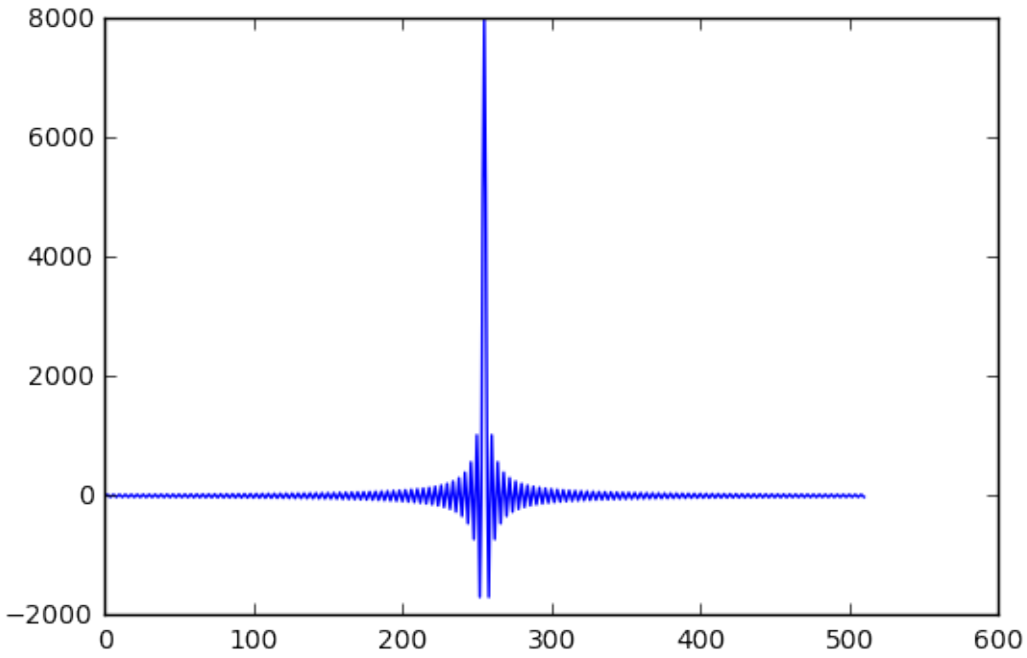
quantum

March 15, 2017

```
In [70]: from numpy import *
         from matplotlib.pyplot import *
         %matplotlib inline
         from audio.fourier import F
         from audio.filters import low_pass
         import audio.index
         import audio.io
         from audio.quantizers import *

In [12]: df = 16000
```

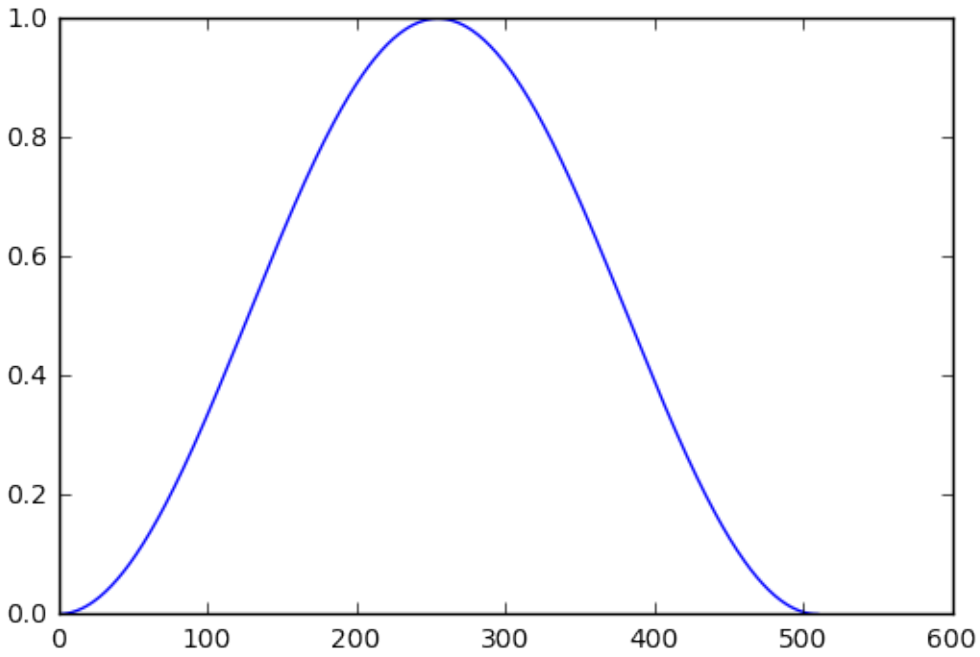
1 Sous-Echantillonage

```
In [60]: data = audio.index.search("vodka")[0].parent.audio
         audio.io.play(data, df=df)

In [61]: data2 = data[::2]
         audio.io.play(data, df=df)
         audio.io.play(data2,df=0.5*df)

In [53]: h=low_pass(fc=4000.0, dt=1.0/df)(511)
         figure()
         plot(h)

Out[53]: [<matplotlib.lines.Line2D at 0x7f58d41d9f10>]
```



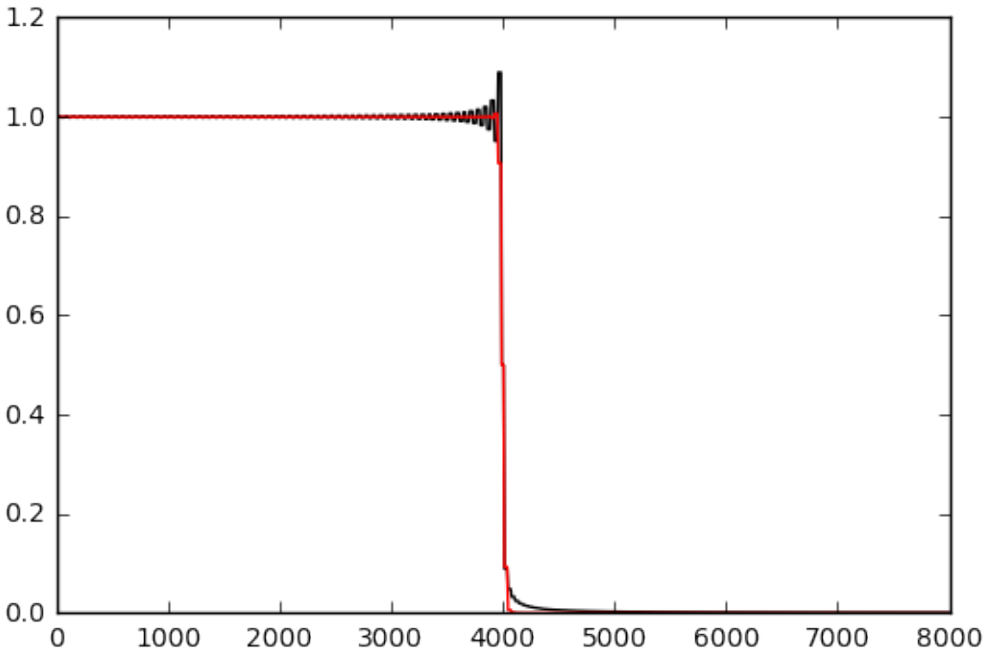
In [54]:
```
window = hanning(511)
plot(window)
```

Out[54]: [<matplotlib.lines.Line2D at 0x7f58d41116d0>]

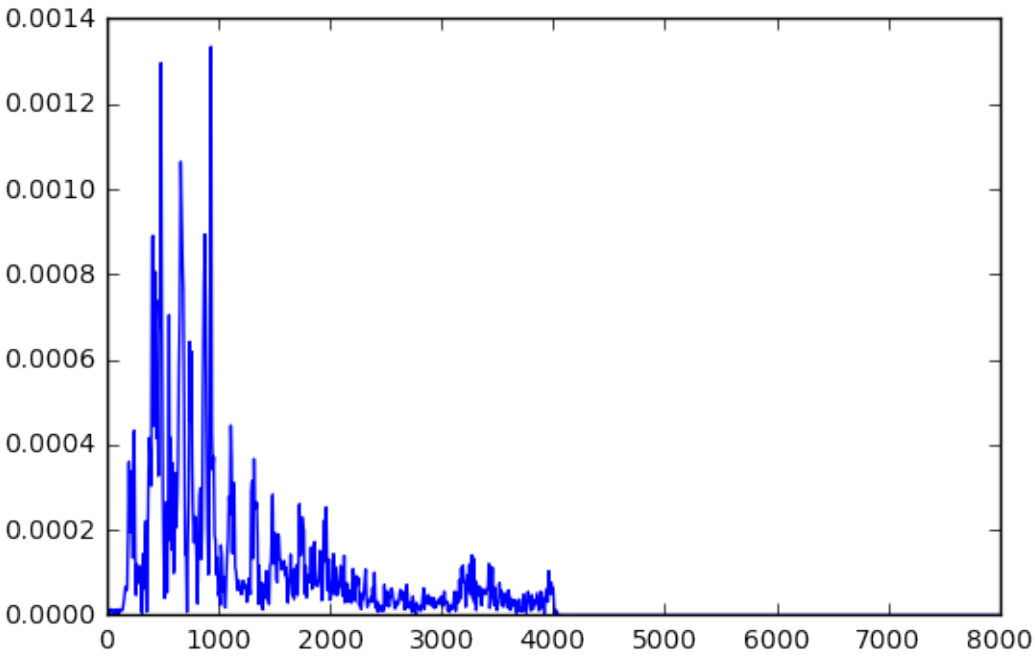


In [56]:
```
Fh = F(h, dt=1.0/df, power_of_two=True)
f = r_[0:0.5*df:0.5*df/1000.0]
figure()
plot(f, abs(Fh(f)), "k")
h2 = h * window
Fh2 = F(h2, dt=1.0/df, power_of_two=True)
plot(f, abs(Fh2(f)), "r")
```

Out[56]:
```
[<matplotlib.lines.Line2D at 0x7f58d406b5d0>]
```



In [66]:
```
data2b = (dt*convolve(h2, data))
Ff = F(data2b, dt=1.0/df, power_of_two=True)
f = r_[0:0.5*df:0.5*df/1000.0]
figure()
#plot(data2b)
plot(f, abs(Ff(f)), "b")
data2b = data2b[::2]
```




```
In [67]: audio.io.play(data, df=df)
         audio.io.play(data2, df=0.5*df)
         audio.io.play(data2b, df=0.5*df)

In [36]: Ff = F(data, dt=1.0/df, power_of_two=True)
         f = r_[0:0.5*df:0.5*df/1000.0]
         Ff2 = F(data2, dt=1.0/(0.5*df), power_of_two=True)
         f2 = r_[0:0.25*df:0.25*df/500.0]
         figure()
         plot(f, abs(Ff(f)), "b")
         plot(f2, abs(Ff2(f2)), "r")

<IPython.core.display.Javascript object>


<IPython.core.display.HTML object>


Out[36]: [<matplotlib.lines.Line2D at 0x7f58d9f99590>]

In [38]: dt = 1.0 / df
         t = r_[0:2.0:dt]
         data = 0.5*(sin(2*pi*440.0*t) + sin(2*pi*7000.0*t))
         audio.io.play(data, df=df)
         data2 = data[::2]
         audio.io.play(data2, df=0.5*df)
```

```
In [41]: Ff = F(data, dt=1.0/df, power_of_two=True)
         f = r_[0:0.5*df:0.5*df/1000.0]
         Ff2 = F(data2, dt=1.0/(0.5*df), power_of_two=True)
         f2 = r_[0:0.25*df:0.25*df/500.0]
         figure()
         plot(f, abs(Ff(f)), "b")
         plot(f2, abs(Ff2(f2)), "r", alpha=0.1)
```

```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.HTML object>
```

```
Out[41]: [<matplotlib.lines.Line2D at 0x7f58d4e6bb50>]
```

2 Quantification

```
In [68]: def SNR(quantizer, data):
             out = quantizer(data)
             b = out - data
             SNR2 = sum(data*data) / sum(b*b)
             return 10.0*log10(SNR2)
```

```
In [78]: quantizer = Uniform(low=-1.0, high=1.0, N=2**8)
         print SNR(quantizer, data), "dB"
         quantizer = Uniform(low=-1.0, high=1.0, N=2**9)
         print SNR(quantizer, data), "dB"
         quantizer = Uniform(low=-1.0, high=1.0, N=2**16)
         print SNR(quantizer, data), "dB"
         print quantizer(0.0)
         quantizer = Uniform(low=-1.0, high=1.0, N=2**16-1)
         print SNR(quantizer, data), "dB"
         quantizer = Uniform(low=-1.0, high=1.0, N=2**8-1)
         print "8 bits uniform:", SNR(quantizer, data), "dB"
         quantizer = mulaw
         print "8 bits mulaw:", SNR(quantizer, data), "dB"
```

```
12.3510812436 dB
18.7571632958 dB
57.2203688924 dB
1.52587890625e-05
96.3294660758 dB
8 bits uniform: 15.1167582148 dB
8 bits mulaw: 35.605110393 dB
```

```
In [ ]:
```