FFT and Spectrum Analyzer

Objective:

- Understand the frequency domain and some of it's uses
- Understand the Discrete Fourier Transform

Preparation: (i) PC and data acquisition system (ii)FFT software

Background:

A signal can be observed from two different domains:

1. The time domain
2. The frequency domain

A spectrometer, e.g. a prism, splits light into its component colors which provides its spectral content. This is similar to the trace on a spectrum analyzer, where the abscissa is the frequency and the ordinate is the signals amplitude at that frequency. We have been familiar with the *time domain* signal such as the trace on an oscilloscope where the ordinate is the signals amplitude, and the abscissa is the time variable.

Any signal can be fully described in either of these domains and they are related by a tool called the *Fourier transform*. The Discrete Fourier Transform (DFT) is used to produce frequency analysis of discrete non-periodic signals.

It is usually employed to transform data which may arise from either an actual continuous time process or perhaps a discrete time process which is being analysed from a continuous time system approach. The DFT is usually used to approximate the Fourier transform of a continuous time process, and it is necessary to understand some of the limitations inherent in this approach.

There are three possible phenomena that result in errors between the computed and the desired transform. These three phenomena are (a) *aliasing*, (b) *leakage*, and (c) *the picket-fence effect.*

(a) *Aliasing*. The only solution to the aliasing problem is to ensure that the sampling rate is high enough to avoid any spectral overlap, or to use an *anti-aliasing filter*.

(b) *Leakage*. This problem arises because of the practical requirement of the signal to be a finite interval. The process of terminating the signal after a finite number of terms is equivalent to multiplying the signal by a *window function*. The net effect is a

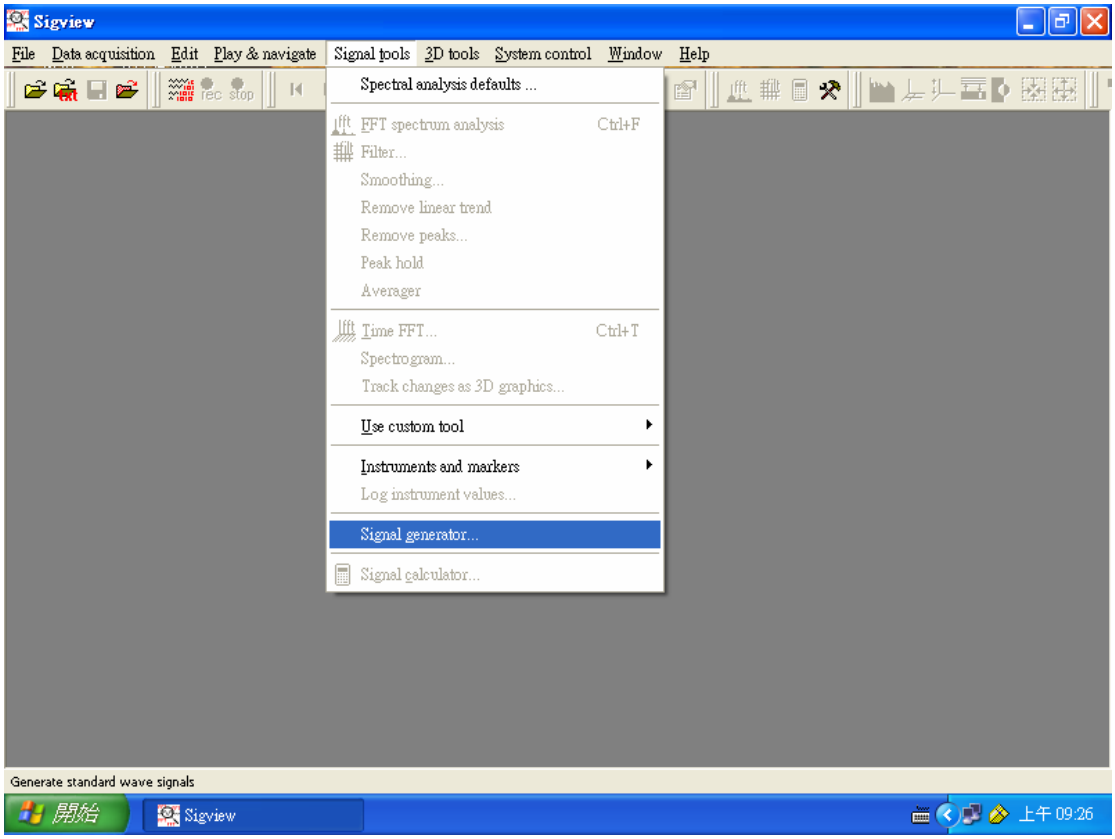
distortion of the spectrum. There is a spreading or leakage of the spectral components away from the correct frequency, resulting in an undesirable modification of the total spectrum.

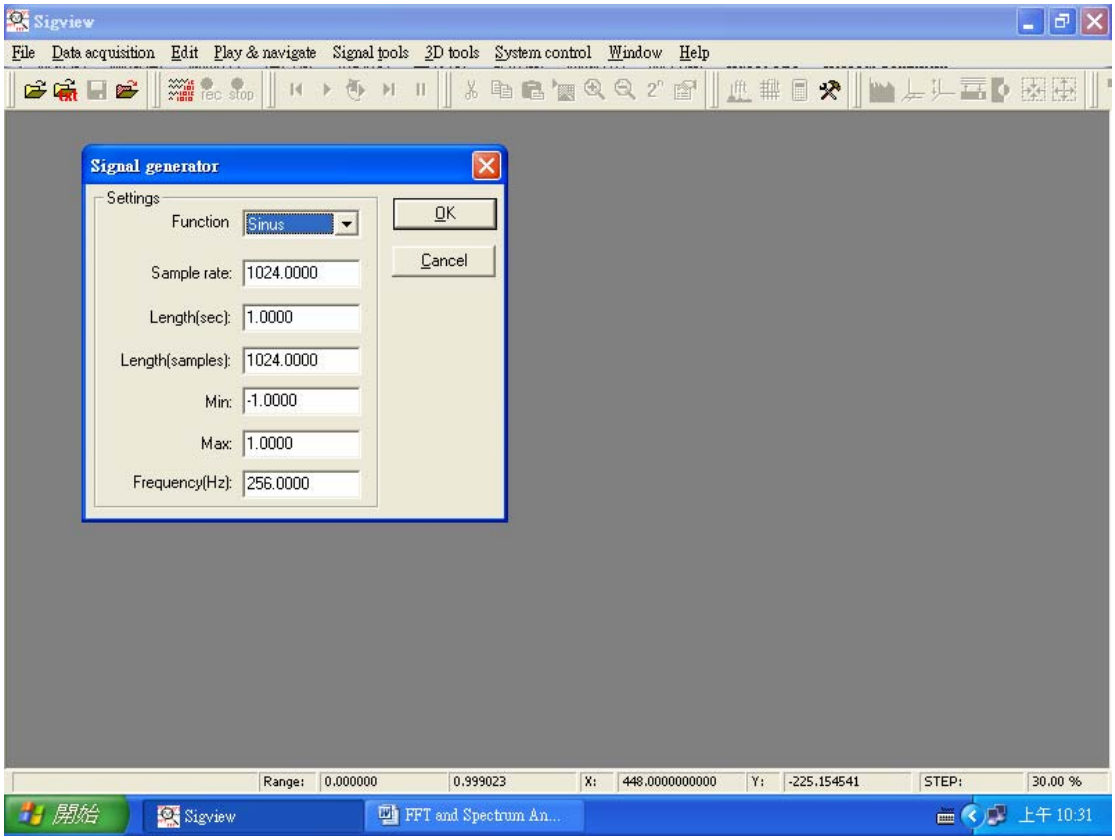
(c) *Picket-Fence Effect*. This effect is produced by the inability of the DFT to observe the spectrum as a continuous function, since computation of the spectrum is limited to integer multiples of the fundamental frequency F (reciprocal of the sample length). Observation of the spectrum with the DFT is analogous to looking at it through a sort of "picket-fence," since we can observe the exact behavior only at discrete points. The major peak of a particular component could lie between two of the discrete transform lines, and the peak of this component might not be detected without some addition processing.

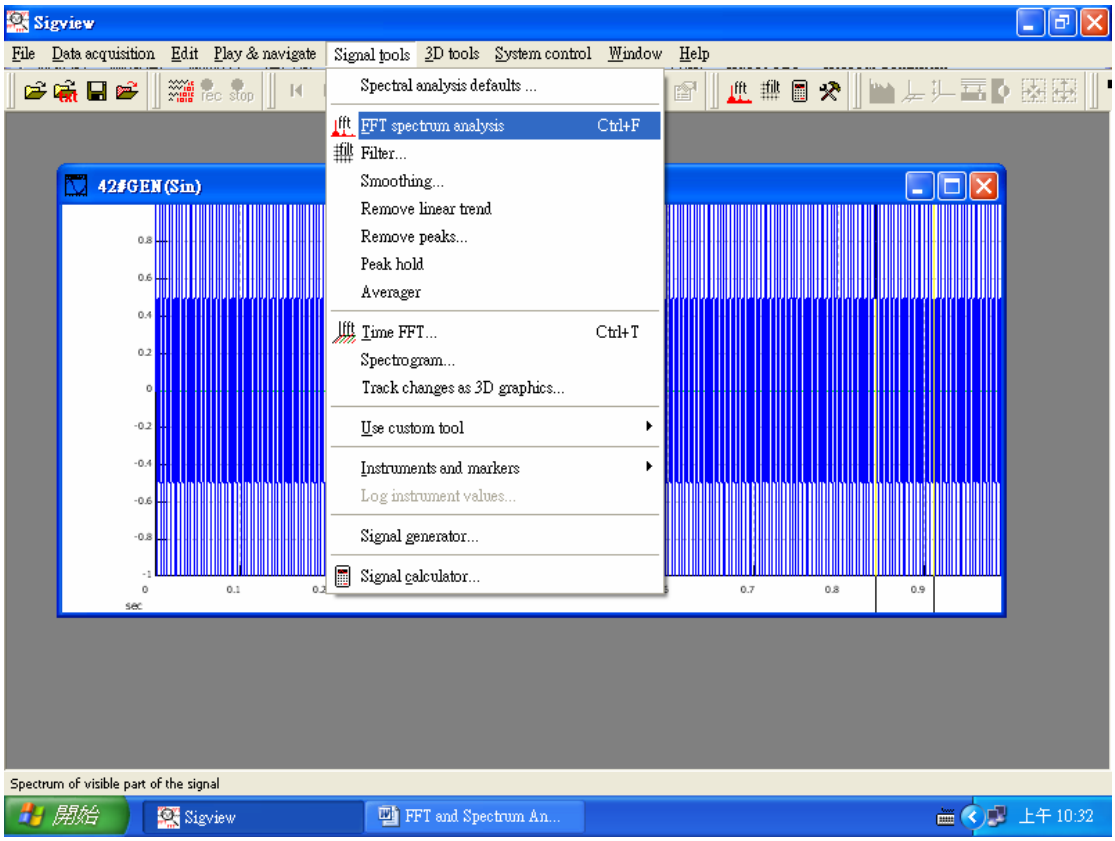
A fast Fourier transform (FFT) is an efficient algorithm to compute the DFT and its inverse. It reduces the number of computations needed for N points from $2N^2$ to $2N\log_2 N$.

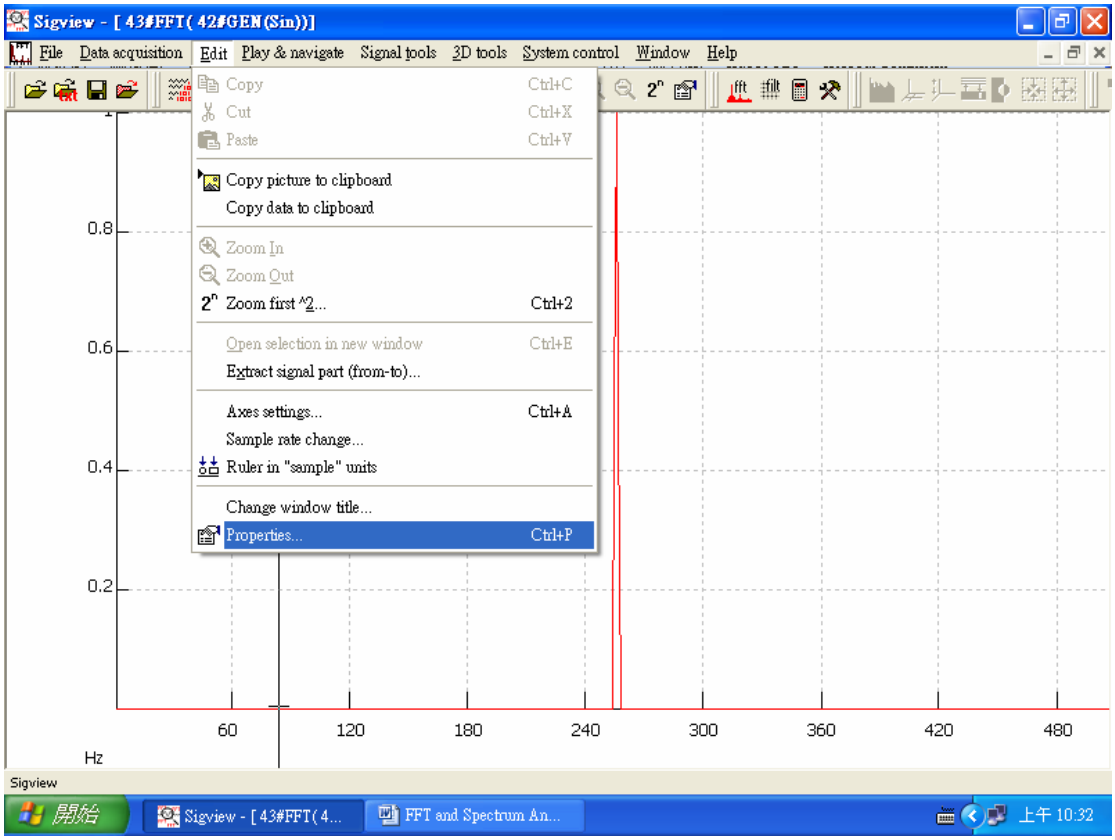
Procedure:

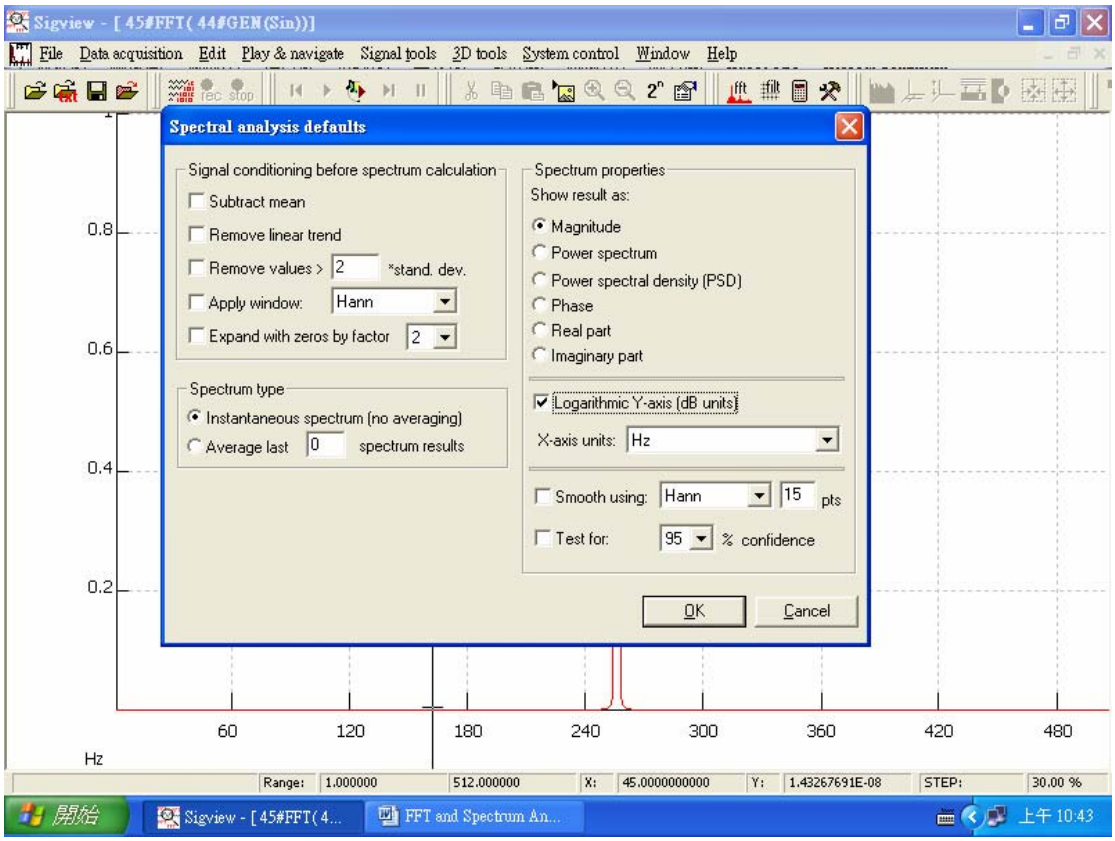
1. Turn on the PC. Run the program “Sigview.”
2. Follow the procedure given below to be familiar with the software.
3. Observe the results carefully and pay attention to the *sampling* (sampling rate) and *truncation* (data length) effect.
4. Generate your own signals and perform FFT to observe their spectra such that you can complete your report.
5. Use sinus and step functions only.

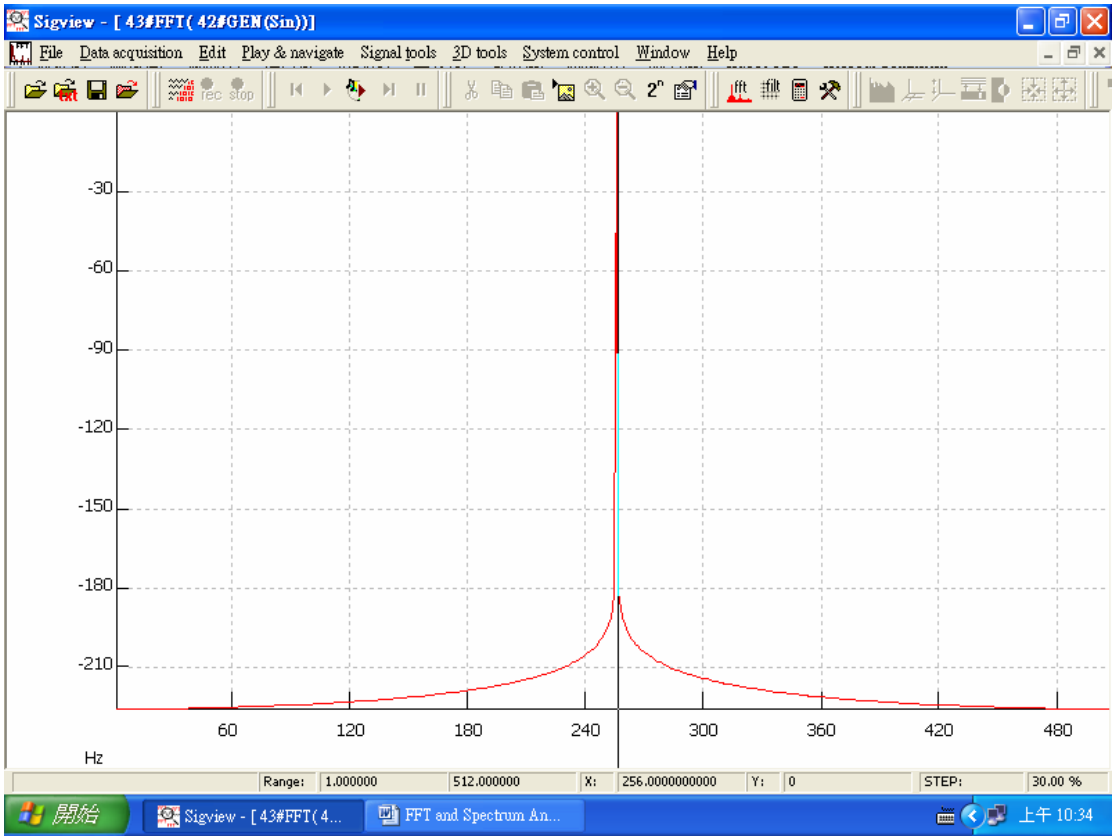

Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults ...
FFT spectrum analysis Ctrl+F
Filter...
Smoothing...
Remove linear trend
Remove peaks...
Peak hold
Averager
Time FFT... Ctrl+T
Spectrogram...
Track changes as 3D graphics...
Use custom tool
Instruments and markers
Log instrument values...
Signal generator...
Signal calculator...
Generate standard wave signals
開始
Sigview
上午 09:26

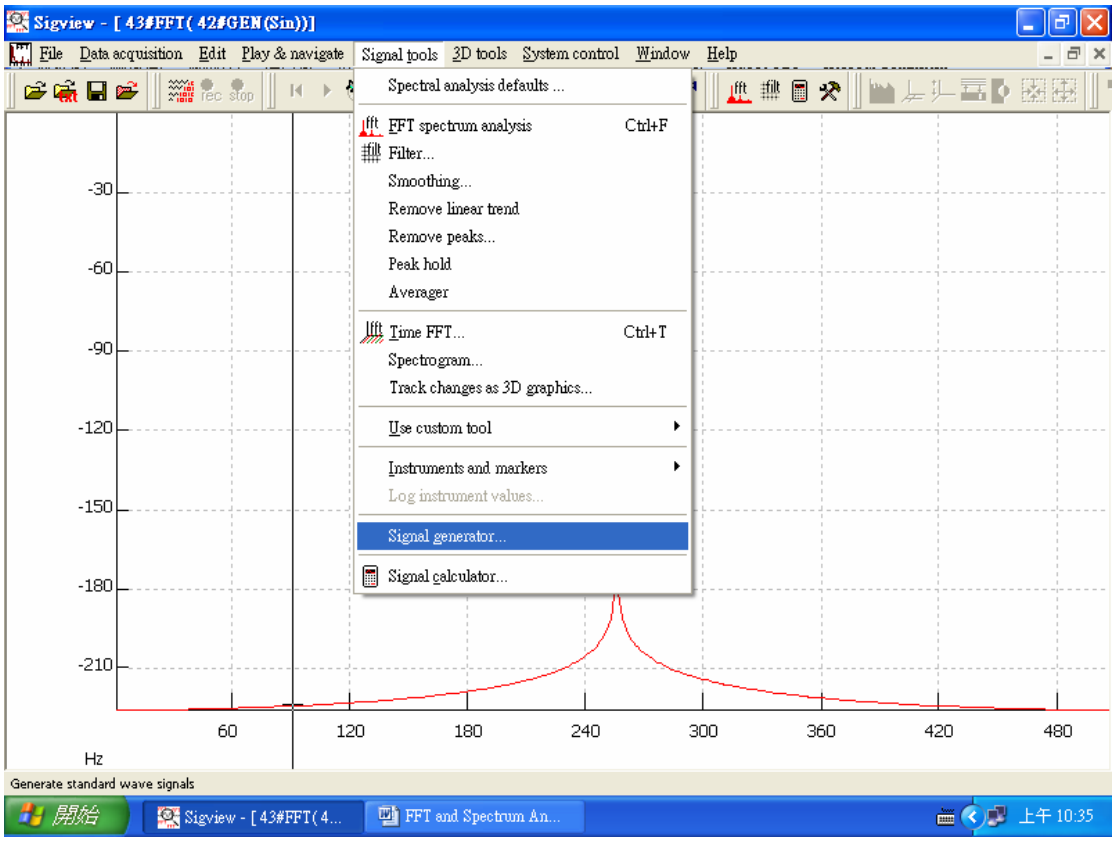

Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Signal generator
Settings
Function Sinus
Sample rate: 1024.0000
Length(sec): 1.0000
Length(samples): 1024.0000
Min: -1.0000
Max: 1.0000
Frequency(Hz): 256.0000
OK
Cancel
Range: 0.000000 0.999023 X: 448.0000000000 Y: -225.154541 STEP: 30.00 %
開始
Sigview
FFT and Spectrum An...
上午 10:31

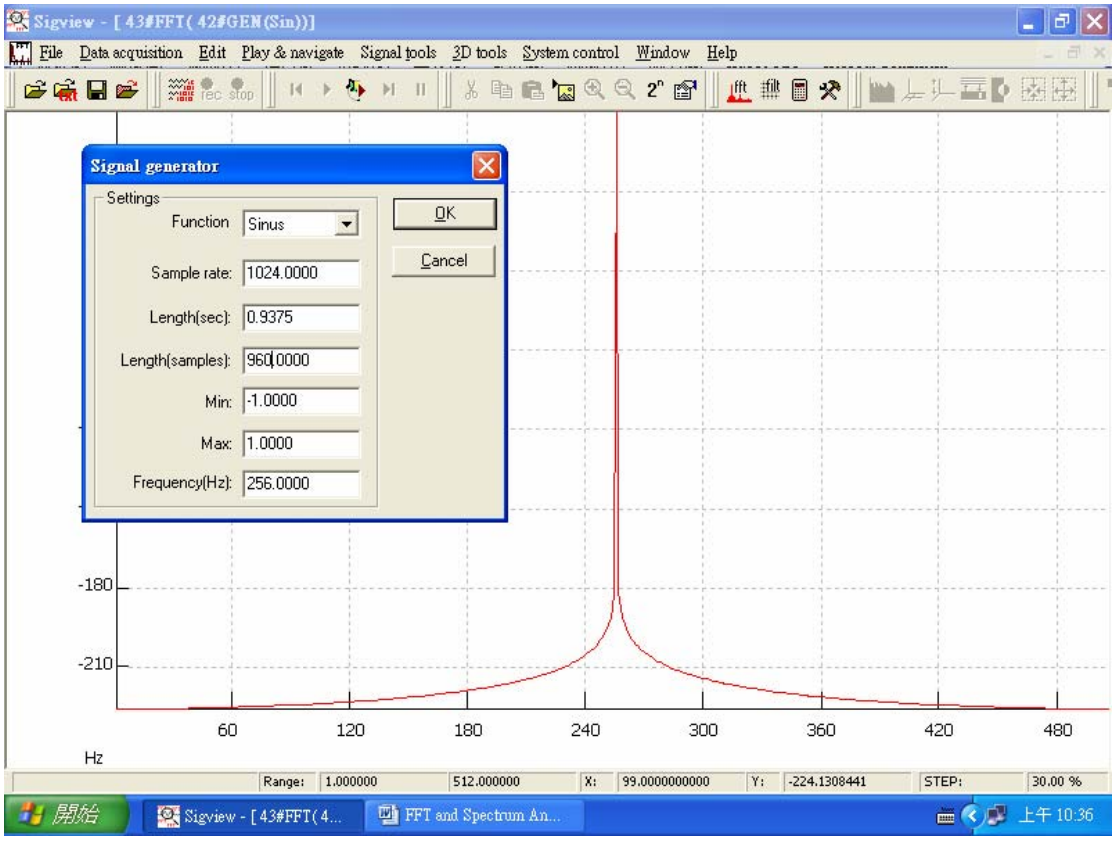

Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults ...
FFT spectrum analysis Ctrl+F
Filter...
Smoothing...
Remove linear trend
Remove peaks...
Peak hold
Averager
Time FFT... Ctrl+T
Spectrogram...
Track changes as 3D graphics...
Use custom tool
Instruments and markers
Log instrument values...
Signal generator...
Signal calculator...
42#GEN(Sin)
sec
Spectrum of visible part of the signal
開始
Sigview
FFT and Spectrum An...
上午 10:32

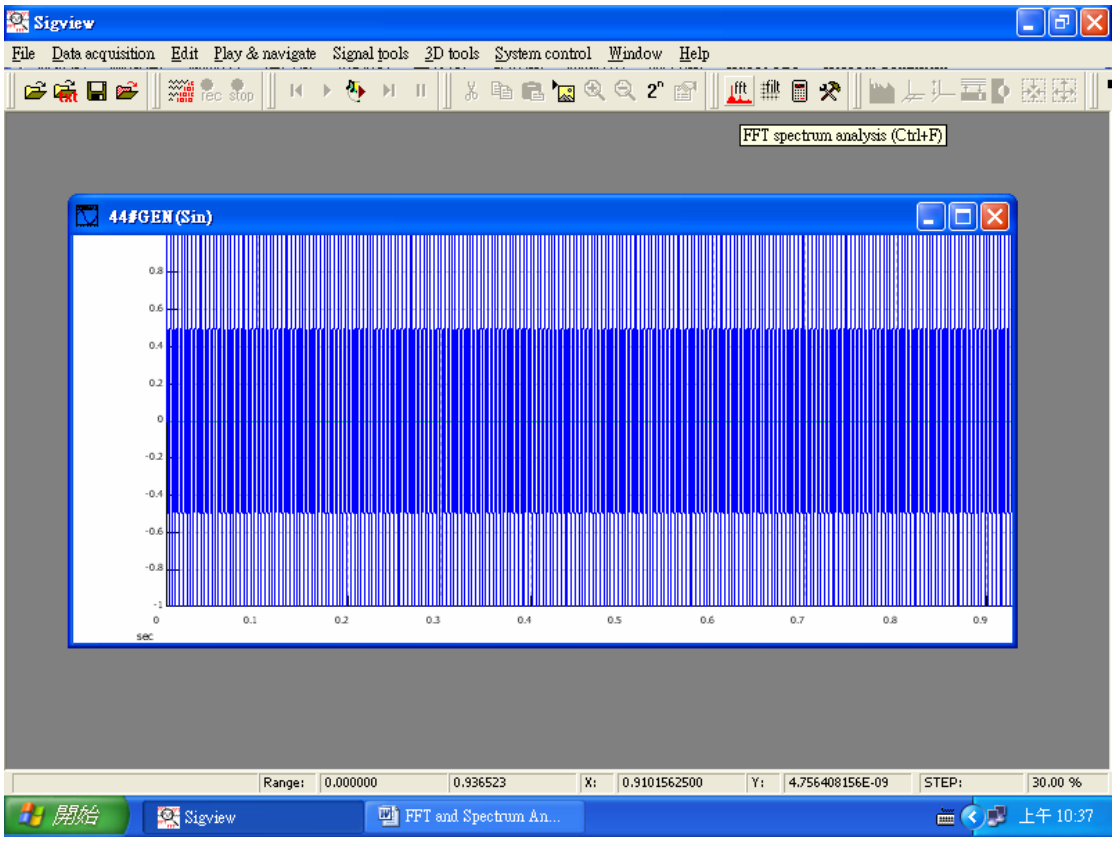

Sigview - [43#FFT(42#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Copy Ctrl+C
Cut Ctrl+X
Paste Ctrl+V
Copy picture to clipboard
Copy data to clipboard
Zoom In
Zoom Out
Zoom first ^2... Ctrl+2
Open selection in new window Ctrl+E
Extract signal part (from-to)...
Axes settings... Ctrl+A
Sample rate change...
Ruler in "sample" units
Change window title...
Properties... Ctrl+P
0.8
0.6
0.4
0.2
60
120
180
240
300
360
420
480
Hz
Sigview
開始
Sigview - [43#FFT(4...
FFT and Spectrum An...
上午 10:32

