Using Utility Stations as Low-band Beacons

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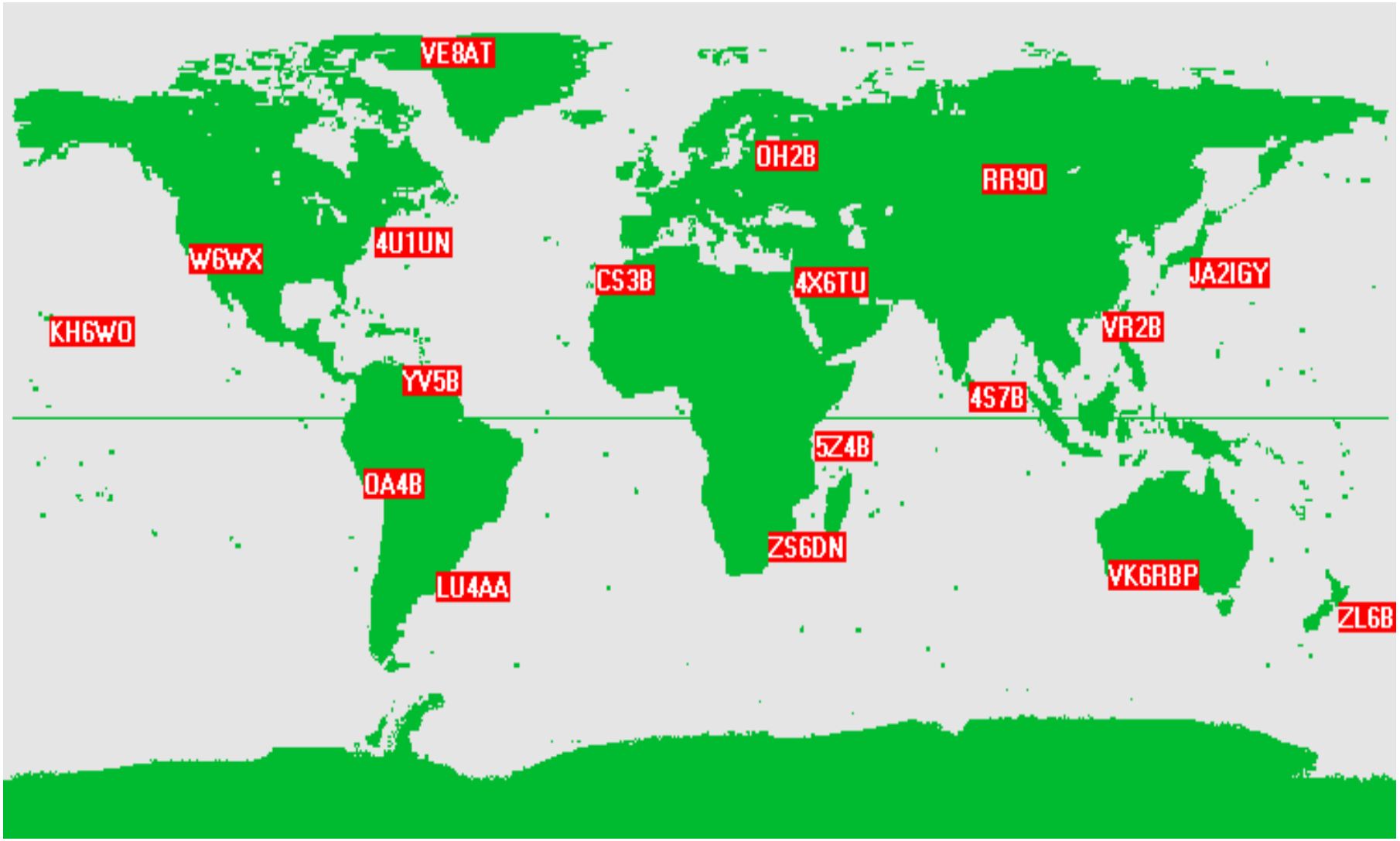
Why?

- NCDXF & ITU beacons (next slide) cover only 20m and up
- If your radio isn't otherwise occupied, it may be useful to see how propagation is changing "right now".
- On the low bands, RX antennas are very important: the S/N on your RX antenna at your QTH is what's important, not a more general indicator.

