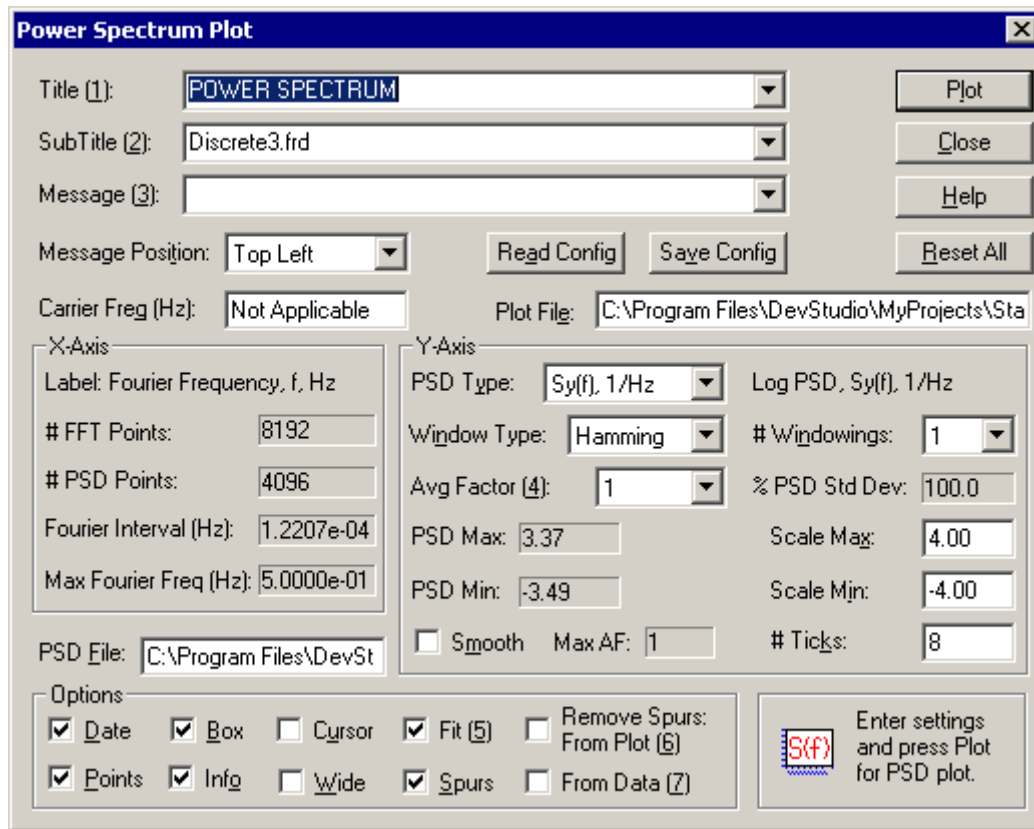


Stable32 Spur Detection, Analysis and Removal

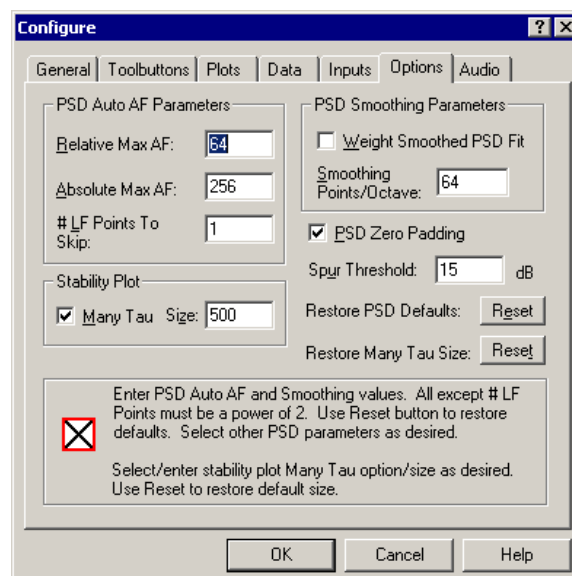
Stable32 Beta Version 1.54 of June 4, 2008 has several enhancements to its Power function, as seen in the following screen shot:



The **Power Spectrum Plot** dialog box contains the following controls:

- Title (1): POWER SPECTRUM
- SubTitle (2): Discrete3.frd
- Message (3):
- Message Position: Top Left
- Carrier Freq (Hz): Not Applicable
- Plot File: C:\Program Files\DevStudio\MyProjects\Sta
- X-Axis:
 - Label: Fourier Frequency, f, Hz
 - # FFT Points: 8192
 - # PSD Points: 4096
 - Fourier Interval (Hz): 1.2207e-04
 - Max Fourier Freq (Hz): 5.0000e-01
- Y-Axis:
 - PSD Type: Sy(f), 1/Hz
 - Log PSD, Sy(f), 1/Hz
 - Window Type: Hamming
 - # Windowings: 1
 - Avg Factor (4): 1
 - % PSD Std Dev: 100.0
 - PSD Max: 3.37
 - Scale Max: 4.00
 - PSD Min: -3.49
 - Scale Min: -4.00
 - ☐ Smooth
 - Max AF: 1
 - # Ticks: 8
- PSD File: C:\Program Files\DevSt
- Options:
 - ☒ Date
 - ☒ Box
 - ☐ Cursor
 - ☒ Fit (5)
 - ☐ Remove Spurs: From Plot (6)
 - ☒ Points
 - ☒ Info
 - ☐ Wide
 - ☒ Spurs
 - ☐ From Data (7)
- Enter settings and press Plot for PSD plot.

The Power Spectrum Plot dialog box has three new checkbox controls to activate the Spurs feature, Remove Spurs From Plot, and From Data. With the Spurs box checked, the PSD display includes heavy green vertical lines to denote the frequency and dBc level of any detected spurs, whose threshold exceeds that entered into the Spur Threshold edit control of the Options page of the Configure property sheet:



The **Configure** dialog box has the following tabs: General, Toolbuttons, Plots, Data, Inputs, Options, Audio.

PSD Auto AF Parameters:

- Relative Max AF: 64
- Absolute Max AF: 256
- # LF Points To Skip: 1

PSD Smoothing Parameters:

- ☐ Weight Smoothed PSD Fit
- Smoothing Points/Octave: 64
- ☒ PSD Zero Padding
- Spur Threshold: 15 dB
- Restore PSD Defaults: Reset
- Restore Many Tau Size: Reset

Stability Plot:

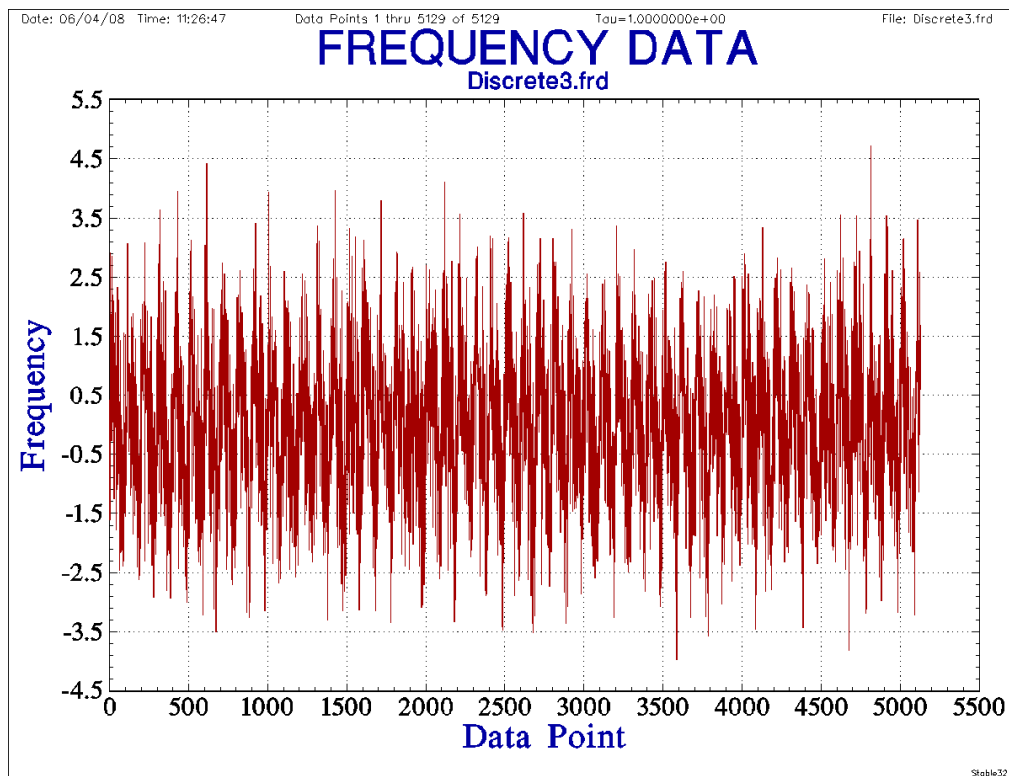
- ☒ Many Tau
- Size: 500

Enter PSD Auto AF and Smoothing values. All except # LF Points must be a power of 2. Use Reset button to restore defaults. Select other PSD parameters as desired.

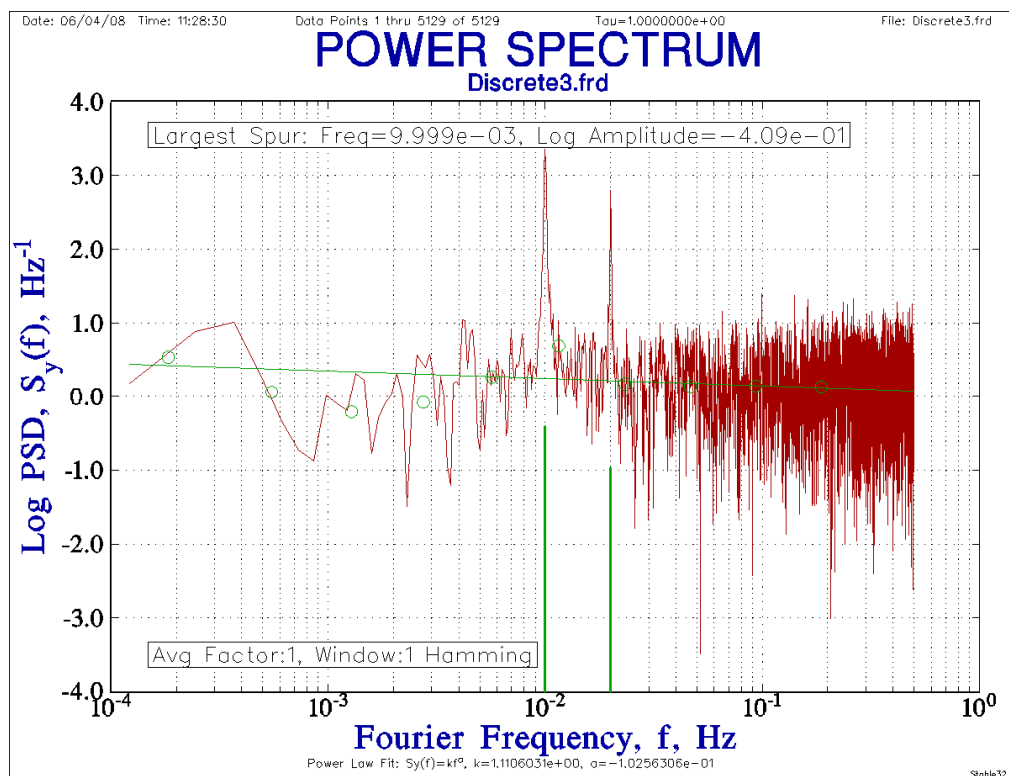
Select/enter stability plot Many Tau option/size as desired. Use Reset to restore default size.

OK Cancel Help

Here is some simulated frequency data that has periodic interference.



Two discrete spectral components can be clearly seen in the default PSD plot for these data with the Spurs checkbox activated:

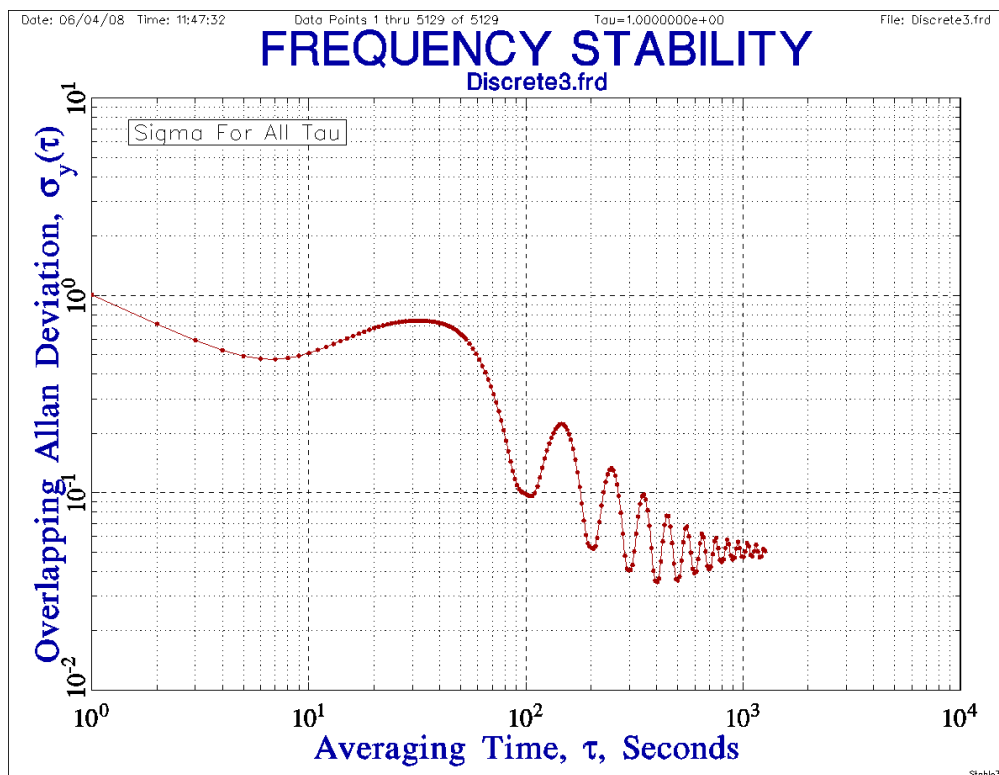


These PSD data are automatically written to a data file.

These spurs are also reported in the following text that is automatically written to the Windows clipboard:

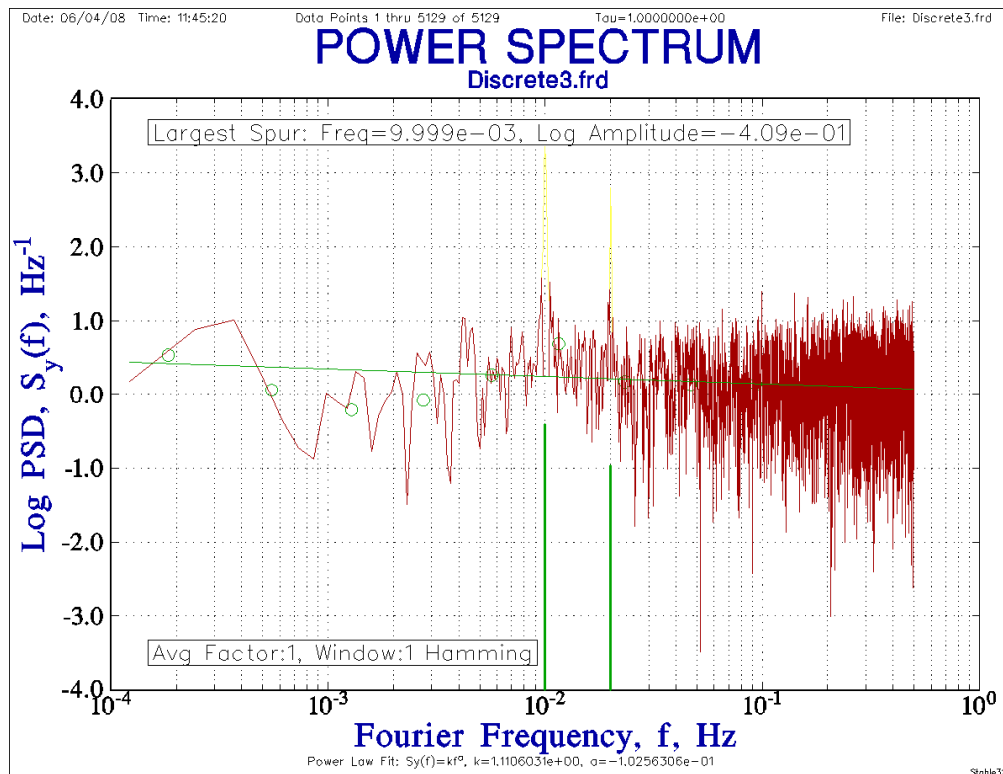
```
File: Discrete3.frd
PSD Type: Sy(f)
Avg Factor:1, Window:1 Hamming
Log Spur Threshold = 1.500e+00 (x31.62)
ENBW = 1.664e-04 Hz, Log NB Corr = -3.78
PSD Discrete Spurs:
Spur FFT  Spur      Discrete
Bin  Frequency Amplitude
#    #          Hz      Log df/f
1    81    9.999e-03 -4.09e-01
2    163   2.000e-02 -9.65e-01
```

The spurs are large enough to have a significant effect of the time domain stability, as shown in the following All Tau Allan deviation plot:



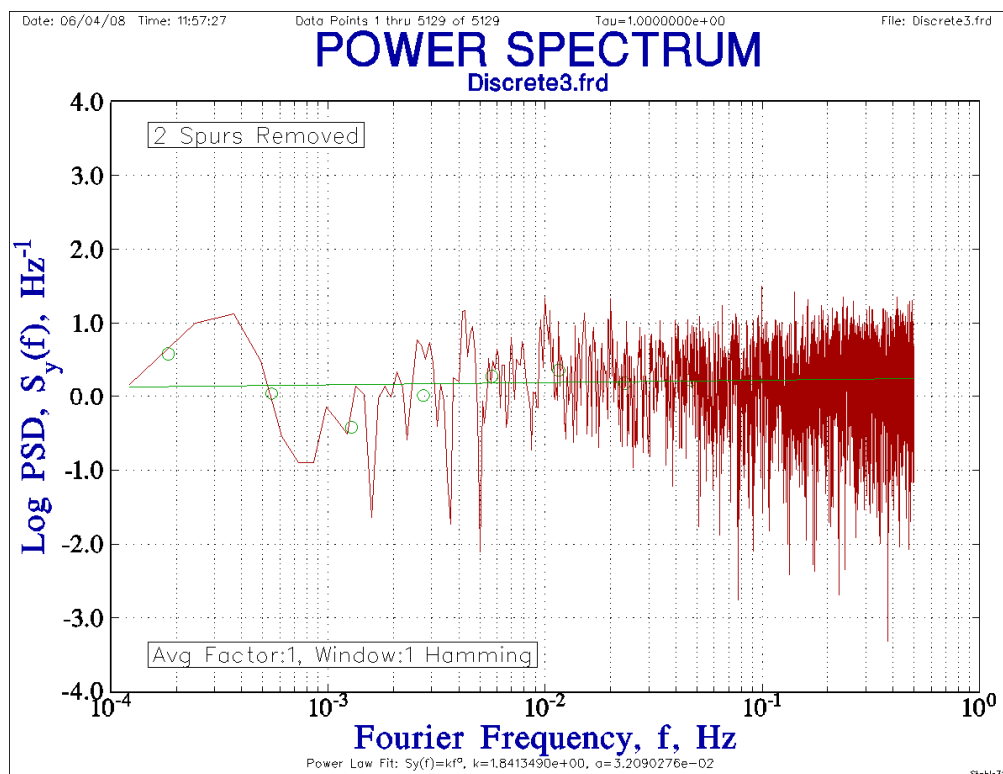
The ADEV plot begins at the correct simulated white FM noise value of 1.0 at $\tau = 1$, but then shows a strong periodic component rather than the normal $\tau^{-1/2}$ slope.

