



INTRODUCTION TO THE
DIGILENT
ANALOG DISCOVERY 2 AND 3

TEST EQUIPMENT
FOR YOUR WORKBENCH

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OVERVIEW – ANALOG DISCOVERY 2/3

- A USB Oscilloscope and So Much More
 - Oscilloscope, Waveform Generator, Power Supply, Voltmeter, Data Logger, Logic Analyzer, Pattern Generator , Static I/O, Spectrum Analyzer, Network Analyzer, Impedance Analyzer, Protocol Analyzer, Curve Tracer
- Analog Discovery 3 (Current Model)
 - Analog Discovery 2 (Previous Model)

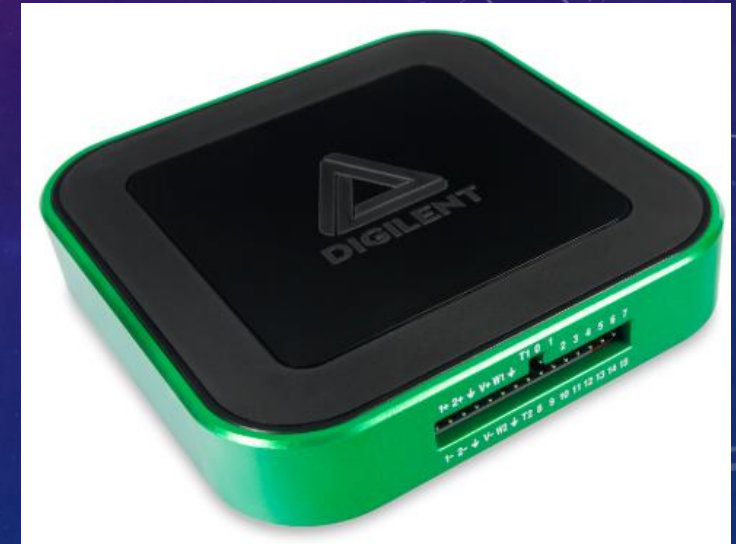


SPACE EFFICIENT

This...



Or This...

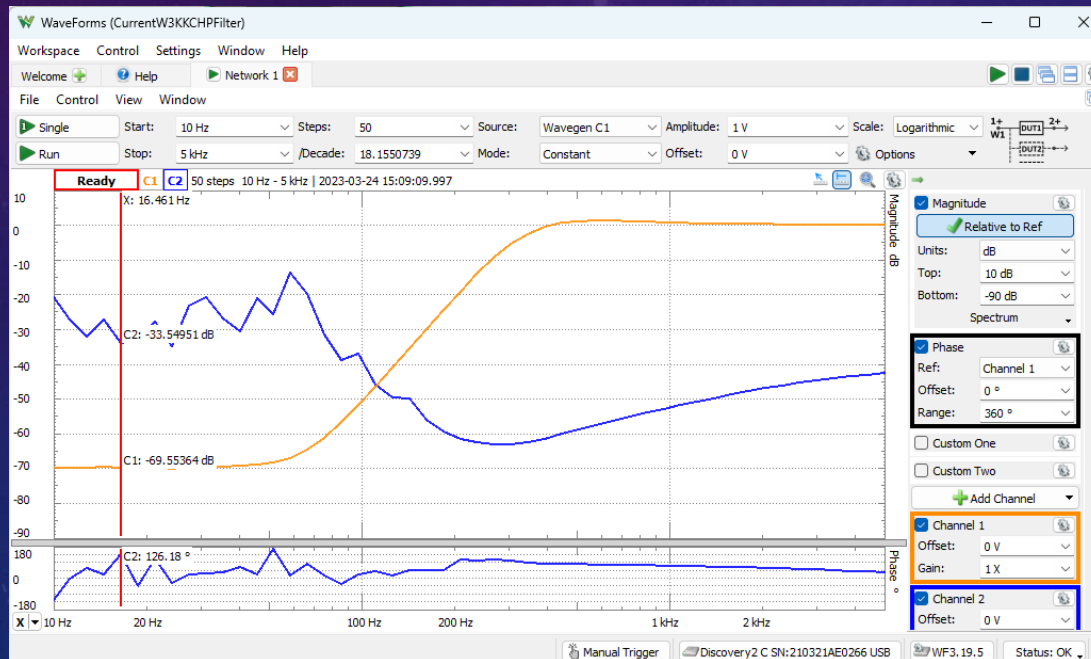


- A Pocket-size Portable Alternative to a Stack of Benchtop Equipment
 - With Some Limits



HOW DO THEY DO THAT?

- Two pieces
 - The USB Hardware Module
 - Waveforms Software for Your PC



- Waveforms Runs On...
 - Linux
 - Windows
 - Mac



HARDWARE SPECS

- Analog Inputs

- Two 14-bit Differential Inputs
- 100 MS/s Per Channel, 30 MHz BW (AD2)
- +/- 25V

- Analog Outputs

- Two 14-bit Single-Ended Outputs
- 100 MS/s Per Channel, 12 MHz BW (AD2)
- +/- 5V

- Note: AD3 Sample Rate is 125 MS/s.

- Digital I/O

- Sixteen Channels
- 3.3V (5V Tolerant)
- 100 MS/s Per Channel (AD2)

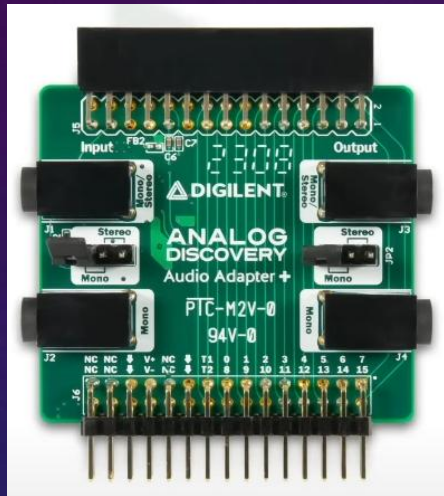
- Programmable Power Supply

- 0.5 to 5V
- -0.5 to -5V
- 800 ma Each With Auxiliary Power Source (USB Cannot Provide This Current)



LOTS OF ACCESSORIES

Audio Adapter



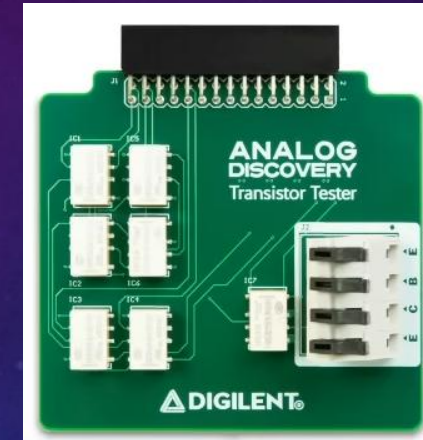
BNC Adapter



Impedance Analyzer



Transistor Tester



Flywires (Included)



And More...



