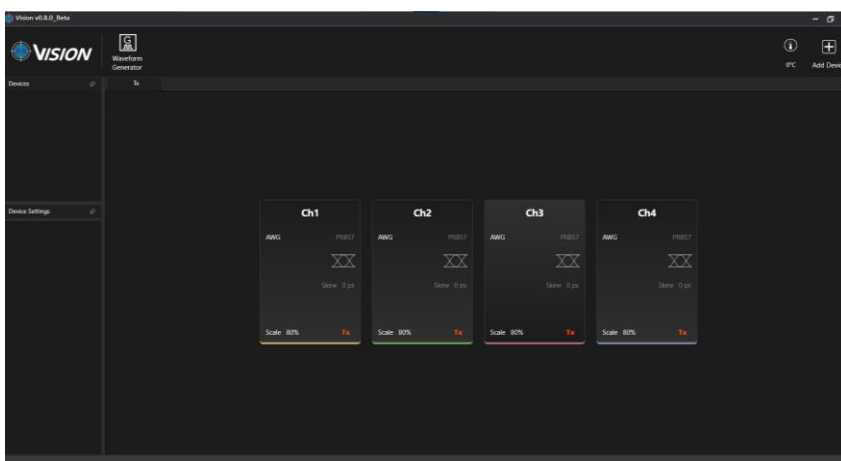# ML AWG Series

Installation | Connection | Calibration| Measurement

User Manual Revision 1.0.3, September 2023

Please note:
Do not turn off the device before setting it to [Low power mode]

Innovation for the next generation

Notices

General Safety Summary
Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.
Only qualified personnel should perform service procedures.
While using this product, you may need to access other parts of the system. Read the General Safety Summary in other system manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Only use the power cord specified for this product and certified for the country of use.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.
Do not apply a potential to any terminal, including the common terminal that exceeds the maximum rating of that terminal.

Do Not Operate Without Covers.
Do not operate this product with covers or panels removed.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate with Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions. Do Not Operate in an Explosive Atmosphere. Keep Product Surfaces Clean and Dry

Caution statements identify conditions or practices that could result in damage to this product or other property.

Table of Contents

Revision Control

Revision number	Description	Release Date
1.0.0	Initial Release	11/3/2022
1.0.1	Vision v0.7.2	11/5/2023
1.0.2	Vision v0.8.0	24/9/2023
1.0.3	Vision v0.8.1	2/10/2023

List of Acronyms

Acronym	Definition
GUI	Graphical User Interface
HW	Hardware
NRZ	Non-Return to Zero
PAM4	Pulse Amplitude Modulation (4-level)
SW	Software

Introduction

This user manual provides a quick introduction to the Vision GUI and explains how to set up and use the AWG. At the end of this document, web links to a set of training videos are provided. Use the following link to get the latest information about the AWG product and download its datasheet.

https://www.multilaneinc.com/products/ml4100l-awg/

GUI Introduction

To install and start using the Vision interface for the first time, follow this step-by-step installation guide (with pictures) below:

1. **Run** the Vision setup file.
2. **Install** Vision.
3. **Connect** the ML AWG to the local network.
4. **Launch** the GUI.
5. **Start** the measurements.

Installation

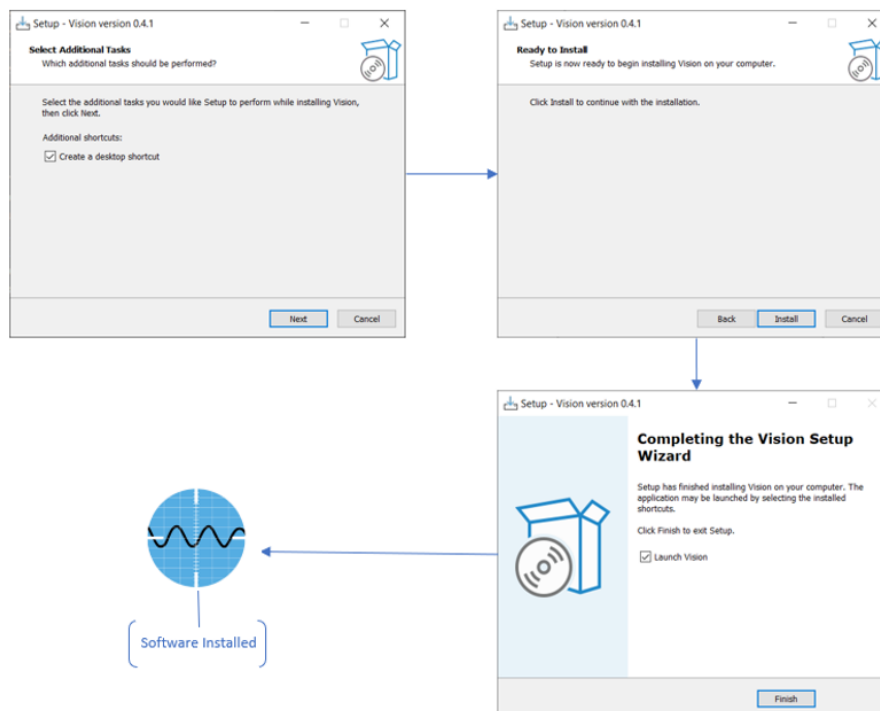After downloading the Vision setup file, select run and follow this easy step-by-step installation procedure:

Figure 1: Setup installation procedure

Vision should now be ready to run, with a shortcut button on the Desktop.

Connecting to the Instrument

To connect to the instrument, follow this sequence of steps (images available in appendix 1):

- *Install* the Vision GUI software.
- *Connect* the power cable to the power jack of the ML4100L AWG and plug it into an AC outlet.

  The power cable is already included in the package accessories.
- *Power Up* the ML4100L AWG.
- *Connect* the device to the network using a RJ45/LAN cable.