Activating the Remove Spurs From Plot checkbox changes the PSD plot to the following:



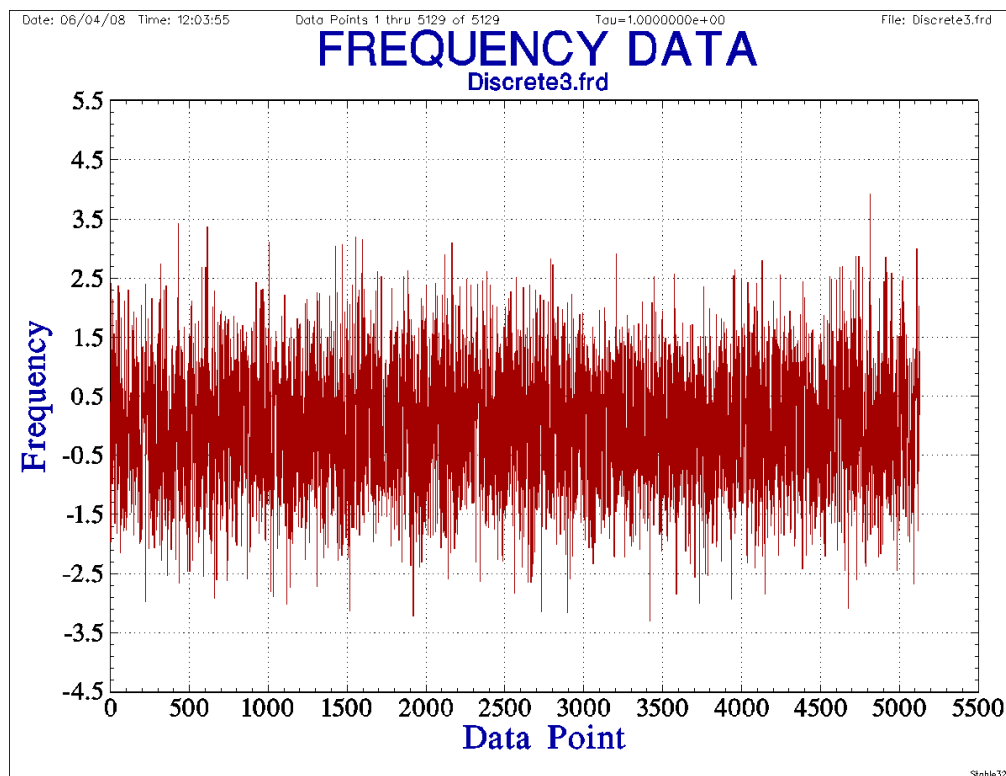
Here the two spurs are removed (denoted by faint yellow points) down to the 1.5 log $S_y(f)$ threshold level.

Activating the Remove Spurs From Data checkbox and repeating the PSD calculation several times gradually eliminates the spurious energy from the frequency data down to the threshold level:



The corrected frequency data is available for further analysis.

The frequency data no longer has obvious interference:



And the time domain stability is now as expected for only the white FM noise:

