SDR Radios:
One Ham's Perspective

Jon Longtin KB8LFP

Overview

- Brief introduction of myself
- SDR radios – an overview
- Adding an SDR to your shack
- Overview of SDRPlay RSP1A (my SRD radio)
  - Capabilities and specs
- Software overview
- Conclusions and final thoughts

A bit about me

- Born and raised in Cincinnati, OH
  - Hence the 8 in KB8LFP
- Novice and Technician Class in 1990
  - Was in a club with a 2m repeater
- Left Cincinnati in 1991 and fell out of the hobby
  - Bay Area, California: 1991 ~ 1995
  - Tokyo, Japan: 1995 ~ 1996
- Came to Long Island in 1996
  - Professor of Mechanical Engineering at Stony Brook University
- Work colleague became an Extra
  - I gave him some old ham equipment
  - He gave me a Baofung UV-5R
- Looked up local repeaters in the area, found W2RC
  - Was listening in on a Tuesday evening about two years ago
  - Heard the ragchew, jumped in and am here before you now

SDR Radios

- Software-Defined Radios – SDR
  - From Wikipedia: “SDR: A radio communication system where components that have been traditionally 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.”
- Very simple interface:
  - 1 antenna connection
  - 1 USB connection to PC
  - No knobs, buttons, or controls
- All control operations done in software
- Most useful feature for most people: *panadaptor*
  - Can see entire band spectrum at once

Advantages vs Disadvantages

- Advantages
  - Inexpensive ($100)
  - Allows viewing entire band at once
  - Easy to identify conversations
  - Can distinguish type of transmission visually (sideband, AM)
  - Comparable (or better!) sensitivity, selectivity, noise reduction comparable to dedicated HF rig
  - Can run many software packages, including dedicated packages
- Disadvantages
  - Slight delay in SDR Audio out – cannot use HF + SDR audio together
  - Sharing antenna with HF Rig for TX
  - Integrating with rig and rig control software (e.g., Ham Radio Deluxe)
  - Workarounds available, but take trial and error

Some Popular SDR radios

- SDRPlay
  - SDR RSP1, RSP1A, RSP2
- AirSpy
  - AirSpy HF+, AirSpy R2, AirSpy Mini
- HackRF One
- Many others: $30 ~ $200
- And some that you might not know
  - Icom 7300
  - Elecraft KX3
  - Icom 7610

SDRPlay RSP1A

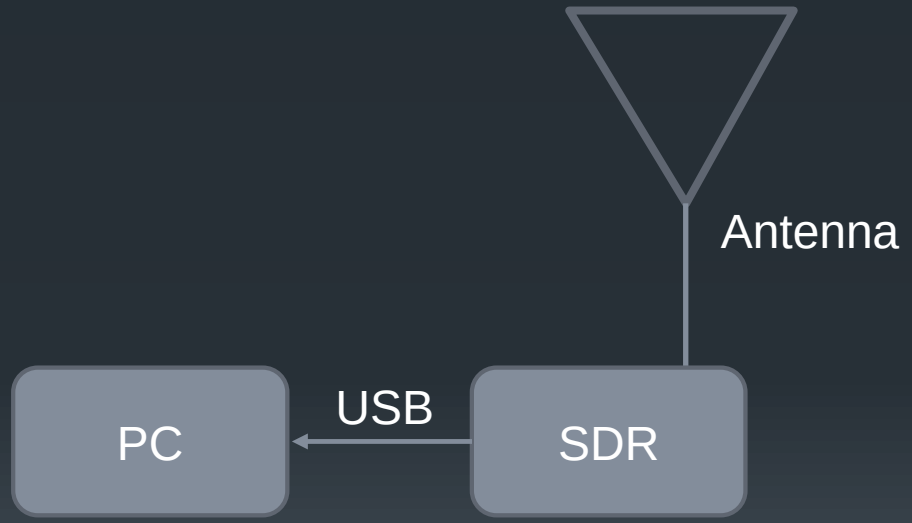
- Single SMA input antenna
- Single USB output
- No power input (USB power)
- Specs
  - 14 bit DAC
  - 1 kHz ~ 2 GHz continuous (no gaps) → all ham bands , including 2,200 and 630 m
  - 10 MHz slice of spectrum
  - Up to 16 individual receivers on this 10 MHz spectrum (but cannot tune outside this 10 MHZ slice)
  - Works with all popular SDR software
- $99 from Ham Radio Outlet

Incorporation SDR into the shack

- Need to share antenna(s) with SDR
- Must be careful to avoid HF TX!
  - will kill SDR input stages
- Need PC

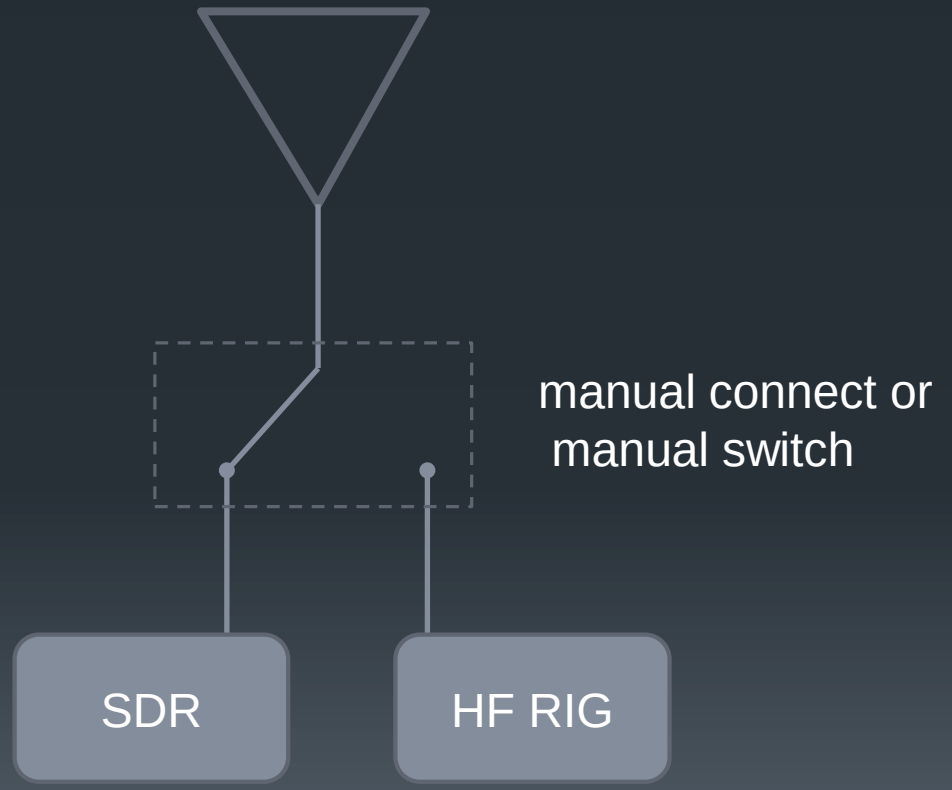
Connecting SDR to Antenna and Radio

- Option #1 – Manual connect antenna to SDR radio
- Cannot use HF rig while SDR is connected
- Listen only



