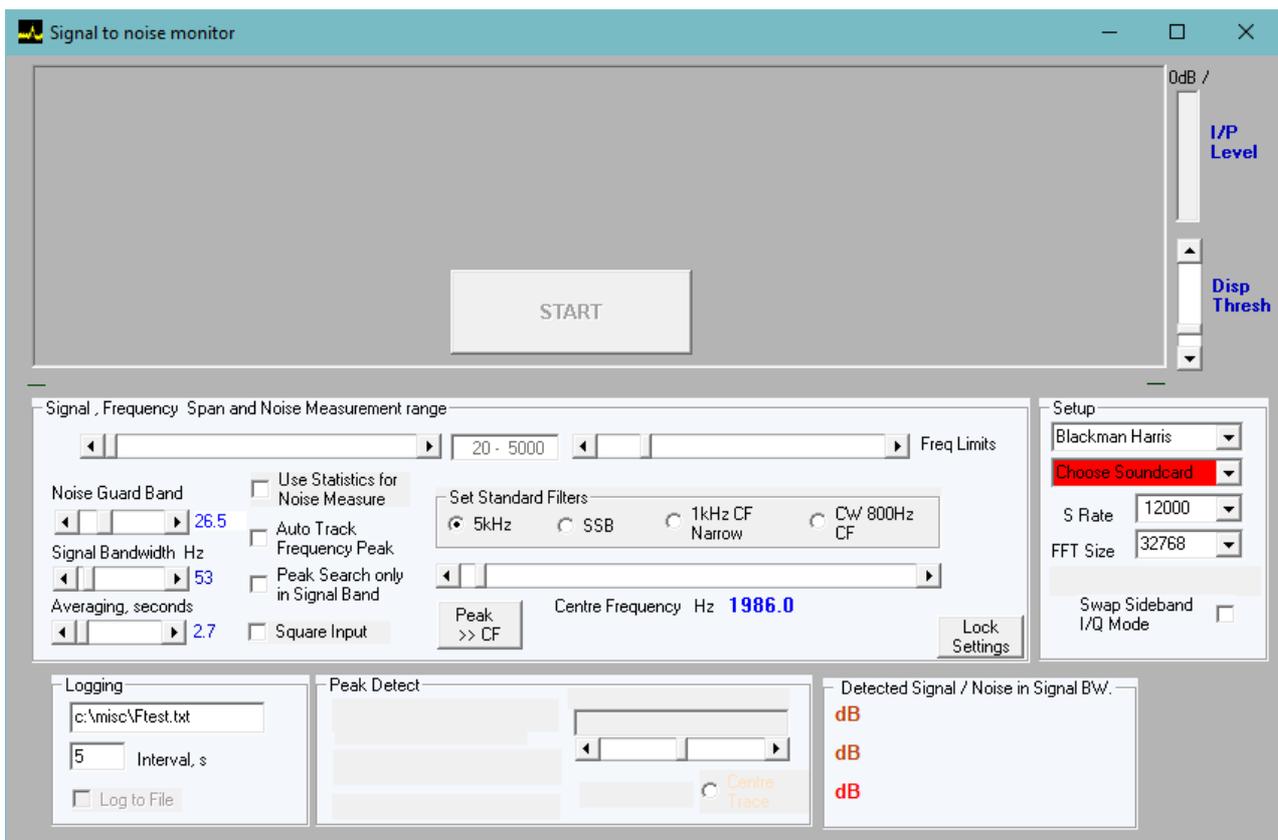


Beacon Monitoring Software

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The latest version of *SignalToNoiseMon* is an updated version *n* that now includes logging, and replaces the old *UWBCNMON* software. A number of new functions have been added

