

# USB4 Electrical Test Tool Documentation

## Hardware requirements

USB4ETT tools are designed to work with the following Wilder controllers:

640-0962-000	USB4-TPA-UC, Microcontroller Only
640-0946-000	CG3-TPA-TR (Microcontroller Gen-3)

## Tool Installation

There are 2 versions of USB4ETT tools.

- USB4ElectricalTestTool.exe uses a GUI interface.
- USB4ElectricalTestToolCLI.exe uses a command-line interface.

There is no installer for these applications. To run either of these tools, follow the instructions below.

Create a directory to contain USB4ETT files.

We will use c:\USB4ETT as an example.

**Copy the USB-IF program(s) into c:\USB4ETT:**

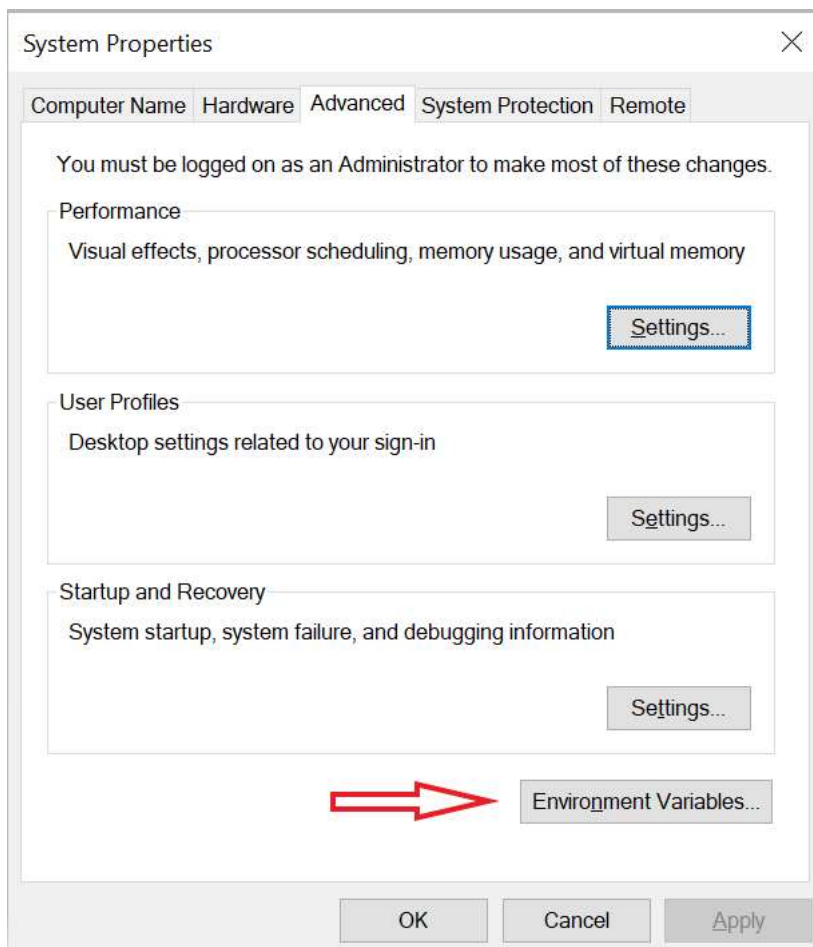
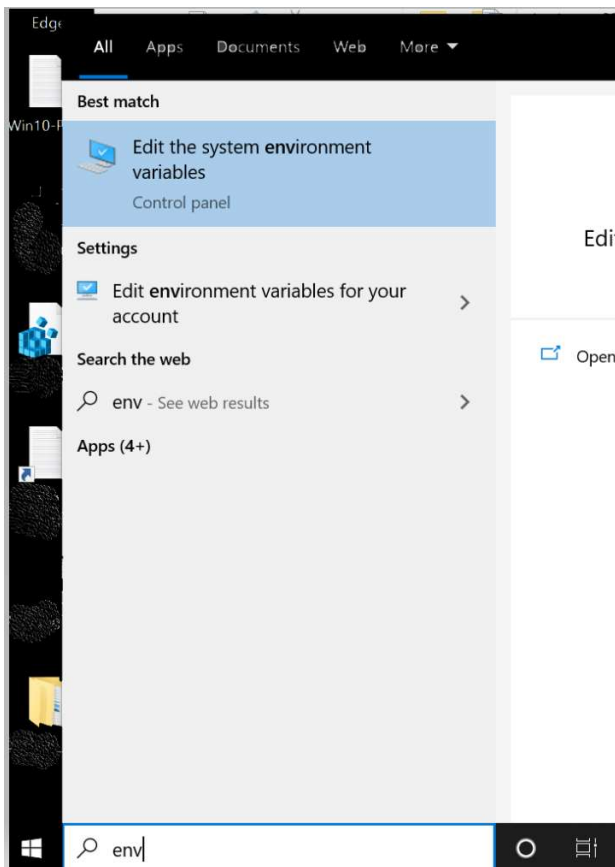
- USB4ElectricalTestTool.exe
- USB4ElectricalTestToolCLI.exe

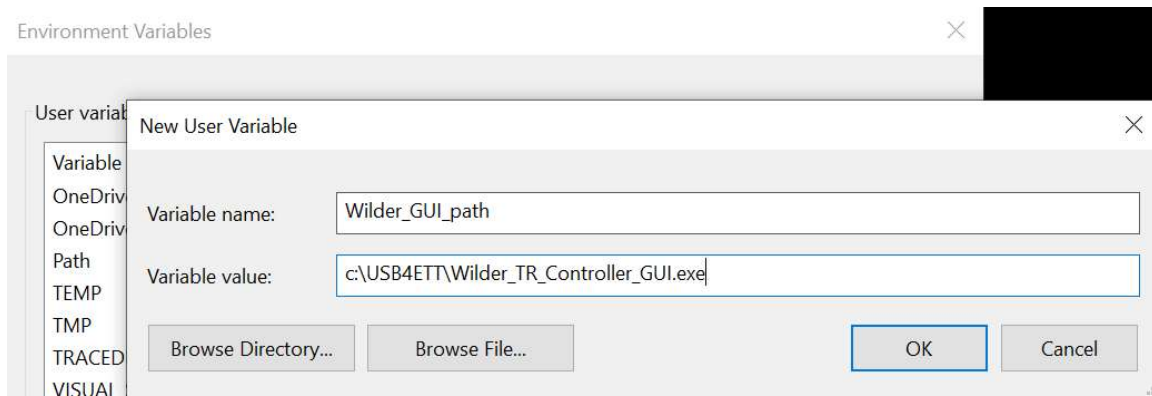
## Install Wilder software

- Install Wilder Controller Driver. See Wilder for documentation specific instructions. Email contact TBD.
- Copy Wilder\_TR\_Controller\_GUI.exe into c:\USB4ETT

## Create environment variable

- Open up the editor for Environment Variables and create a variable named Wilder\_GUI\_path. Set the variable value to the full path and filename of the Wilder\_TR\_GUI\_Controller.exe.

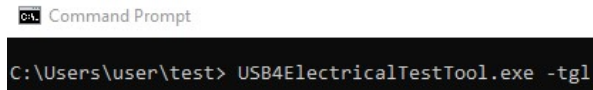




## USB4ETT – GUI Mode (USB4ElectricalTestTool.exe)

Open the USB4ElectricalTestTool.exe

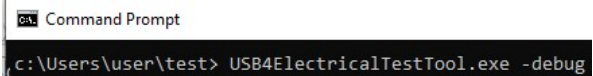
- For TigerLake, please use **-tgl** argument when running USB4ElectricalTestTool.exe



```
Command Prompt
C:\Users\user\test> USB4ElectricalTestTool.exe -tgl
```

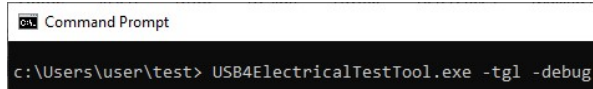
## USB4ETT – GUI Debug Mode (USB4ElectricalTestTool.exe)

Open the USB4ElectricalTestTool.exe with **-debug** argument



```
Command Prompt
c:\Users\user\test> USB4ElectricalTestTool.exe -debug
```

- For TigerLake, please use **-tgl -debug** arguments when running USB4ElectricalTestTool.exe



```
Command Prompt
c:\Users\user\test> USB4ElectricalTestTool.exe -tgl -debug
```

The debug mode opens few additional options:

- ✓ CLI Command generator: Automatically generates the CLI command.
- ✓ File Semaphore: select this check box when need to generate CLI Command with File Semaphore. Also, there is an option to change the semaphore path.
- ✓ SB Debug Mode – this debug option prints SB Traffic (TxRx Transaction Commands, Bytes or both). By default – disabled.
- ✓ Debug Print – prints test flow details.
- ✓ Option to define specific FTDI device – in case of more than one FTDI devices in the system.

## USB4ETT – CLI Mode (USB4ElectricalTestToolCLI.exe)

USB4ElectricalTestToolCLI utilizes a command line interface, which allows integration with other tools.

Table 1.0 describes all possible arguments and values.

All arguments are optional (i.e. all arguments have default values).

For Help run the tool with **-h** argument (see examples below).

All messages/requests during the test execution will appear on the screen – user interaction required.

For automated tests use Semaphore files by adding the **-S** argument.

By default – file semaphore path is `c:\temp\semaphore.txt`

User may change the path by adding **-Sp** argument with new path.

- When the Tool wants to send the message to user it creates the Semaphore File with the message. The tool pending the deleting of the file (as acknowledge that user got the message and addressed it).

- When the user requested to supply some information to the tool, user creates the Semaphore file with the message. The tool pending the creation of the Semaphore File, then reads it and deletes it (as acknowledge to user that the tool got the message and addressed it).

Argument		Value	Description
Short	Long		
-h	--help		show this help message and exit
-Nf	--ftdiName	<i>FTDINAME</i>	TestEquipment FTDI Name. Example:'Dual RS232-HS A' (None by Default)
-U	--SbDebugMode	Disabled,Commands,Traffic,Full	Side Band Debug Mode (Disabled/Commands/Traffic/Full, by default:Disabled)
-S	--FileSemaphore		Use File Semaphore for FFE Preset Request (by default: Disabled)
-Sp	--FileSemaphorePath	<i>FILESEMAPHOREPATH</i>	Set File Semaphore path.(default is 'c:\temp\semaphore.txt')
-P	--DebugPrint		Debug Print Flag (by default: Disabled)
-tgl	--TigerLakeMode		TigerLake Mode Enabled (by default: Disabled)
-Dp	--PortDUT	0,1, 2, ..., 63	DUT Tested Port (0...63, by default:0)
-L0	--Lane0		DUT Lane0 Enabled (by default: Disabled)
-L1	--Lane1		DUT Lane1 Enabled (by default: Disabled)
-L	--TestedLane	0,1,All	DUT Tested Lane (0/1/All, by default:All)
-T	--TBT3		DUT TBT3 Support Enabled (by default: Disabled)
-G3	--Gen3		DUT Gen3 Support Enabled (by default: Disabled)
-Sw	--SwapLanes	None,Router,Retimer#2,Router+Retimer#2	Swap Lanes in Router side (by default: 'None')
-E	--EarlyOperation		Early Operation Mode Enabled (by default: Disabled)
-O	--Operation	SET_TX_COMPLIANCE,SET_RX_COMPLIANCE, START_BER_TEST,END_BER_TEST,END_BURST_TEST, READ_BURST_TEST,ENTER_EI_TEST, READ_LANE_MARGIN_CAP,RUN_HW_LANE_MARGINING, RUN_SW_LANE_MARGINING,READ_SW_MARGIN_ERR, CONTROLLER_INIT	Operation Name (SET_TX_COMPLIANCE, SET_RX_COMPLIANCE, START_BER_TEST,END_BER_TEST, END_BURST_TEST, READ_BURST_TEST,ENTER_EI_TEST,READ_LANE_MARGIN_CAP, RUN_HW_LANE_MARGINING,RUN_SW_LANE_MARGINING, READ_SW_MARGIN_ERR,CONTROLLER_INIT, by default:None)
-Tt	--Test	TX,RXBER,RXBURST,RXRL,TXFREQVARTRAIN, ENTER_EI_TEST	Test Name (TX,RXBER,RXBURST,RXRL,TXFREQVARTRAIN,ENTER_EI_TEST, by default:None)
-D	--DutType	Router,All,Receptacle,TxFrequencyVariation	DUT Type (Router, Receptacle, All, by default:Router)
-X	--xTalk		Cross Talk Enable (by default:Disabled)
-Pa	--Pattern	PRBS31,PRBS15,PRBS9,PRBS7,SQ128,SQ32,SQ4,SQ2, SLOS1	Pattern (PRBS31/PRBS15/PRBS9/PRBS7/SQ128/SQ32/SQ4/SQ2/SLOS1, by default:PRBS15)
-Pr	--Preset	0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	FFE Preset (0...15, by default:0)
-M	--TxModificationEnable		Enables non-default values for Preset and for Tx Modifications (by default: Disabled)
-De	--DeEmphasisEnable		Enables de-emphasis Tx Modifications (by default: Disabled)
-Ps	--PreShootEnable		Enables pre-shoot Tx Modifications (by default: Disabled)
-Wt	--WaitTime	<i>TIME</i>	Test Time[Sec] (by default:3 Sec)
-Wm	--WaitManual		Set Manual Test Time(by default: Disabled)
-Mt	--MarginingTest	T,V	Lane Margining Voltage/Time Test (V/T, by default:T)
-Mi	--MarginIndependent	Both,Either,Min	Independent Margin: minimum between the high and low, either high or low or both high or low (Both/Either/Min, by default:Both)
-Mm	--Margin	H,R,L	High/Low Lane Margin for Voltage Tests or Right/Left Lane Margin for Timing Tests, (H/L or R/L, by default:L)
-Mb	--MarginBerLevel	<i>BERLEVEL</i>	Lane Margining BER Level Contour (by default:0)