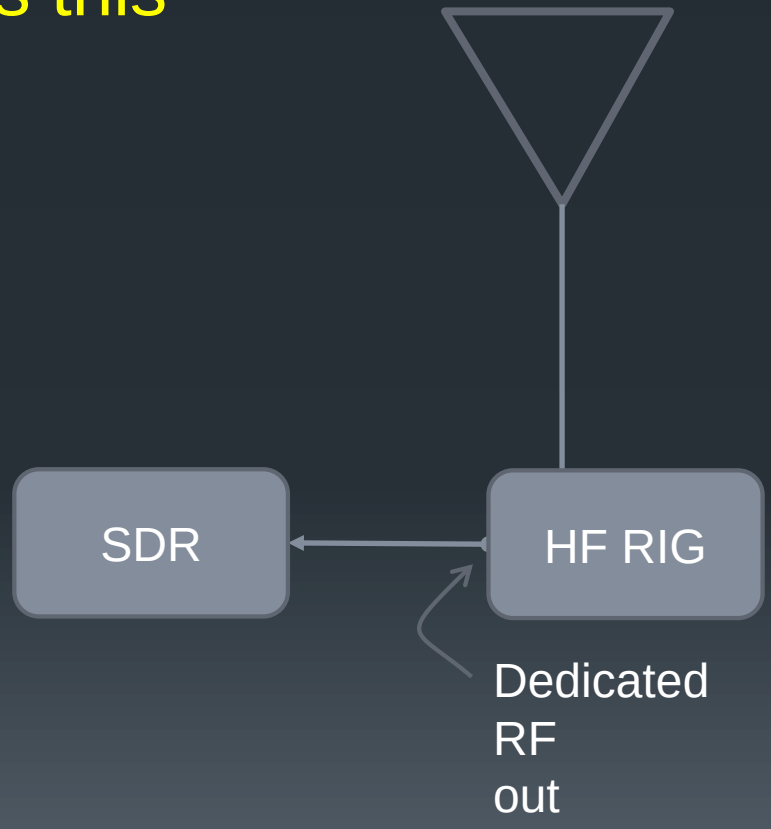
Connecting SDR to Antenna and Radio

- Option #2 – Manual Switchover
- Can use HF or SDR but not both



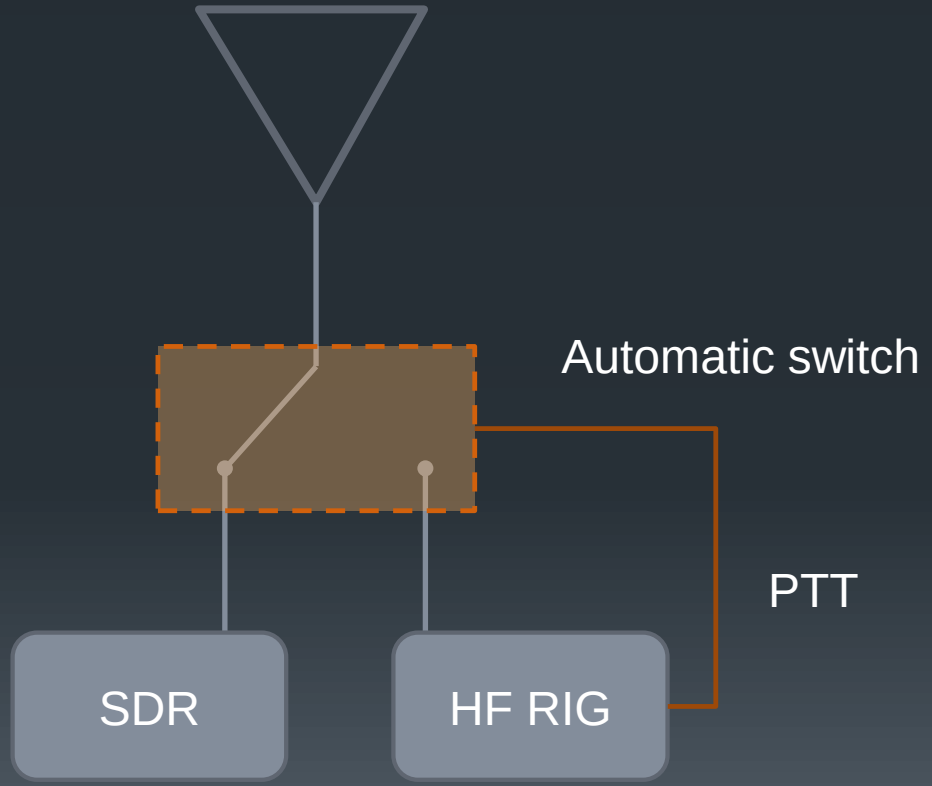
Connecting SDR to Antenna and Radio

- Option #3 – Some radios have dedicated RF output for SDR (7300, TS-590SG)
- Ideal, if your rig supports this



Connecting SDR to Antenna and Radio

- Option #4 – Automatic switch
  - MFJ 1708 –SDR (several versions)
  - Switches to HF rig and grounds SDR input when HF transmits

