



Linux® in Your Ham Shack



Andy Stewart

KB1OIQ

May 15, 2019

Presented to the
Boston Linux and Unix User Group
Cambridge, MA

Biographical Info

Tech: 1/07, General 1/08, Extra 1/09

President: PART of Westford, MA (9/09)

ARRL EMA: Assistant Section Manager (2016), ACC (2017)

Founder: Worcester Linux Users' Group (1997)

Founder and Acting President:

Chelmsford Linux Meetup Group (2006-present)

Linux Instructor:

Chelmsford Community Education (2004 - 2011)

Linux user since 1997

Computer Engineer – digital logic verification

What do hams do?

- Many ways to communicate with one another via radio:
 - Morse code: more common than you'd think
 - Voice: AM, FM, SSB, digital
 - Text: keyboard to keyboard (no internet):
Many, many different digital modes
 - Via Satellite (voice and telemetry)
 - Mixed radio/internet: Echolink
- Logging: keep track of these communications (often for awards)
- Locate hidden transmitters (fox hunting or ARDF)
- Tinker: restore old radios, soldering kits, repair broken power supplies, alternative power, program Arduinos, etc.
- Design, build, and install antennas
- Perhaps the original "makers"

Goals

- Promote Linux
- Give back to ham radio and Linux communities
- Build on top of an existing Linux distribution
- Create a software collection containing as much ham radio software as possible – nothing proprietary
- Goal: Everything just works!
- Focus on the radio hobby!
- The idea of "Andy's Ham Radio Linux" began this way

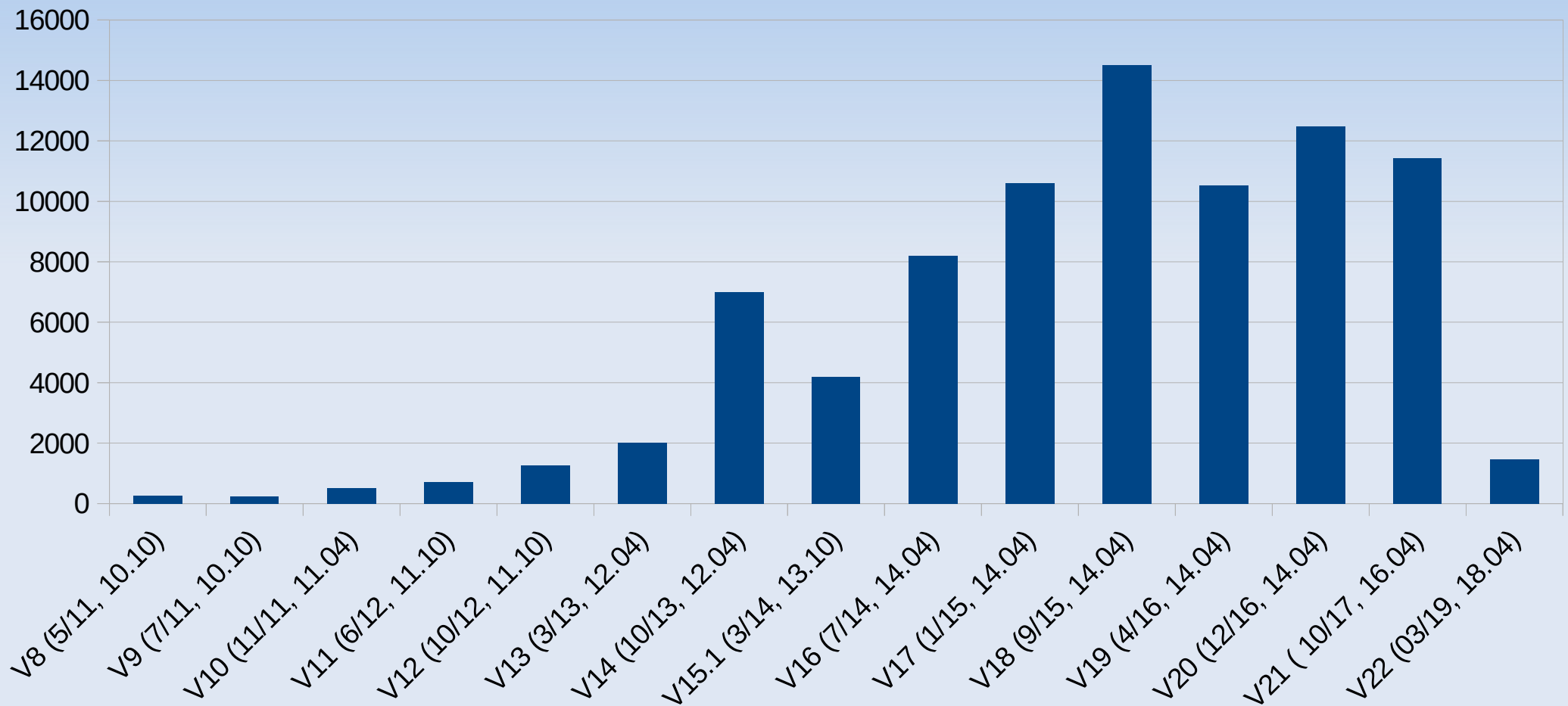
Andy's Ham Radio Linux

- V22 is Ubuntu Linux 18.04.* remastered
- Download the ISO file from SourceForge
 - Search for: Andy's Ham Radio Linux
 - Software is GPL or similarly free license
- Ways to get started:
 - Download the ISO first, then.....
 - Boot it in Virtualbox, or.....
 - Create a DVD, or.....
 - Create a bootable USB thumb drive
- Install to the hard drive once you decide you like it

Development Environment

- Live CD Customization:
<https://help.ubuntu.com/community/LiveCDCustomizationFromScratch>
- I created scripts to automate this process
- Jump into the chroot jail
- Install software, customize menus, update docs, etc.
- Get out of the chroot jail
- `./do_it` to build the ISO file
- Test it in Virtualbox
- Iterate until release
- For some reason, I've never released these files, just the resulting ISO file

Downloads



Target Computer

- Older computer (but newer works, too!)
- Has been run on 7-10 year old computers
- Bare minimum requirements
 - 1-2 GB of memory
 - Network for hard drive installation
 - 1GHz x86 processor (more for SDR)
 - 8-12 GB for hard drive install

Initial Boot Screen

Machine View Devices Help

```
ISOLINUX 4.04 20110518 ETCD Copyright (C) 1994-2011 H. Peter Anvin et al
```

```
*****
```

```
Andy's Ham Radio Linux, version 19, April 2016
```

```
This is an Ubuntu 14.04 Remix (64bit) created by Andy Stewart (KB1OIQ).
```

```
Type one of the following at the boot prompt:
```

```
live      - boot the live system      <- you probably want this one!  
memtest  - run a memory test  
check    - check the medium for defects  
hd       - boot from the first hard drive
```

```
After the computer boots, use this username and password to login.
```

```
Login:  ubuntu
```

```
Password: (just hit enter)
```

```
*****
```

```
boot:  _
```

 Right Ctrl

kubuntu

Initial Login Screen

Andy's Ham Radio Linux

Login: ubuntu

Password:



Initial Desktop

Machine View Devices Help

xosview@ub... [Terminal] [Terminal (big font)] [Web Browser]

LOAD 0.0 PROCS/MIN 2546 MHz
CPU 9% USR/SYS/NI0/IDLE
MEM 926M USED/BUFF/SLAB/MAP/C
DISK 0 READ/WRITE/IDLE
SWAP 0 USED/FREE
PAGE 0 IN/OUT/IDLE
NET 0 IN/OUT/IDLE
BTRY100% CHRG/FULL

Terminal
Terminal (big font)
Web Browser
Amateur Radio
Documentation
System
Utilities
Toolbar
Programs
Windows
Help
Settings
Logout...