NCDXF/ITU Beacons



Why? (2)

- Beacons indicate conditions, and the potential for contacts: band monitors like Skimmer indicate activity.

On the other hand…

- There are other indicators, e.g., local full-time internet-accessible skimmers like K4TD's
- Or you could set up your own low-band skimmers
- NCDXF/IARU beacons and skimmers respond within the ham bands, not between them.
- VE3NEA has an automated NCDXF/IARU beacon monitoring program, Faros.

So, What to Do?

- Take advantage of utility stations operating around the low ham bands at reasonable power levels.
- Devise a means of identifying stations
- Put your radio's and computer's idle time to work gathering propagation information.

Reliable Time/Freq Beacons

- WWV/WWVH 2.5 MHz, 2500 W
- WWV/WWVH 5 MHz, 10 kW
- WWV/WWVH 10 MHz, 10 kW
- CHU 3.33 MHz, 3000 W
- CHU 7.85 MHz, 10 kW

There are others operating below 100 kHz, but these are the reliable ones still operating on HF.

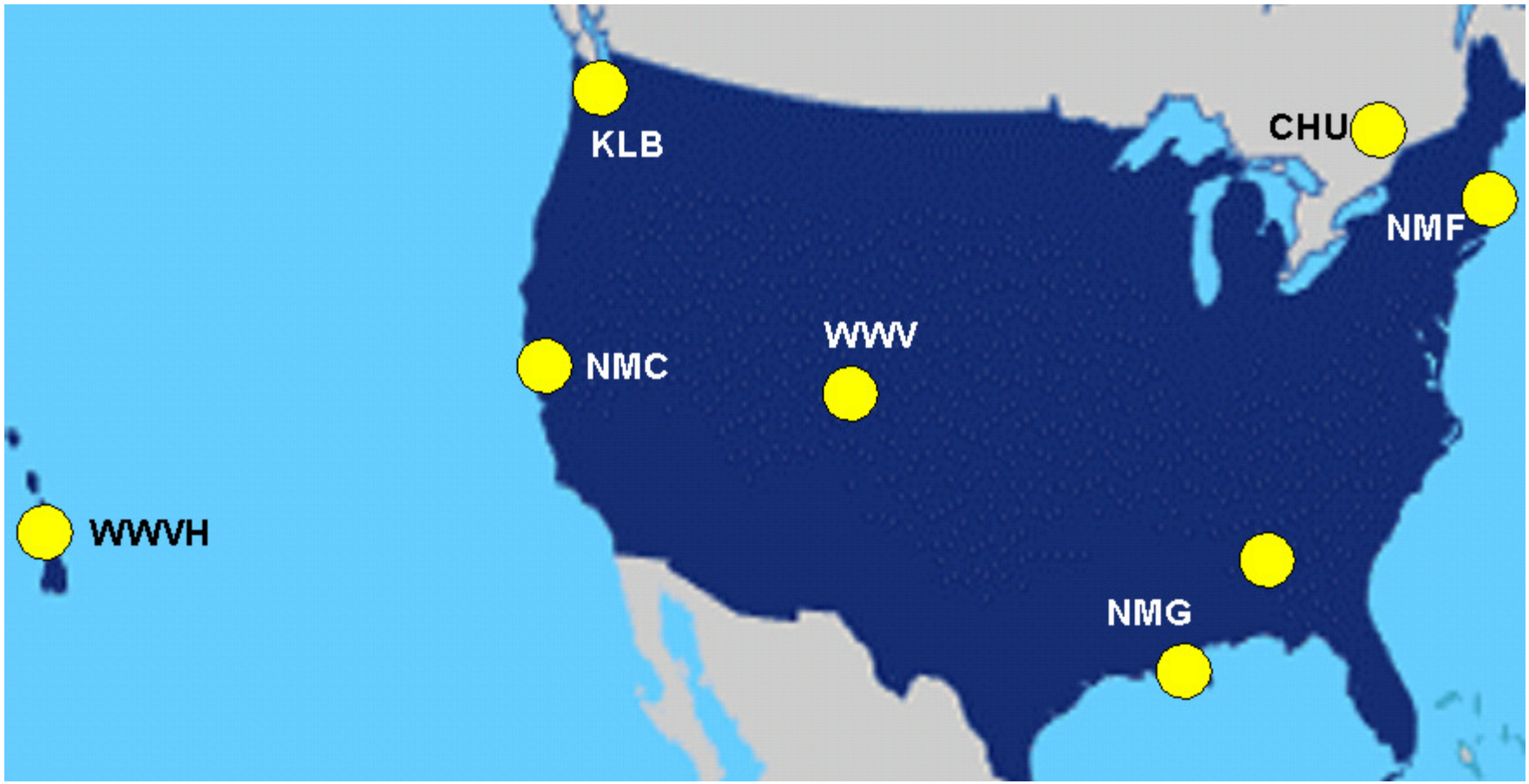
And some Reliable Utility Stations

- KLB 6.3187 MHz (Seattle) CW ID
- NMF 4.235 MHz (Boston) Fax 4 kW
- NMG 4.316 MHz (New Orleans) Fax 4 kW
- NMC 4.246 MHz (Pt. Reyes) Fax 4 kW

There are many air and marine fax stations worldwide – the trick is determining their schedules.

Beacons Between Bands

Follow the beacons as MUF changes


KLB
CHU
NMF
WWV
NMC
WWVH
NMG

Automated Listening Method

- Define “Stations”
- Periodically listen for each station and display Heard 🟢 /Not Heard 🔴 status
  - Tune radio (if tuned by computer)
  - Check for required frequencies, SNRs, and times last heard
  - Evaluate “station heard” logic
- Optionally, at the top of the minute, record station statuses for subsequent analysis

Station Definition

- Collection of demodulated frequencies. To be “heard”,
  - Each must be heard at a minimum rate,
  - Each must have a minimum SNR
- All frequencies must be “heard” for the station to be “heard”.
- Stations of the same name are ORed together.

Station Example: WWV

a) 100 Hz tone is heard every second

b) 1000 Hz tone is heard every minute

c) 500 Hz tones are heard every second during even minutes

d) 600 Hz tones are heard every second during odd minutes

So, WWV=(a • b • c) + (a • b • d), and each frequency a, b, c, and d, has appropriate "must be heard every…" settings.

