

MINERVA

EP6121 PCIe x16 Gen 5 with ReDriver for MCIO 74P dual port

Performance & Burn In Test Rev. 1.0

Table of Contents

- 1. Overview
- 2. Performance Measurement Tools and Results
 - 2.1 Test Platform
 - 2.2 Test target and U.2 NVMe SSD
 - 2.3 Install Hardware
 - 2.4 BIOS & Windows 11 OS environment setup
 - 2.5 CrystalDiskMark 8.0 x64 performance test
 - 2.6 AS SSD Benchmark 2.0.7 performance test
 - 2.7 ATTO Disk Benchamrk 4.0.1 performance test
 - 2.8 AnvilBenchmark_V110_B337 Benchmark performance test

3. Burn In Tests and Results

3.1 BurnInTest v10.2 Pro burn in test

4. Summary

1. Overview

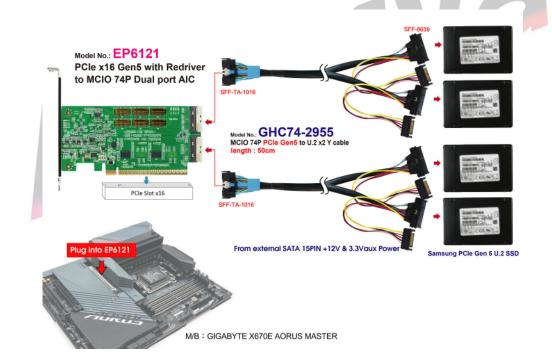
The Host Bus Adapter may provide PCIe x16 Gen 5, 32GT/s high-speed signals extension, bulit-in ReDriver controller to provides equalization up to **22 dB at 16 GHz** to MCIO 74P.

2. Tools and Results of Performance Measurement

2.1 Test Platform:

M/B :	GIGABYTE X670E AORUS MASTER
CPU :	AMD Ryzen 5, 7600X 6-Core
Memory :	Kingston KF556C36BBEK2, DDR5-5600MT/s, 64GB(32GB DIMM*2)
ATX Power :	Apexgaming AN-550, 550W ATX, 12V V2.2 Power Supply
AIC:	EP6121 PCIe x16 Gen 5 with Redriver to MCIO 74P dual port ADD-in Card
Cable:	PCIe 5.0 MCIO 74P to U.2(SFF-8639) dual port, 50cm Cable
OS :	Microsoft Windows 11 64bit OS

2.2 Test target: EP6121 & Samsung U.2 PM1783 / 15.36TB NVMe SSD



2.3 Install Hardware

Inserts U.2 NVMe SSD into MCIO 74P to U.2 dual port cable, and connects cable to EP6121 AIC. The EP6121 AIC plugs into PCIe x16 Slot of GIGABYTE X670E AORUS MASTER

2.4 BIOS & Windows 11 OS environment setup

- 2.4.1 Primary SATA SSD installed Windows 10 OS.
- 2.4.2 U.2 NVMe SSD, formatted to NTFS Mode. Don't install any program.

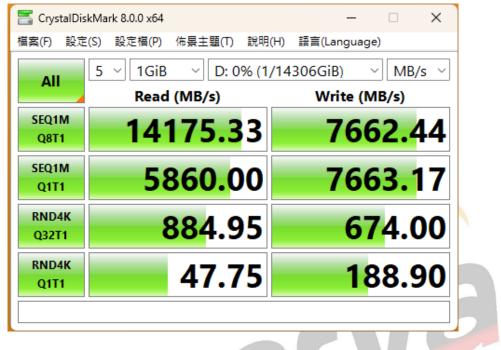




2.5 CrystalDiskMark 8.0 x64 performance test

Weight Benchmark (Sequential Read & Write / default = 1MB)

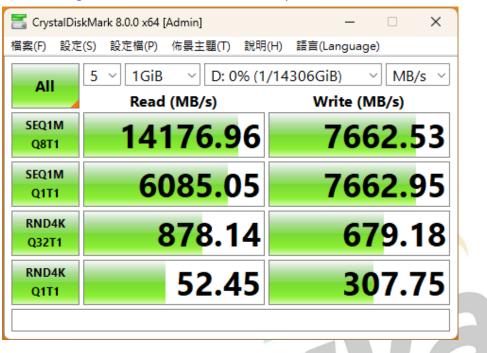
2.5.1 Samsung U.2 PM1783 / 15.36TB SSD performance in Lane 0~3 as below:



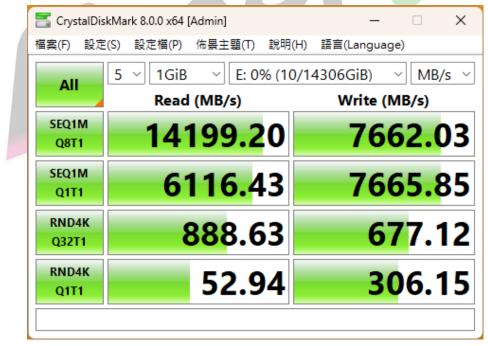
2.5.2 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 4~7 as below:

📑 CrystalDis	kMark 8.0.0 x64 [Admin]	– 🗆 X
檔案(F) 設定	(S) 設定檔(P) 佈景主題(T) 說明(H	H) 語言(Language)
All	5 ~ 1GiB ~ E: 0% (10,	/14306GiB) ~ MB/s ~
	Read (MB/s)	Write (MB/s)
SEQ1M Q8T1	14203.16	7663.07
SEQ1M Q1T1	6030.20	7666.54
RND4K Q32T1	882.83	<mark>67</mark> 6.00
RND4K Q1T1	53.03	<mark>30</mark> 9.69

2.5.3 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 8~11 as below:



2.5.4 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 12~15 as below:



2.6 AS SSD Benchmark 2.0.7 performance test

Benchmark (Read & Write by MB/s, default block size = 16MB)

2.6.1 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 0~3 as below:

Edit View Tools AMSUNG MZWLO15THBL AMSUNG PPA3B5Q provme - OK 1384 K - OK	5 5 1	Write:
Seq Seq	10366.01	7252.86 MB/s
4K	49.42 MB/s	278.78 MB/s
4K-64Thrd	2810.11 MB/s	3880.17 MB/s
Acc.time	0.022 ms	0.014 ms
core:	3896	4884
	10	597

2.6.2 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 4~7 as below:

File Edit View Tools E: SAMSUNG MZWLO15THBL	3 3 1				
SAMSUNG OPPA3B5Q stornyme - OK 16384 K - OK 14306.00 GB	Read:	Write:			
Seq	10390.42	7251.63 MB/s			
☑ 4K	50.26 MB/s	278.60 MB/s			
4K-64Thrd	2830.34 MB/s	3967.27 MB/s			
Acc.time	0.023 ms	0.014 ms			
Score:	3920	4971			
	10	719			
Star	t	Abort			

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2.6.3 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 8~11 as below:

AS SSD Benchmark 2.0.731	6.34247	- 🗆 X					
File Edit View Tools	Language Help						
D: SAMSUNG MZWLO15THBL	A-00A07 ~ 1 GB ~						
SAMSUNG OPPA3B5Q stornvme - OK 16384 K - OK 14306.00 GB	Read:	Write:					
🛛 Seq	10369.25	7194.18 MB/s					
☑ 4K	49.92 MB/s	279.53 MB/s					
4K-64Thrd	2808.84 MB/s 3894.12 MB/s						
Acc.time	0.023 ms	0.014 ms					
Score:	3896	4893					
	10603						
	·	()					
Star	t	Abort					

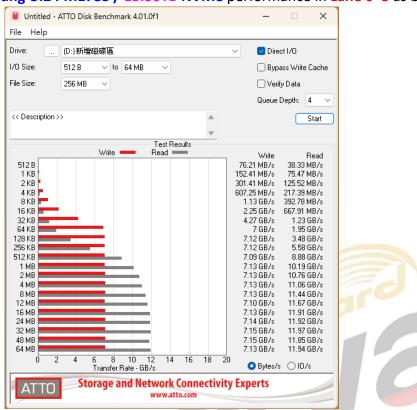
2.6.4 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane12~15 as below:

File Edit View Tool: E: SAMSUNG MZWLO15THBI		
SAMSUNG OPPA3B5Q stornvme - OK 16384 K - OK 14306.00 GB	Read:	Write:
Seq	9794.69 MB/s	4816.13 MB/s
☑ 4K	49.41 MB/s	277.47 MB/s
4K-64Thrd	2813.98 MB/s	3914.00 MB/s
Acc.time	0.022 ms	0.014 ms
Score:	3843	4673
	10	213
Sta	xt	Abort

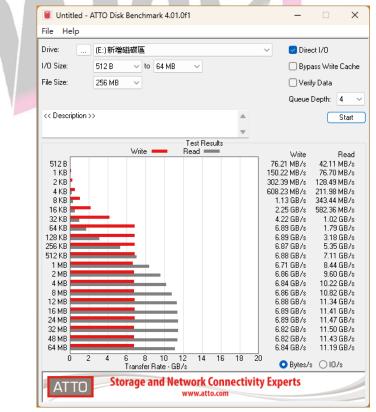


2.7 ATTO Disk Benchamrk 4.01 performance test

2.7.1 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 0~3 as below:



2.7.2 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 4~7 as below:



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2.7.3 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 8~11 as below:

Untitled - ATTO Disk Benchmark 4.01.0f1		-		×
ile Help				
Drive: (D:) 新增磁碟區	\sim	🔽 Dire	ect I/O	
/O Size: 512 B v to 64 MB v		🗌 Вур	ass Write	Cache
File Size: 256 MB		□ Veri	fy Data	
		_	· .	
		Queue	Depth:	4 ~
<< Description >>				Start
	-			
Test Results				
Write —— Read ——		Write		Read
512 B 1 KB		5.72 MB/s 0.71 MB/s	42.11 77.67	
2 KB •		3.36 MB/s	134.991	
4 KB 🟴	60	6.27 MB/s	190.52	MB/s
8 KB 💳		1.13 GB/s	313.81	
16 KB		2.23 GB/s	600.341	
32 KB		4.23 GB/s 6.81 GB/s		GB/s GB/s
128 KB		6.79 GB/s		GB/s
256 KB		6.96 GB/s		GB/s
512 KB		6.97 GB/s	8.89	GB/s
1 MB		6.98 GB/s	10.10	
2 MB		6.98 GB/s	10.56	
4 MB		7 GB/s 7.03 GB/s	10.88 11.35	
12 MB		7.03 GB/s 6.88 GB/s	11.35	
16 MB		7.04 GB/s	11.75	
24 MB		7.05 GB/s	11.83	GB/s
32 MB		7.05 GB/s	11.85	
48 MB		7.07 GB/s 7.05 GB/s	11.82 11.82	
64 MB	8 20	7.00 GB/S	11.82	ub/s
0 2 4 6 8 10 12 14 16 1 Transfer Rate - GB/s	0 20	O Bytes/s	s () 107	's
Storage and Network Conne	etivity Ex	morte		
ATTO Storage and Network Connect	cuvity E	cheire		
www.atto.com				

2.7.4 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 12~15 as below:

📕 Untitled - A	ATTO Disk Ber	chmark 4.0	1.0f1			_	
File Help							
Drive:	(E:)新增磁碟	區				🖂 🖂 Direc	x1/0
1/0 Size:	512 B	to 64 MB	~			🗌 Вура	iss Write Cache
File Size:	256 MB	-				🗌 Verifj	y Data
						Queue (Depth: 4 🗸
<< Description >	>						Start
					Ŧ		
		rite 💻	Test Re Read ■				
	W		neau =			Write	Read
512 B						75.96 MB/s	42.11 MB/s
1 KB 2 KB						150.71 MB/s 302.88 MB/s	78.40 MB/s 136.30 MB/s
4 KB						604.32 MB/s	248.64 MB/s
8 KB						1.13 GB/s	398.63 MB/s
16 KB						2.24 GB/s	661.78 MB/s
32 KB	_					4.21 GB/s	1.10 GB/s
64 KB						6.92 GB/s	1.98 GB/s
128 KB						6.86 GB/s	3.54 GB/s
256 KB						7.03 GB/s	5.69 GB/s
512 KB		-				7.03 GB/s	8.67 GB/s
1 MB						7.03 GB/s	10.04 GB/s
2 MB						7.03 GB/s	10.41 GB/s
4 MB						7.04 GB/s	10.81 GB/s
8 MB 12 MB						6.92 GB/s 7.07 GB/s	11.16 GB/s 11.47 GB/s
16 MB						7.07 GB/s	11.47 GB/s
24 MB						7.07 GB/s	11.80 GB/s
32 MB						7.07 GB/s	11.82 GB/s
48 MB						7.08 GB/s	11.75 GB/s
64 MB						6.98 GB/s	11.75 GB/s
0 2	4 6 Trar	8 10 nsferRate-G	12 14 B/s	16	18 2	D 💿 Bytes/s	○ 10/s
ATTO	Storag	je a <mark>nd</mark> No	twork www.at		ectivit	y Experts	

2.8 AnvilBenchmark_V110_B337

2.8.1 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 0~3 as below:

	1	1	-						
le Benchmarks	IOmeter	System Inf	o Settings	Test size 1GB	Drive 🗖 d:	(新増磁碟區)	✓ Screenshot		
SD Bench	mark					SA	MSUNG MZWLO	015THBLA 60GB/OPP	
						-			
Read	Resp.	time	MB read	IOPS	MB/s				
Seq 4MB	0.488	3ms	2,048.0	2,048.00	8,192.00				
4K	0.078	1ms	625.4	12,808.28	50.03				
4K QD4	0.078	4ms	2,492.2	51,039.14	199.37	1	12,452.91		
4K.QD16	0.083	2ms	9,392.6	192,358.81	751.40	Run read	12,452.9	91	
32K	0.082	6ms	4,000.0	12,100.59	378.14				
128K	0.104	5ms	16,000.0	9,570.09	1,196.26		32,763	.71	
117.5			10	1005		Run	32	,763.71	
Write	Resp.		/IB written	IOPS	MB/				-
Seq 4MB	0.546	9ms	1,024.0	1,828.57	7,314.29				
4K	0.013	3ms	640.0	74,967.39	292.84	Run write	20,310.81 20,310.8	1	
4K QD4	0.014	4ms	640.0	277,057.04	1,082.25		20,010.0		
4K QD16	0.021	9ms	640.0	732,022.95	2,859.46				
/icrosoft Windows :	11家用版 64 ①	立元 Build (226	i31)				SAMSUNG MZWLO		
670E AORUS MAST				Drives :			Drive D: 14,306.0/14 NTFS - Cluster size 4		(100.
\MD Ryzen 5 7600 1emory : 64,662 Mi				Notes :			Storage driver stor		
Professional Ed							Alignment 16384KB O		
							Compression 100% (ncompressible)	

2.8.2 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 4~7 as below:

📵 An	wil's Storage Ut	ilities 1.1.0 (2	014-Januar	y-1)					- 0	×
File	Benchmarks	IOmeter	System In	fo Settings	Test size 1GB	🔹 Drive 🔳 e	:(新増磁碟區]	 ✓ Screenshot 	Help	
SSD) Benchn	nark					SAM	ISUNG MZWLC	015THBL	
										7.00000
	Read	Resp.	time	MB read	IOPS	MB	/s			
	Seq 4MB	0.4883	3ms	2,048.0	2,048.00	8,192.0	0			
[4K	0.078	Oms	626.1	12,822.20	50.0	9			
	4K QD4	0.0783	3ms	2,494.9	51,095.92	199.5	9	12,455.27		
	4K QD16	0.0831	lms	9,403.3	192,578.92	752.2	6 Run read	12,455.27 12,455.2	7	
	32K	0.0826	ôms	4,000.0	12,100.59	378.1	4		-	
	128K	0.104	ōms	16,000.0	9,570.09	1,196.2		32,704.	43	~
	Write	Resp.	time	MB written	IOPS	MB	Run	32	,704.4	3
	Seq 4MB	0.5508		1.024.0	1.815.60	7,262.4				
_	4K	0.013	3ms	640.0	75,206.31	293.7		20,249.16		
	4K QD4	0.014		640.0	276,770.22	1.081.1	3 Run write	20,249.1	6	
	4K QD16	0.0219	9ms	640.0	731,157.53	2,856.0	8		_	
					,	,				
Micro	osoft Windows 11	家用版 64 位	〕 元 Build (22	631)				SAMSUNG MZWLO	15THBLA-00	0A07 15
X670	E AORUS MASTE	R/F24c, AM5		,	Drives :			Drive E: 14,306.0/14 NTFS - Cluster size 40		e (99.9%)
) Ryzen 5 7600X ory : 64,662 MB	6-Core Proces			Notes :			Storage driver stor		
	ofessional Edi							Alignment 16384KB O Compression 100% (I		e)

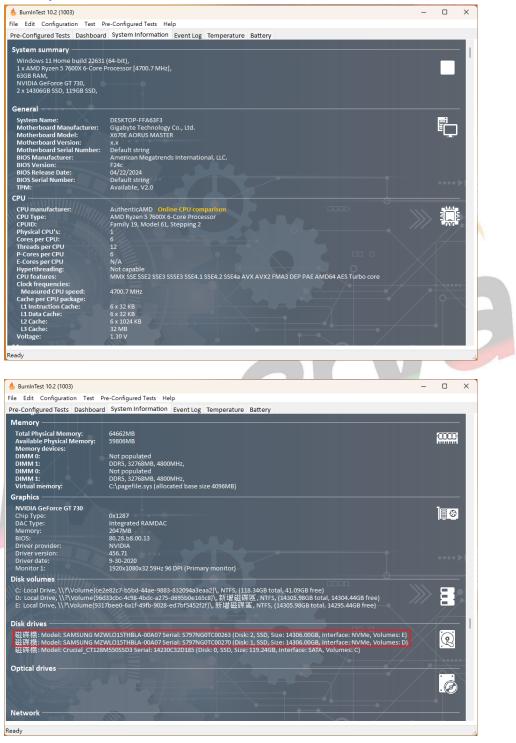
Anvil's Storage Ut	tilities 1.1.0 (2014-Jan	uary-1)				-	\Box \times
le Benchmarks	IOmeter System	n Info Settings	Test size 1GB	🔹 Drive 🔳 d: 席	所増磁碟區]	✓ Screenshot Help	
SD Benchn	nark				SAN	ISUNG MZWLO15TH	BLA-00A07
						1000000	
Read	Resp. time	MB read	IOPS	MB/s			
Seq 4MB	0.4590ms	2,048.0	2,178.72	8,714.89			
4K	0.0777ms	628.6	12,872.84	50.28			
4K QD4	0.0781ms	2,500.8	51,215.42	200.06		12,991.88	
4K QD16	0.0831ms	9,398.5	192,481.36	751.88	Run read	12,991.88 12,991.88	
32K	0.0823ms	4,000.0	12,154.59	379.83			
128K	0.1039ms	16,000.0	9,626.23	1,203.28		33,466.86	
Write	Resp. time	MB written	IOPS	MB/s	Run	33,466	0.80
Seq 4MB	0.5508ms	1,024.0	1,815.60	7,262.41			
4K	0.0131ms	640.0	76,329.38	298.16		20,474.98 20,474.98	
4K QD4	0.0141ms	640.0	283,049.20	1,105.66	Run write	20,474.98	
4K QD16	0.0216ms	640.0	742,650.84	2,900.98			
(670E AORUS MASTE		(22631)	Drives :			SAMSUNG MZWLO15THBL Drive D: 14,306.0/14,304.4G NTFS - Cluster size 4096B	
AMD Ryzen 5 7600X Memory : 64,662 MB	6-Core Processor		Notes :			Storage driver stornvme	
Professional Edi	ition					Alignment 16384KB OK Compression 100% (Incompre	

2.8.4 Samsung U.2 PM1783 / 15.36TB NVMe performance in Lane 12~15 as below:

) An	vil's Storage Uti	ilities 1.1.0 (2	014-January-1))					- 0	×
ile	Benchmarks	IOmeter	System Info	Settings	Test size 1GB	🔹 Drive 🔳 e: 🛱	f増磁碟區]	 ✓ Screenshot 	Help	
SD	Benchm	nark					SAI	ISUNG MZWLO	015THBLA 60GB/OPP	
_										
	Read	Resp. t	ime M	MB read	IOPS	MB/s				
	Seq 4MB	0.4883	ms 🛛	2,048.0	2,048.00	8,192.00				
[4K	0.0777	ms	628.3	12,867.80	50.26				
	4K QD4	0.0782	ms 🛛	2,499.0	51,179.07	199.92		12.458.53		
-	4K QD16	0.0831	ms 🤅	9,403.0	192,573.04	752.24	Run read	12,458.53 12,458.5	53	
	32K	0.0828	ms 🧳	4,000.0	12,083.45	377.61				
	128K	0.1044	ms 1	6,000.0	9,581.56	1,197.69		32,857	.29	
	Write	Resp. t	ime ME	8 written	IOPS	MB/s	Run	34	2,857.29	,
9	Seq 4MB	0.5508	ms	1,024.0	1,815.60	7,262.41				
	4K	0.0132	ms	640.0	75,540.12	295.08	Run write	20,398.75 20,398.75	75	
	4K QD4	0.0142	ms	640.0	281,136.07	1,098.19	Hun write	20,396.1	5	
-	4K QD16	0.0217	ms	640.0	739,111.46	2,887.15				
Microsoft Windows 11 家用版 64 位元 Build (22631) X670E AORUS MASTER/F24c, AM5 AMD Ryzen 5 7600X 6-Core Processor					Drives : Notes :			SAMSUNG MZWLO Drive E: 14,306.0/14 NTFS - Cluster size 4	1,295.4GB free 096B	
	nyzen 5 7600×1 ory:64,662 MB	o-cule Floces:	SOI		notes:			Storage driver stor	nvme	
	fessional Edit							Alignment 16384KB C Compression 100% (

3. Burn In Tests and Results

- 3.1 BurnInTest v10.2 Pro for Samsung U.2 PM1783 / 15.36TB SSD
 - 3.1.1 System Information for lane 0~7 as below:

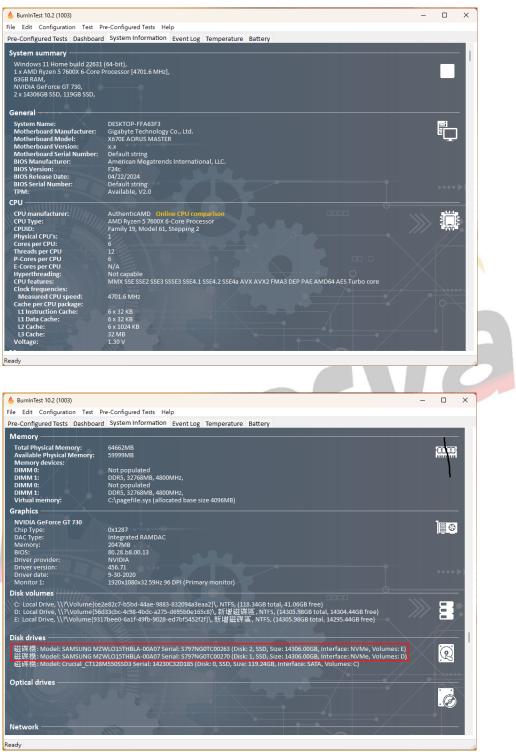


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3.1.2 24-hour Burn-in test PASSED

🍐 BurnInTest 10.2 (1003)				-	
File Edit Configuration Test	Pre-Configured Tests Hel	,			
Start time: 1 Stop time: T	Wed May 29 17:58:27 20 hu May 30 17:58:36 20)24		╵┍╸ ╒╢ ┍╸╵ ╸	
Operations	559 Trillion		553 Trillion		
	0		0		
No errors		No errors			
					••• > > > 3
PASSEE)	PASSED			
					- / -
					N
					~~~~~
	1	FCTC DAC	SED		
Ready					
Pre-Configured Tests       Dashboard       System Information       Event Log       Temperature       Battery         Image: Start time: Wed May 29 17:58:27 2024       Stop time: Thu May 30 17:58:36 2024       Image: Start time: Wed May 29 17:58:36 2024       Image: Start time: Wed May 29 17:58:36 2024         Image: Disk (D:) Test: Results (1 of 2)       Image: Start time: Wed May 29 17:58:36 2024       Image: Start time: Wed May 29 17:58:36 2024         Image: Operation: Code of the start time: Wed May 30 17:58:36 2024       Image: Start time: Wed May 30 17:58:36 2024       Image: Start time: Wed May 30 17:58:36 2024         Image: Operation: Code of the start time: Wed May 30 17:58:36 2024       Image: Start time: Wed May 30 17:58:36 2024       Image: Start time: Wed May 30 17:58:36 2024         Image: Operation: Start time: Wed May 29 17:58:37 2024       Image: Start time: Wed May 30 17:58:36 2024       Image: Start time: Wed May 30 17:58:36 2024         Image: Operation: Start time: Wed May 30 17:58:36 2024       Image: Start time: Wed May 30 17:58:36 2024       Image: Start time: Wed May 30 17:58:36 2024         Image: Operation: Start time: Wed May 30 17:58:37       Image: Start time: Wed May 30 17:58:37 Tillion       Image: Start time: Wed May 30 17:58:37 Tillion       Image: Start time: Wed May 30 17:58:37 Tillion         Image: Operation: No errors       Image: Start time:					

#### 3.2.1 System Information for lane 8~15 as below:



### 3.2.2 24-hour Burn-in test PASSED

File Edit Configuration Test Pre-Configured Tests Help         Pre-Configured Tests Dashboard System Information Event Log Temperature Battery         Start time: Thu May 30 19:06:31 2024         Stop time: Fri May 31 19:06:41 2024         Duration: 024h 00m 10s         Test config file: Last Used         Operations         Stop trons         Stop trons         Stop trons         Stop trons         Stop trons         PASSED	🗄 BurninTest 10.2 (1003)			– 🗆 X	
Start time: Thu May 30 19:06:31 2024 Stop time: Fri May 31 19:06:31 2024 Duration: 024h 00m 10s Test config file: Last Used Disk (D:) Test: Results (1 of 2) Cycle Orefations Errors No errors No errors No errors Config file: Last Used Disk (E:) Test: Results (2 of 2) Cycle Orefations Errors No errors Config file: Last Used Disk (E:) Test: Results (2 of 2) Cycle Orefations Errors No errors Config file: Last Used Disk (E:) Test: Results (2 of 2) Cycle Orefations Errors No errors Config file: Last Used Disk (E:) Test: Results (2 of 2) Cycle Orefations Errors No errors Config file: Last Used Disk (E:) Test: Results (2 of 2) Cycle Orefations Errors No errors Config file: Last Used Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycle Cycl	File Edit Configuration Test Pre-Conf	igured Tests Help			
Cycle     1720     Cycle     1707       Operations     559 Trillion     Operations     554 Trillion       Error bescription     0     Error bescription     0       No errors     No errors     No errors     0	RESET Start time: Thu May Stop time: Fri May 3 Duration: 024h 00m	/ 30 19:06:31 2024 31 19:06:41 2024 1 10:5	ݱ┍┠		
Cycle     1720     Cycle     1707       Operations     559 Trillion     Operations     554 Trillion       Error bescription     0     Error bescription     0       No errors     No errors     No errors     0	Disk (D:) Test: Results (1 of 2)	👰 Disk (E:) Test: Results (2 o	of 2)	,i	
Errors 0 Errors 0 Last Error Description No errors No errors No errors					
3 No errors No errors	Errors	0 Errors			
PASSED PASSED					
PASSED PASSED					
	PASSED	PASSED			
				»» / <u>=</u>	
TESTS PASSED		TESTS PAS	SED		
Ready	Ready				
iron .	rowy				

#### 4. Summary

- 4.1 U.2 NVMe SSD is PCIe Gen 5, 32GT/s , 4 Lanes Interface, I/O speed, max. to 128Gbps.
- 4.2 EP6121 Host Bus Adapter I/O performance is based on U.2 NVMe SSD.