  LAN connections can be validated with a ping to the static instrument IP.
- *Run* Vision software.
- *Add device* by clicking on the add device button and setting the roper Device Name and IP.
- *Connect to* a device by right clicking on it when added to the devices tab and click connect.
- *Activate* a device by right click on it and click Activate.
- *Rename* a device by making another device active and then right click Rename.
- *Set Low Power mode* a device by right click on it and click Set to Low Power.

Launching the GUI

After establishing connection to the ML4100L AWG, the GUI is initialized immediately, and all the ML4100L AWG features are ready for use. The general display of the Vision GUI will appear and you can start testing.
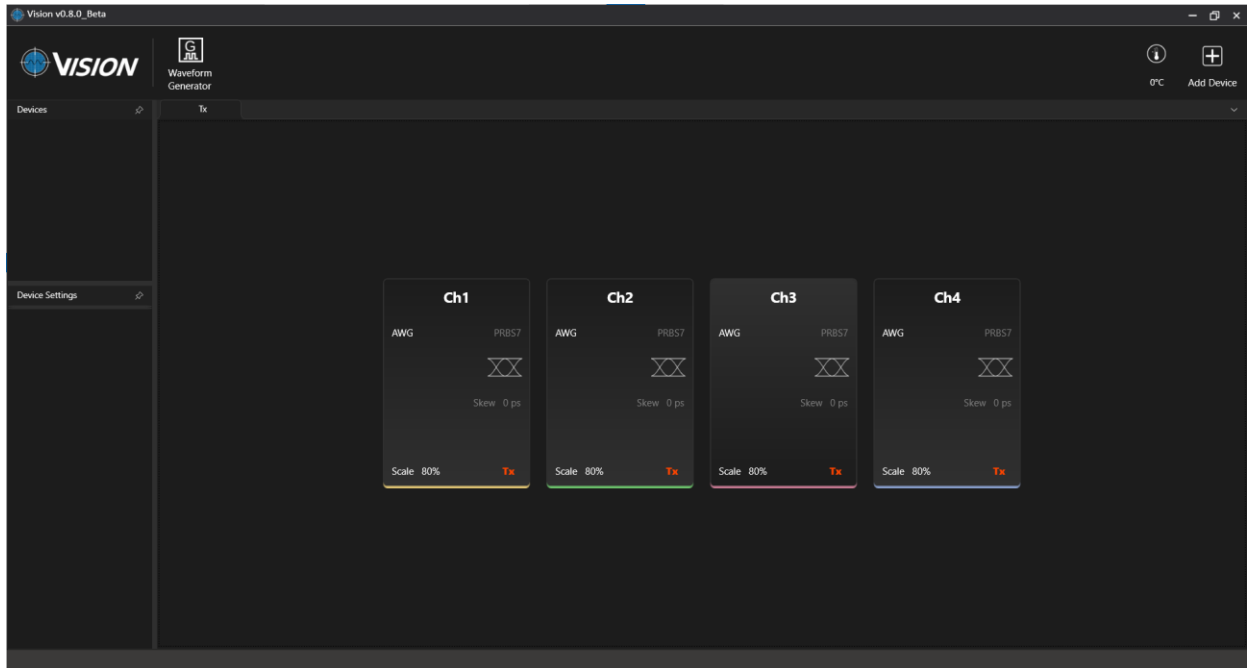
Figure 2: General GUI display (ML4100L AWG)

GUI Overview

Vision provides end users with the ability to simulate and configure specific waveforms.

Vision Configurations

This section is used to parameterize the AWG and to control the TX configurators of each channel in addition to clock rate and other common AWG settings.
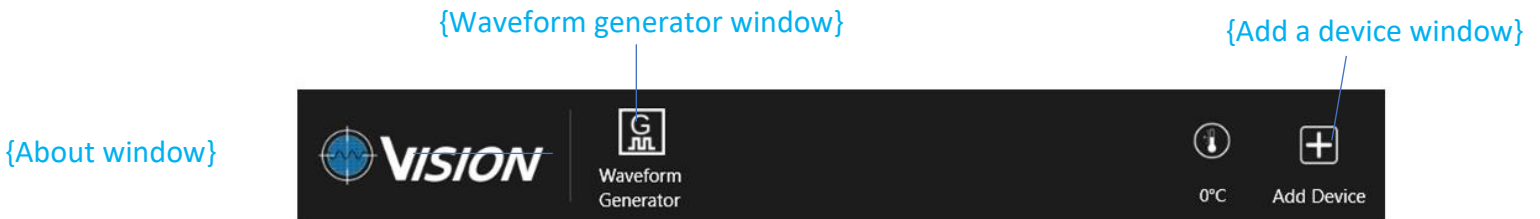
{Waveform generator window}

{Add a device window}

{About window}

Figure 4: Vision control tab

- **About Window** (Figure 4) will give you access to the necessary information about the product including:
    - o SW versions and Release Note
    - o A link to this User Guide

- **Waveform Generator Window** contains:
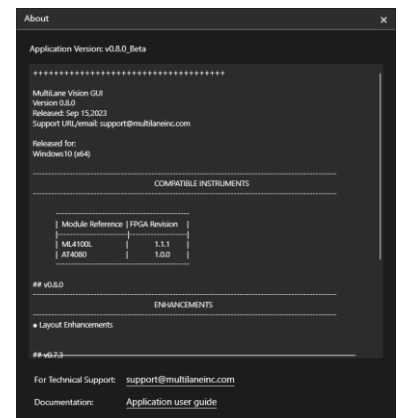
Figure 3: About window

- o Top bar that contains:
  - ▪ Load waveform button (.wfm)
  - ▪ Import waveform button (.txt)
  - ▪ Waveform configuration button
  - ▪ Pattern configuration button
  - ▪ Multitone configuration button
- o Generated Waveform Left tab
- o Graph main tab
- o Waveform Settings right upper tab
- o Graph settings right lower tab

- ▪ **Add Device Window** contains:
  - o Device name
  - o Device IP

- ▪ **Device initialization contains:**

  - o Initialize button which should be clicked after connecting and choosing the two following values.

