

无线通信实验在线开放课程

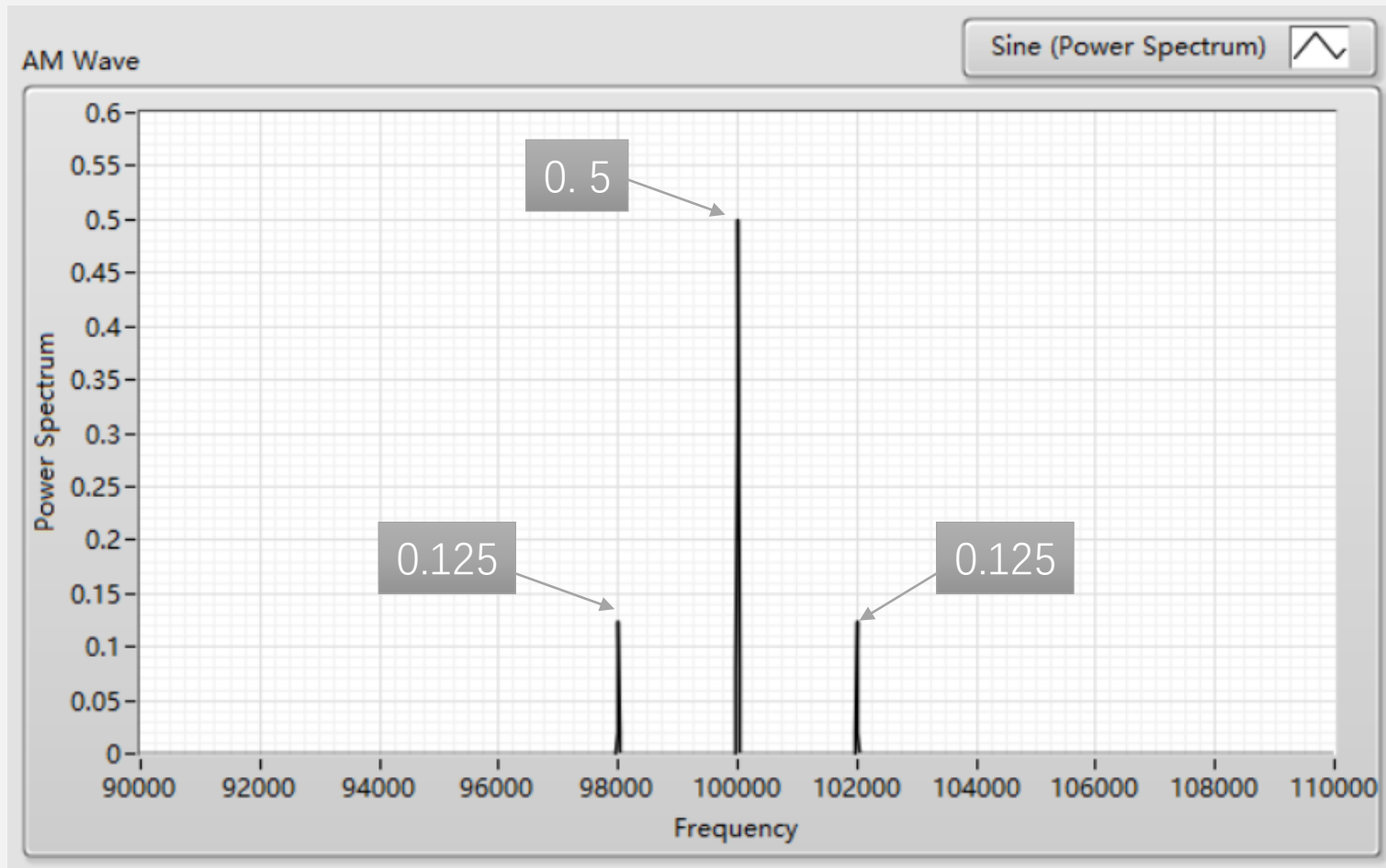
主讲人：吴光 博士

广东省教学质量工程建设项目





大部分功率用来传输载波



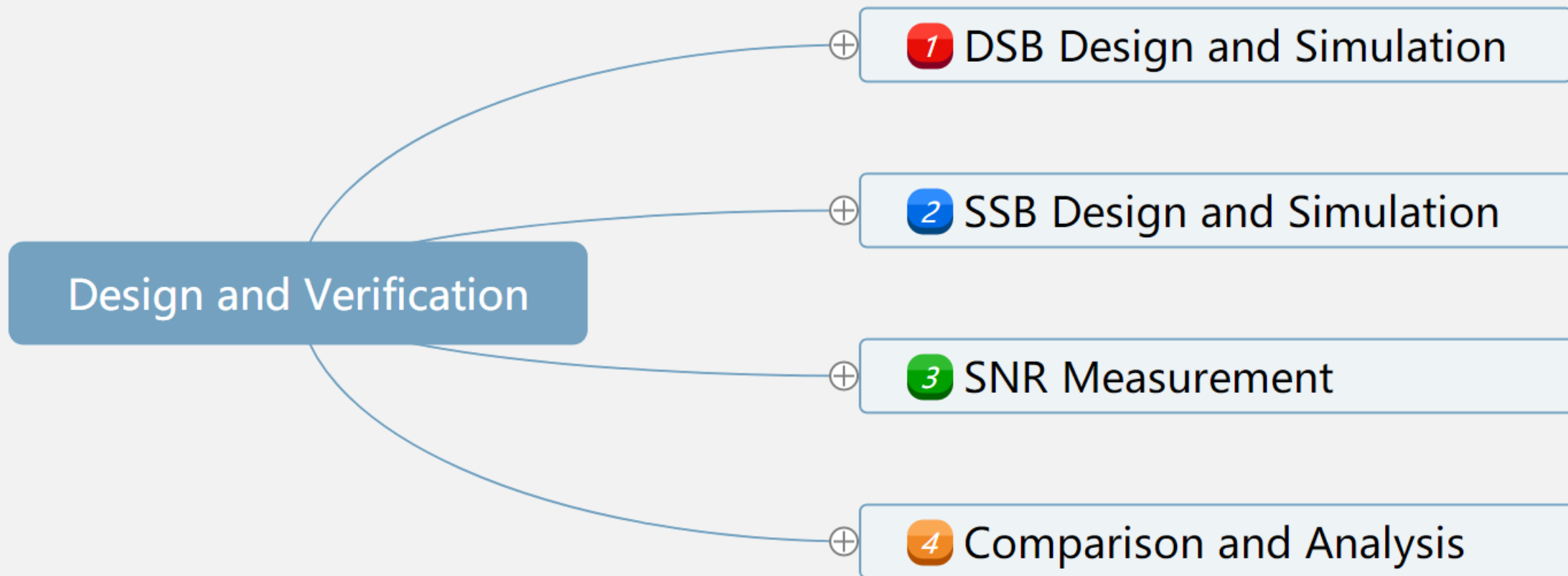


Lab 3: DSB and SSB

(DSB)

主讲人：吴光 博士

Email: wug@sustech.edu.cn

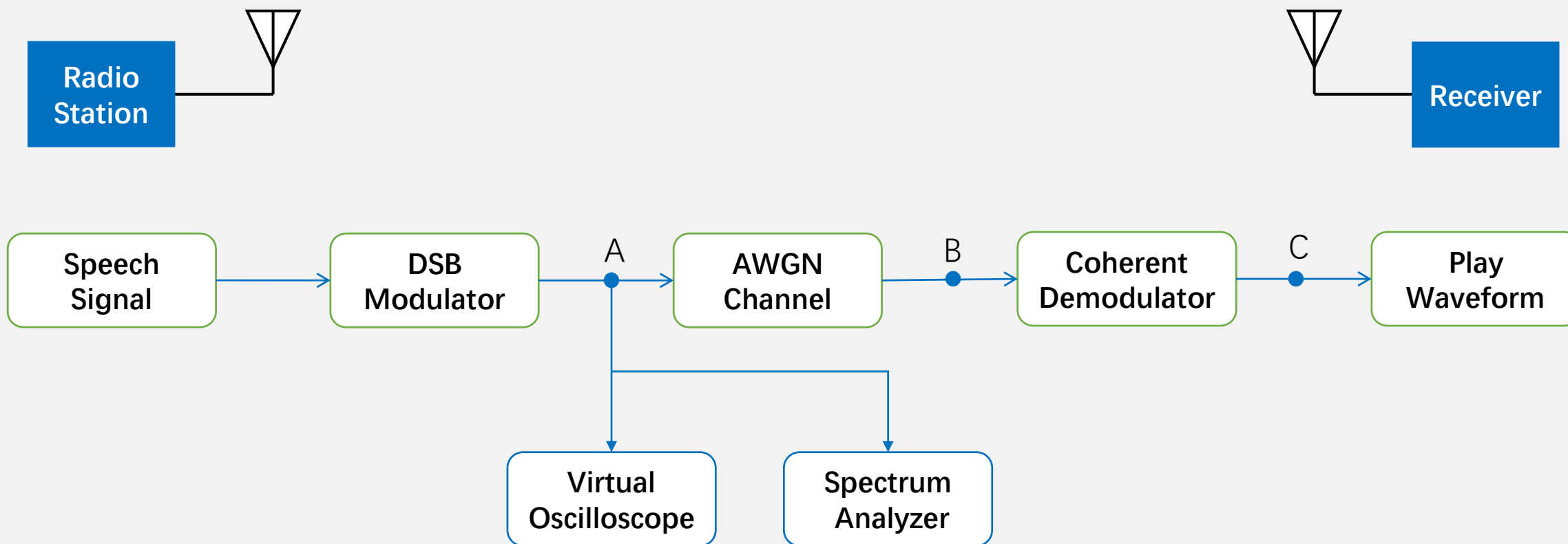




Demo: Double-Sideband (Single Tone)



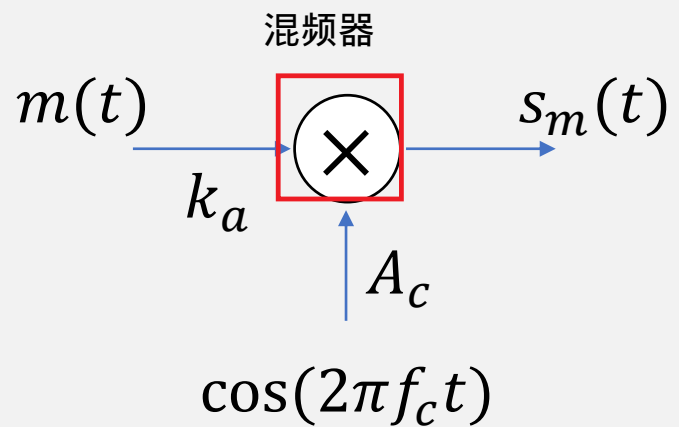
Simulation Model of DSB System



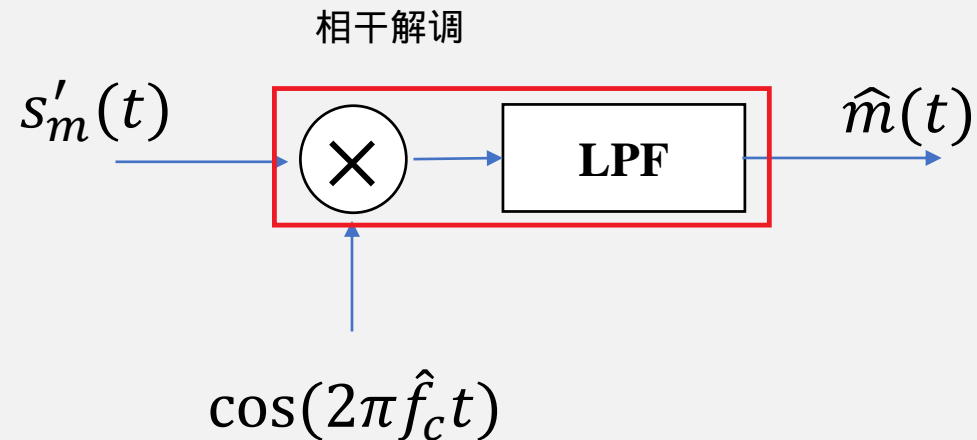


Pre-Lab: DSB Mathematical Model

Modulator



Demodulator



Sensitivity

Carrier

$$s_m(t) = A_c(k_a m(t))\cos(2\pi f_c t)$$

Baseband

$$s'_m(t) \cdot \cos(2\pi \hat{f}_c t)$$



$$\hat{f}_c = f'_c$$

$$= \frac{1}{2}A_c(k_a m(t)) + \frac{1}{2}\cos(4\pi f_c t)$$



Exercise: Double-Sideband Programming

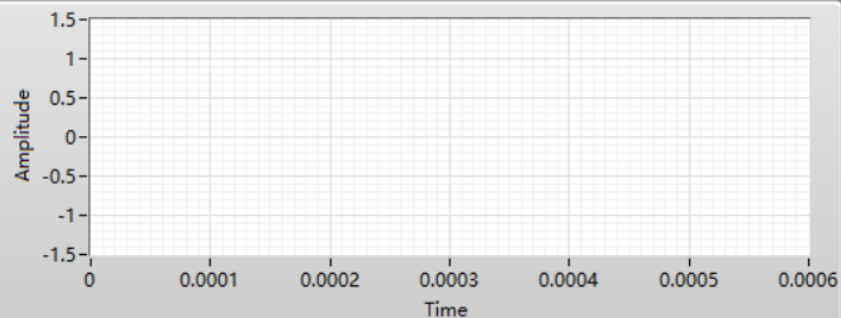
DSB Modulation

DSB Wave

Upper Envelope

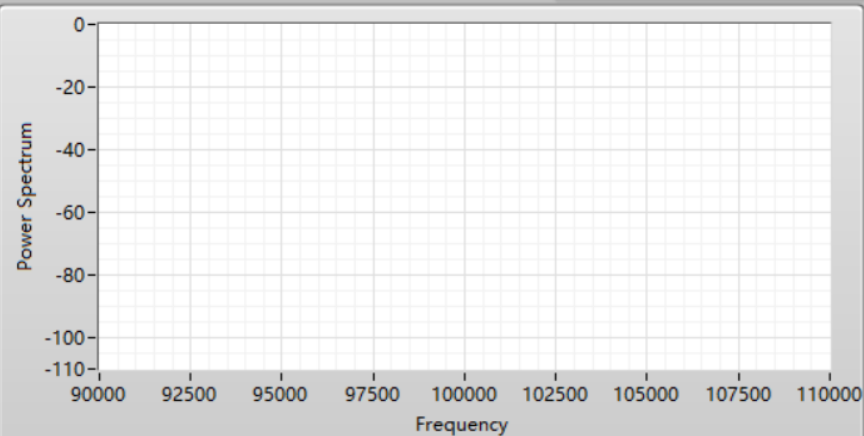


Modulated Signal



DSB Wave

Sine (Power Spectrum)



Carrier Amp.

1

Carrier Freq.

100000

Modulation Freq.

2000

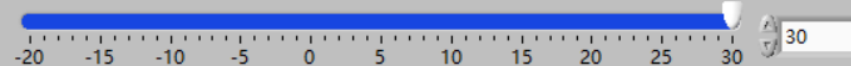
LPF Cut-Off

10000

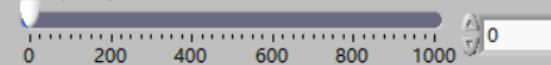
WAV Sample Rate

44100

AWGN (dB)



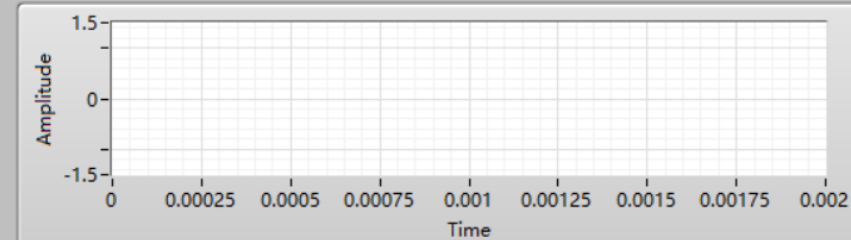
Frequency Offset



stop

STOP

Baseband

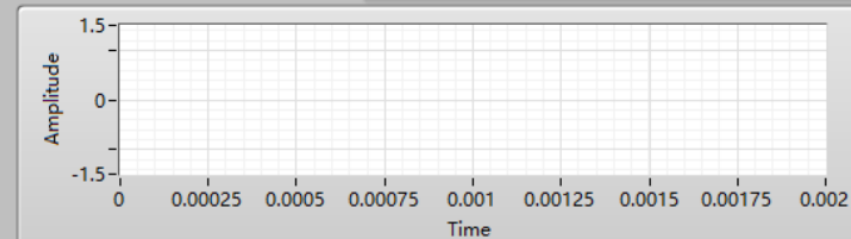


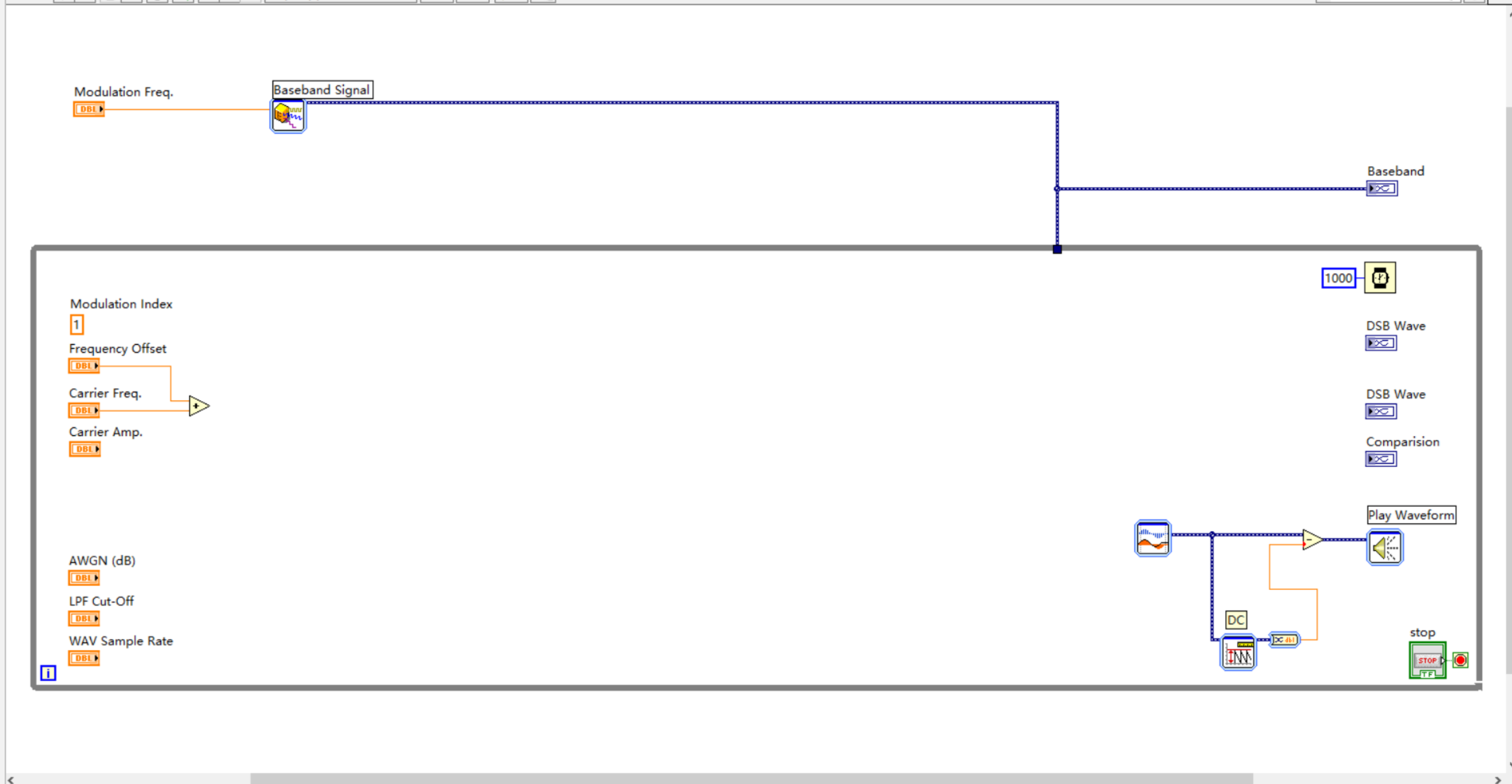
Comparison

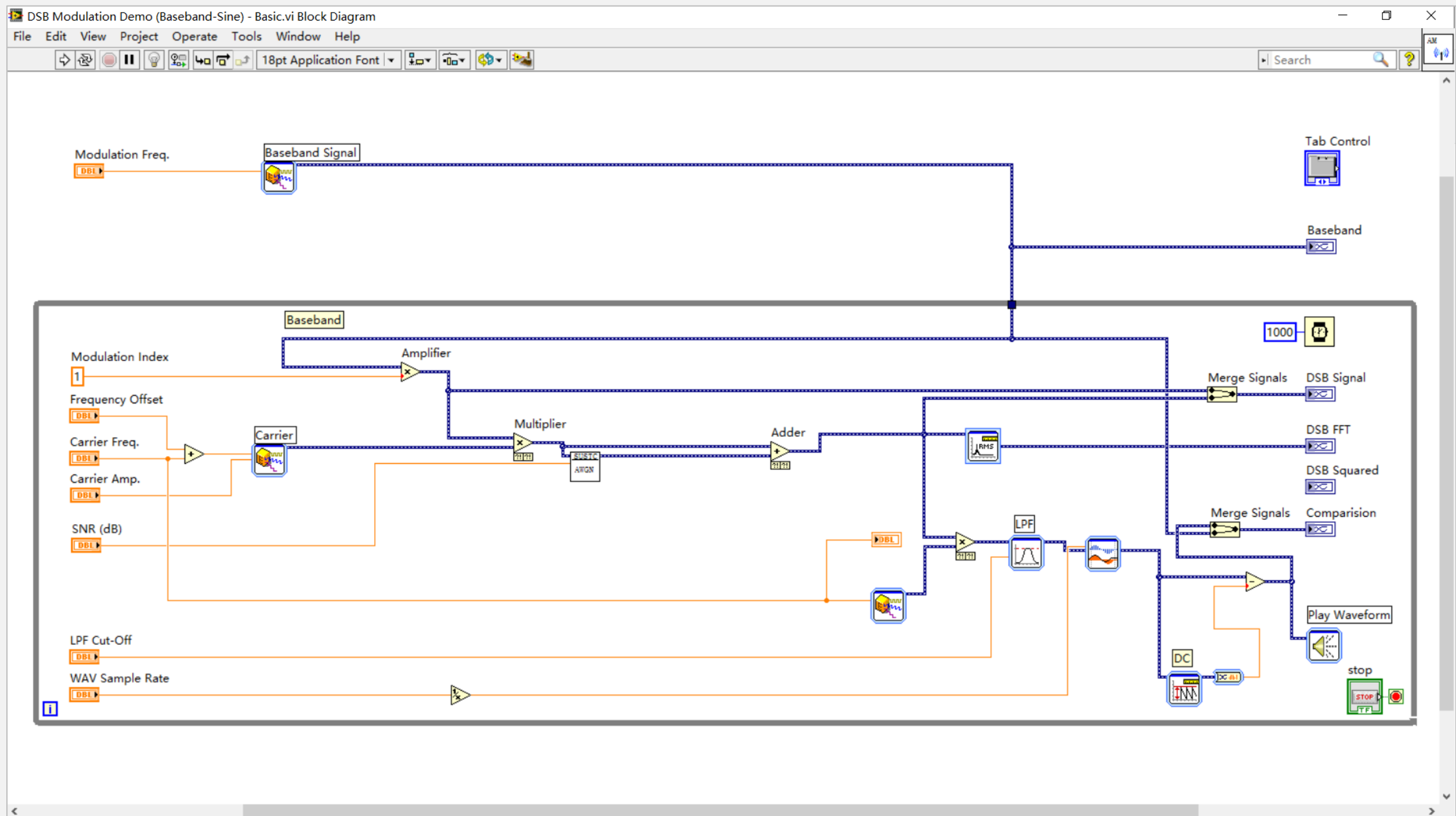
Recovered Signal

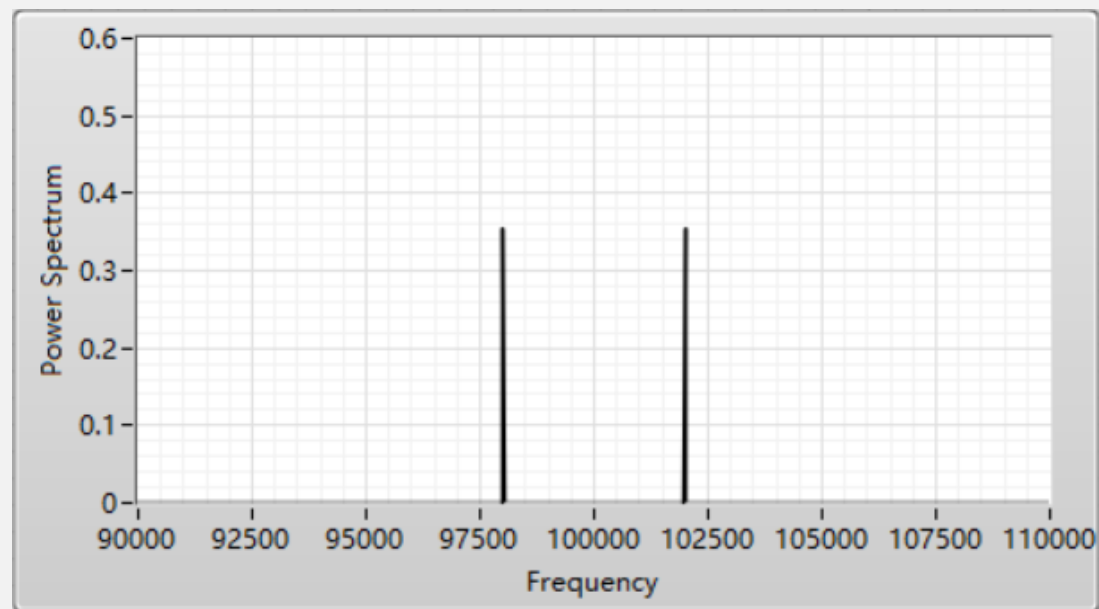
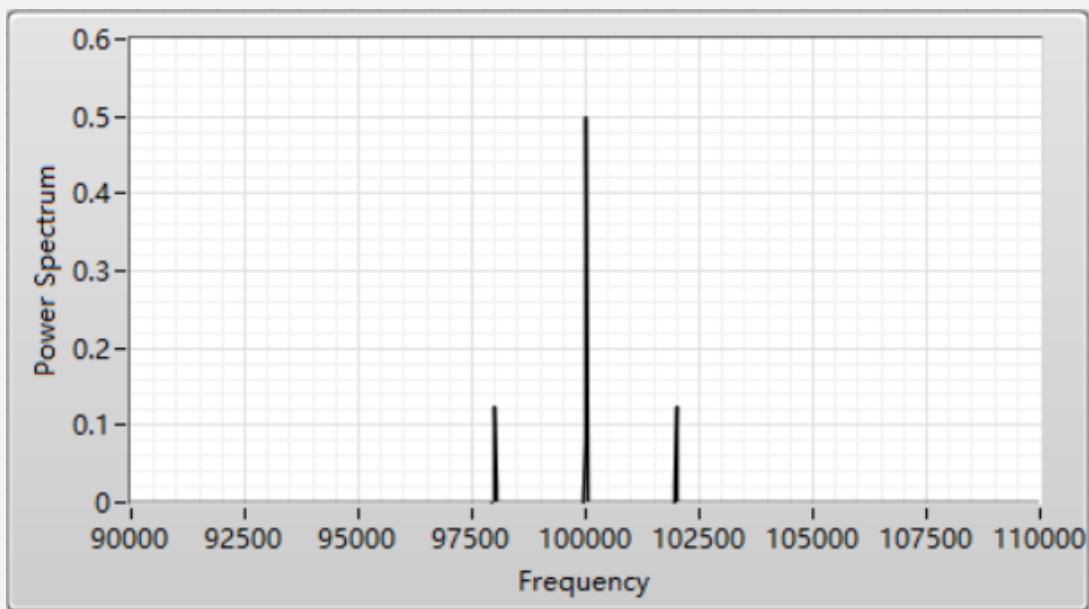


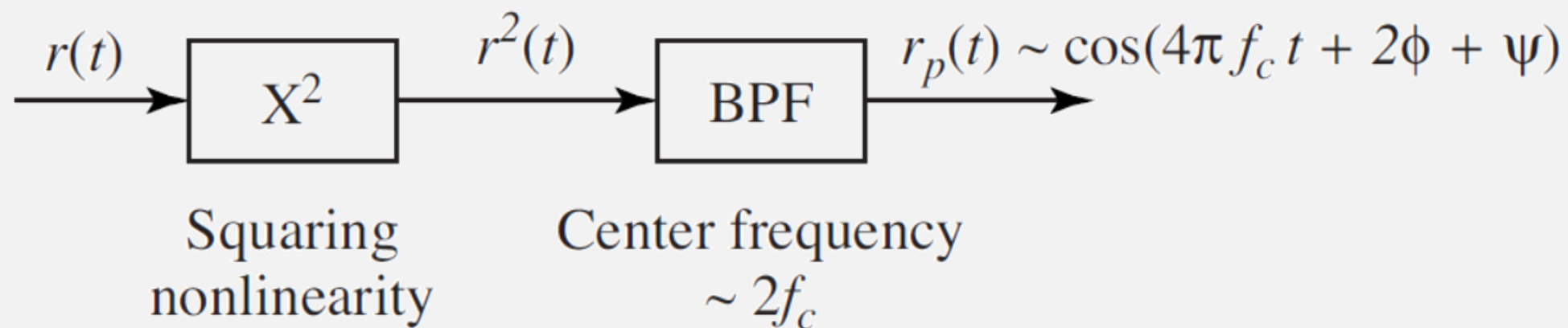
Baseband Signal











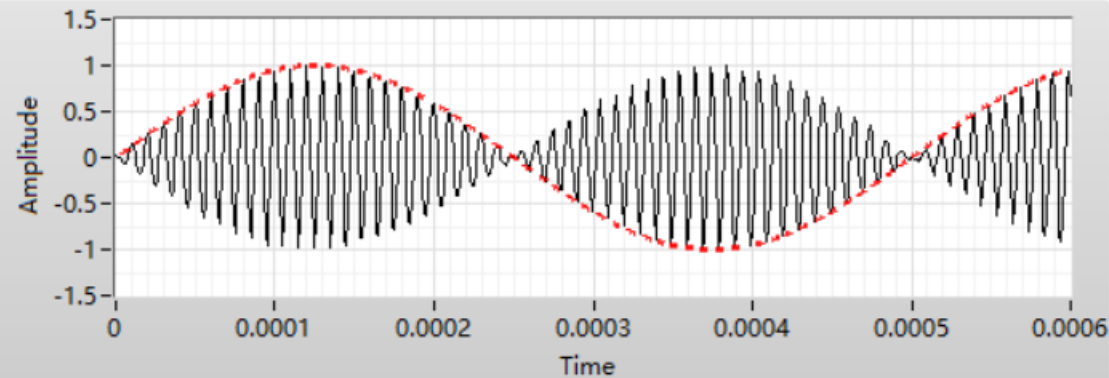
DSB Modulation

DSB Signal

Envelope

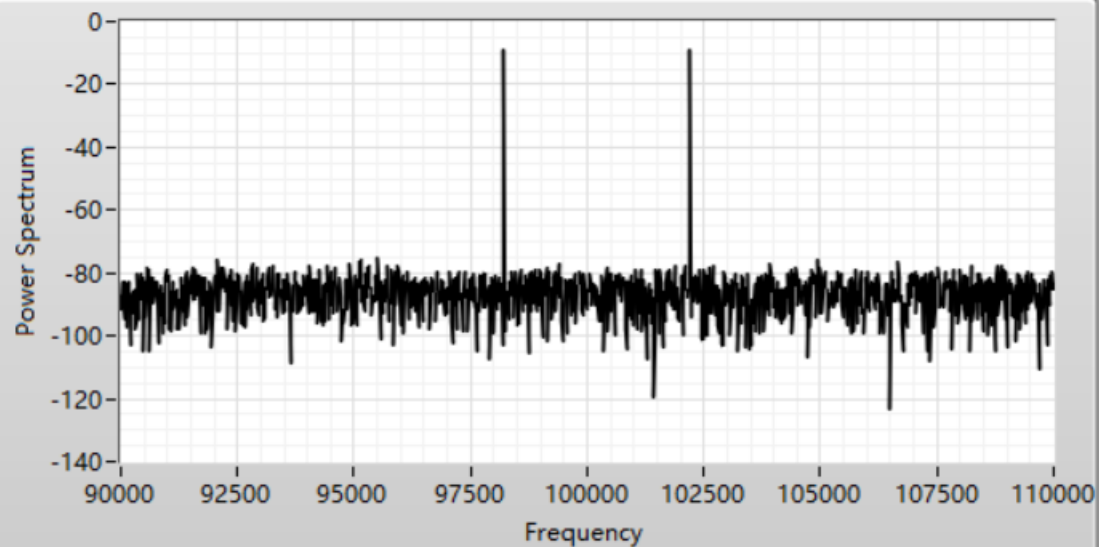


DSB Signal



DSB FFT

DSB Squared



Carrier Amp.

1

Carrier Freq.

100000

Modulation Freq.

2000

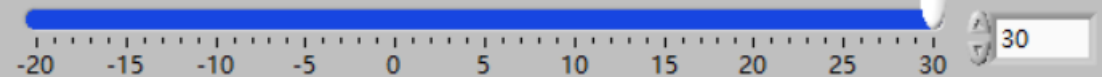
LPF Cut-Off

5000

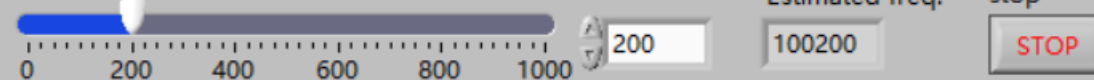
WAV Sample Rate

44100

SNR (dB)



Frequency Offset



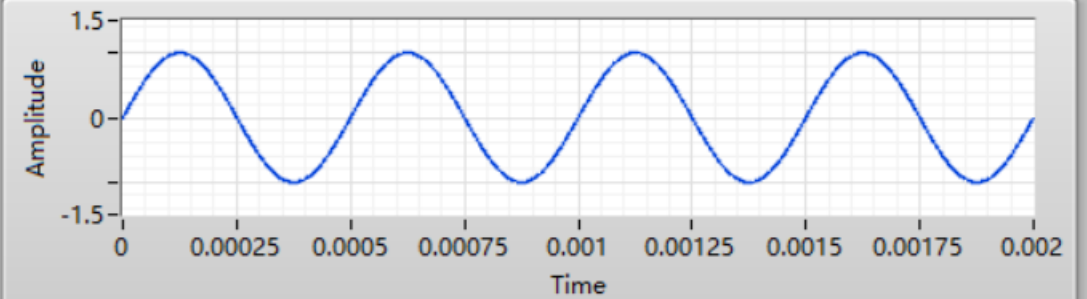
Estimated freq.

100200

stop

STOP

Baseband

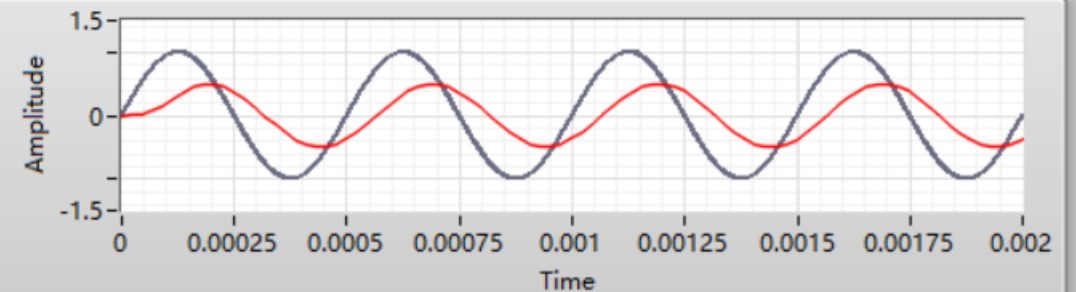


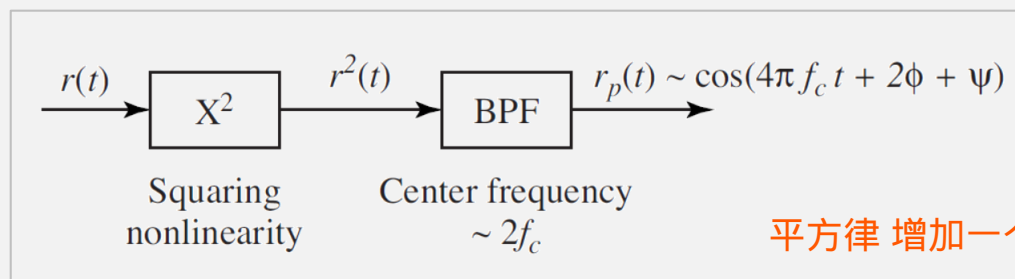
Comparison

Recovered Signal

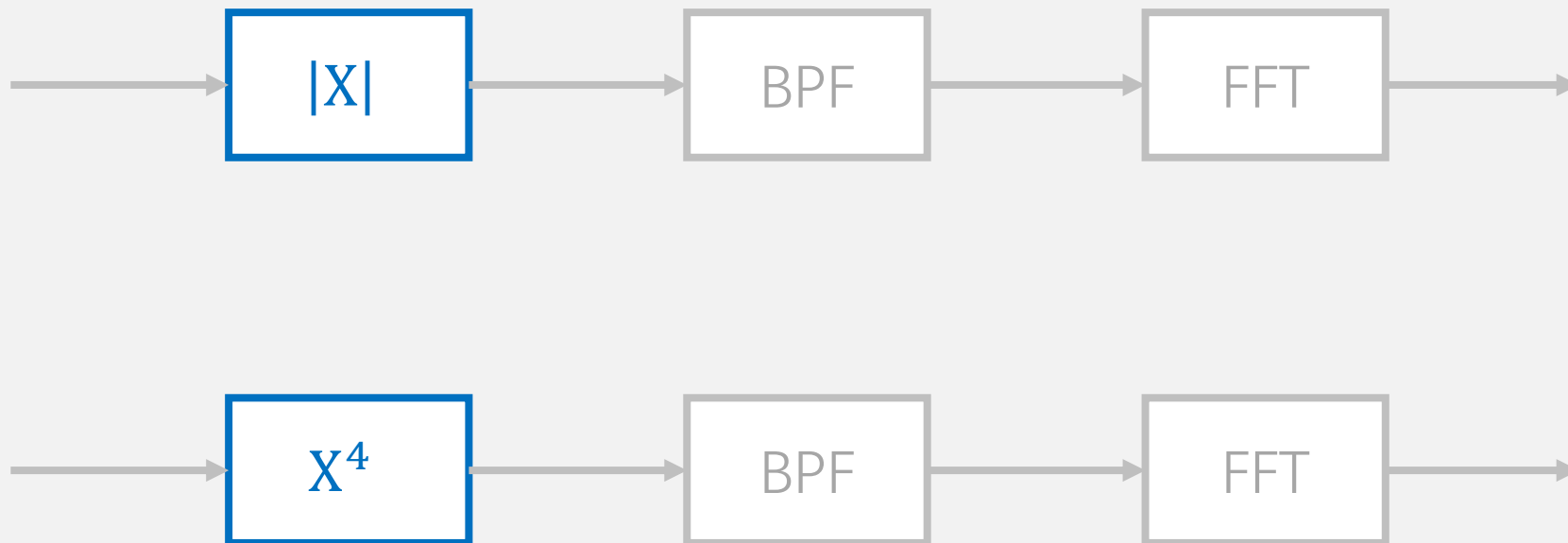


Baseband Signal



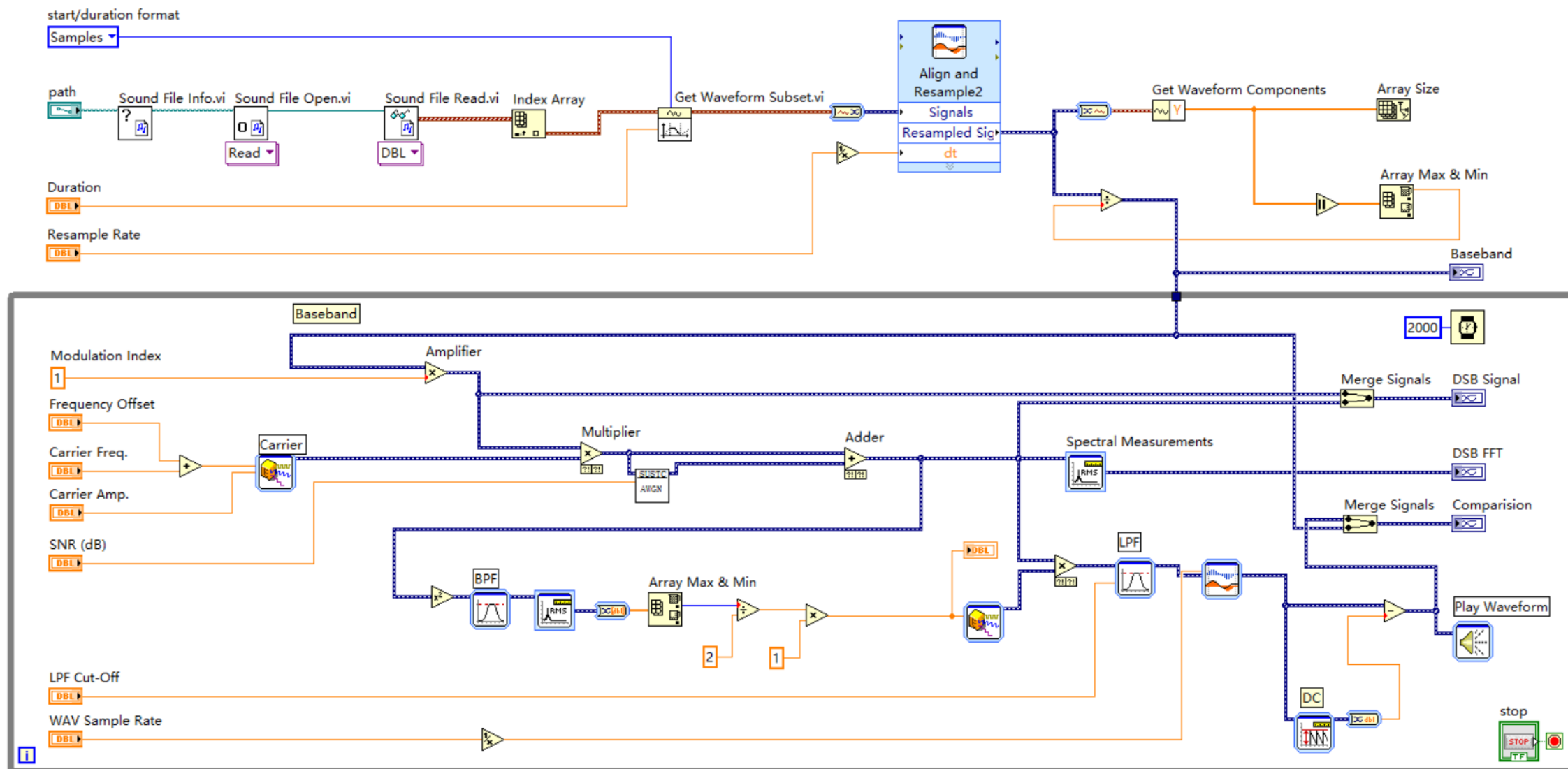


平方律 增加一个乘法器



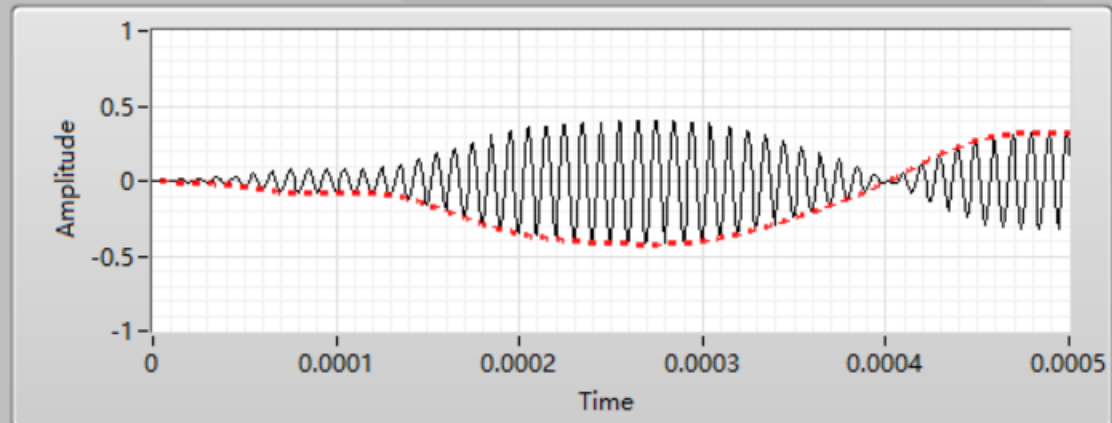


Demo: Double-Sideband (Music)

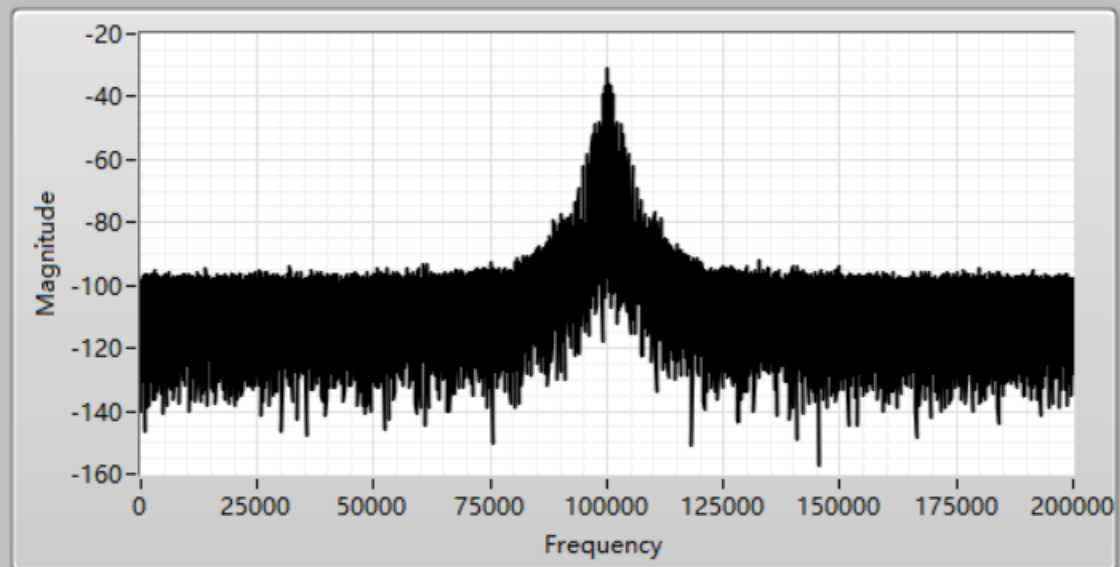


DSB Modulation

DSB Signal



DSB FFT



path

D:\File\mozart.wav

Duration

44101

LPF Cut-Off

5000

Carrier Amp.

1

Carrier Freq.

100000

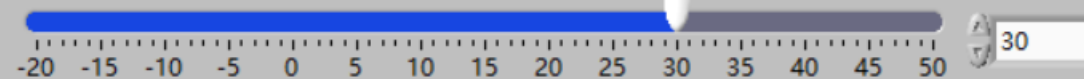
WAV Sample Rate

44100

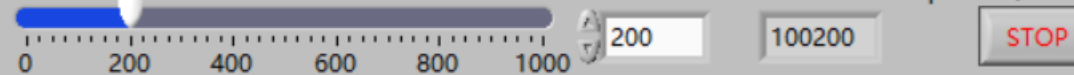
Resample Rate

1000000

SNR (dB)



Frequency Offset



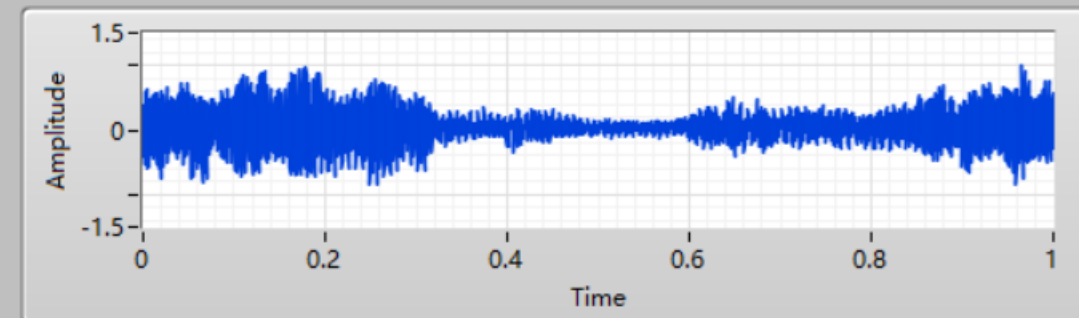
Estimated freq.

100200

stop

STOP

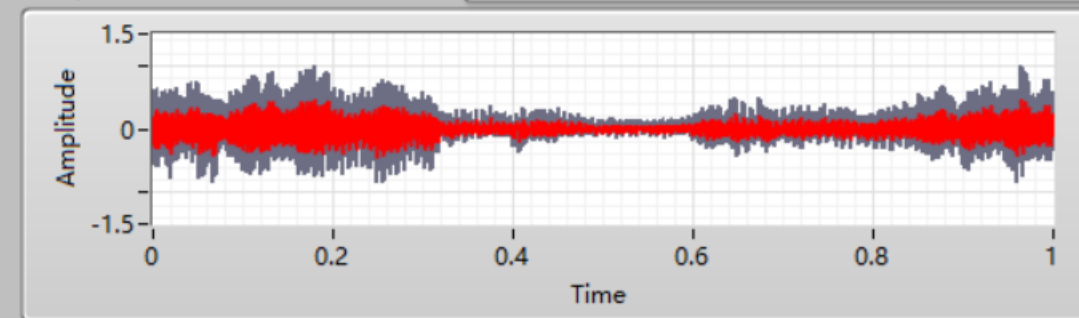
Baseband



Comparison

Recovered Signal

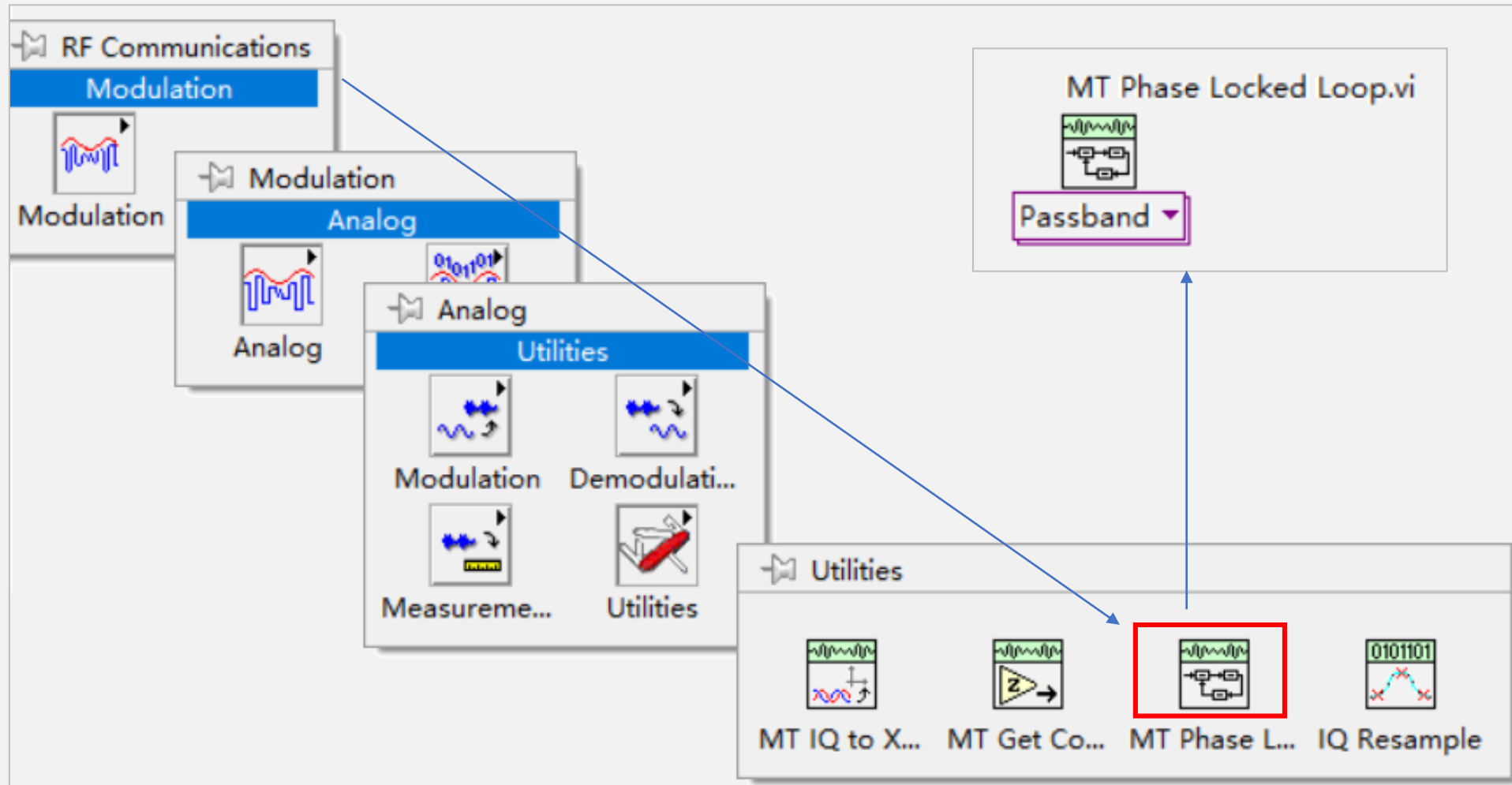
Baseband Signal

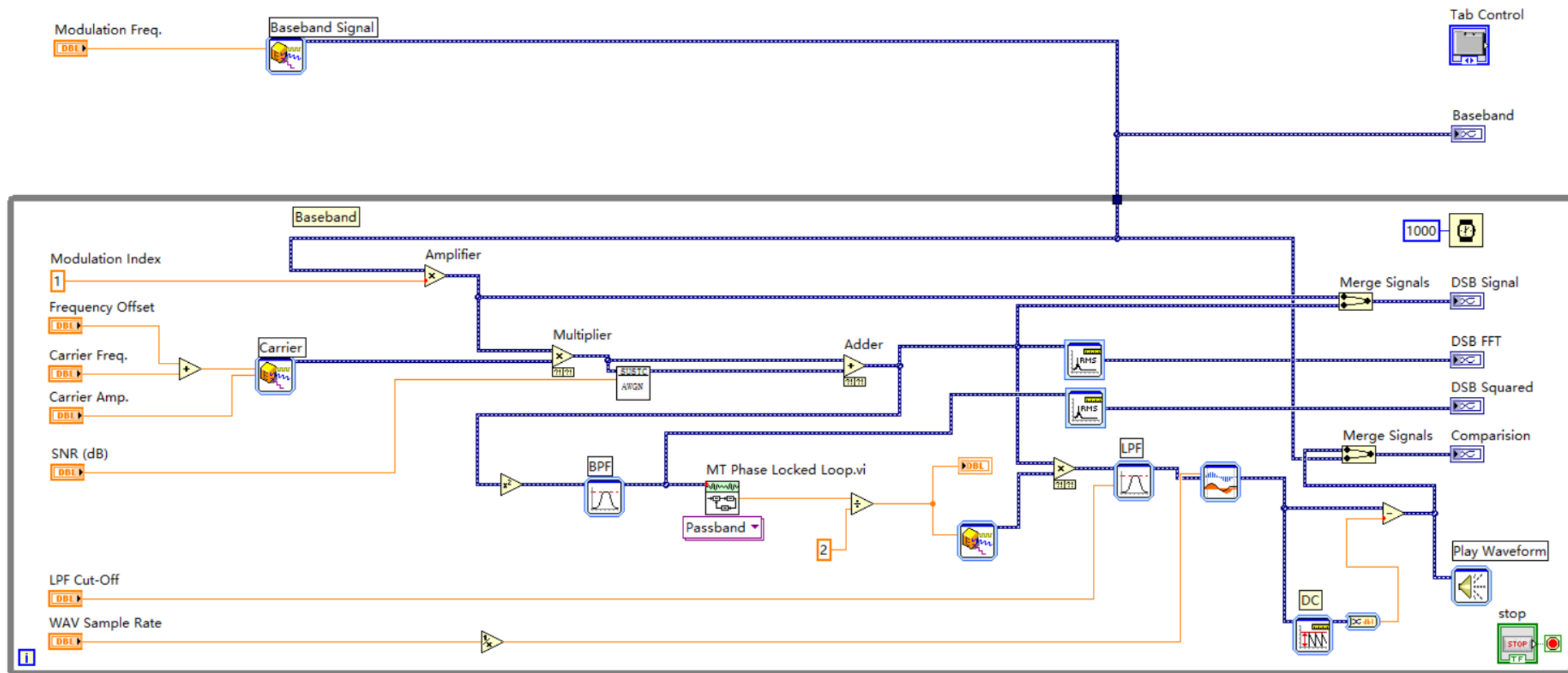


PLL: Phase Locked Loop



MT Phase Locked Loop





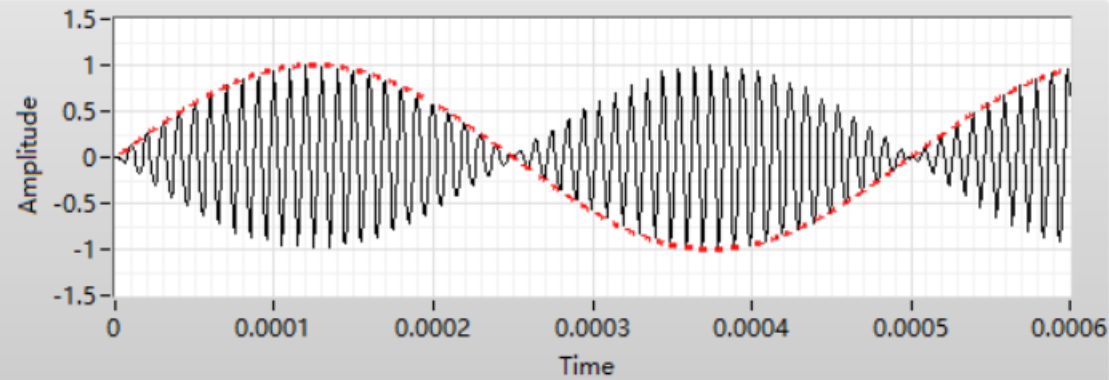
DSB Modulation

DSB Signal

Envelope

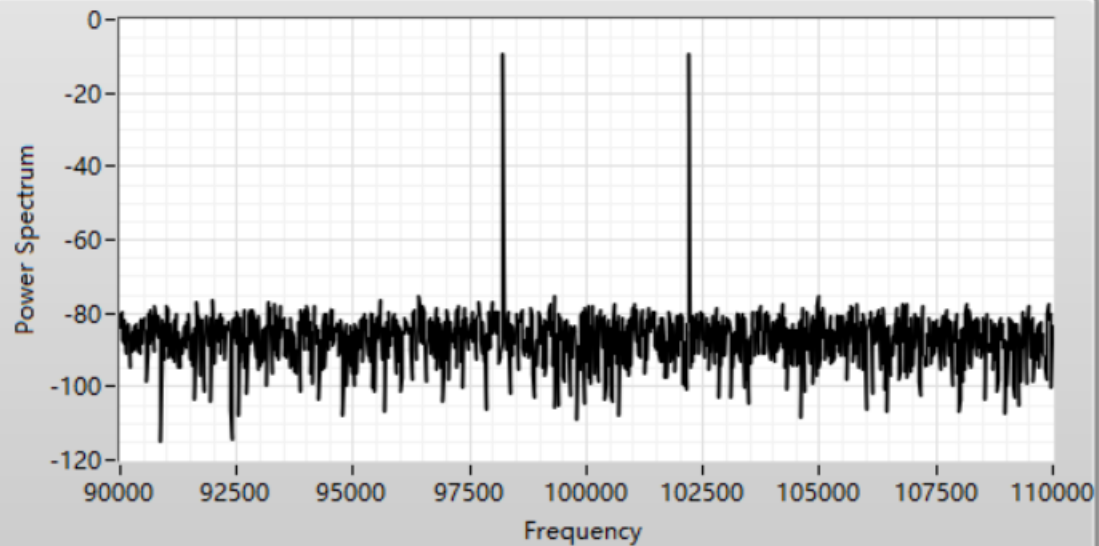


DSB Signal



DSB FFT

DSB Squared



Carrier Amp.

1

Carrier Freq.

100000

Modulation Freq.

2000

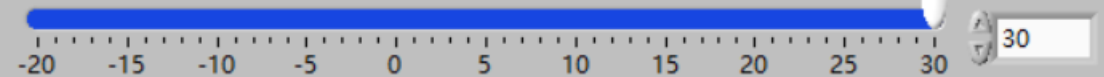
LPF Cut-Off

5000

WAV Sample Rate

44100

SNR (dB)



Frequency Offset



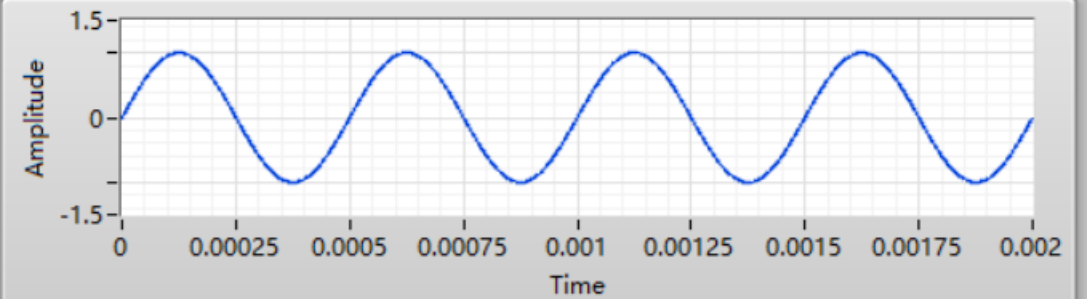
Estimated freq.

100200

stop

STOP

Baseband

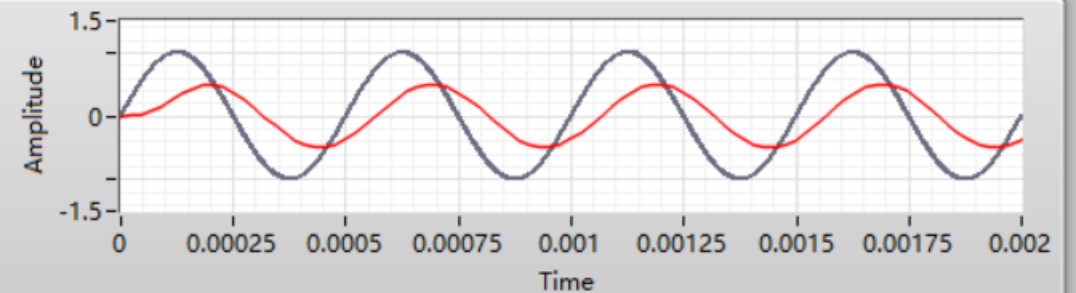


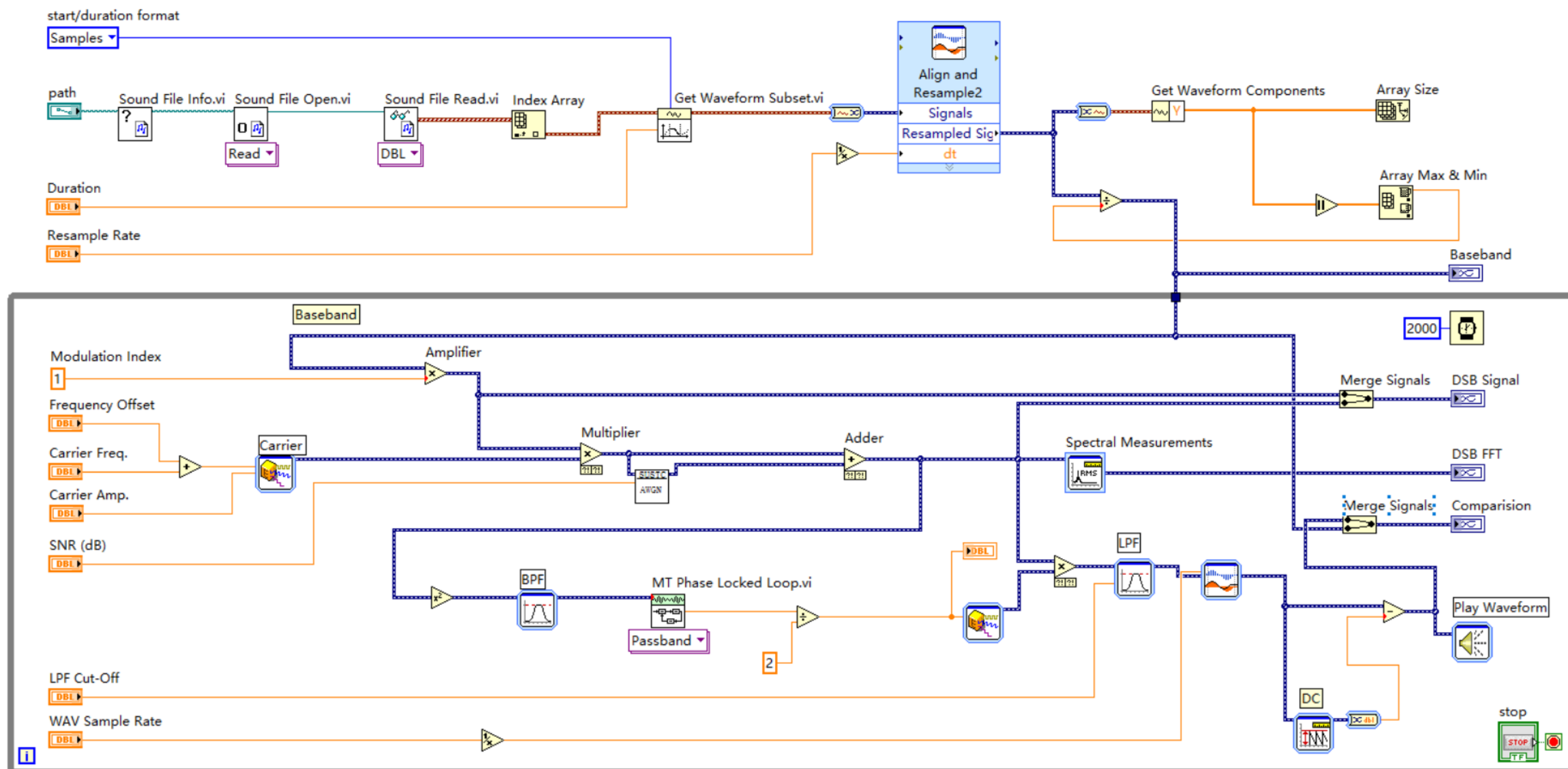
Comparison

Recovered Signal



Baseband Signal





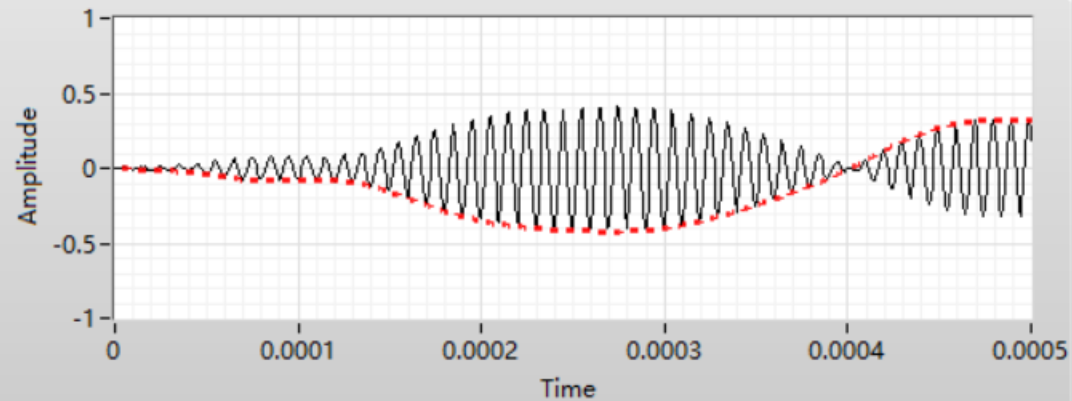
DSB Modulation

DSB Signal

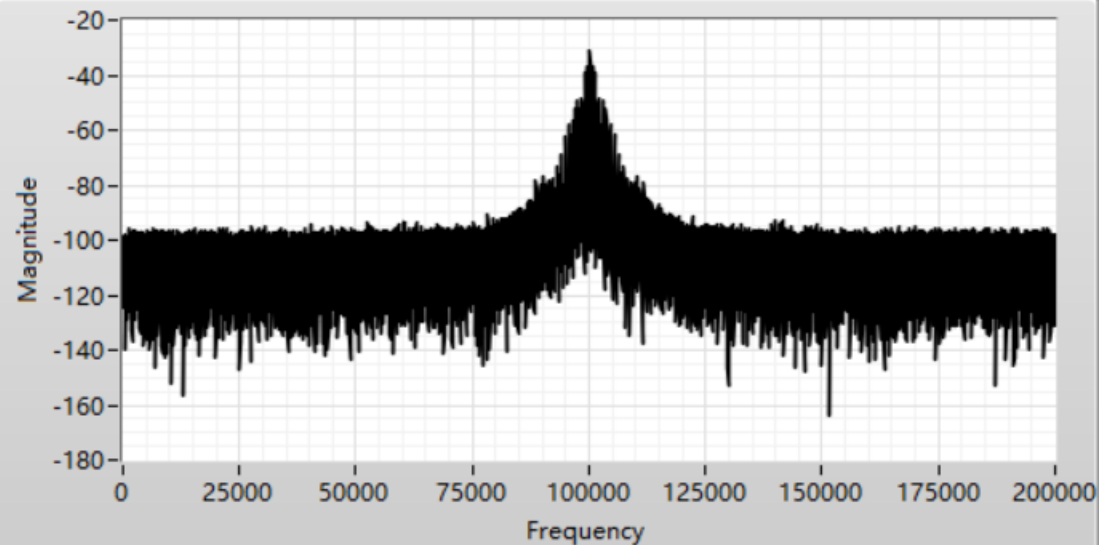
Envelope



Modulated Signal



DSB FFT



path

D:\File\mozart.wav

Duration

44101

LPF Cut-Off

5000

Carrier Amp.

1

Carrier Freq.

100000

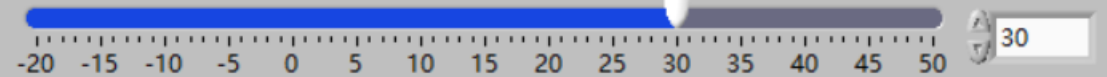
WAV Sample Rate

44100

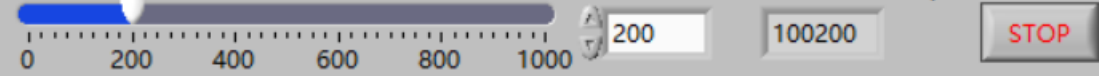
Resample Rate

1000000

SNR (dB)



Frequency Offset



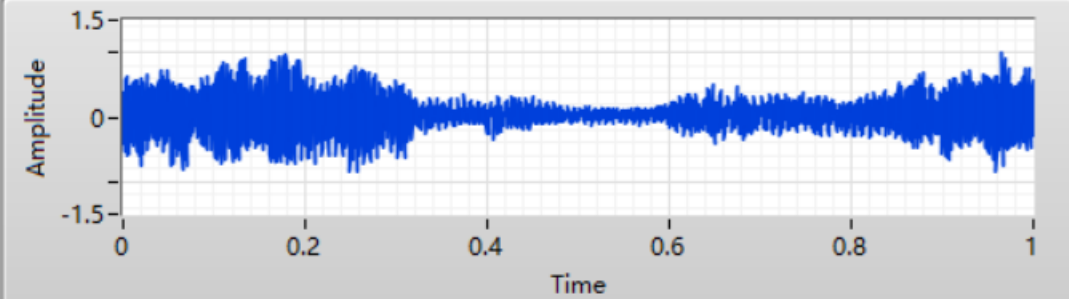
Estimated freq.

100200

stop

STOP

Baseband

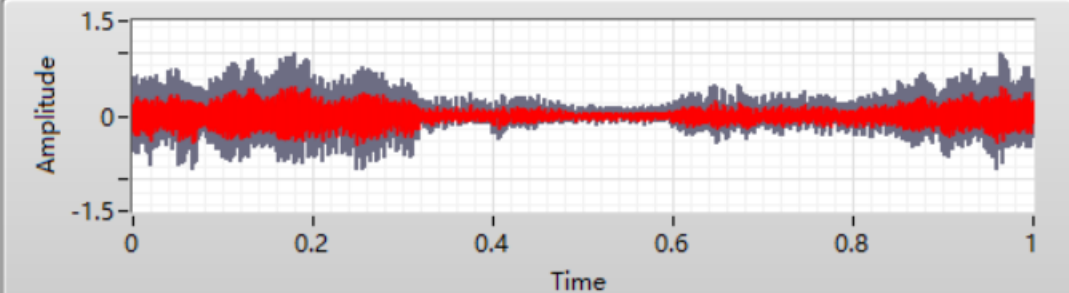


Comparison

Recovered Signal



Baseband Signal





- Question ?





【通信新说】



腾讯课堂