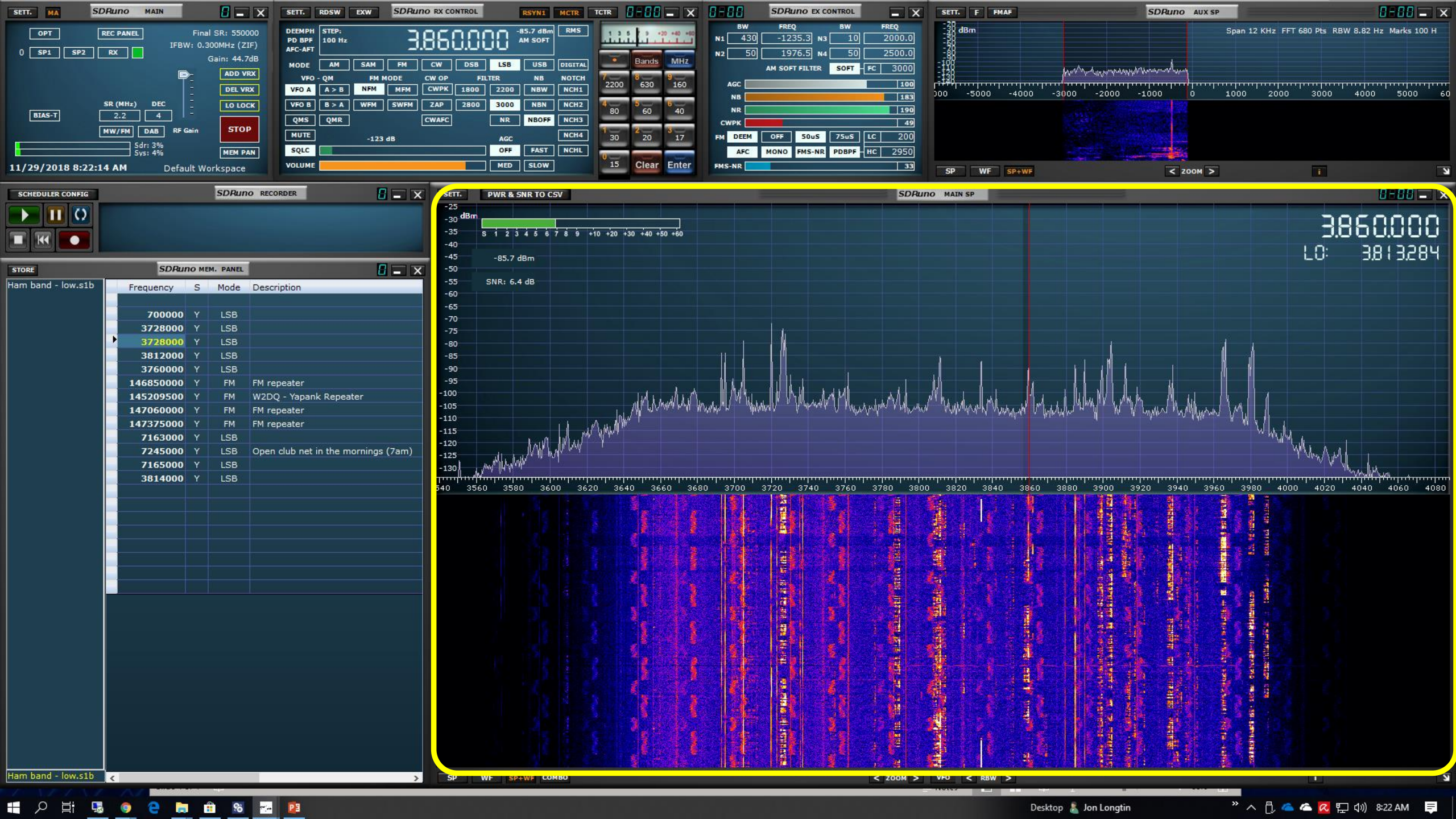


SDR Software

- Can run your choice of software programs
  - SDR interface is standardized
  - Often will get most features/performance from software provided by hardware manufacturer
  - SDR Radios → SDRUno (https://www.sdrplay.com/windl2.php)
- Some other popular SDR programs
  - HDSDR (whttp://www.hdsdr.de/) (free)
  - SDR# (https://airspy.com/)
  - SDR-Radio.com (https://www.sdr-radio.com/)
  - Linrad (http://www.sm5bsz.com/linuxdsp/linrad.htm)
  - CubicSDR (https://github.com/cjcliffe/CubicSDR)
  - Others

Software: SDRUno

- SDRUno made by SDRPlay
- Free!
- Hardware and software made by same company
  - Compatibility
  - Maximal use of hardware features
  - Minimizes finger-pointing for problems


