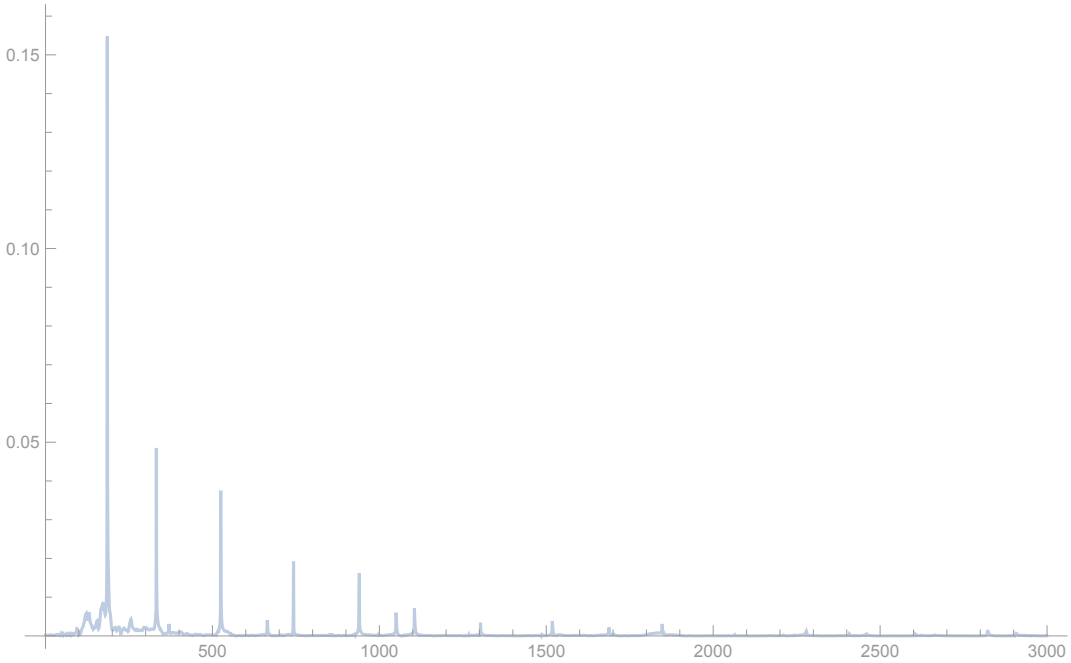
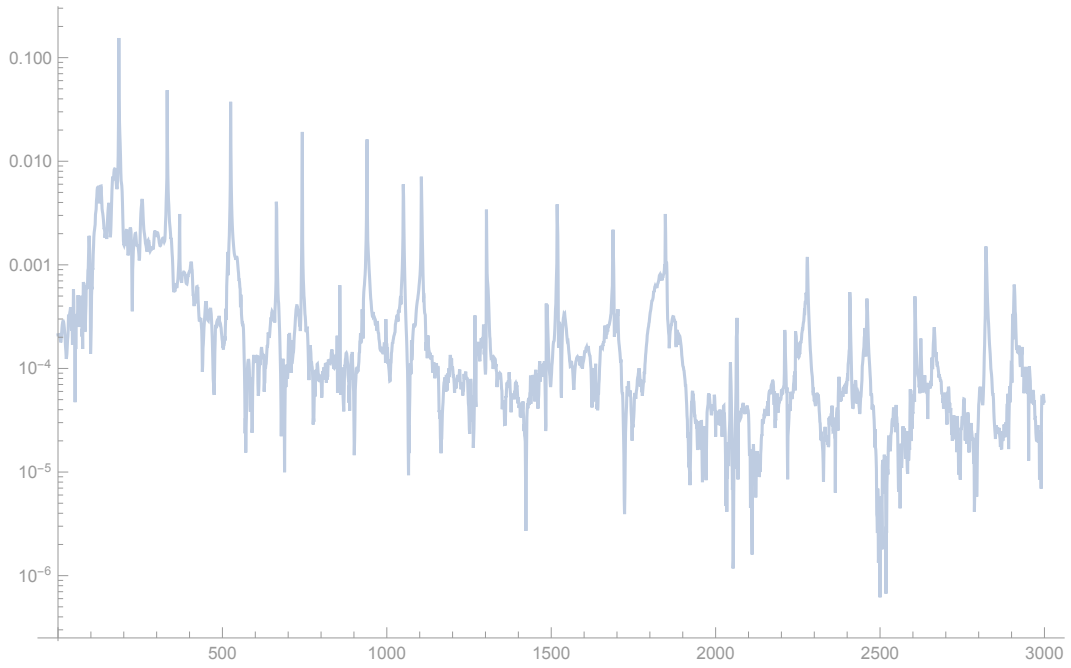
Analyzing the strings of the hyperPiano

```
allFiles = FileNames["*.wav", NotebookDirectory[] <> "hyperOctaveSoundFiles"];
analyze[file_] := Module[{},
    data = First@Import[file, "Data"];
    sr = 44 100; nfft = 44 100;
    wav = data[[1 ;; nfft]];
    spec = Abs[Fourier[wav, FourierParameters → {-1, 1}]];
    ssf = N[Range[0, sr / 2, sr / nfft]];
    maxFreq = 3000;
    numDisp = Length[Select[ssf, # < maxFreq &]];];

thisFile = allFiles[[1]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All] ,
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 185
```

```
10 Low A
```





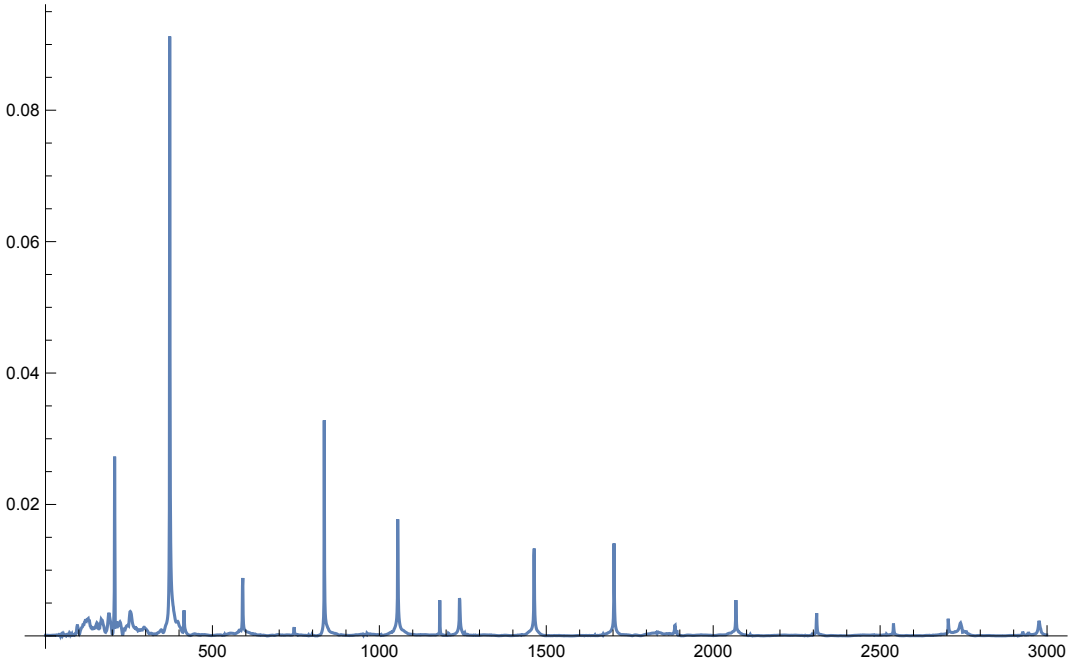

```
{{186, 0.154748}, {333, 0.0485249}, {371, 0.00309703},
 {526, 0.037478}, {665, 0.00406303}, {744, 0.0191849}, {941, 0.0162405},
 {1051, 0.00599007}, {1106, 0.00709346}, {1304, 0.0034097},
 {1519, 0.00383907}, {1689, 0.0021842}, {1848, 0.00309746}}
```

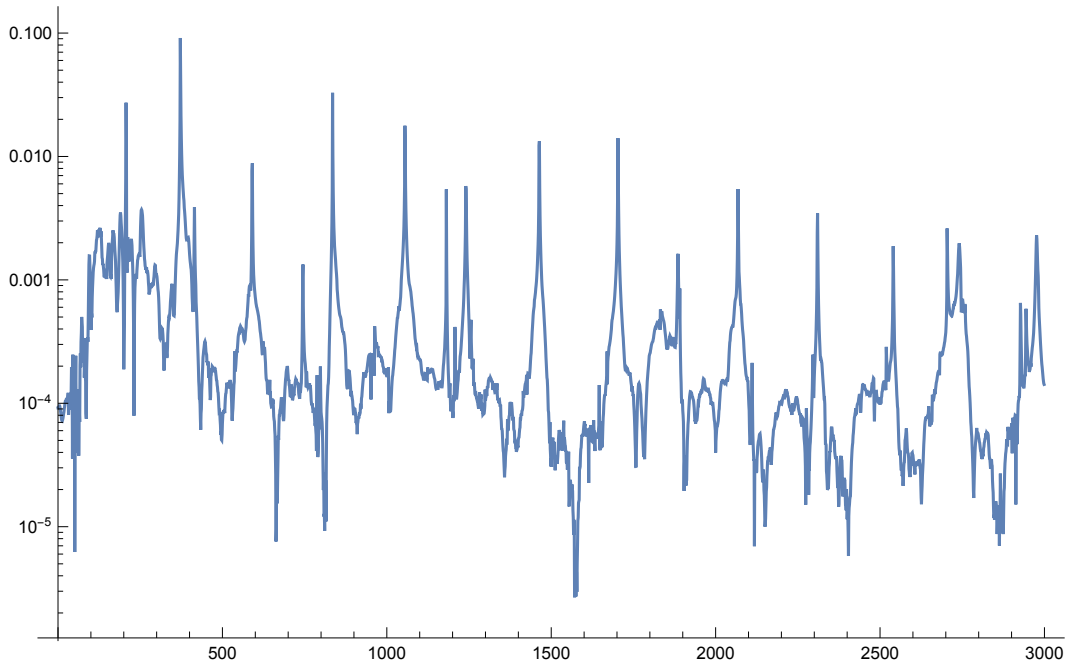
```
{185., 332., 370., 525., 664., 743., 940., 1050., 1105., 1303., 1518., 1688., 1847.}
```

```
{1., 1.79459, 2., 2.83784, 3.58919, 4.01622,
 5.08108, 5.67568, 5.97297, 7.04324, 8.20541, 9.12432, 9.98378}
```

```
thisFile = allFiles[[2]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
   ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 207
```

11 Low A♯





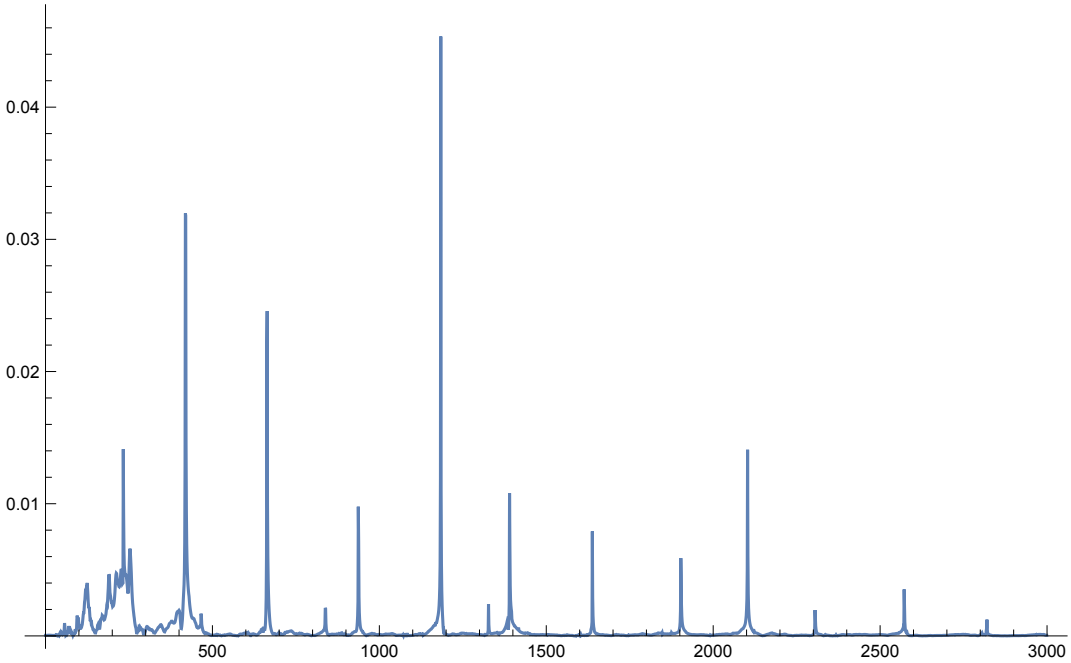
```
{{208, 0.0272831}, {213, 0.00222399}, {373, 0.0912233}, {416, 0.0038899},
 {592, 0.00881517}, {836, 0.0328078}, {1056, 0.0177557}, {1182, 0.00542485},
 {1241, 0.00575644}, {1465, 0.0132942}, {1704, 0.0140811}, {2069, 0.00544705},
 {2311, 0.00346186}, {2541, 0.00187658}, {2705, 0.00261229}}
```

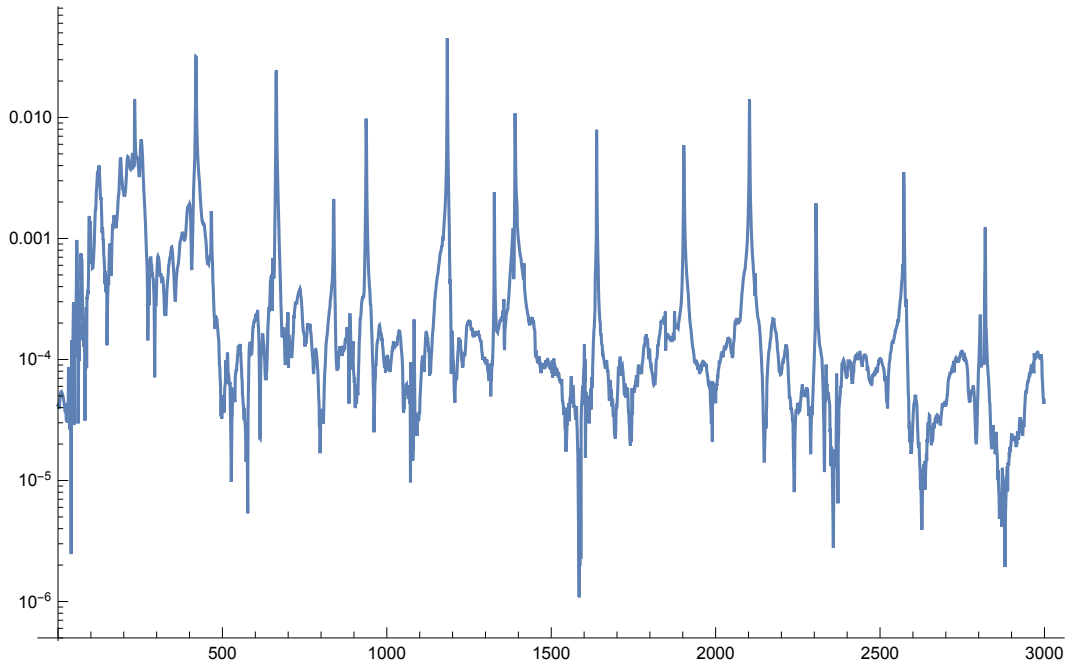
```
{207., 212., 372., 415., 591., 835., 1055.,
 1181., 1240., 1464., 1703., 2068., 2310., 2540., 2704.}
```

```
{1., 1.02415, 1.7971, 2.00483, 2.85507, 4.03382, 5.09662, 5.70531,
 5.99034, 7.07246, 8.22705, 9.99034, 11.1594, 12.2705, 13.0628}
```

```
thisFile = allFiles[[3]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 233
```

```
12 Low B
```