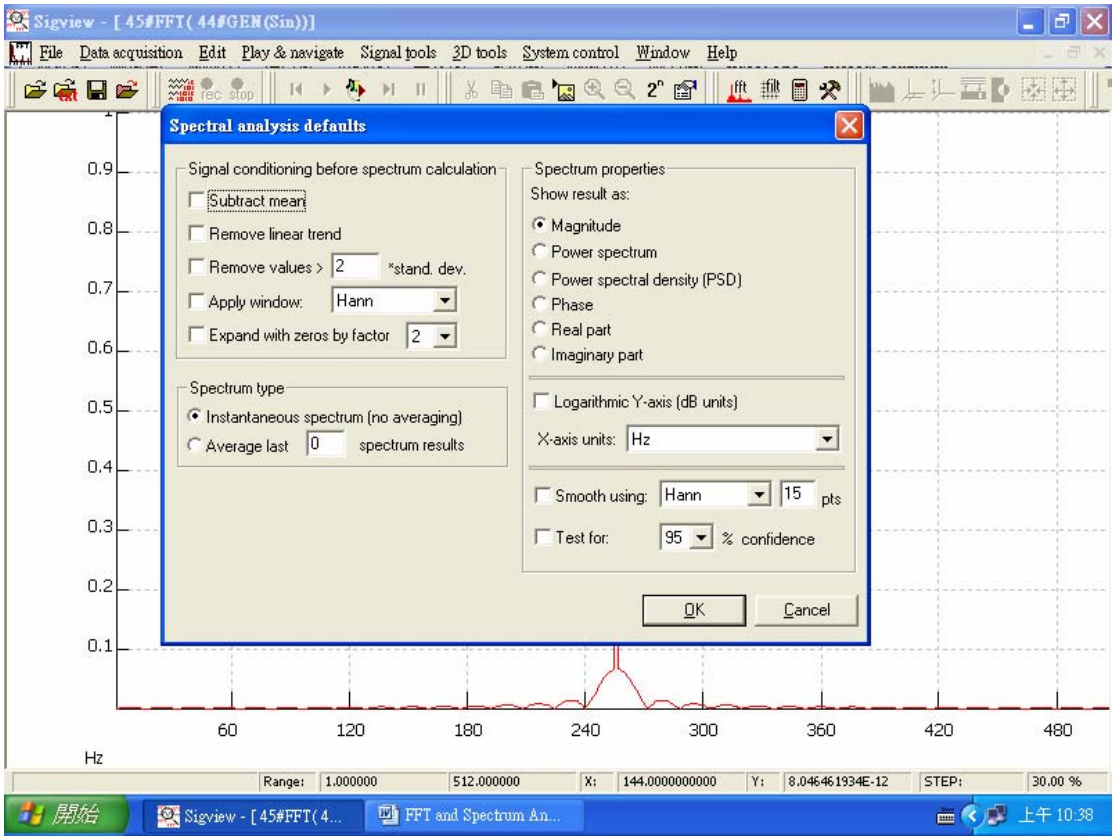

Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hann
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
0.8
0.6
0.4
0.2
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 45.0000000000 Y: 1.43267691E-08 STEP: 30.00 %
開始 Sigview - [45#FFT(4... FFT and Spectrum An... 上午 10:43

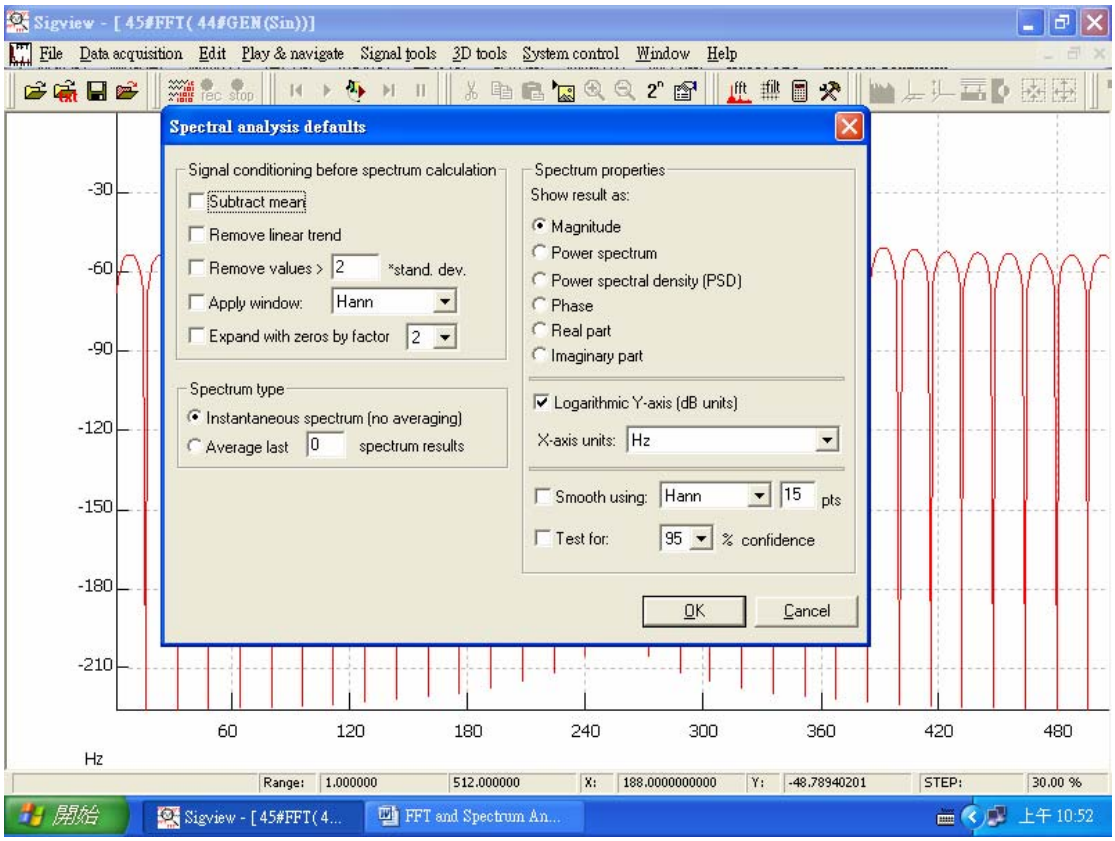

Sigview - [43#FFT(42#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-30
-60
-90
-120
-150
-180
-210
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 256.0000000000 Y: 0 STEP: 30.00 %
開始 Sigview - [43#FFT(4... FFT and Spectrum An... 上午 10:34


Sigview - [43#FFT(42#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults ...
FFT spectrum analysis Ctrl+F
Filter...
Smoothing...
Remove linear trend
Remove peaks...
Peak hold
Averager
Time FFT... Ctrl+T
Spectrogram...
Track changes as 3D graphics...
Use custom tool
Instruments and markers
Log instrument values...
Signal generator...
Signal calculator...
-30
-60
-90
-120
-150
-180
-210
60
120
180
240
300
360
420
480
Hz
Generate standard wave signals
開始
Sigview - [43#FFT(4...
FFT and Spectrum An...
上午 10:35


Sigview - [43#FFT(42#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Signal generator
Settings
Function Sinus
Sample rate: 1024.0000
Length(sec): 0.9375
Length(samples): 960.0000
Min: -1.0000
Max: 1.0000
Frequency(Hz): 256.0000
OK
Cancel
-180
-210
60
120
180
240
300
360
420
480
Hz
Range: 1.000000
512.000000
X: 99.0000000000
Y: -224.1308441
STEP:
30.00 %
開始
Sigview - [43#FFT(4...
FFT and Spectrum An...
上午 10:36


Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
FFT spectrum analysis (Ctrl+F)
44#GEN(Sin)
sec
Range: 0.000000 0.936523 X: 0.9101562500 Y: 4.756408156E-09 STEP: 30.00 %
開始 Sigview FFT and Spectrum An... 上午 10:37


Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hann
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
Hz
Range: 1.000000 512.000000 X: 144.0000000000 Y: 8.046461934E-12 STEP: 30.00 %
開始 Sigview - [45#FFT(4... FFT and Spectrum An... 上午 10:38


Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hann
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
-30
-60
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-120
-150
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-210
60
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240
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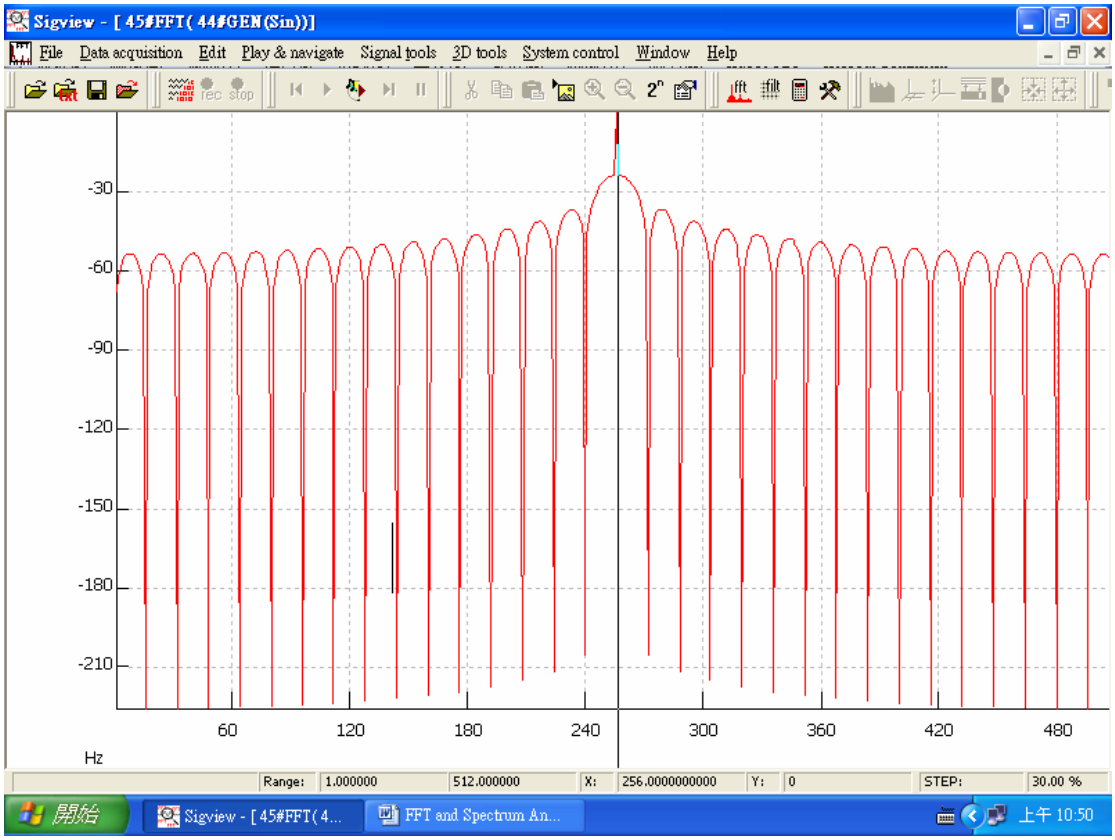
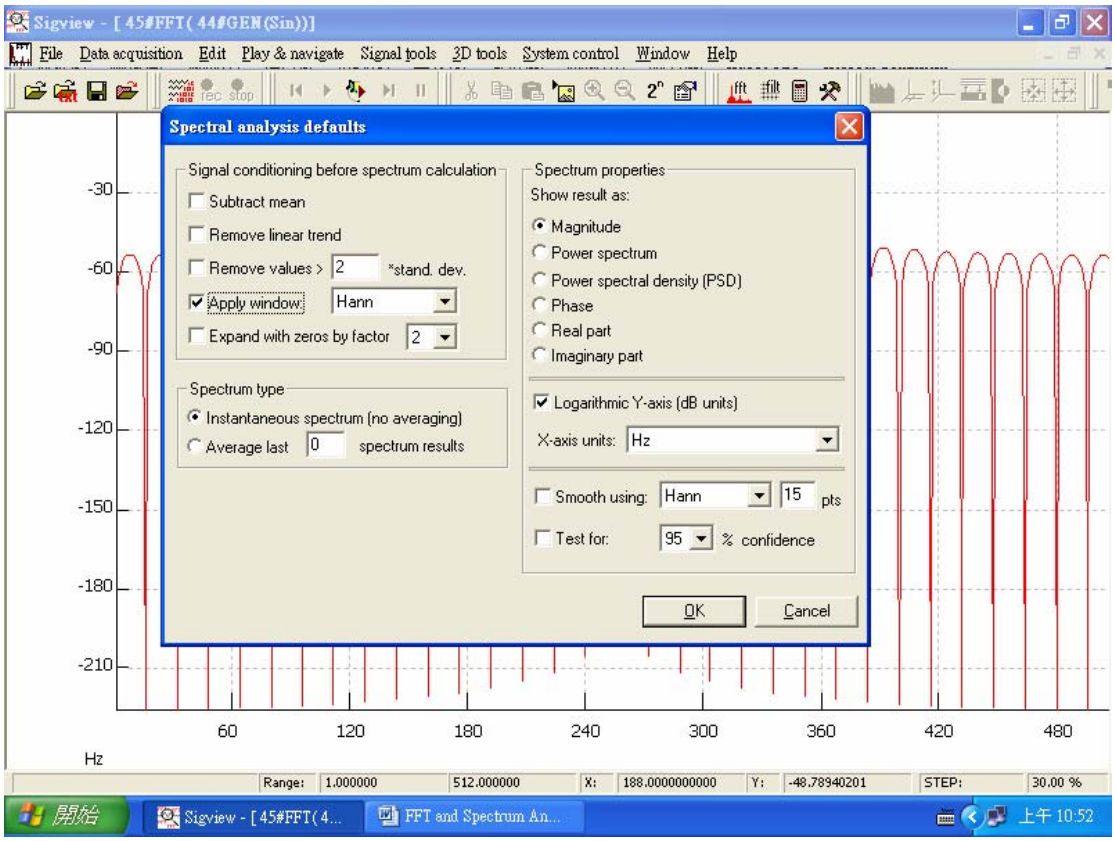
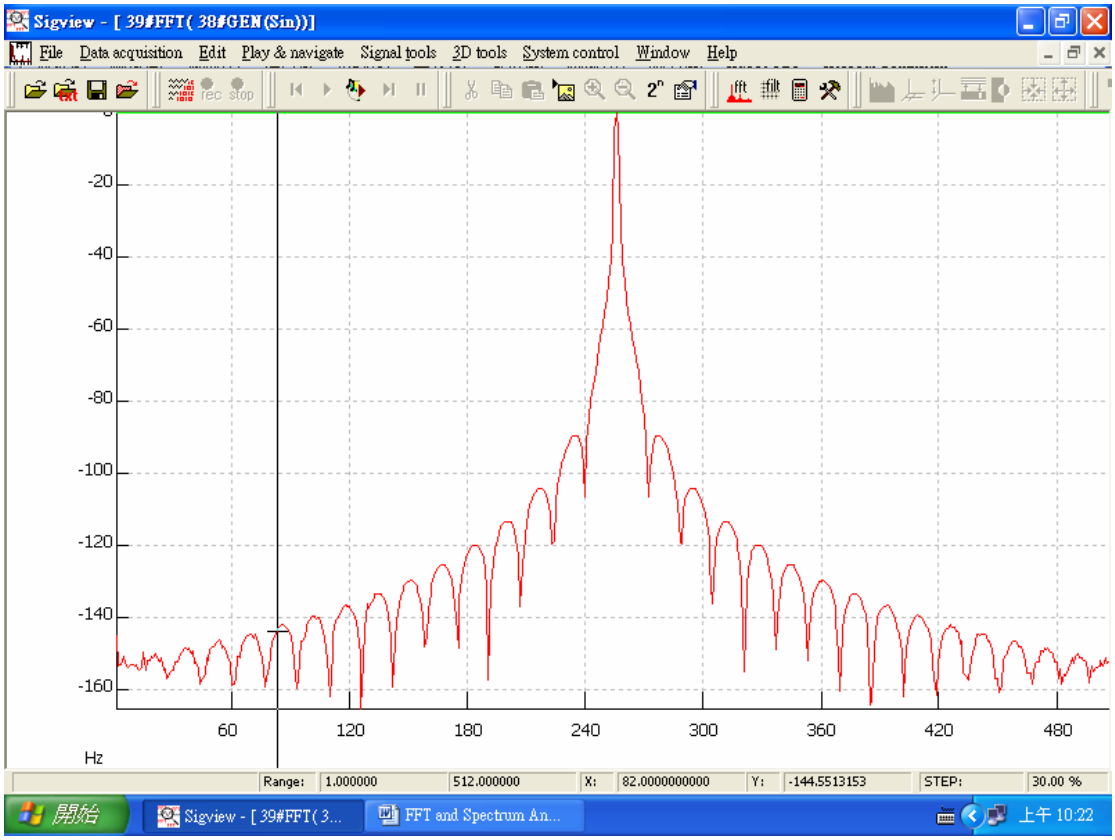
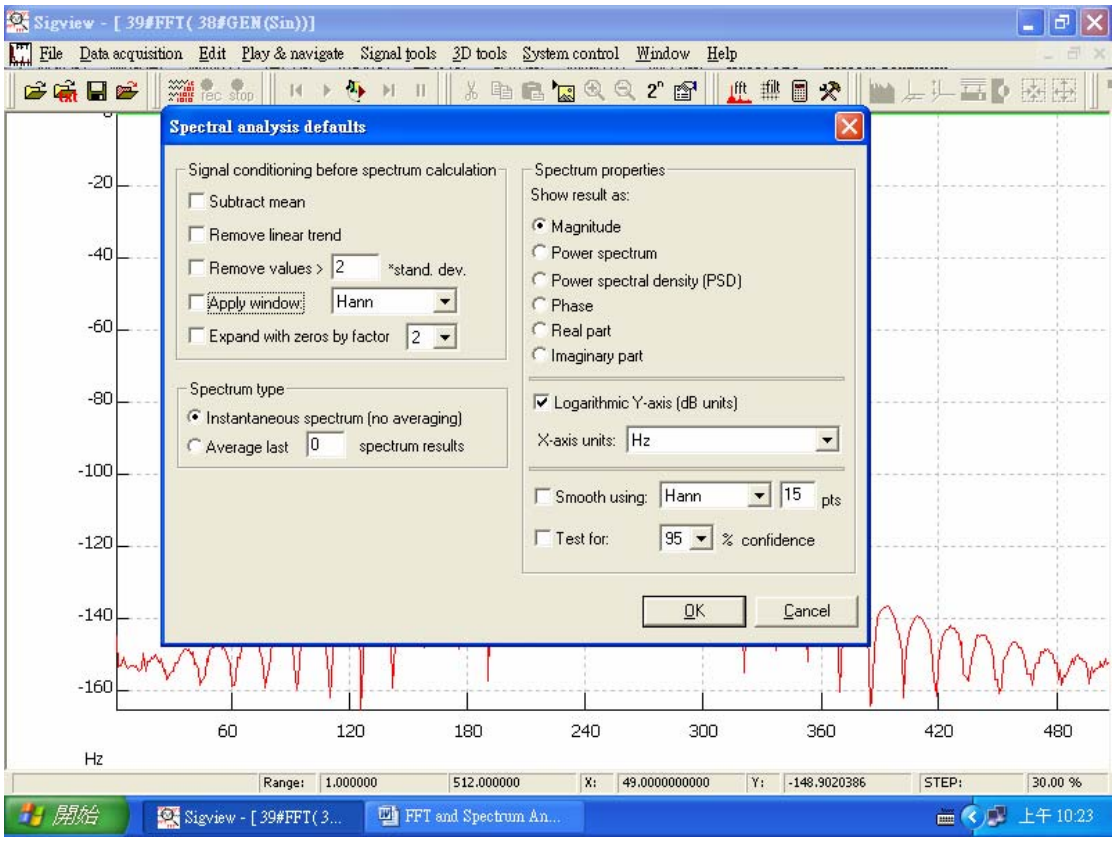
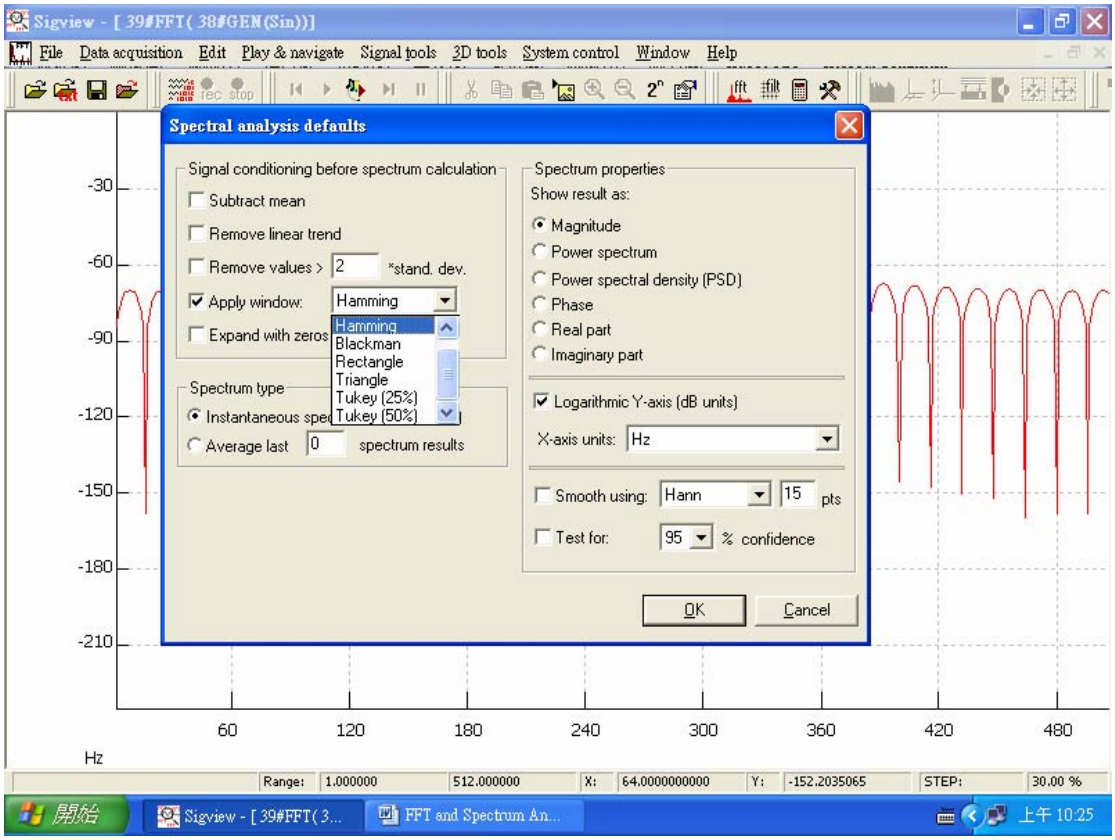
360
420
480
Hz
Range: 1.000000 512.000000 X: 188.0000000000 Y: -48.78940201 STEP: 30.00 %
開始
Sigview - [45#FFT(4...
FFT and Spectrum An...
上午 10:52

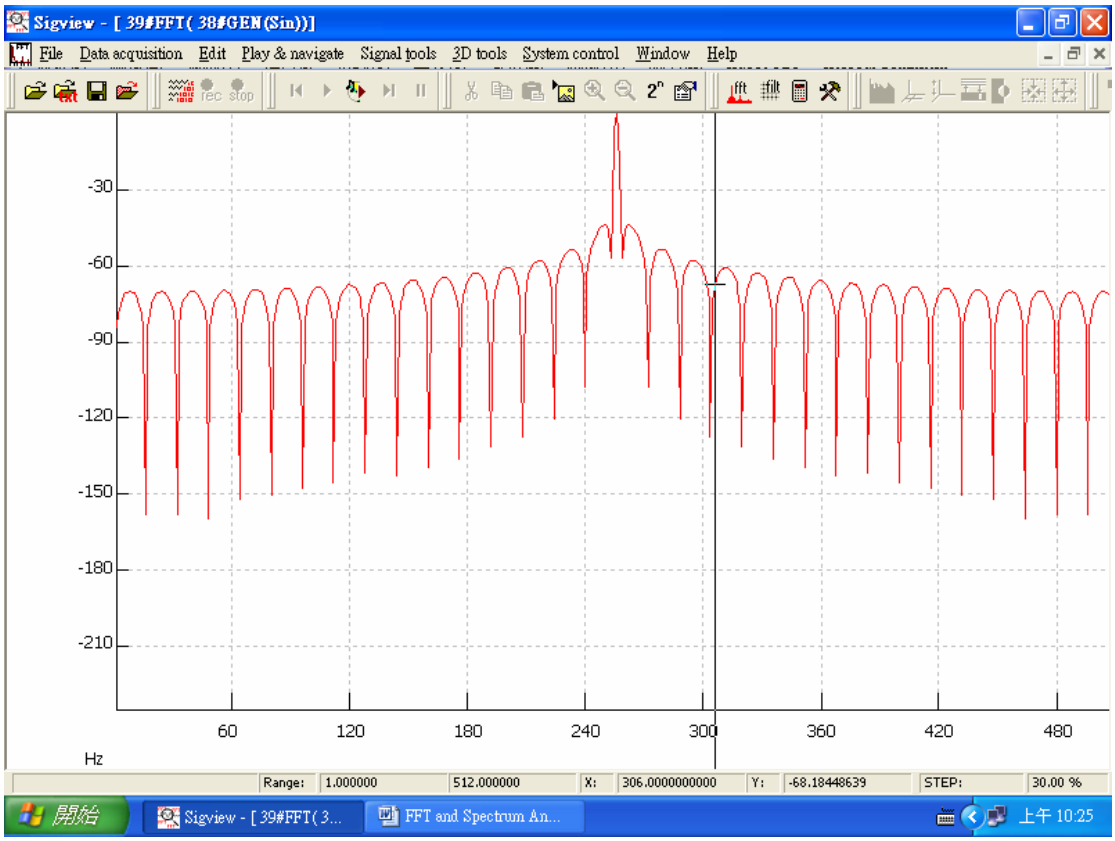

Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-30
-60
-90
-120
-150
-180
-210
60
120
180
240
300
360
420
480
Hz
Range: 1.000000 512.000000 X: 256.0000000000 Y: 0 STEP: 30.00 %
開始
Sigview - [45#FFT(4...
FFT and Spectrum An...
上午 10:50

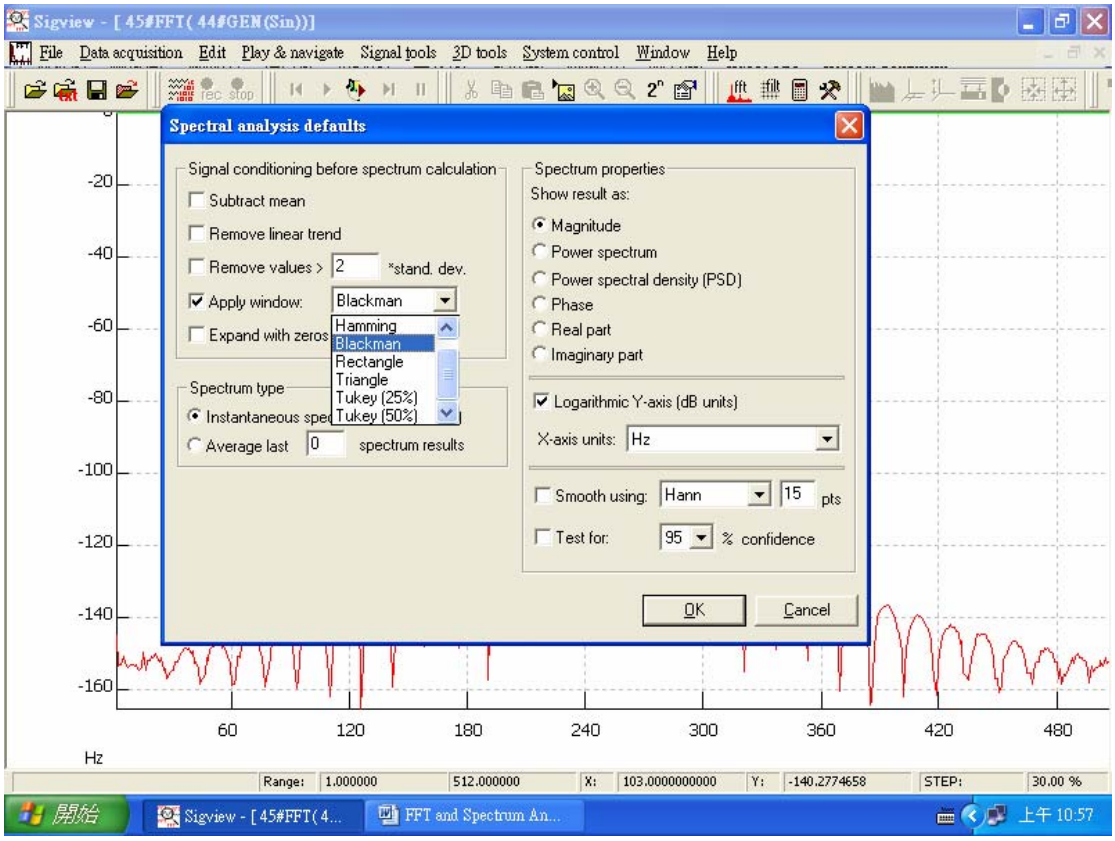

Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hann
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
-30
-60
-90
-120
-150
-180
-210
60
120
180
240
300
360
420
480
Hz
Range: 1.000000 512.000000 X: 188.0000000000 Y: -48.78940201 STEP: 30.00 %
開始
Sigview - [45#FFT(4...
FFT and Spectrum An...
上午 10:52