SDRuno MAIN
Final SR: 550000
IFBW: 0.300MHz (ZIF)
Gain: 44.7dB
11/29/2018 8:22:14 AM
Default Workspace
SDRuno RX CONTROL
3.860.000
SDRuno EX CONTROL
SDRuno AUX SP
SDRuno RECORDER
SDRuno MEM. PANEL
Ham band - low.s1b
Frequency S Mode Description
700000 Y LSB
3728000 Y LSB
3728000 Y LSB
3812000 Y LSB
3760000 Y LSB
146850000 Y FM FM repeater
145209500 Y FM W2DQ - Yapank Repeater
147060000 Y FM FM repeater
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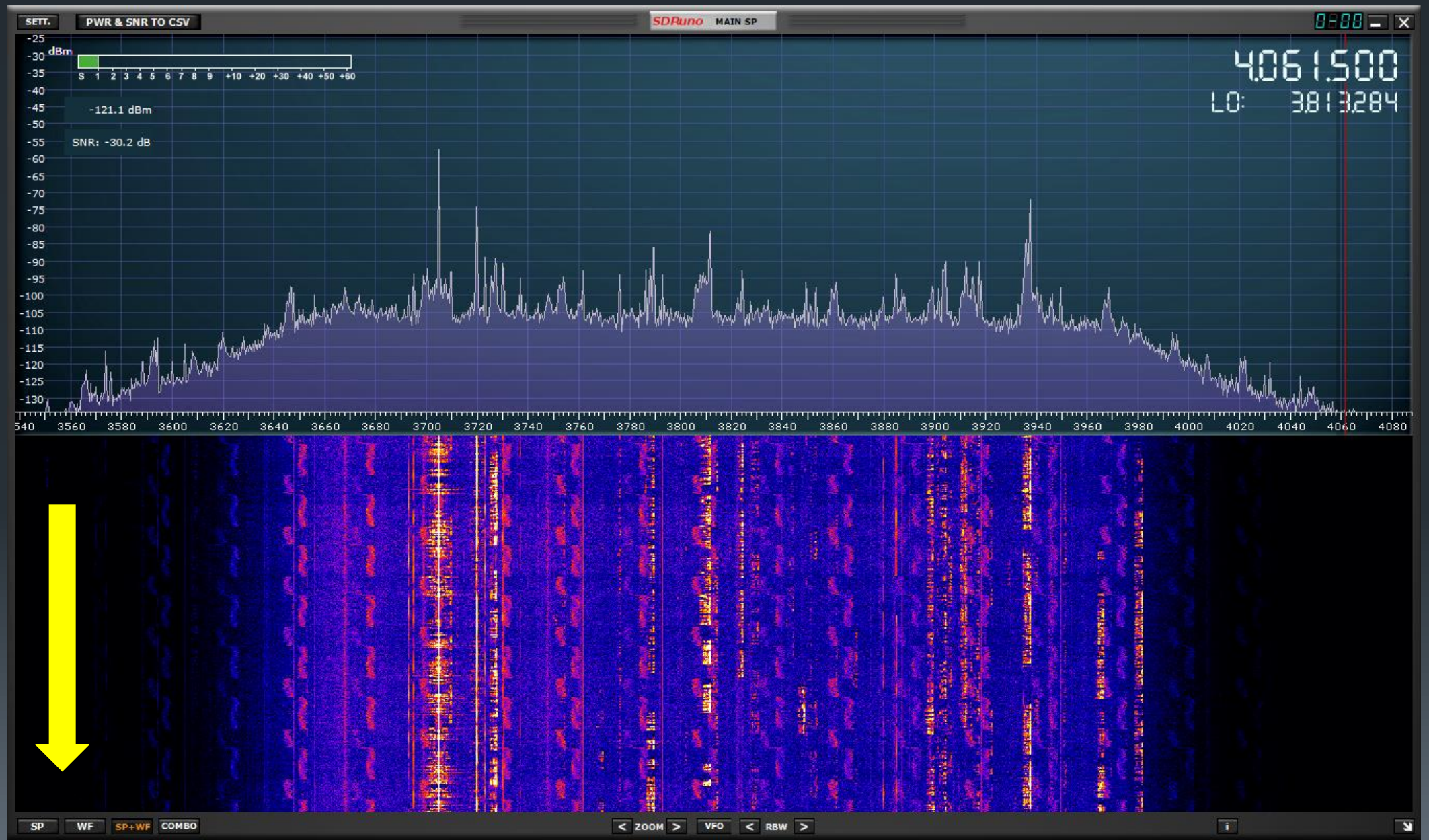
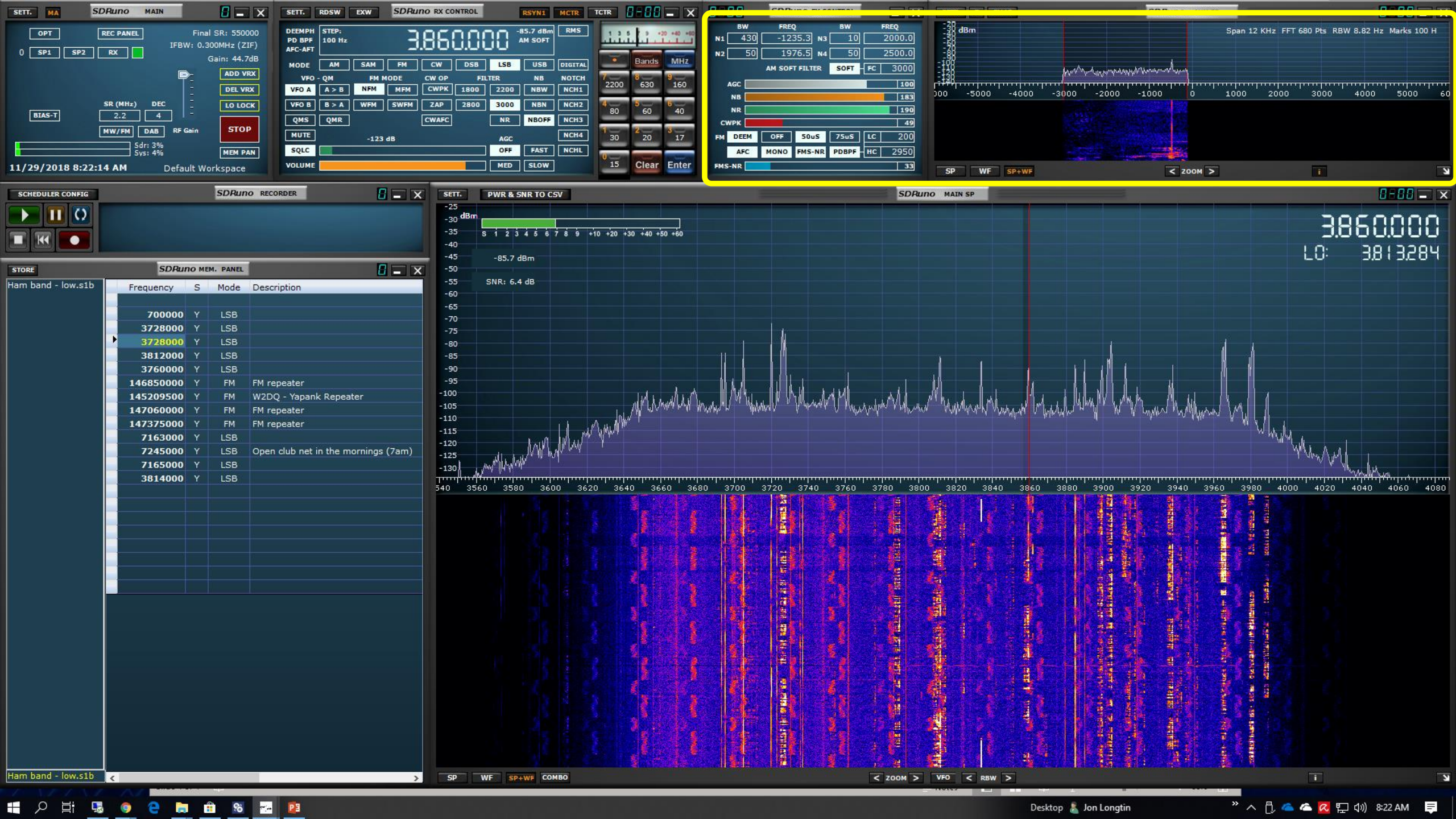
7245000 Y LSB Open club net in the mornings (7am)
7165000 Y LSB
3814000 Y LSB
SDRuno MAIN SP
PWR & SNR TO CSV
-85.7 dBm
SNR: 6.4 dB
3.860.000
LO: 3.813.284

