MAP65 Version 2

A Panoramic, Polarization-Matching Receiver for JT65

Joe Taylor, K1JT

Joint Mid-Atlantic and North East VHF Conference

October 13, 2012

MAP65: What is it?

- SDR software, works with JT65 signals
- “Big brother” to WSJT
- Rx hardware converts RF to baseband
- Decodes all JT65 signals in 90 kHz BW
- X-Pol: Automatic polarization matching
- Designed for EME on 144, 432, 1296 MHz

JT65 Protocol

- 60 s T/R sequences
- Compact, structured messages
- Modulation: 65-tone FSK, 2.7 baud
- ECC: Reed-Solomon $(63,12)_6$
- Works at 10 to15 dB below CW limit
- > 1000 EME users on 144 MHz !

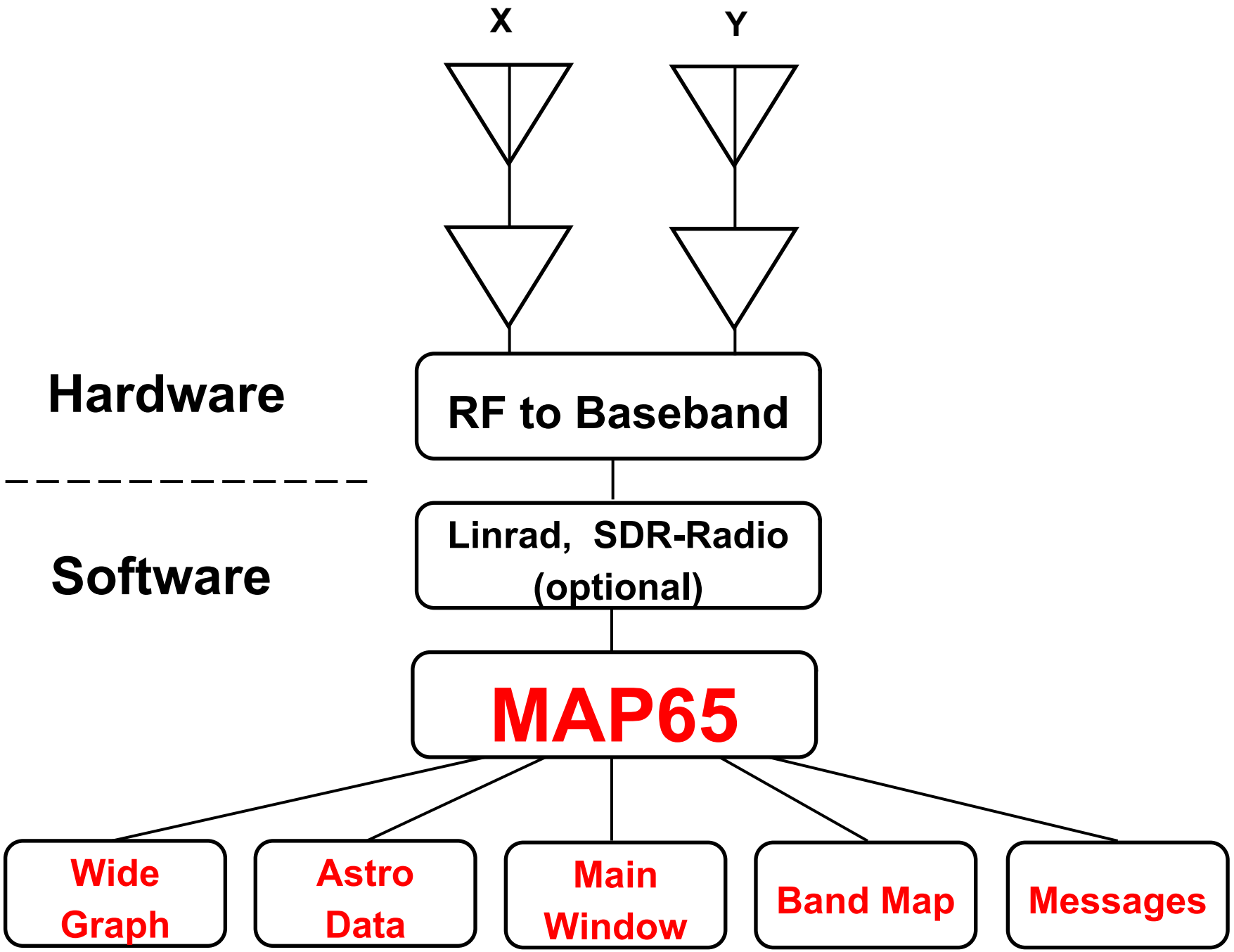
Program Comparison

WSJT

- BW 2-5 kHz
- Many modes
- Decodes one signal
- One polarization

MAP65

- BW 90 kHz
- JT65 only
- Decodes all signals in passband
- All polarizations (avg 3 dB better)
- Automatic Band Map


X
Y
Hardware
RF to Baseband
Software
Linrad, SDR-Radio
(optional)
MAP65
Wide
Graph
Astro
Data
Main
Window
Band Map
Messages

MAP65: Version 2 Features

- Supports X-pol and Single-pol systems
- Sub-modes JT65A, B, and C
- Sample rate: 96000 or 95238 Hz
- Optional front-ends: Linrad, SDR-Radio
- Rx hardware: WSE converters, IQ+, Perseus, SDR-IQ, FUNcube Dongle, SoftRock, …
- QtSDK, C++ for GUI; Fortran for decoder
- Windows, OS X, Linux, …