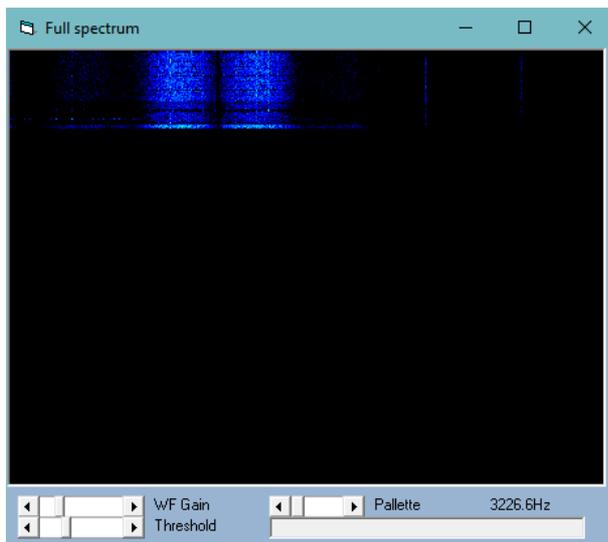
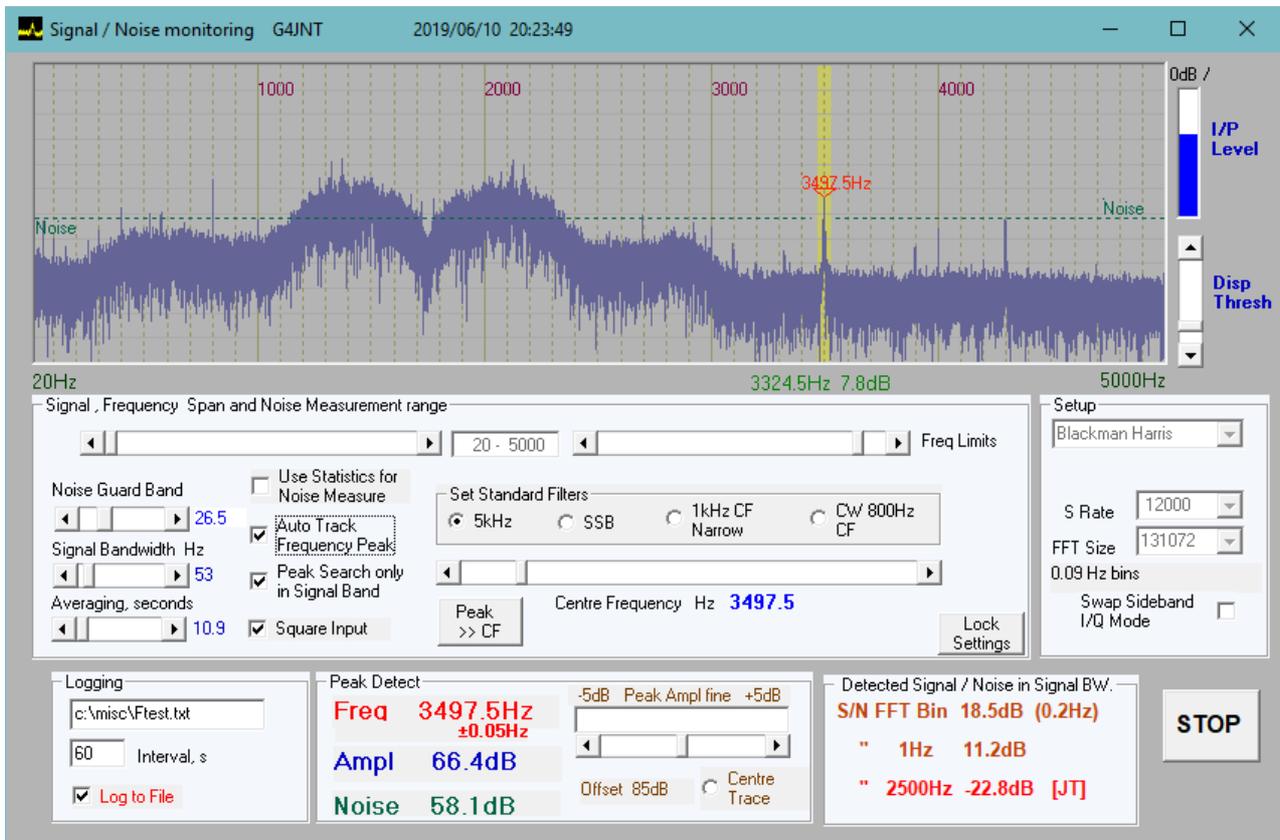
When you run *SignalToNoiseMon.exe*, you will be presented with a screen similar to the first one shown below.



Select your soundcard from the pulldown menu, initially highlighted in red as a warning to set this first before starting the software running. Once started running, the soundcard cannot be changed..

The monitoring software is designed to detect a single signal only, such as that transmitted from beacons transmitting a plain carrier. The audio from an SSB receiver is input to the soundcard which samples this. A Fourier Transform is performed on blocks of the digitised data and the detection software works on the signal power values output from the FFT routine.

The FFT size can be set from values between 1024 and 128K which, when combined with the choice in sampling rates, offers detection bin sizes of 47Hz down to 0.06Hz. This 'Bin bandwidth' value is the fundamental unit of measurement used from this point on within the detection algorithm. Select an appropriate size from the FFT Parameters menu, and press 'START'. After a short delay (depending on FFT size detected) this will change to a screen similar to that in the second picture.



The frequency span of interest can be adjusted to match the input signal using the two sliders to set upper and lower limits for tone frequency, or one of four preset standard filters can be applied. All subsequent signal detection is made on just the span shown in the spectrum display window, even if the input bandwidth is wider.

A small waterfall display shows the entire input spectrum from the soundcard

Ensure a single signal peak is visible in the spectrum display. Either click on this peak on the spectrum display, or move the 'Centre Frequency' slider to a value that covers the signal peak, or click the 'CF To Peak' button. Ensure the light yellow block on the display straddles the signal, the width of this can be varied with the 'Signal Bandwidth' control. This particular bandwidth is not used in the calculations, but is needed in order to encompass signals that are spread out from a carrier, such as Rainscatter, EME echoes and (possibly) modulation. Once the signal is centred, values will appear in the 'Detected Signal / Noise' window.

