Multi-Instrument®

a powerful PC based virtual instrument software
all-in-one solution for test & measurement
fully functional FREE trial!

Multi-Instrument

Waterfall Plot
Oscilloscope
Spectrogram
Spectrum Analyzer
Correlation Analyzer
Distortion Analyzer
Signal Generator
Bode Plot
Vibrometer

96.99 dB — Sound Level Meter
1000.020 Hz
3000.020 Hz — Frequency Counter

Device Test Plan

31.749 H
797.831 pF — LCR Meter
199.484 kΩ

Data Logger
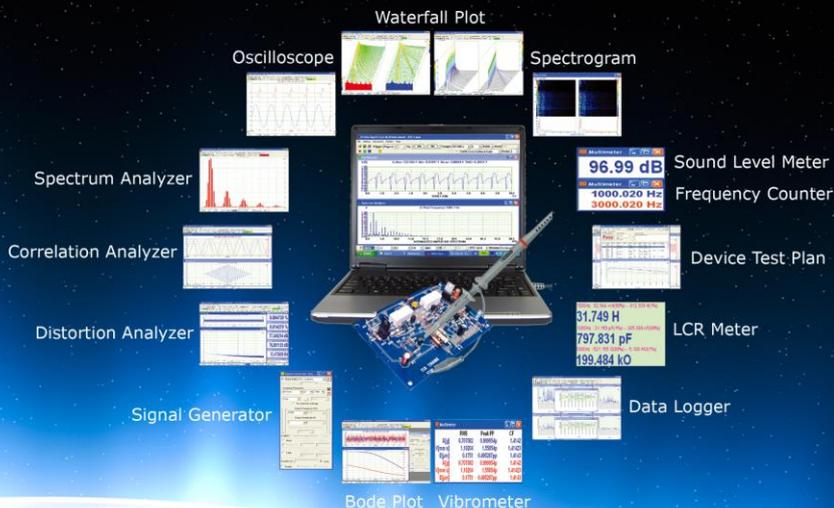
Introduction

Multi-Instrument is a powerful multi-function virtual instrument software. It supports a variety of hardware ranging from sound cards which are available in almost all computers to proprietary ADC and DAC hardware such as NI DAQmx cards, VT DSO, VT RTA, VT IEPE, VT CAMP and so on. It consists of an oscilloscope, a spectrum analyzer, a signal generator, a multimeter, a spectrum 3D plot, a data logger, a Vibrometer, a LCR meter and a device test plan, all of which can run simultaneously and in real time. It has been widely used in education, scientific research, audio & acoustic engineering, electronic engineering, vibration analysis, medical diagnosis, musical instrument inspection, etc. The software can be downloaded from: www.virtins.com/MIsetup.exe for a 21-day fully functional FREE trial, with your computer sound card as the ADC and DAC devices.

Oscilloscope

View Type
- Waveform for Ch.A and Ch.B
- Waveform for Ch.A + Ch.B
- Waveform for Ch.A − Ch.B
- Waveform for Ch.A × Ch.B
- Lissajous Plot
- Mixed Signal Display

Inter-frame Processing
It is performed among a specified number of adjacent data frames in time domain. It includes:
- Linear Averaging (2~200 frames, forever)
- Exponential Averaging

Demodulation   Interpolation in Curve Plotting
AM, FM, PM   Linear / SINC

Digital Filtering
- FFT (Low Pass, High Pass, Band Pass, Band Stop, Arbitrary)
- FIR (Low Pass, High Pass, Band Pass, Band Stop, Arbitrary)
- IIR (Arbitrary)
- DC Removal and Half/Full Wave Rectification

Record Mode
This is one of the streaming modes. Under this mode, the acquired data will be written to the hard disk continuously in wave file format. Meanwhile, data analysis and display will still be performed in order to monitor the input signal in real time.

Roll Mode

(Mixed Signal Display)

(Sine Wave Frequency Sweep in Rainbow Persistence Mode)
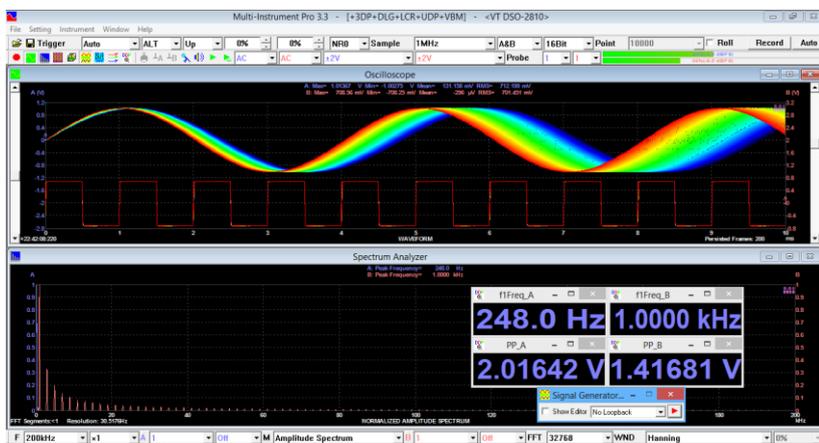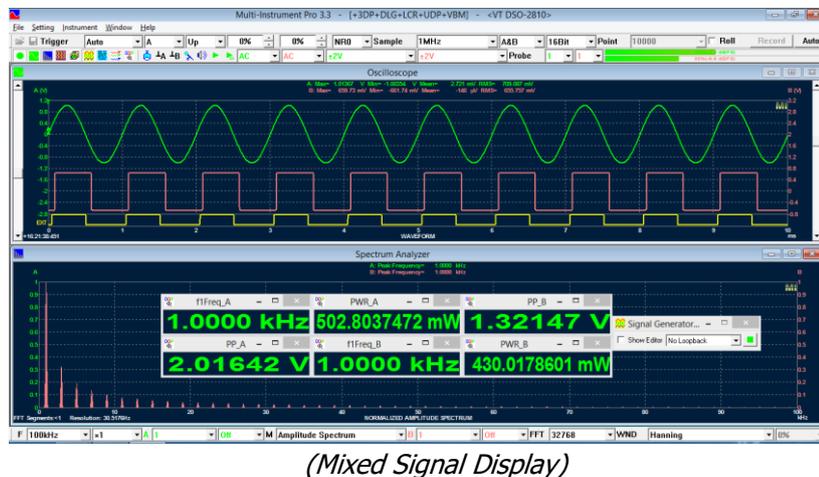
This is one of the streaming modes. Under this mode, the oscilloscope frame is split into many segments with the length of each segment equal to the Roll Width. The data displayed in the oscilloscope will shift left at a step of one Roll Width each time when a new segment of data arrives. The newly arrived data will be shown in the right most portion of the graph. Roll Mode can be used if the sweep time of the oscilloscope is too long (e.g. greater than 1 s) to avoid long time waiting for screen update.

Persistence Mode
This mode allows hundreds of consecutive waveforms to be superimposed / drawn in the oscilloscope window in three ways: Phosphorescent, Rainbow, Equivalent Time Sampling. The former two are useful to capture intermittent and unstable events hidden in a series of repeated normal events, while the latter one can be used to increase the displayed samples per cycle when the real time samples per cycle is insufficient to render the actual waveform properly, provided that the signal itself is repetitive.

Spectrum Analyzer

View Type
- Amplitude / Power Spectrum
- Phase Spectrum
- Auto Correlation Function
- Cross Correlation Function
- Coherence / Non Coherence Function
- Transfer Function (Bode Plot) / Impedance Analyzer
- Impulse Response

FFT Size vs Record Length
If the FFT size is greater than the record length of a data frame, then zeros will be padded at the end of the data frame during FFT computation.

If the FFT size is less than the record length of a data frame, then the data frame will be split into different segments with the size of each segment equal to the FFT size. The last segment of data will be dropped if its size is not equal to the FFT size. The final result will be obtained by averaging the FFT results from all segments.

Window Function   Window Overlap
55 window functions   0%~99%

Processing

Intra-Frame Processing
It is performed within a data frame in frequency domain. It includes:

- Frequency Compensation
- Frequency Weighting (A, B, C, ITU-R 468)
- Remove DC
- Smoothing via moving average

Inter-Frame Processing
It is performed among a specified number of adjacent data frames in frequency domain. It includes:

- Peak Hold (2~200 frames, forever)
- Linear Averaging (2~200 frames, forever)
- Exponential Averaging

Parameter Measurement
It is performed after the Intra-Frame and Inter-Frame processes. Parameters that can be measured are:
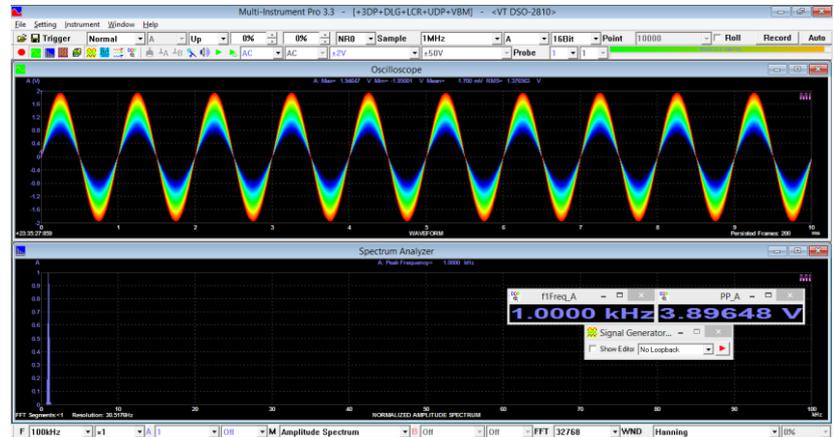
(Sine Wave Amplitude Sweep in Rainbow Persistence Mode)
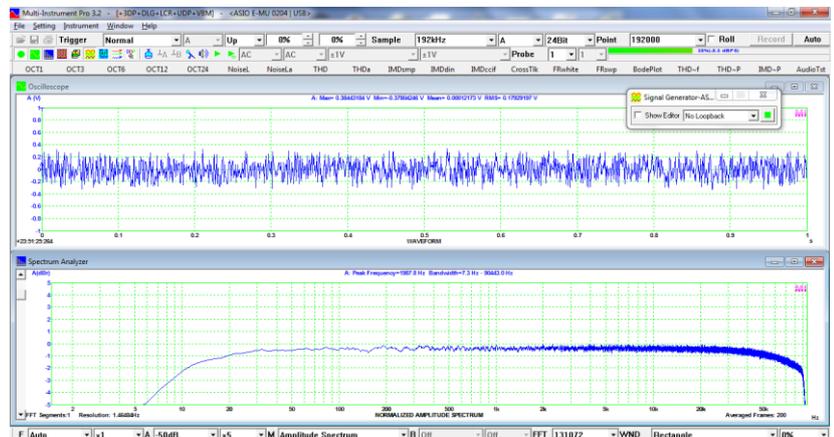
(Frequency Response Measurement using white noise and narrow band spectrum analysis)
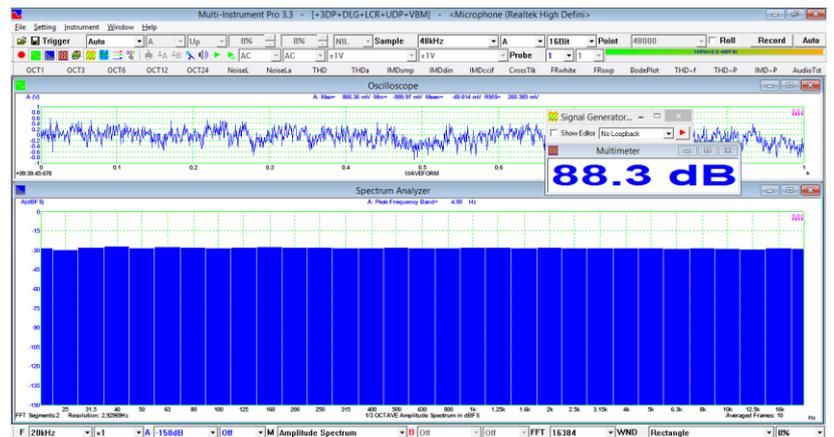
(Frequency Response Measurement using pink noise and octave band analysis)