Antenna
CW
Digital Modes
Electronic Design
HF Propagation
Logging
Rig Control
Satellites
SDR

cwwav
e2c ebook2cw
flwkey
MicroFox
grq
xcwcp

GPREDICT: Amateur

File Edit Help

2016/05/03 02:54:33

sample · Copenhagen, Denmark Next: FO-29 in 47:47

sample
SO-50
ISS
FO-29
AO-51
SO-57
HO-68
AO-27

sample Next: FO-29 in 47:46

SO-50

- Azimuth : 312.89°
- Elevation : -68.18°
- Slant Range : 12485 km
- Range Rate : 1.554 km/sec
- Next Event : AOS: 2016/05/03 03:48:49
- SSP Loc. : CG28CM
- Footprint : 5348 km
- Altitude : 605 km
- Velocity : 7.582 km/sec
- Doppler@100M : -518 Hz
- Sig. Loss : 154.33 dB
- Sig. Delay : 41.64 msec
- Mean Anom. : 240.12°
- Orbit Phase : 337.67°
- Orbit Num. : 71847
- Visibility : Daylight

debian [Taskbar icons] 1 2 3 4 GPREDICT: Amateur xosview@ubuntu 02:54:33 AM Right Ctrl

Desktop

- Icewm
 - Light on system resources
 - Virtual desktops
 - Easy customization, many themes available
- Menus
 - Customized for amateur radio use
- Toolbar
 - Menu, quickly start apps, status monitors, clock

System Software Highlights

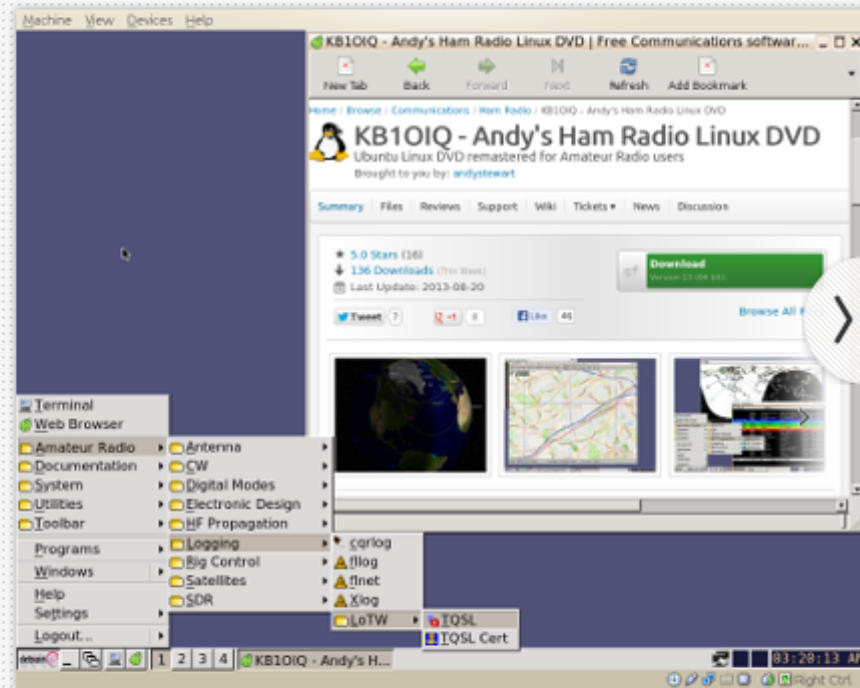
- Network Configuration: wicd
- Browsers: Firefox and Dillo
- Installation: Ubiquity, multibootusb, and brasero (DVD)
- Printing: CUPS
- Graphical file manager (Xfe), PDF viewer (evince)
- Text editors (LeafPad, nano, vi), I install emacs later... :-)
- PulseAudio sound and utilities
- Smart package manager
- Email: Sylpheed (it works great with Fldigi)

Hard Drive Installer

Andy's Ham Radio Linux

Chosen with older computers in mind, the icewm window manager provides modern features while requiring relatively few system resources.

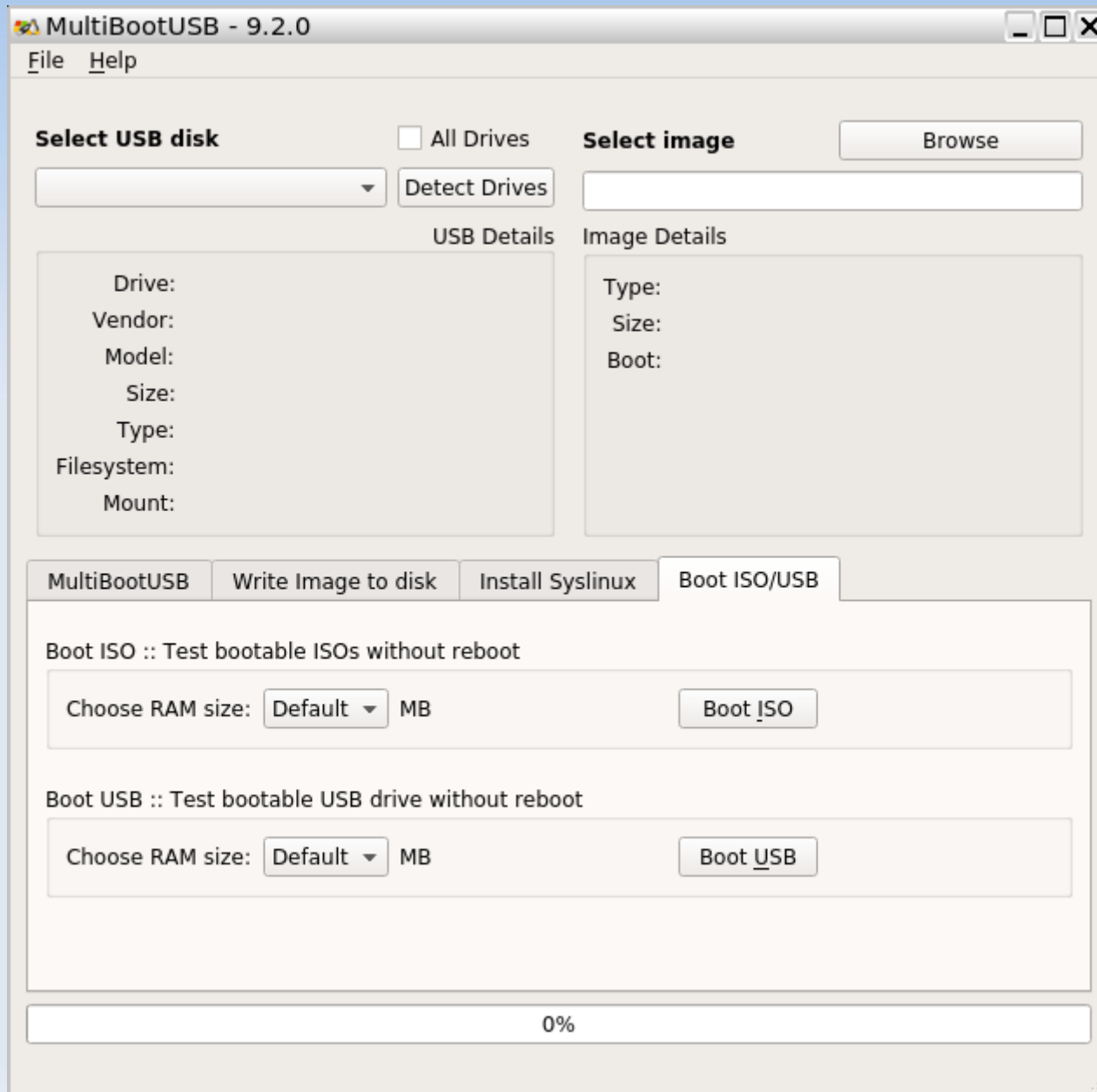
- * Virtual desktops
- * Desktop themes
- * Easily customized
- * Help files included!



▶ Copying files...

Skip

multibootusb



Documentation

- Updated for V22 (Jan 2019), uses Dillo to read docs
- Docs specific to this software collection:
 - Menu->Documentation->
 - Andy's Ham Radio Linux
 - RELEASE_NOTES
 - CHANGES (from release to release)
 - Miscellaneous HOWTOs by KB1OIQ
 - Icewm documentation
 - Ham Radio software documentation
 - See also files in this directory:
`/usr/local/share/doc/Andy_Ham_Radio_Linux`

Ham Radio Software Summary




- Logging: cqrlog, xlog, TQSL (for LoTW)
- APRS: Xastir, soundmodem, direwolf
- Digital modes: Fldigi and friends (NBEMS)
 - Qsstv, wsjt(-x), Echolink client
- CW: xcwcp, qrq, cwwav (text to CW)
- Antenna analysis:
 - Xnec2c, Fl_Moxgen, aa-analyzer
- Satellite: Gpredict, Fox 1A telemetry decoder
- Program your handheld radio: CHIRP

More Ham Radio Software

- EDA Software
 - gschem – schematic capture
 - pcb – board layout
 - Spice and GUI with waveform viewer (gwave)
- SDR
 - gqrx – sdr radio receiver used with USB dongle
 - Gnuradio companion
- FreeDV / Codec2
- Pskmail client and server

Logging SW: Xlog

Log Edit Options Tools Page Settings Help








 Write Update Delete

QSO 691

Date: 16 Aug 2010
 UTC: 0023
 Call: AB1HD ?
 MHz: 50
 Mode: SSB
 TX(RST): 59
 RX(RST): 59
 QSL out QSL in
 Locator: FN42ho
 Remarks: Rich, Chelmsford, MA 01824 USA