Example Receivers



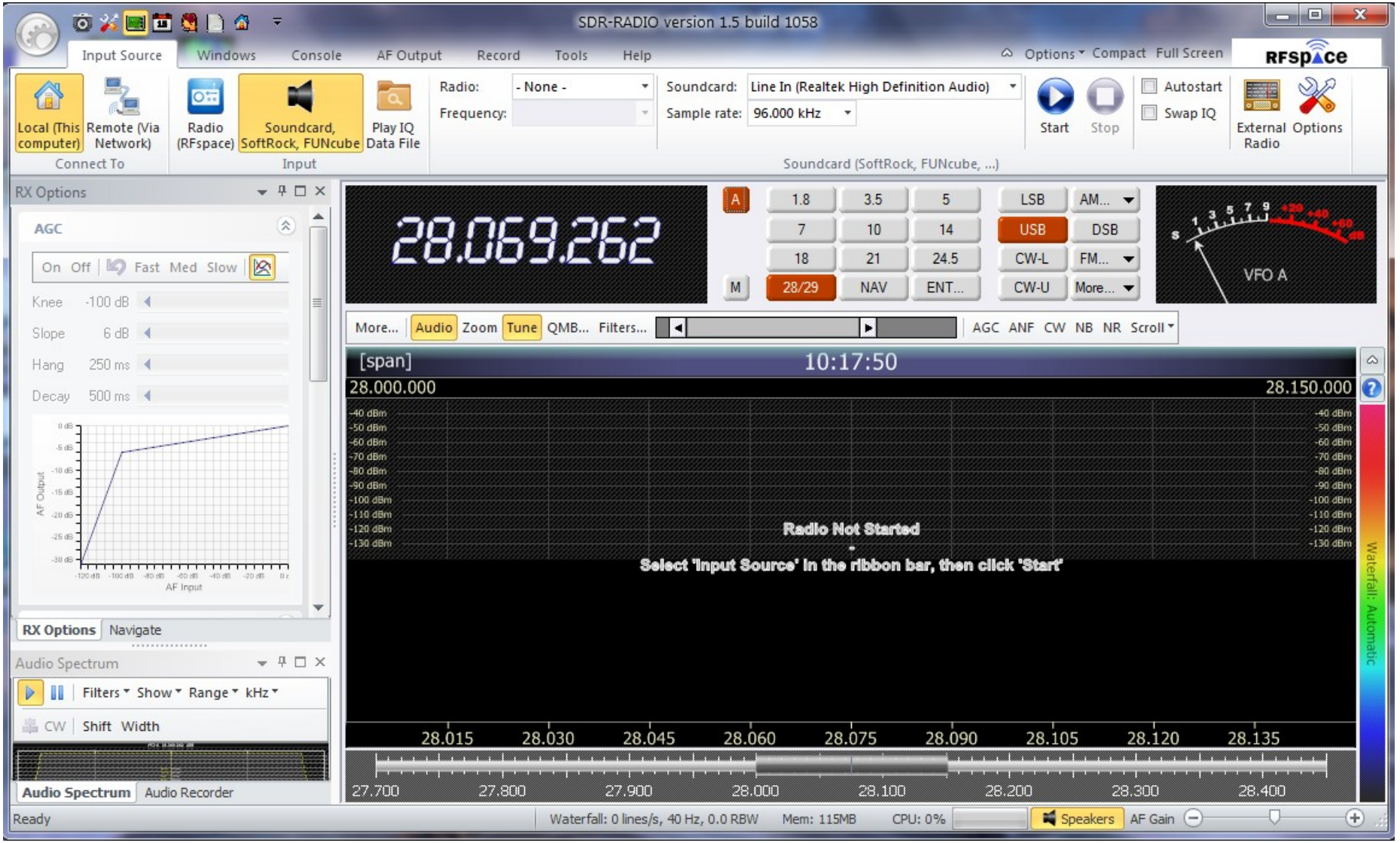








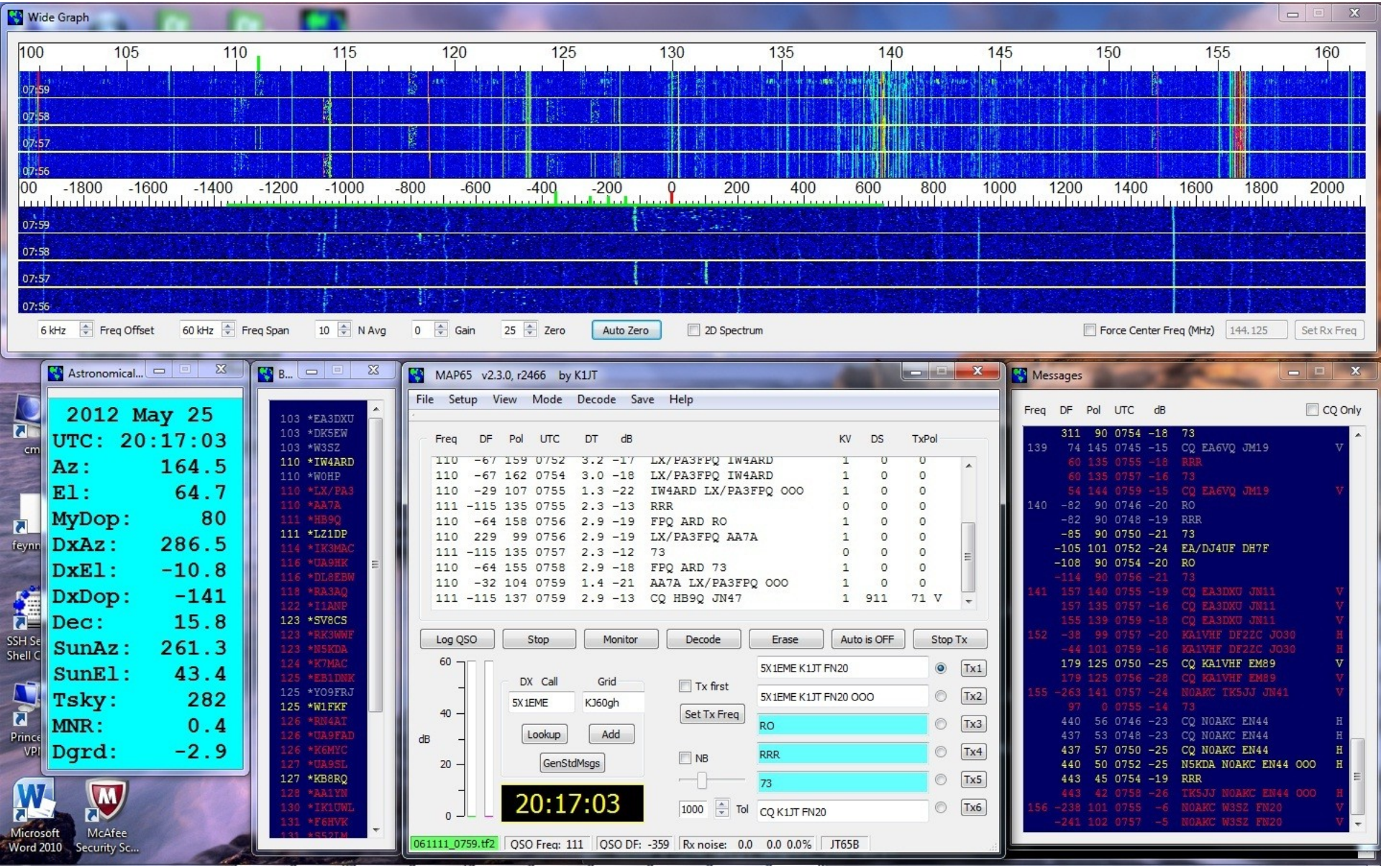
SDR-Radio


SDR-RADIO version 1.5 build 1058
Input Source
Windows
Console
AF Output
Record
Tools
Help
Options
Compact
Full Screen
RFSpace
Local (This computer)
Remote (Via Network)
Connect To
Radio (RFspace)
Soundcard, SoftRock, FUNcube
Play IQ Data File
Input
Radio:
- None -
Frequency:
Soundcard:
Line In (Realtek High Definition Audio)
Sample rate:
96.000 kHz
Start
Stop
Autostart
Swap IQ
External Radio
Options
Soundcard (SoftRock, FUNcube, ...)
RX Options
AGC
On Off Fast Med Slow
Knee -100 dB
Slope 6 dB
Hang 250 ms
Decay 500 ms
AF Output
AF Input
RX Options