www.virtins.com   www.multi-instrument.com   www.multi-tech.cn (中文)
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- THD, THD+N, SINAD, SNR, Noise Level, in a specified frequency band. The highest order of harmonics for THD calculation can be specified.
- IMD (SMPTE/DIN, CCIF...)
- Bandwidth
- Crosstalk
- Harmonics (including frequencies, amplitudes & phases)
- Energy in user defined frequency bands
- Peaks, SFDR
- Sound Loudness, Loudness Level & Sharpness
- Wow & Flutter (weighted or not weighted)
- Non-Coherent Distortion & Noises
- GedLee Metric for Perception based Nonlinear Distortion

X Scaling
- Linear
- Log
- Octave 1/1, 1/3, 1/6, 1/12, 1/24, 1/48, 1/96

Y Scaling
Relative Mode
- Linear
- dBr

Absolute Mode
- Vrms
- dBV
- dBu
- dBSPL
- dBFS

Signal Generator

Waveform
- Sine
- Rectangle (with adjustable duty cycle)
- Triangle
- Saw Tooth
- White Noise
- Pink Noise
- Multi-Tones
- Arbitrary waveform
- MLS, with adjustable length (127~16777215)
- DTMF
- Unit Impulse
- Unit Step
- Musical Scale
- Wave File

Frequency/Amplitue Sweep
- Linear
- Log

Burst Generation
A periodic on/off mask can be configured to mask on/off the output signal. This feature can be used to generate burst-like signal. An option is provided to phase lock each burst.