THE SOFTWARE -- WAVEFORMS

- Two-channel USB digital oscilloscope (1 M Ω , \pm 25 V, differential, 14-bit, 100 MS/s, 30 MHz+*)
FFT, Spectrogram, Lock-In Amplifier, Additional Software Input Filters, Eye Diagram, XY Plot views, and more
- Two-channel arbitrary waveform generator (\pm 5 V, 14-bit, 100 MS/s, 12 MHz+ bandwidth*)
Standard waveforms, amplitude and frequency modulated signals, direct playback from analog inputs, custom waveforms
- 16-channel digital logic analyzer (3.3 V CMOS and 1.8 V or 5 V tolerant, 100 MS/s)
- 16-channel pattern generator (3.3 V CMOS, 100 MS/s)
- 16-channel virtual digital I/O including buttons, switches, displays, and LEDs, which is perfect for logic training applications
- Two input/output digital trigger signals for linking multiple instruments or providing an external trigger source
- Two channel voltmeter
- Network Analyzer with Bode, Nyquist, Nichols transfer diagrams of a circuit. The Network Analyzer has a range of 1 Hz to 10 MHz. Also measures distortion.



THE SOFTWARE -- WAVEFORMS

- Spectrum Analyzer capable of power spectrum and spectral measurements (noise floor, SFDR, SNR, THD, etc.)
- Data Logger with exportable data and plot functionality
- Impedance Analyzer for analyzing capacitive and inductive elements
- Curve Tracer to analyze characteristics of discrete semiconductors such as diodes and transistors
- Protocol Analyzer with SPI, I2C, CAN, AVR, UART, 1-Wire
- Two programmable power supplies (0.5 V to 5 V , -0.5 V to -5 V). The maximum available output current and power depend on the Analog Discovery 2 powering choice.
- Stereo audio amplifier to drive external headphones or speakers with replicated Arbitrary Waveform Generator signals
- An available Software Development Kit for programming with Python and C++, and a toolkit for programming with LabVIEW.



WAVEFORMS -- WORKSPACE

The screenshot displays the WaveForms software interface. On the left is a vertical toolbox with various tool icons. A red callout box with the text "Open One or More Tools from the Toolbox" points to the toolbox. The main workspace area shows a "Recent:" list of workspace files with their paths and timestamps. At the bottom, there are buttons for "New", "Save", and "Save As", along with the Digilent logo and hardware information.

WaveForms (CurrentW3KKCHPFilter)

Workspace Control Settings Window Help

Welcome Help Network 1

Open Workspace

Recent:

CurrentW3KKCHPFilter	C:/Users/user/My Drive/SCOM/Ref/HighPassFilter/CurrentW3KKCHPFilter.dwf3work	2023-03-24 15:10:12
EarlyW3KKCHPFilter	C:/Users/user/My Drive/SCOM/Ref/HighPassFilter/EarlyW3KKCHPFilter.dwf3work	not found
CurrentW3KKCHPFilter_2	C:/Users/user/My Drive/SCOM/Ref/HighPassFilter/CurrentW3KKCHPFilter_2.dwf3work	2023-03-24 16:50:30
CurrentW3KKCHPFilter_2	G:/My Drive/SCOM/Ref/HighPassFilter/CurrentW3KKCHPFilter_2.dwf3work	not found
CurrentW3KKCHPFilter	G:/My Drive/SCOM/Ref/HighPassFilter/CurrentW3KKCHPFilter.dwf3work	not found
EarlyW3KKCHPFilter	G:/My Drive/SCOM/Ref/HighPassFilter/EarlyW3KKCHPFilter.dwf3work	not found