Navigate
Audio Spectrum
Filters
Show
Range
kHz
CW
Shift
Width
Audio Spectrum
Audio Recorder
28.069.262
A
1.8
3.5
5
LSB
AM...
7
10
14
USB
DSB
18
21
24.5
CW-L
FM...
M
28/29
NAV
ENT...
CW-U
More...
VFO A
More...
Audio
Zoom
Tune
QMB...
Filters...
AGC
ANF
CW
NB
NR
Scroll
[span]
10:17:50
28.000.000
28.150.000
Radio Not Started
Select 'Input Source' in the ribbon bar, then click 'Start'
Waterfall: Automatic
28.015
28.030
28.045
28.060
28.075
28.090
28.105
28.120
28.135
27.700
27.800
27.900
28.000
28.100
28.200
28.300
28.400
Ready
Waterfall: 0 lines/s, 40 Hz, 0.0 RBW
Mem: 115MB
CPU: 0%
Speakers
AF Gain

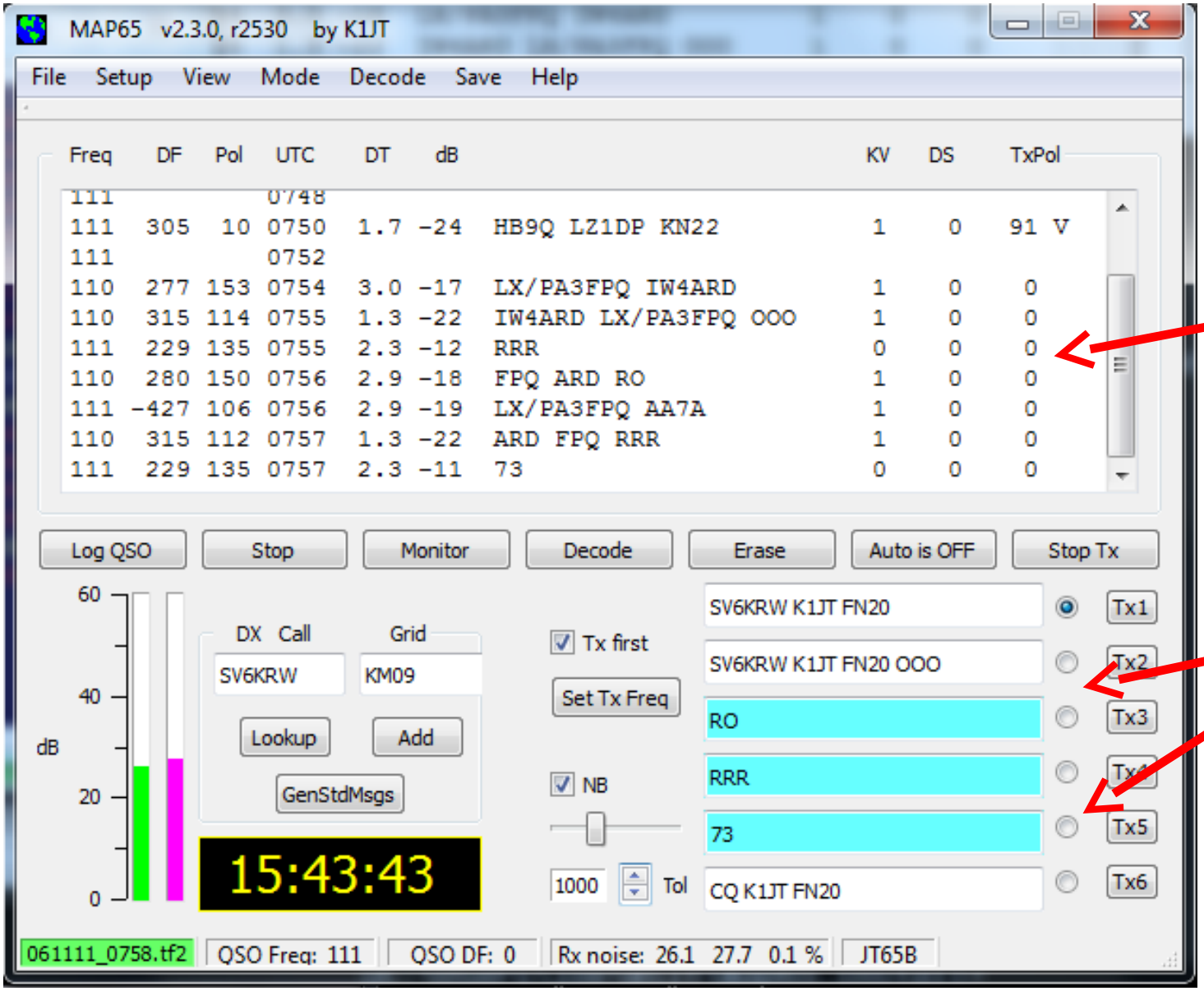
Normal Operation at K1JT (2m EME)

1. Turn on Rx, warm up PA
2. Start Linrad and MAP65
3. Click to track Moon
4. Callsigns start to appear on screen
5. Double-click on a CQing callsign
6. Select Tx polarization (H or V)
7. Click “Auto On” to call him

MAP65: Full Screen Display



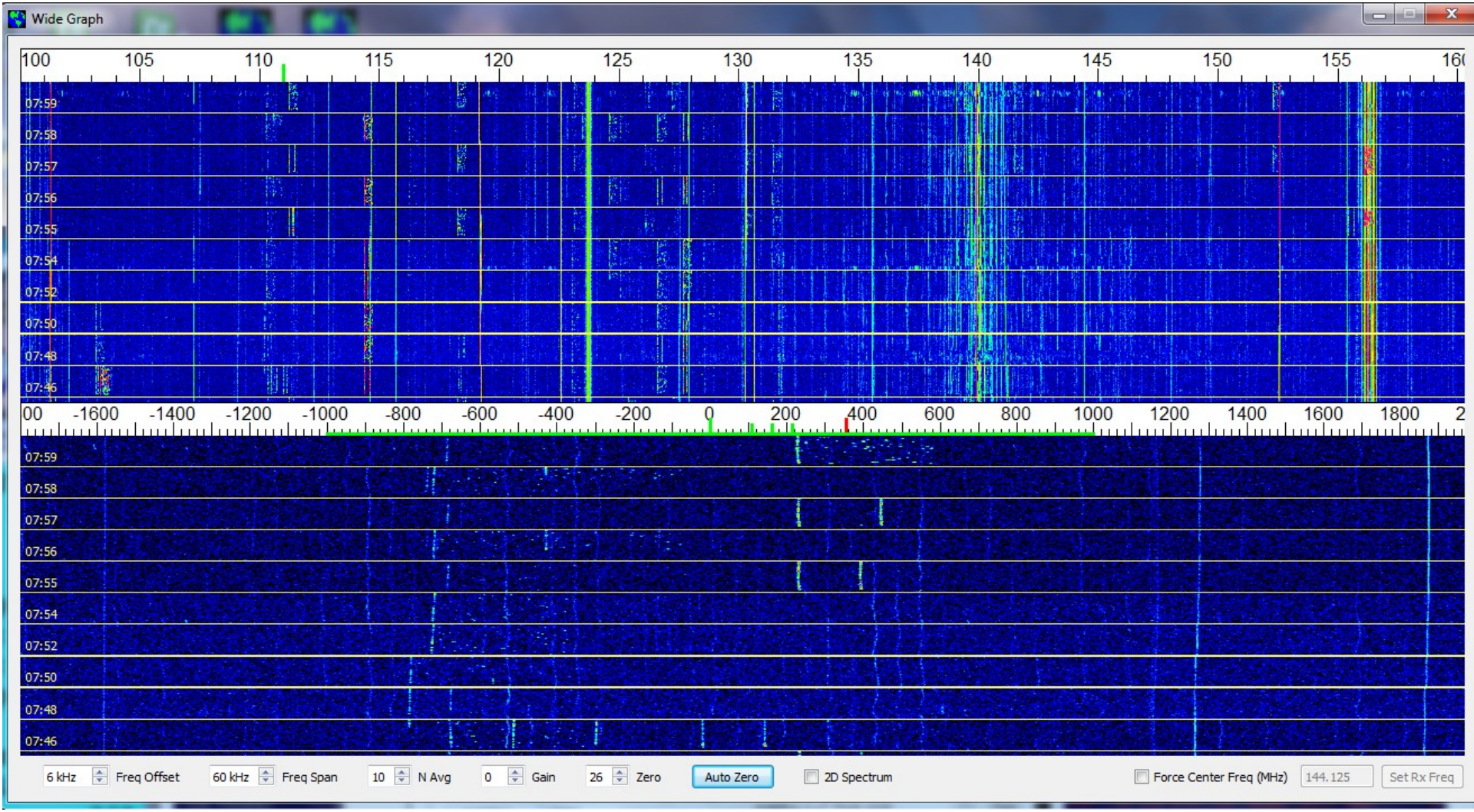
Main Window



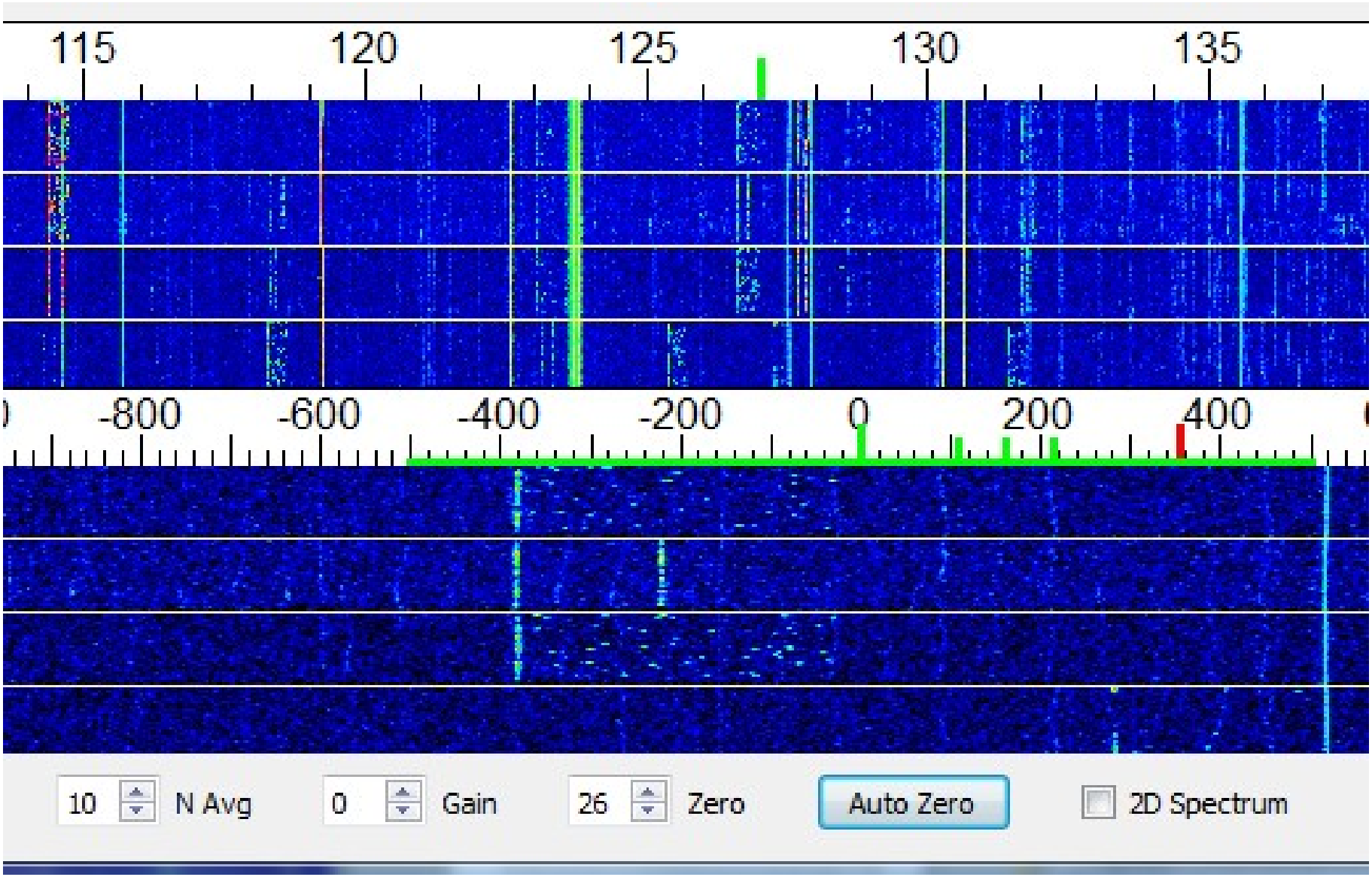
QSO Window

Tx Messages

Wide Graph

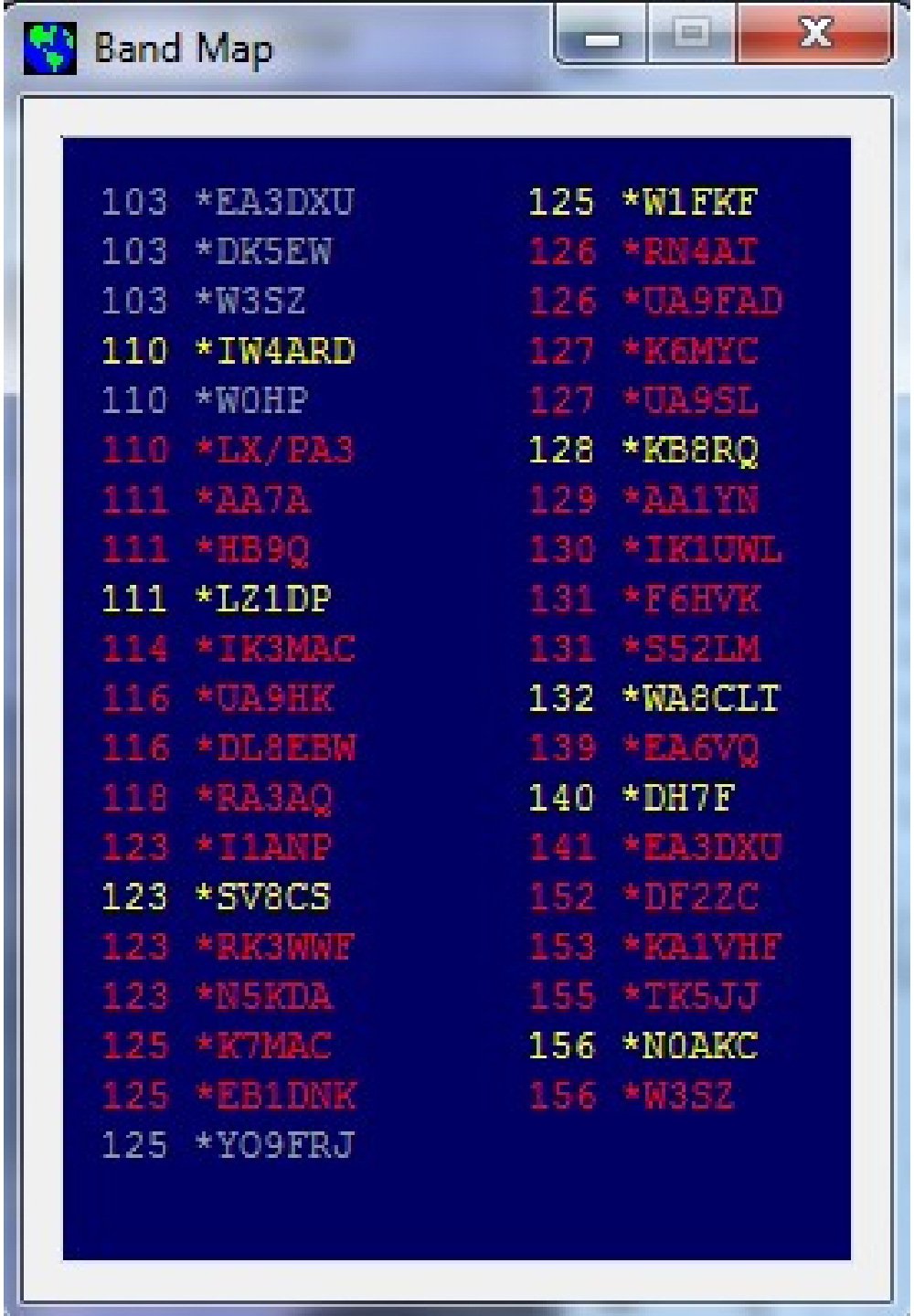

Wide Graph
100 105 110 115 120 125 130 135 140 145 150 155
07:59
07:58
07:57
07:56
07:55
07:54
07:52
07:50
07:48
07:46
00 -1600 -1400 -1200 -1000 -800 -600 -400 -200 0 200 400 600 800 1000 1200 1400 1600 1800
6 kHz
Freq Offset
60 kHz
Freq Span
10
N Avg
0
Gain
26
Zero
Auto Zero
2D Spectrum
Force Center Freq (MHz)
144.125
Set Rx Freq

Wide Graph (detail)