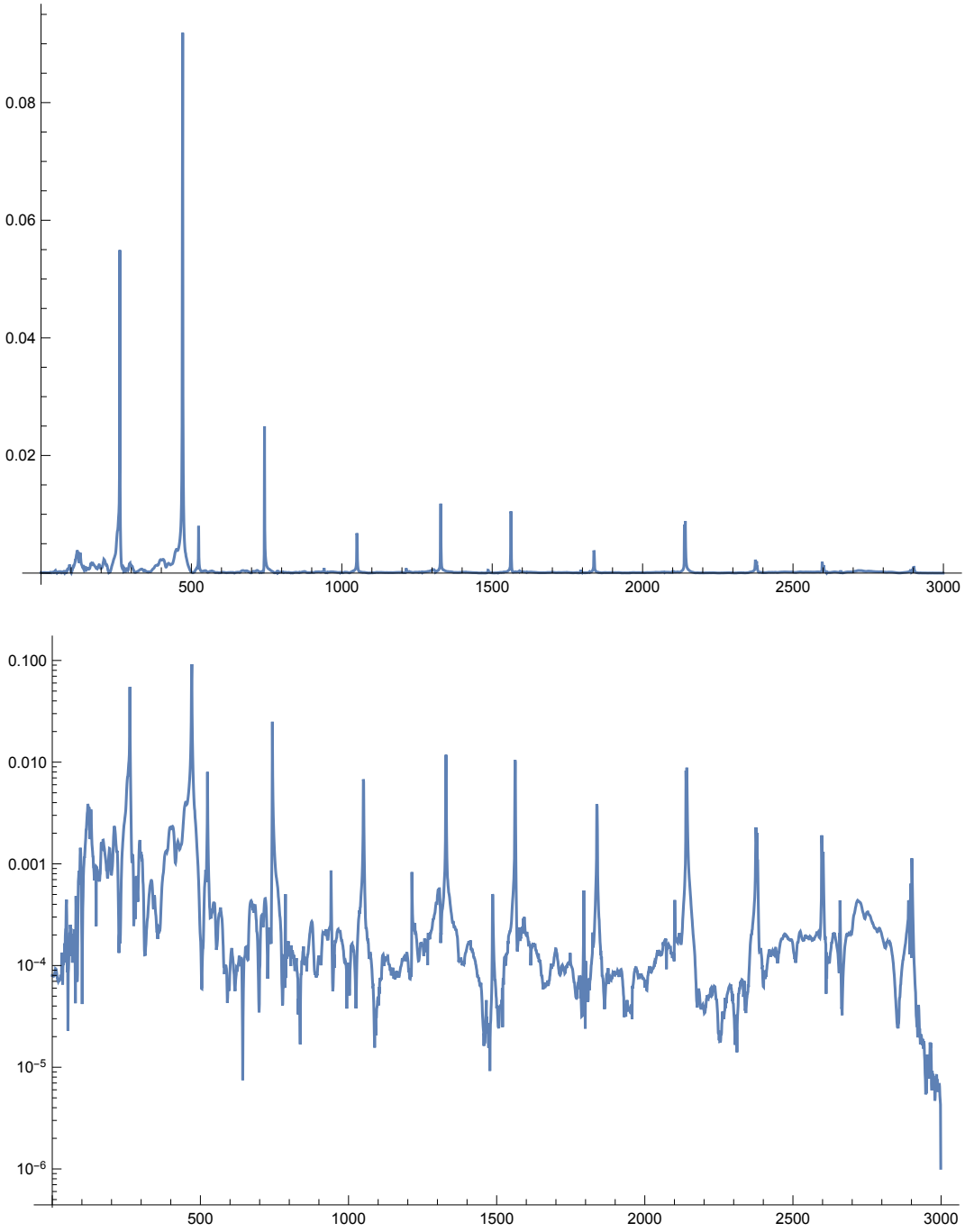

```
{{234, 0.014132}, {420, 0.0319611}, {467, 0.00168249}, {665, 0.0245715},
 {839, 0.00211423}, {938, 0.0097751}, {1185, 0.045348}, {1328, 0.00241053},
 {1391, 0.0107988}, {1639, 0.00790812}, {1904, 0.00588356}, {2104, 0.0140832},
 {2306, 0.00195377}, {2573, 0.00351739}, {2821, 0.00123333}}
```

```
{233., 419., 466., 664., 838., 937., 1184.,
 1327., 1390., 1638., 1903., 2103., 2305., 2572., 2820.}
```

```
{1., 1.79828, 2., 2.84979, 3.59657, 4.02146, 5.08155, 5.69528,
 5.96567, 7.03004, 8.16738, 9.02575, 9.8927, 11.0386, 12.103}
```

```
thisFile = allFiles[[4]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 262
```

```
13 Middle C
```



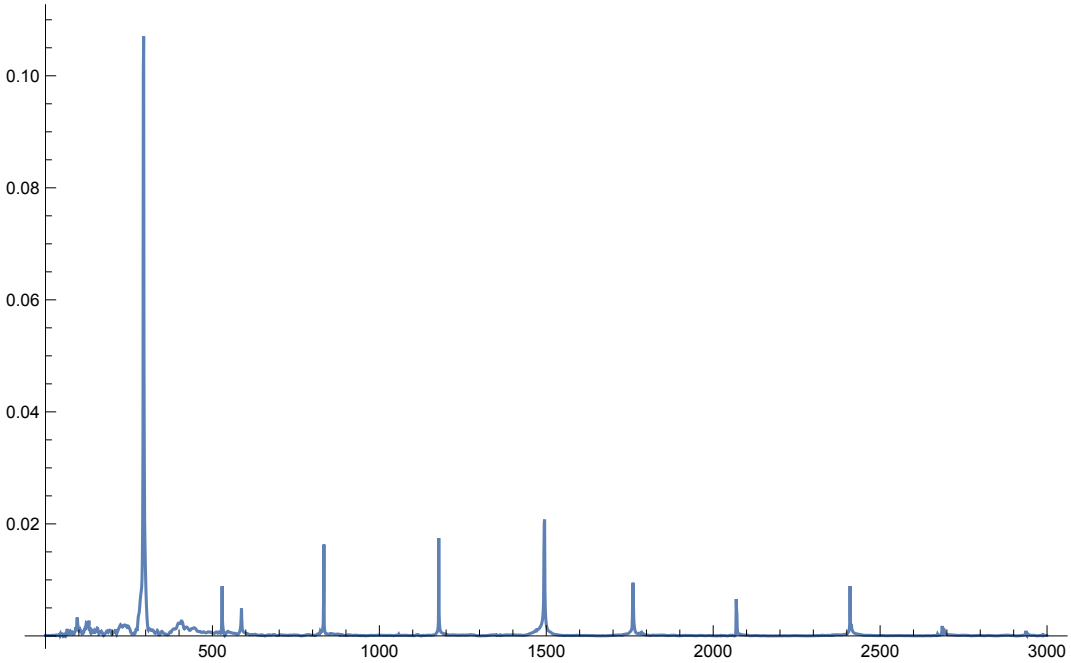
```
{{125, 0.00361536}, {131, 0.00343854}, {263, 0.0549202},
 {472, 0.0918606}, {525, 0.00800977}, {744, 0.0249686}, {1051, 0.00678166},
 {1215, 0.000829601}, {1330, 0.0118111}, {1563, 0.0105016}, {1839, 0.00385721},
 {2140, 0.00826307}, {2143, 0.00883363}, {2376, 0.00228174},
 {2380, 0.00200966}, {2598, 0.00190876}, {2902, 0.00113497}}
```

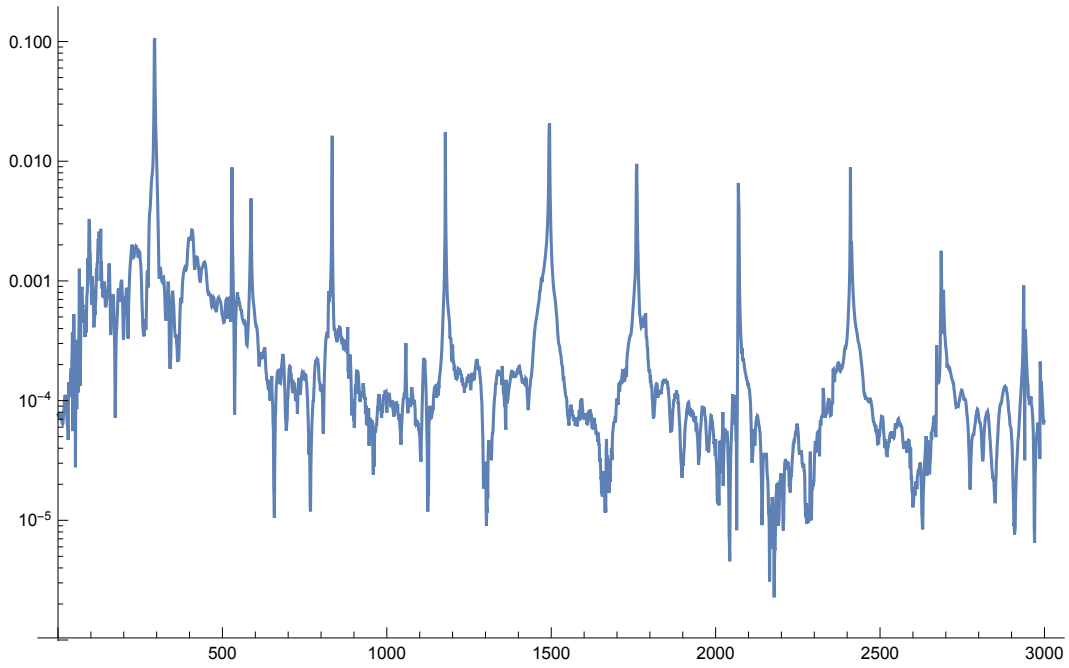
```
{124., 130., 262., 471., 524., 743., 1050., 1214.,
 1329., 1562., 1838., 2139., 2142., 2375., 2379., 2597., 2901.}
```

```
{0.473282, 0.496183, 1., 1.79771, 2., 2.83588, 4.00763, 4.63359, 5.07252,
 5.96183, 7.01527, 8.16412, 8.17557, 9.06489, 9.08015, 9.91221, 11.0725}
```

```
thisFile = allFiles[[5]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 294
```

```
14 High C♯
```





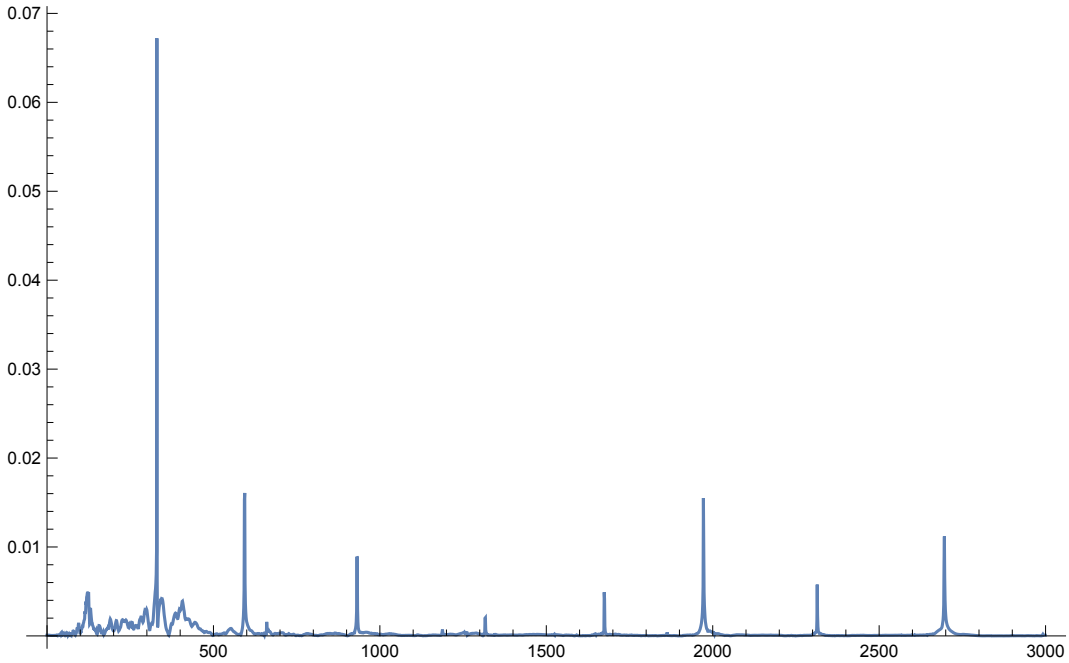

```
{{66, 0.00126485}, {96, 0.00328463}, {126, 0.00258185}, {131, 0.00272532},
 {295, 0.10702}, {530, 0.00888655}, {588, 0.00488748}, {835, 0.0163224},
 {1179, 0.0174697}, {1496, 0.0207639}, {1761, 0.00950054}, {2070, 0.00658516},
 {2411, 0.00890403}, {2414, 0.00212268}, {2687, 0.00178565}}
```

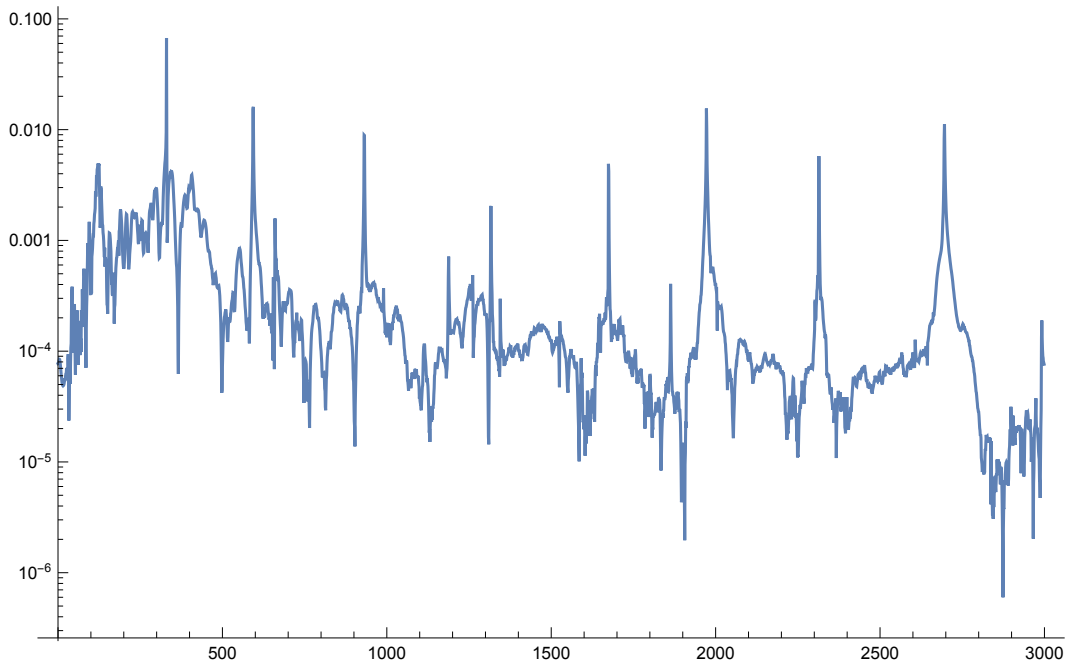
```
{65., 95., 125., 130., 294., 529., 587.,
 834., 1178., 1495., 1760., 2069., 2410., 2413., 2686.}
```

```
{0.221088, 0.323129, 0.42517, 0.442177, 1., 1.79932, 1.9966,
 2.83673, 4.0068, 5.08503, 5.98639, 7.03741, 8.19728, 8.20748, 9.13605}
```

```
thisFile = allFiles[[6]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
15 High D
```





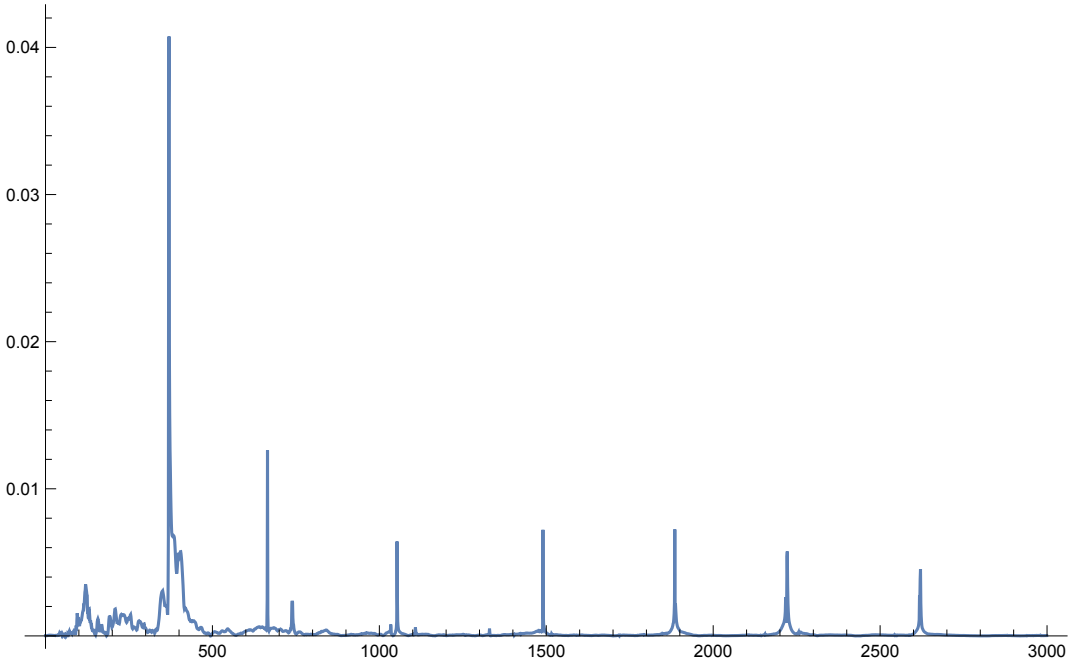

```
{{115, 0.00277162}, {118, 0.00386905}, {126, 0.00491817},
 {131, 0.00300419}, {331, 0.0672061}, {595, 0.016075}, {661, 0.00157856},
 {932, 0.00892604}, {1318, 0.00204388}, {1675, 0.00491004},
 {1973, 0.0155064}, {2315, 0.00577063}, {2697, 0.0111862}}
```

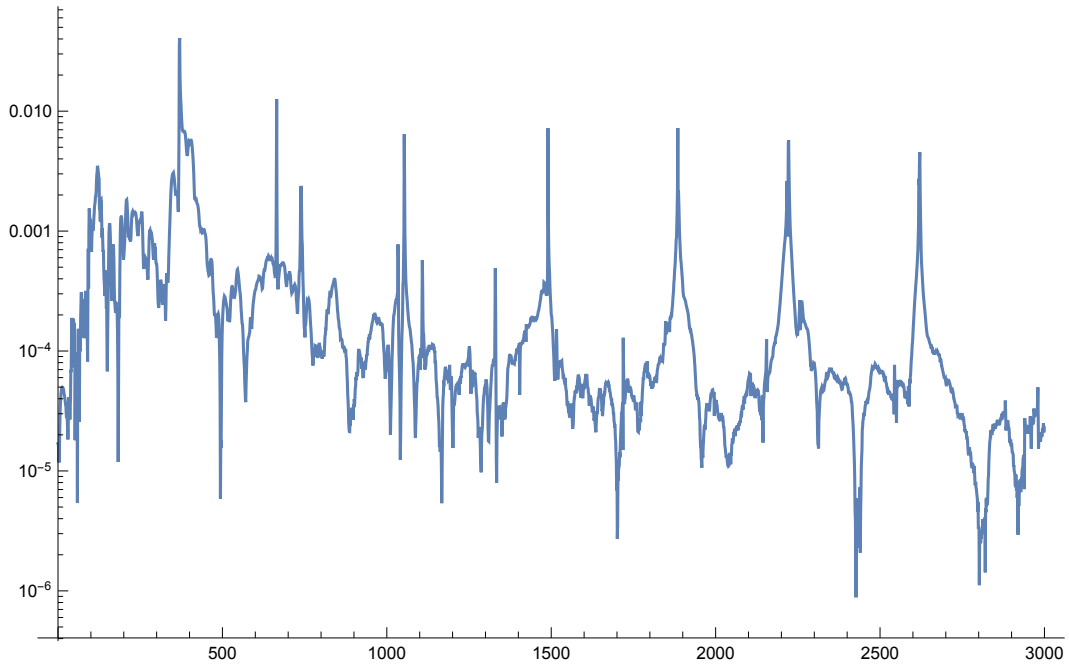
```
{114., 117., 125., 130., 330., 594., 660., 931., 1317., 1674., 1972., 2314., 2696.}
```

```
{0.345455, 0.354545, 0.378788, 0.393939, 1., 1.8,
 2., 2.82121, 3.99091, 5.07273, 5.97576, 7.01212, 8.1697}
```

```
thisFile = allFiles[[7]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
16 High D⌗
```





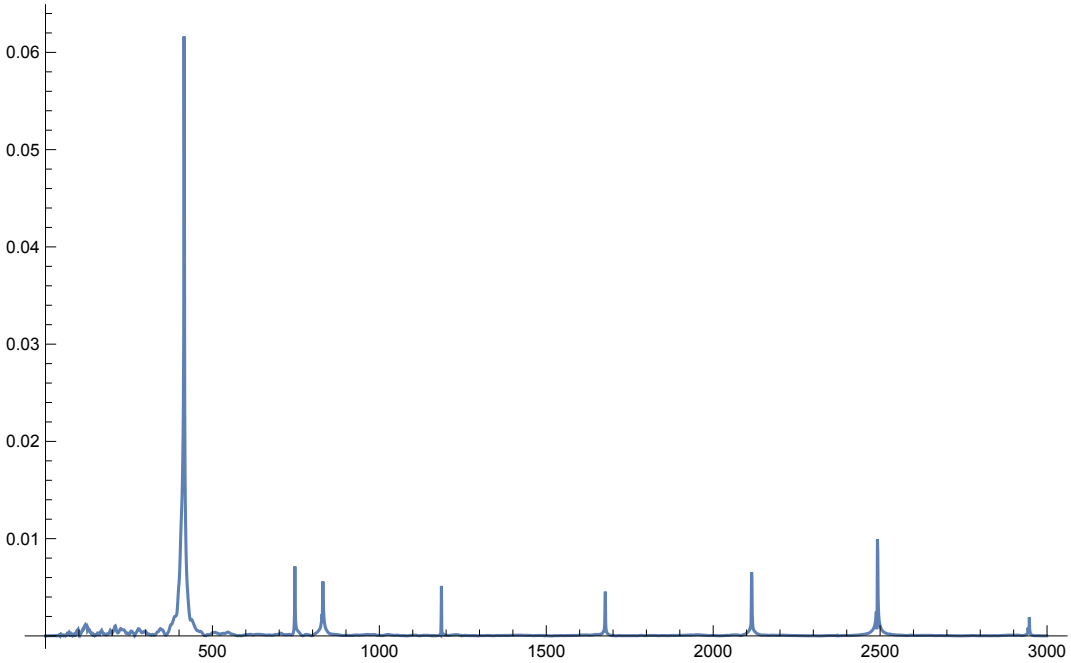

```
{{371, 0.040745}, {666, 0.0126131}, {1054, 0.00641863},
 {1491, 0.00721165}, {1886, 0.00723746}, {2218, 0.00261807},
 {2223, 0.00573712}, {2619, 0.00272734}, {2622, 0.00453382}}
```

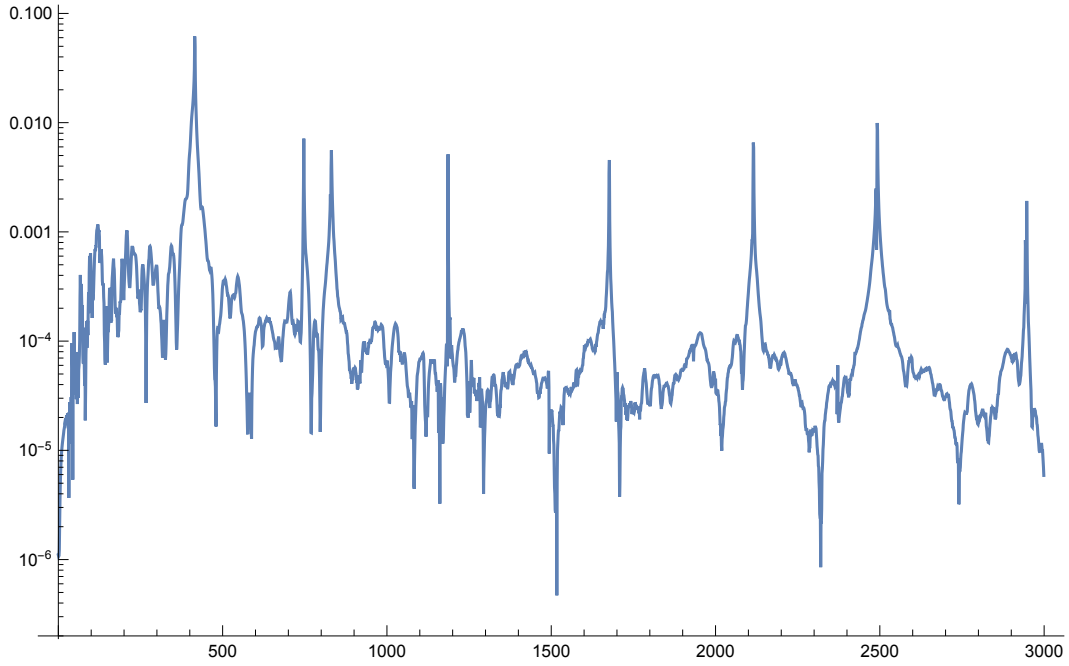
```
{370., 665., 1053., 1490., 1885., 2217., 2222., 2618., 2621.}
```

```
{1., 1.7973, 2.84595, 4.02703, 5.09459, 5.99189, 6.00541, 7.07568, 7.08378}
```

```
thisFile = allFiles[[8]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
17 High E
```





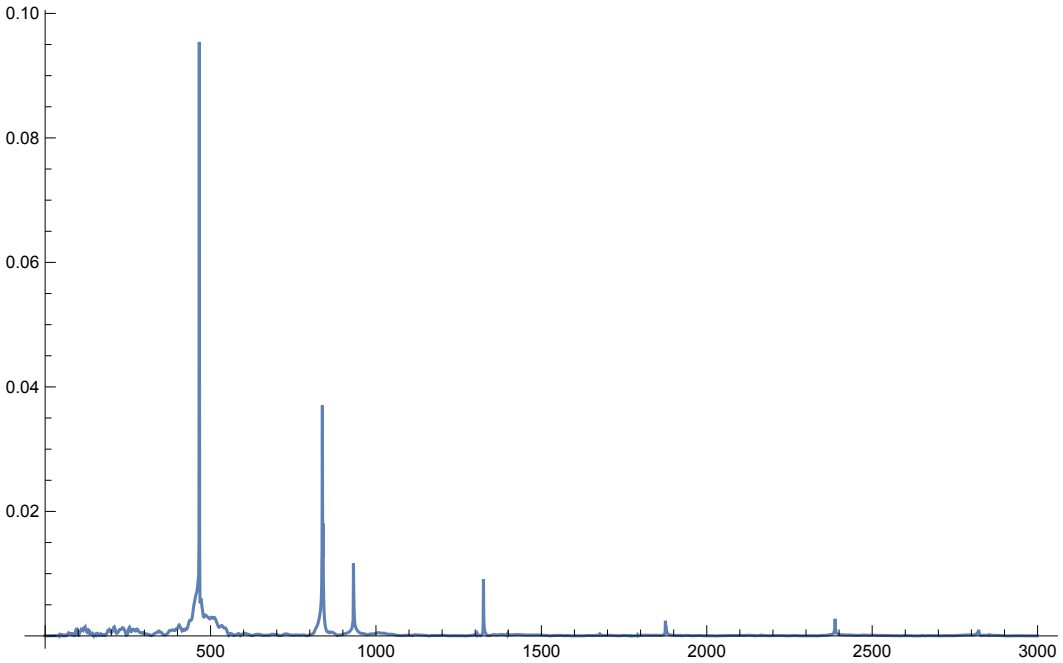

```
{{416, 0.0616379}, {748, 0.00714337}, {829, 0.00220796}, {832, 0.00559802},
 {1187, 0.00513874}, {1678, 0.00455137}, {2116, 0.00657077},
 {2490, 0.00250041}, {2493, 0.00993155}, {2948, 0.00192014}}
```

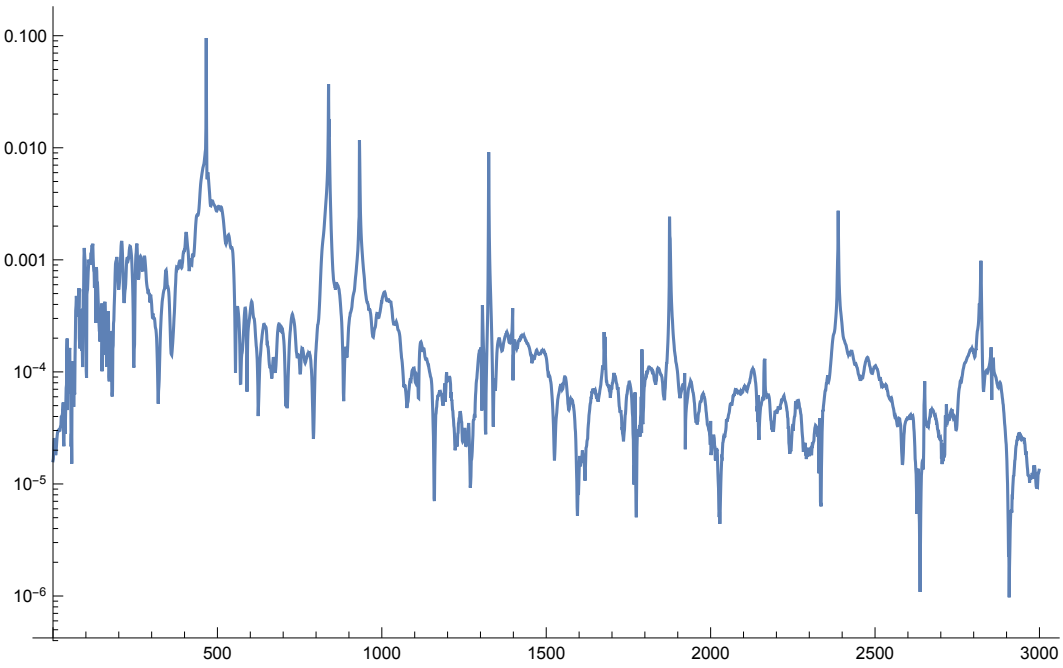
```
{415., 747., 828., 831., 1186., 1677., 2115., 2489., 2492., 2947.}
```

```
{1., 1.8, 1.99518, 2.00241, 2.85783, 4.04096, 5.09639, 5.99759, 6.00482, 7.1012}
```

```
thisFile = allFiles[[9]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
18 High F
```





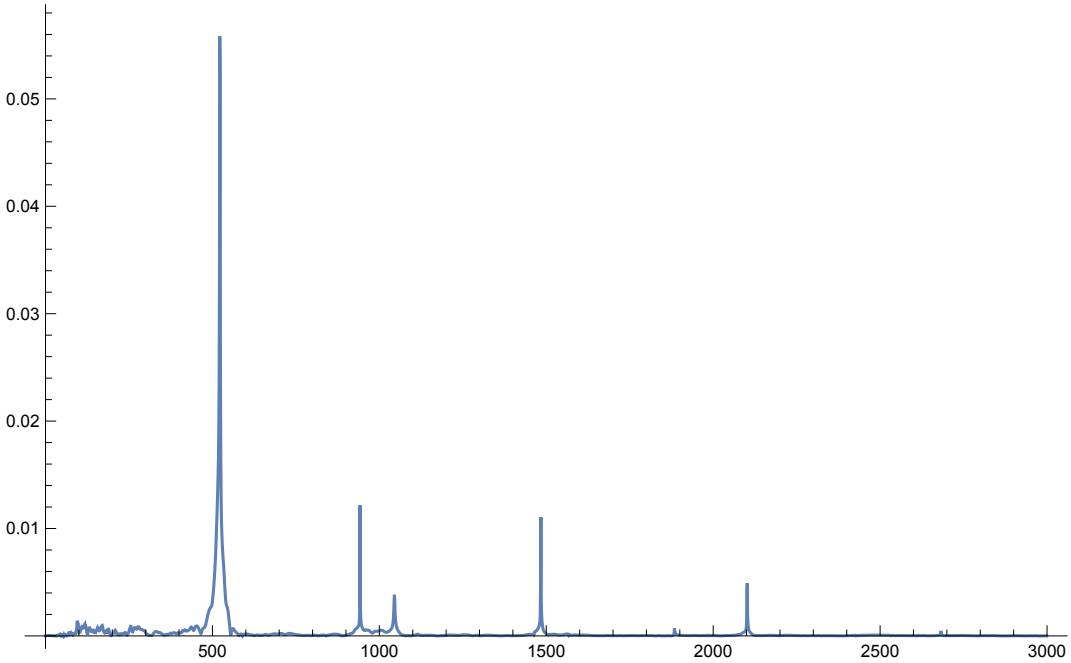

```
{{467, 0.0954217}, {839, 0.0370113}, {841, 0.0180741}, {933, 0.0117051},
 {1326, 0.00914323}, {1876, 0.00242439}, {2389, 0.00274268}}
```