NR	DATE	UTC	CALL	BAND	MODE	RST	MYRST	QSLQ	QSLIN	LOCATOR
691	16 Aug 2010	0023	AB1HD	50	SSB	59	59			FN42ho
690	16 Aug 2010	0023	WA1KBE	50	SSB	59	59			FN42ho
689	08 Aug 2010	2035	VE3CWU	7	CW	579	229			FN03
688	08 Aug 2010	2000	N2JNZ	7	CW	459	559			FN24
687	08 Aug 2010	1910	KL7GLL	7	CW	459	449			FM18
686	31 Jul 2010	2145	I5ZSS	18	SSB	59	58			JN53ku
685	12 Jul 2010	0016	WA1KBE	50	SSB	59	59			FN42ho
684	11 Jul 2010	2151	WM4X	7	CW	579	579			FM18
683	11 Jul 2010	2140	W8JRA	7	CW	559	559			EN80
682	11 Jul 2010	1627	N8KZH	7	CW	359	559			EN90
681	11 Jul 2010	1305	W12X	7	CW	599	419			FN30
680	11 Jul 2010	1240	VA2NB	7	CW	359	579			FN25

Ready.    22 Aug 2010 1330 UTC

Xlog Development

- Maintained by KB10IQ
- Most recent version: 2.0.17, released Jan. 2019
- Added support for JS8 mode
- Updated to ADIF 3.0.9

CQRLOG

Machine View Devices Help

New QSO ... (CQRLOG for Linux), database: Log 001

File View Window Statistics Help

qsodate	time_on	callsign	freq	mode	rst_s	rst_r

QSO nr. 1 QTH profile: [dropdown]

Call: KB1OIQ **Frequency:** 7.025 **Mode:** AUTO CW **His RST:** 599 **My RST:** 599

Name: Andy **QTH:** Chelmsford **GRID:** FN42 **PWR:** 5 **QSL_S:** [dropdown] **QSL_R:** [dropdown]

ITU: 08 **WAZ:** 05 **IOTA:** [dropdown] **Country:** USA **State:** MA **Award:** [dropdown]

DXCC ref.: W **Comment to QSO:** Linux rocks! **QSL VIA:** [dropdown]

Offline **Comment to callsign:** [text area]

Date: 2012-08-20 **Start time:** 04:10 **End time:** 04:12

QSO takes 0 hours, 2 minutes, 29 seconds

DXCC stat.

	1.8	3.5	7	10.	14	18	21	24	28	50	144	430
SSE												
CW												
DIG												

DXCC info
Country: USA - CT,MA,ME,NH,RI,VT

WAZ: 05 **Cont:** NA
ITU: 08 **DXCC:** W
LAT: 42N **LONG:** 71W
DIST.: **AZIM:**

● 09:58:29 ● 23:39:16
 2012-08-19 22:12:19 GE
Local:

Callbook (HamQTH.com)

Save QSO [enter] Quit program

My grid (to change press CTRL+L) Ref. call (to change press CTRL+R) KN1OIQ Ver. 1.4.1

APRS™

Automatic Packet Reporting System

Bob Bruninga WB4APR

Xastir

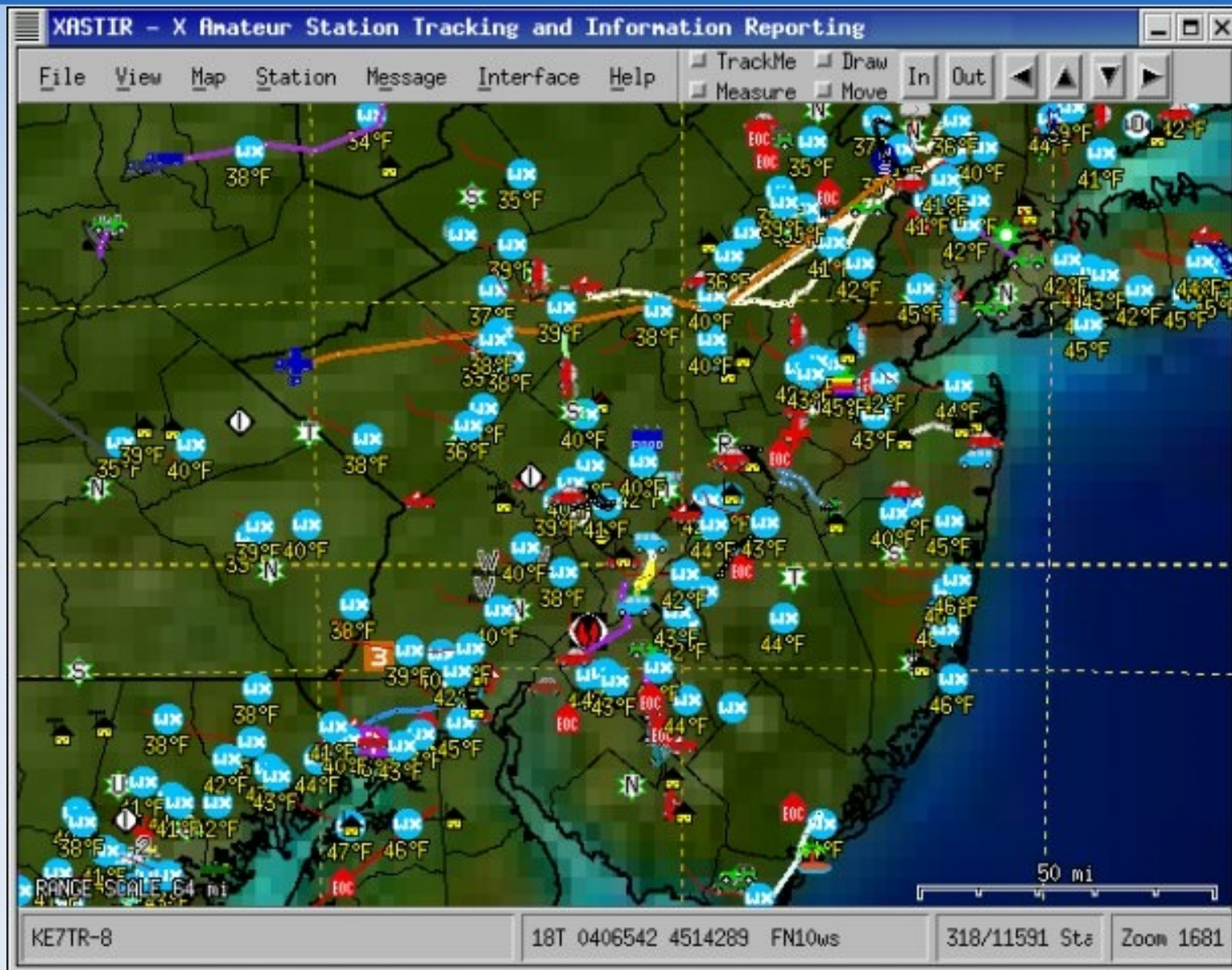
X Amateur Station Tracking and Information Reporting