Modulation
AM, FM, PM

DDS/Stream Mode
Both are supported.
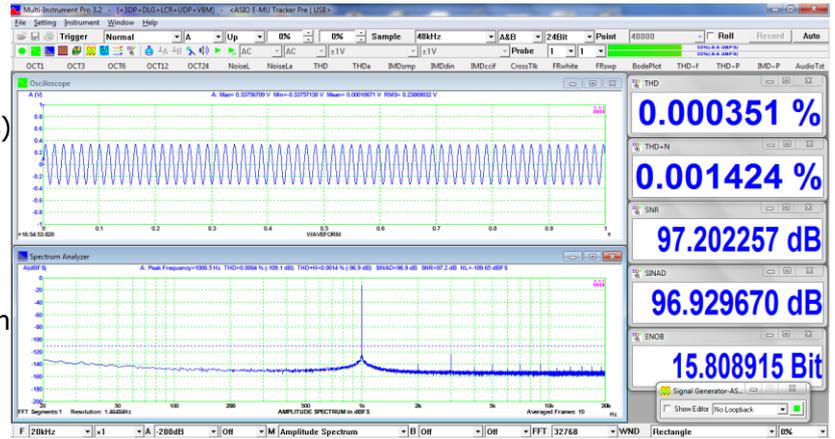
(Measurement of THD, THD+N, SNR, SINAD, ENOB)
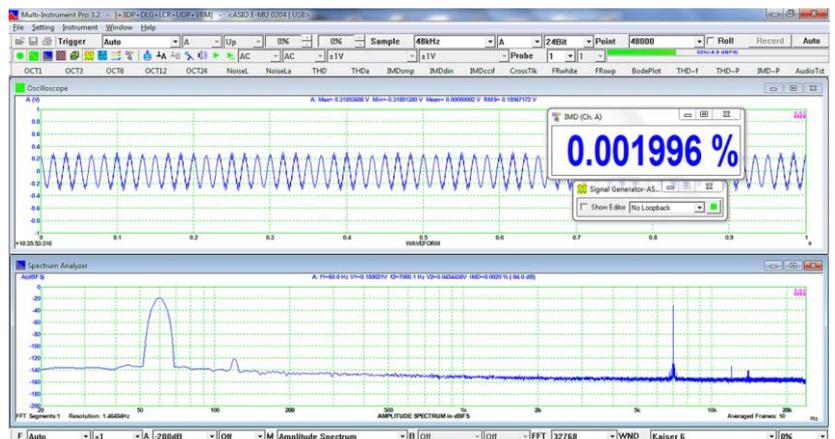
(Measurement of SMPTE IMD)
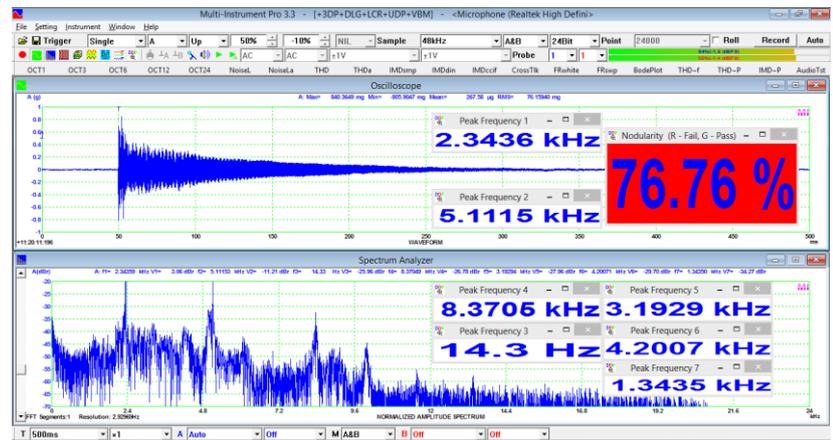
(Impact Test by detecting multiple frequency peaks)

(Burst Sine)

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Turn a PC into Multiple Virtual Instruments!
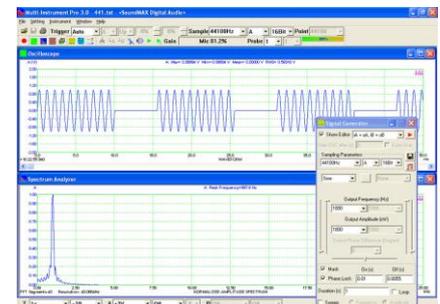
Loopback Mode
Loopback is generally used to feed the signal output by the signal generator to the input of the oscilloscope, so that the output signal can be displayed and analyzed in real time.

Hardwired Loopback
It is established via an external cable, to loopback the output signal to the input of the oscilloscope.

Mixer Level Loopback (sound card only)
It is established at the sound card mixer level through the configuration under Windows Control Panel.

Software Level Loopback
• No Loopback
• iA=oA, iB=oB
• iA=oA, iB=oA
• iB=oA
• Sync. No Loopback
• Sync. iB=oA
• Sync. iB<--oA

Multimeter

View Type
• RMS
• dBV
• dBu
• dBSPL
• dB(A)
• dB(B)
• dB(C)
• Frequency Counter
• RPM (Revolutions Per Minute)
• Counter
• Duty Cycle
• F/V (Freq. Volt. Conversion)
• Cycle RMS
• Cycle Mean
• Pulse Width

The latter eight involve a pulse counting process, and the software allows you to configure the counter's trigger level, trigger hysteresis and frequency dividing ratio.

Spectrum 3D Plot

It is used to trace the spectrum variation with time. Two types of plots are provided:

• Waterfall Plot
• Spectrogram

with adjustable tilt angle of T axis, adjustable height of Y axis, and selectable color palettes.

(Measurement of Transfer Function (Bode Plot) using Dual FFT)
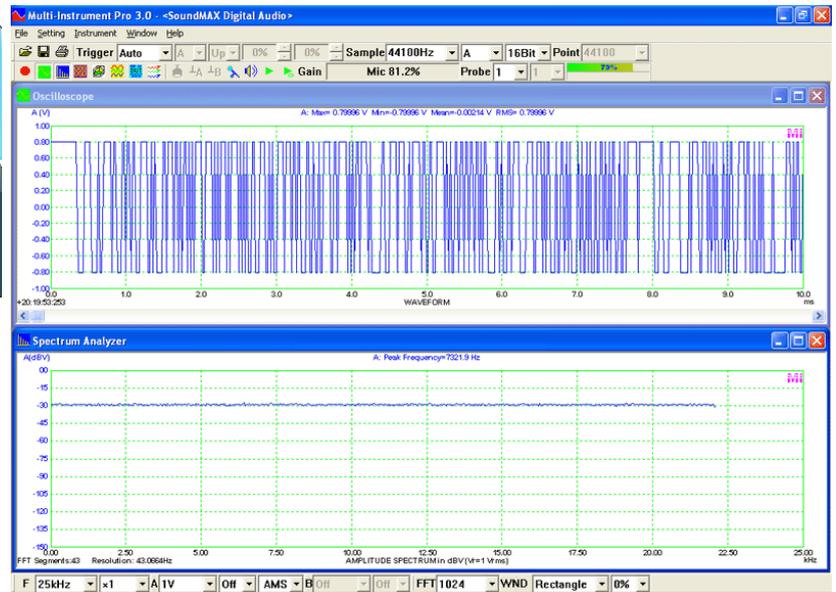
(Maximum Length Sequence (MLS) in narrow band spectral analysis)
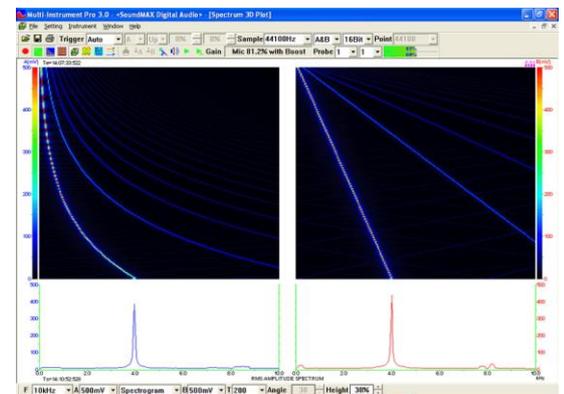
(Spectrogram)
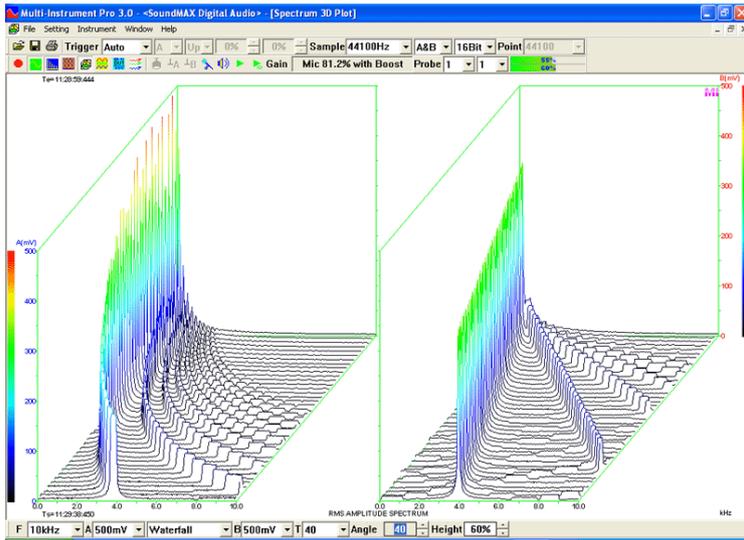
(Waterfall Plot)
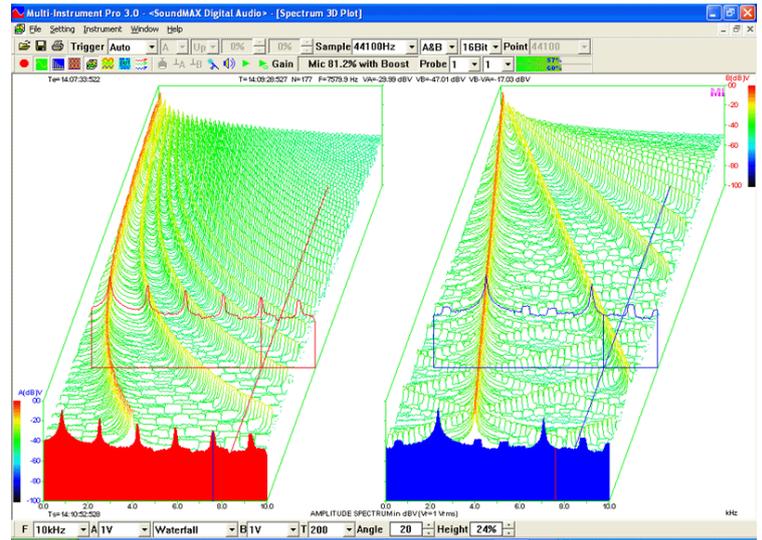
(Waterfall Plot with a 3D Cursor Reader)

Data Logger

It provides long time data logging function for 196 derived data points and 16 user defined data points, including RMS value, peak frequency, sound pressure level, RPM, THD, etc. Up to eight data logger windows can be opened and each window can trace up to 8 variables. The logged data files can be reloaded into the data logger for review.

Three logging methods are supported:

- Fastest
  Take one record whenever new data are available

- Time Interval
  Take one record whenever new data are available and the specified time duration has elapsed since the last update.

(Data Logger)