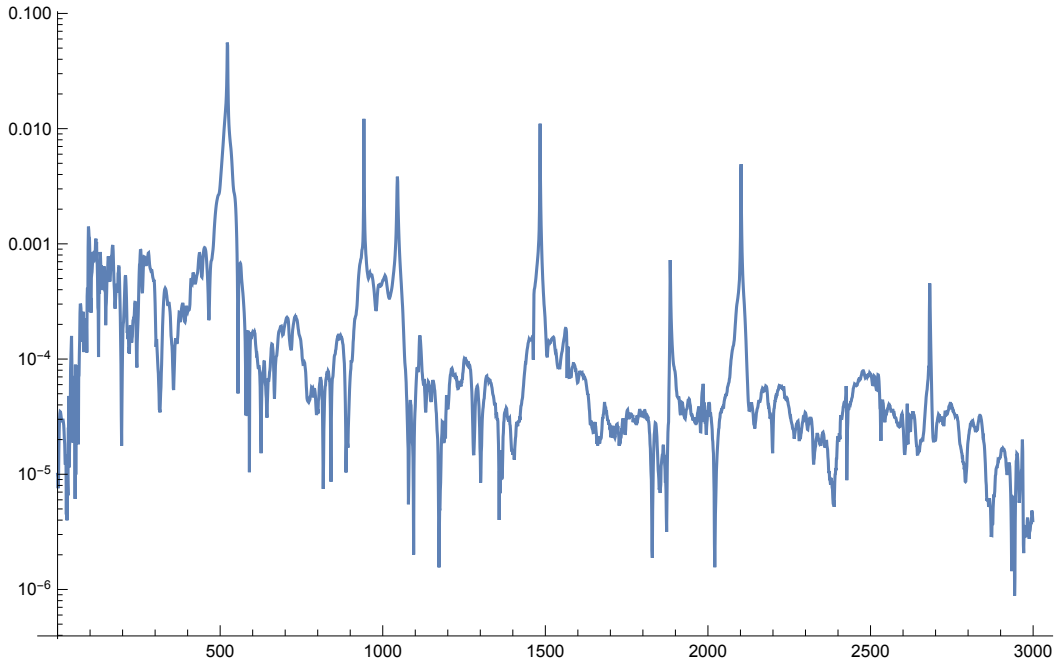
```
{466., 838., 840., 932., 1325., 1875., 2388.}
```

```
{1., 1.79828, 1.80258, 2., 2.84335, 4.02361, 5.12446}
```

```
thisFile = allFiles[[10]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
19 High F⌗
```





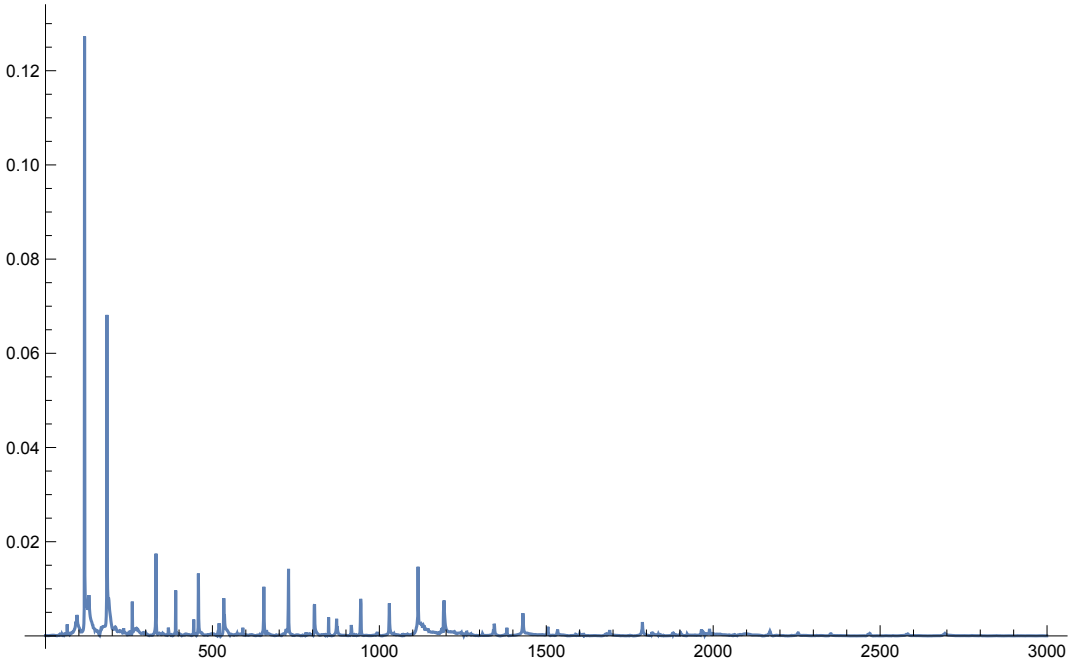

```
{{523, 0.0558117}, {943, 0.0121661},
 {1046, 0.00382886}, {1485, 0.0110412}, {2103, 0.00491486}}
```

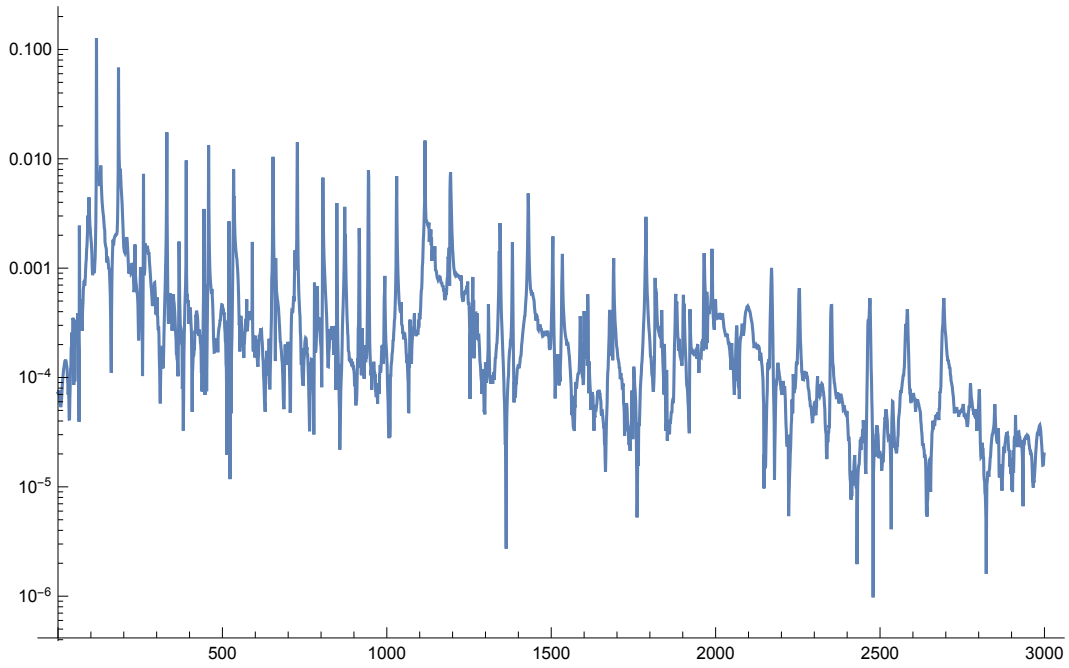
```
{522., 942., 1045., 1484., 2102.}
```

```
{1., 1.8046, 2.00192, 2.84291, 4.02682}
```

```
thisFile = allFiles[[11]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 65
```

```
1 Low C
```


0.12
0.10
0.08
0.06
0.04
0.02
500
1000
1500
2000
2500
3000


0.100
0.010
0.001
10^-4
10^-5
10^-6
500
1000
1500
2000
2500
3000

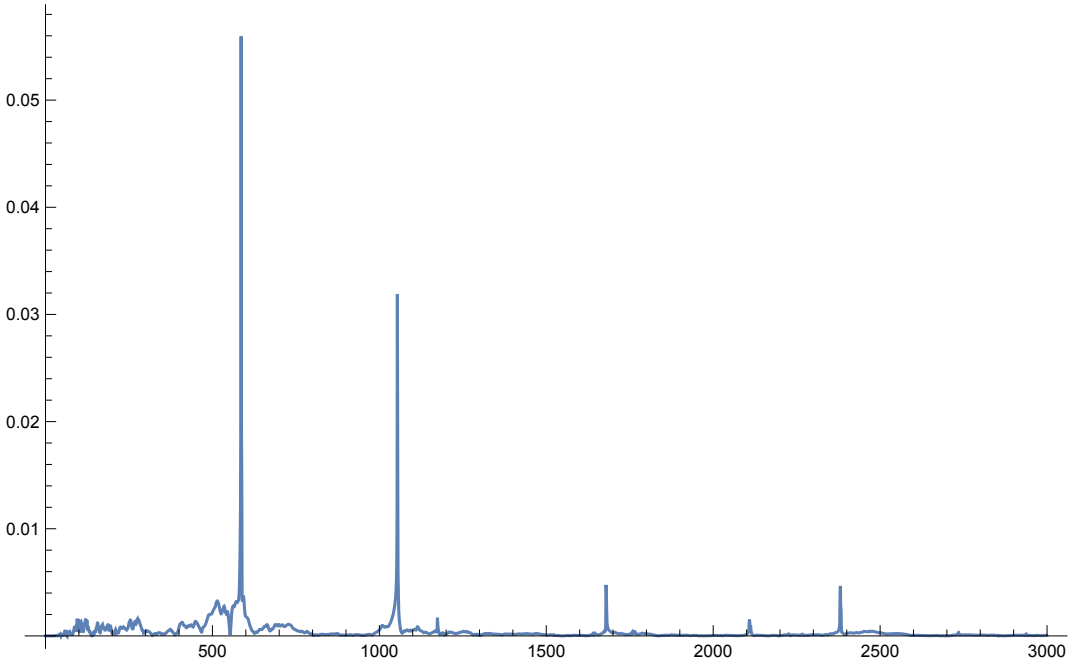
```
{{66, 0.00244855}, {92, 0.00302586}, {95, 0.00444616},
 {118, 0.127273}, {126, 0.00686399}, {128, 0.00651403}, {131, 0.00867106},
 {185, 0.0681571}, {235, 0.00164623}, {261, 0.00728169}, {332, 0.0174651},
 {369, 0.00174955}, {391, 0.00965099}, {445, 0.00347925}, {459, 0.0132403},
 {521, 0.00268278}, {535, 0.00800144}, {537, 0.00453486}, {592, 0.00173673},
 {655, 0.0104296}, {663, 0.00123636}, {729, 0.014234}, {781, 0.00073696},
 {807, 0.00672277}, {849, 0.00393951}, {873, 0.00363628}, {875, 0.00205552},
 {917, 0.00232098}, {945, 0.00786842}, {1031, 0.00691739}, {1117, 0.014684},
 {1129, 0.00260482}, {1137, 0.00189757}, {1195, 0.00753485},
 {1343, 0.00143097}, {1345, 0.00258366}, {1383, 0.00173297},
 {1431, 0.00481592}, {1506, 0.00194788}, {1789, 0.00294842}, {1990, 0.001502}}
```

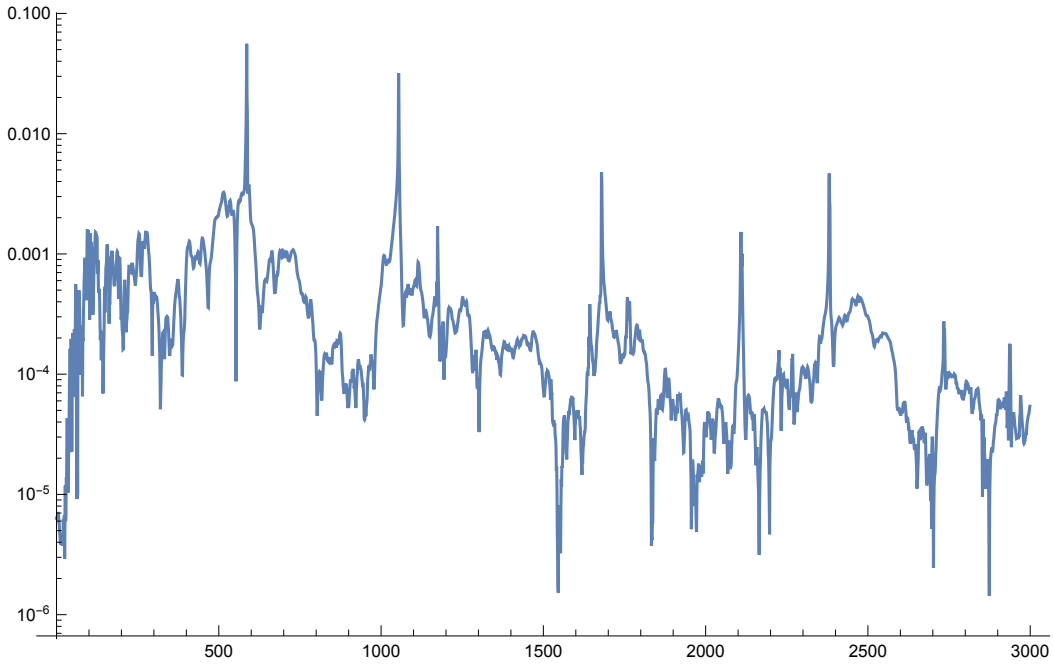
```
{65., 91., 94., 117., 125., 127., 130., 184., 234., 260., 331., 368., 390., 444., 458.,
 520., 534., 536., 591., 654., 662., 728., 780., 806., 848., 872., 874., 916., 944.,
 1030., 1116., 1128., 1136., 1194., 1342., 1344., 1382., 1430., 1505., 1788., 1989.}
```

```
{1., 1.4, 1.44615, 1.8, 1.92308, 1.95385, 2., 2.83077, 3.6, 4., 5.09231, 5.66154, 6.,
 6.83077, 7.04615, 8., 8.21538, 8.24615, 9.09231, 10.0615, 10.1846, 11.2, 12.,
 12.4, 13.0462, 13.4154, 13.4462, 14.0923, 14.5231, 15.8462, 17.1692, 17.3538,
 17.4769, 18.3692, 20.6462, 20.6769, 21.2615, 22., 23.1538, 27.5077, 30.6}
```

```
thisFile = allFiles[[12]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
20 High G
```





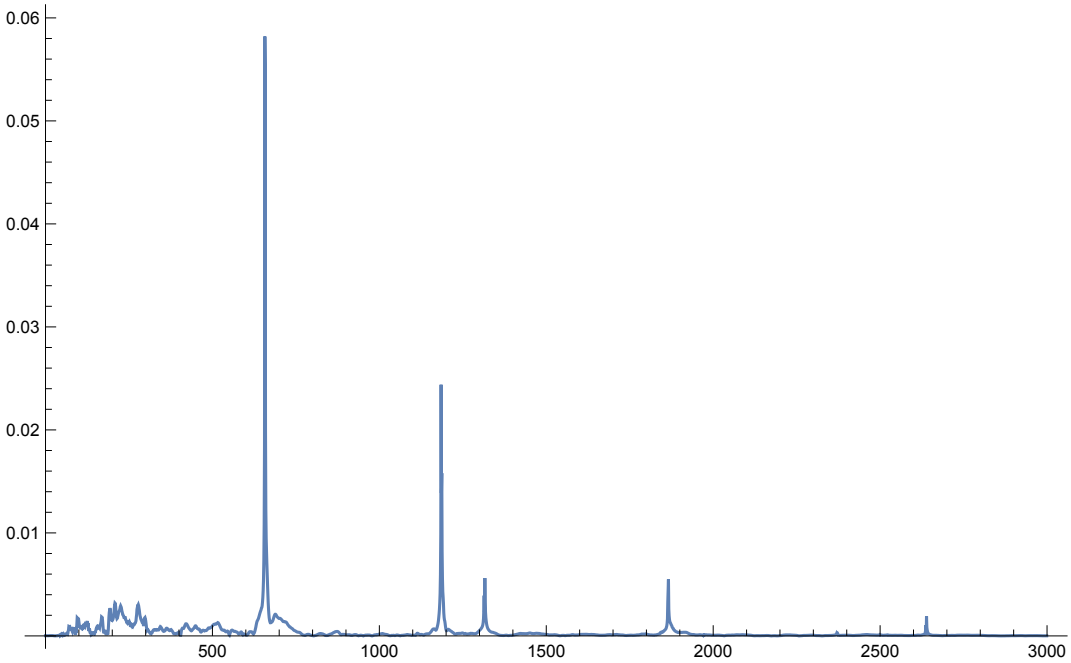

```
{{587, 0.05594}, {1055, 0.0319008},
 {1175, 0.00169576}, {1680, 0.00475831}, {2382, 0.00466174}}
```

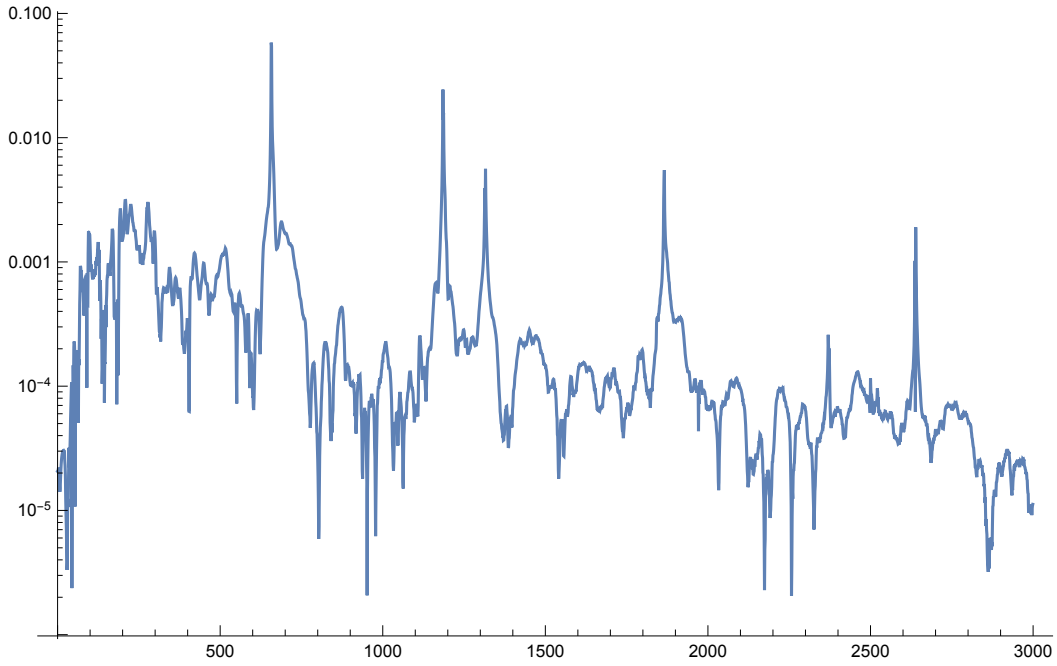
```
{586., 1054., 1174., 1679., 2381.}
```

```
{1., 1.79863, 2.00341, 2.86519, 4.06314}
```

```
thisFile = allFiles[[13]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
21 High G♯
```





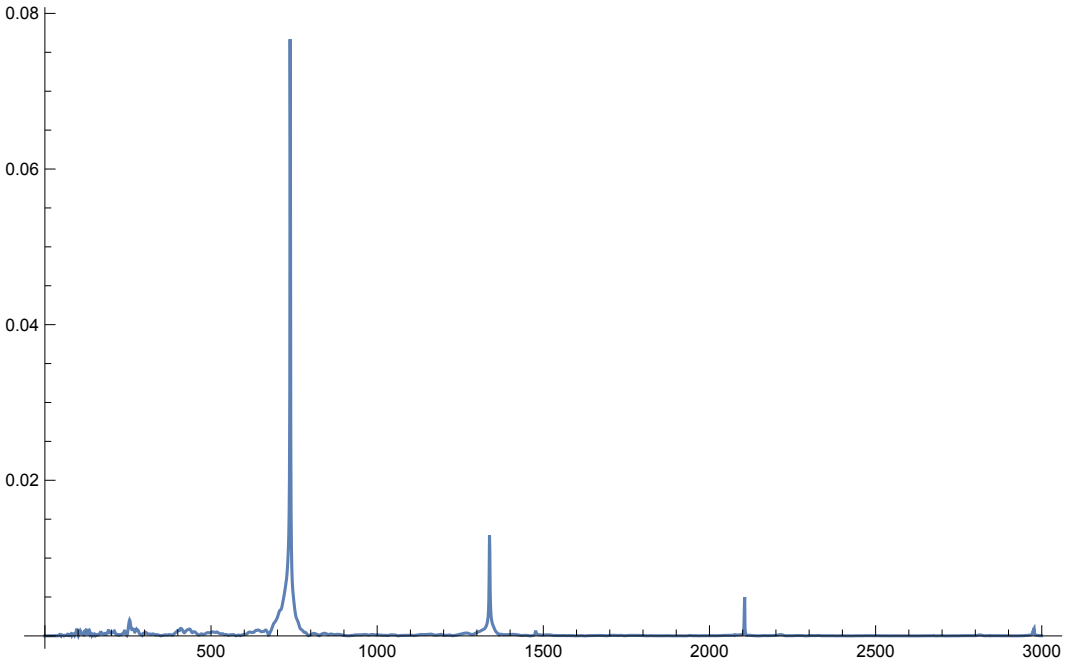

```
{{92, 0.000810759}, {658, 0.058197}, {1186, 0.0243879},
 {1188, 0.0157994}, {1315, 0.00391844}, {1317, 0.00561486},
 {1867, 0.00548898}, {2638, 0.00102151}, {2640, 0.00190223}}
```

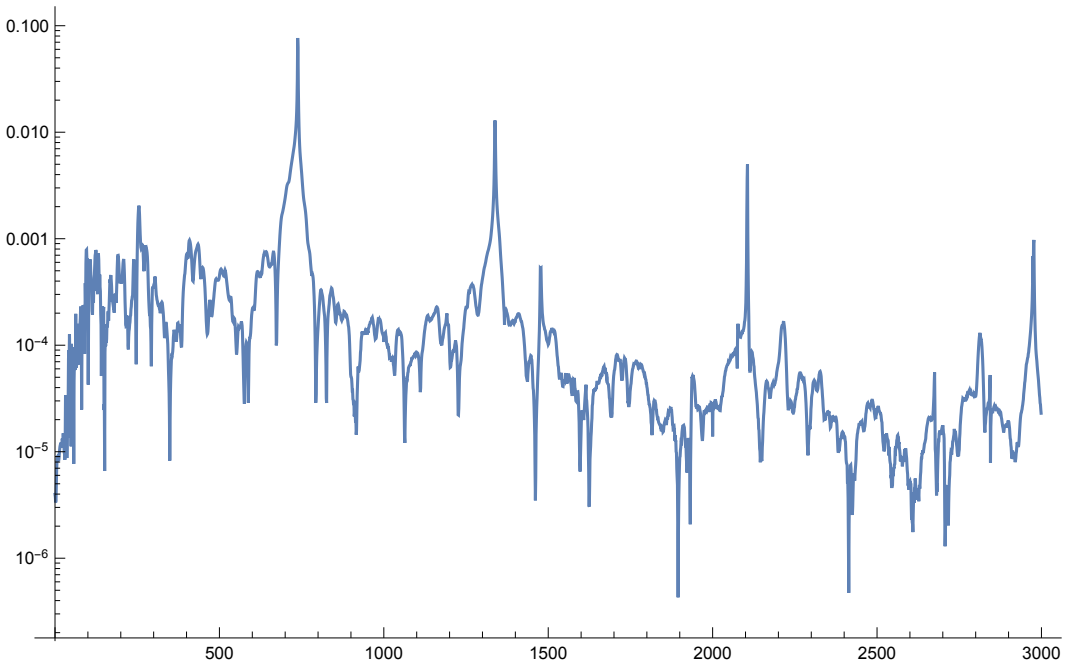
```
{91., 657., 1185., 1187., 1314., 1316., 1866., 2637., 2639.}
```

```
{0.138508, 1., 1.80365, 1.8067, 2., 2.00304, 2.84018, 4.0137, 4.01674}
```

```
thisFile = allFiles[[14]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
22 High A
```





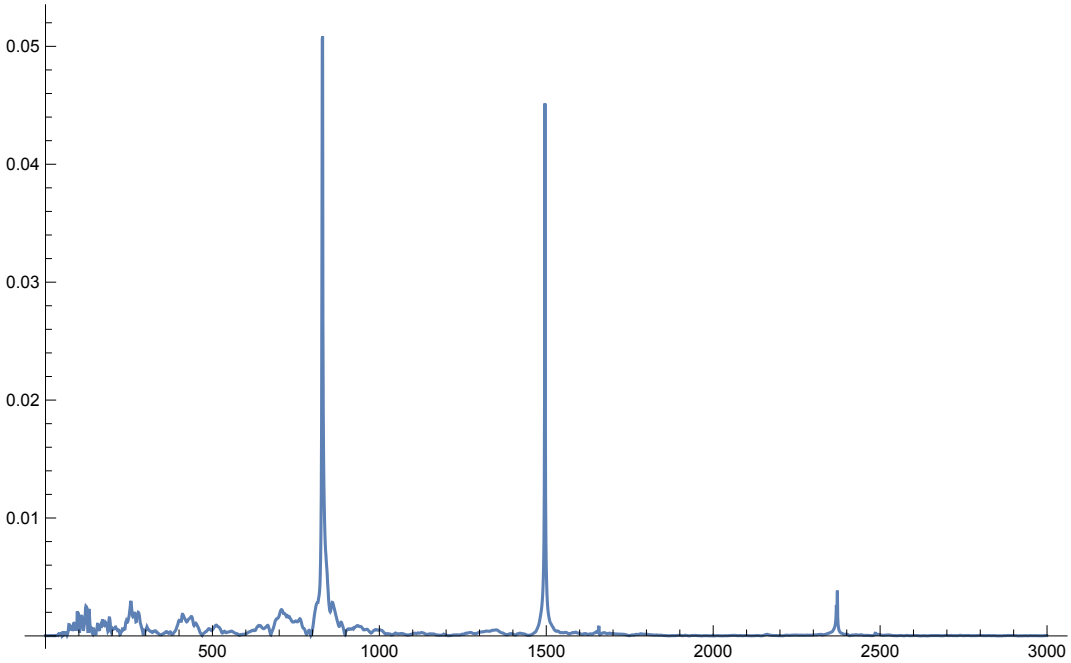

```
{{739, 0.0766788}, {1339, 0.0129058}, {2107, 0.00498721}}
```

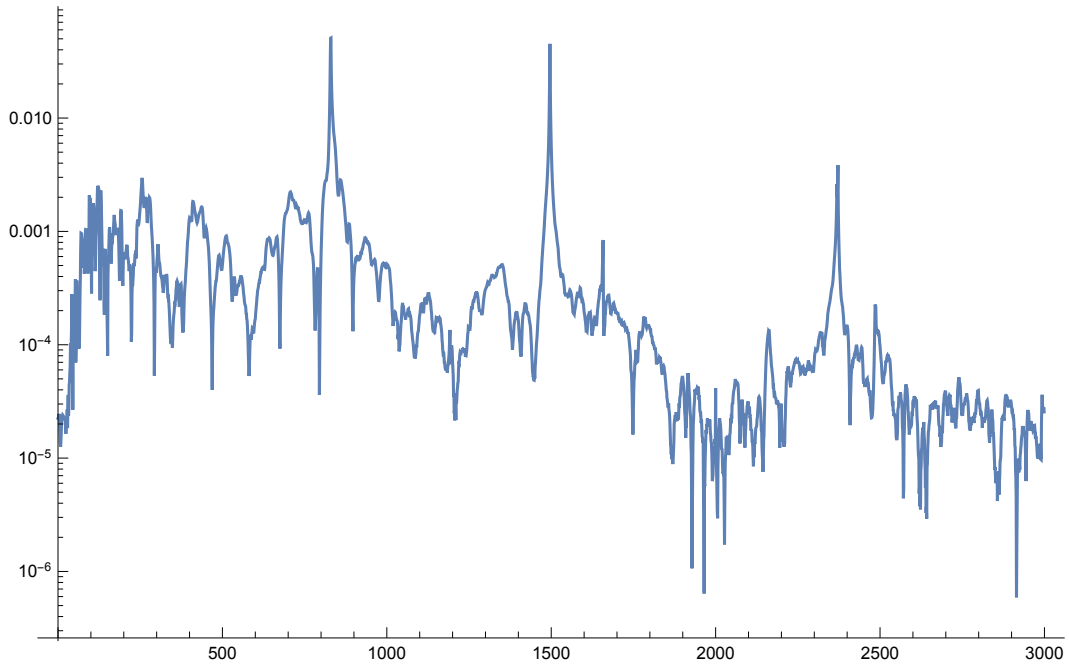
```
{738., 1338., 2106.}
```

```
{1., 1.81301, 2.85366}
```

```
thisFile = allFiles[[15]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
23 High A♮
```





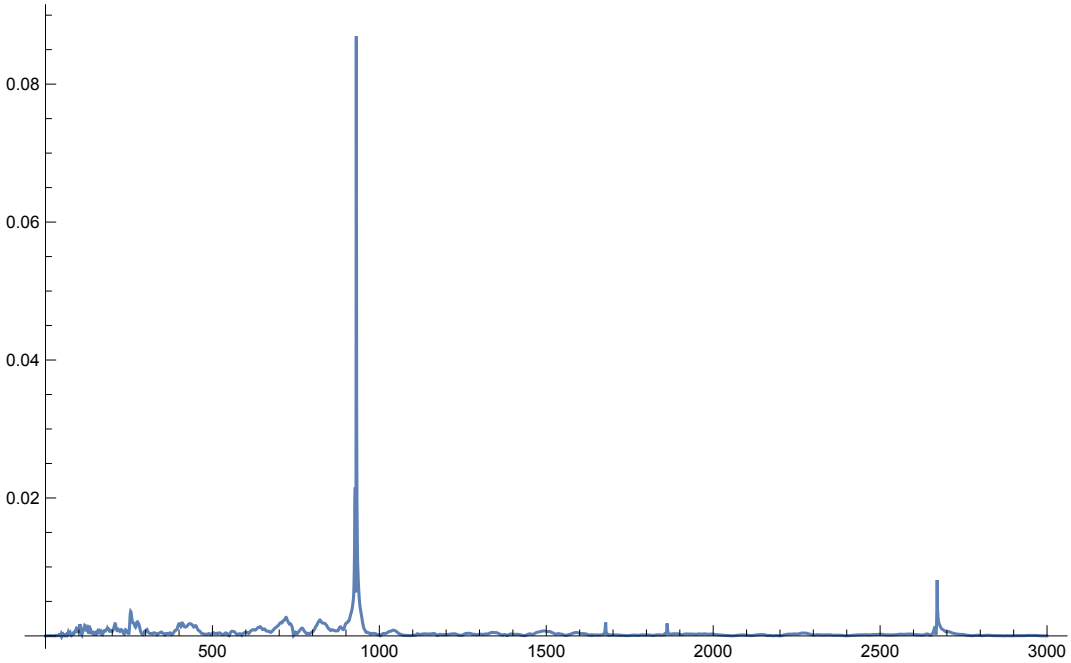

```
{{96, 0.00207788}, {131, 0.00229377}, {831, 0.0508382},
 {1497, 0.0451556}, {2370, 0.00261864}, {2373, 0.00384324}}
```

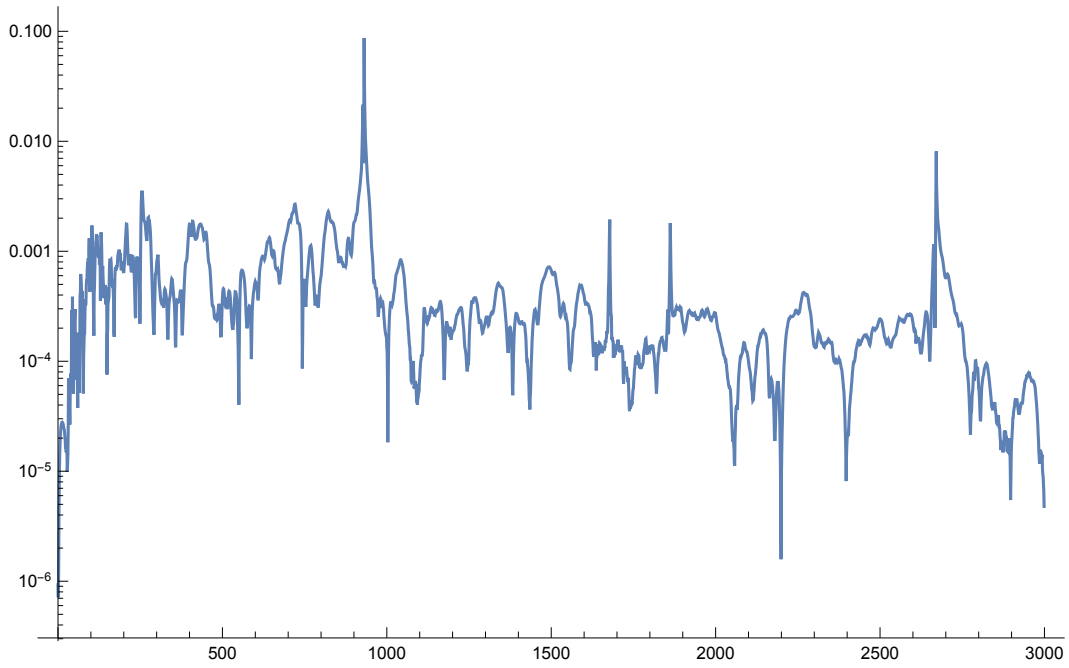
```
{95., 130., 830., 1496., 2369., 2372.}
```

```
{0.114458, 0.156627, 1., 1.80241, 2.85422, 2.85783}
```

```
thisFile = allFiles[[16]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
24 High B
```





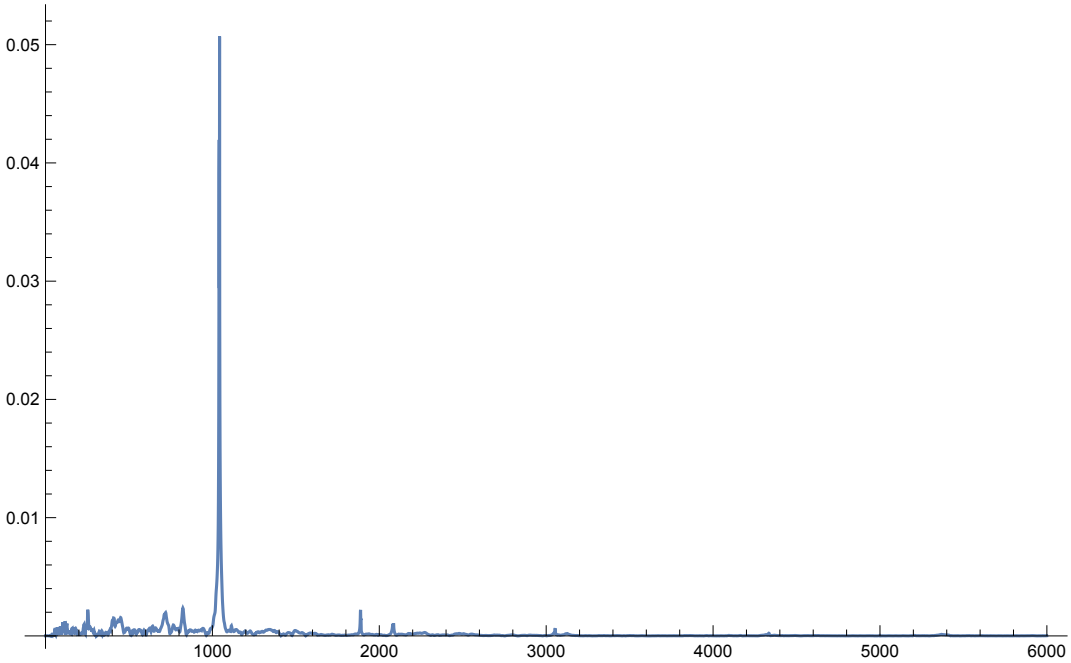

```
{{104, 0.00171348}, {929, 0.0215405}, {932, 0.0869118},
 {1679, 0.00193937}, {1863, 0.00180606}, {2672, 0.00809784}}
```

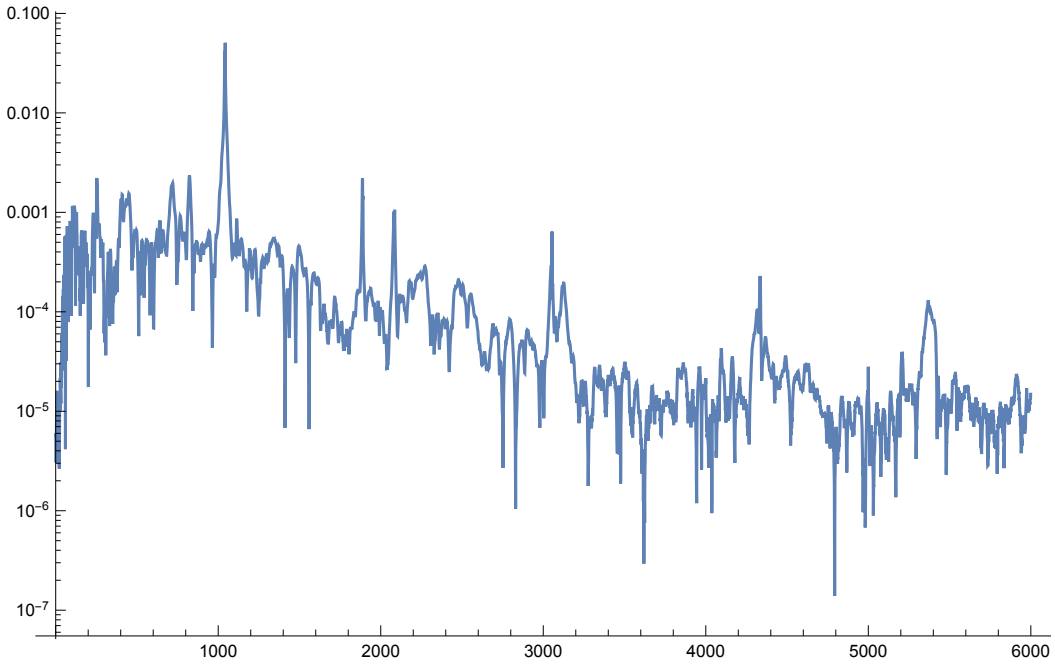
```
{103., 928., 931., 1678., 1862., 2671.}
```

```
{0.110634, 0.996778, 1., 1.80236, 2., 2.86896}
```

```
thisFile = allFiles[[17]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; 2 numDisp]], spec[[1 ;; 2 numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; 2 numDisp]], spec[[1 ;; 2 numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; 2 numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / freqs0[[ind]]
```

```
25 High C
```





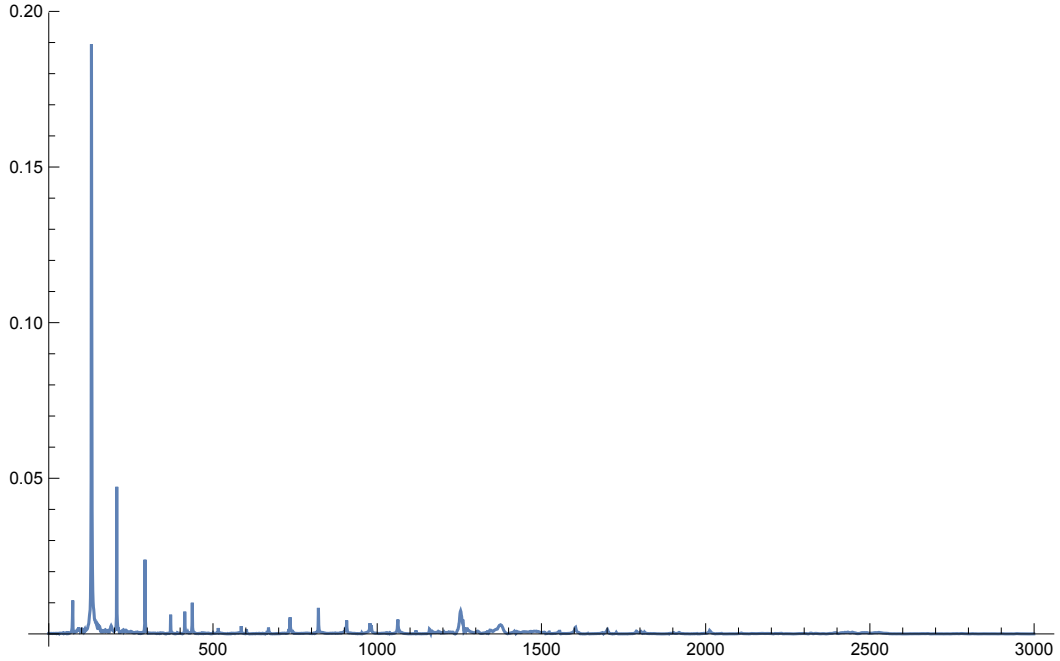

```
{{104, 0.00116055}, {1042, 0.0419535}, {1044, 0.0506938}}
```

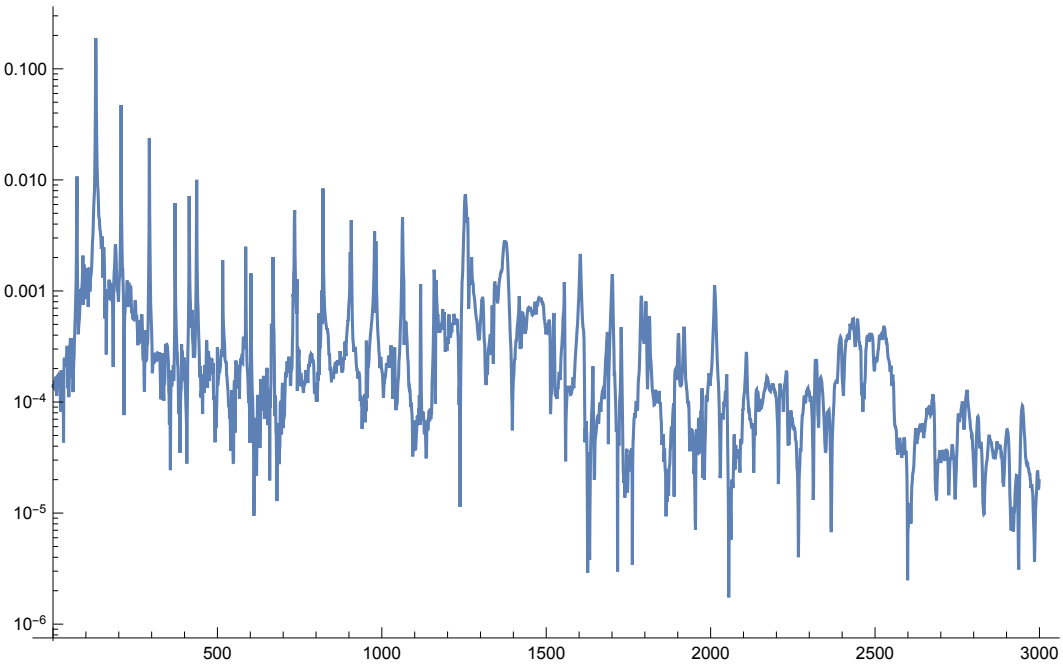
```
{103., 1041., 1043.}
```

```
{0.0987536, 0.998082, 1.}
```

```
thisFile = allFiles[[18]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
   PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 73
```

2 Low C♯





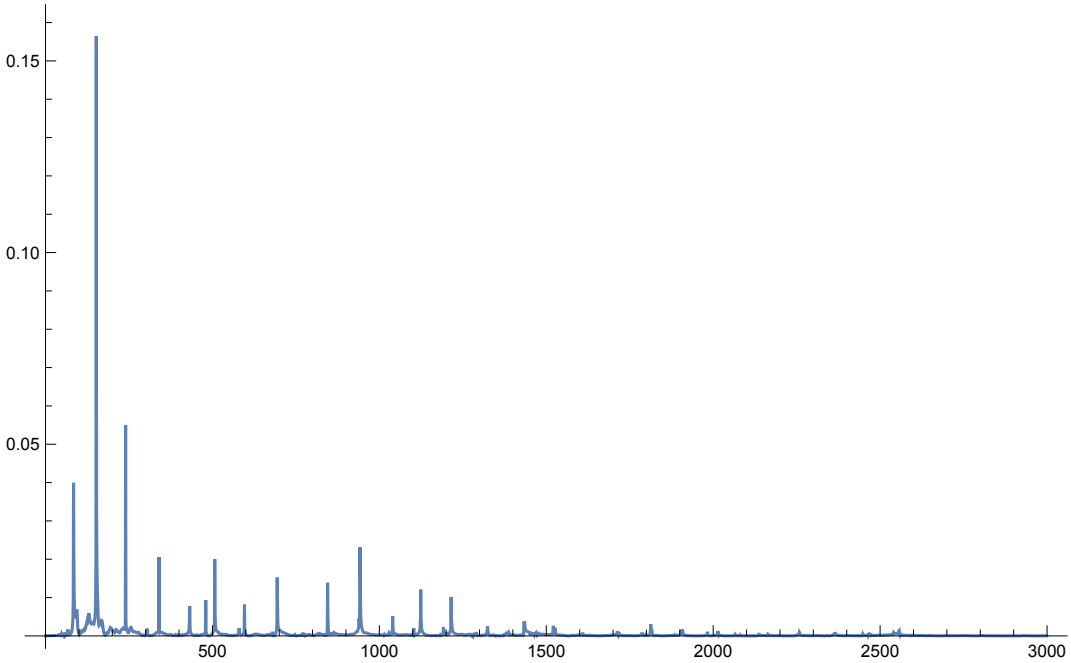

```
{{74, 0.0107335}, {92, 0.00208073}, {131, 0.189481}, {208, 0.0472637},
 {294, 0.0238464}, {372, 0.00617867}, {415, 0.00714938}, {438, 0.0100162},
 {517, 0.00189109}, {587, 0.00250221}, {603, 0.00144242}, {670, 0.00202152},
 {736, 0.00532867}, {743, 0.00127728}, {822, 0.00836363}, {905, 0.0022369},
 {908, 0.00432286}, {979, 0.00344205}, {983, 0.00279765}, {1064, 0.0046225},
 {1119, 0.00114792}, {1262, 0.00459781}, {1274, 0.00202194}}
```

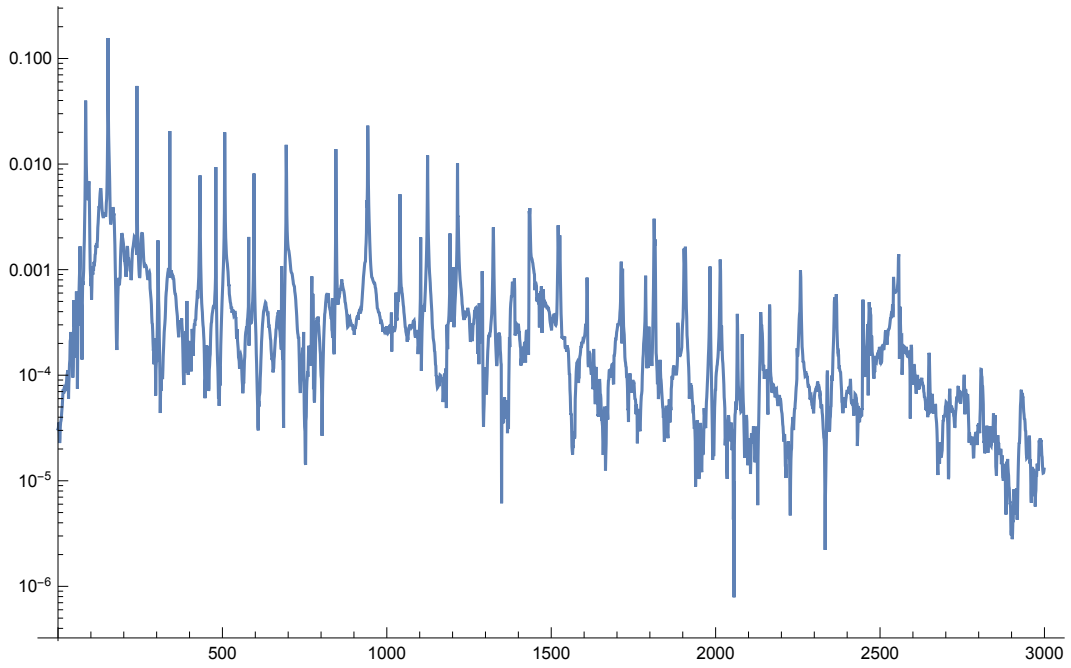
```
{73., 91., 130., 207., 293., 371., 414., 437., 516., 586., 602., 669.,
 735., 742., 821., 904., 907., 978., 982., 1063., 1118., 1261., 1273.}
```

```
{1., 1.24658, 1.78082, 2.83562, 4.0137, 5.08219, 5.67123,
 5.9863, 7.06849, 8.0274, 8.24658, 9.16438, 10.0685, 10.1644, 11.2466,
 12.3836, 12.4247, 13.3973, 13.4521, 14.5616, 15.3151, 17.274, 17.4384}
```

```
thisFile = allFiles[[19]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 84
```

3 Low D





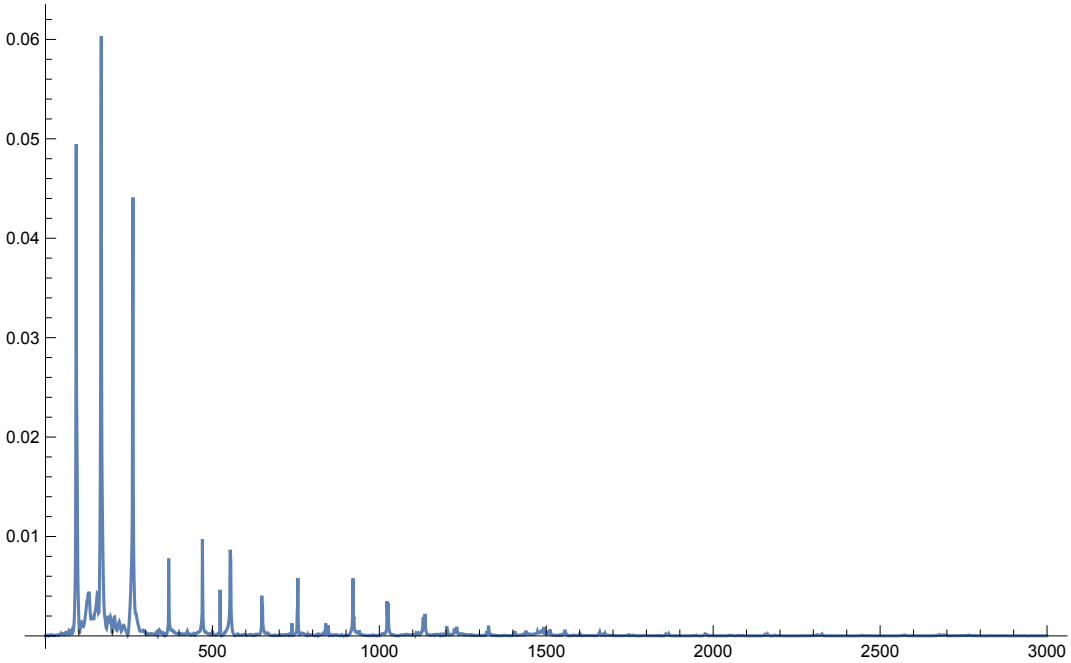

```
{{68, 0.00166492}, {85, 0.0399307}, {92, 0.00666809}, {95, 0.0068748},
 {153, 0.156374}, {241, 0.054971}, {305, 0.00189578}, {341, 0.0205587},
 {433, 0.00781888}, {481, 0.00936598}, {508, 0.0199948}, {581, 0.00204082},
 {597, 0.00815489}, {681, 0.00108095}, {695, 0.0152177}, {846, 0.0138603},
 {940, 0.0045272}, {943, 0.0231378}, {1041, 0.00518562}, {1104, 0.00202029},
 {1125, 0.0120723}, {1193, 0.00220401}, {1203, 0.00105824}, {1216, 0.0101593},
 {1218, 0.00324397}, {1325, 0.00251448}, {1434, 0.00359069},
 {1436, 0.00382862}, {1522, 0.00263072}, {1527, 0.00211586},
 {1714, 0.00118986}, {1814, 0.00303642}, {1817, 0.00193393},
 {1905, 0.0015827}, {1909, 0.00164838}, {1984, 0.00107134}, {2558, 0.00139954}}
```