-Mo	--OptionalVoltageOffsetRangeEnable		Lane Margining Optional Voltage Offset Range Enable (by default: Disabled)
-Mf	--voltageTimeOffset	VOLTAGETIMEOFFSET	Lane Margining Voltage/Time Offset (by default:0)
-Me	--errorCounter	NOP,CLEAR,START,STOP	Error Counter Control (NOP/CLEAR/START/STOP, by default:NOP)
-V	--Version		Shows tool version in CLI.

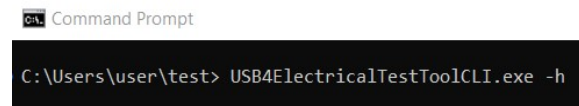
Table 1.0: all possible arguments and values.

## CLI Examples:

### 1. Help:

use **-h** argument:

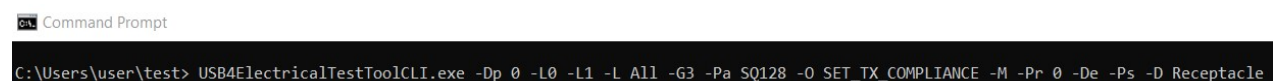
**USB4ElectricalTestToolCLI.exe -h**



### 2. Operation SET\_TX\_COMPLIANCE example:

Operation	SET_TX_COMPLIANCE
Port	0
Lane0 Active	True
Lane1 Active	True
Tested Lane	All
GEN	GEN3
USB4/TBT3	USB4
Pattern	SQ128
Modification Enabled	True
Preset	0
Preshoot Enabled	True
De-emphasis Enabled	True
DUT Type	Receptacle

**USB4ElectricalTestToolCLI.exe -Dp 0 -L0 -L1 -L All -G3 -Pa SQ128 -O SET\_TX\_COMPLIANCE -M -Pr 0 -De -Ps -D Receptacle**



### 3. Test: Receiver BER:

Test	RXBER
Port	1
Lane0 Active	True
Lane1 Active	True
Tested Lane	0
GEN	GEN2
USB4/TBT3	TBT3
Swap Lanes	On Router
Crosstalk Enabled	True
Generator Preset	7
Test Time	10 sec
Pattern	PRBS31
DUT Type	All