- Update Threshold
  Take one record whenever new data are available and the change compared with the last update exceeds the specified update threshold.
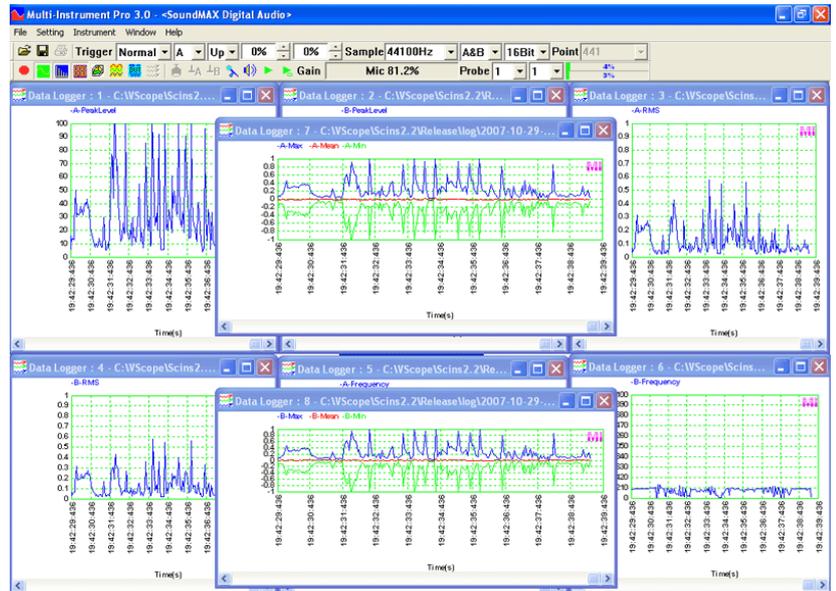
LCR Meter

It is one of the dedicated Device Test Plans. It is used to measure the value of an inductor, a capacitor or a resistor, or the impedance of a network of them.

Two types of external connections are supported:

- Serial connection for high impedance measurement
- Parallel connection for low impedance measurement
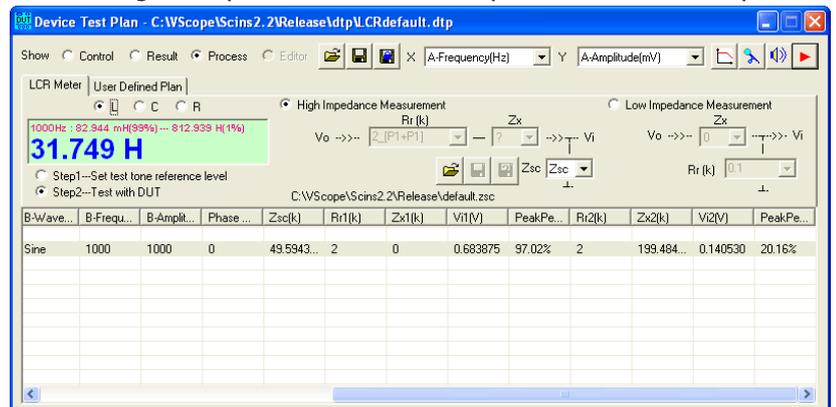
Device Test Plan

(LCR Meter)

It provides a mechanism to configure and conduct your own device test steps. It takes the advantage of the hardware's capability of simultaneous input and output, to generate a stimulus to the Device Under Test (DUT) and acquire the response from that device at the same time. Different stimuli can be generated and the response can be analyzed in different ways. The DUT can be marked as Pass or Fail after a sequence of test steps.

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Device Test Plan supports 23 instructions with corresponding parameters. Test results (e.g. Gain vs Frequency, Phase vs Frequency, etc.) can be plotted in up to 8 X-Y plots in real time.
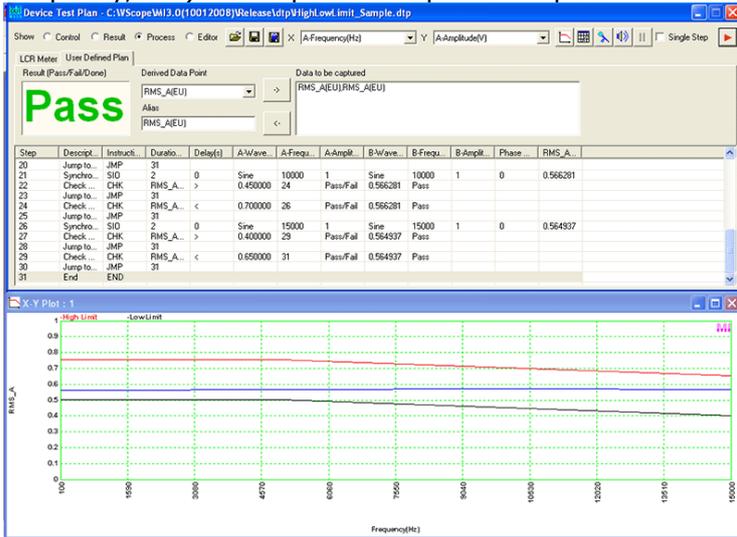
(Pass / Fail Test)
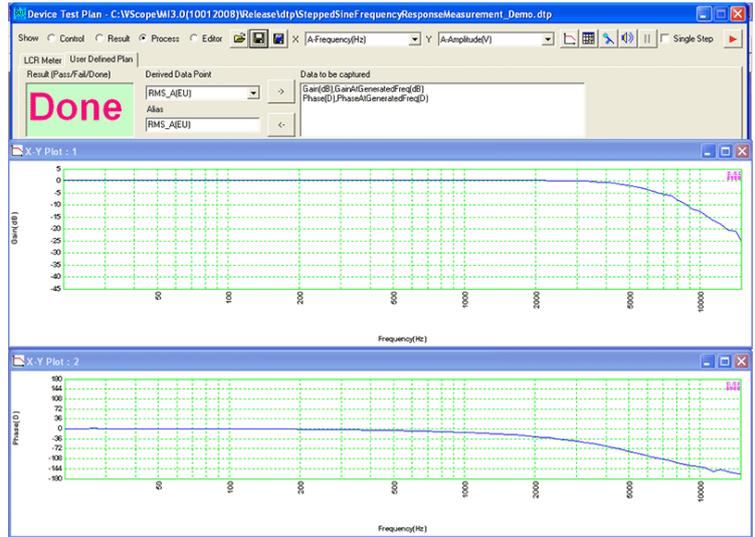
(Gain and Phase Plot using frequency stepped sine)
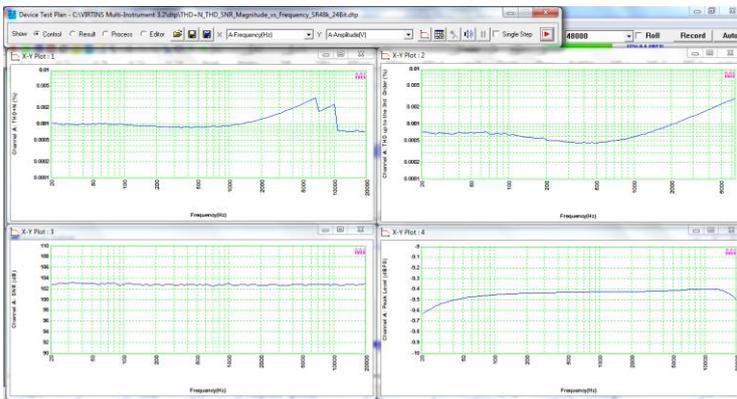
(THD, THD+N, SNR, Magnitude Response vs Frequency)
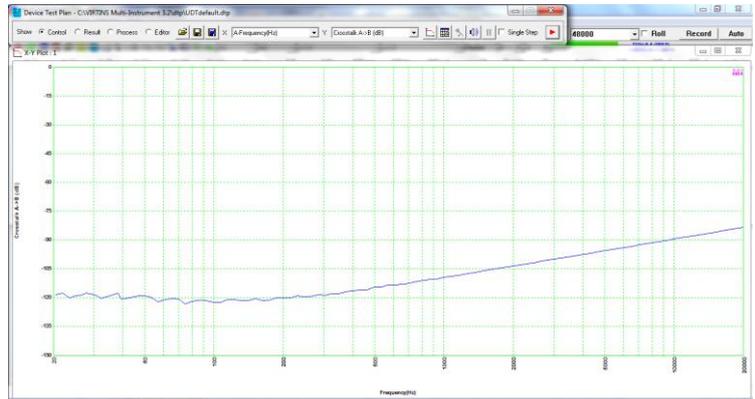
(Crosstalk vs Frequency)