Waterfall Window




SDRuno MAIN
SDRuno RX CONTROL
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SDRuno MAIN SP
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SNR: 6.4 dB
Span 12 KHz FFT 680 Pts RBW 8.82 Hz Marks 100 H
Ham band - low.s1b
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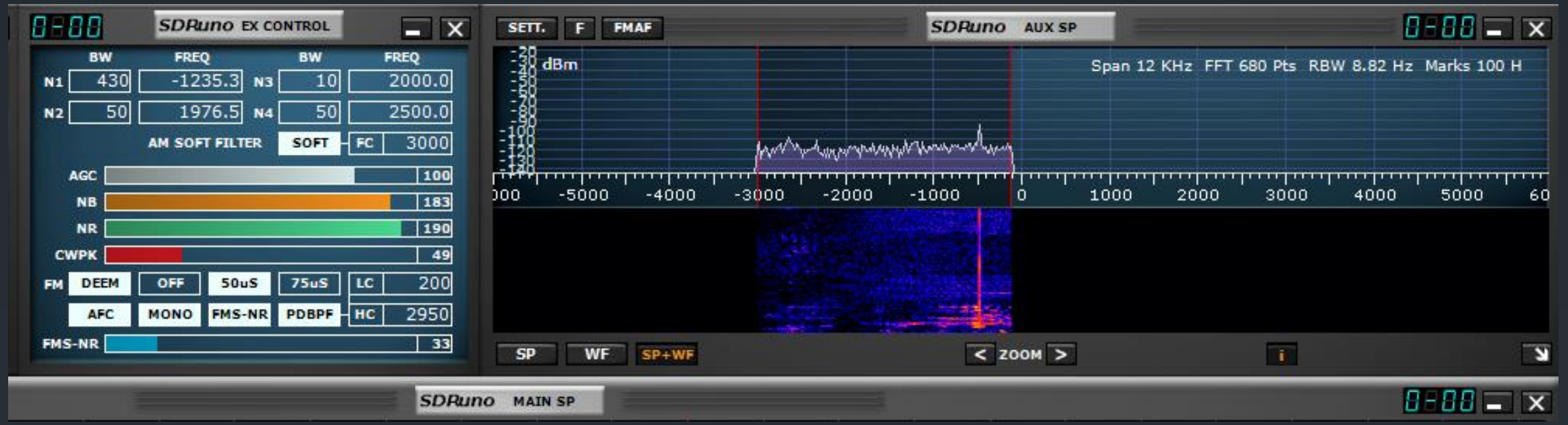
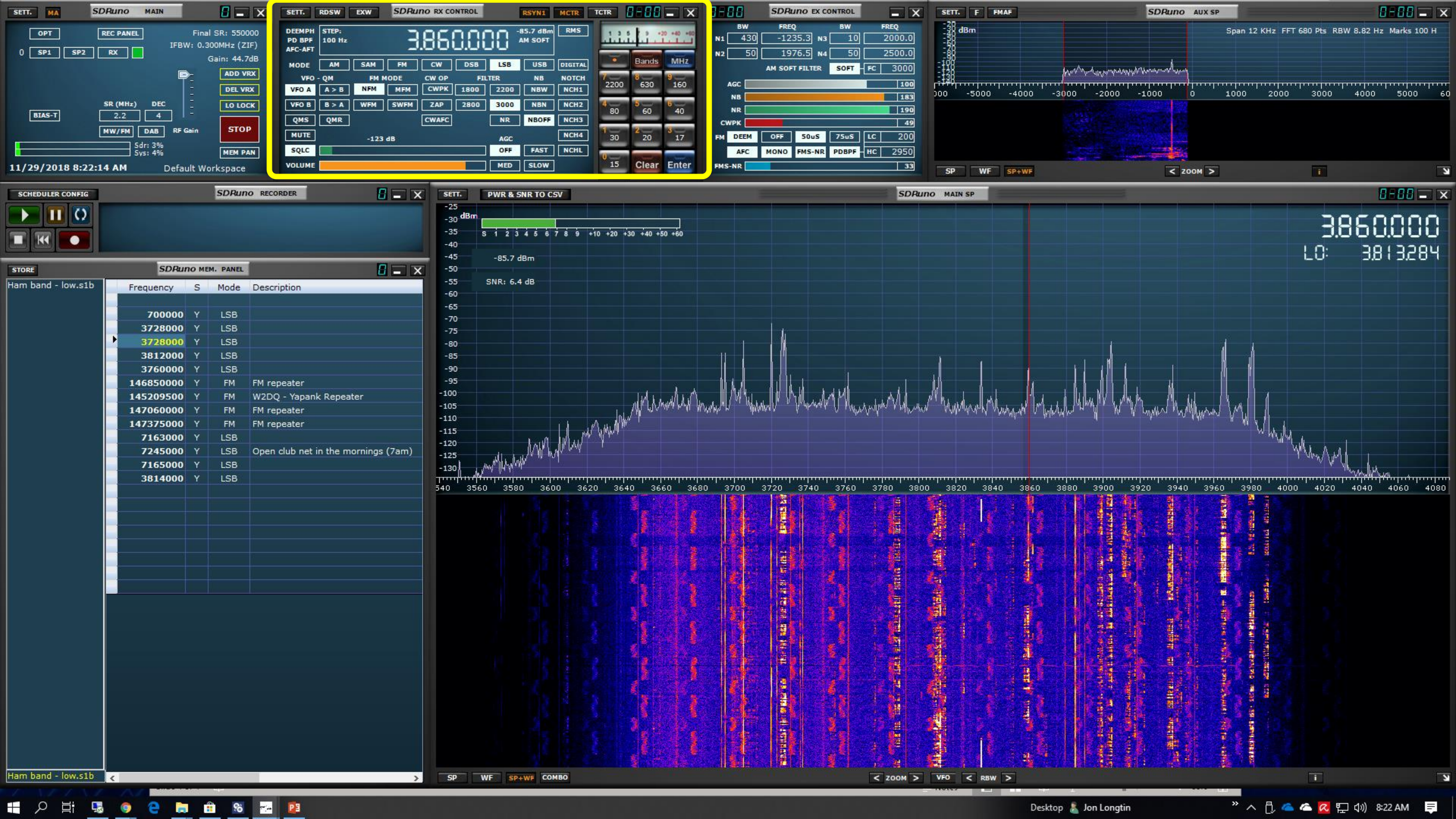
3814000 Y LSB
11/29/2018 8:22:14 AM
Default Workspace
Desktop
Jon Longtin
8:22 AM

Filtering and Noise Reduction



- Bandwidth: drag left- and right edge of sideband (100 Hz ~ 3 kHz)
- Select up to four notch filter frequencies and width
- Digital noise reduction
- Automatic gain control (AGC)
- Others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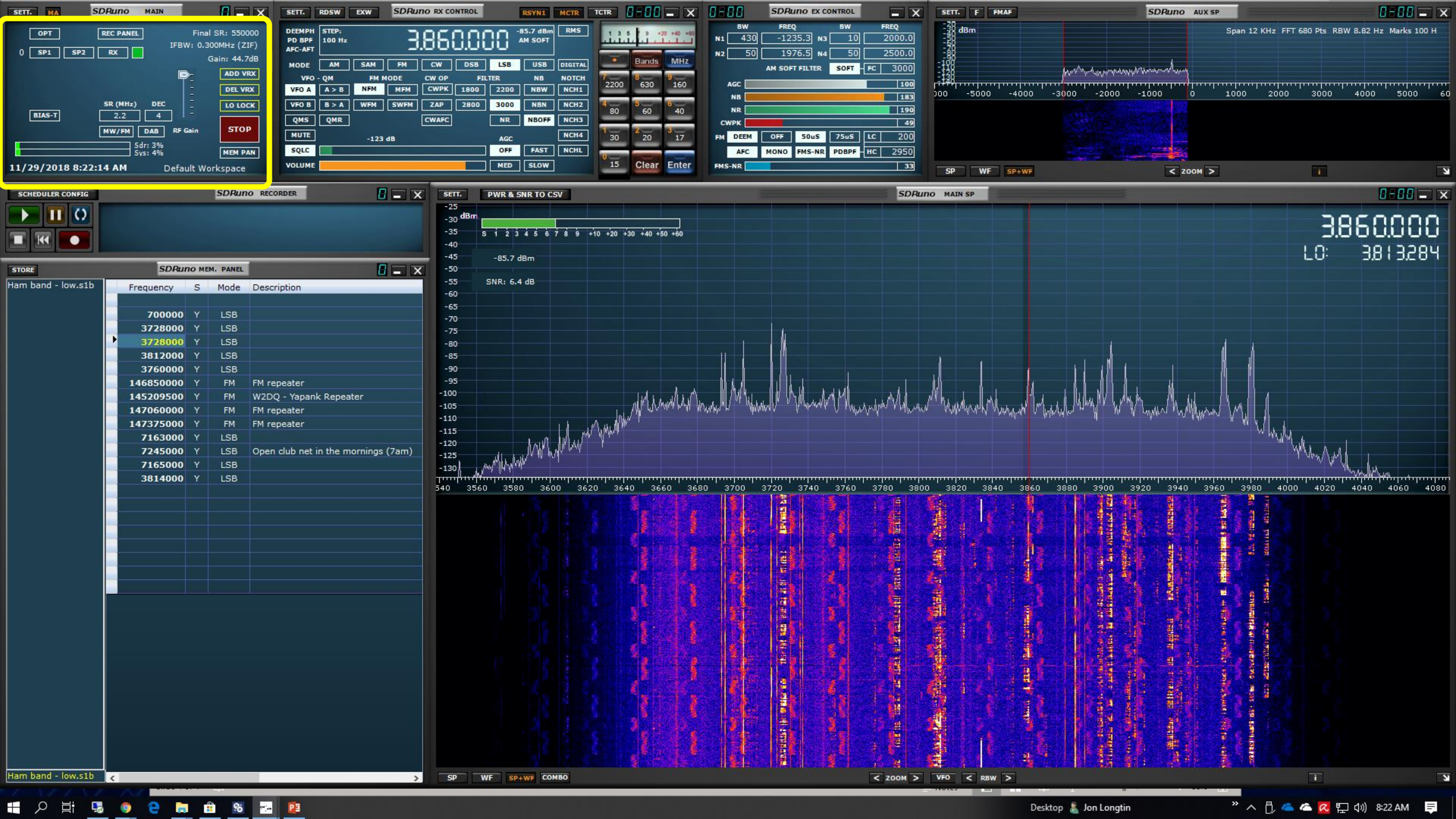
SDRuno MAIN SP
PWR & SNR TO CSV
-85.7 dBm
SNR: 6.4 dB
3.860.000
LO: 3.813.284

Band Select and Tuning

- Ham Band select and direct frequency tune
- Model select (AM, Synchronous AM, FM, LSB, USB, CW, DSB)
- VFO A & B, quick memory save (QMS) and recall (QMR)
- Bandwidth filter, FM mode, CW options
- Noise blank and notch filters


SDRuno MAIN
OPT
REC PANEL
Final SR: 550000
IFBW: 0.300MHz (ZIF)
SP1
SP2
RX
Gain: 44.7dB
ADD VRX
DEL VRX
LO LOCK
SR (MHz)
DEC
2.2
4
BIAS-T
MW/FM
DAB
RF Gain
STOP
MEM PAN
Sdr: 3%
Sys: 4%
11/29/2018 8:22:14 AM
Default Workspace
SDRuno RX CONTROL
RDSW
EXW
RSYN1
MCTR
TCTR
DEEMPH
PD BPF
AFC-AFT
STEP:
100 Hz
3.860.000
-85.7 dBm
AM SOFT
RMS
MODE
AM
SAM
FM
CW
DSB
LSB
USB
DIGITAL
VFO - QM
FM MODE
CW OP
FILTER
NB
NOTCH
VFO A
A > B
NFM
MFM
CWPK
1800
2200
NBW
NCH1
VFO B
B > A
WFM
SWFM
ZAP
2800
3000
NBN
NCH2
QMS
QMR
CWAFC
NR
NBOFF
NCH3
MUTE
-123 dB
AGC
NCH4
SQLC
OFF
FAST
NCHL
VOLUME
MED
SLOW
Bands
MHz
Clear
Enter
SDRuno EX CONTROL
BW
FREQ
N1
430
-1235.3
N3
10
2000.0
N2
50
1976.5
N4
50
2500.0
AM SOFT FILTER
SOFT
FC
3000
AGC
NB
NR
CWPK
FM
DEEM
OFF
50uS
75uS
LC
200
AFC
MONO
FMS-NR
PDBPF
HC
2950
FMS-NR
SDRuno AUX SP
FMAF
dBm
Span 12 KHz FFT 680 Pts RBW 8.82 Hz Marks 100 H
SP
WF
SP+WF
ZOOM
SCHEDULER CONFIG
SDRuno RECORDER
STORE
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PWR & SNR TO CSV
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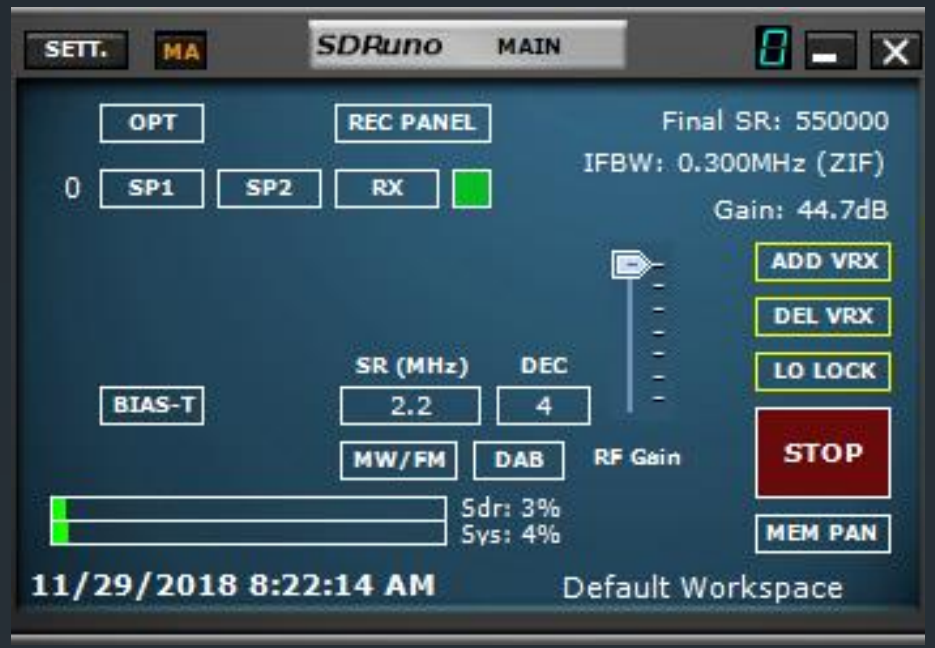
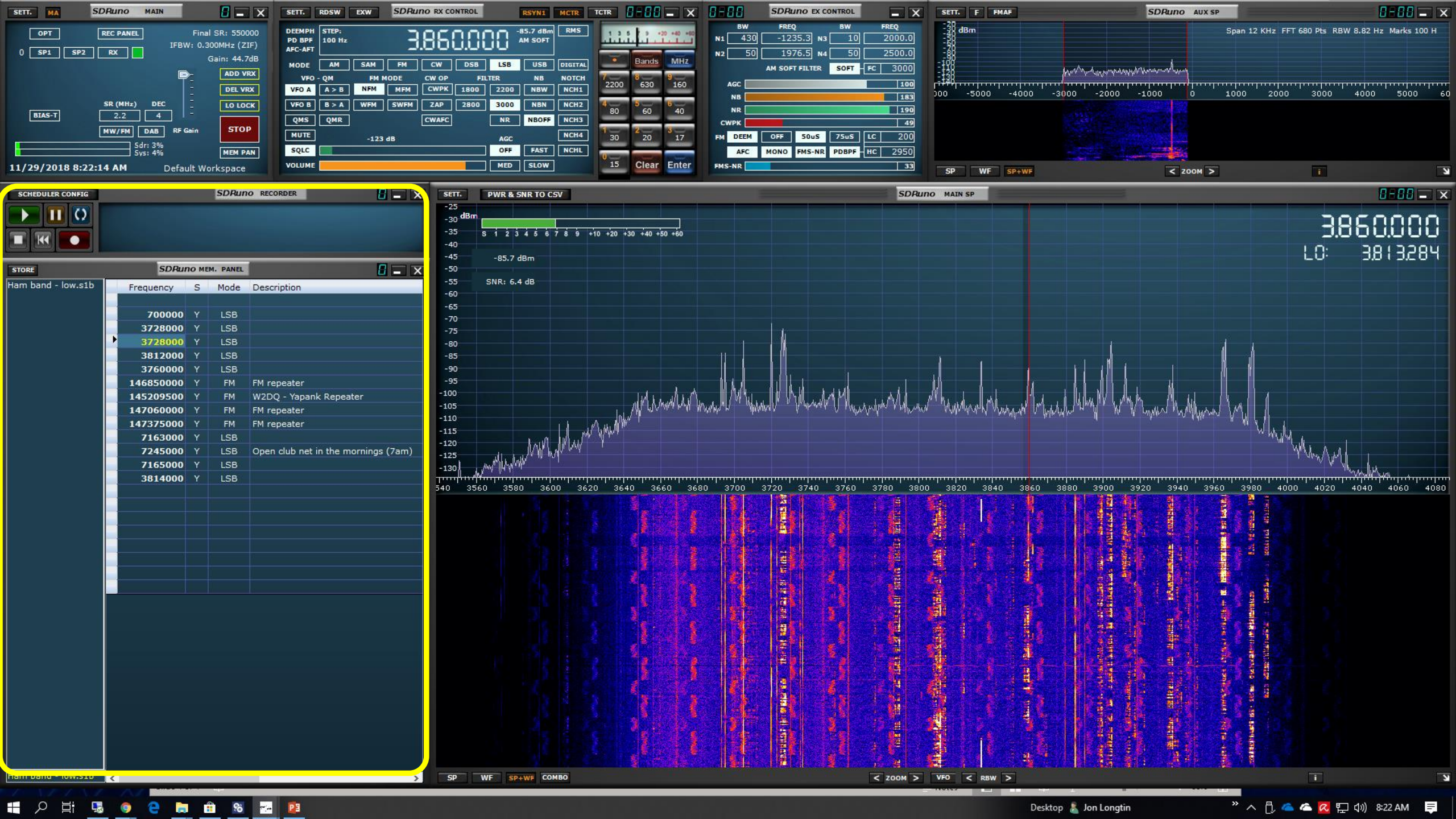
SP
WF
SP+WF
COMBO
ZOOM
VFO
RBW
Desktop
Jon Longtin
8:22 AM

SDR Hardware controls



- Start / Stop
- RF Gain
- Some other options that I do not claim to understand…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PWR & SNR TO CSV
SDRuno MAIN SP
-85.7 dBm
SNR: 6.4 dB
3.860.000
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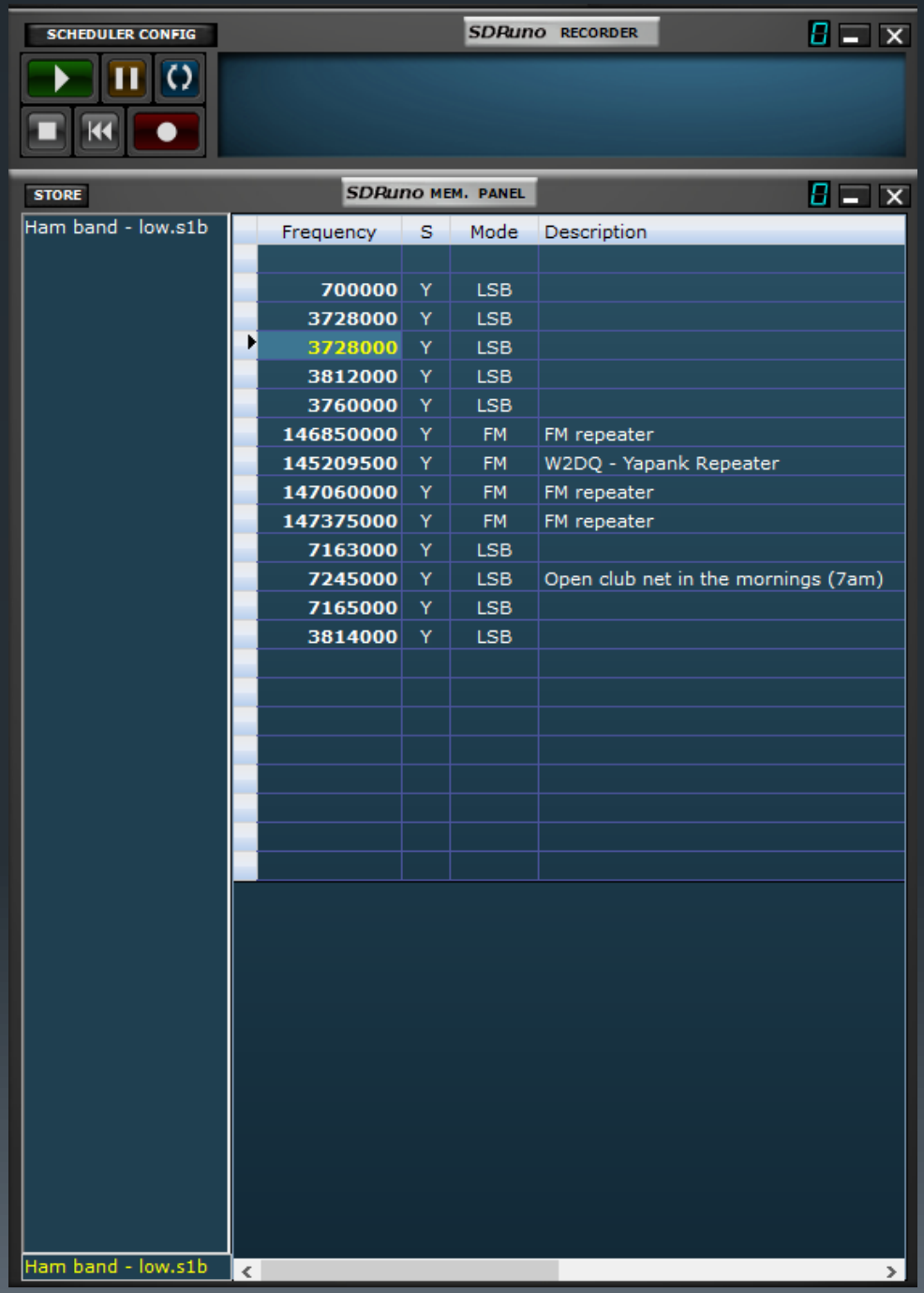
Channel memory

