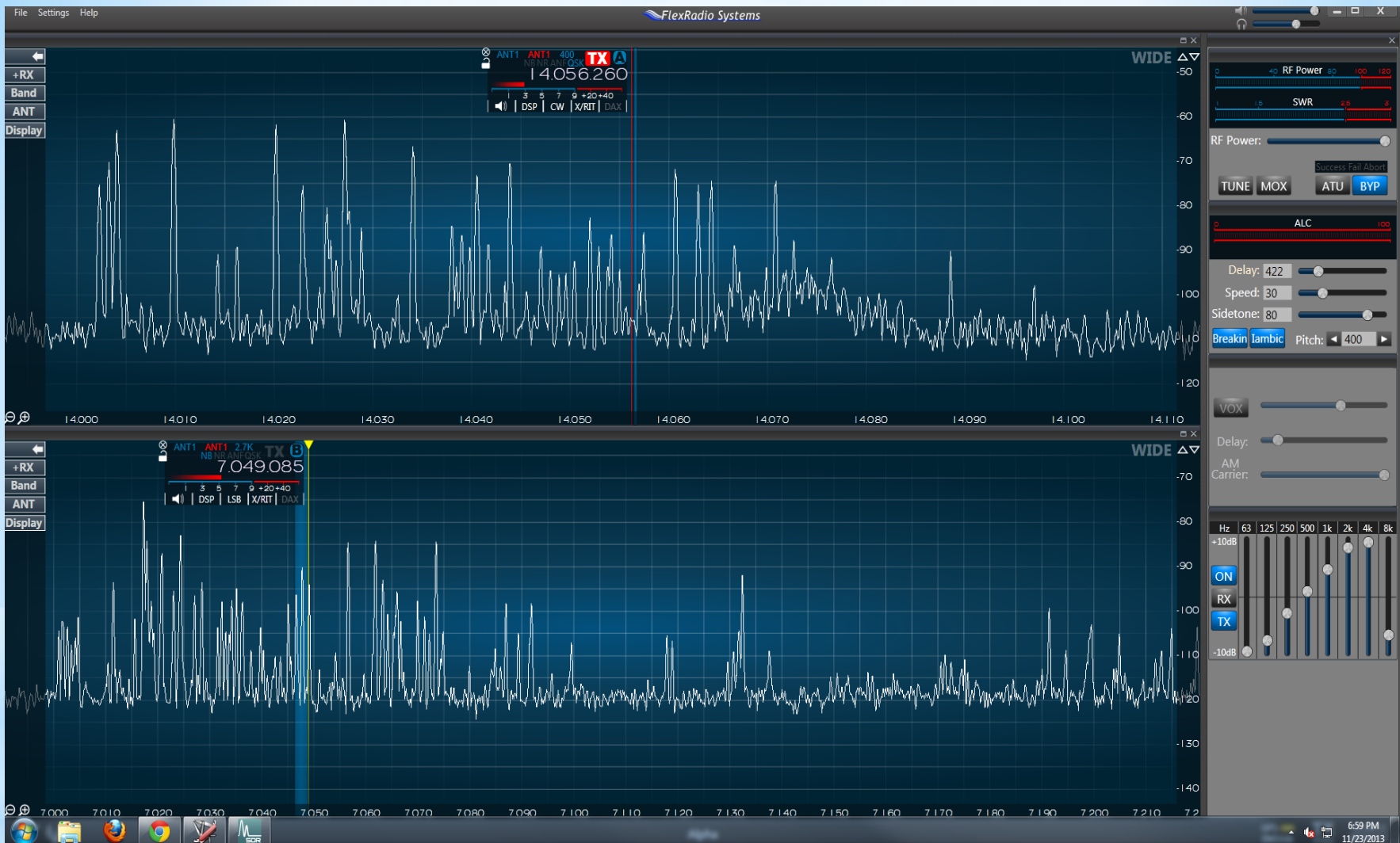
\* FT5ZM Skimmer





\* Pointed towards EU

\* FT5ZM Skimmer



# \* CQ WW 2013