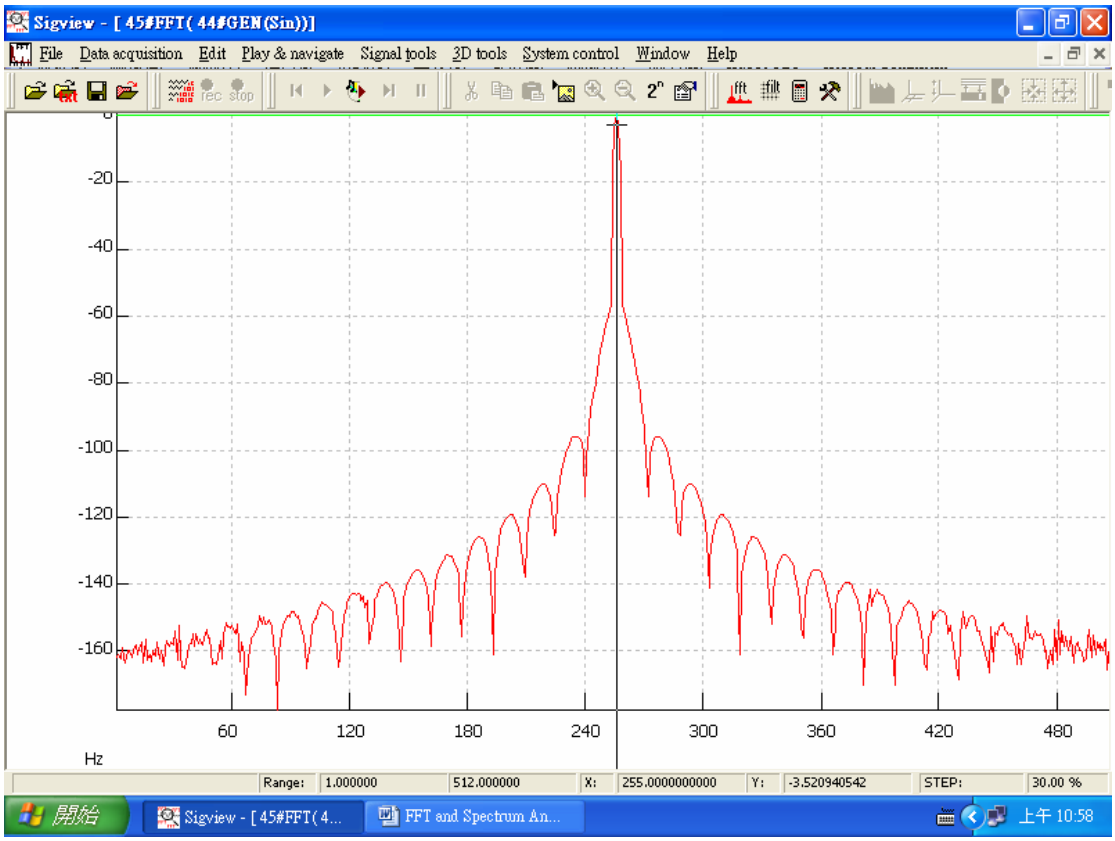

Sigview - [39#FFT(38#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-20
-40
-60
-80
-100
-120
-140
-160
60
120
180
240
300
360
420
480
Hz
Range: 1.000000 512.000000 X: 82.0000000000 Y: -144.5513153 STEP: 30.00 %
開始
Sigview - [39#FFT(3...
FFT and Spectrum An...
上午 10:22

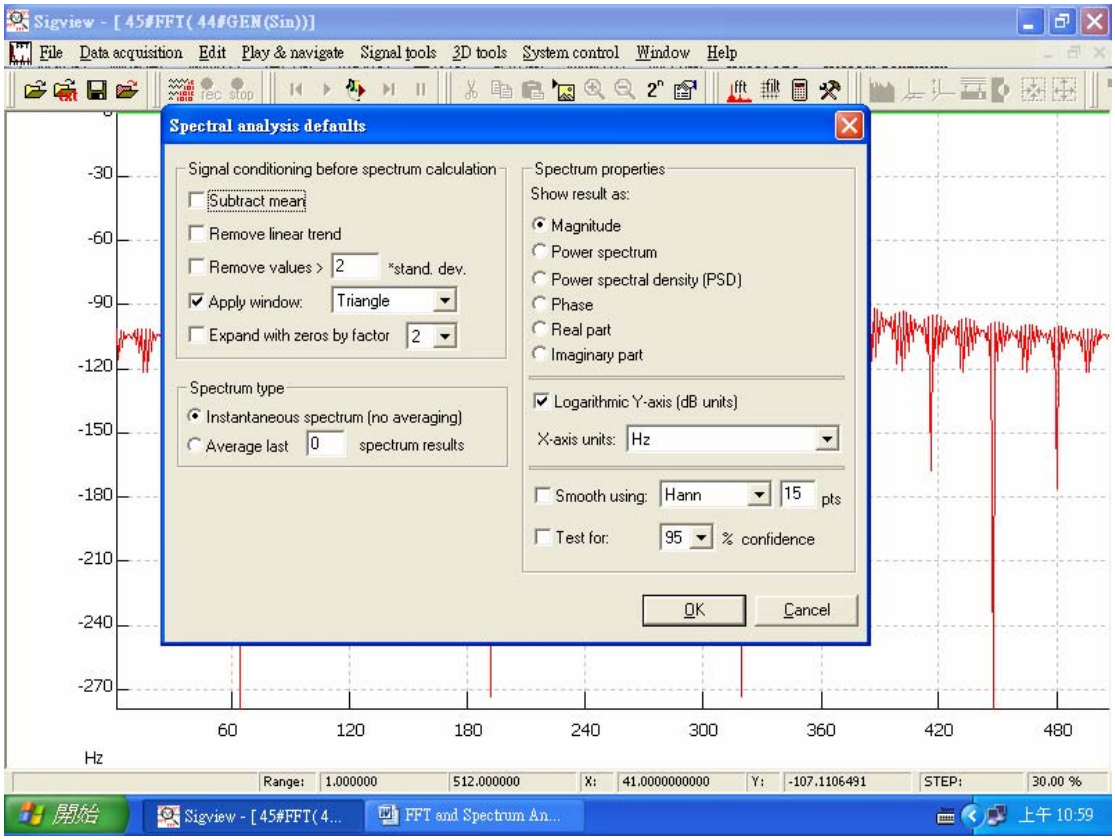

Sigview - [39#FFT(38#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hann
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
-20
-40
-60
-80
-100
-120
-140
-160
60
120
180
240
300
360
420
480
Hz
Range: 1.000000 512.000000 X: 49.0000000000 Y: -148.9020386 STEP: 30.00 %
開始
Sigview - [39#FFT(3...
FFT and Spectrum An...
上午 10:23

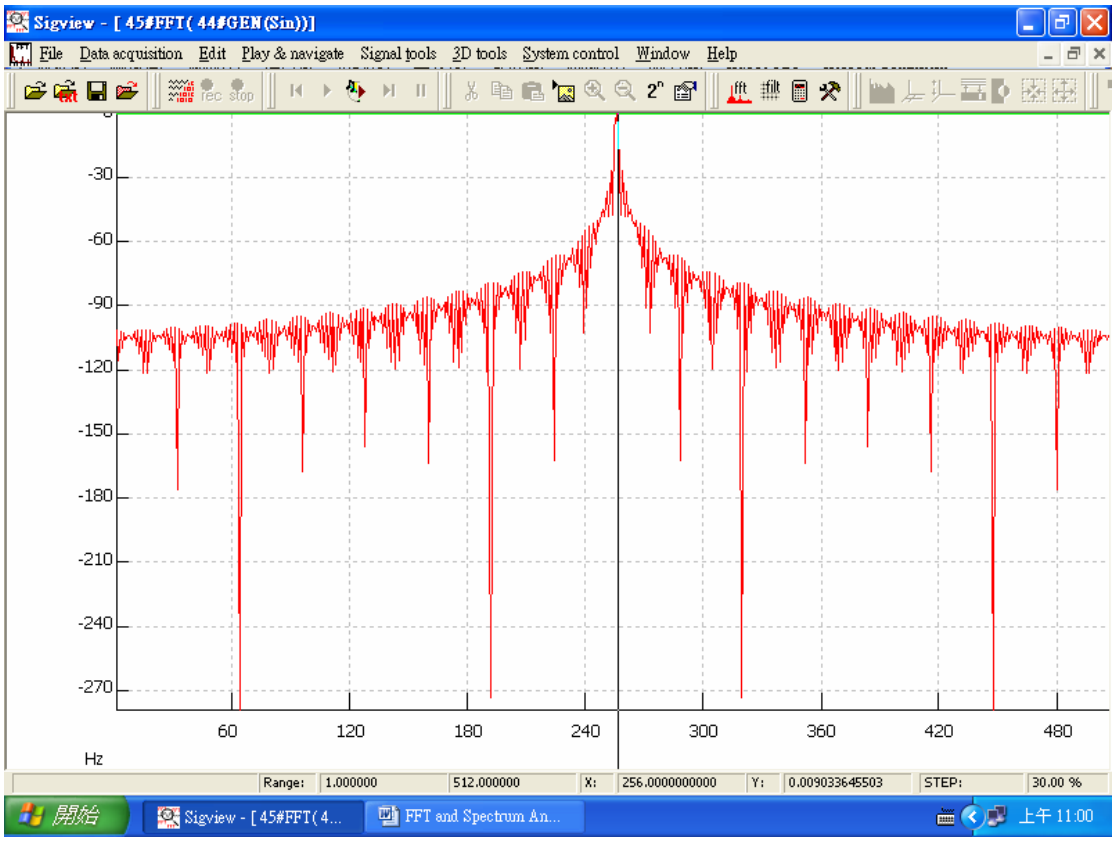

Sigview - [39#FFT(38#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hamming
Hamming
Blackman
Rectangle
Triangle
Tukey (25%)
Tukey (50%)
Expand with zeros
Spectrum type
Instantaneous spec
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
-30
-60
-90
-120
-150
-180
-210
60
120
180
240
300
360
420
480
Hz
Range: 1.000000 512.000000 X: 64.0000000000 Y: -152.2035065 STEP: 30.00 %
開始
Sigview - [39#FFT(3...
FFT and Spectrum An...
上午 10:25

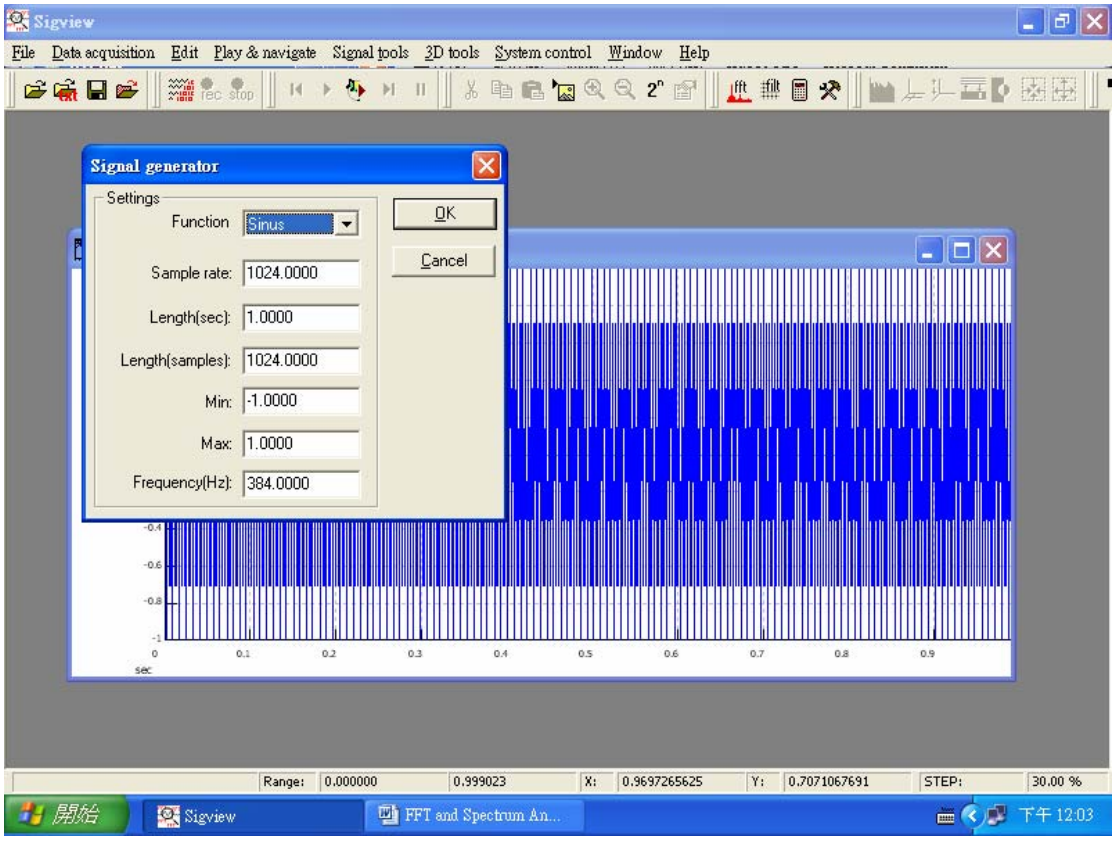

Sigview - [39#FFT(38#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-30
-60
-90
-120
-150
-180
-210
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 306.0000000000 Y: -68.18448639 STEP: 30.00 %
開始 Sigview - [39#FFT(3... FFT and Spectrum An... 上午 10:25