- ~ 30 memory channels
- Click to tune
- Retains other settings (mode, bandwidth, etc)
- Recorder doesn't seem to work (or I am not using it correctly…)

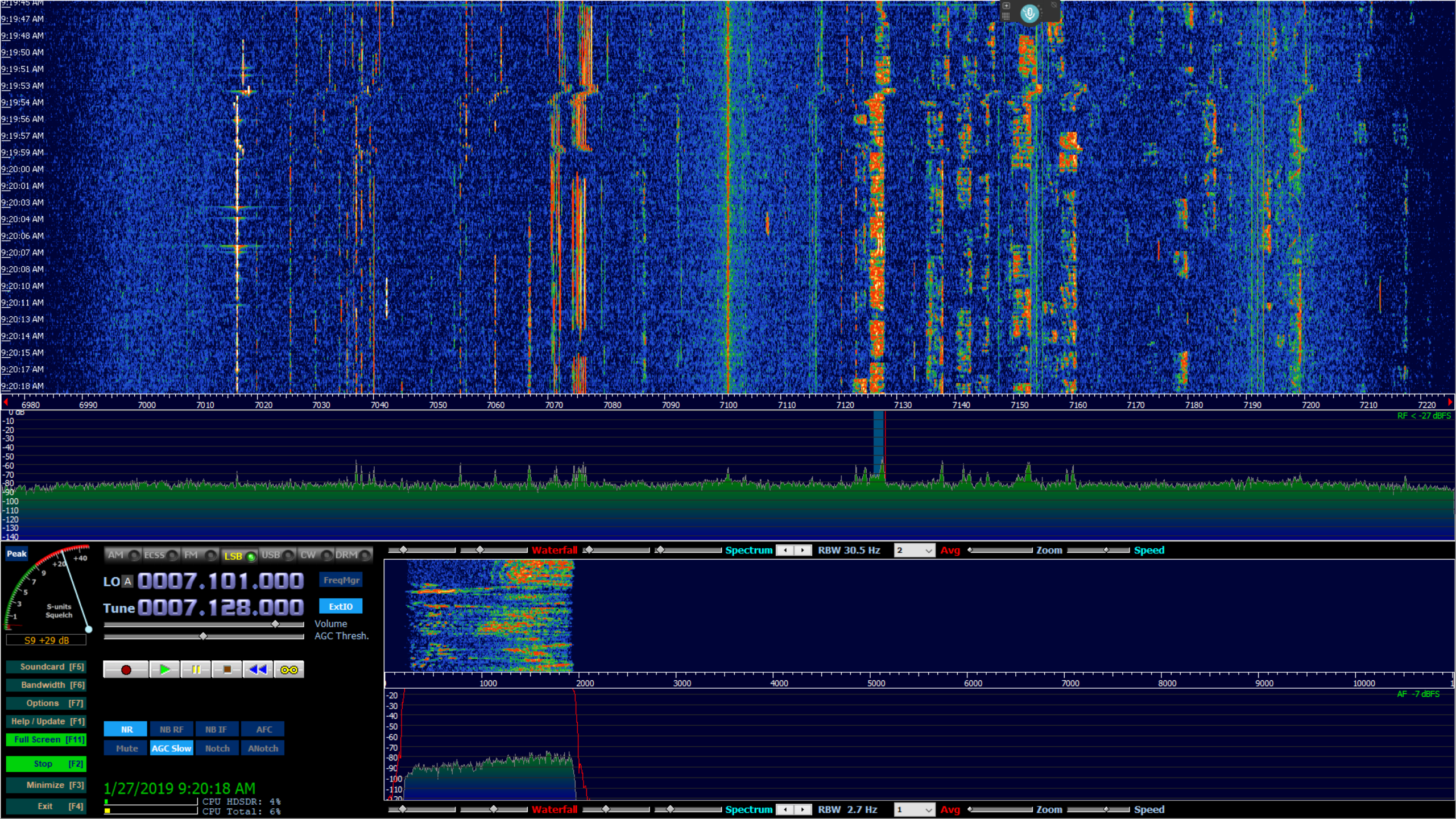


Time for a movie!

- SDRPlay RSP1A
- G5RV straight into SDR (not shared with HF rig)
- SDRUno software

Other SDR radio software

- One example: HDSDR (High-Definition SDR Radio) (Free)


9:19:47 AM
9:19:48 AM
9:19:50 AM
9:19:51 AM
9:19:53 AM
9:19:54 AM
9:19:56 AM
9:19:57 AM
9:19:59 AM
9:20:00 AM
9:20:01 AM
9:20:03 AM
9:20:04 AM
9:20:06 AM
9:20:07 AM
9:20:08 AM
9:20:10 AM
9:20:11 AM
9:20:13 AM
9:20:14 AM
9:20:15 AM
9:20:17 AM
9:20:18 AM
6980 6990 7000 7010 7020 7030 7040 7050 7060 7070 7080 7090 7100 7110 7120 7130 7140 7150 7160 7170 7180 7190 7200 7210 7220
RF < -27 dBFS
Peak
S-units Squelch
S9 +29 dB
AM ECSS FM LSB USB CW DRM
LO A 0007.101.000
Tune 0007.128.000
FreqMgr
ExtIO
Volume
AGC Thresh.
Soundcard [F5]
Bandwidth [F6]
Options [F7]
Help / Update [F1]
Full Screen [F11]
Stop [F2]
Minimize [F3]
Exit [F4]
NR NB RF NB IF AFC
Mute AGC Slow Notch ANotch
1/27/2019 9:20:18 AM
CPU HDSDR: 4%
CPU Total: 6%
Waterfall Spectrum RBW 30.5 Hz 2 Avg Zoom Speed
1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
AF -7 dBFS
Waterfall Spectrum RBW 2.7 Hz 1 Avg Zoom Speed

Other SDR radios

- HDSDR (High-Definition SDR Radio) (Free)
- All programs will generally have the same features
- May prefer a particular interface or layout
- Can experiment! Many are free

Conclusions

- SDR radios are inexpensive, useful additions to the shack
- Easy visualization of the entire band
- Point-and-click tuning, sophisticated noise processing, other features make life easier
- BUT need to consider integration into rig carefully
  - Antenna
  - Interfacing with existing hardware
- Will likely see SDR radio use continue to become an integral part of the hobby
- Could be a nice choice for someone interested in the hobby
- I am a beginner myself with these devices!

73!

Questions / Discussion ?

Jon Longtin KB8LFP