<http://www.xastir.org>

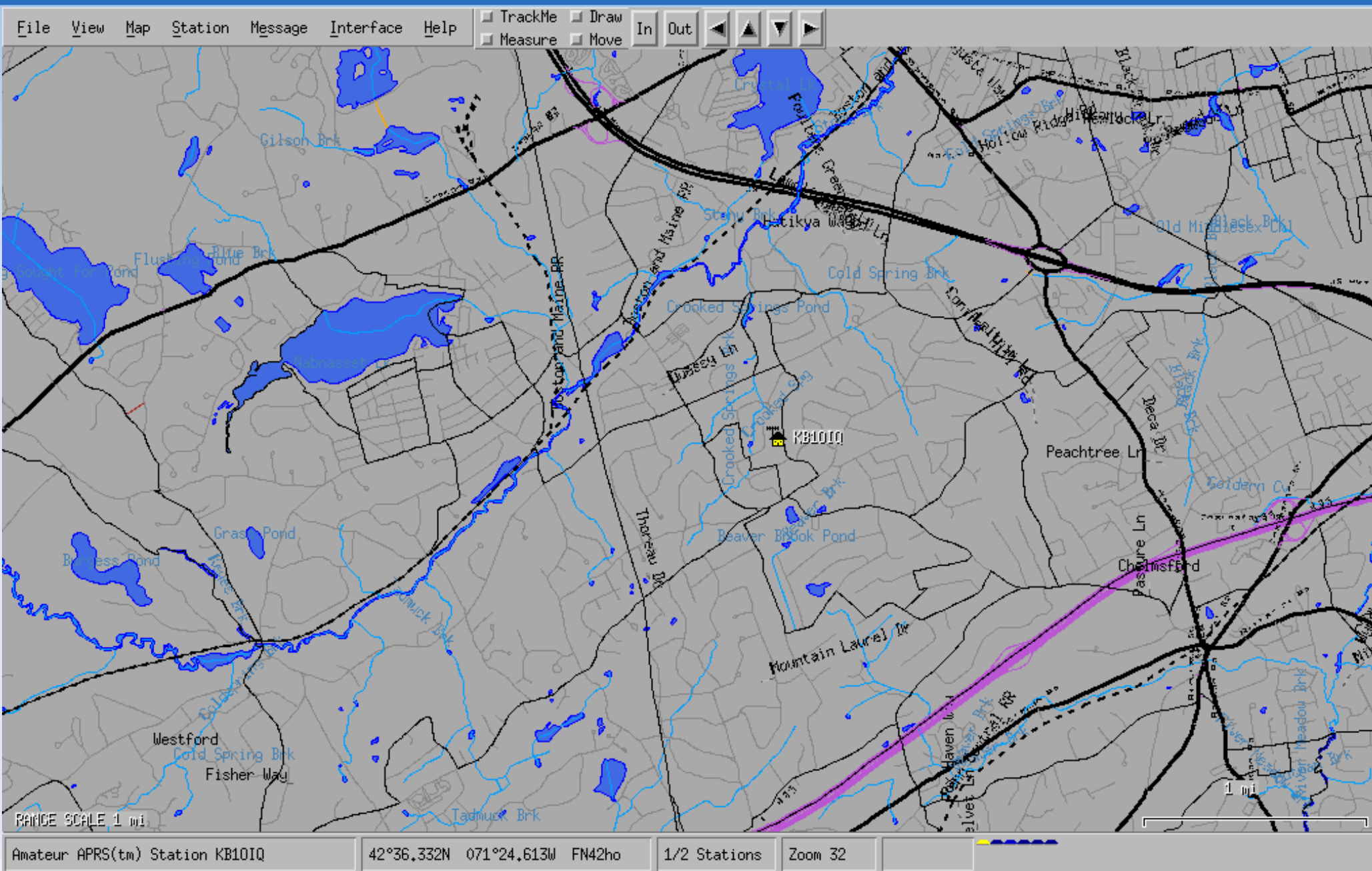
Supports many, many map formats

Including OpenStreetMap !

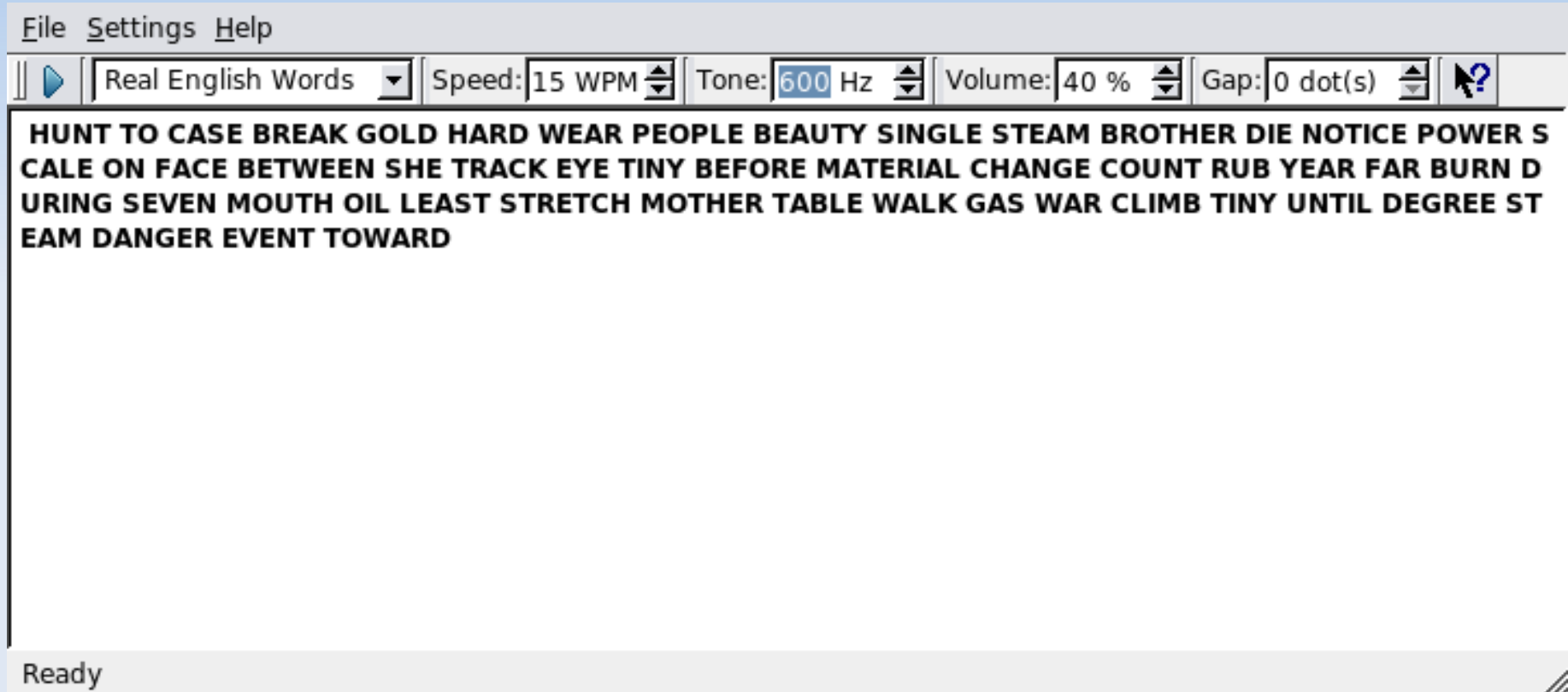
Xastir



Xastir Screenshot



Practice Morse Code: xcwcp



Qtel EchoLink Client

The screenshot displays the Qtel EchoLink Client interface. At the top, there is a menu bar with 'Machine', 'View', 'Devices', and 'Help'. Below this is a window titled 'Qtel - the Qt EchoLink Client' with a sub-menu 'File Directory Station Settings Help'. The main area is divided into several sections:

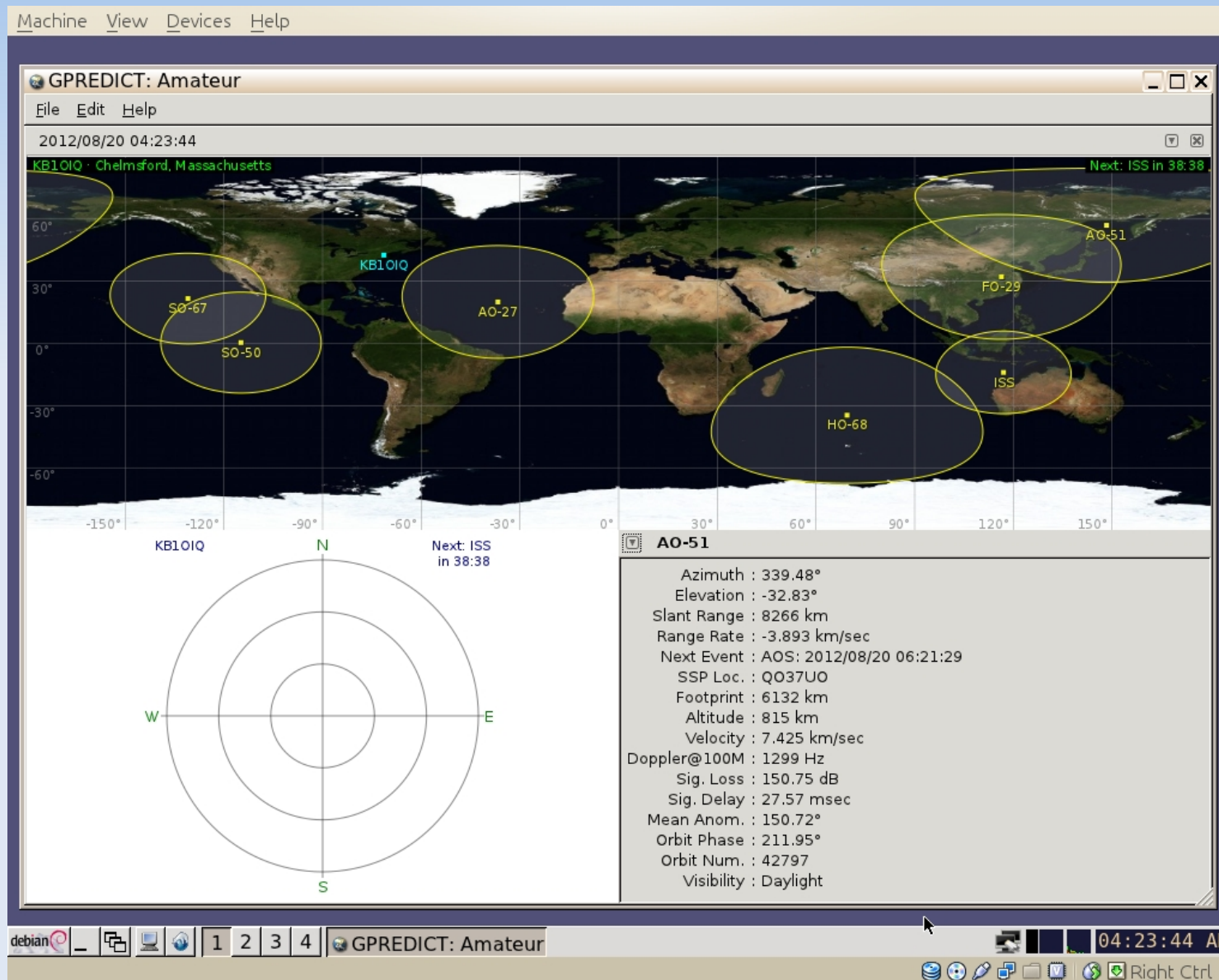
- Explorer:** A sidebar on the left with icons for Bookmarks, Conferences, Links, Repeaters, and Stations.
- Station List:** A table with columns: Station, Location/Description, Status, Local time, and Node ID. The 'Repeaters' section is expanded, showing a list of stations.
- Messages:** A text area on the bottom left containing the text: 'EchoLink Server v2.5.9997' and 'ECHOEC2-3: Herndon, VA USA'.
- Incoming connections:** A table on the bottom right with columns: Callsign, Name, Time, and buttons for 'Accept' and 'Clear'.

The station list table contains the following data:

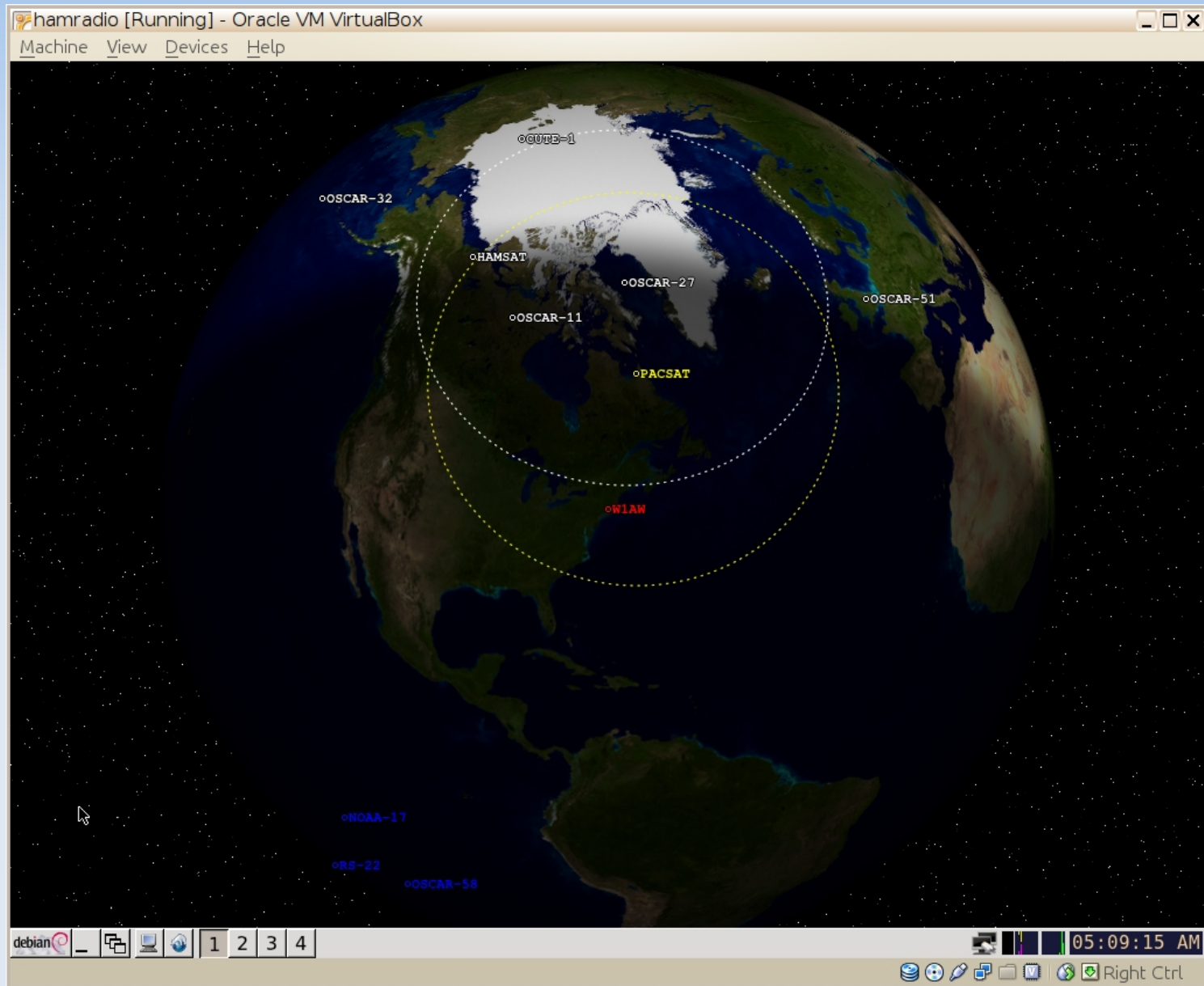
Station	Location/Description	Status	Local time	Node ID
WB0QXW-R	St. Louis, MO 145.210	ON	23:12	466277
WB0TSR-R	[Svx] Brookings, SD USA	ON	23:15	409605
WB0VHB-R	Mt. Pleasant, Iowa	ON	23:16	339174
WB0VTM-R	W9RNM/R Marion, IL	ON	23:14	564519
WB0YLA-R	Oma/swIA/OffuttAFB (1)	ON	23:15	366048
WB0YLE-R	Bucks Cnty PA [0/5]	ON	00:20	554286
WB1GIC-R	Manchester, CT USA	ON	00:17	718259
WB1GOF-R	Westford, MA	ON	00:17	380799
WB1GQR-R	Bolton, VT. USA 145.150	ON	00:15	97406
WB1GRB-R	In Conference *IRELAND*	BUSY	00:16	158564
WB2BQW-R	Montgomery, N.Y.	ON	00:20	14070
WB2CIK-R	West Hills, NY USA	ON	00:20	204546
WB2FTX-R	Connection to 895	ON	00:13	362930
WB2JPQ-R	Western, NY	ON	21:19	57780
WB2KAD-R	Perth, NY 144.850	ON	00:22	70007

The taskbar at the bottom shows the system tray with the time '04:19:19 AM' and the text 'Right Ctrl'.

Satellites: Gpredict



Earthtrack



Slow Scan TV: QSSTV

File Options Help

SSTV WF Text BSR ID

Receive Transmit Gallery

Receive

SSTV DRM

Use VIS Filter 600Hz Video

Autoadjust Slant Sensitivity 1

Autosave Mode Auto

Receiving Scottie 2

Max dB 0 Range 35

Saved: /home/andy/BW8_20140712_172546.png

PTT

Slow Scan TV: QSSTV

File Options Help

SSTV WF Text BSR ID

Receive Transmit Gallery

K5JRW MMSSTV Ver 1.13

N9GFP
595

RECEIVING SCOTTIE 2

K5JRW

Max dB 0 Range 35

PTT

The screenshot displays the QSSTV software interface. The main window shows a Slow Scan TV (SSTV) image of a purple alien with a large head and a small body, looking at a cassette tape. The alien is holding a white ball. The background is dark blue. The text 'K5JRW' is visible in the top left and bottom right corners of the image. The text 'N9GFP' and '595' are visible in the top left corner of the image. The text 'RECEIVING SCOTTIE 2' is visible in the bottom right corner of the image. The text 'MMSSTV Ver 1.13' is visible in the top right corner of the image. The interface includes a menu bar with 'File', 'Options', and 'Help'. Below the menu bar are buttons for 'SSTV', 'WF Text', 'BSR', and 'ID'. There are also buttons for 'Receive', 'Transmit', and 'Gallery'. A vertical color calibration bar is on the left side of the main window. On the right side, there is a control panel with tabs for 'SSTV' and 'DRM'. The 'SSTV' tab is active. It contains a 'Filter' dropdown menu set to '600Hz Video', a 'Sensitivity' slider set to '1', and a 'Mode' dropdown menu set to 'Auto'. There are checkboxes for 'Use VIS' (unchecked), 'Autoadjust Slant' (checked), and 'Autosave' (checked). A 'Receiving Scottie 2' label is present. At the bottom of the control panel, there is a spectrum analyzer showing a signal waveform. The spectrum analyzer has a 'Max dB' slider set to '0' and a 'Range' slider set to '35'. A 'PTT' button with a green indicator light is at the bottom right of the interface.

Keyboard Digital Modes

Fldigi – W1HKJ and friends

Supports a large(!) number of digital modes

Keyboard to keyboard communications

BPSK-31, RTTY, Hellschreiber, and more!

ARQ file transfers (auto repeat request)

NBEMS – Narrow Band Emergency Messaging System

Great support! Yahoo Group: linuxham

Fldigi, fllog, flmsg, flrig, flarq, flwrap, flwkey

Fldigi

The screenshot displays the Fldigi software interface. At the top, there is a menu bar with options: File, Op Mode, Configure, View, Logbook, and Help. To the right of the menu are status indicators for Spot, RxID, TxID, and TUNE.