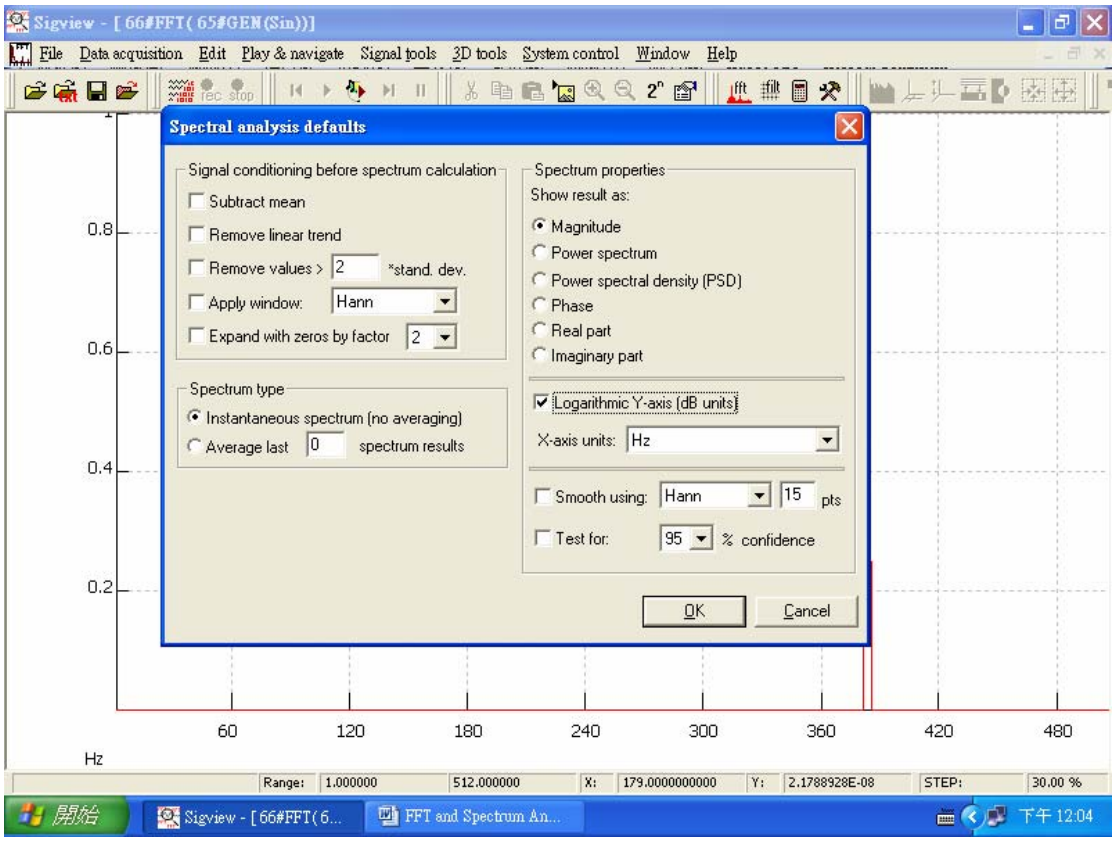

Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Blackman
Hamming
Blackman
Rectangle
Triangle
Tukey (25%)
Tukey (50%)
Expand with zeros
Spectrum type
Instantaneous spec
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
-20
-40
-60
-80
-100
-120
-140
-160
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 103.0000000000 Y: -140.2774658 STEP: 30.00 %
開始 Sigview - [45#FFT(4... FFT and Spectrum An... 上午 10:57

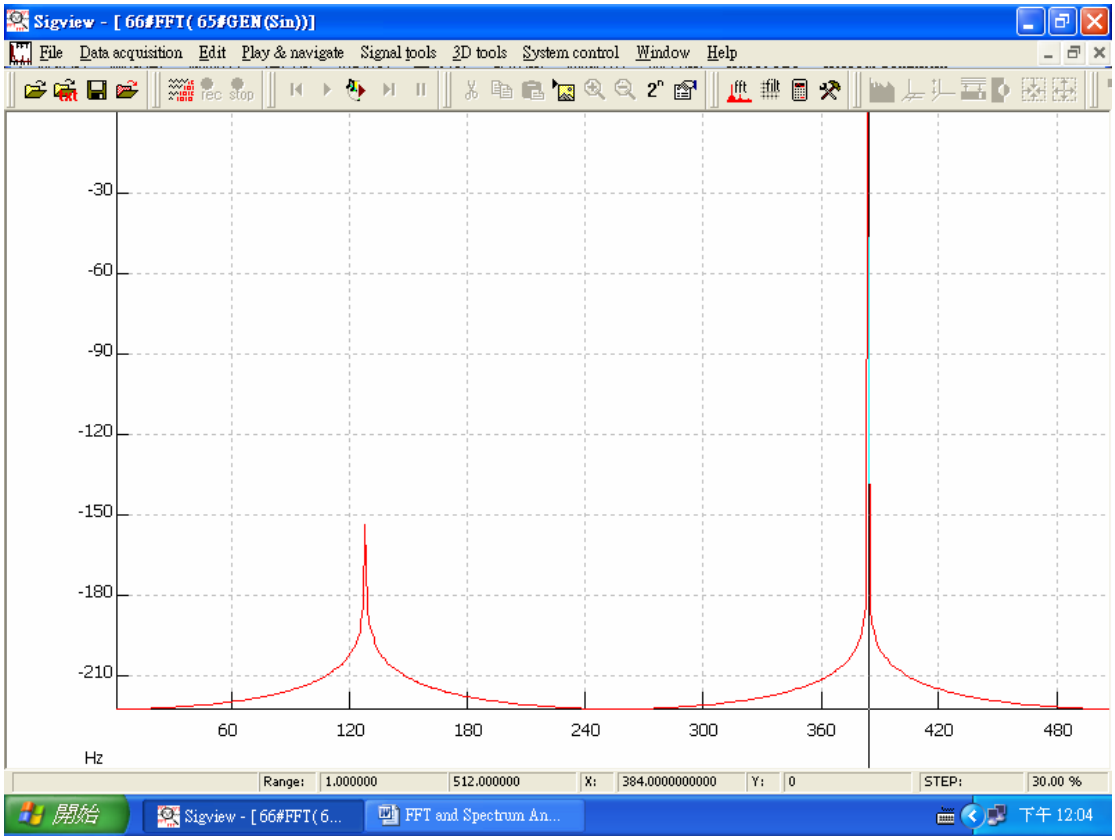

Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-20
-40
-60
-80
-100
-120
-140
-160
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 255.0000000000 Y: -3.520940542 STEP: 30.00 %
開始 Sigview - [45#FFT(4... FFT and Spectrum An... 上午 10:58

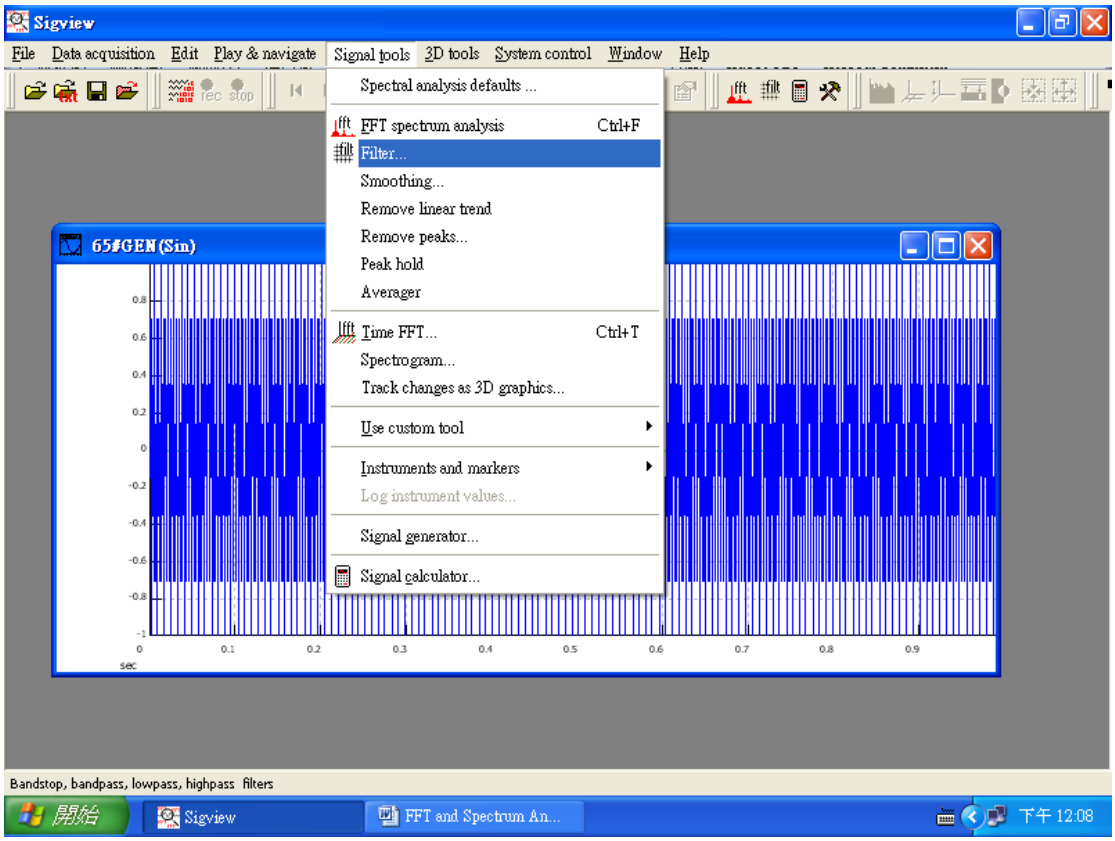

Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Triangle
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
-30
-60
-90
-120
-150
-180
-210
-240
-270
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 41.0000000000 Y: -107.1106491 STEP: 30.00 %
開始 Sigview - [45#FFT(4... FFT and Spectrum An... 上午 10:59

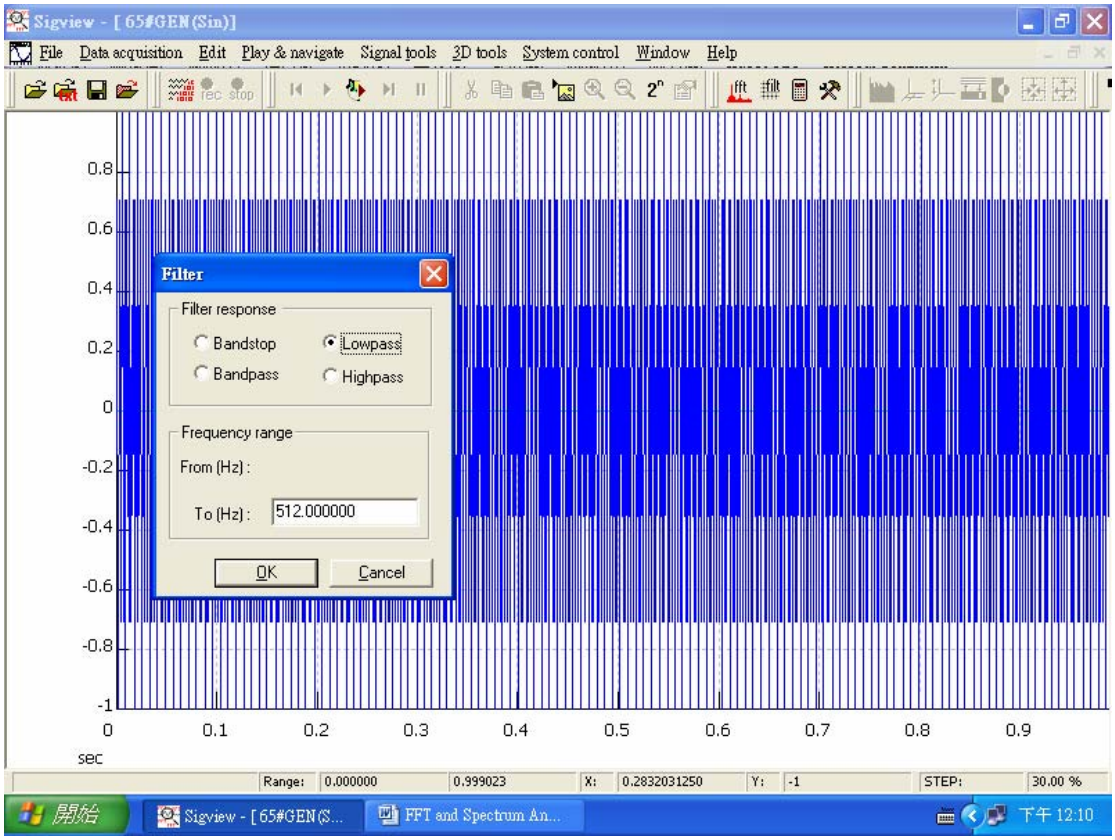

Sigview - [45#FFT(44#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-30
-60
-90
-120
-150
-180
-210
-240
-270
60
120
180
240
300
360
420
480
Hz
Range: 1.000000 512.000000 X: 256.0000000000 Y: 0.009033645503 STEP: 30.00 %
開始 Sigview - [45#FFT(4... FFT and Spectrum An... 上午 11:00

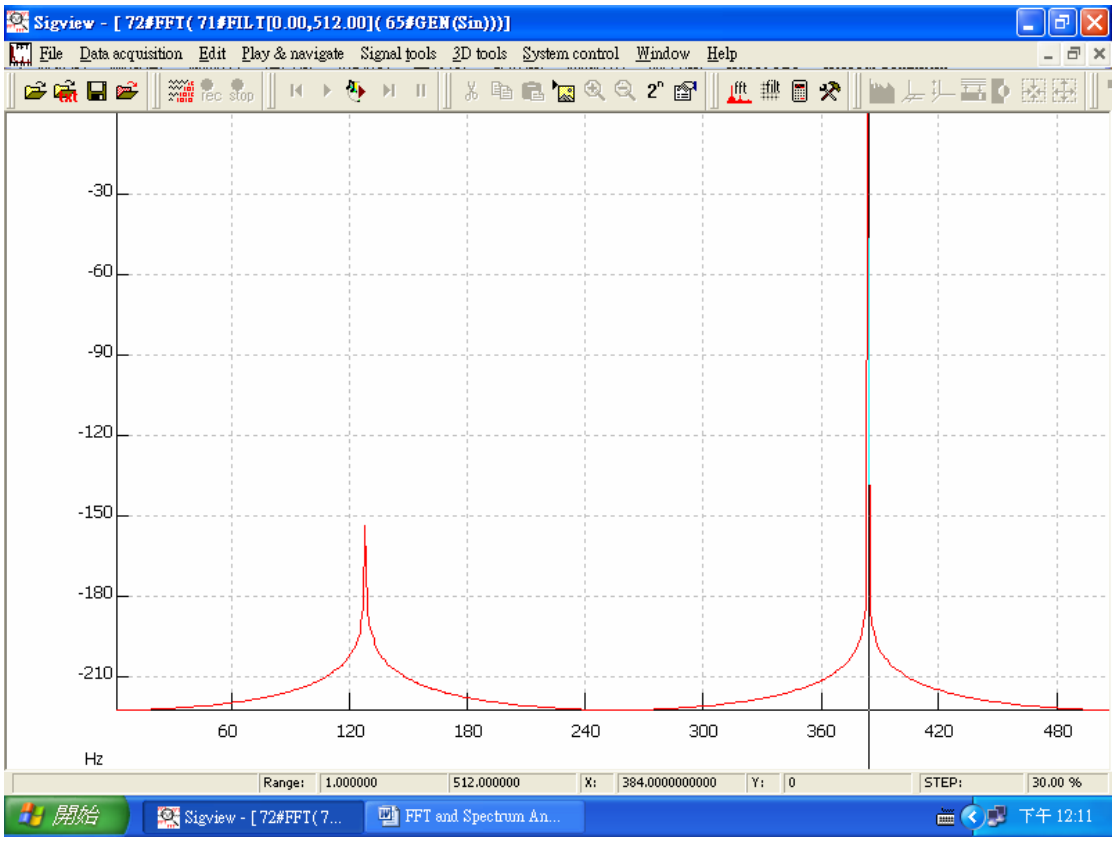

Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Signal generator
Settings
Function Sinus
Sample rate: 1024.0000
Length(sec): 1.0000
Length(samples): 1024.0000
Min: -1.0000
Max: 1.0000
Frequency(Hz): 384.0000
OK
Cancel
sec
Range: 0.000000 0.999023 X: 0.9697265625 Y: 0.7071067691 STEP: 30.00 %
開始 Sigview FFT and Spectrum An... 下午 12:03