Vibrometer

It can perform waveform conversion among acceleration, velocity and displacement when acceleration, velocity or displacement sensors are used. The RMS, Peak/PP, Crest Factor values for acceleration, velocity, displacement are also displayed.

DDP Viewer

It is used to display the value of a Derived Data Point (DDP) in a dedicated window with a bigger font size. It is also possible to specify the DDP's high-high, high, low, low-low limits for alarming and the number of decimal places for display. Up to 16 DDP viewers can be opened. These DDP viewers can also be used to define and display User Defined Data Points (UDDP). A UDDP can be expressed as a function of DDPs and earlier-updated UDDPs. The mathematical expression may consist of constants, DDPs, UDDPs, mathematical operators, and mathematical functions. A DDP Array Viewer can be launched from the DDP Viewer, which can be used to display a DDP array or a combination of DDP arrays, such as a harmonic analysis report consisting of arrays of harmonics frequencies, amplitudes and phases.

General Functions

Sensor Sensitivity

The acquired data can be rescaled according to the sensor sensitivity configured by the user so that the displayed data are expressed in engineering unit corresponding to the physical quantity sensed by the sensors. This is very different from a conventional oscilloscope whereby only voltage can be displayed.
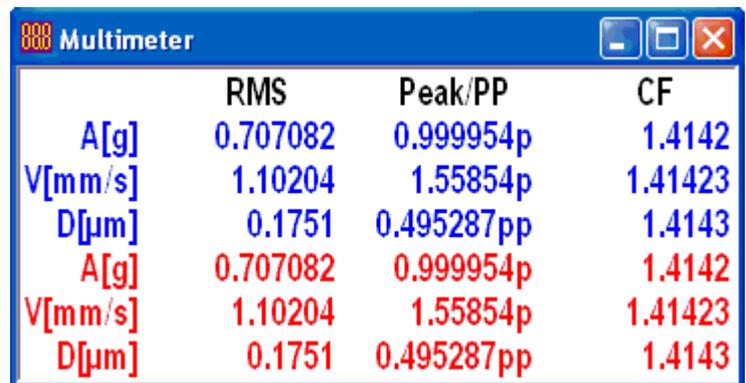
Graph Operation
Zooming and Scrolling is supported in all graphs, allowing you to investigate the fine details of the data. This is very important when a large amount of data are displayed in one screen. A cursor reader is provided in each graph to show the x and y readings of the actual measurement point. For Spectrum 3D Plot, the cursor reader supports the readout of x, y, t values of the actual measurement point. Two markers are provided in each graph to get the x and y readings of the actual measurement points nearest (in horizontal direction) to the points of the mouse clicks. Five chart types are supported: Line, Scatter, Column, Bar, Step. Line width and colors of the graph are configurable. Options are provided to either display all data points (slow) or only display one data points per vertical raster line (fast). The data in any graph can be copied into the clipboard as text and later paste into other software such as Microsoft Excel for further analysis. The image of the graph can be copied into the clipboard as Bitmap image and later paste into other software such as Microsoft Word.

Reference Curves
Up to five reference curves can be set for each channel in each graph. The reference curve can be configured by either copying the current curve, or loading a properly formatted text file or a previously saved reference file from the hard disk.

File Import and Export
The collected frame of data can be saved as a wave file (*.wav) or exported as a text file (*.txt). All analysis results can be exported as text files (*.txt). All graphs can be exported as bitmap files (*.bmp) or printed out directly. A long wave file can be imported frame by frame either manually or automatically. Wave files with PCM format or properly formatted text file can be imported for analysis. The signal generated by the signal generator can be saved as a wave file or a text file for a given duration of up to 1000 seconds.

Data Merging and Extraction
Combining data from individual channels of different wave files, and extracting part of data from a wave file are supported.

Save and Load Panel Setting
You can save your preferred instrument panel setting either as default or as a customized panel setting for later use.

Controls/Options Enabling and Disabling
Graphical User Interface items such as menu items, button, combo box, edit box, radio box, check box are enabled/disabled based on context, so as to void any mis-understanding and mis-operation.

Multilingual User Interface
It supports Multilingual User Interface under Windows XP, Vista, 7, 8 and 10. Supported languages are English, French, German, Italian, Portuguese, Spanish, Russian, Simplified Chinese, Traditional Chinese, Japanese and Korean.

Supported Hardware

Sound Card
The software can be used with a sound card and a microphone to measure and analyze sounds. To measure electric signal, the following dedicated sound card oscilloscope probe kit can be used.

P601PC Probe Kit

- Maximum Allowable Input Voltage: **±24 V**
- Built-in input protection circuit ensures its output to be less than 3V at all time, provided the input voltage is within the allowable range.
- Three switchable attenuation positions: 1, 2, 3, with input impedance equal to 1kΩ + Zsc, 201kΩ + Zsc, 10.001MΩ + Zsc, respectively. Note that Zsc is the sound card input impedance which ranges from 600Ω to 50kΩ typically.
- Its back end is a RCA plug and can be connected to an ordinary sound card through a stereo-to-2RCA converter or a mono-to-1RCA converter. No converter is required for those sound cards that have RCA jacks for input and output.

VT RTA
The software supports VT RTA series. A Real Time Analyzer (RTA) is usually used to measure in real time the frequency response of an audio system within the confinement of an environment, such as auditoriums, home theatres and cars, taking into account the frequency response of the audio system itself as well as all the environmental effects such as resonance and

constructive and destructive interference. One can then adjust the equalizer to make an inversed frequency response such that the combined frequency response is flat or aligned to the preference of the audiences.

VT DSO

The software supports VT DSO series. A Digital Storage Oscilloscope (DSO) is used to acquire, process and analyze electronic signals. Virtins Technology offers a comprehensive list of DSOs as follows.

Model	ADC (Oscilloscope)						DI		DAC (Signal Generator)					
	AI	Band Width (MHz)	Max. Sampling (MSPS)	Bit Depth (Bits)	Buffer* (Bytes)	Full Scale Range (V)	EXT as DI	Full Scale Range (V)	AO	Band Width (MHz)	Max. Sampling (MSPS)	Bit Depth (Bits)	DDS Buffer *(Byes)	Full Scale Range (V)
2810	2	40	100	8~16	40000	±0.01 ~ ±50	Y	±20	1	0.15	3.125	10	2048	±2
2810E	2	40	100	8~16	40000	±0.01 ~ ±50	Y	±20	1	60	200	10	2048	±2
2810R	2	40	100	8~16	40000	±0.05 ~ ±50								
2820	2	80	200	8~16	40000	±0.01 ~ ±50	Y	±20	1	0.15	3.125	10	2048	±2
2820E	2	80	200	8~16	40000	±0.01 ~ ±50	Y	±20	1	60	200	10	2048	±2
2820R	2	80	200	8~16	40000	±0.05 ~ ±50								
2A10	2	40	100	10~16	40000	±0.01 ~ ±50	Y	±20	1	0.15	3.125	12	2048	±2
2A10E	2	40	100	10~16	40000	±0.01 ~ ±50	Y	±20	1	60	200	12	2048	±2
2A10R	2	40	100	10~16	40000	±0.05 ~ ±50								
2A20	2	80	200	10~16	40000	±0.01 ~ ±50	Y	±20	1	0.15	3.125	12	2048	±2
2A20E	2	80	200	10~16	40000	±0.01 ~ ±50	Y	±20	1	60	200	12	2048	±2
2A20R	2	80	200	10~16	40000	±0.05 ~ ±50								
2840E	2	150	400	8~16	40000	±0.01 ~ ±50	Y	±20	1	60	200	10	2048	±2
2840R	2	150	400	8~16	40000	±0.05 ~ ±50								
2A40E	2	150	400	10~16	40000	±0.01 ~ ±50	Y	±20	1	60	200	12	2048	±2
2A40R	2	150	400	10~16	40000	±0.05 ~ ±50								

NI DAQmx Cards

The software supports NI DAQmx cards.