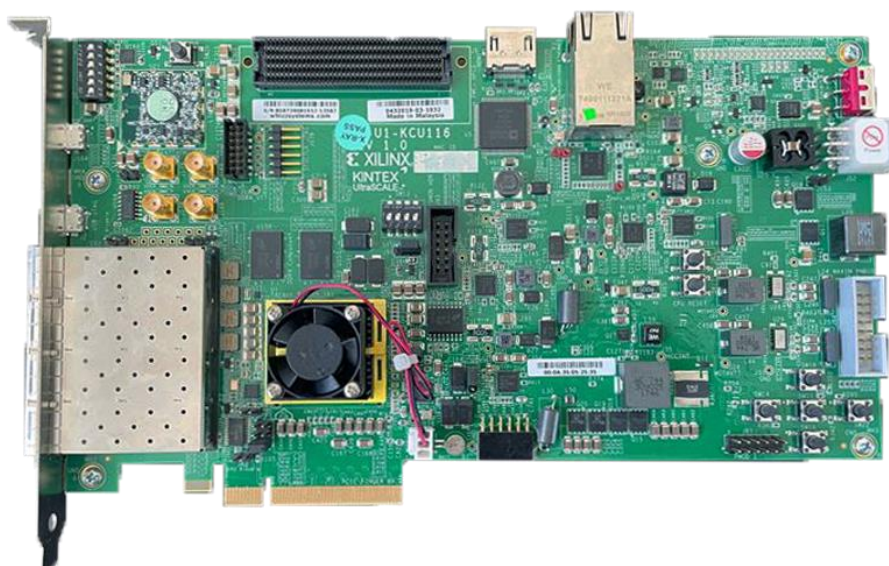


# PCIe Gen3 Test Card

## Users Guide

Model PM142



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# Table of Contents

Introduction.....	3
What’s Inside .....	3
General Notes.....	5
Hardware Requirements.....	5
Compatibility .....	5
Testing PCIe x1 slot:.....	5
Multiple PCIe Test Cards.....	5
Speed.....	6
Electrostatic Discharge Caution.....	6
Windows Installation: .....	6
Step 1 – Installing the PCIe Test card in a PC Chassis.....	6
Step 2 – Install the device driver.....	7
Step 3 – Starting the Test Software.....	9
Loopback Test.....	9
Benchmark Test .....	9
Advanced Error Reporting .....	10
Uninstalling in Windows .....	11
Trouble shooting .....	11
Updating the firmware .....	11
Technical Specifications .....	15
Disclaimer .....	15

## Introduction

The PCIe Gen 3 Tester can be used to diagnose and troubleshoot PCIe slots. With the PCIe Gen 3 Tester, you can test that PCI-Express slots function correctly and provide the expected speed. It is possible to verify that:

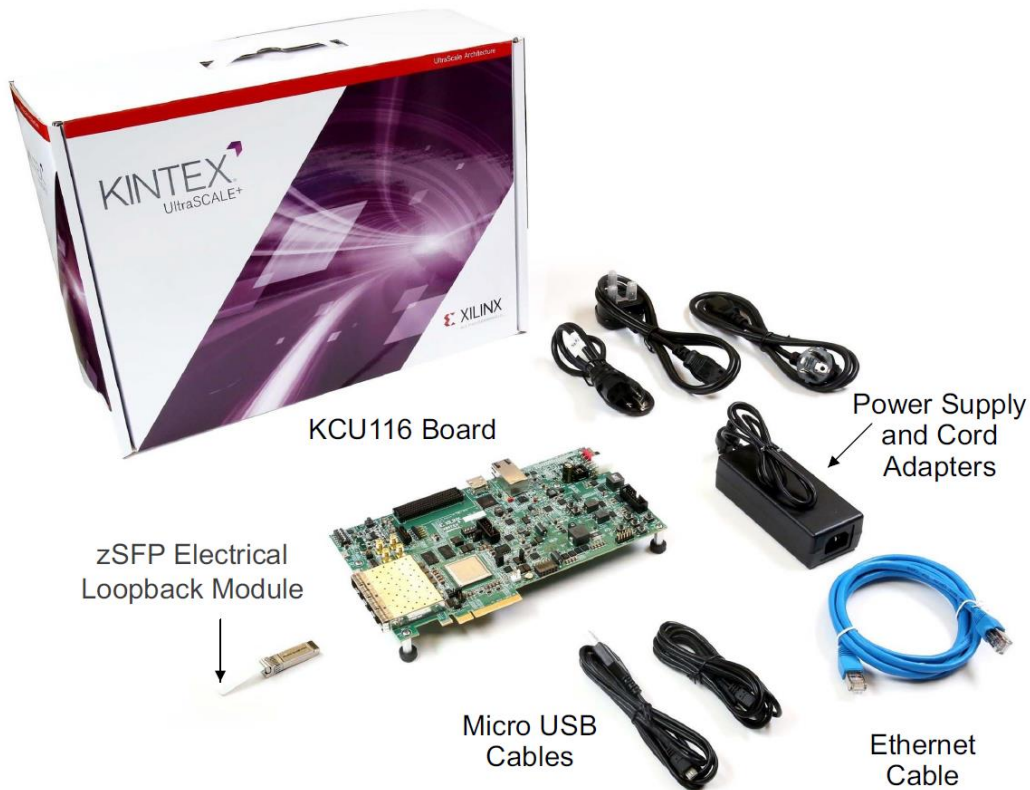
- The PCIe slot is powered.
- That a port is capable of Gen3.0 (8Gb/s per lane) or Gen2.0 (5Gb/s per lane) or GEN1.0 (2.5Gb/s per lane). The maximum speed of the slot can be benchmarked. (On Windows only)
- That data can be sent and received from the PCIe host slot.
- That data can be transferred without error.
- The system remains stable under long periods of load.
- Concurrently check multiple PCIe slots at the same time

The PCIe Test Card is software upgradable via an included micro USB cable.

## What's Inside

The PCIe Gen3 Tester is a software developed by Passmark Software that runs on a Xilinx KCU116 kit. By purchasing the software, you will receive a complete KCU116 kit.

Please note some of the accessories such as zSPF Electrical Loopback Module and Ethernet cable are not required for PCIe testing.





KCU116 Board  
Featuring the XCKU5P-2FFVB676E FPGA



USB Micro Cable for updating the firmware on the card.



Power Adapter



Power Cord Multiple (UK, USA and European plugs)

## General Notes

### ***Hardware Requirements***

You need a Xilinx KCU116 Evaluation Kit. This kit is manufactured by Xilinx and comes as part of Passmark PCIe Gen3 Test card.

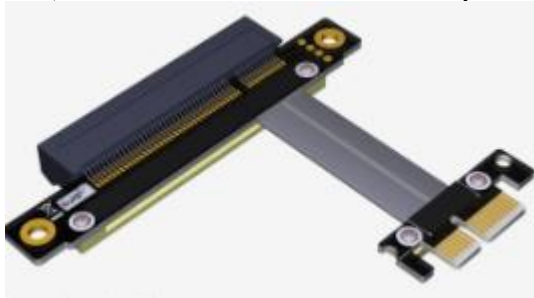
### ***Compatibility***

Windows 7, 8, 10 and 11 supported.

PCIeGen3Test software is required for Windows. Only 64bit Windows driver is available.

### ***Testing PCIe x1 slot:***

The card has a x8 edge which means it can't be inserted into a x1 slot. For testing a x1 slot, you need a PCIe Gen 3 (or higher) riser card extension adapter (x1 to x8 or x1 to x16). Please note this extension adapter is not included in the kit.



### ***Multiple PCIe Test Cards***

Multiple PCIe Test Cards can be connected, and simultaneous loopback and benchmark testing carried out.

Each PCIe Test Card is unique and has its own serial number, which is displayed by PCIeGen3Test.exe. This can be used to distinguish between multiple cards plugged into your system.

## Speed

PCIe Gen3.0 is normally quoted as 8GBps per lane. Data rates will never reach these speeds on a real device because some signalling bandwidth is used by bit encoding, TLP, DLLP and PLP overhead. On a correctly functioning PC with a single PCIe device connected; you should typically see measured maximum speed results shown in the below table:

PCIe Gen3 Lane width	Expected speed
X1	985MB/s
X8	5500MB/s

The PCIe Test Card has a maximum bandwidth of 5500 MBps, so the card cannot benchmark up to the PCIe gen 3.0 maximum x8 bandwidth of ~7880 MBps).

## Electrostatic Discharge Caution

**CAUTION!** ESD can damage electronic components when they are improperly handled and can result in total or intermittent failures. Always follow ESD-prevention procedures when installing or removing the PCIe test card.

To prevent ESD damage:

- Use an ESD wrist or ankle strap and ensure that it makes skin contact.
- Connect the equipment end of the strap to an unpainted metal surface on the chassis.
- Avoid touching the adapter against your clothing. The wrist strap protects components from ESD on the body only.
- Handle the adapter by its bracket or edges only.
- Avoid touching the printed circuit board or the connectors.
- Put the adapter down only on an antistatic surface such as the bag supplied in your kit.

## Windows Installation:

### Step 1 – Installing the PCIe Test card in a PC Chassis

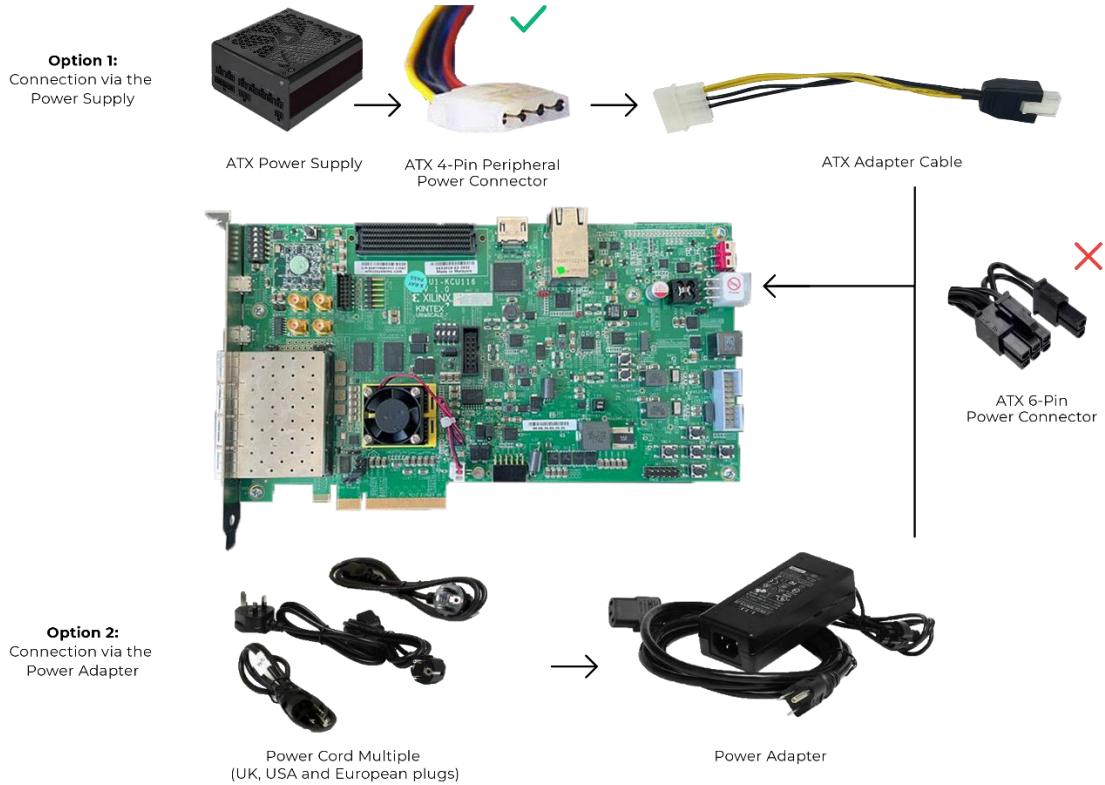
Make sure the computer is completely off. Insert the PCIe card into a vacant PCIe slot. When the card is installed in the PCIe slot, power is provided from the ATX power supply 4-pin peripheral connector through the ATX adapter cable which is plugged into J52 on the PCIe Test card.



**CAUTION!** Do NOT plug a PC ATX power supply 6-pin connector into J52. The ATX 6-pin connector has a different pin out than J52. **Connecting an ATX 6-pin connector into J52 damages the PCIe Test card and voids the board warranty.**

In case your PSU doesn't have a ATX 4-Pin peripheral power connector, you can use the external adapter that comes with the kit.

The image below illustrates the two options for powering up the board.



Slide the KCU116 board power switch SW1 to the ON position. Wait a few seconds until the board boots, then power on the PC.

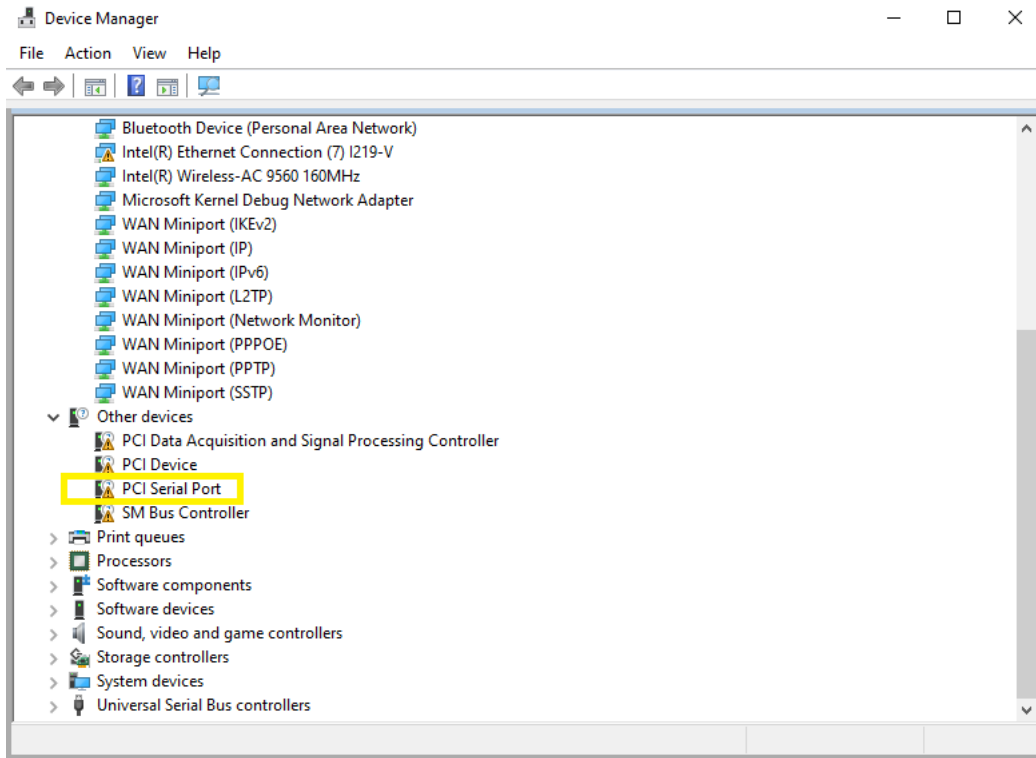
### **Step 2 – Install the device driver**

If a PassMark PCIe Test Card has been installed on the system previously, the device drivers will be automatically installed, and the installation is complete.

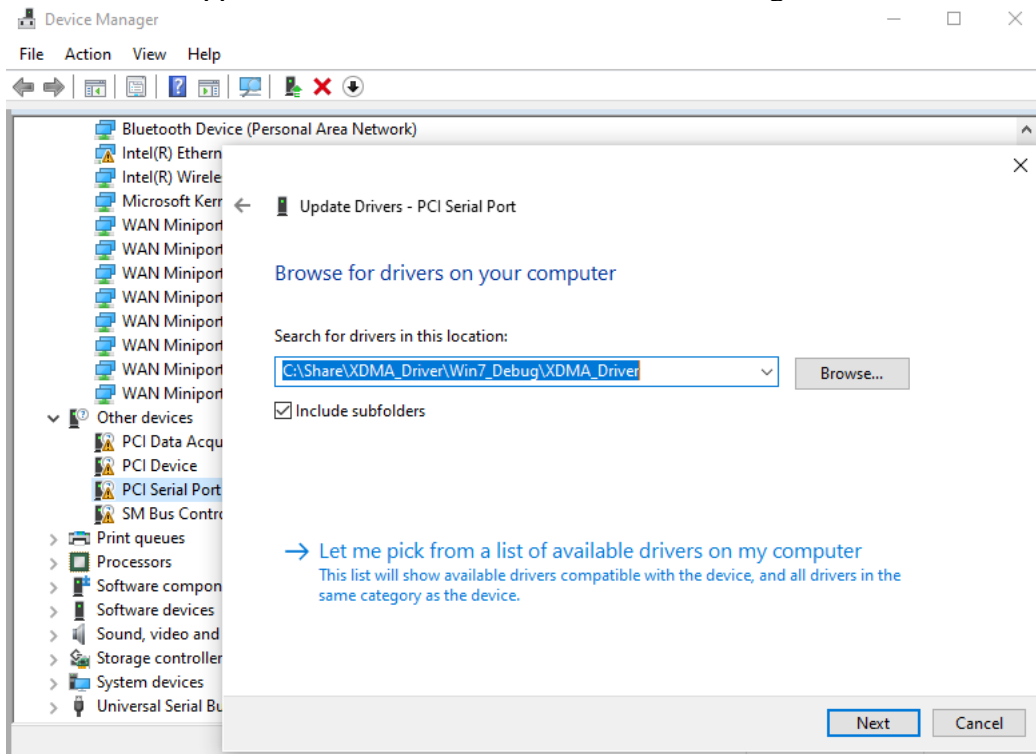
If the driver is not installed, download the latest device driver from the below link and follow the below steps to install the driver.

<https://www.passmark.com.au/products/pcie-gen3-test-card/download.php>

Start Device Manager by selecting Windows Start and typing “Device Manager” or through the Control Panel. If the PCIe Test Card has never been installed before, it should appear as “PCI Serial Port” under Device Manager>>Other devices



If the PCIe Test Card already has drivers installed and you wish to update the driver then it should appear as “Xilinx DMA” under Device Manager >> Xilinx Drivers



Right-click the device and select “Update Driver Software...” from the drop-down menu.  
Select “Browse my computer for driver software” and enter the location of the device drivers. Click Install.



After successful installation, a Window will be displayed indicating that “Windows has successfully updated your driver software”.

If the PCIe Test Card already has drivers installed and you wish to update the driver then it should appear as “Xilinx DMA” under Device Manager >> Xilinx Drivers

### Step 3 – Starting the Test Software

The PCIe Test Card can be used to test PCIe slots with PCIeGen3Test software. The latest version of PCIeGen3Test software can be downloaded from the below link.

<https://www.passmark.com.au/products/pcie-gen3-test-card/download.php>

To run PCIeGen3Test, download the standalone test application from Passmark website and click on “PCIeGen3Test.exe”.

## Loopback Test

In Loopback test, the software sends 16MB of data to the plug and reads back the data from the card. Then, data is verified, and low-level errors occurred during communication will be reported.

The screenshot shows the PassMark(R) PCIeTest application window. The 'Select PCIe test' section is configured with 'Device: PCIe-0, Windows ID: {74c7e4a9-6d5d-4a70-bc0d-20691dff9e9d}', 'Duration: 0 Minutes', and 'Mode: Loopback'. A photograph of the PCIe test card is shown on the right. The 'Results' section displays the following data:

Results		Status: LOOPBACK test - Complete
Duration:	000h 00m 04s	Operations: 91 Errors: 0
START OF PCIE TEST - LOOPBACK TEST		
Testing device		
Testing device PCIe-0, Windows ID:{74c7e4a9-6d5d-4a70-bc0d-20691dff9e9d}		
Loopback blocks 1-10:	Min 5421.0 MB/s, Max 5908.0 MB/s	Max. Rate NA 8000 6000 4000 2000 0 (MB/s) R/W
Loopback blocks 11-20:	Min 5482.0 MB/s, Max 5693.0 MB/s	
Loopback blocks 21-30:	Min 5233.0 MB/s, Max 5553.0 MB/s	
Loopback blocks 31-40:	Min 5383.0 MB/s, Max 5691.0 MB/s	
Loopback blocks 41-50:	Min 5406.0 MB/s, Max 5574.0 MB/s	
Loopback blocks 51-60:	Min 5406.0 MB/s, Max 5537.0 MB/s	
Loopback blocks 61-70:	Min 5399.0 MB/s, Max 5594.0 MB/s	
Loopback blocks 71-80:	Min 5482.0 MB/s, Max 5615.0 MB/s	
Loopback blocks 81-90:	Min 5427.0 MB/s, Max 5691.0 MB/s	
Test Start time: Mon Mar 27 17:07:31 2023		
Duration: 000h 00m 04s		
91 Operations.		
0 Read error(s), 0 Write error(s), 0 Verification error(s).		
Test passed: PCIe-0, Windows ID:{74c7e4a9-6d5d-4a70-bc0d-20691dff9e9d}		

Control buttons on the right include: Start, Configure, Save Log, About, and Exit.

## Benchmark Test

In the Benchmark test, the Test application initiates 16MB transfers and measures the time each transfer takes to calculate the throughput. The transfer size can be changed via the Configuration window.

**Results** *Status: BENCHMARK test*

Duration: 000h 00m 01s Operations: 218

Read blocks 61–70: Min 4327.0 MB/s, Max 4608.0 MB/s	
Write blocks 61–70: Min 4696.0 MB/s, Max 4765.0 MB/s	
Read blocks 71–80: Min 4458.0 MB/s, Max 4588.0 MB/s	
Write blocks 71–80: Min 4625.0 MB/s, Max 4748.0 MB/s	
Read blocks 81–90: Min 4401.0 MB/s, Max 4616.0 MB/s	
Write blocks 81–90: Min 4635.0 MB/s, Max 4740.0 MB/s	
Read blocks 91–100: Min 4449.0 MB/s, Max 4591.0 MB/s	
Write blocks 91–100: Min 4473.0 MB/s, Max 4747.0 MB/s	
<b>Overall benchmark result:</b>	
Duration: 000h 00m 01s	
Maximum read data rate: 5255.0 MB/s (42.04 Gb/s)	
Average read data rate: 4591.1 MB/s (36.73 Gb/s)	
Minimum read data rate: 4181.0 MB/s (33.45 Gb/s)	
Maximum write data rate: 5484.0 MB/s (43.87 Gb/s)	
Average write data rate: 4768.8 MB/s (38.15 Gb/s)	
Minimum Write data rate: 4473.0 MB/s (35.78 Gb/s)	
Average combined R/W data rate: 4680.0 MB/s (37.44 Gb/s)	

## Advanced Error Reporting

AER (Advanced Error Reporting) is a PCI Express feature that allows for more enhanced reporting and control of errors than the basic error reporting scheme. AER errors are categorized as either correctable or uncorrectable and can be detected by the test software.

Correctable errors include those error conditions where hardware can recover without any loss of information. Hardware corrects these errors and software intervention is not required.

Uncorrectable errors are those error conditions that impact functionality of the interface. There is no mechanism defined by PCIe specification to correct these errors. The below table summarize the list of errors that can be detected by the PCIe Gen3 Test card.

Name of Error	Classification & severity
Data Link Protocol Error	Uncorrectable
Poisoned TLP	Uncorrectable
Flow Control Protocol Error	Uncorrectable
Completion Timeout	Uncorrectable
Completer Abort	Uncorrectable
Unexpected Completion	Uncorrectable
Receiver Overflow	Uncorrectable
Malformed TLP	Uncorrectable
Unsupported Request Error	Uncorrectable
Uncorrectable Internal Error	Uncorrectable
Receiver Error	Correctable
Bad TLP	Correctable
Bad DLLP	Correctable

Replay Num Rollover	Correctable
Replay Timer Timeout	Correctable
Advisory Non Fatal Error	Correctable
Corrected Internal Error	Correctable
Header Log Overflow	Correctable

## Uninstalling in Windows

From the Windows "Start" option, select "Control Panel", "System", "Hardware", "Device Manger", from the "Xilinx Drivers" branch of the device tree, select the "Xilinx DMA" device and from the menu select "Action", "Uninstall".

## Trouble shooting

Symptom: Power, but no appearance of a PCI Device under Device Manager  
 The basic PCIe device enumeration process could not be completed. This could be a fault in the Windows O/S installation or with the PCIe hardware in the computer.

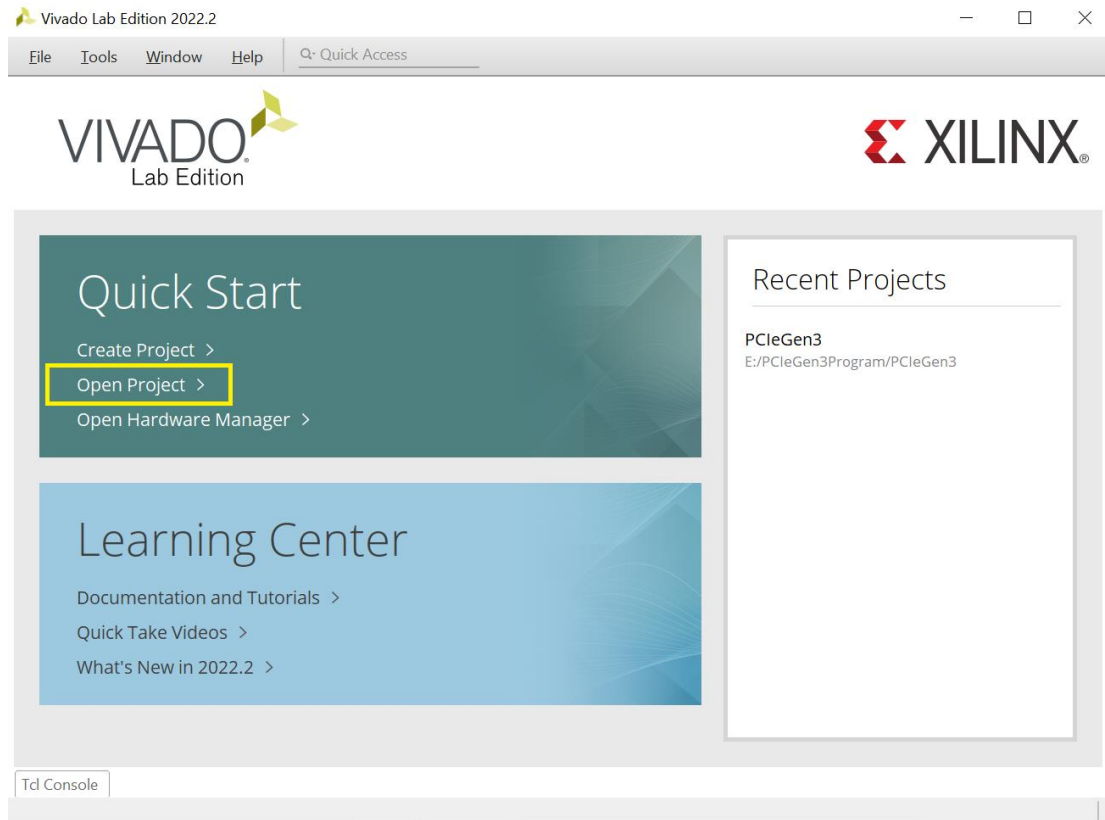
## Updating the firmware

You need Vivado Lab Edition to update the firmware on the card.  
<https://www.xilinx.com/support/download.html>

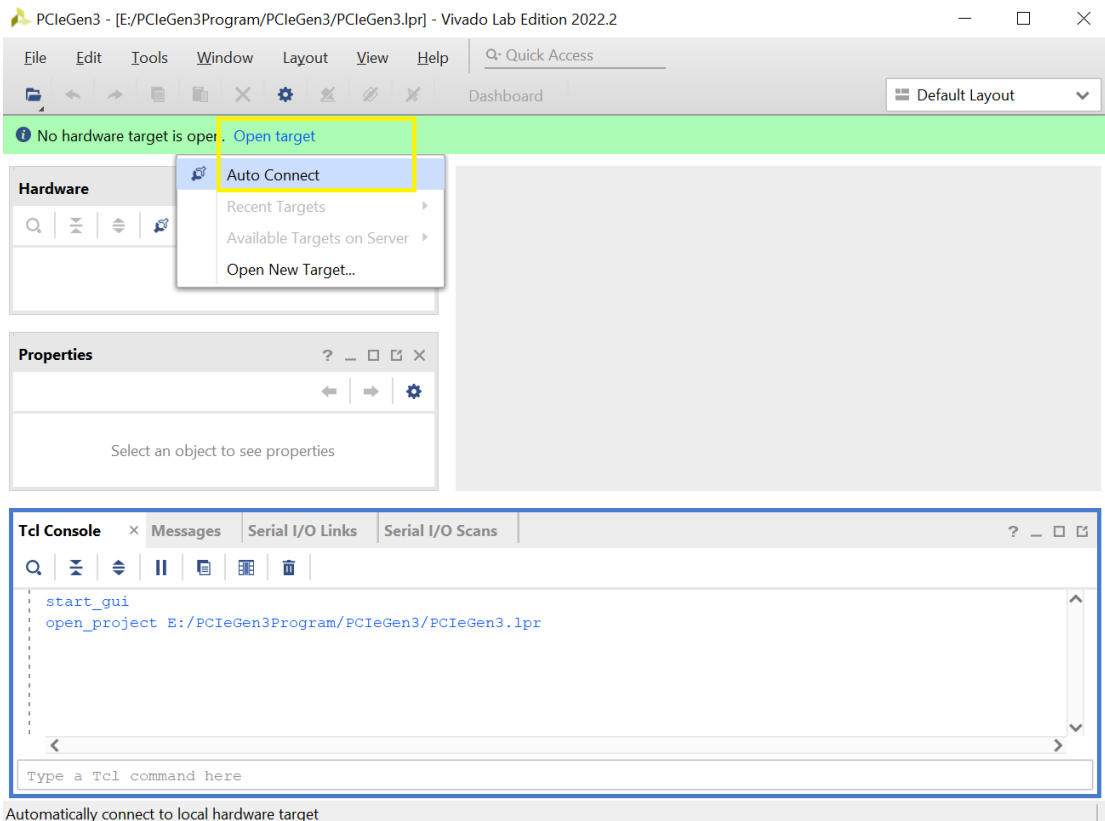
The firmware file can be downloaded from the below link.  
<https://www.passmark.com/products/pcie-gen3-test-card/download.php>

- 1- Turn off the PC

- 2- Insert the PCIe card into a vacant PCIe slot
- 3- Power up the card via the ATX power adapter or external adapter and turn on the PC
- 4- Open Vivado Lab Edition and select “Open Project”. Select the Vivado Lab Project file inside the firmware directory.

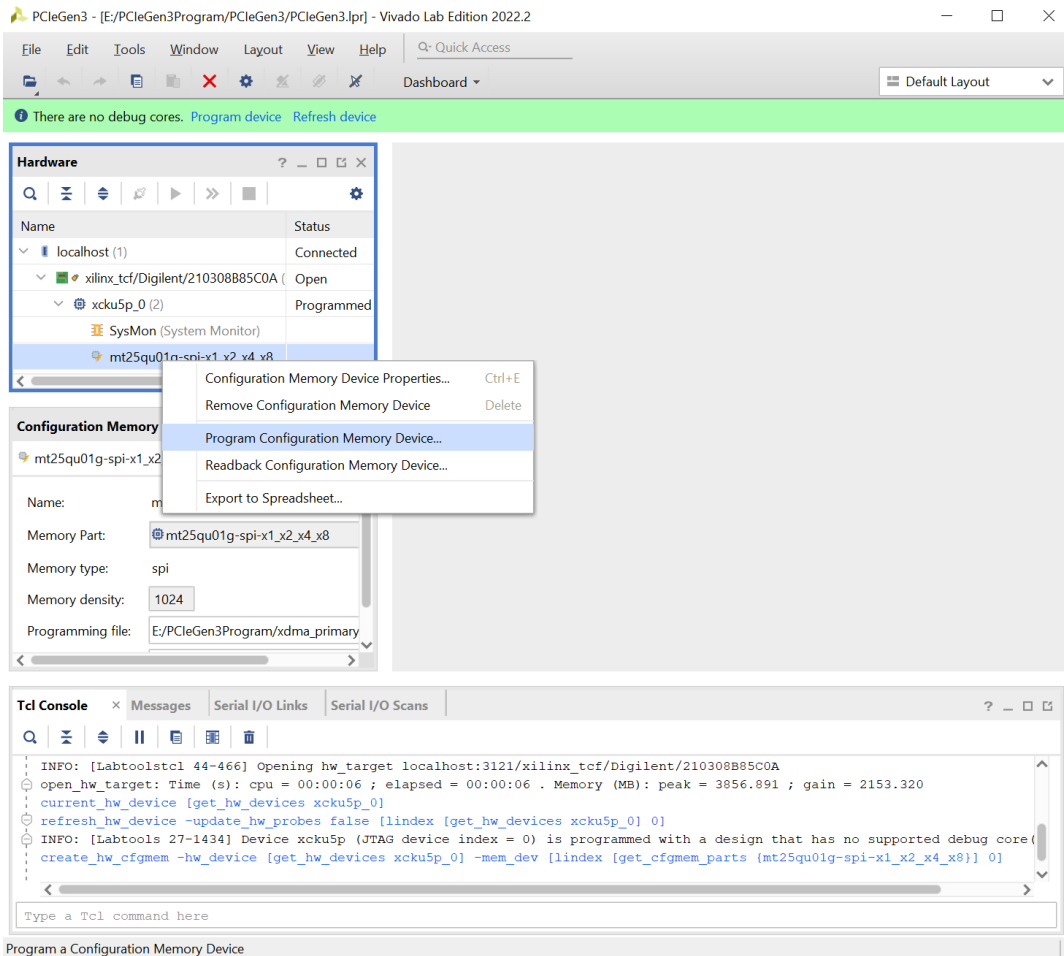


- 5- Click on “Open Target” and click “Auto Connect”



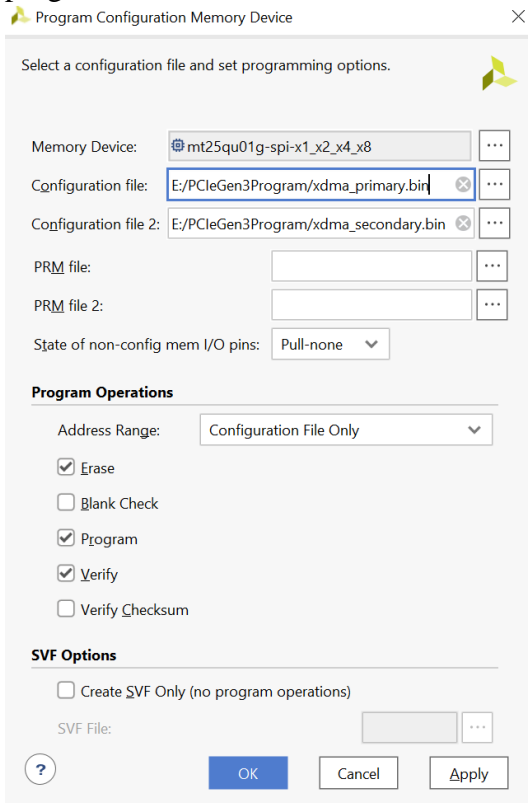
Automatically connect to local hardware target

- 6- From with “Hardware Window”, right click on “mt25qu01g-x1\_x2\_x4\_x8” and click “Program Configuration Memory Device...”



Program a Configuration Memory Device

7- Click “OK”. Do not unplug or remove power while firmware update is in progress.



- 8- Turn off the PC and slide the KCU116 board power switch SW1 to the OFF position. Wait a few seconds and then slide SW1 to ON and turn on the PC. The card is now ready for testing.

## Technical Specifications

Product Code	PM142
PCIe Standard	Gen3, Gen2 and Gen 1 (also compatible with Gen4 and Gen 5, running at Gen3 speeds)
Physical connector	x8 PCIe edge connector (can be used on x1 using a x8 to x1 adapter)
Max speed	8 Gbits/sec per lane
PCIe Transfer modes	DMA - Direct memory access
FPGA	Xilinx Kintex UltraScale+ XCKU5P-2FFVB676E FPGA
Clock speed	100MHz
Device memory	1 GB DDR4 component memory (two [256 Mb x 16] devices)
Operating Voltage	12VDC via included external adapter
Dimensions	Height: 6.927 inch (17.59 cm) Thickness (±5%): 0.061 inch (0.1549 cm) Length: 9.5 inch (24.13 cm)
Weight	256g
EMC standards	EN 55022:2010, EN 55024:2010
Storage Temperature	-25C to 60C
Usage Temperature	0C to 45C
Humidity	10% to 90% non-condensing
Model number	PMPCIE03
Electrical Compliance	CE
RoHS (Lead free)	YES

## Disclaimer

This product is not warranted nor intended to be used for medical, life support, life saving, critical control or safety applications, unless pursuant to an express written agreement with PassMark Software. Furthermore, PassMark Software does not authorize this product for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of this PassMark Software product in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies PassMark Software against all charges.