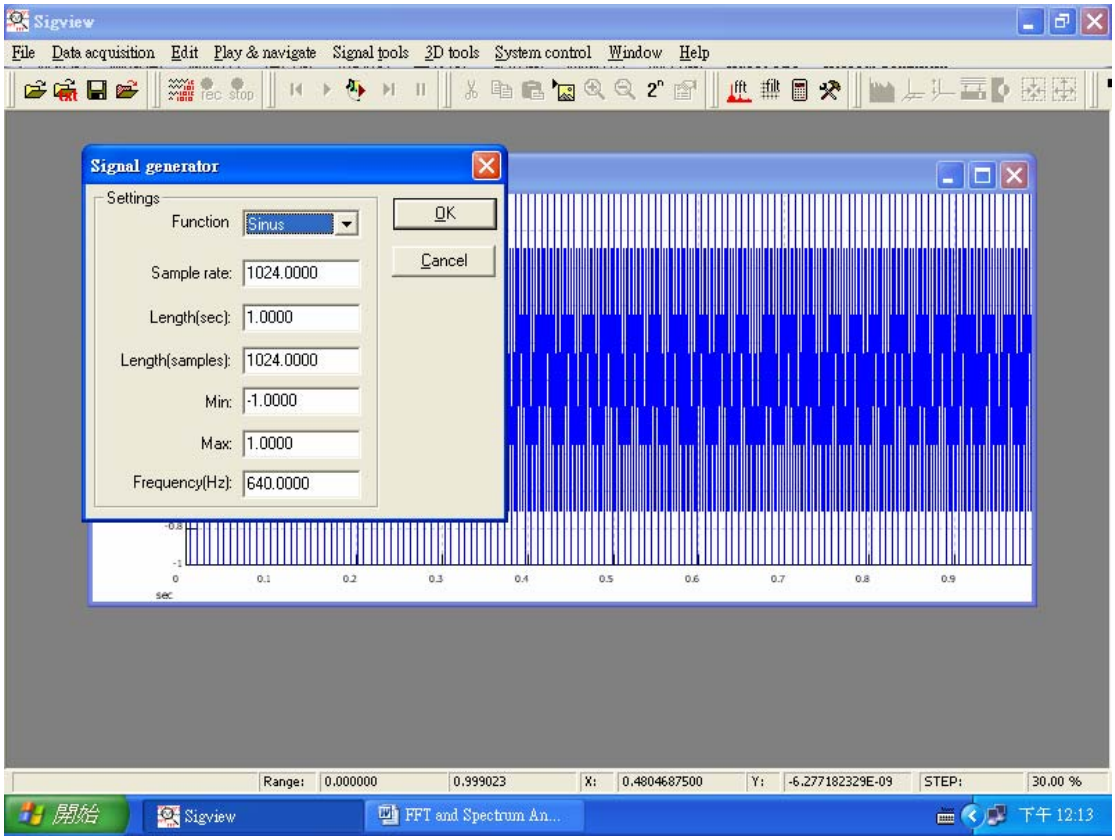

Sigview - [66#FFT(65#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hann
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
0.8
0.6
0.4
0.2
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 179.0000000000 Y: 2.1788928E-08 STEP: 30.00 %
開始 Sigview - [66#FFT(6... FFT and Spectrum An... 下午 12:04

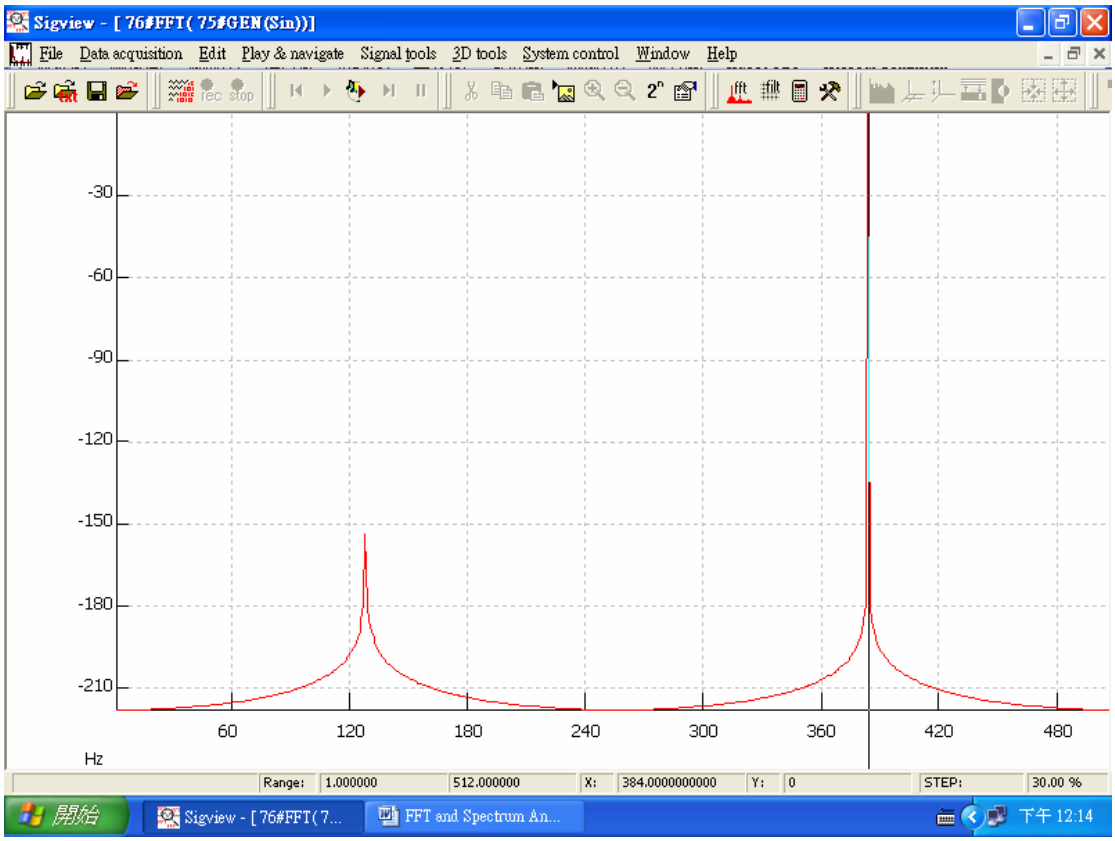

Sigview - [66#FFT(65#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-30
-60
-90
-120
-150
-180
-210
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 384.0000000000 Y: 0 STEP: 30.00 %
開始 Sigview - [66#FFT(6... FFT and Spectrum An... 下午 12:04

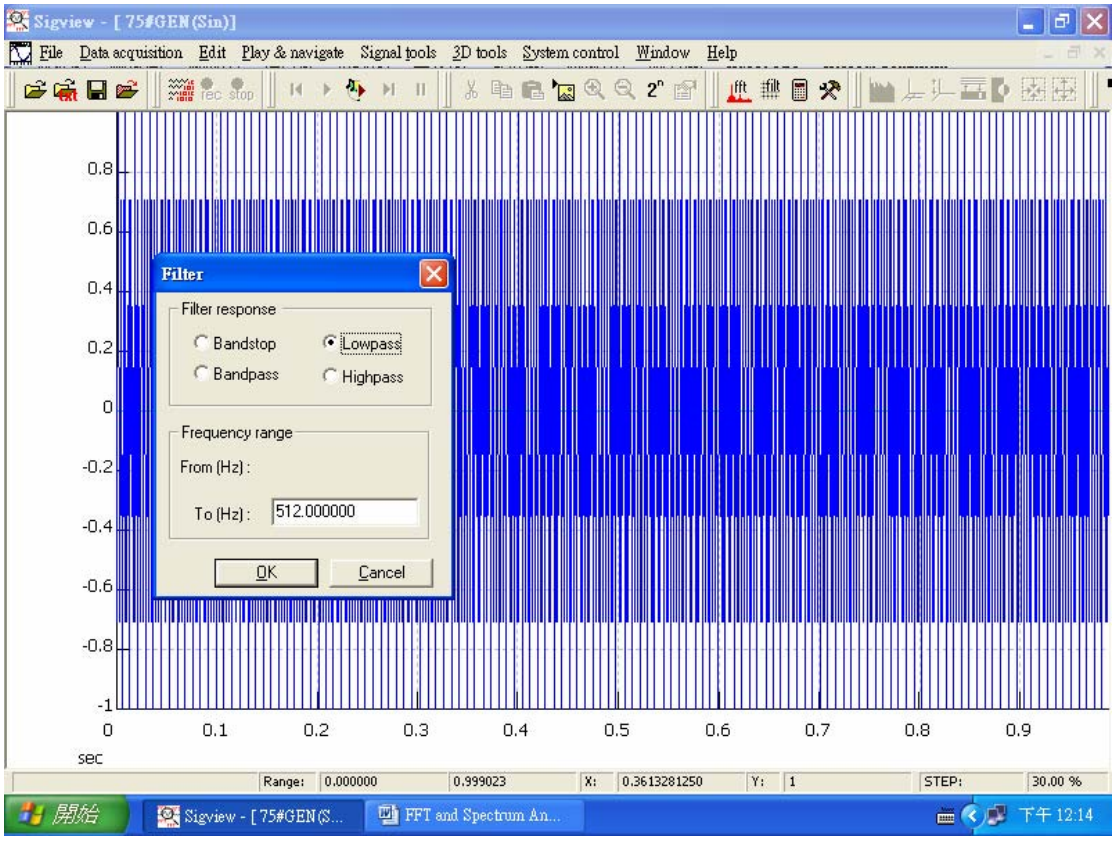

Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults ...
FFT spectrum analysis Ctrl+F
Filter...
Smoothing...
Remove linear trend
Remove peaks...
Peak hold
Averager
Time FFT... Ctrl+T
Spectrogram...
Track changes as 3D graphics...
Use custom tool
Instruments and markers
Log instrument values...
Signal generator...
Signal calculator...
65#GEN (Sin)
sec
Bandstop, bandpass, lowpass, highpass filters
開始
Sigview
FFT and Spectrum An...
下午 12:08

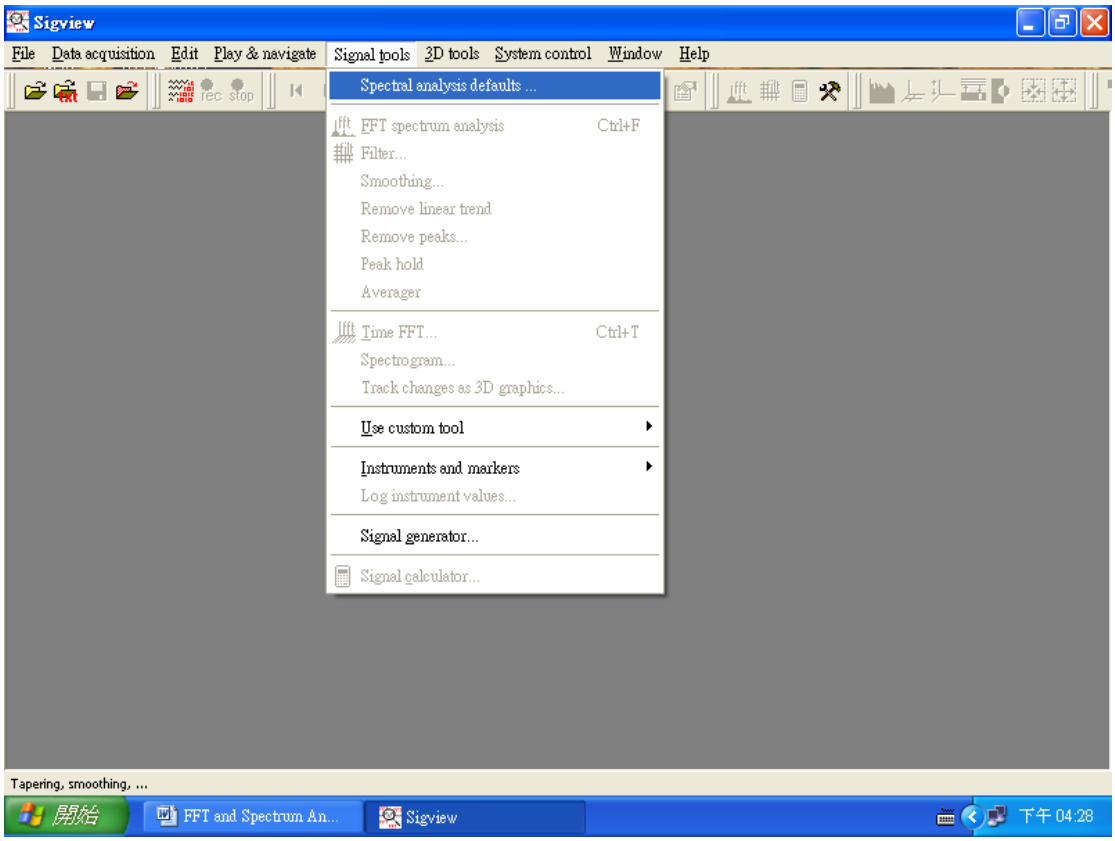

Sigview - [65#GEN (Sin)]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Filter
Filter response
Bandstop
Lowpass
Bandpass
Highpass
Frequency range
From (Hz) :
To (Hz) :
512.000000
OK
Cancel
sec
Range: 0.000000 0.999023 X: 0.2832031250 Y: -1 STEP: 30.00 %
開始
Sigview - [65#GEN (S...
FFT and Spectrum An...
下午 12:10

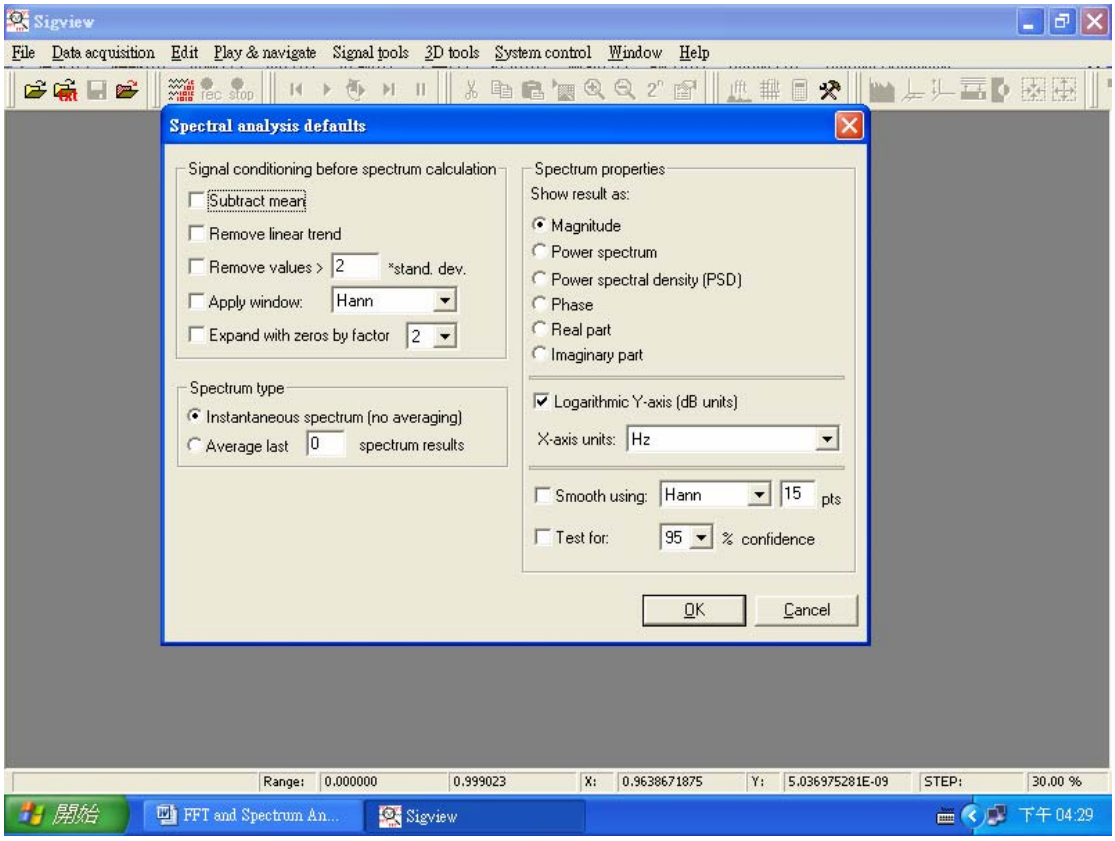

Sigview - [72#FFT(71#FILT[0.00,512.00](65#GEN(Sin)))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-30
-60
-90
-120
-150
-180
-210
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 384.0000000000 Y: 0 STEP: 30.00 %
開始 Sigview - [72#FFT(7... FFT and Spectrum An... 下午 12:11

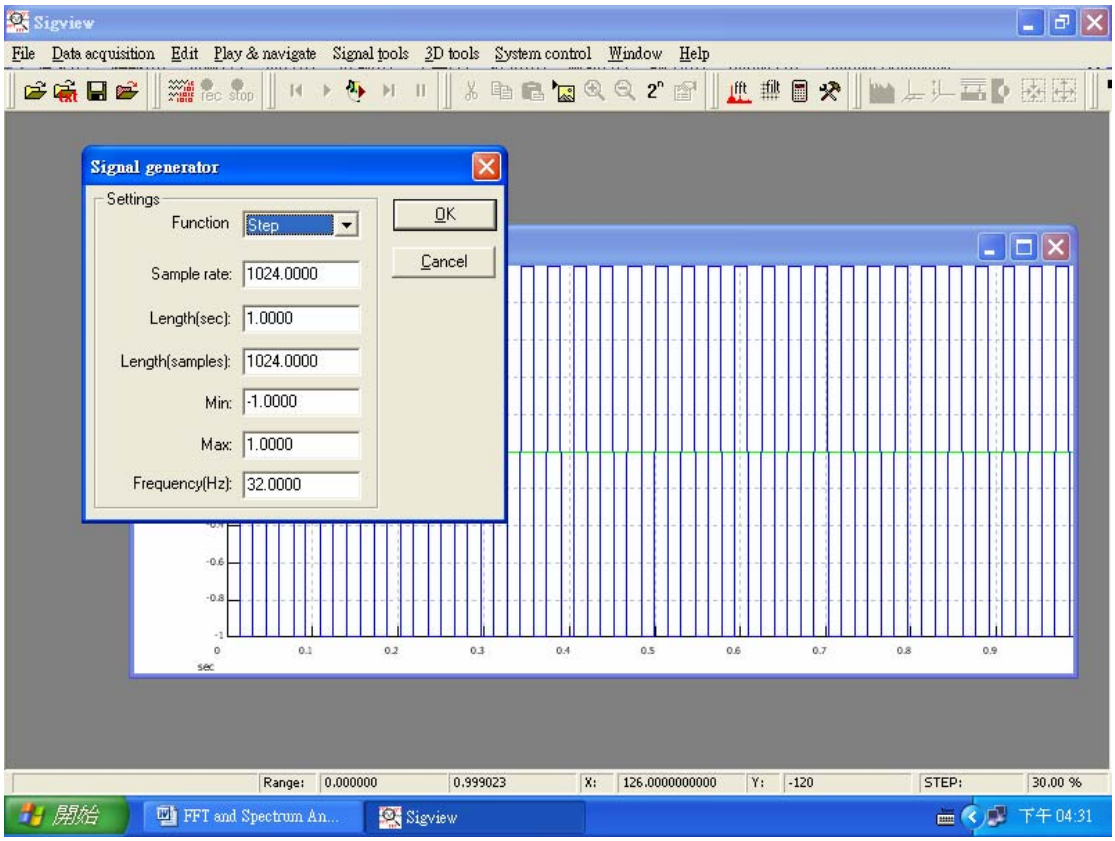

Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Signal generator
Settings
Function Sinus
Sample rate: 1024.0000
Length(sec): 1.0000
Length(samples): 1024.0000
Min: -1.0000
Max: 1.0000
Frequency(Hz): 640.0000
OK
Cancel
sec
Range: 0.000000 0.999023 X: 0.4804687500 Y: -6.277182329E-09 STEP: 30.00 %
開始 Sigview FFT and Spectrum An... 下午 12:13

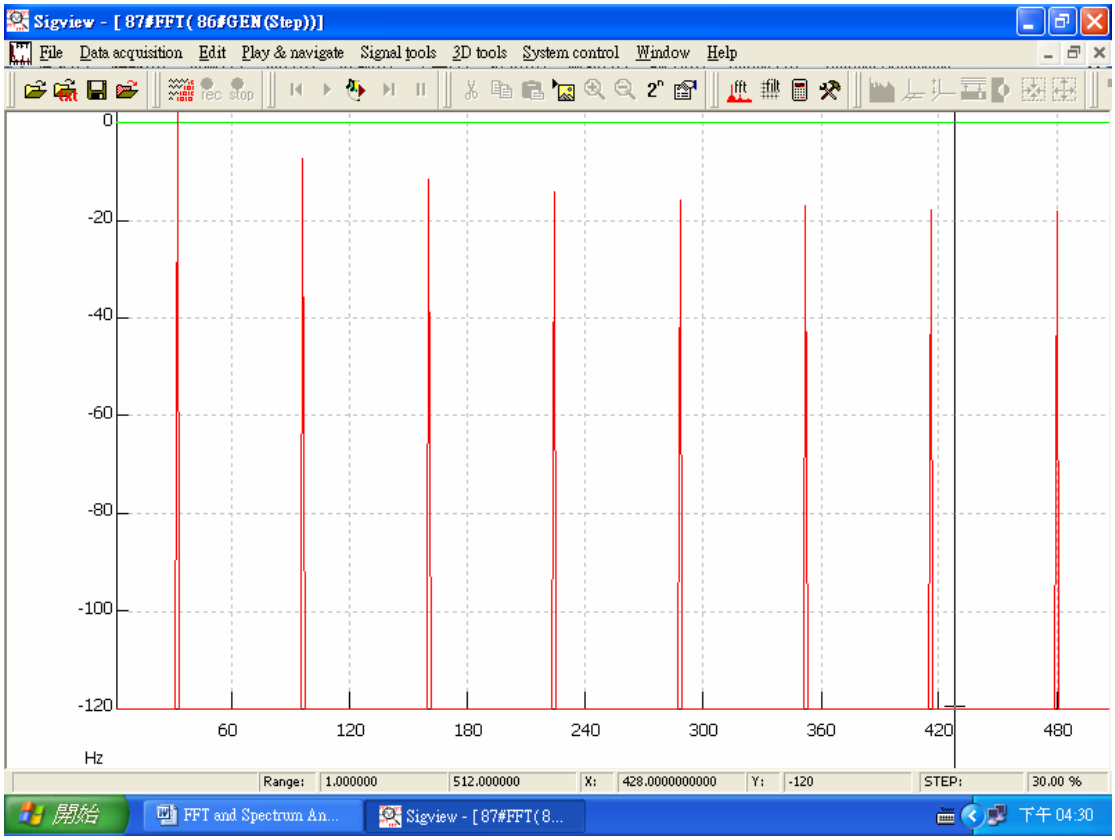

Sigview - [76#FFT(75#GEN(Sin))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
-30
-60
-90
-120
-150
-180
-210
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 384.0000000000 Y: 0 STEP: 30.00 %
開始 Sigview - [76#FFT(7... FFT and Spectrum An... 下午 12:14

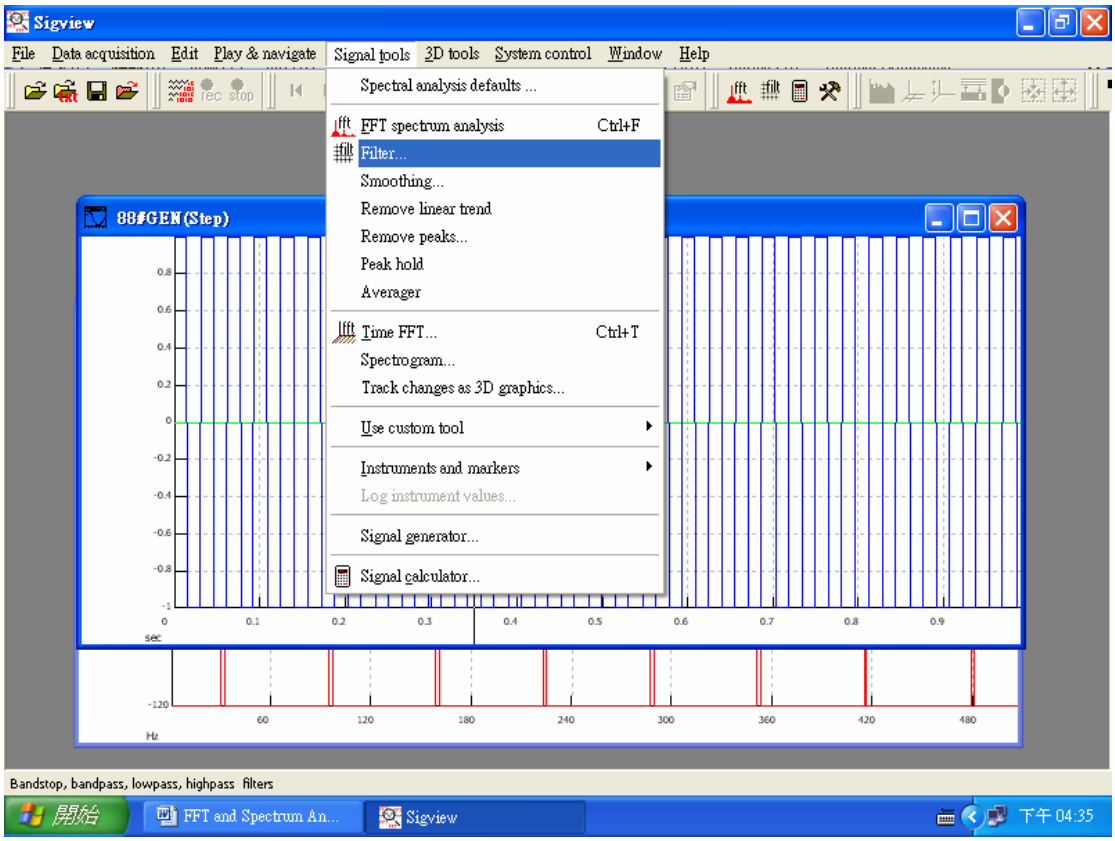

Sigview - [75#GEN(Sin)]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Filter
Filter response
Bandstop
Lowpass
Bandpass
Highpass
Frequency range
From (Hz) :
To (Hz) : 512.000000
OK
Cancel
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
sec
Range: 0.000000 0.999023 X: 0.3613281250 Y: 1 STEP: 30.00 %
開始 Sigview - [75#GEN(S... FFT and Spectrum An... 下午 12:14


Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults ...
FFT spectrum analysis Ctrl+F
Filter...
Smoothing...
Remove linear trend
Remove peaks...
Peak hold
Averager
Time FFT... Ctrl+T
Spectrogram...
Track changes as 3D graphics...
Use custom tool
Instruments and markers
Log instrument values...
Signal generator...
Signal calculator...
Tapering, smoothing, ...
開始
FFT and Spectrum An...
Sigview
下午 04:28


Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Spectral analysis defaults
Signal conditioning before spectrum calculation
Subtract mean
Remove linear trend
Remove values > 2 *stand. dev.
Apply window: Hann
Expand with zeros by factor 2
Spectrum type
Instantaneous spectrum (no averaging)
Average last 0 spectrum results
Spectrum properties
Show result as:
Magnitude
Power spectrum
Power spectral density (PSD)
Phase
Real part
Imaginary part
Logarithmic Y-axis (dB units)
X-axis units: Hz
Smooth using: Hann 15 pts
Test for: 95 % confidence
OK
Cancel
Range: 0.000000 0.999023 X: 0.9638671875 Y: 5.036975281E-09 STEP: 30.00 %
開始
FFT and Spectrum An...
Sigview
下午 04:29


Sigview
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
Signal generator
Settings
Function Step
Sample rate: 1024.0000
Length(sec): 1.0000
Length(samples): 1024.0000
Min: -1.0000
Max: 1.0000
Frequency(Hz): 32.0000
OK
Cancel
sec
Range: 0.000000 0.999023 X: 126.0000000000 Y: -120 STEP: 30.00 %
開始 FFT and Spectrum An... Sigview 下午 04:31


Sigview - [87#FFT(86#GEN (Step))]
File Data acquisition Edit Play & navigate Signal tools 3D tools System control Window Help
0
-20
-40
-60
-80
-100
-120
60 120 180 240 300 360 420 480
Hz
Range: 1.000000 512.000000 X: 428.0000000000 Y: -120 STEP: 30.00 %
開始 FFT and Spectrum An... Sigview - [87#FFT(8... 下午 04:30



Report:

Discuss the following limitations of the DFT from the results you obtained.

1. The signal must be band limited, and the sampling rate must be sufficiently high to avoid aliasing.
2. If it necessary to limit the length of the signal for computational purposes, the spectrum will be degraded somewhat by the leakage effect. Leakage is most severe when the simple rectangular window function is used.
3. For periodic functions, leakage can be avoided by choosing a proper data length.
4. Components lying between discrete frequency lines are subject to error in magnitude due to the "picket-fence" effect.