New Save Save As

Open last workspace on start

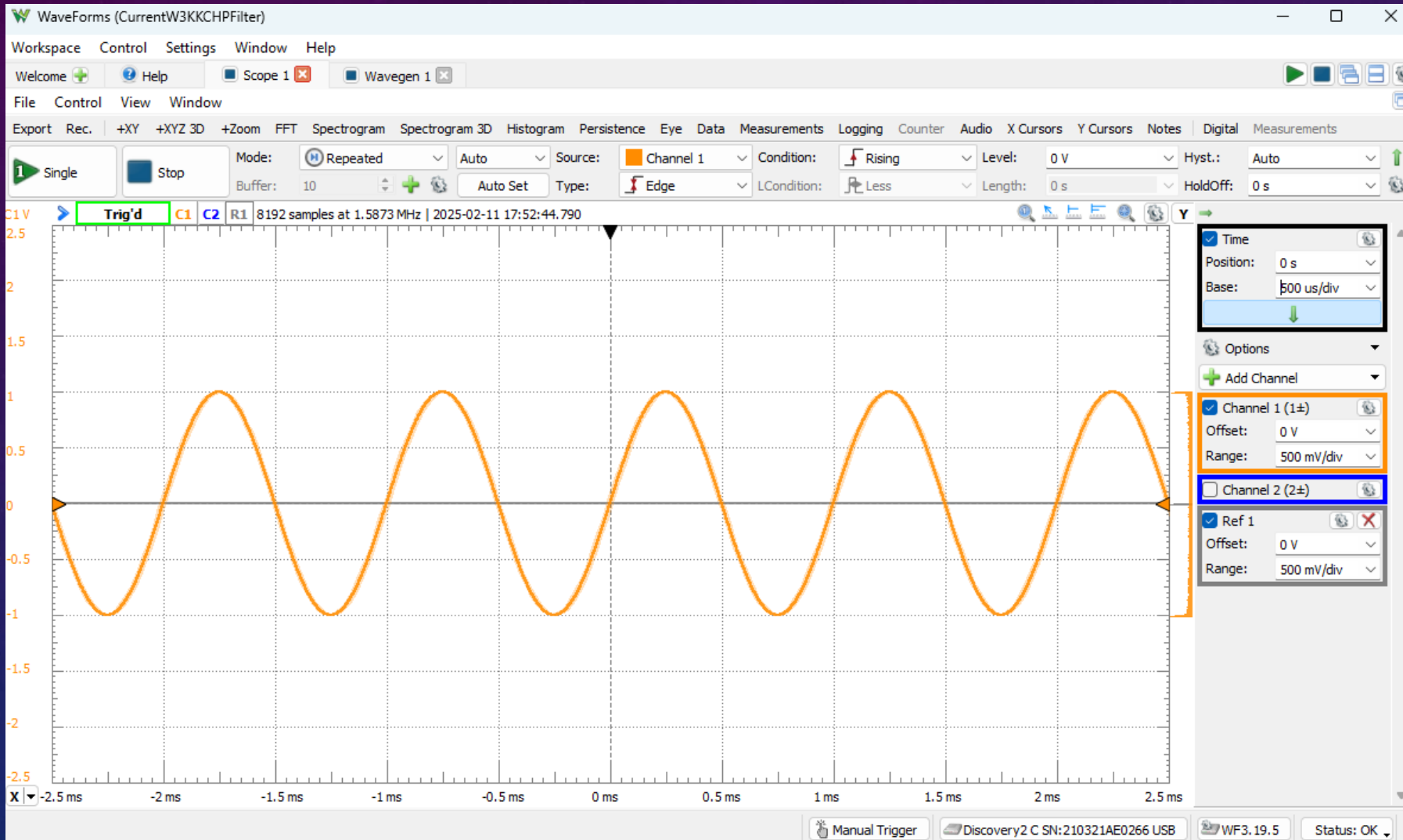
DIGILENT
An NI Company

Manual Trigger Discovery2 C SN:210321AE0266 USB WF3.19.5 Status: OK

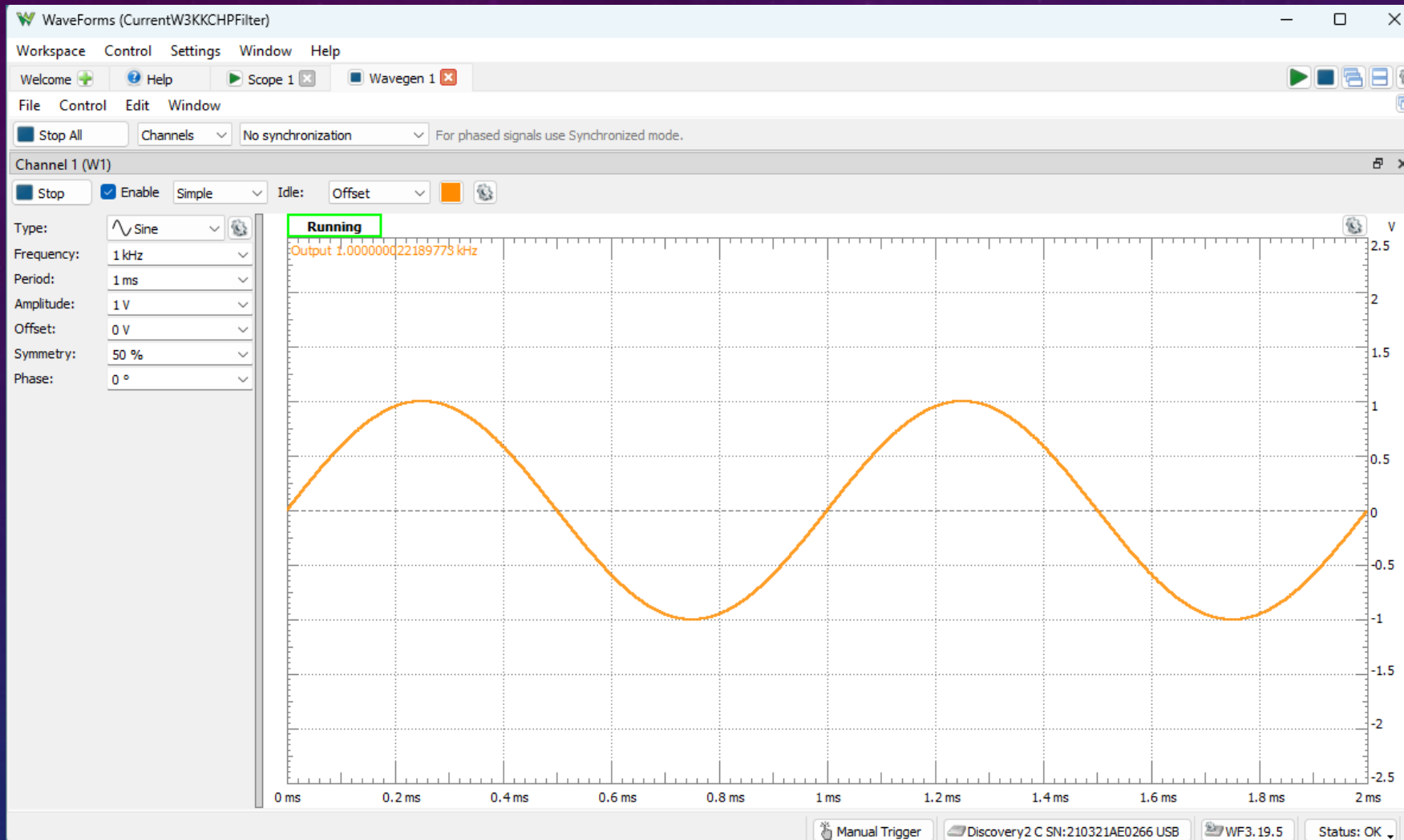
To create custom application see the [WaveForms SDK](#).
For more information visit [Digilent T&M Reference Page](#).
Observations are welcome on [Test and Measurement Forum](#).



WAVEFORMS -- OSCILLOSCOPE



WAVEFORMS – WAVEFORM GENERATION (WAVEGEN)



- DC
- ~ Sine
- Square
- △ Triangle
- ∇ RampUp
- ∇ RampDown
- ⚡ Noise
- ▭ Pulse
- ⤴ Trapezium
- ⤵ SinePower
- C# Scope C1 (ADC)
- C# Scope C2 (ADC)
- C# Scope C1 (AVG)
- C# Scope C2 (AVG)
- C# Filter C1 (F1)
- C# Filter C4 (F2)



WAVEFORMS – POWER SUPPLIES

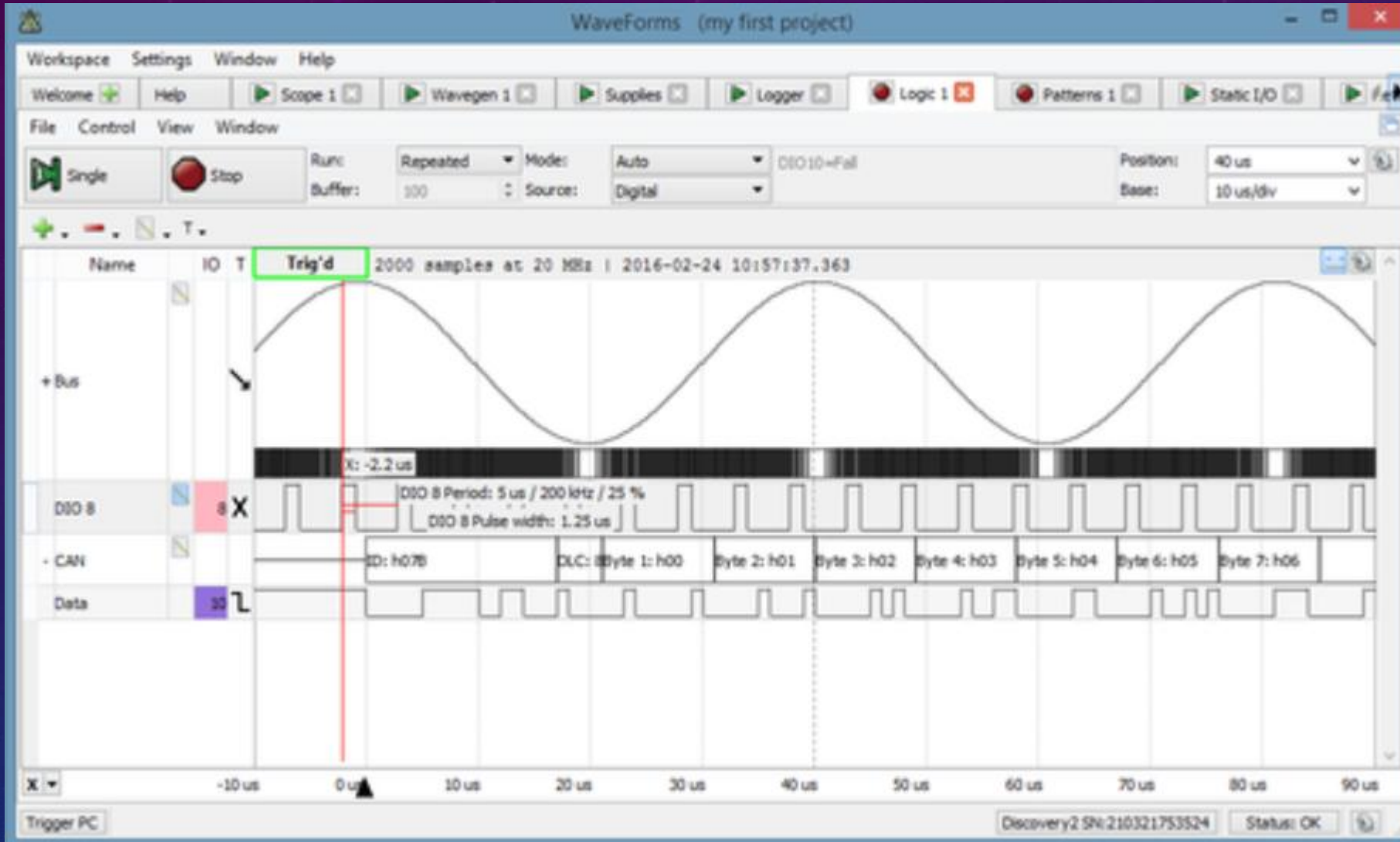
The screenshot displays the WaveForms software interface for a power supply unit. The window title is "WaveForms (CurrentW3KKCHPFilter)". The menu bar includes "Workspace", "Control", "Settings", "Window", and "Help". The toolbar shows "Welcome", "Help", and "Supplies". The main interface features a "Master Enable is On" status bar. Below it, there are two supply channels: "Positive Supply (V+) On" set to 5 V and "Negative Supply (V-) On" set to -5 V. Both channels have a "Tracking" checkbox. A note indicates "USB powered, allowing up to 500 mW total or 700 mA output per channels." The "System Monitor" section displays the following data:

USB Voltage:	4.739 V	AUX Voltage:	0.000 V	Temperature:	46.00 °C / 114.80 °F
USB Current:	364.7 mA	AUX Current:	0.0 mA		

The bottom status bar includes "Manual Trigger", "Discovery 2 C SN:210321AE0266 USB", "WF3.19.5", and "Status: OK".