  - o ADC/DAC rate configuration

  - o OSR configuration (Low OSR leads to enabling the 7-tap FIR while High OSR allows using the 60-tap FIR)
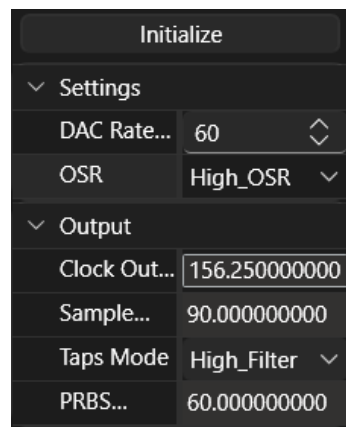
Figure 5: Device settings and initialization

Tx Tab
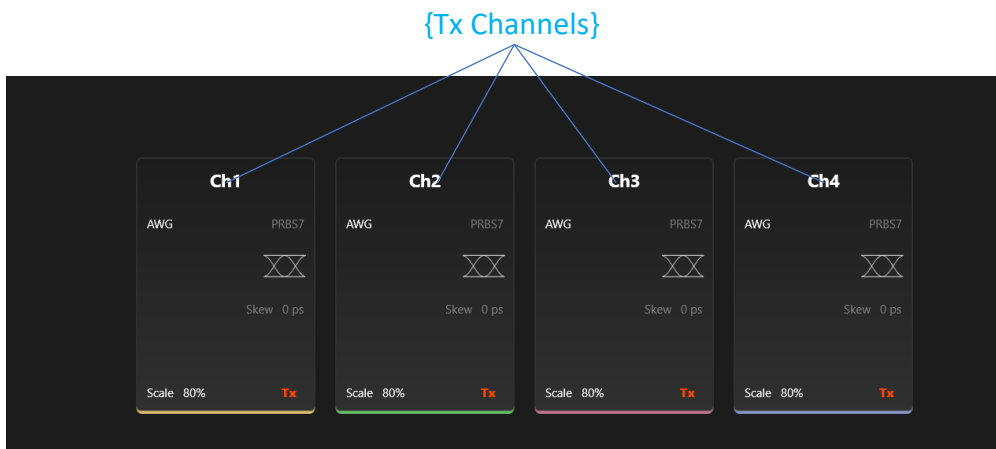
Figure 6: Tx tab

- **Tx Channels** consist of 4 channels:
  - HI: Horizontal In-Phase
  - HQ: Horizontal Quadrature
  - VI: Vertical In-Phase
  - VQ: Vertical Quadrature

Each one of these channels can work independently in AWG mode, or in pair (Ch1 and Ch3, Ch2 and Ch4)

Figure 7: Channel Configuration

Each of these channels when clicked on will open a popup in which we find all the related settings. These channels can be switched between AWG and PRBS mode, and depending on the selected mode the appropriate settings will be available.

AWG Mode
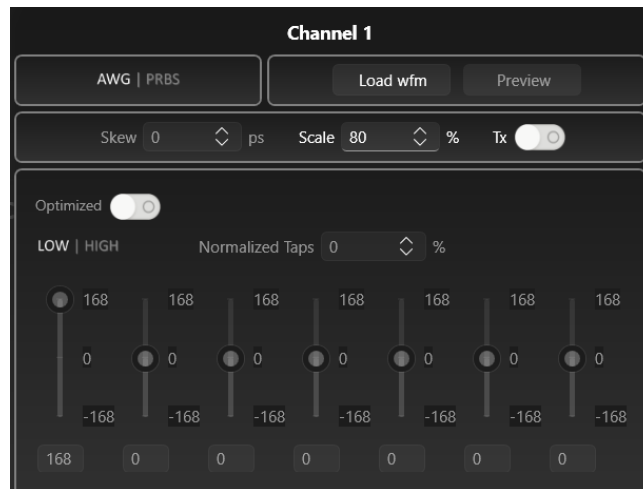
Figure 8: AWG mode

In AWG mode a .wfm file that is already generated and saved in the waveform generator should be loaded. In this mode the scale can be changed in addition to turning the channel ON/OFF.

PRBS Mode

Figure 12: PRBS NRZ Mode High filter
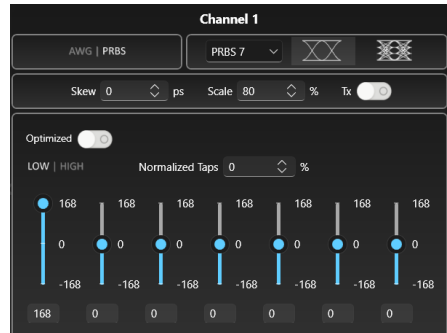
Figure 12: PRBS NRZ Mode Low filter
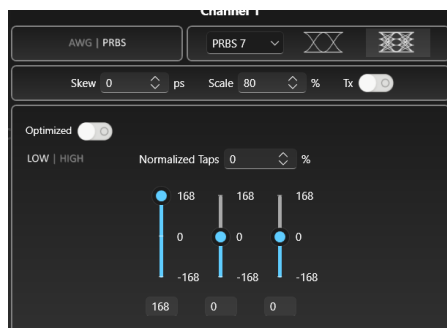
Figure 12: PRBS PAM4 Mode Low filter
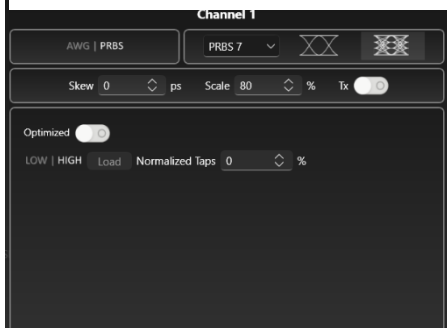
Figure 12: PRBS PAM4 Mode High filter

In PRBS Mode the signal can be set to NRZ with High filter (Figure 8), NRZ with Low filter (Figure 9), PAM4 with Low filter (Figure 10) or PAM4 with High filter (Figure 11).

When NRZ is selected with Low filter the 7 taps sliders will be enabled and editable by the user.

When PAM4 is selected with Low filter the 3 taps sliders will be enabled and editable by the user.

When High filter is selected with each of PAM4 or NRZ, all the tap sliders will be disabled and a file (.txt) containing 60 tap value should be loaded.

Figure 13: Optimized taps

If the instrument is calibrated, Optimized taps can be set by enabling optimized and adjusting the amplitude slider to the desired value.

Waveform Generator

Waveform Configuration
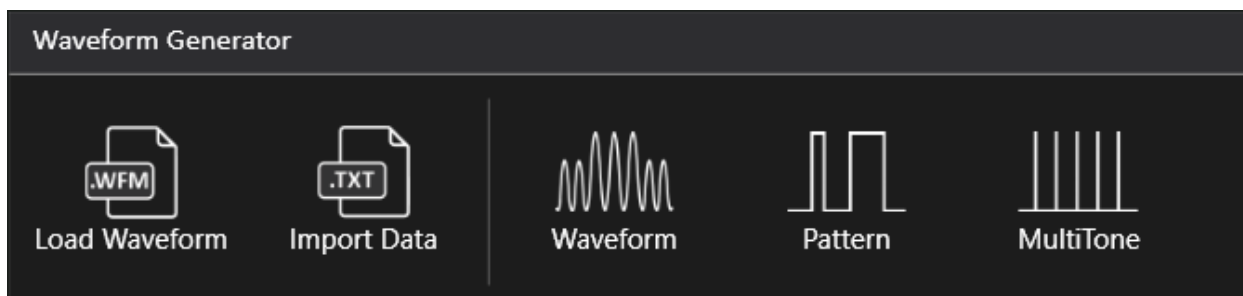
Figure 14: Waveform Generator tab control

- **Load Waveform** will give you access to load an already configured and saved (.wfm) file.
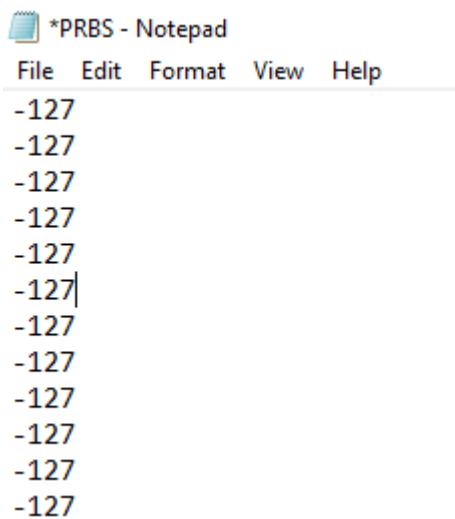- **Import Data** will give you access to load an already configured and saved (.txt) file.
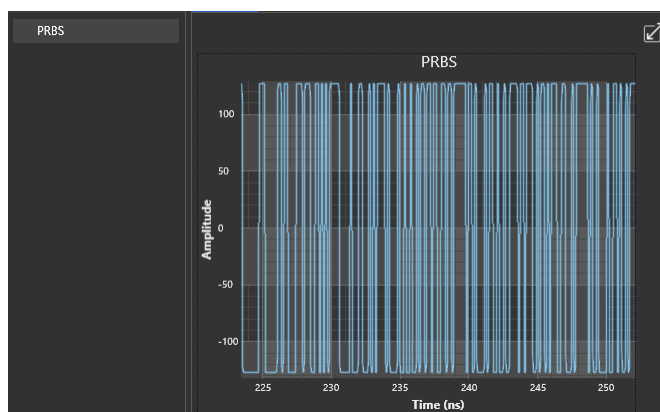

Figure 15: (.txt) file

Figure 16:user-defined waveform loaded as (.txt) file

- o The pattern length per channel is limited to 33600 samples. Also, the pattern length must be multiple of 120.
- o The amplitude range is from -127 to +127.

- **Waveform Window** allows you to choose and configure between 18 types of already defined waveforms:

  - Chirp Function
  - Damped Oscillation
  - Distorted Sine
  - Exponential Fall
  - Exponential Rise
  - Gaussian

  - Half Sine
  - Haversine
  - Logarithmic
  - Lorentz
  - Serial Data
  - Sinc

  - Sine
  - Square
  - Stairs
  - Surge Pulse
  - Trapezoid
  - Triangle

- **Pattern Window** allows you to generate and configure a PRBS waveform.
- **Multitone Window** allows you to generate and configure a multitone wave.

⚠️ *For each one of the waveforms, Pattern and Multitone the signal can be projected and seen in the frequency domain using the show in frequency domain button.*

Waveform Generator Display

Figure 17: Waveform Generator Display

- **Generated Waveform** is the section where all the saved waveforms will be stored.
- **Waveform Settings** is the section where all the selected waveform settings will be shown.
- **Graph** is the section where the selected waveform will be drawn.
- **Graph Settings** is the section where the user can change the graph color and enable/disable the vertical and horizontal marker.

Table of figure

Appendix 1 – Connecting to the Instrument

- ▪ *Add device*
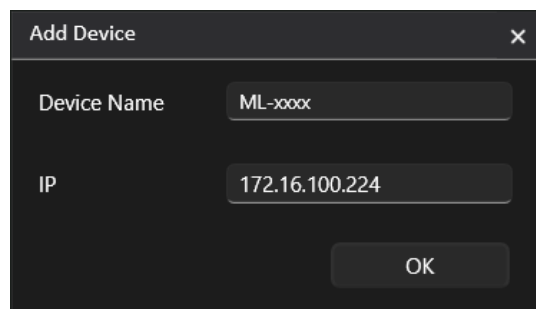
Figure 18: Add Device tab

- ▪ *Connect to* a device

Figure 19: Connect to a device
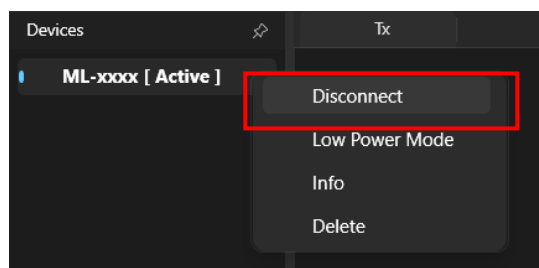
- ▪ *Disconnect* a device

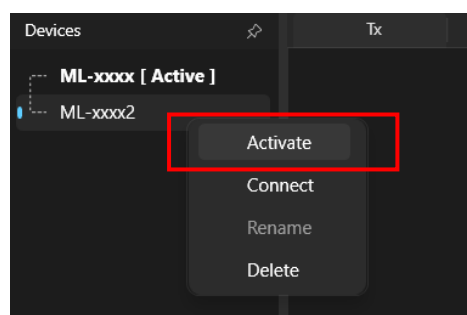*Figure 20: Disconnect from device*

- ▪ *Activate* a device

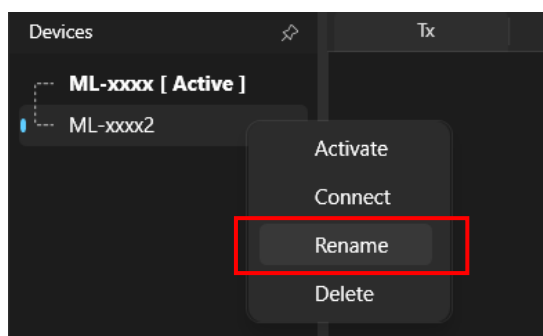*Figure 21: Activate Device*

- **Rename** a device

Figure 22: Rename Device
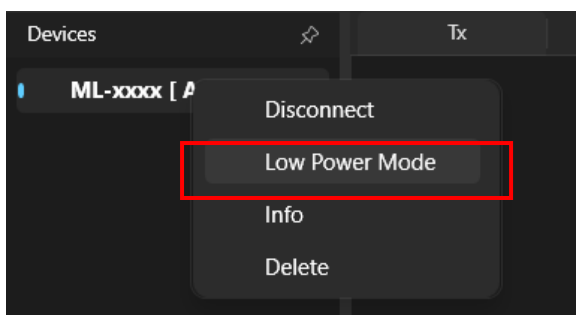
- **Set Low Power mode** a device

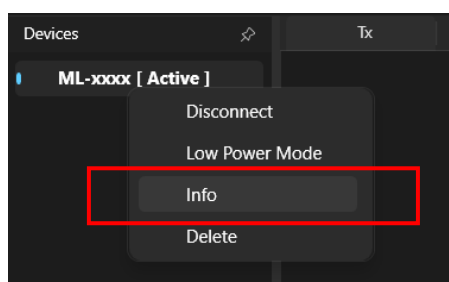*Figure 23: Set Low Power Mode*

- **Device Info**

Figure 24: See device info

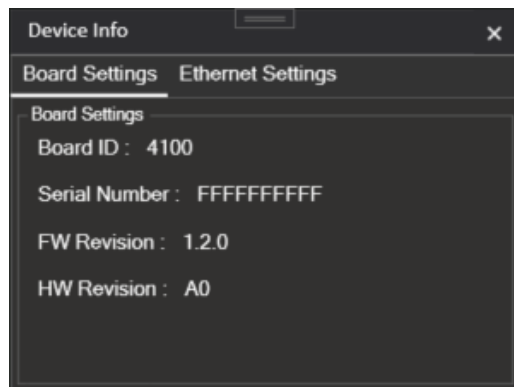- **Board settings**
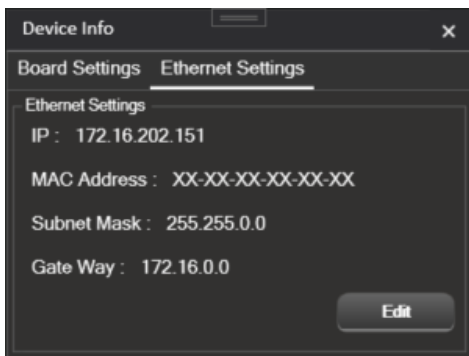

Figure 25: Board info tab

- **Ethernet settings**

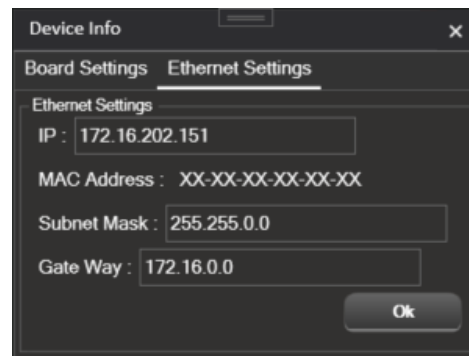*Figure 27: Ethernet Settings tab*

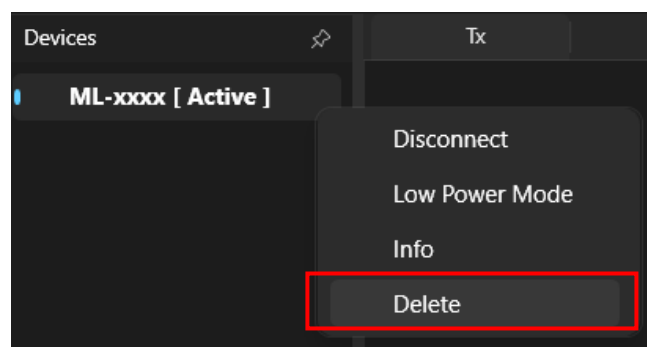*Figure 27: Ethernet Settings tab in edit mode*

- **Delete a device**

Figure 28: delete a device.

Appendix 2 – Generating a waveform

- **Wave form generator**
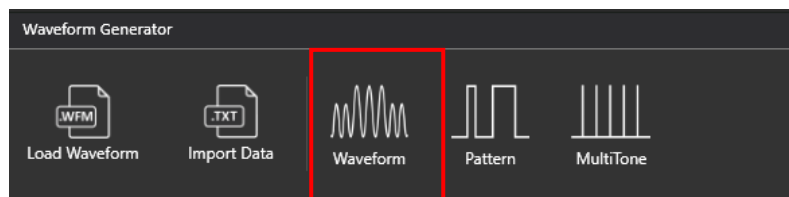

- **Waveform**

Figure 29: wave form generator tab

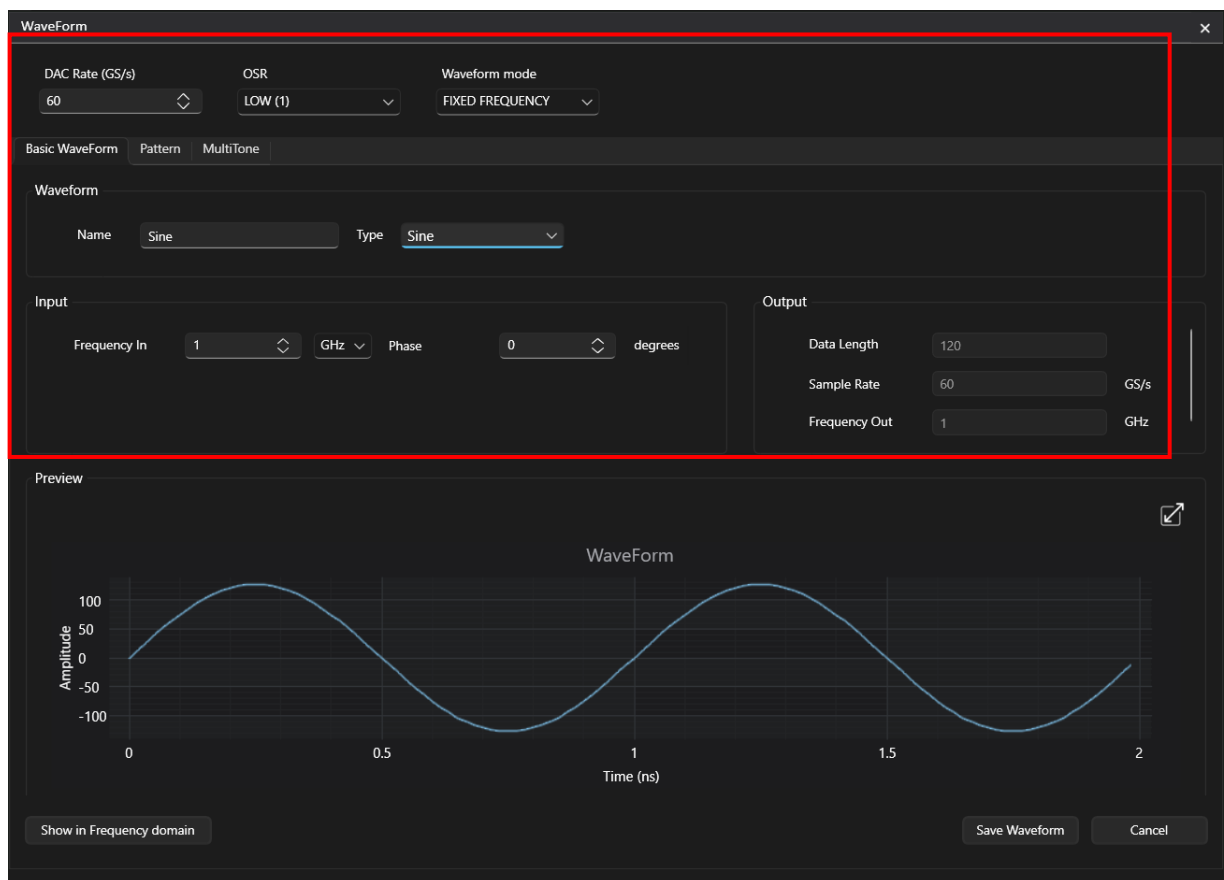- **Select the desired the waveform (i.e., sine wave) and fill the input parameters:**

Figure 30 : waveform parameters

Appendix 3 – Generating a pattern.

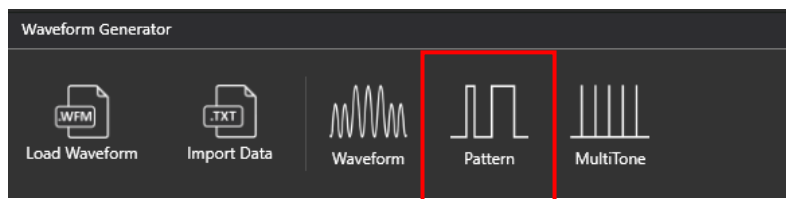- **Wave form generator**

- **Pattern**

Figure 31:waveform generator tab

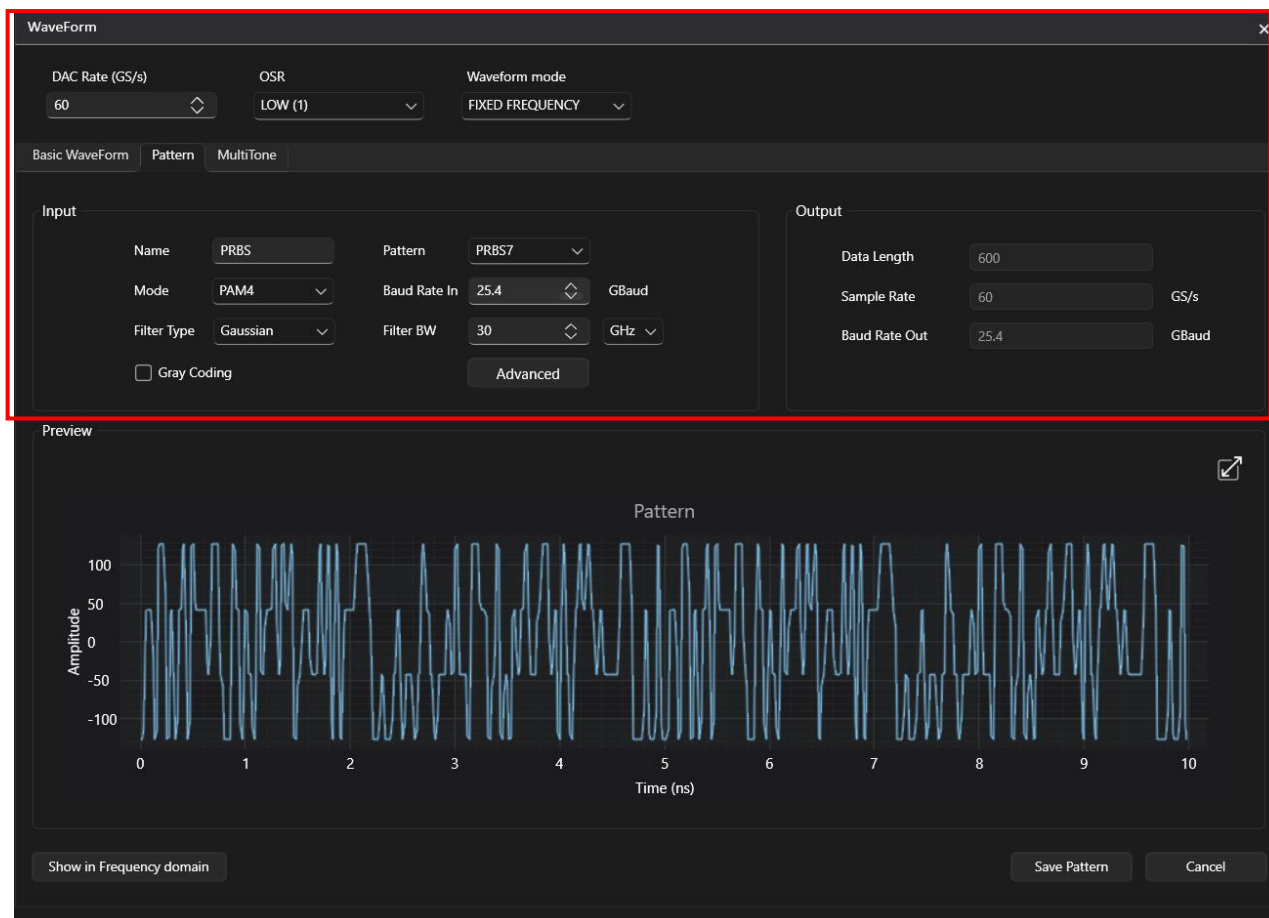- **Select the desired pattern (i.e., PRBS7) and fill the input parameters:**

Figure 32:Pattern parameters

Appendix 4 – Generating a Multitone

- ▪ **Wave form generator**

- ▪ **Multitone**

Figure 33: waveform generator tab

- ▪ **Select the desired Multitone and fill the input parameters:**
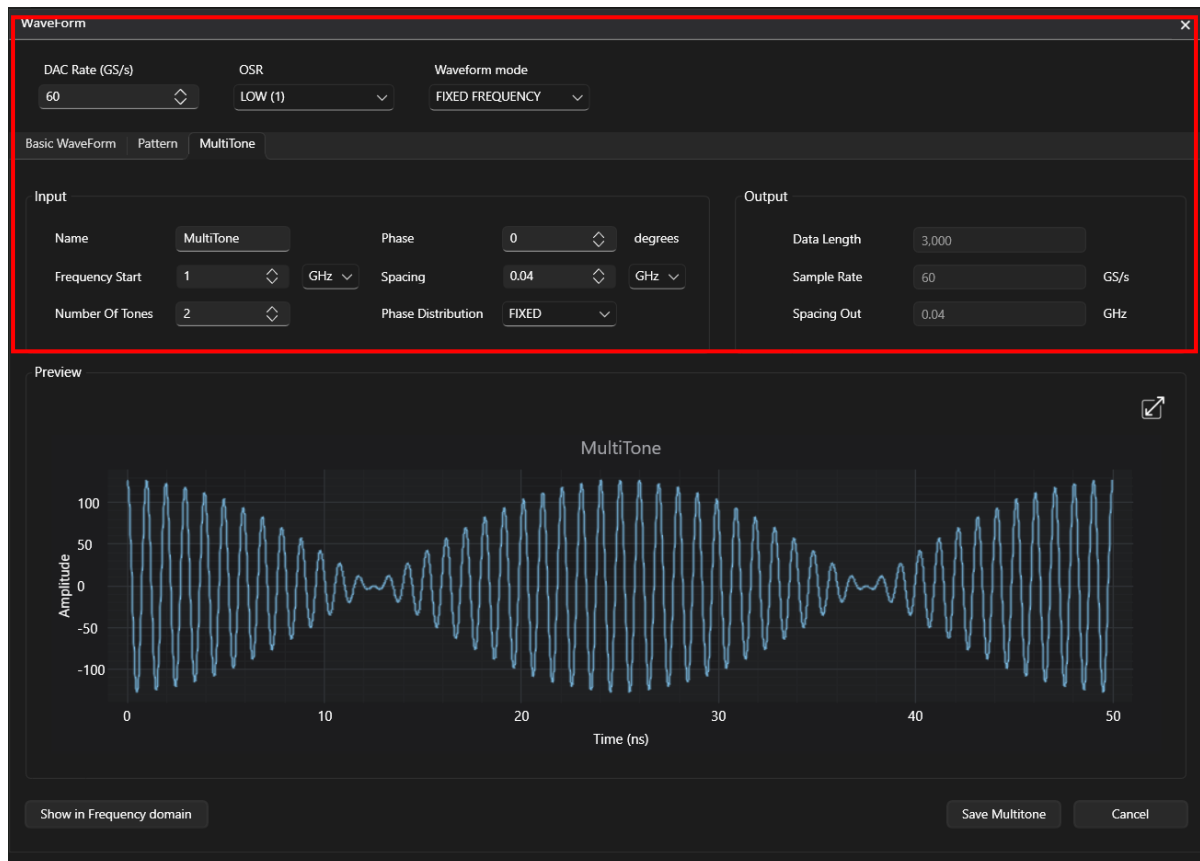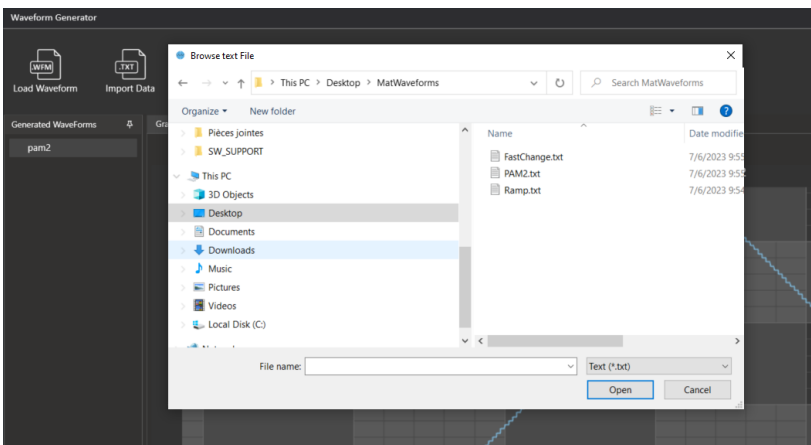

Figure 34: Multitone parameters

- *After saving the waveform generated, it will be displayed in the waveform generator window, where it can be renamed, edited, saved, sent to all channels, a single channel or deleted.*
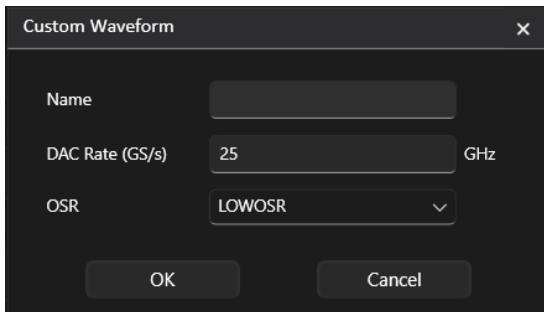

Figure 35: saving and sending the waveform generated.

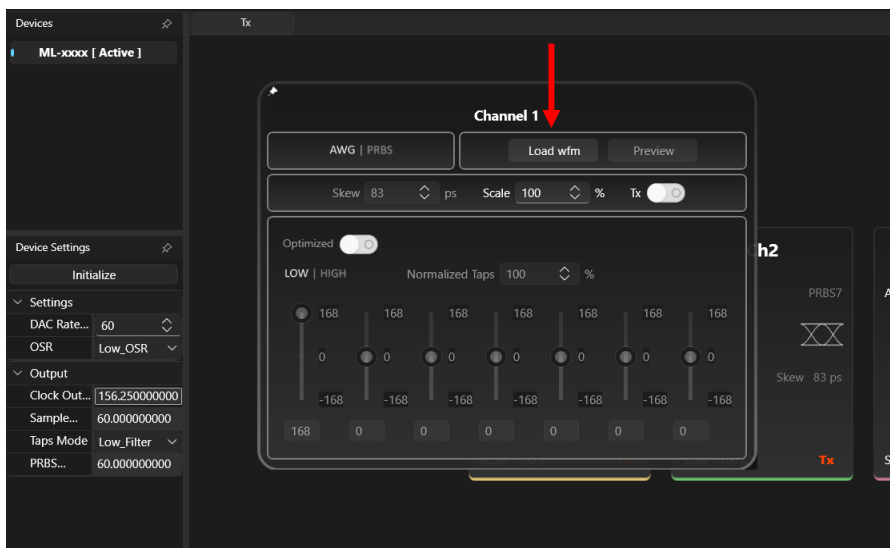## Appendix 5 – Import Txt file

- **Open Waveform Generator**
- **Click on Import Data**
- **Browse .txt file.**
  - **Max number of samples per channel =33600**
  - **Data length must be multiple of 120**
  - **Range +/- 127**

- **Fill in the name, Linerate (DAC) and OSR**
- **Click OK**

- **Saved waveforms (wfm and cwfm) can be sent directly to the AWG channel(s) from the main window**

Appendix 6 – External clock

- *The external clock is auto-detected, if there is an external clock source, the highest priority is for that source, if not, the clock will be generated internally.*

Appendix 7 – Pattern Configuration and Generation

Please click on **Demo** *to play the corresponding training video:*

- *Demo1: Generation of* **16G** *PRBS signal at* **96Gsps** *DAC rate in* **AWG mode** *while using Advanced Settings to emulate channel impairments (Noise, RJ, SJ, ISI) and perform signal transformation and pre-equalization.*
- *Demo2: Generation of* **26.5625G** *PRBS signal in* **PRBS mode** *and applying the built-in 7-Tap FIR filter to perform pre-equalization and PAM4 transformation.*
- *Demo3: Generation of* **32G** *PRBS signal in* **PRBS mode** *and applying the built-in 7-Tap FIR filter to perform pre-equalization and PAM4 transformation.*
- *Demo4: Generation of* **53.125G** *PRBS signal at* **96.001476378Gsps** *DAC rate in* **AWG mode**.