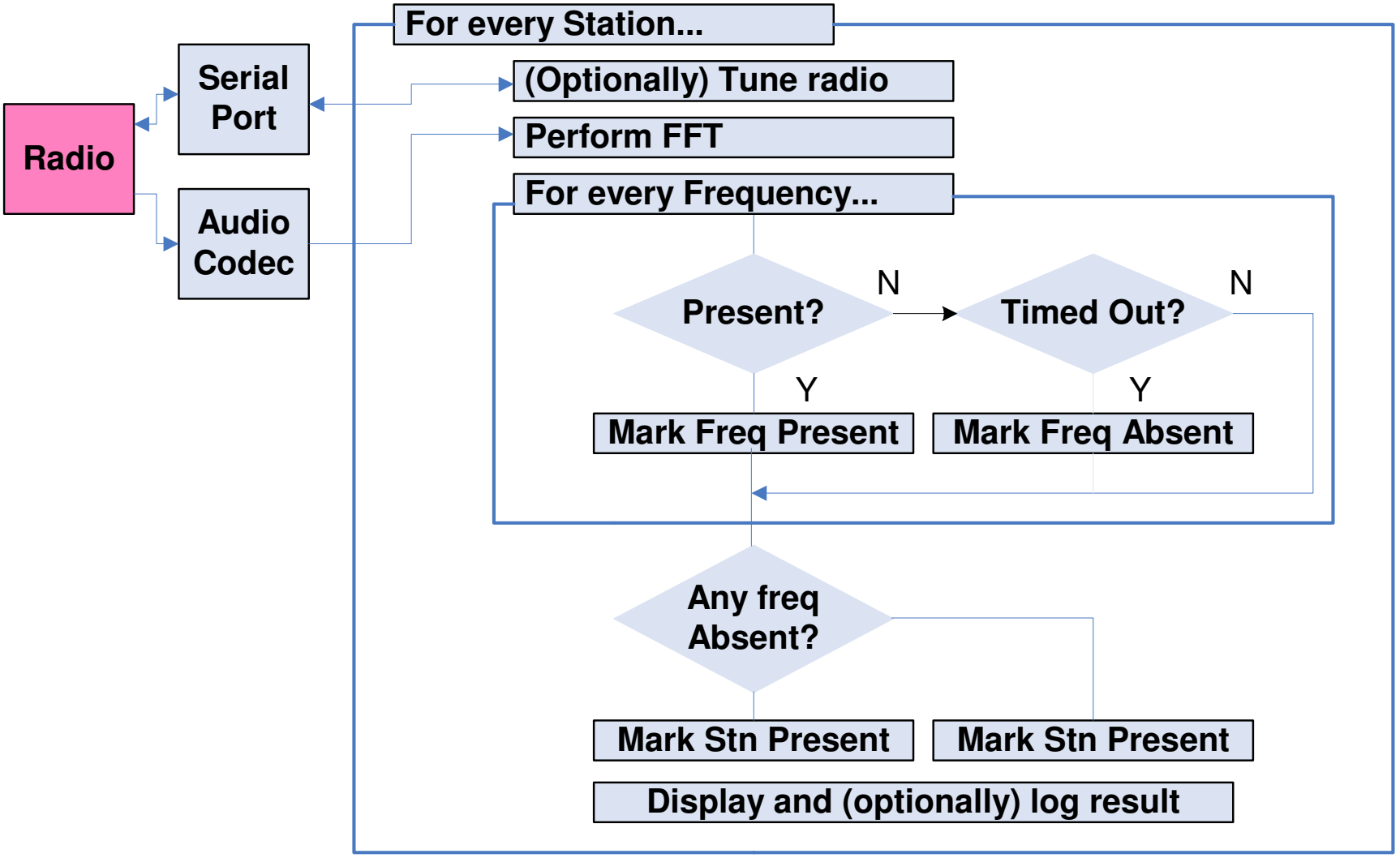
Station Example: FAX

- Sync and black are received every scan line, based on the lines-per-minute rate and index of cooperation. A short timeout period on these 2.3 kHz bursts reduces false positives.
- White will occur somewhere within 20 lines on any “reasonable” fax, so the timeout for this 1.5 kHz frequency can be set accordingly.