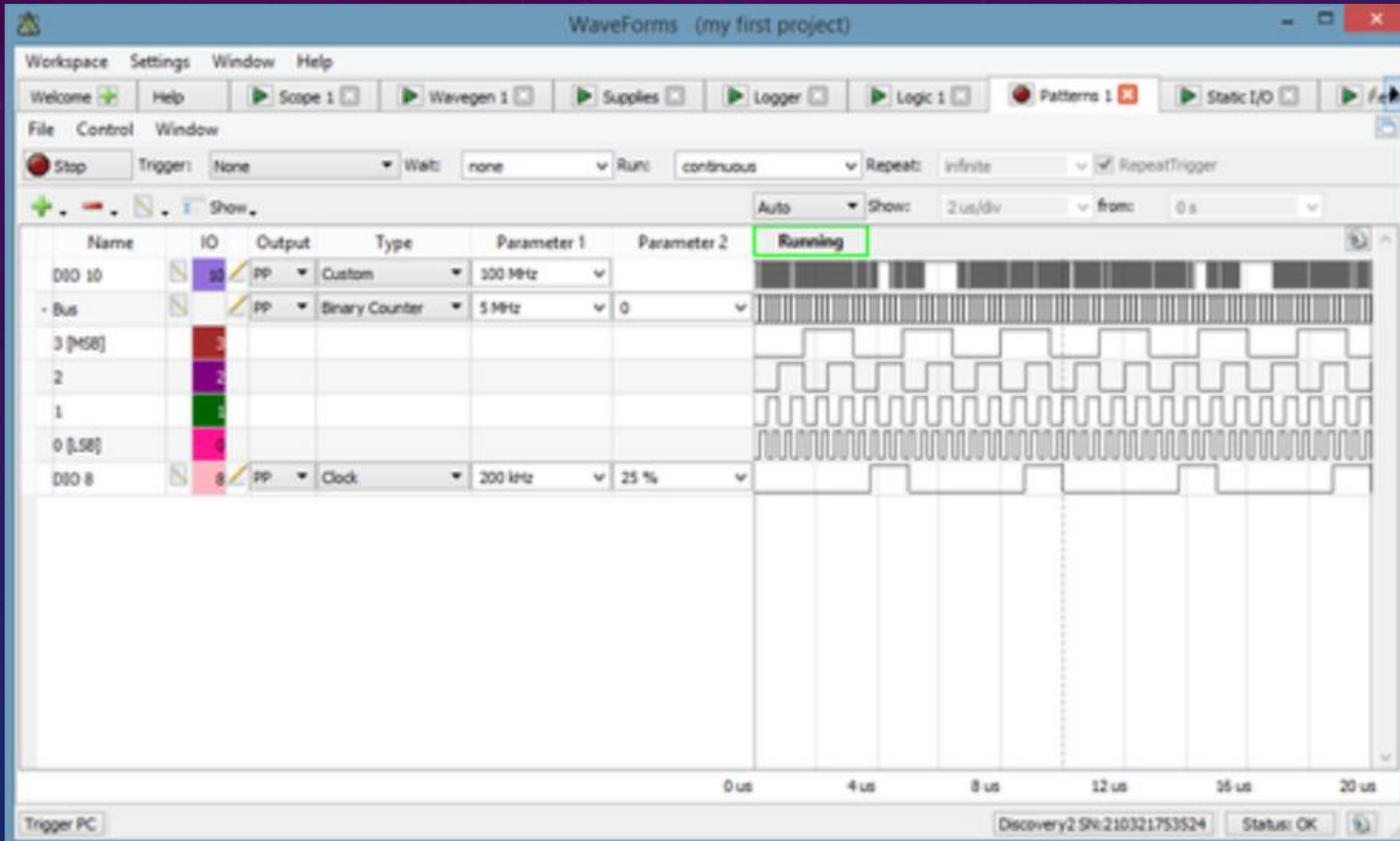
WAVEFORMS – LOGIC ANALYZER



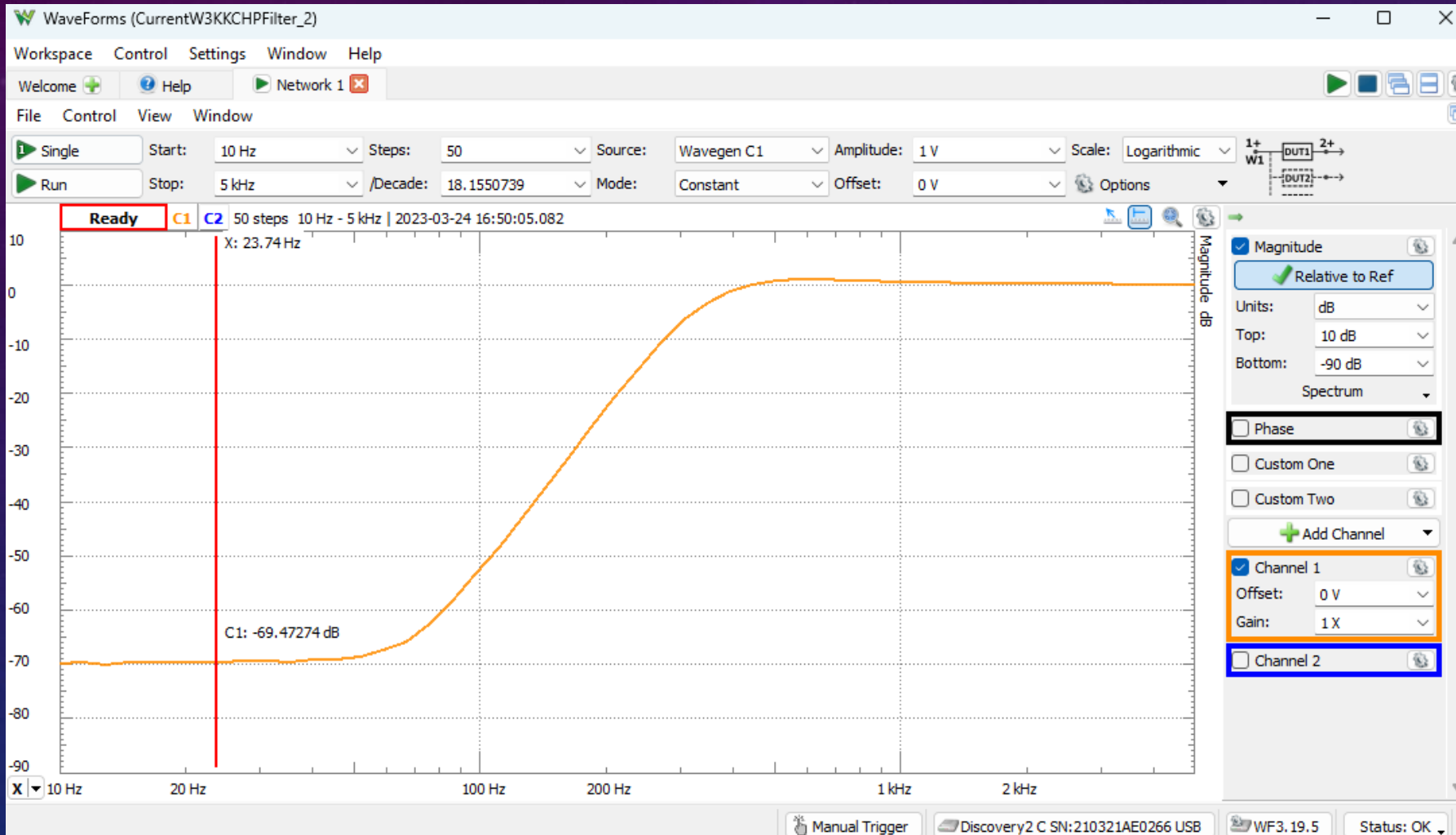
- Scope
- Logic Analyzer
- Protocol Analyzer