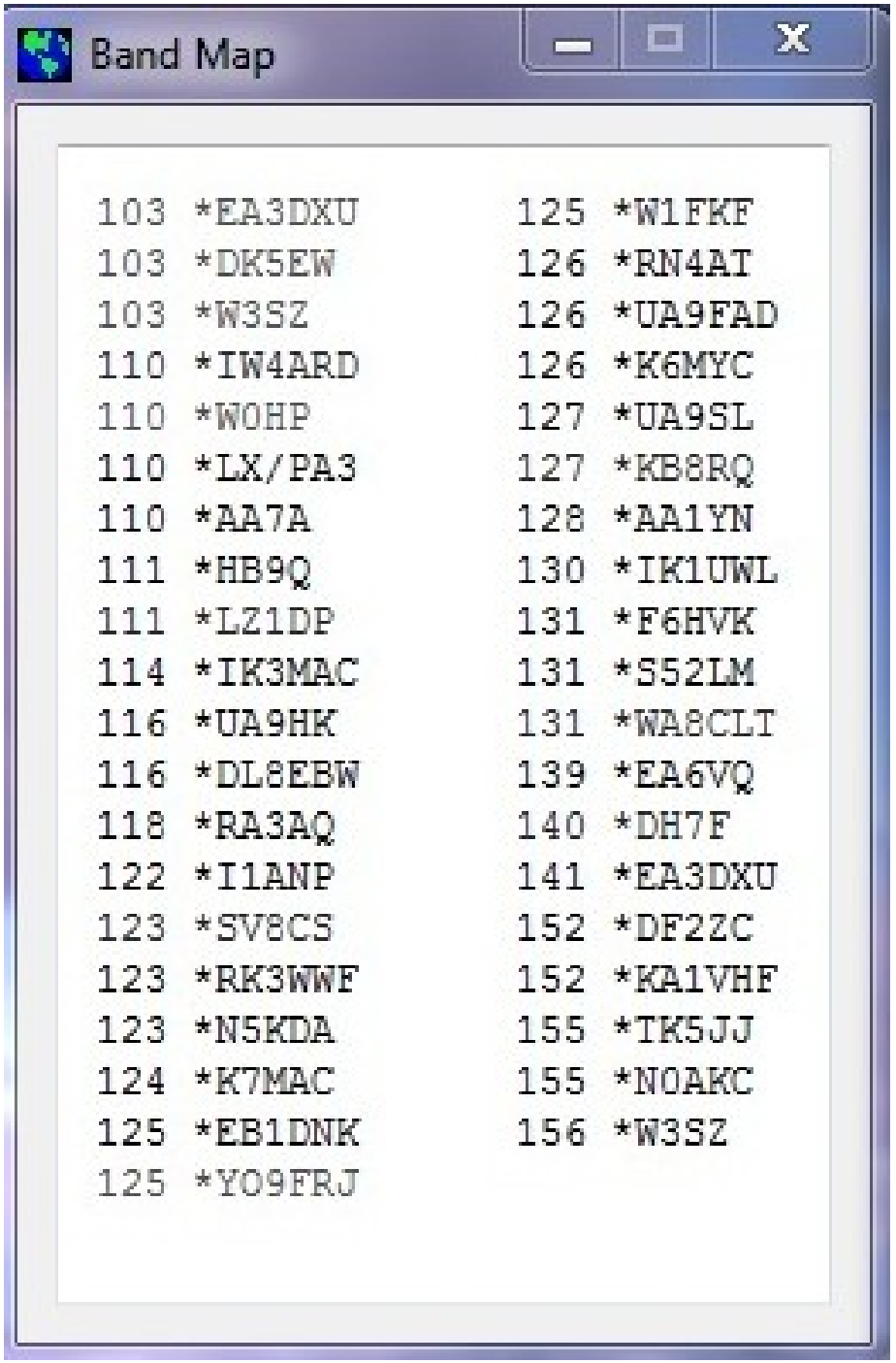


Band Map

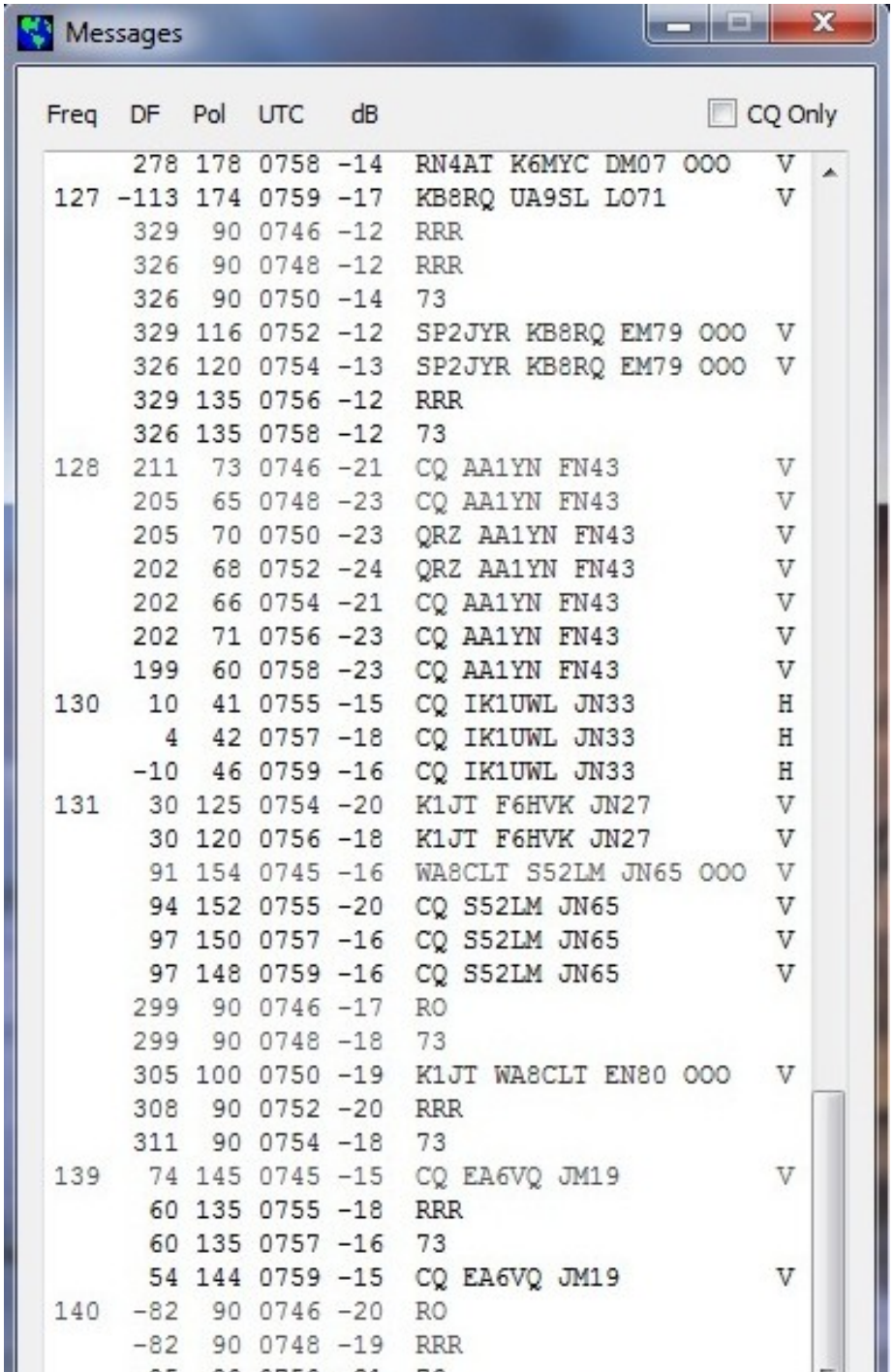
2 × 10-element
Xpol Yagis



Band Map
(grayscale)



Messages


Messages
Freq DF Pol UTC dB
CQ Only
278 178 0758 -14 RN4AT K6MYC DM07 OOO V
127 -113 174 0759 -17 KB8RQ UA9SL LO71 V
329 90 0746 -12 RRR
326 90 0748 -12 RRR
326 90 0750 -14 73
329 116 0752 -12 SP2JYR KB8RQ EM79 OOO V
326 120 0754 -13 SP2JYR KB8RQ EM79 OOO V
329 135 0756 -12 RRR
326 135 0758 -12 73
128 211 73 0746 -21 CQ AA1YN FN43 V
205 65 0748 -23 CQ AA1YN FN43 V
205 70 0750 -23 QRZ AA1YN FN43 V
202 68 0752 -24 QRZ AA1YN FN43 V
202 66 0754 -21 CQ AA1YN FN43 V
202 71 0756 -23 CQ AA1YN FN43 V
199 60 0758 -23 CQ AA1YN FN43 V
130 10 41 0755 -15 CQ IK1UWL JN33 H
4 42 0757 -18 CQ IK1UWL JN33 H
-10 46 0759 -16 CQ IK1UWL JN33 H
131 30 125 0754 -20 K1JT F6HVK JN27 V
30 120 0756 -18 K1JT F6HVK JN27 V
91 154 0745 -16 WA8CLT S52LM JN65 OOO V
94 152 0755 -20 CQ S52LM JN65 V
97 150 0757 -16 CQ S52LM JN65 V
97 148 0759 -16 CQ S52LM JN65 V
299 90 0746 -17 RO
299 90 0748 -18 73
305 100 0750 -19 K1JT WA8CLT EN80 OOO V
308 90 0752 -20 RRR
311 90 0754 -18 73
139 74 145 0745 -15 CQ EA6VQ JM19 V
60 135 0755 -18 RRR
60 135 0757 -16 73
54 144 0759 -15 CQ EA6VQ JM19 V
140 -82 90 0746 -20 RO
-82 90 0748 -19 RRR

Rx Hardware Interfacing

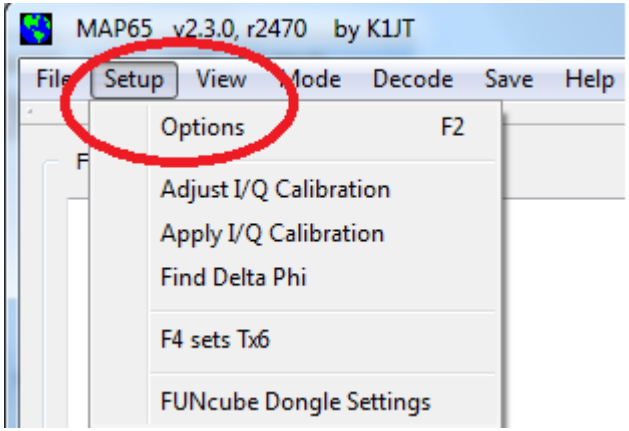
	SoftRock	FUNcube Dongle	SDR-IQ, Perseus	SoftRock × 2	IQ+ VL, V, U	WSE
Input Freq (MHz)	28, 144	144, 432, 1296	28	28, 144	50, 144, 432	144
Polarizations	1	1	1	2	2	2
Soundcard Channels	2	–	–	4	4	4
Digital Interface	USB	USB	USB	USB	USB	Parallel Port
Frequency Control*	L, S, M	L, S, M	L, S	L, M	L, M	L
Front-End Software*	L or S optional	–	L or S required	L optional	L optional	L optional