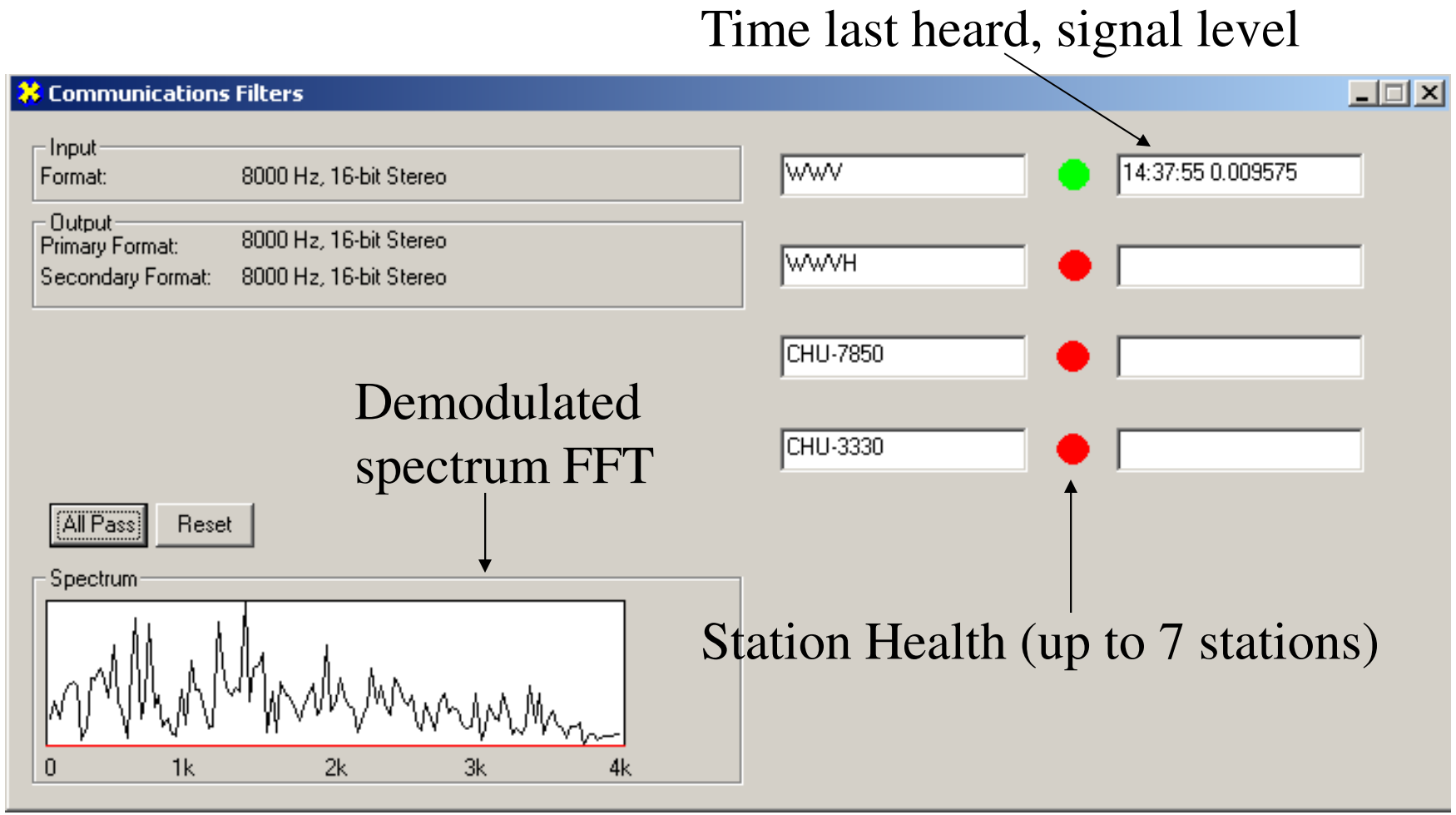
Signal-to-Noise Ratio

- Each demodulated frequency has a required SNR to keep noise from producing false positives.
- Because FFTs with finite durations are used, multiple desired frequencies may be present in a single frequency-domain snapshot.
- Therefore, desired components contribute to each other's noise.