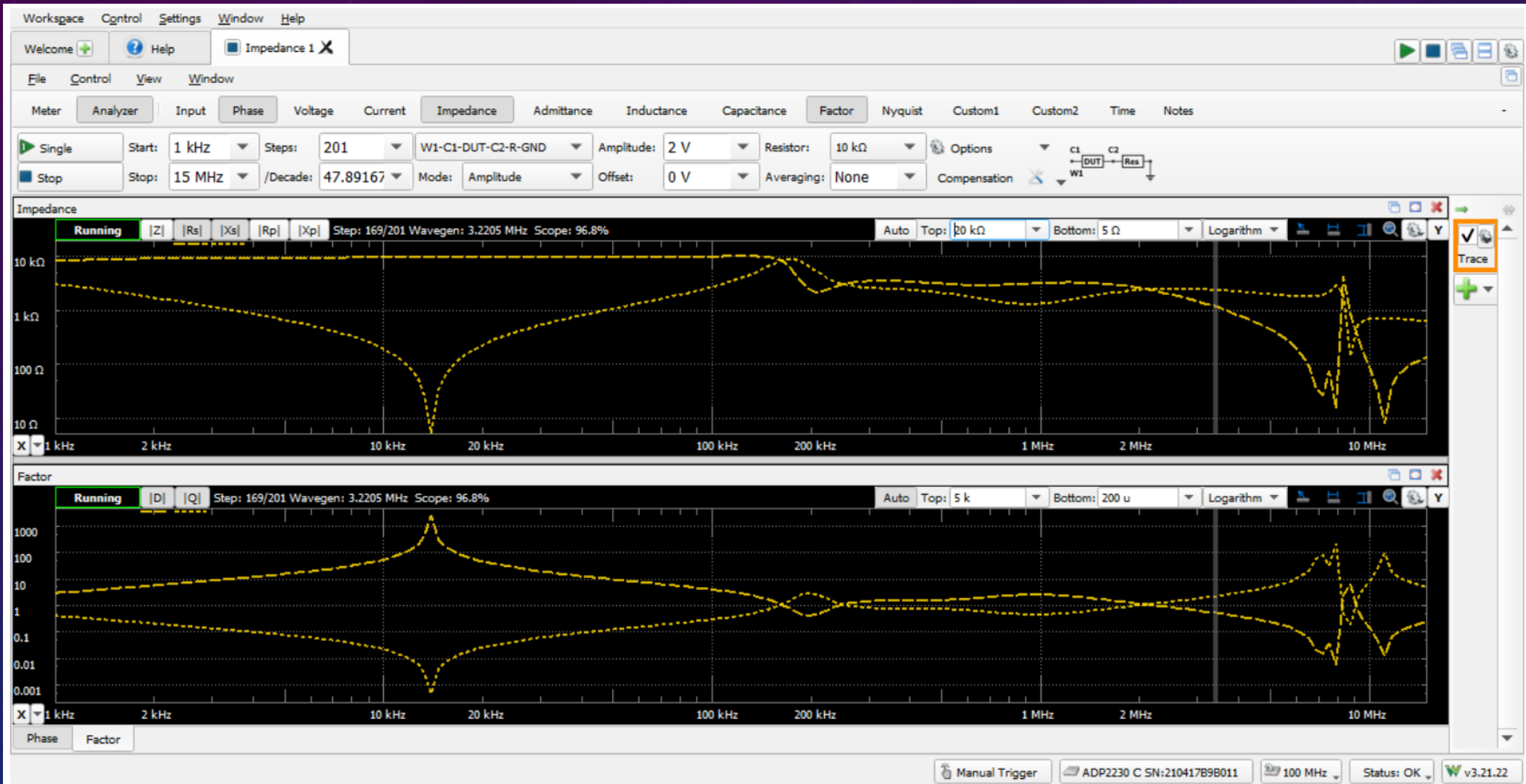
WAVEFORMS – PATTERN GENERATOR



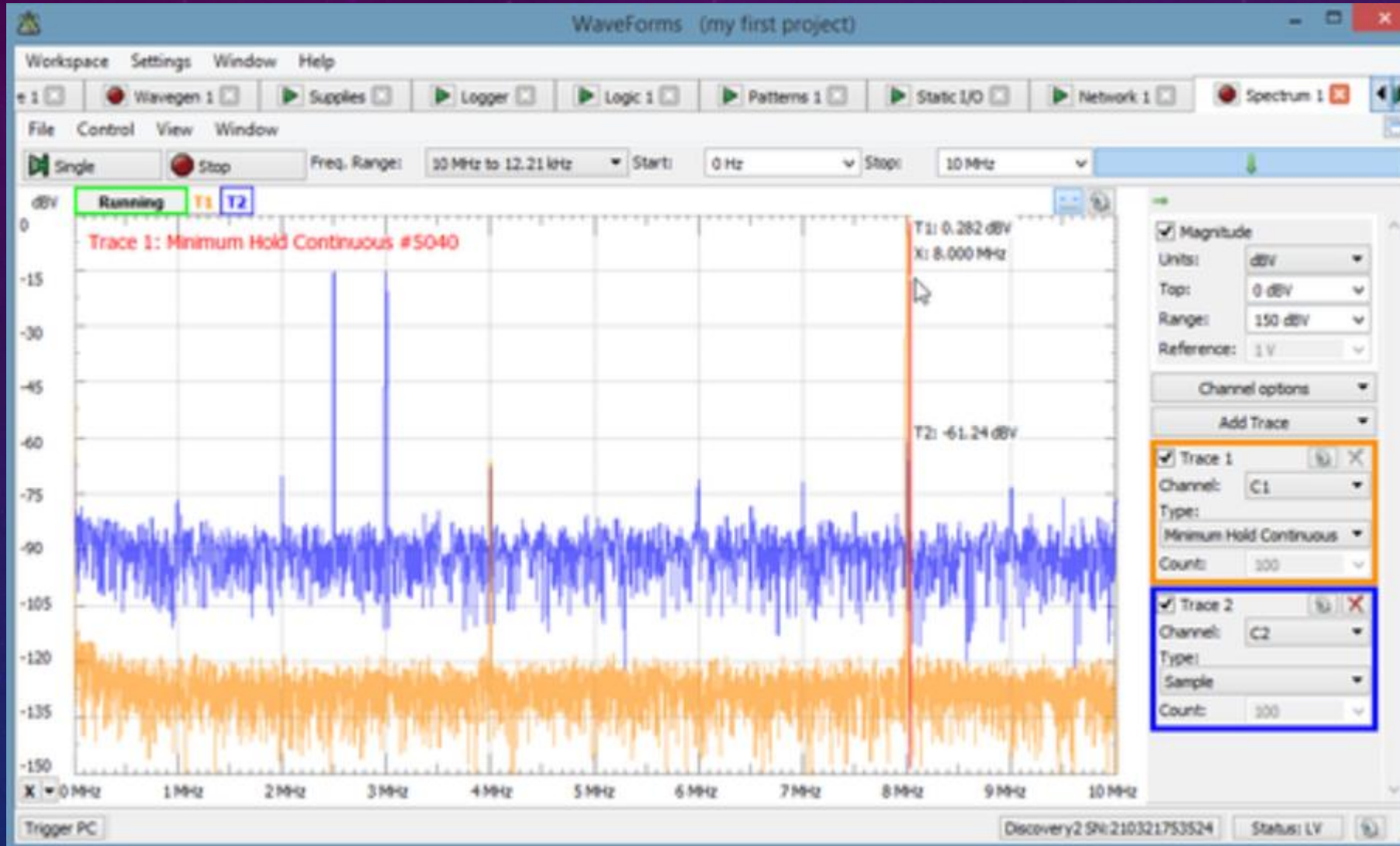
WAVEFORMS – NETWORK ANALYZER



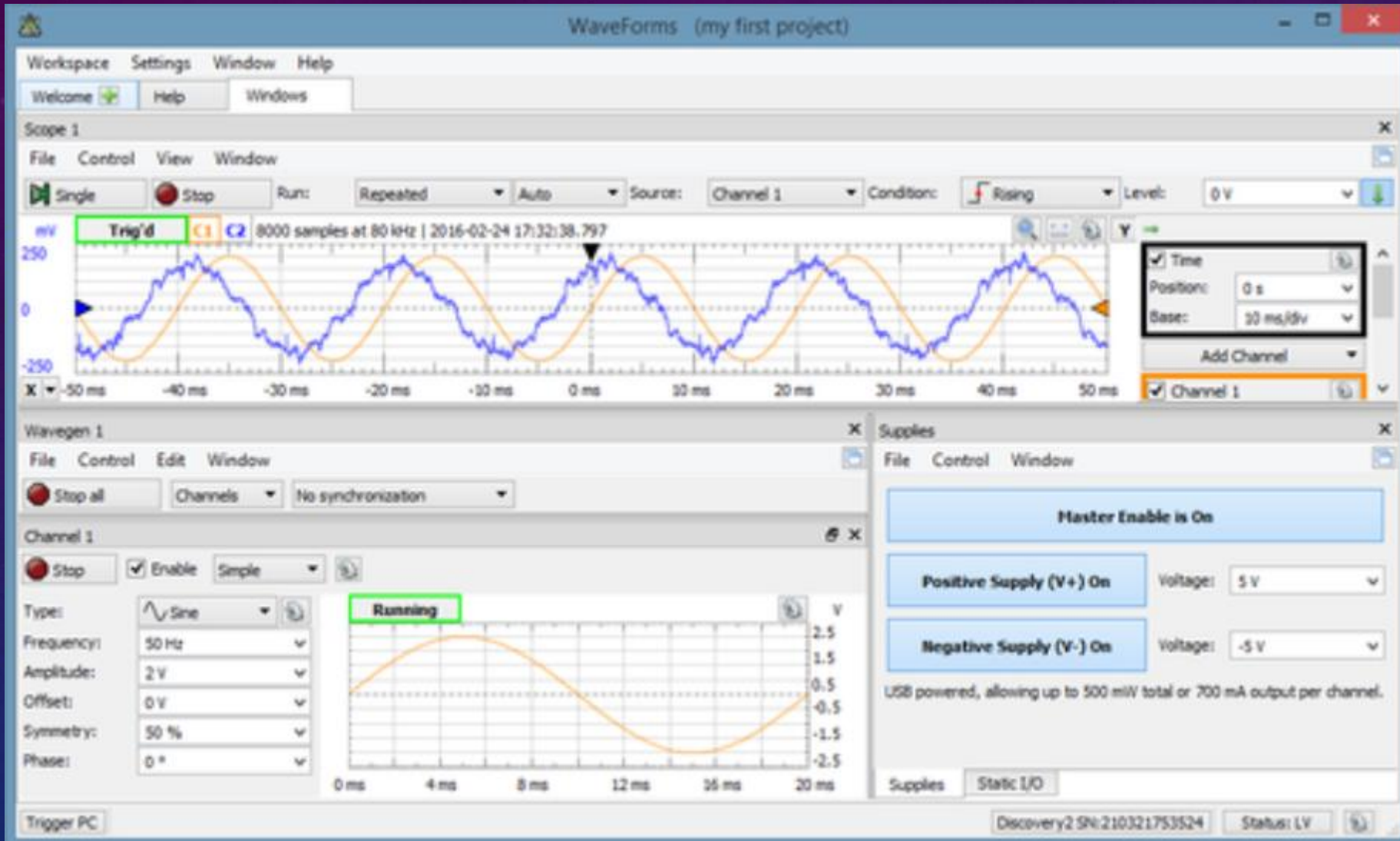