Below the menu bar, the main control area includes:

- Enter Xcvr Freq: 14071.804
- On/Off buttons and Off time: 0323
- In/Out frequency fields
- Call and Op fields
- Azimuth (Az) field
- Mode: USB, Bandwidth: 3000
- Qth, St, Pr, and Loc fields

The central part of the interface is a text log with two entries:

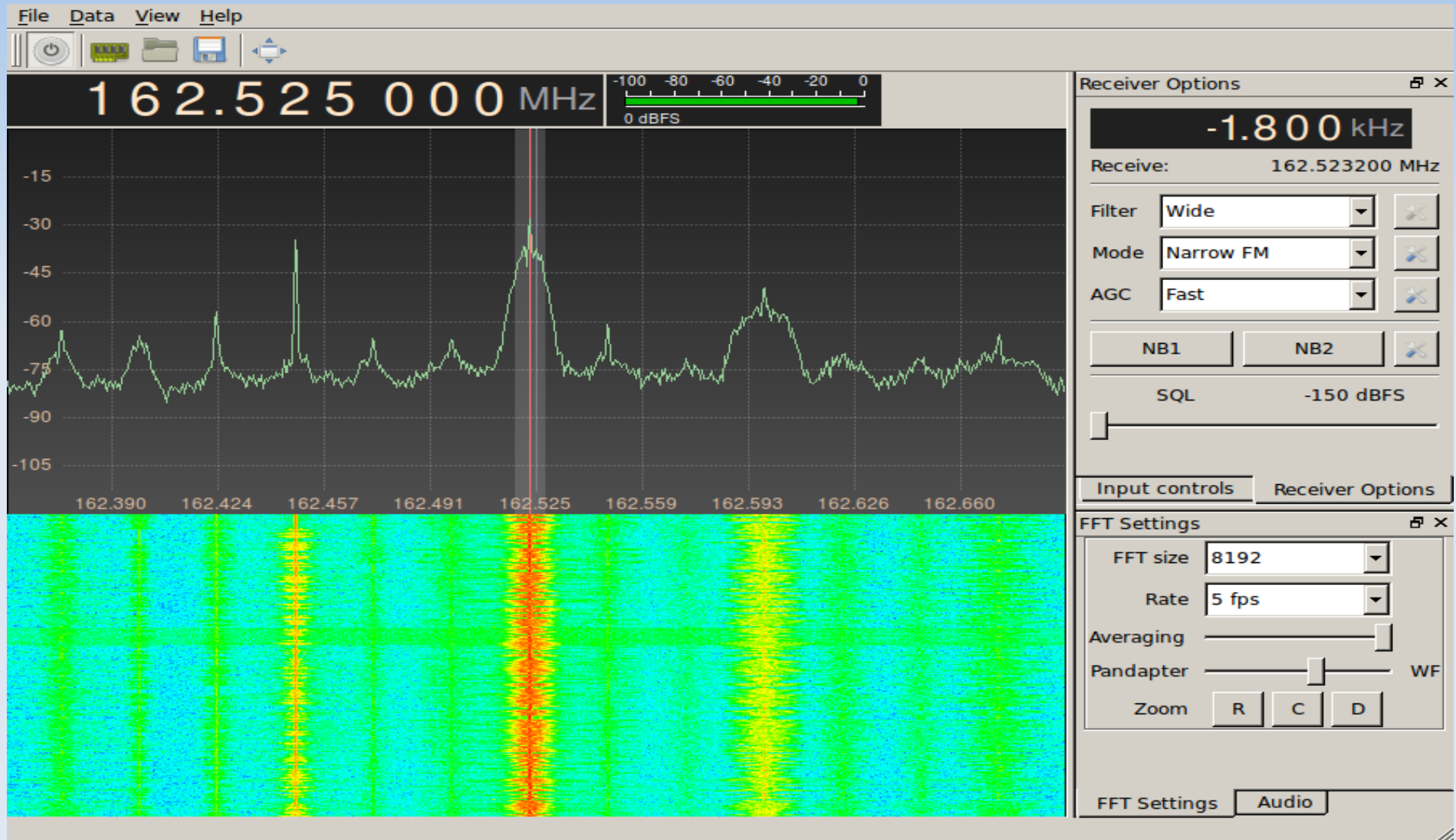
- Entry 13 (yellow background): CQ CQ Cm de K5POC K5POC K5POC calling mobile from Brady Lake in THE heart of Texas CQ pse
CQ CQ CQ de K5POC K5P K5PO calling mobile from Brady Lake in THE heart of Texas CQ pse
- Entry 12 (light blue background): [Empty]

Below the log is a control bar with buttons for CQ, ANS, QSO, KN, SK, Me, QTH, Brag, Tx, Rx, and MAPIT.

The bottom section features a waterfall display showing frequency from 14070.5 to 14072.5 kHz. A prominent signal is visible at approximately 14071.8 kHz. Below the waterfall are various control buttons and meters:

- WF, -10, 55, x1, NORM, 1804, QSY, Store, Lk, Rv, T/R
- BPSK31, s/n 13 dB, imd -29 dB, -3.0, AFC, SQL

SDR: gqrx



Digital Voice: FreeDV

- Free Digital Voice
- Originally written in response to proprietary D-Star
- Codec2: David (VK5DGR) Rowe
- Compress speech down to 700-1600 bits/sec
 - Modulated onto a 1.25 kHz signal
 - Audio is sent to the mic input of an SSB radio
 - Commonly found here: 14.236 MHz
- Requires 2 soundcards
- Very actively developed
- Linux, Windoze, and OSX versions are available

SM1000

- Free Digital Voice – hardware in a box
- No computer required – everything is in the box
- Connect it to your rig with your own cable
- Cost: \$200
- My setup:
 - Heil Headset (Pro Set Plus)
 - ICOM 746PRO
 - 3 stereo audio cables: Speaker, Mic, PTT
 - Could also make a cable with RJ-45 connector and internal jumpers

SM1000



GNU Radio Companion

- Visual programming language
- Used for signal processing
- Uses the GNU Radio libraries
- Many tutorials on the internet

GNU Radio Companion

The screenshot displays the GNU Radio Companion (GRC) interface. At the top, there is a menu bar with 'File', 'Edit', 'View', 'Build', and 'Help'. Below the menu bar is a toolbar with various icons for file operations, editing, and execution. The main workspace contains a flowchart with the following components:

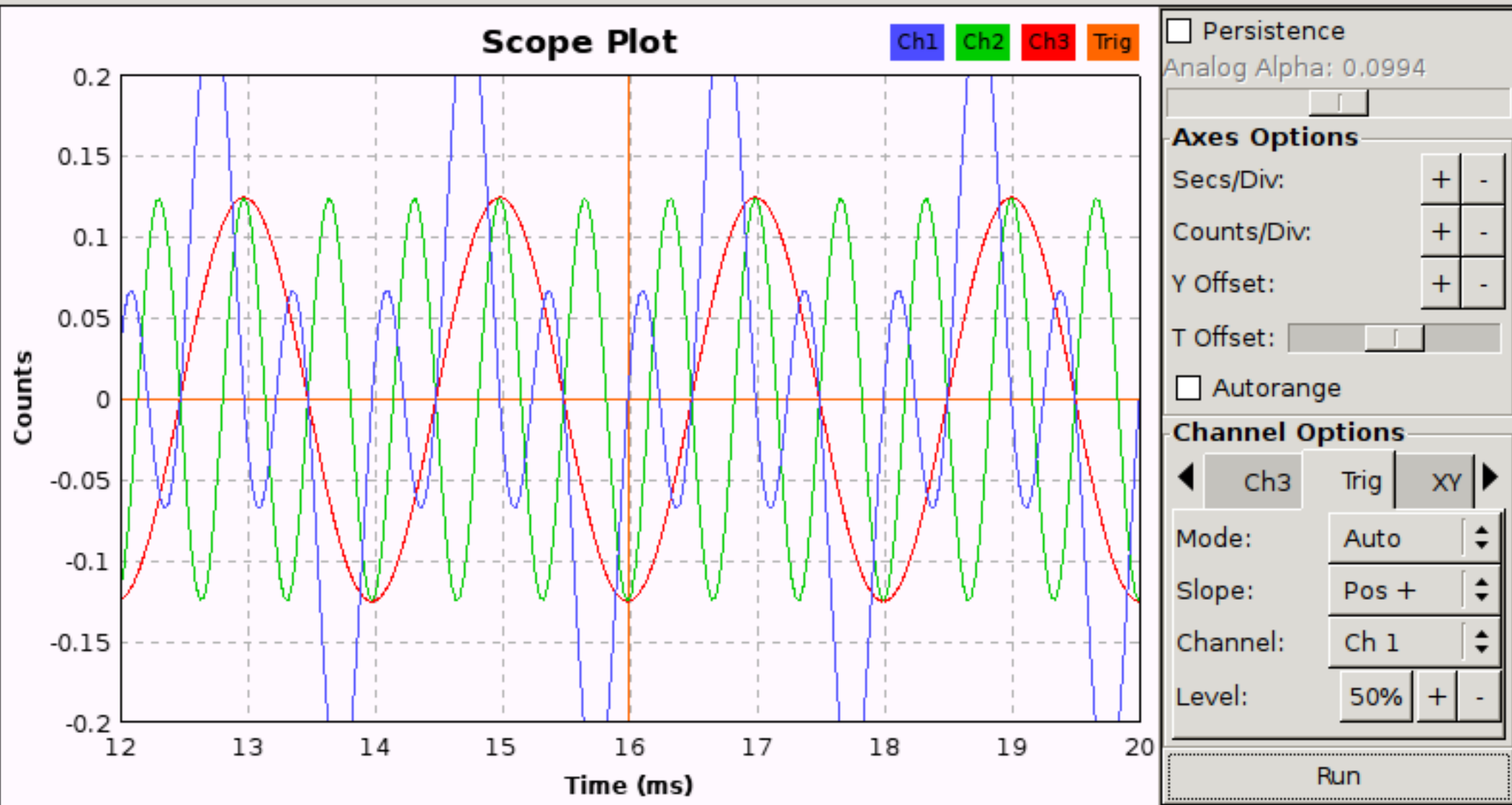
- Options:** ID: top_block, Title: Tutorial 1, Author: Andy Stewart, Generate Options: WX GUI.
- Variable:** ID: samp_rate, Value: 32k.
- Signal Source 1:** Sample Rate: 32k, Waveform: Cosine, Frequency: 500, Amplitude: 500m, Offset: 0.
- Signal Source 2:** Sample Rate: 32k, Waveform: Cosine, Frequency: 1k, Amplitude: 500m, Offset: 0.
- Multiply:** A block that takes two inputs (in0 and in1) and produces an output (out).
- Throttle:** Sample Rate: 32k, with an input (in) and output (out).
- High Pass Filter:** Decimation: 1, Gain: 1, Sample Rate: 32k, Cutoff Freq: 1k, Transition Width: 200, Window: Hamming, Beta: 6.76.
- Low Pass Filter:** Decimation: 1, Gain: 1, Sample Rate: 32k, Cutoff Freq: 1k, Transition Width: 200, Window: Hamming, Beta: 6.76.
- WX GUI Scope Sink:** Title: Scope Plot, Sample Rate: 32k, V Scale: 50m, T Scale: 1m, XY Mode: On, Trigger Mode: Auto, Y Axis Label: Counts. It has three inputs (in0, in1, in2).
- Audio Sink:** Sample Rate: 32k, with an input (in).

The flowchart shows the following connections: The two signal sources feed into the Multiply block. The output of the Multiply block feeds into the Throttle block. The output of the Throttle block splits into two paths: one goes to the High Pass Filter and the other to the Low Pass Filter. The outputs of both filters feed into the WX GUI Scope Sink. The output of the Low Pass Filter also feeds into the Audio Sink.

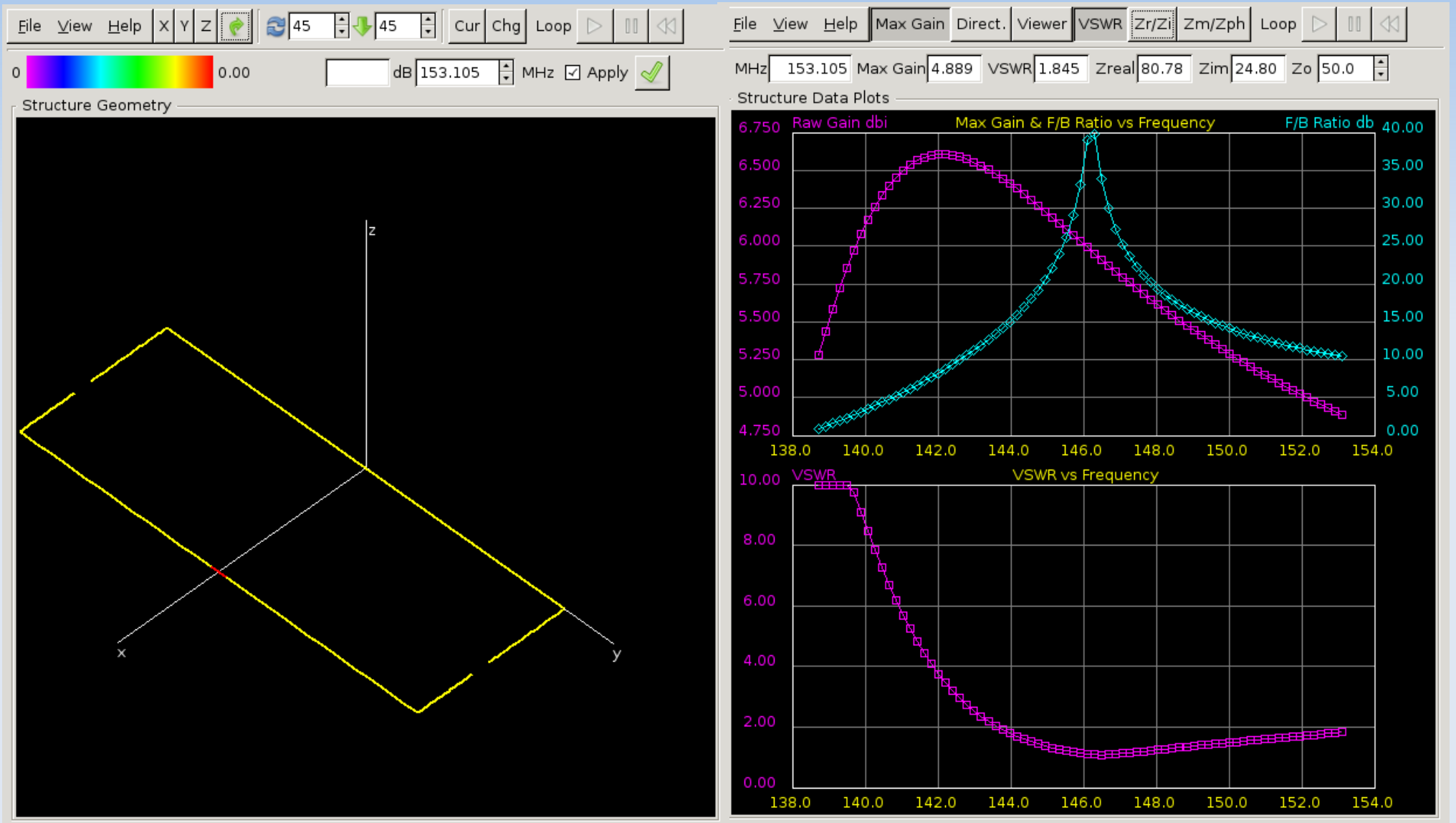
At the bottom of the window, a terminal window shows the following text:

```
Executing: "/home/andy/gnuradio/top_block.py"  
Using Volk machine: sse3_64_orc
```


GRC Scope Plot



xnec2c

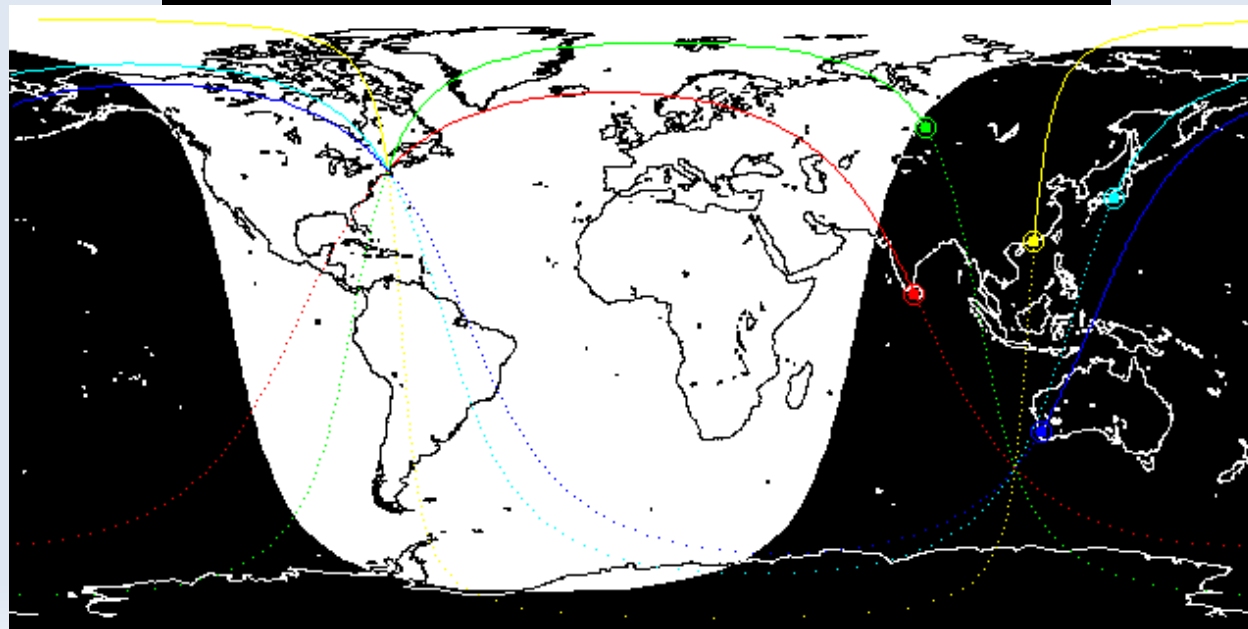


HF Beacons

```
13:46:21z          FN42ho          IBP v0.21
```

	4U1UN	United Nations	New York City	298km	227/ 47deg
	VE8AT	Canada	Eureka, Nunavut	4200km	356/176deg
	W6WX	United States	Mt. Umunhum	4290km	279/ 99deg
	KH6WO	Hawaii	Laie	8128km	284/104deg
28,200 MHz	ZL6B	New Zealand	Masterton	14615km	248/ 68deg
24,930 MHz	VK6RBP	Australia	Rolystone	18677km	328/148deg
21,150 MHz	JA21GY	Japan	Mt. Asama	10981km	337/157deg
18,110 MHz	RR90	Russia	Novosibirsk	8894km	15/195deg
14,100 MHz	VR2B	Hong Kong	Hong Kong	12780km	354/174deg
	4S7B	Sri Lanka	Colombo	13789km	35/215deg
	ZS6DN	South Africa	Pretoria	12676km	104/284deg
	5Z4B	Kenya	Kilifi	11582km	78/258deg
	4X6TU	Israel	Tel Aviv	8817km	56/236deg
	OH2B	Finland	Espoo	6261km	36/216deg
	CS3B	Madeira	Santo da Serra	4842km	84/264deg
	LU4AA	Argentina	Buenos Aires	8689km	169/349deg
	OA4B	Peru	Lima	6106km	187/ 7deg
	YV5B	Venezuela	Caracas	3606km	172/352deg

Keys: 1...5: select band m: toggle multi-band q: quit



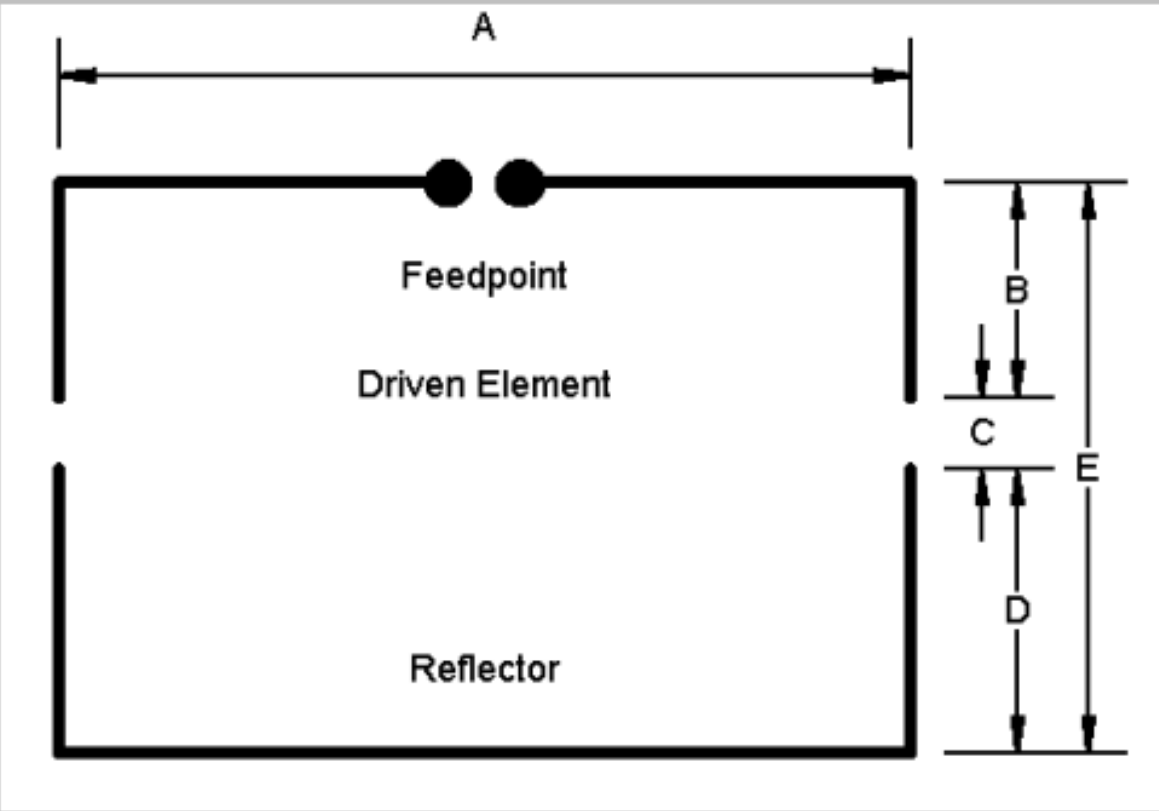
Software Created by KB1OIQ

- FI_MoxGen – Moxon Rectangle design aid
- Aa-analyzer (for RigExpert analyzers)
- Micro-Fox Config GPL (Fox hunting transmitter)
- TinyTrak3 Config GPL (APRS GPS position encoder)
- Perl scripts for Wordsworth
 - K1IG earned Cover Plaque Award, QST 5/2017
- All are freely available on SourceForge

FI_MoxGen

File Help

Frequency (MHz) Wire Size AWG



A 29.172 in
B 4.048 in
C 1.172 in
D 5.561 in
E 10.781 in

Result Units
 Inches
 Feet
 Millimeters
 Meters

Micro-Fox Config GPL



Micro-Fox Config GPL

File Help

Tone Speed ms

Tones Duration sec

Loop Time sec

Initial Delay sec

Frequency MHz

Calibration %

Tones

1, 5, 1, 5, 1, 3, 3, 3, 1, 5, 1, 5, 1, 3, 3, 3,
1, 6, 1, 6, 1, 4, 4, 4, 1, 6, 1, 6, 1, 4, 4, 4,
1, 7, 1, 7, 1, 5, 5, 5, 1, 7, 1, 7, 1, 5, 5, 5,
1, 8, 1, 8, 1, 6, 6, 6, 1, 8, 1, 8, 1, 6, 6, 6,

Morse Code ID

Text

Speed WPM

Tone

Enable LED

Configure

MicroFox Version Info:
MicroFox v1.64

TinyTrak 3 (tt3_gpl)

File Help

Primary Secondary

Callsign

Path

Symbol Table

Frequency MHz

Timing

Auto TX Delay msec

Auto TX Rate sec

Manual TX Delay msec

Manual TX Rate sec

Quiet Time msec

Calibration

Status

Text

Send Every Send Separate Don't Send '>'

Transmit Altitude Allow TTL Serial No TX Out on PTT In Serial Out High Alternative Digi Paths Invert CD In Send NMEA

Only Send Valid Send 300 Baud Serial 9600 Baud TX Twist Send DAO No Startup Packet

Timestamp

Mic-E

Enable Message

Force Printable Path

Time Slotting

Enable Offset sec

Smart Beaconsing

Enable Slow Speed MPH

Min Turn Angle deg Slow Rate sec

Turn Slope Fast Speed MPH

Min Turn Time sec Fast Rate sec

Power Switch

Enable sec

Configure

Test Tones

File

Companies to Thank #1

- RigExpert Ukraine Ltd.
- KB1OIQ asked for information to retrieve data from the device
- They said YES!
 - Info is posted on RigExpert website.
- Many thanks to Denis Nechitailov!!!
- aa-analyzer.pl was created
- Works on many/most/all(?) AA-xxx analyzers
 - If it works for you, send me email: kb1oiq@arrl.net
- Download from Sourceforge.net

Companies to Thank #2

- Byonics, LLC in Chandler, AZ
- MicroFox 15 and TinyTrak3
- Many thanks to Allen Lord and Byon Garrabrant!
- Download from Sourceforge.net

Release Schedule

- Most recent release V22: January 2019
- Next release (V23): Fall/Winter 2019 (predicted)
- Sticking with LTS releases of Ubuntu
- No major additions planned, just minor stuff
 - Send email if you'd like to see something added!
 - kb1oiq@arri.net

Things to Add/Change

- Might also customize Xfce
- Personal PPA on my own computer
- Suggestions? Email: kb1oiq@arrl.net

Last Slide!

- Questions?
- Slides available:
 - Email: kb1oiq@arri.net
- Thanks for coming to this talk!
- Have a lot of fun, and 73 de Andy KB1OIQ

Attributions

RigExpert® is a registered trademark of Rig Expert Ukraine Ltd in Ukraine and in the USA.

APRS™ is a trademark of Bob Bruninga

Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries.

Other trademarks are the property of their respective owners.

References

PART of Westford, MA

<http://www.wb1gof.org>

Worcester Linux Users' Group

<http://www.wlug.org>

Chelmsford Linux Meetup Group

<http://linux.meetup.com/393>