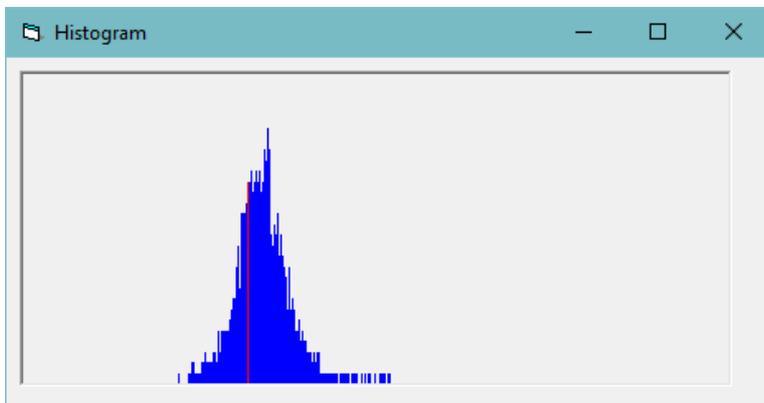
These are a measurement of (relative) signal and noise levels of the carrier, plus the S/N ratio measured in three different bandwidths : The FFT Bin size; normalised to 1Hz; and normalised to the 'standard' 2500Hz often taken for amateur communications calculations in an SSB channel.

On the spectrum display, the measured noise level is shown by the green line. The noise is measured by looking at all frequency bins that are separated from the signal by two signal-bandwidths – the spectral region used is shown by the green line. The noise level shown by the line is normalised to the 'Bin' bandwidth.

The highest signal peak detected is marked by the red arrow. If this meets the frequency selection criteria (it sits within the signal band) it is marked as valid and energy around it to the limit of the designated signal bandwidth is summed and normalised to the Bin bandwidth to get the signal power. If the '*AutoTrack Frequency Peak*' box is checked, a slowly drifting carrier will be followed automatically. Try slowly tuning the Rx or changing the frequency of the input signal to experiment with this function.

A history of the last N FFTs is kept in memory and used to calculate an average power level. The number kept in the history can be set between 2 to 64 by the 'No. of FFTs in Log History' control, but an optimum number is automatically calculated when the programme is started, based on FFT size and the required 'Stable Detection Period'.

If other carriers or interference are present, or the noise level is not flat, the spectrum used for the software can be reduced with the 'Constrain Frequency Band' control or the noise guard bands can be adjusted based on observation.



Alternatively, the '*Use Stats for Noise*' button can be ticked. In this case a different technique is used for determining the noise level based on statistics. The resulting measured noise level is shown by a purple line in addition to the green one. The colour of the reported noise level also changes to purple.

A histogram plot shows the statistical distribution of power levels in each FFT bin. Pure noise generates a more-or-less normal probability curve with strong

signals showing as low level spikes further to the right. The red line shows the lower quartile.

This statistical noise determination can be useful if other interfering signals are present as it is relatively immune to multiple narrowband interferers, however strong they may be.

The button labelled '*Peak Search in Signal Band Only*' allows a signal to be detected or tracked when it is not the highest peak in the spectrum window. Signal searching only takes place within the signal band, marked by the yellow highlight. It can be useful when signals need to be tracked in the presence of stronger ones, as is the case in the diagram above.

The fourth button, labelled '*Square Input*' can be used to recover a carrier from some types of modulation. In particular it will generate a carrier from a BPASK modulated waveform. The regenerated carrier tone is at twice the centre frequency of the BPSK waveform. This situation is the one in use for the screen shot shown

above. The main signal of interest forms the two broad peaks centred on 1.75kHz. The squaring operation results in a small component at 3.5kHz – the one being tracked. The squaring is applied to the whole input waveform from the sound card, so large numbers of second order intermodulation products will be generated, making this function only useful for some specialised operations. It was included specifically to allow tracking of the Es'Hail QO100 BPSK beacon. This is the signal shown above.

Logging to File

Logging the measured frequency and S/N results to file is started by entering a file name in the window and ticking the 'Log to File' button. The Signal, Noise and S/N normalised to 1Hz are saved as a comma separated file in the format *Time, Signal, Noise, S/N* :

```
20:07:33, 1999.51, 25.1, 1.2, 28.9
20:07:38, 1999.51, 25.2, 1.3, 29.0
20:07:43, 1999.51, 25.4, 4.5, 26.0
20:07:49, 1999.51, 25.2, 2.8, 27.5
```

No header or date information is stored; tests that straddle midnight or last several days will need manual intervention to sort out the time rollover.

Software is available from www.g4jnt.com/SignalToNoiseMon.exe