WAVEFORMS – IMPEDANCE ANALYZER



WAVEFORMS – SPECTRUM ANALYZER



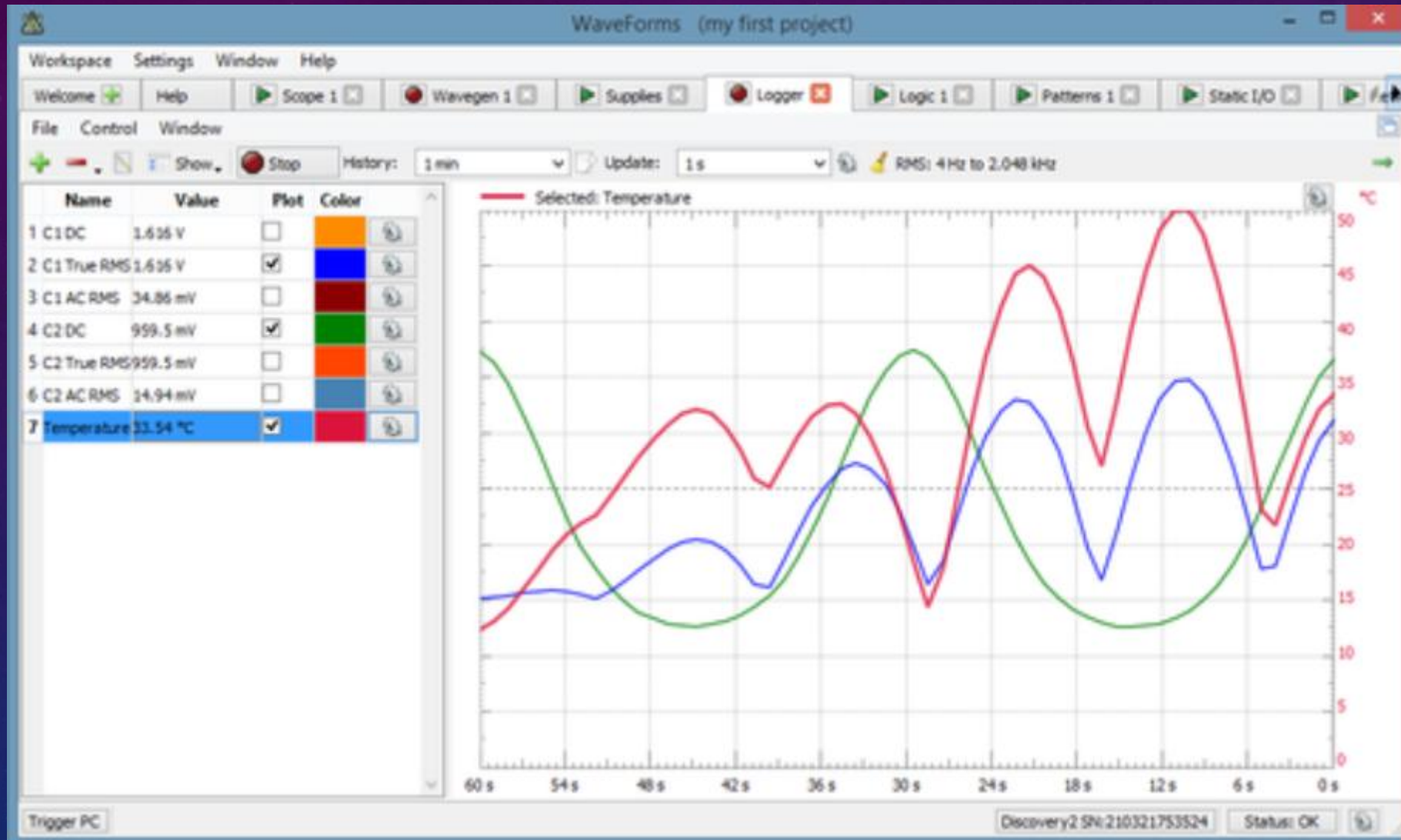
WAVEFORMS – DISPLAY MULTIPLE INSTRUMENTS



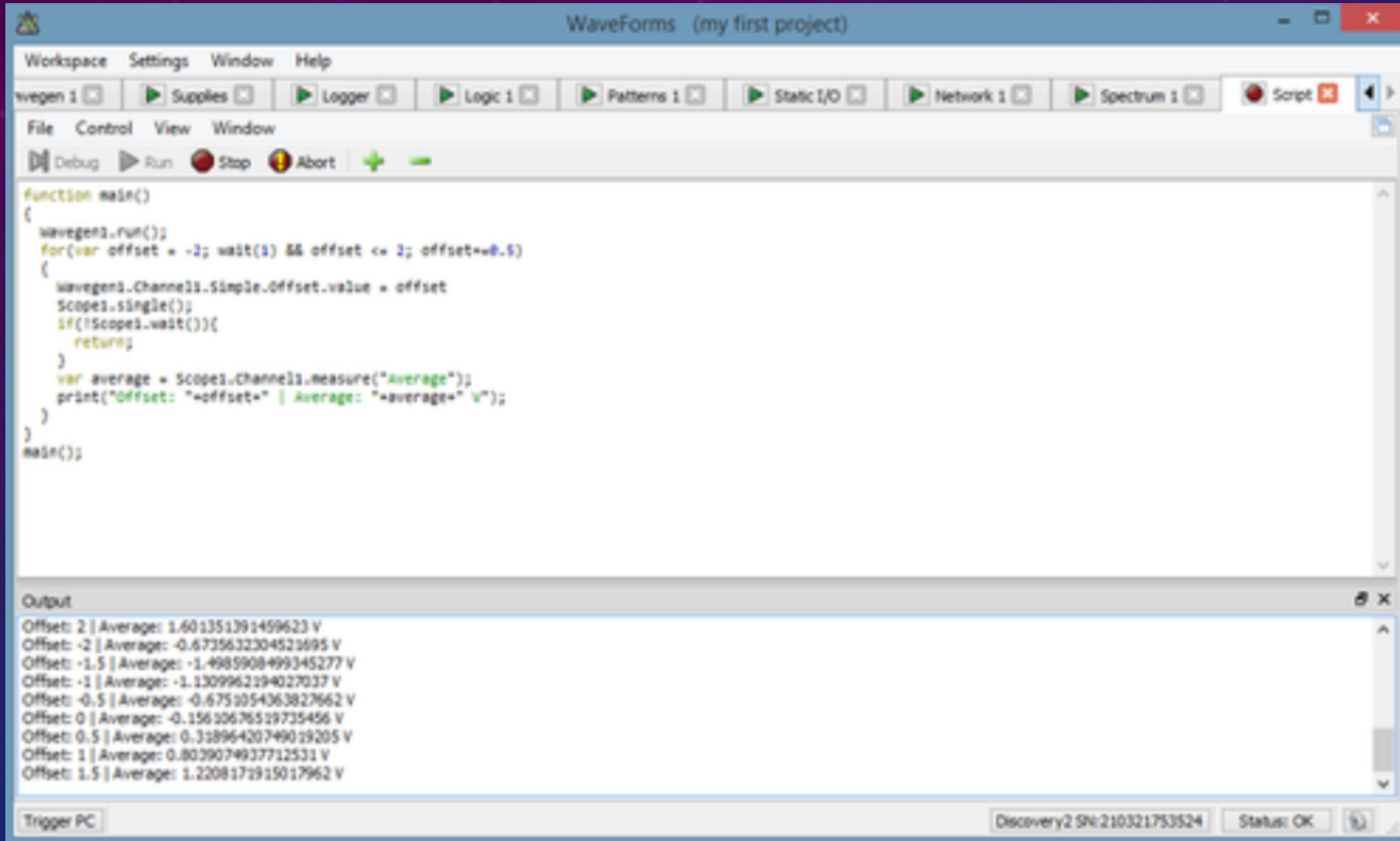
- Scope
- Wavegen
- Power Supplies



WAVEFORMS – LOGGER



WAVEFORMS – SCRIPTING



The screenshot shows the WaveForms software interface for a project named "my first project". The main window displays a JavaScript script for the "Script" component. The script iterates through offsets from -2 to 2, measuring the average voltage for each. The output window shows the results of these measurements.

```
function main()
{
  wavegen1.Run();
  for(var offset = -2; wait(1) && offset <= 2; offset+=0.5)
  {
    wavegen1.Channel1.Simple.Offset.value = offset
    Scopes.single();
    if(!Scopes.wait()){
      return;
    }
    var average = Scopes.Channel1.measure("Average");
    print("Offset: "+offset+" | Average: "+average+" V");
  }
}
main();
```

Output

```
Offset: 2 | Average: 1.601351391459623 V
Offset: -2 | Average: -0.6735632304521695 V
Offset: -1.5 | Average: -1.4985908499345277 V
Offset: -1 | Average: -1.1309962194027037 V
Offset: -0.5 | Average: -0.6751054363827662 V
Offset: 0 | Average: -0.15630676519735456 V
Offset: 0.5 | Average: 0.31896420749019205 V
Offset: 1 | Average: 0.8039074937712531 V
Offset: 1.5 | Average: 1.2208171915017962 V
```

Trigger PC Discovery2 S/N: 210321753524 Status: OK



BUNDLES

- It's Lightweight! Take It With You
 - Repeater Site Trips
 - Field Day, SOTA, POTA
- Add a Connector to Your Projects
 - I have it on a module Test Board and a Repeater Controller Test Board
 - Samtec SSQ-115-02-T-D-RA
- Other Thoughts...
 - BNC Adapter Card is Worth Having – Gives You The Best Oscilloscope Bandwidth, Better Than Flywires
 - Need Scope Probes? Get the Pro Bundle



Ref: <https://digilent.com/shop/analog-discovery-3-pro-bundle/>



REFERENCES –

<https://digilent.com/shop/analog-discovery-3/>

<https://digilent.com/shop/analog-discovery-3-pro-bundle/>

<https://digilent.com/reference/software/waveforms/waveforms-3/reference-manual>

https://www.youtube.com/results?search_query=analog+discovery+3

<https://digilent.com/reference/test-and-measurement/analog-discovery-2/hardware-design-guide>

https://www.youtube.com/results?search_query=analog+discovery+tutorials



THANK YOU!!!