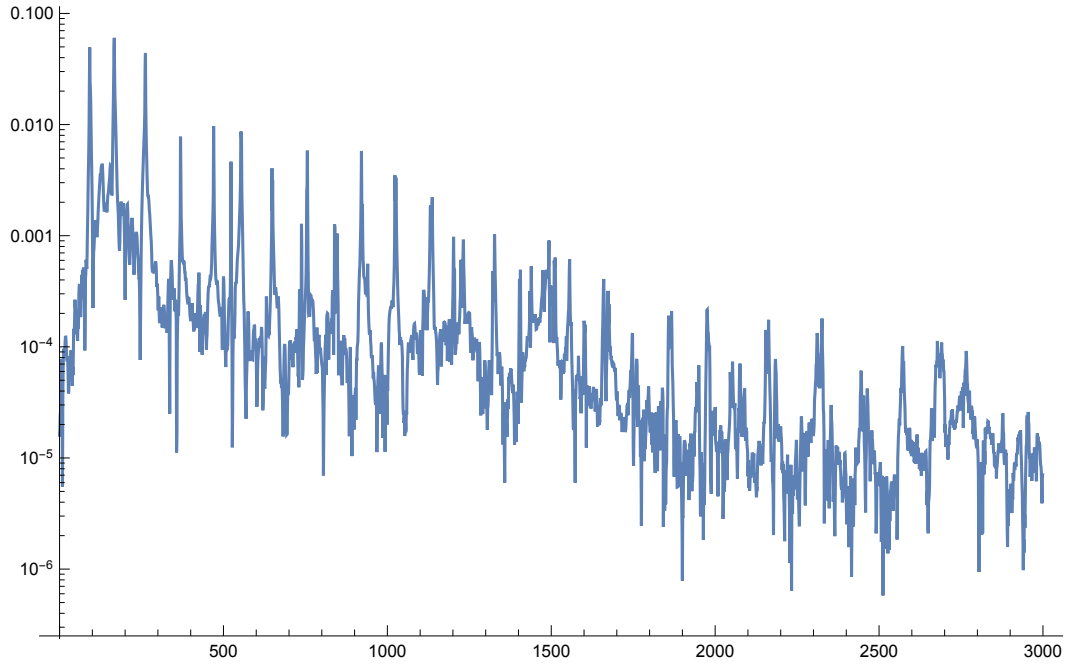
```
{67., 84., 91., 94., 152., 240., 304., 340., 432., 480., 507., 580., 596., 680.,
 694., 845., 939., 942., 1040., 1103., 1124., 1192., 1202., 1215., 1217., 1324.,
 1433., 1435., 1521., 1526., 1713., 1813., 1816., 1904., 1908., 1983., 2557.}
```

```
{0.797619, 1., 1.08333, 1.11905, 1.80952, 2.85714, 3.61905, 4.04762, 5.14286, 5.71429,
 6.03571, 6.90476, 7.09524, 8.09524, 8.2619, 10.0595, 11.1786, 11.2143, 12.381,
 13.131, 13.381, 14.1905, 14.3095, 14.4643, 14.4881, 15.7619, 17.0595, 17.0833,
 18.1071, 18.1667, 20.3929, 21.5833, 21.619, 22.6667, 22.7143, 23.6071, 30.4405}
```

```
thisFile = allFiles[[20]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 92
```

```
4 Low D♯
```





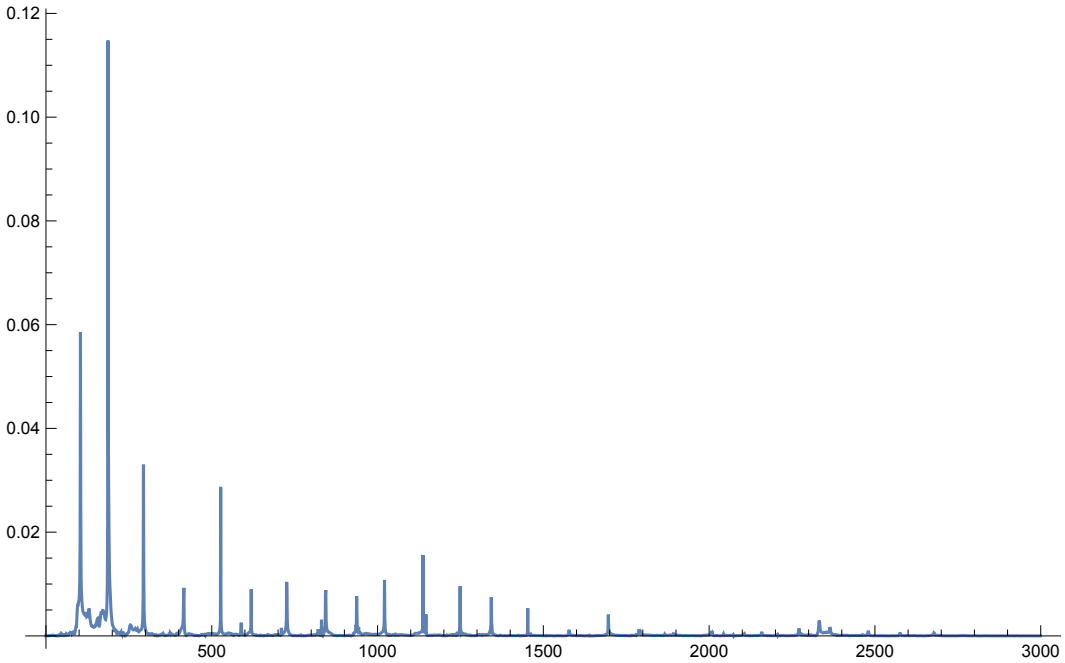

```
{{93, 0.0494401}, {168, 0.0602961}, {263, 0.0440896}, {370, 0.00777748},
 {471, 0.00970532}, {524, 0.00463457}, {554, 0.00866295}, {649, 0.00403858},
 {651, 0.00316983}, {739, 0.00127846}, {757, 0.00582528}, {840, 0.00126147},
 {848, 0.00104385}, {922, 0.00578559}, {925, 0.00190679}, {1024, 0.00349351},
 {1027, 0.00332663}, {1133, 0.00186915}, {1138, 0.00221807}}
```

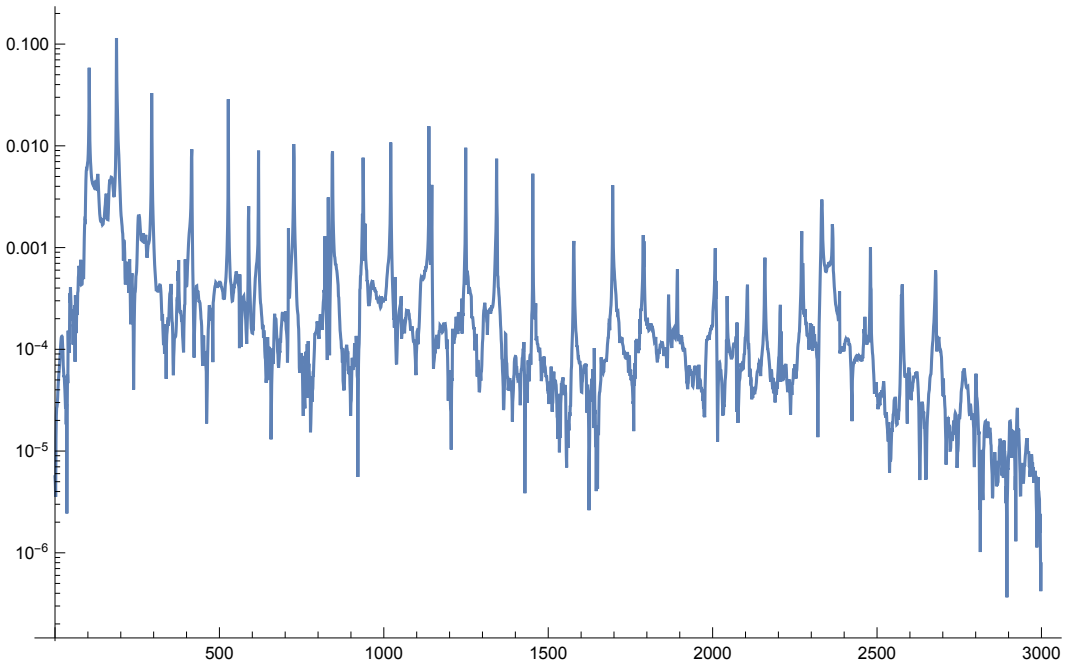
```
{92., 167., 262., 369., 470., 523., 553., 648., 650.,
 738., 756., 839., 847., 921., 924., 1023., 1026., 1132., 1137.}
```

```
{1., 1.81522, 2.84783, 4.01087, 5.1087, 5.68478, 6.01087, 7.04348, 7.06522, 8.02174,
 8.21739, 9.11957, 9.20652, 10.0109, 10.0435, 11.1196, 11.1522, 12.3043, 12.3587}
```

```
thisFile = allFiles[[21]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 104
```

5 Low E





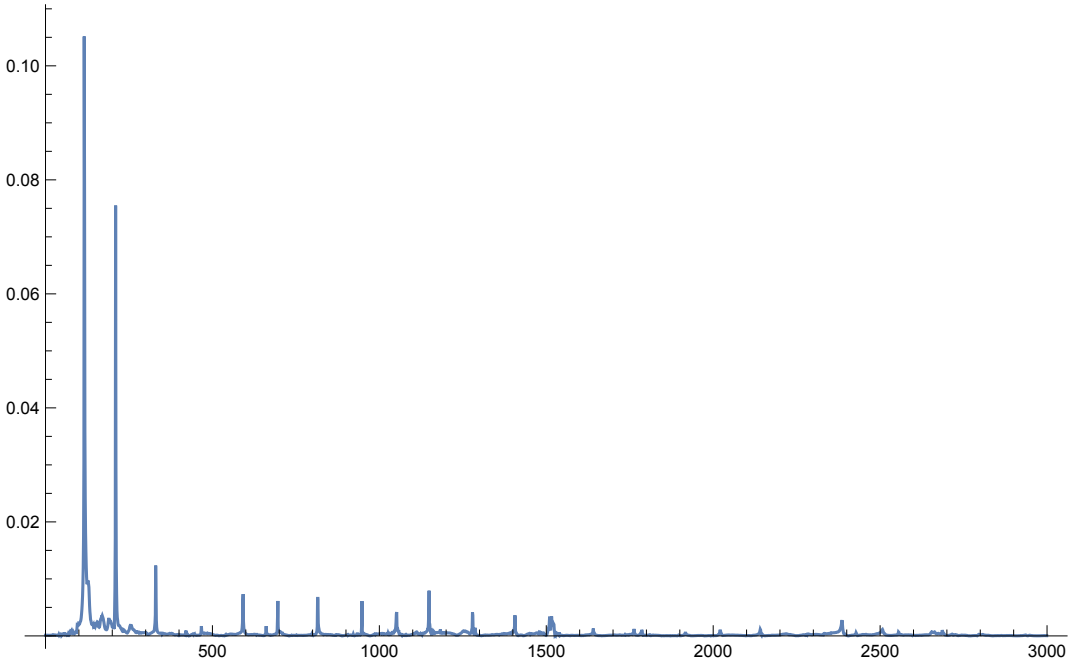

```
{{105, 0.0585441}, {188, 0.114774}, {295, 0.0330142}, {417, 0.00925674},
 {528, 0.0287349}, {590, 0.00255074}, {620, 0.00897328}, {711, 0.0015483},
 {727, 0.0104169}, {822, 0.00129352}, {832, 0.00311074}, {845, 0.00879485},
 {936, 0.00214285}, {938, 0.00764693}, {944, 0.00171645}, {1022, 0.0107867},
 {1138, 0.0155802}, {1147, 0.00413293}, {1250, 0.00957959}, {1344, 0.00747286},
 {1454, 0.00532077}, {1697, 0.00410411}, {1790, 0.00132796},
 {2009, 0.000984725}, {2272, 0.00144786}, {2481, 0.00100683}}
```

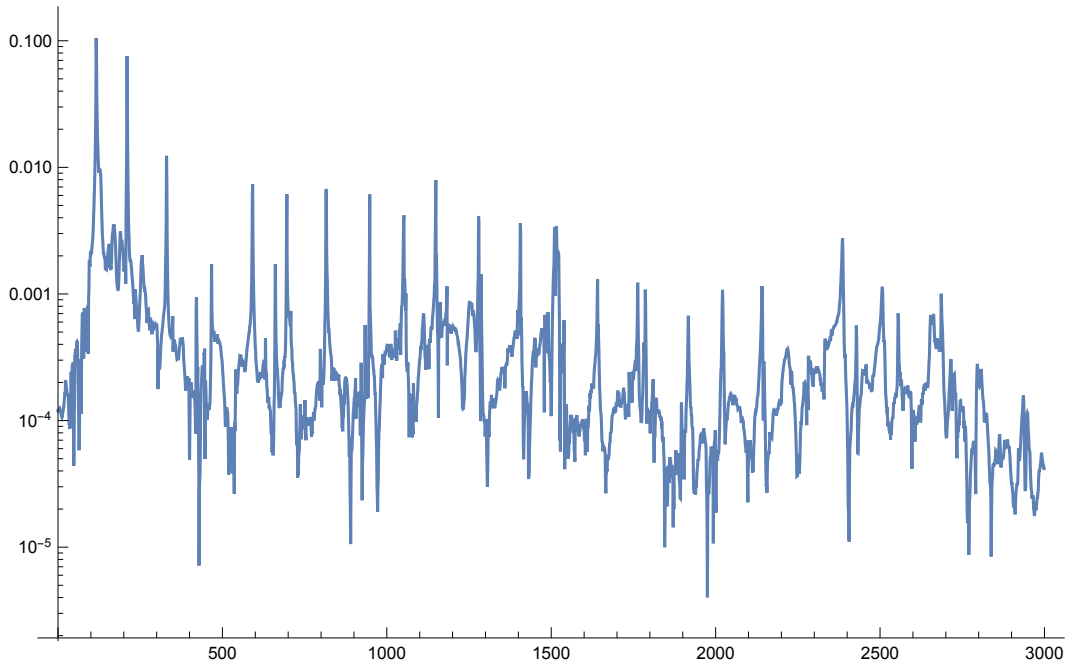
```
{104., 187., 294., 416., 527., 589., 619., 710., 726., 821., 831., 844., 935., 937.,
 943., 1021., 1137., 1146., 1249., 1343., 1453., 1696., 1789., 2008., 2271., 2480.}
```

```
{1., 1.79808, 2.82692, 4., 5.06731, 5.66346, 5.95192, 6.82692, 6.98077, 7.89423,
 7.99038, 8.11538, 8.99038, 9.00962, 9.06731, 9.81731, 10.9327, 11.0192,
 12.0096, 12.9135, 13.9712, 16.3077, 17.2019, 19.3077, 21.8365, 23.8462}
```

```
thisFile = allFiles[[22]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 116
```

```
6 Low F
```





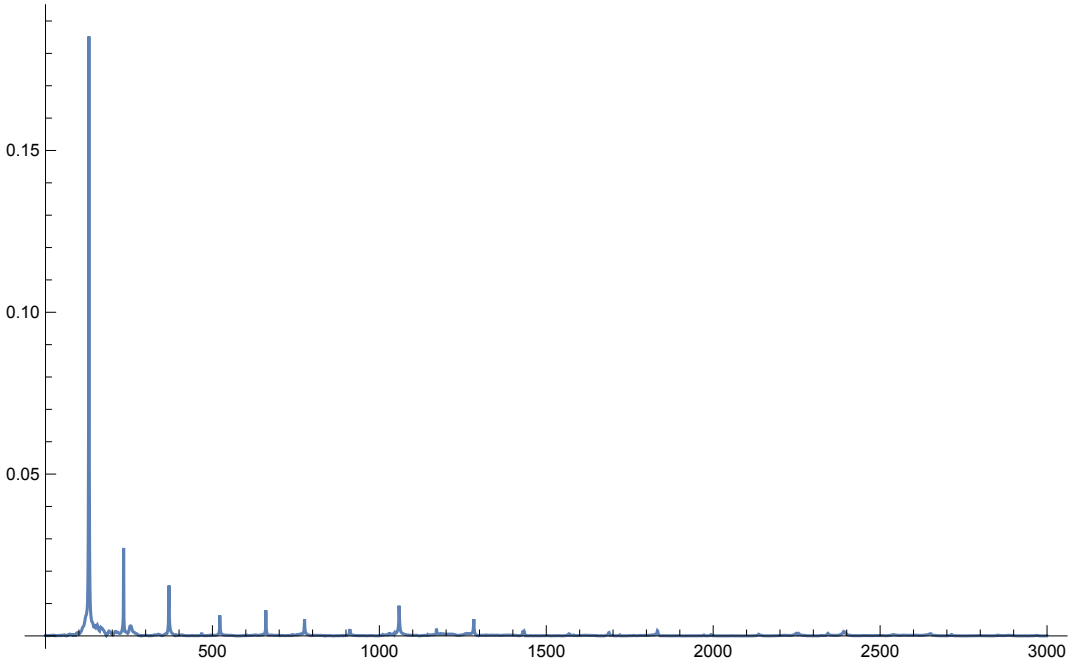

```
{{117, 0.105152}, {211, 0.0754886}, {331, 0.0123389}, {468, 0.00172317},
 {593, 0.00733041}, {662, 0.00171868}, {697, 0.00612808}, {816, 0.00657298},
 {949, 0.00610393}, {1053, 0.00417677}, {1150, 0.00793437}, {1184, 0.00114922},
 {1280, 0.00413063}, {1288, 0.00142589}, {1407, 0.00361937}, {1511, 0.00337764},
 {1517, 0.00341432}, {1642, 0.00130099}, {1764, 0.00122736}, {1787, 0.00108164}}
```

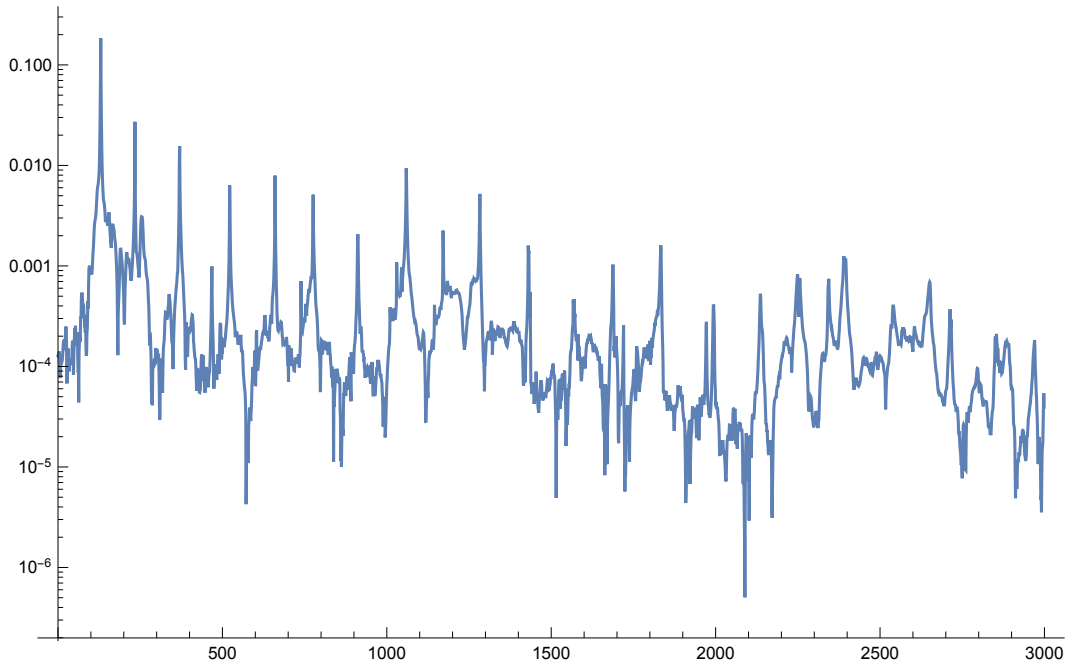
```
{116., 210., 330., 467., 592., 661., 696., 815., 948., 1052.,
 1149., 1183., 1279., 1287., 1406., 1510., 1516., 1641., 1763., 1786.}
```

```
{1., 1.81034, 2.84483, 4.02586, 5.10345, 5.69828,
 6., 7.02586, 8.17241, 9.06897, 9.90517, 10.1983, 11.0259,
 11.0948, 12.1207, 13.0172, 13.069, 14.1466, 15.1983, 15.3966}
```

```
thisFile = allFiles[[23]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 130
```

```
7 Low F♯
```





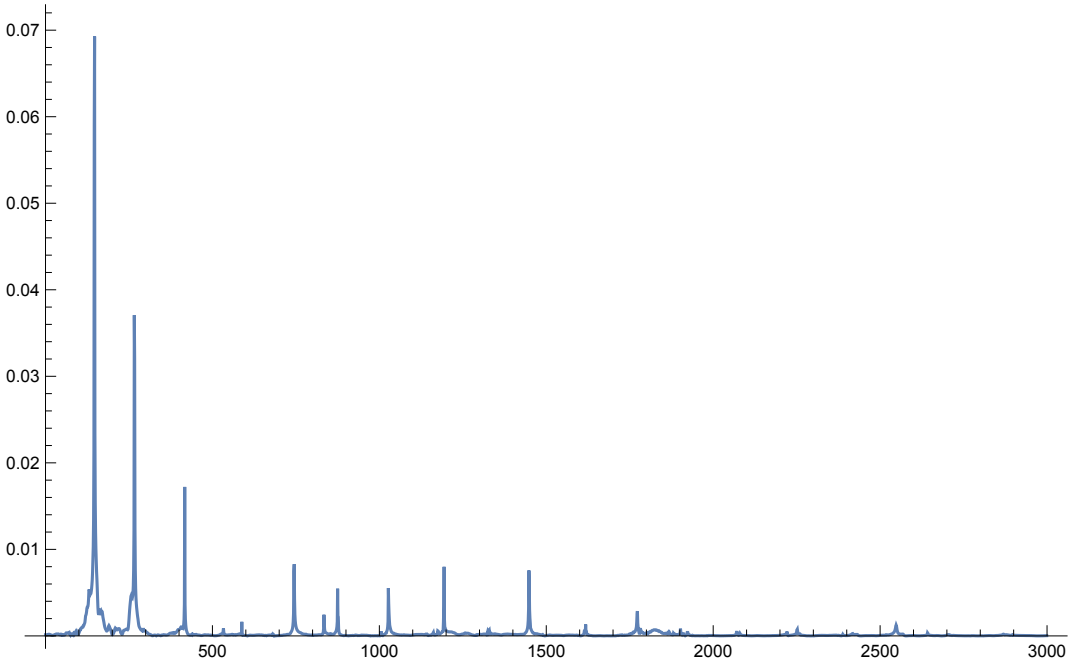

```
{{131, 0.185227}, {235, 0.0271865}, {371, 0.0155873}, {523, 0.00635626},
 {661, 0.00791868}, {777, 0.00512093}, {1031, 0.00108984}, {1060, 0.00934293},
 {1172, 0.00224688}, {1284, 0.00520953}, {1431, 0.00159268}}
```

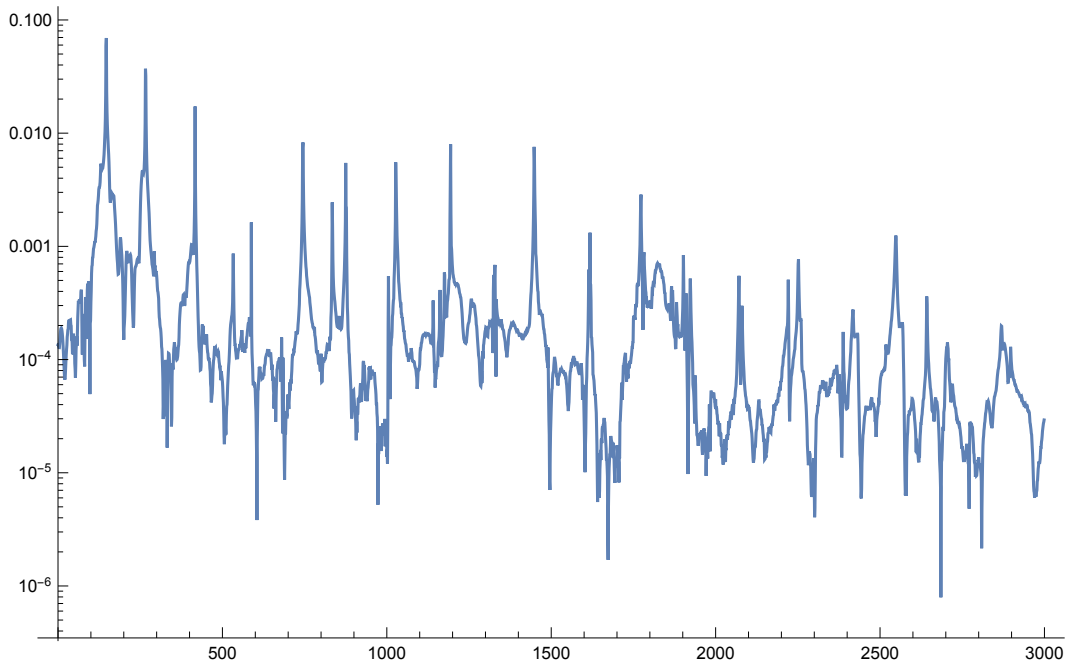
```
{130., 234., 370., 522., 660., 776., 1030., 1059., 1171., 1283., 1430.}
```

```
{1., 1.8, 2.84615, 4.01538, 5.07692, 5.96923, 7.92308, 8.14615, 9.00769, 9.86923, 11.}
```

```
thisFile = allFiles[[24]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 147
```

8 Low G





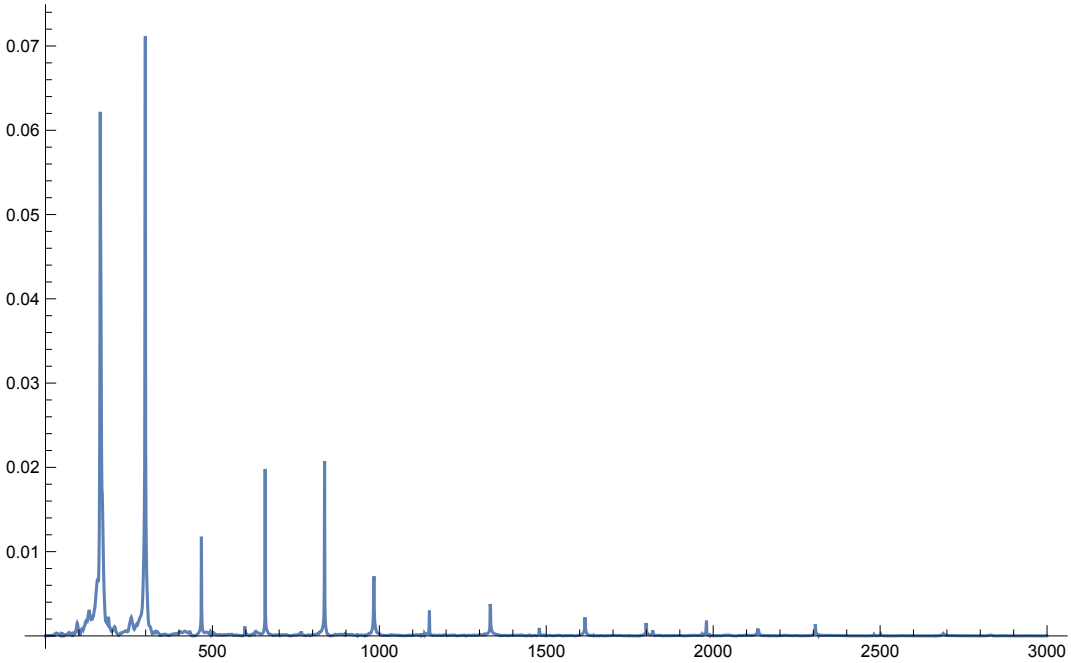

```
{{148, 0.0692724}, {267, 0.0370682}, {418, 0.0172173}, {589, 0.00163006},
 {746, 0.0082861}, {835, 0.00244926}, {876, 0.00545814}, {1028, 0.00553112},
 {1195, 0.00798639}, {1449, 0.00756847}, {1619, 0.00132134}, {1774, 0.0028668}}
```

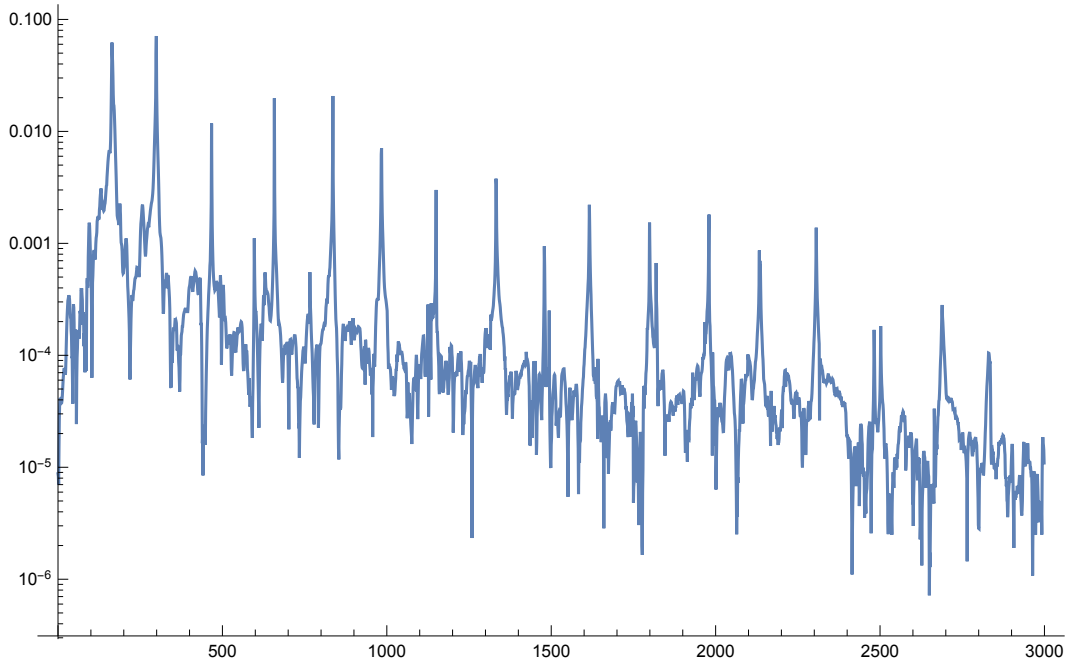
```
{147., 266., 417., 588., 745., 834., 875., 1027., 1194., 1448., 1618., 1773.}
```

```
{1., 1.80952, 2.83673, 4., 5.06803, 5.67347,
 5.95238, 6.98639, 8.12245, 9.85034, 11.0068, 12.0612}
```

```
thisFile = allFiles[[25]]; analyze[thisFile]; FileBaseName[thisFile]
GraphicsColumn[{ListLinePlot[
    Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}], PlotRange → All],
  ListLogPlot[Transpose[{ssf[[1 ;; numDisp]], spec[[1 ;; numDisp]]}],
    PlotRange → All, Joined → True]}, ImageSize → 600]
peaks = FindPeaks[spec[[1 ;; numDisp]], 0, 0.001, 0.0003]
ind = First@First@Position[Transpose[peaks][[2]], Max[Transpose[peaks][[2]]]];
freqs0 = ssf[[First@Transpose[peaks]]]
freqs0 / 164
```

9 Low G♯






```
{{165, 0.062187}, {300, 0.0711326}, {468, 0.0117676}, {598, 0.00111177},
 {659, 0.01981}, {837, 0.0207166}, {985, 0.00707796}, {1151, 0.003},
 {1333, 0.00378412}, {1617, 0.00221045}, {1800, 0.00153263},
 {1981, 0.00180884}, {2134, 0.000864682}, {2307, 0.00138075}}
```

```
{164., 299., 467., 597., 658., 836., 984.,
 1150., 1332., 1616., 1799., 1980., 2133., 2306.}
```

```
{1., 1.82317, 2.84756, 3.64024, 4.0122, 5.09756, 6.,
 7.0122, 8.12195, 9.85366, 10.9695, 12.0732, 13.0061, 14.061}
```

Detected fundamentals:
hyperOctave note name - frequency in Hz

low C - 65
c# - 73
d - 84
d# - 93
e - 104
f - 116
f# - 130
g - 147
g# - 164
a - 185
a# - 207
b - 233
c - 262
c# - 194
d - 330
d# - 370
e - 415
f - 466
f# - 522
g - 586
g# - 657
a - 738
a# - 830
b - 931
c - 1042