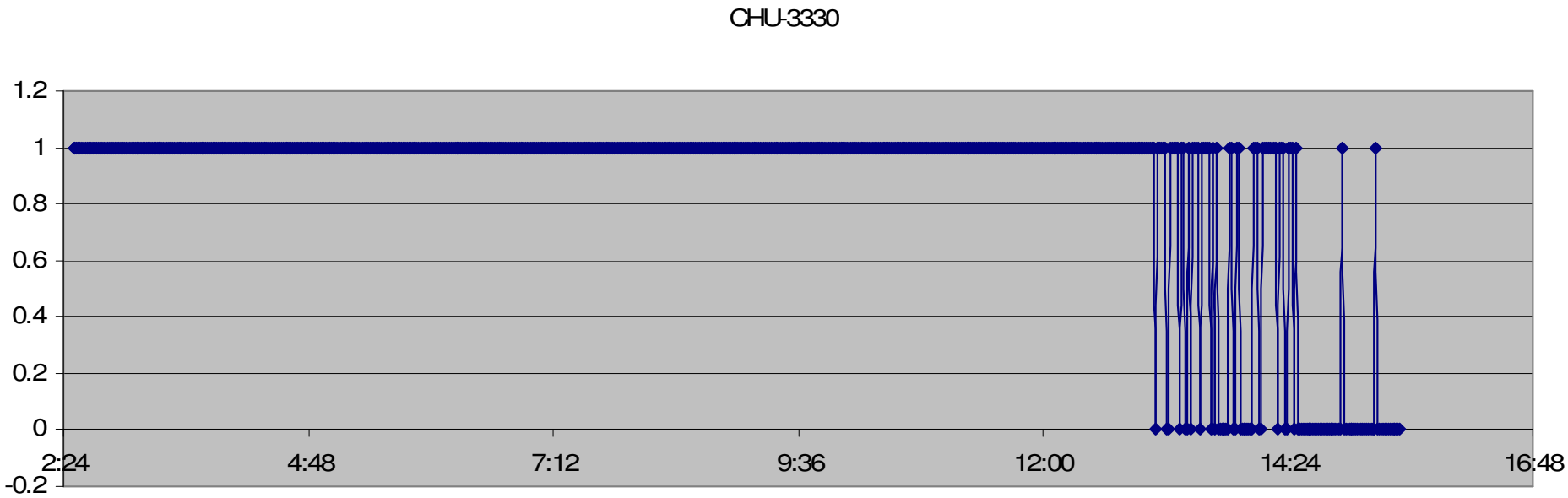
Program Flow



Screen


Time last heard, signal level
Communications Filters
Input
Format: 8000 Hz, 16-bit Stereo
Output
Primary Format: 8000 Hz, 16-bit Stereo
Secondary Format: 8000 Hz, 16-bit Stereo
WWV
14:37:55 0.009575
WWVH
CHU-7850
CHU-3330
Demodulated spectrum FFT
All Pass
Reset
Spectrum
0
1k
2k
3k
4k
Station Health (up to 7 stations)

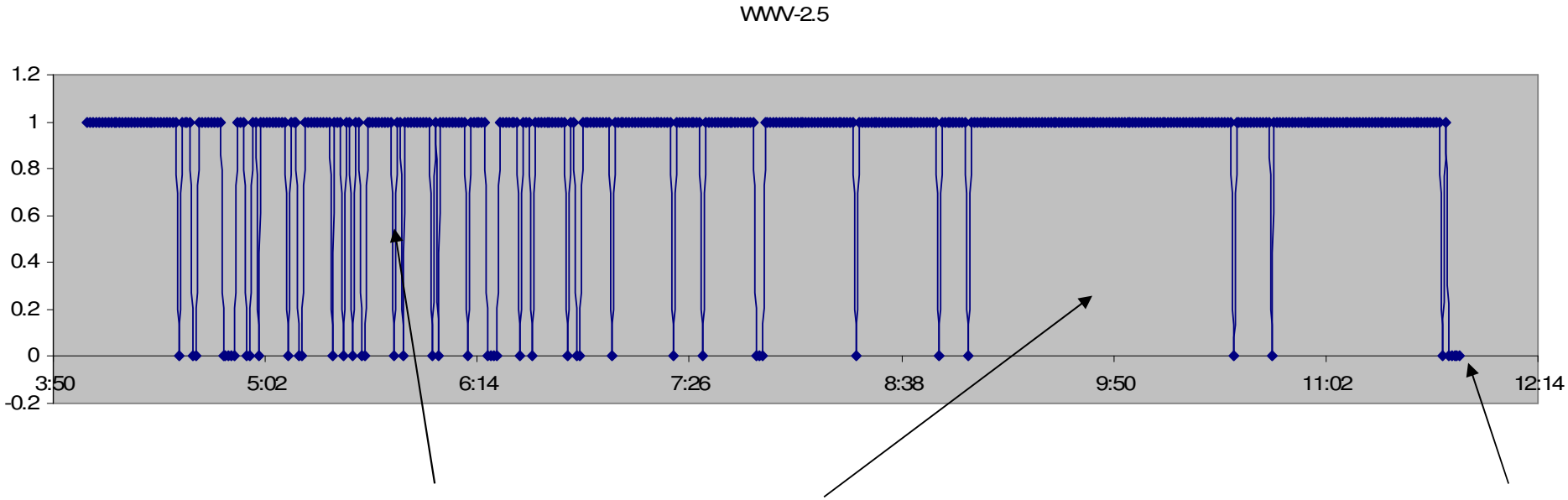
CHU 3.33 MHz Example



CHU SR ~ 11:53

HSV SR ~ 12:15

WWV 2.5 MHz Example



ARRL SSB DX
160m “crud”

Contesters asleep

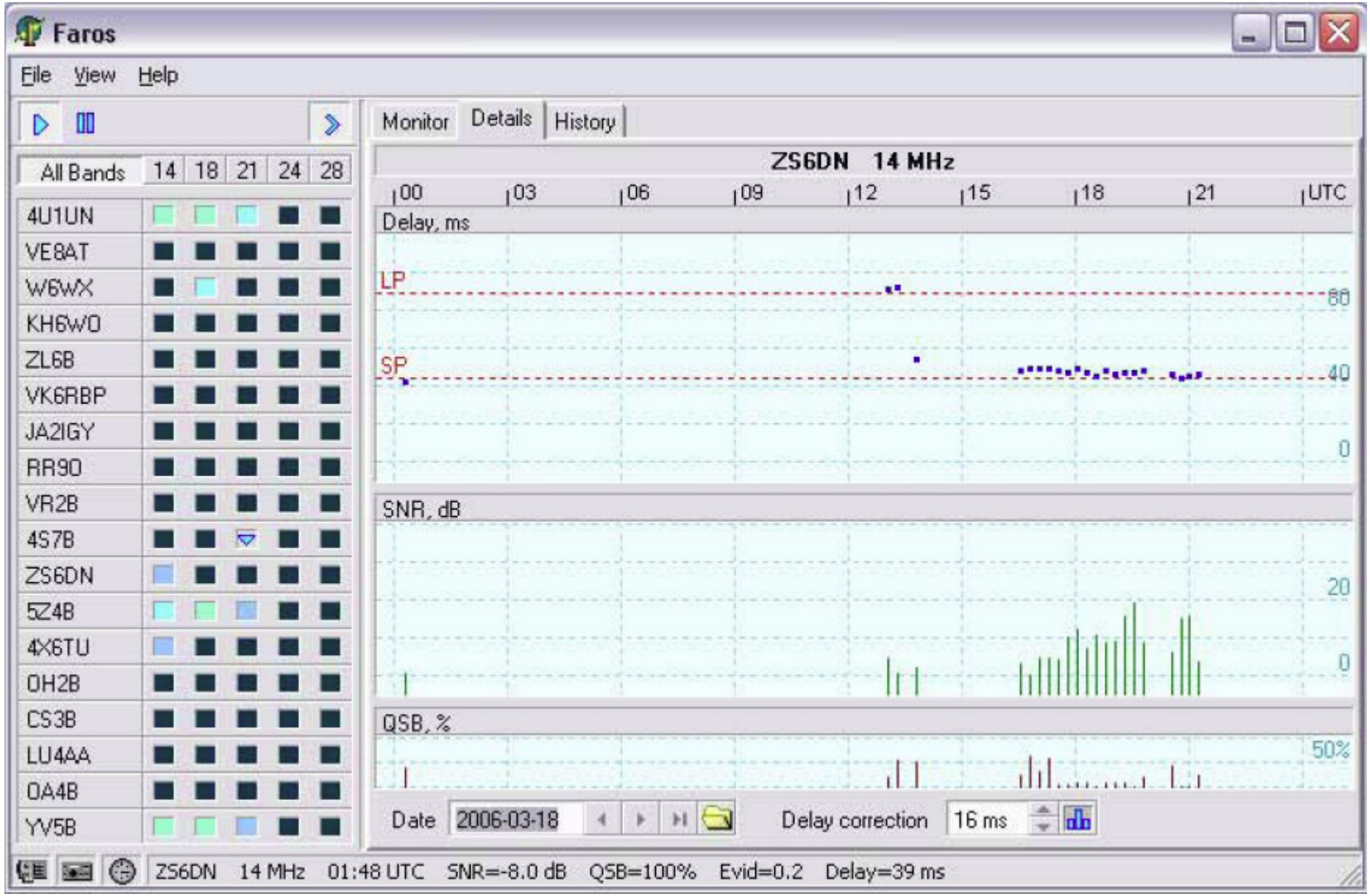
AM BCB harmonics,
daytime power

Needed

- “Minimum presence” time to reduce false positives due to noise.
- Scheduling: WWV/WWVH schedules are more complicated than shown, and fax utilities run on schedules.
- SNR calculation needs to be corrected and expressed in dB. SNR should be exported for plotting.

Niceties

- Support for more radios
- Integrate SoftRock tuning and demodulation
- Output in same graphical format as VE3NEA Faros.


Faros
File View Help
All Bands 14 18 21 24 28
4U1UN
VE8AT
W6WX
KH6WO
ZL6B
VK6RBP
JA2IGY
RR9O
VR2B
4S7B
ZS6DN
5Z4B
4X6TU
OH2B
CS3B
LU4AA
OA4B
YV5B
Monitor Details History
ZS6DN 14 MHz
00 03 06 09 12 15 18 21 UTC
Delay, ms
LP
SP
60
40
0
SNR, dB
20
0
QSB, %
50%
Date 2006-03-18
Delay correction 16 ms
ZS6DN 14 MHz 01:48 UTC SNR=-8.0 dB QSB=100% Evid=0.2 Delay=39 ms