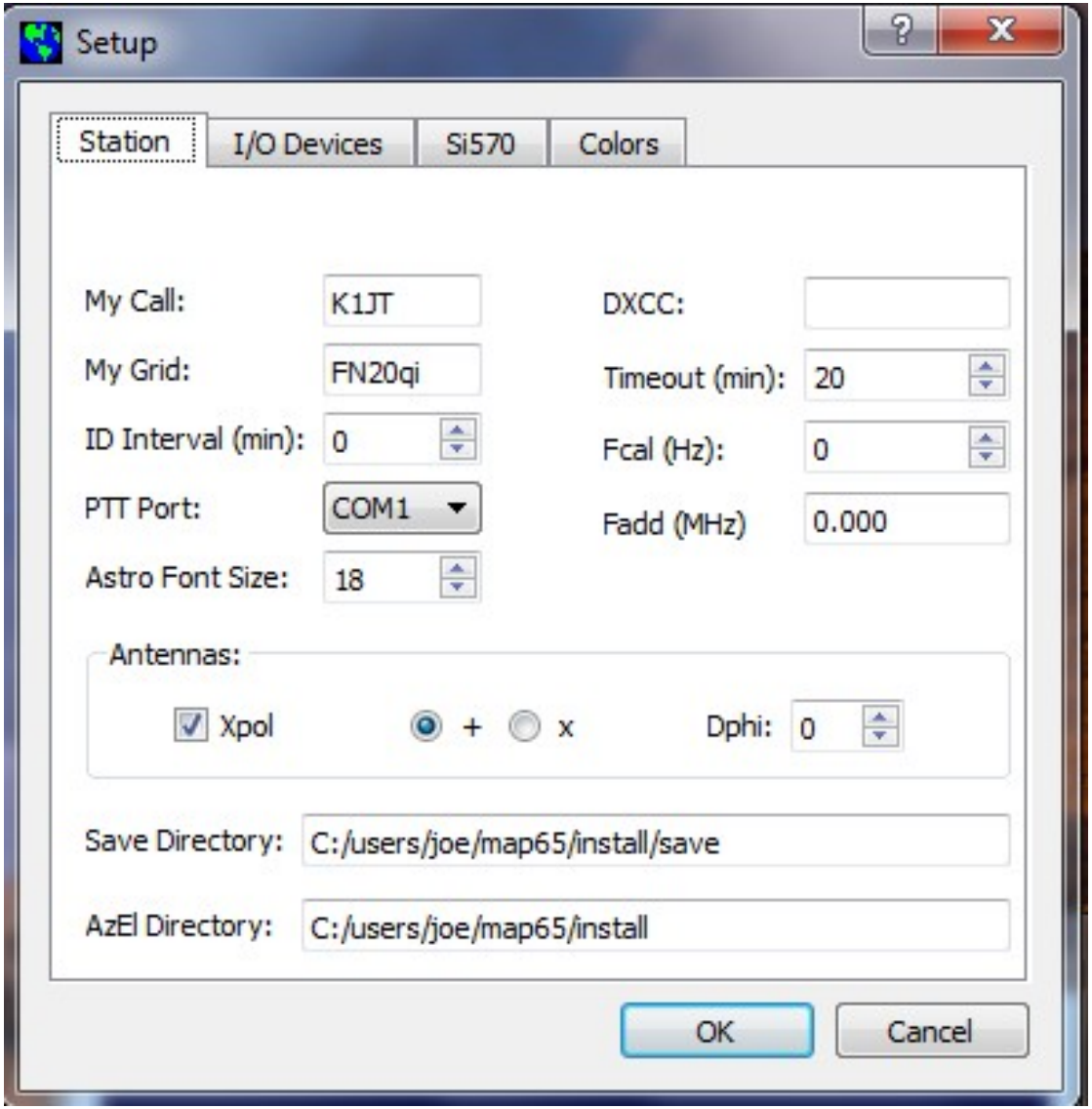
* L = Linrad, S = SDR-Radio, M = MAP65

MAP65: Why do you need it?

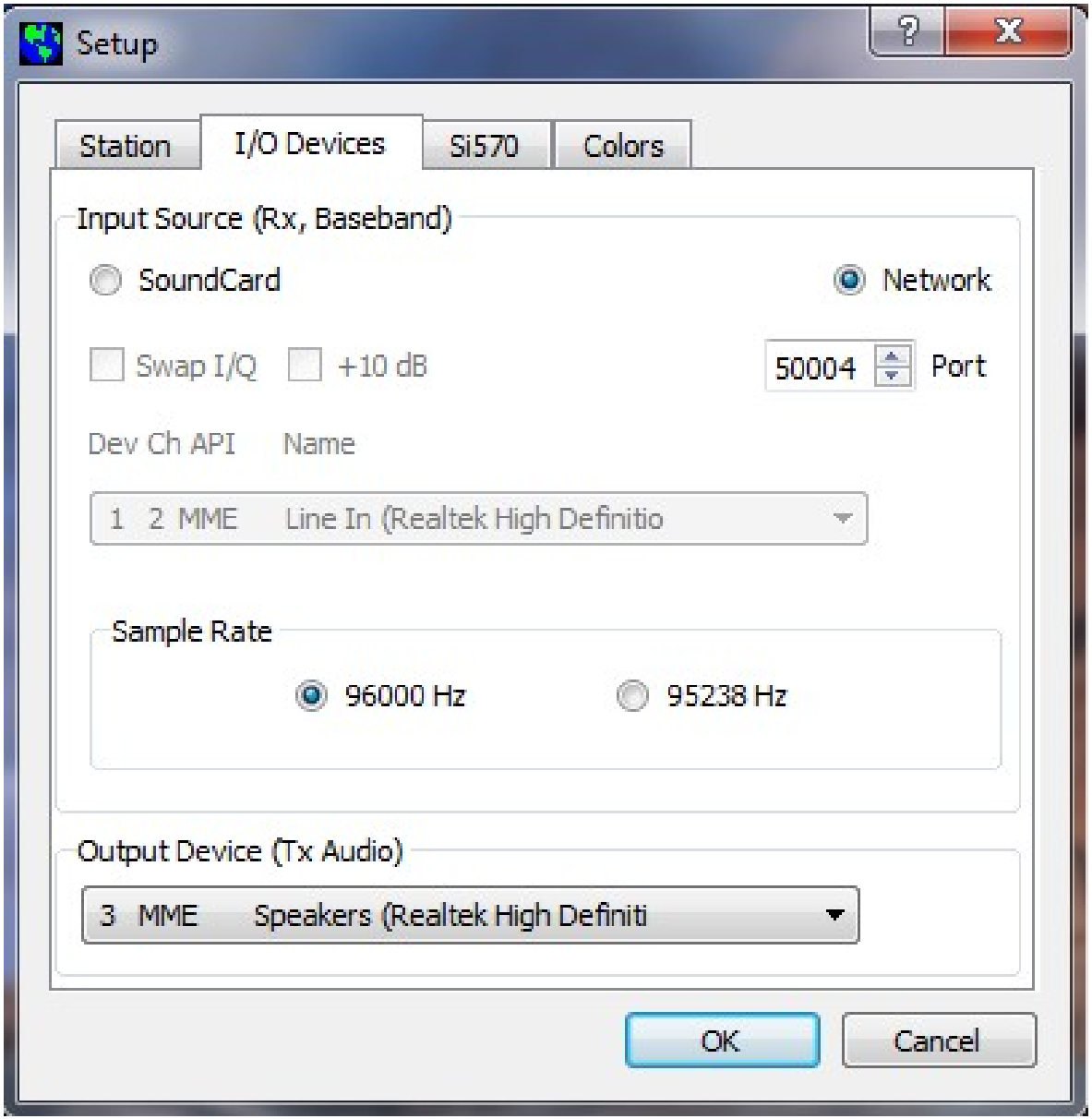
- Random EME on 144, 432, 1296 (no skeds or logger)
- Superb wideband noise blanker
- Copy all EME signals in band
- Monitor CW as well as JT65 portions of band
- Powerful EME contest operating aid **!**

Setup | Options – Station tab

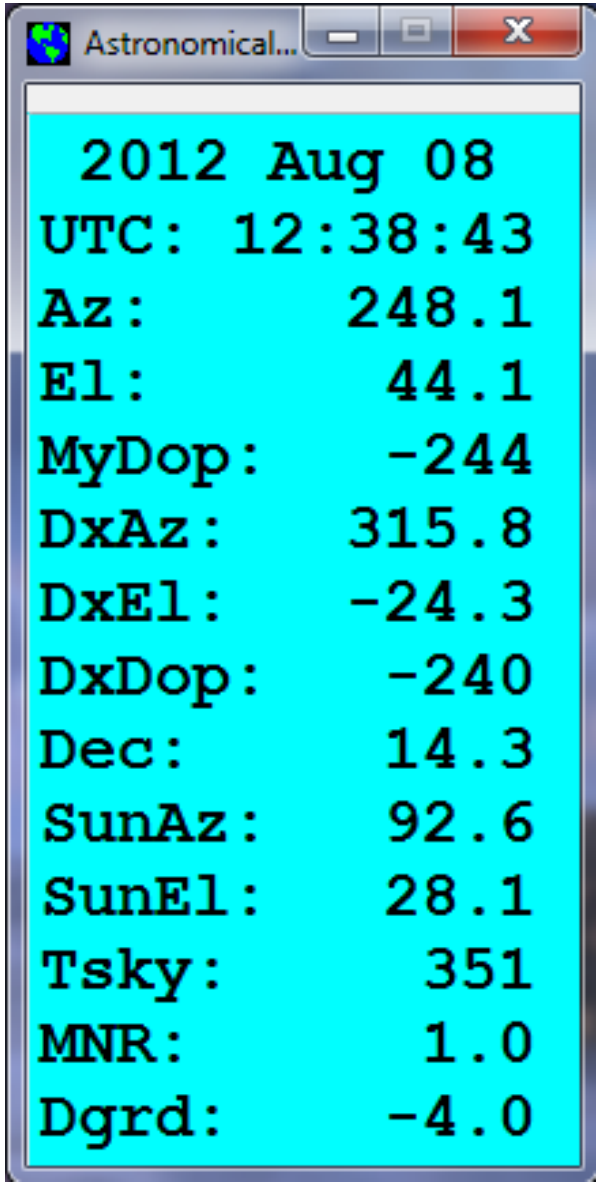




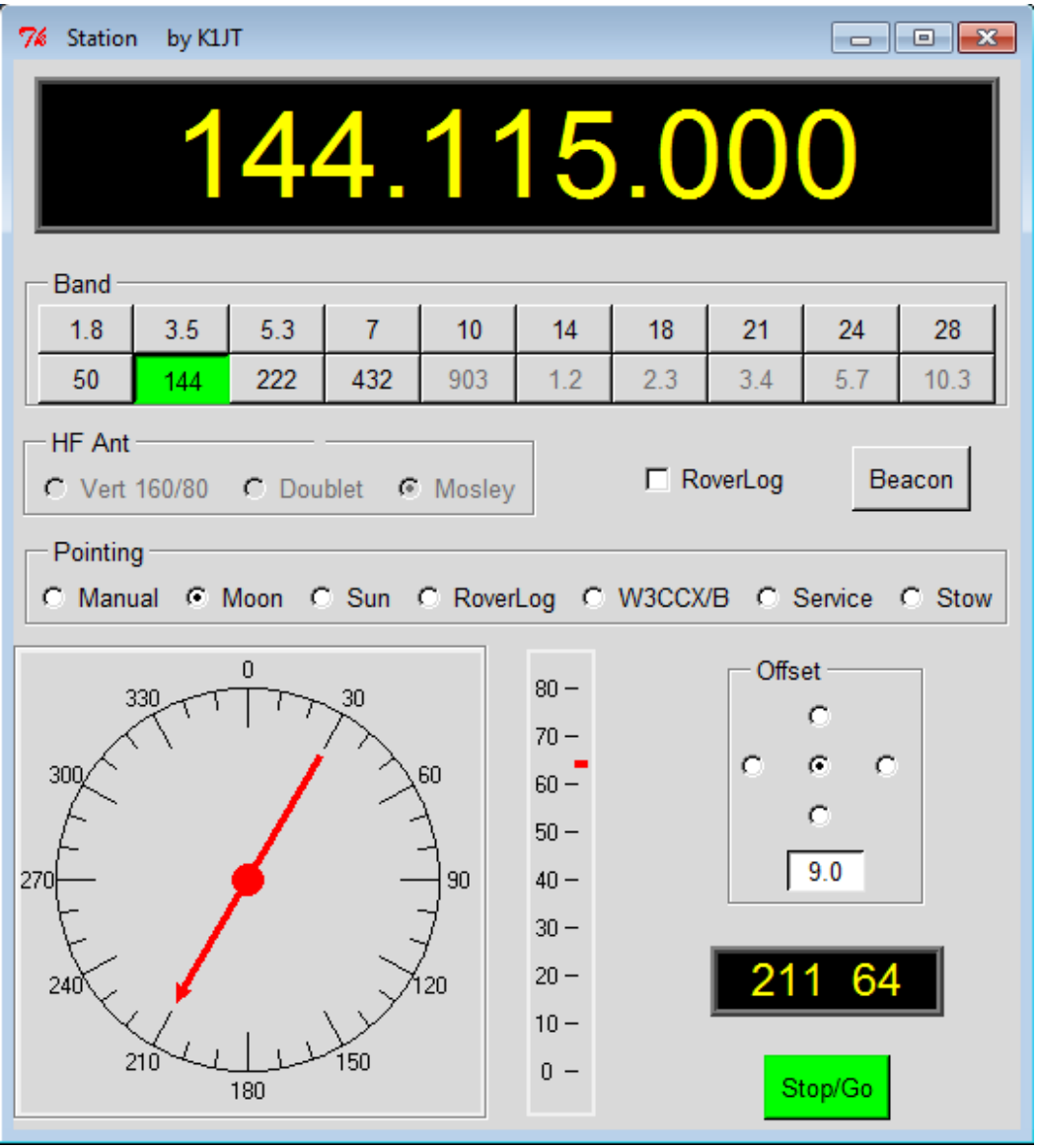
Setup | Options – I/O Devices



Astronomical Data

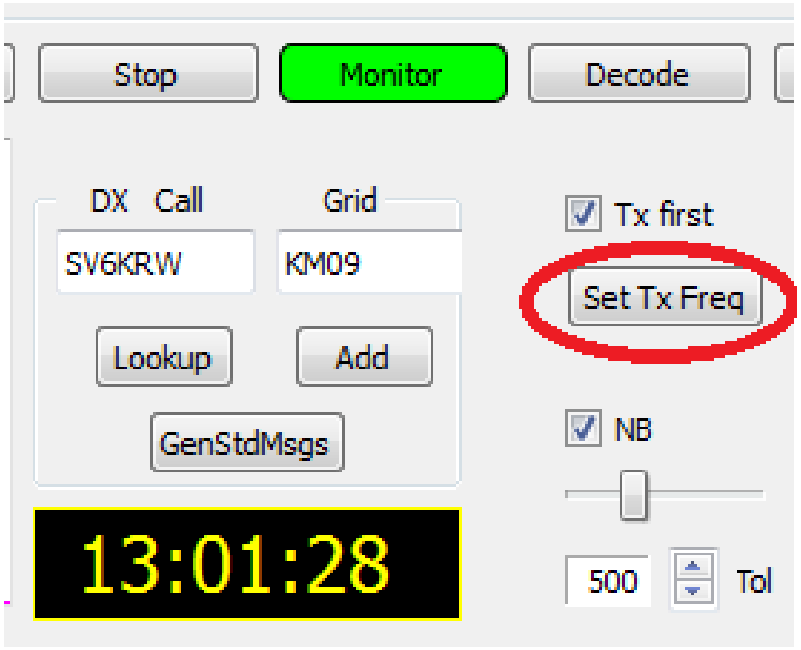


Station Control at K1JT

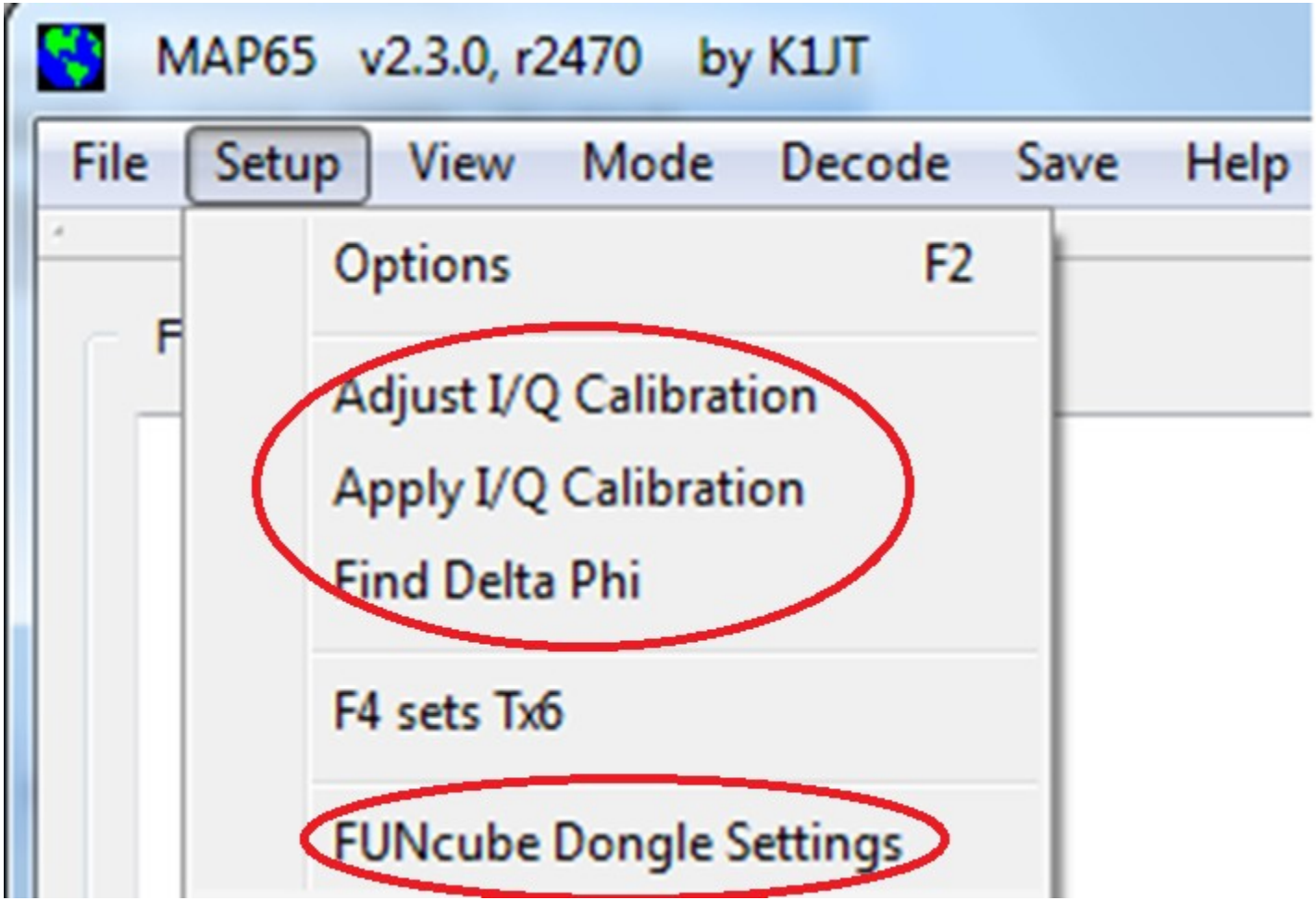


File azel.dat

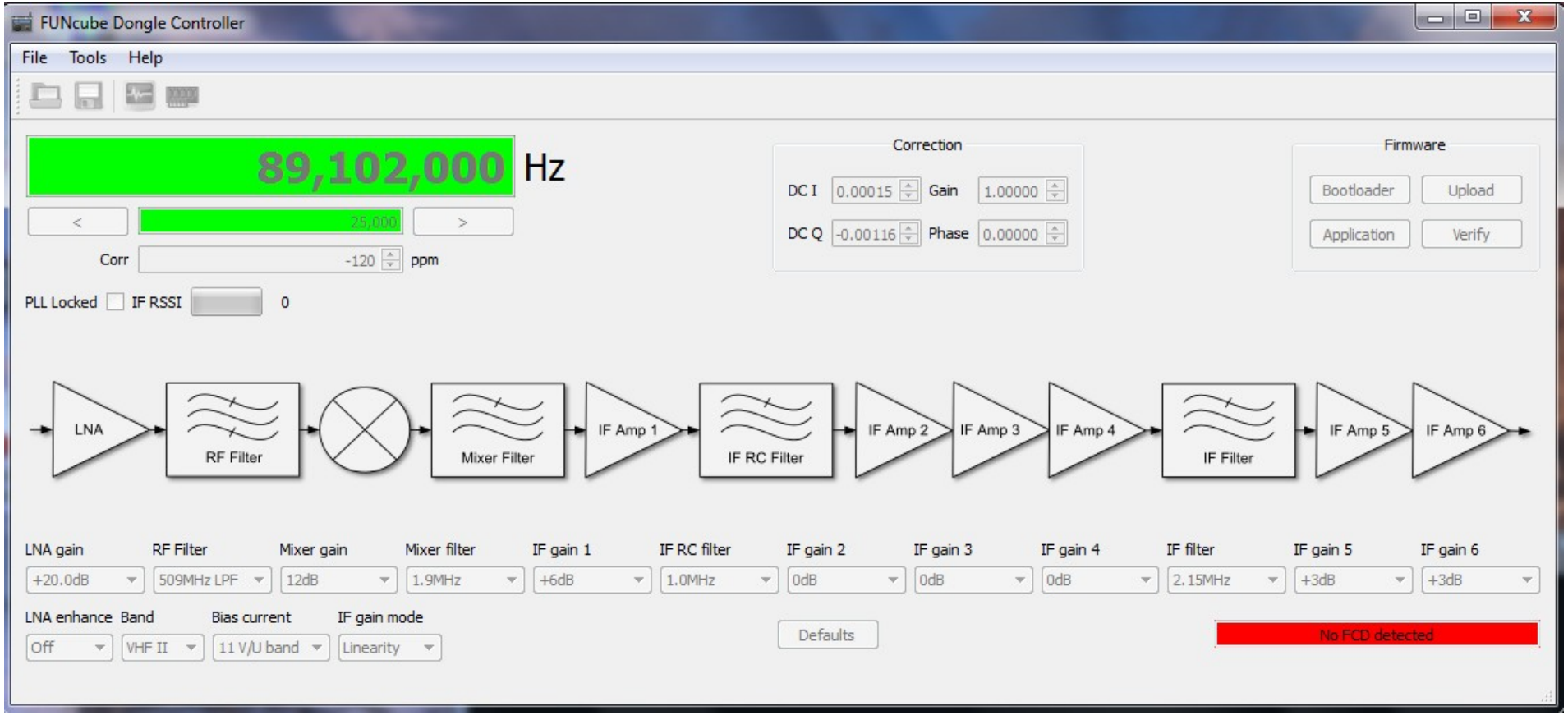
```
13:01:28,211.3, 64.1,Moon
13:01:28, 98.3, 33.9,Sun
144,   162,Doppler
115,0,fQSO
```



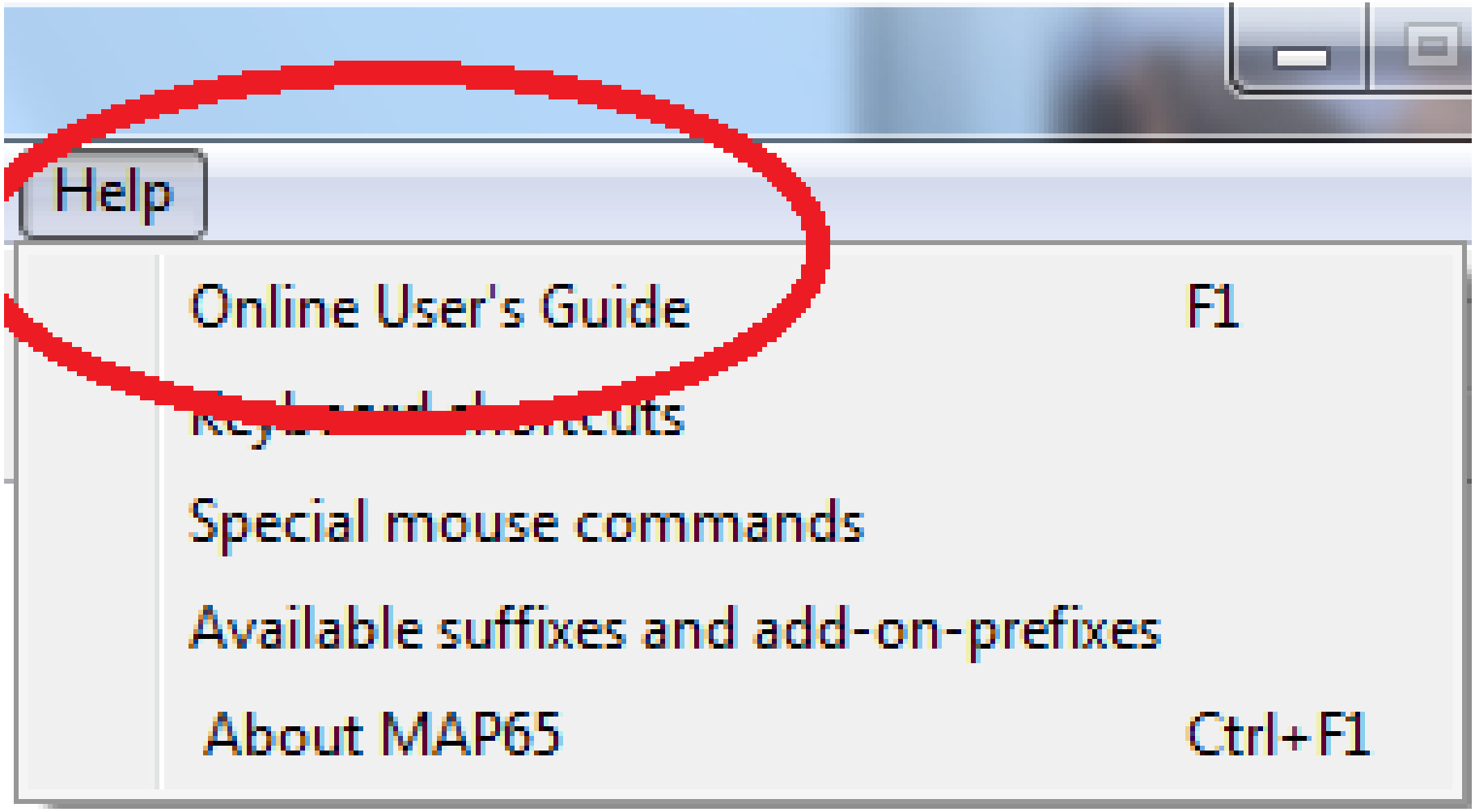
More Setup Features



Setup Utility for FUNcube Dongle



Online User’s Guide



432 and 1296 MHz

- “Best” EME bands
- Much smaller T_{sys}
- Much smaller antennas are “enough”
- Hear your own echoes with:
  - 432: 4 x 6m yagis, 250 W
  - 1296: 3m dish, 150 W
- MAP65 is great for JT65 and CW !
- Use Xpol Yagis on 432
- Single pol’n (RHC/LHC) on 1296

Possible Future Modes?

JT65B2, JT65C2

- 2 × speed, for EME contesting
- 30 s T/R sequences ➔ up to 20 QSOs per hour !
- Sensitivity: 3 dB less
- Presently available in WSJT (only)
- Possible problems …
  - QRM? Sub-band plan? Switching between modes?