USB4ElectricalTestToolCLI.exe -Dp 1 -L0 -L1 -L 0 -Pa PRBS31 -Tt RXBER -D All -Wt 10 -Pr 7 -X -T -Sw Router

```
Command Prompt
C:\Users\user\test> USB4ElectricalTestToolCLI.exe -Dp 1 -L0 -L1 -L 0 -Pa PRBS31 -Tt RXBER -D All -Wt 10 -Pr 7 -X -T -Sw Router
```

### 4. Test: Receiver BER test with Semaphore:

Test	RXBER
Port	0
Lane0 Active	True
Lane1 Active	True
Tested Lane	1
GEN	GEN3
USB4/TBT3	USB4
Swap Lanes	Retimer#2
Crosstalk Enabled	False
Generator Preset	15
Test Time	300 sec
Pattern	PRBS31
DUT Type	All

USB4ElectricalTestToolCLI.exe -Dp 0 -L0 -L1 -L 1 -G3 -Pa PRBS31 -Tt RXBER -D All -Wt 300 -Pr 15 -Sw Retimer#2 -S

```
Command Prompt
C:\Users\user\test> USB4ElectricalTestToolCLI.exe -Dp 0 -L0 -L1 -L 1 -G3 -Pa PRBS31 -Tt RXBER -D All -Wt 300 -Pr 15 -Sw Retimer#2 -S
```

## Semaphore for FFE Preset Request

Semaphore created by Test - Condition	Semaphore Value	Description
Receiver Test, the DUT finished the TxFFE Negotiation Flow	"Done"	BERT preset negotiation finished – delete the semaphore and continue to test execution
Receiver Test, the DUT requested new TxFFE Preset from the BERT	<i>Preset Value</i>	Set requested BERT Preset and delete the semaphore when done
Transmitter Test Configuration Done	"Ready"	The transmitter transmits requested configuration, do Scope measurements and delete the semaphore
BER Test Done	<i>Receiver Statistics</i>	When the BER/BURST Test Done, the Receiver returns Measurement Statistics. Read the data and delete the semaphore.
READ_LANE_MARGIN_CAP Statistics	<i>Supported Capabilities</i>	Returns Supported Margin Capabilities. Read the data and delete the semaphore.
The Result of following Operations: RUN_SW_LANE_MARGINING RUN_HW_LANE_MARGINING READ_SW_MARGIN_ERR	<i>Margining Statistics</i>	Returns Margining Test Statistics. Read the data and delete the semaphore.

Semaphore created by User - Condition	Semaphore Value	Description
Transmitter Test with Modification Enabled – set new Transmitter Preset (or exit the test)	<i>Preset Value</i>	To Change the Preset - Create the semaphore with required Preset value (in range 0-15). To Exit the Test - Create the semaphore with any other value. Wait while the semaphore exists. When deleted – Transmitter got the New Preset and configures it (or exits).
Transmitter Frequency Variation test – Scope triggered, Start	N/A	Create the semaphore when the scope is triggered. Wait while the semaphore exists. When deleted – Transmitter got the command and starts the Router transmitter.
Receiver Frequency Variation test – Clock Switch Turned On	N/A	Create the semaphore when the Clock Switch Turned On (on the BERT) . Wait while the semaphore exists. When deleted – test starts.
Receiver BER test with Manual Test Time – Stop the Test (Call END_BER_TEST operation)	N/A	Create the semaphore when need to stop the BER test. Wait while the semaphore exists. When deleted – test ends, wait for Test Result Semaphore.
Receiver BURST test with Manual Test Time – Read statistics without Test Stop	N/A	Create the semaphore when need to Read Statistics and Continue the Test. Wait while the semaphore exists. When deleted – wait for Test Result Semaphore.
Receiver BURST test with Manual Test Time – Read statistics and Stop the Test	"END"	Create the semaphore when need to Read Statistics and stop the Test. Wait while the semaphore exists. When deleted – test ends, wait for Test Result Semaphore.



## FAQ

### How to configure non-rounded bitrates

USB4/TBT3 switch configures the bitrates: USB4 is rounded, TBT3 is non-rounded.

### What does “Swap Lanes” do?

See diagram below:

