HIROTA

Direct Evaluation for Solid State Drive

SMART TESTER *for* PCIe Series

EDSFF (E1.S, E1.L, E3.S) Supported.

SMART TESTER for PCIe G4

【Support Interface PCIe Gen 4 *x 4 Lane*】

NVMe 1.4

SMART TESTER for PCIe

【Support Interface PCIe Gen 3 *x 4 Lane*】

Example：Performance Evaluation, PCIe Gen3 vs Gen4 SSD

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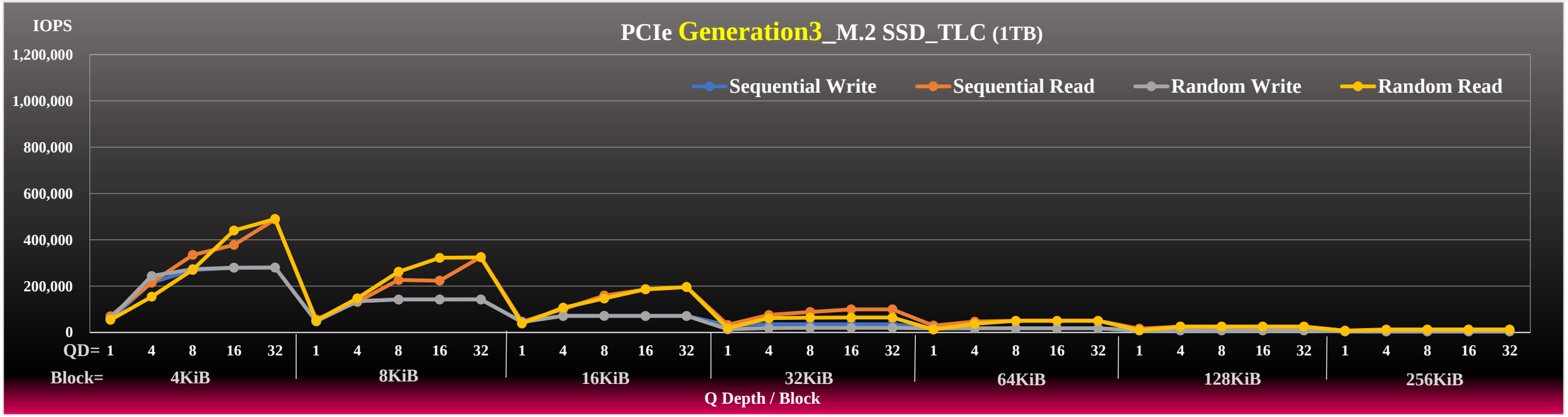

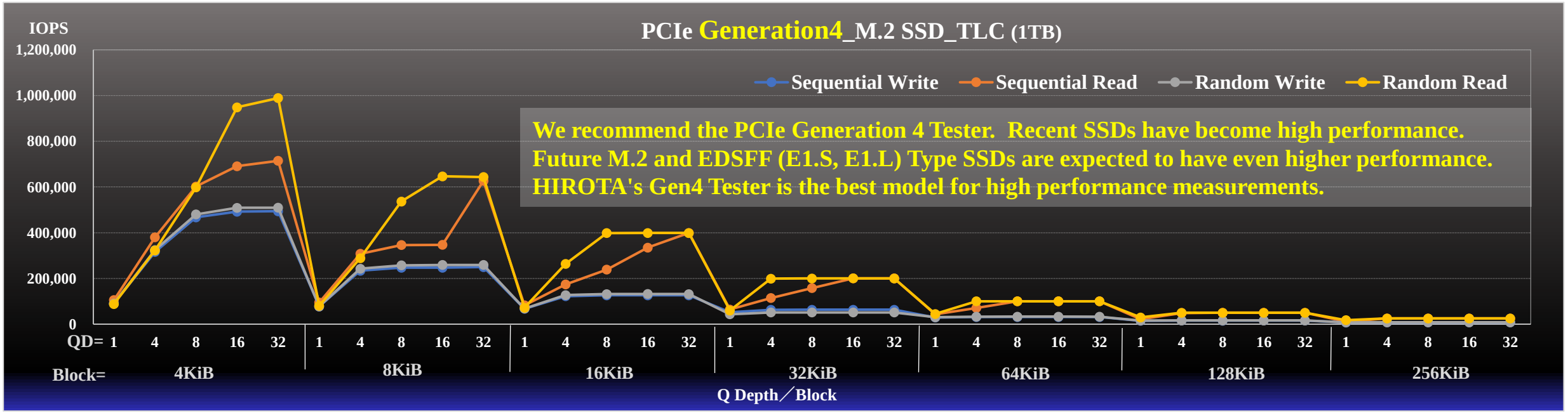

Example：Performance Evaluation PCIe Generation 4 SSD

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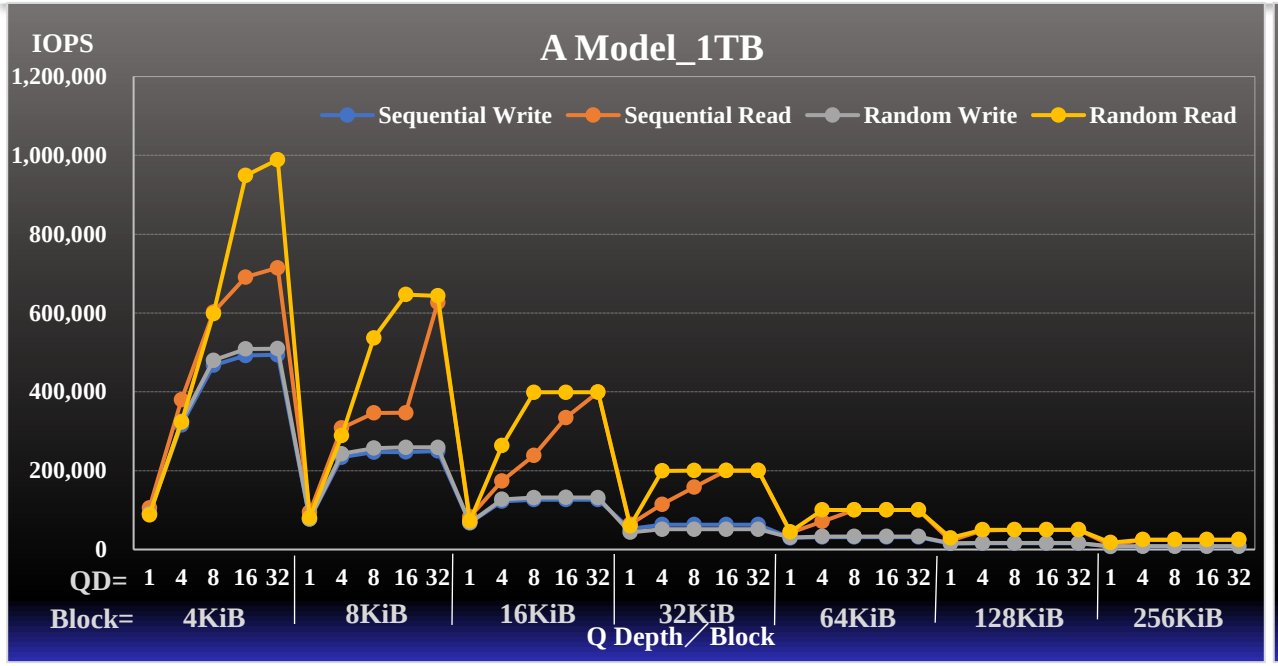

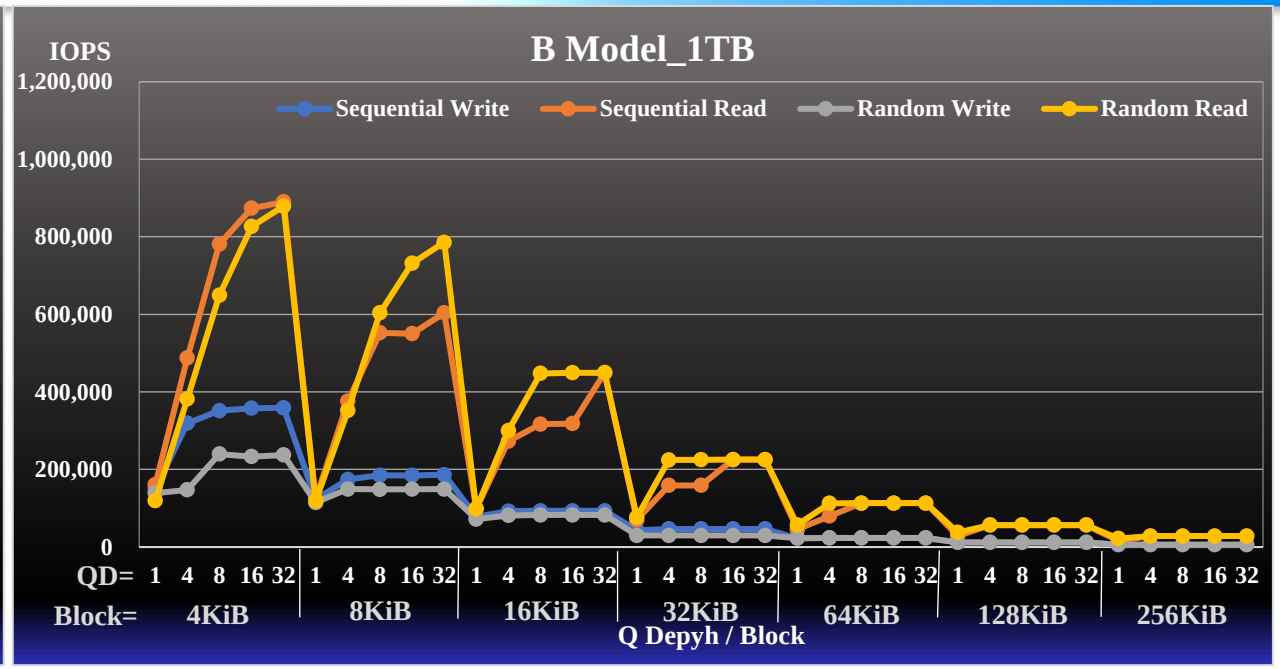

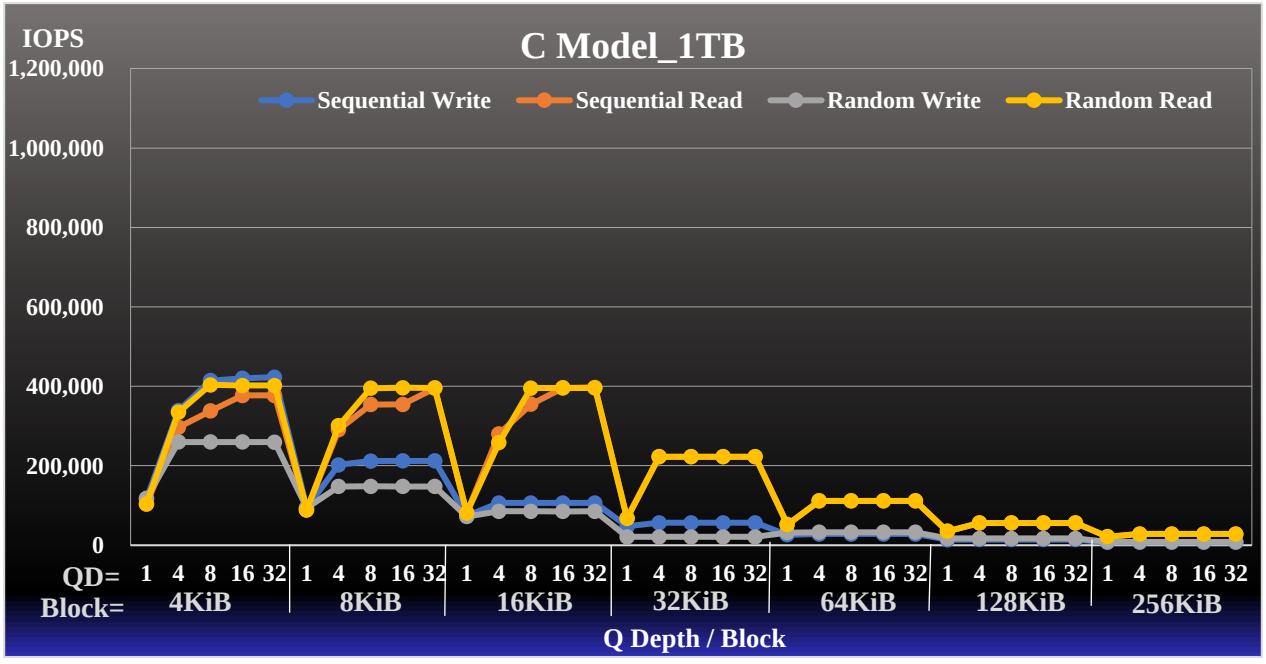

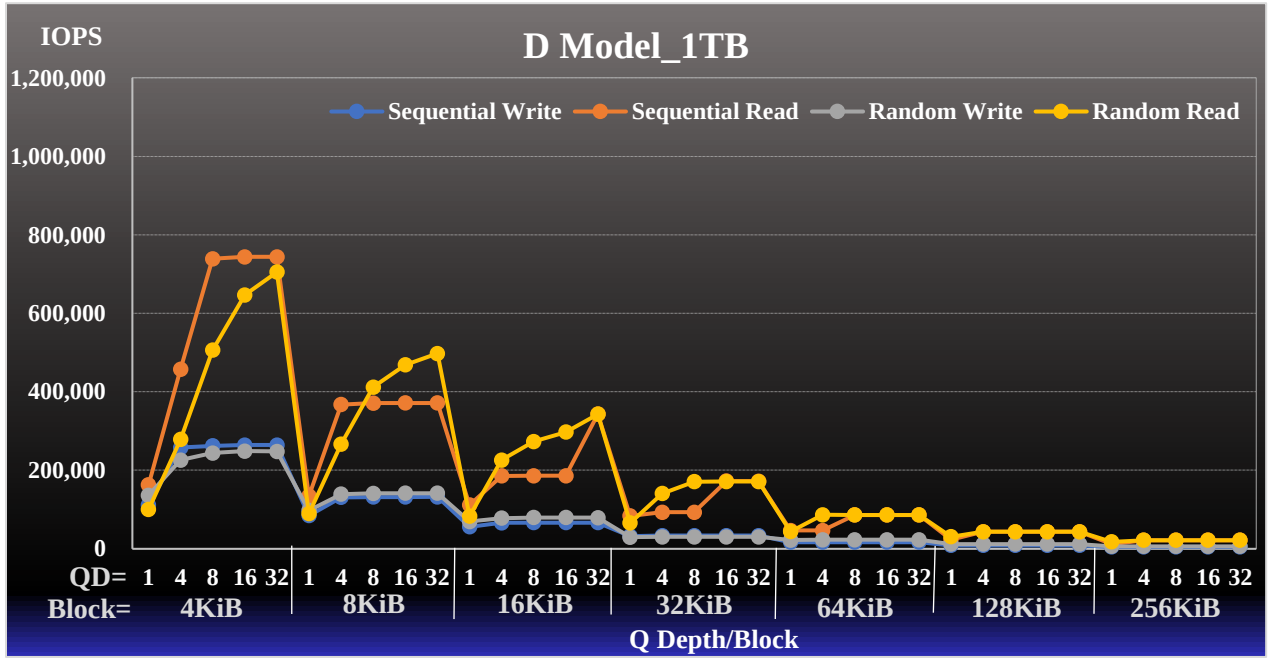

SMART TESTER for PCIe G4 Variation

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Size：Not include protrusions

Size: W460 x D420 x H350mm

M.2 SSD (2280) Connection Image

➢ One Unit Type

Model：H4PC-P4

Excellent compact design with built-in air cooling fan for SSD.

【 Support Foam Factor 】

Standard：Add in Card
Option ：M.2, U.2, CFexpress card

~Not include conversion adapter ~

➢ Separate Type

The control box and drive unit are separated.
Excellent compact design with built-in air cooling fan for SSD.

There are two type s of drive units that connect to the control box.

【Control Box】
(Tester)

Size：W340 x D325 x H180mm

【Drive Units】

➢ Add in Card Base Type

Model：H4PS-P4

M.2 SSD (2280) Connection Image

Size：W282 x D330 x H300mm

➢ EDSFF Type

Model：H4PE-P4

Size：W300 x D440 x H300mm

SMART TESTER for PCIe G4 Variation　Separate Type Image

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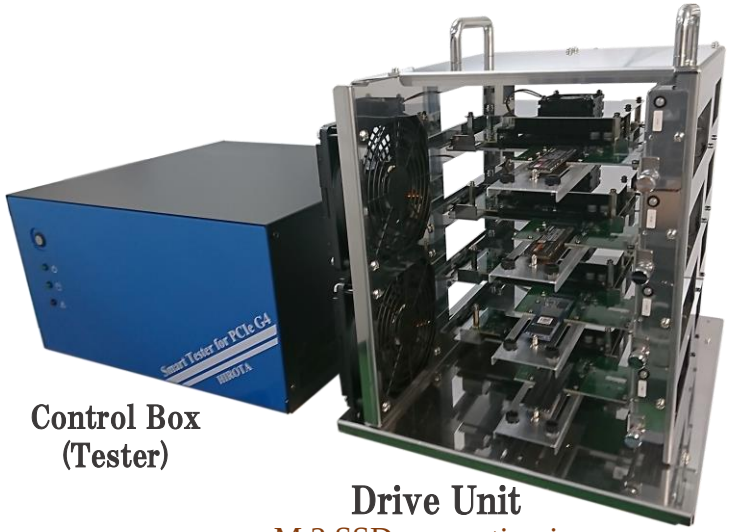
Model：H4PS-P4

➢ Add in Card Base Type Drive Unit



Control Box
(Tester)

Drive Unit
~M.2 SSD connection image~

Control Box Size：W340 x D325 x H180mm(Not include protrusions)
Drive Unit Size ：W282 x D330 x H300mm(Not include protrusions)

【 Support Foam Factor 】

Standard：Add in Card
Option ：M.2, U.2, CFexpress card

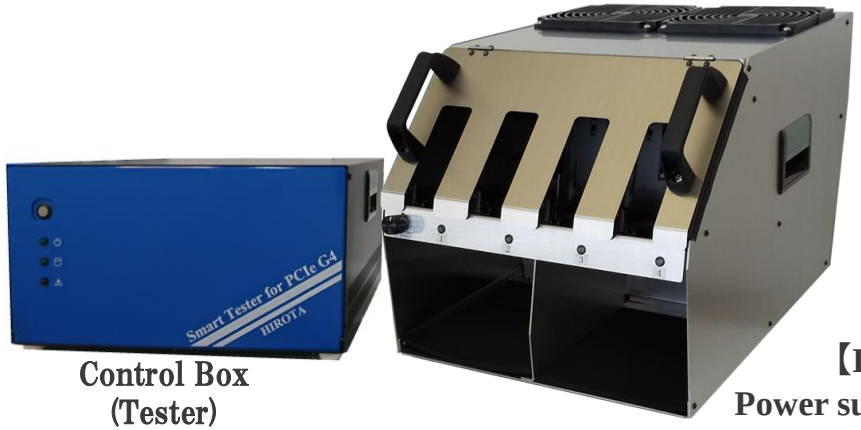
~Not include conversion adapter ~

Model：H4PE-P4

➢ EDSFF Type Drive Unit

~SSD（E1.L) connected image~

Drive Unit
~SSD non connected image~



Control Box
(Tester)

【Drive Unit】
Power supply: AC95-242V

Control Box Size：W340 x D325 x H180mm(Not include protrusions)
Drive Unit Size ：W300 x D440 x H300mm(Not include protrusions)

【 Drive Unit Structural Image 】

Standard
Back Plane Board
AIC

Built-in
Conversion Adapter
EDSFF

【 Support Foam Factor 】
【 E1.S, E1.L, E3.S 】

Each fixture can be set in the chamber to evaluate the temperature and humidity environment.

EDSFF Drive Unit Connection Image

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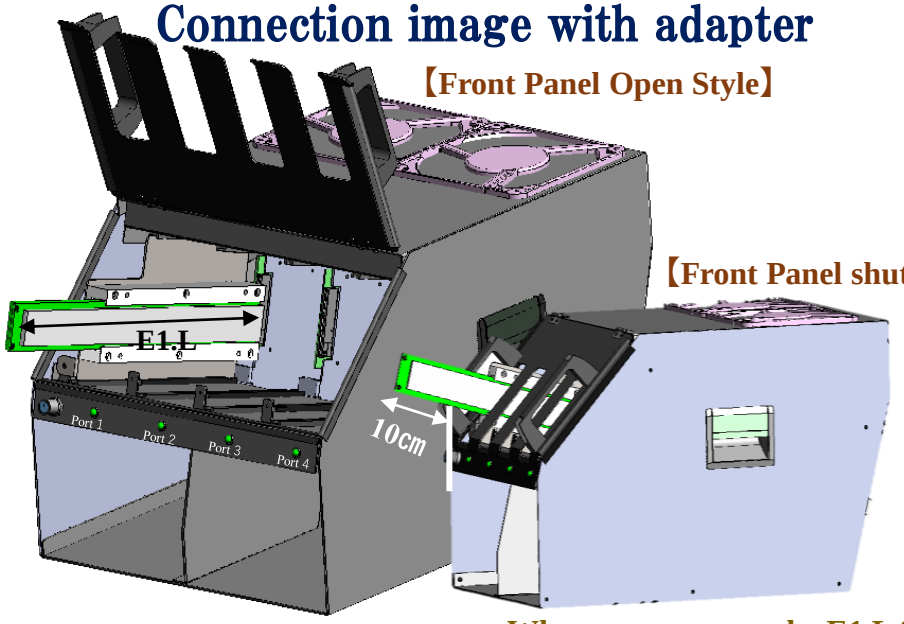
E1.L

Connection image with adapter

【Front Panel Open Style】

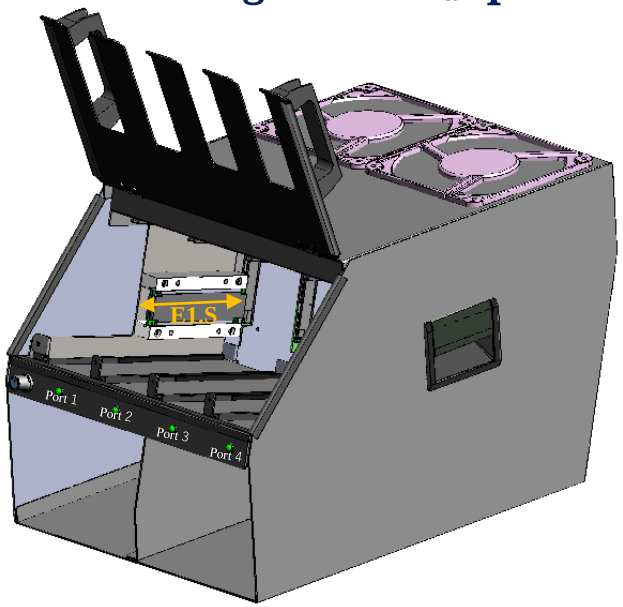


【Front Panel shut Style】

When user connect the E1.L SSD and
shut the front panel, the SSD pops out about 10 cm.

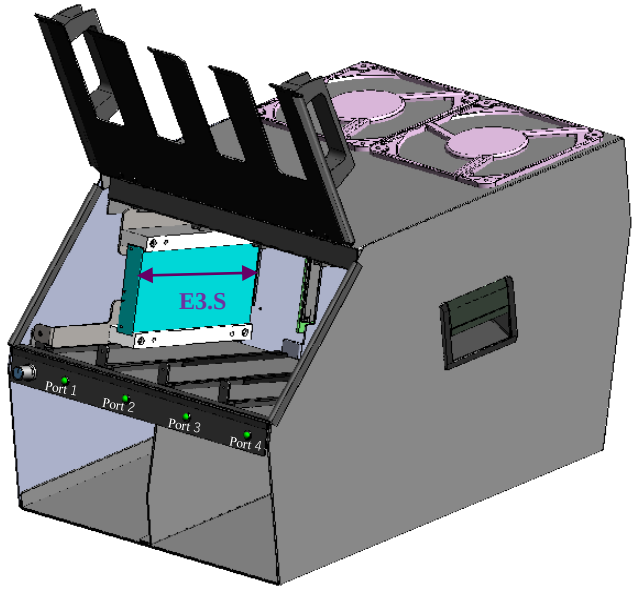
E1.S

Connection image with adapter

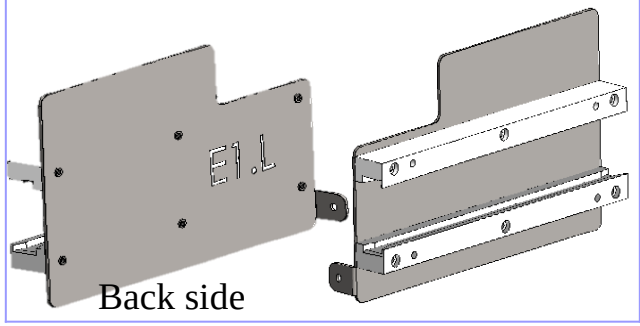
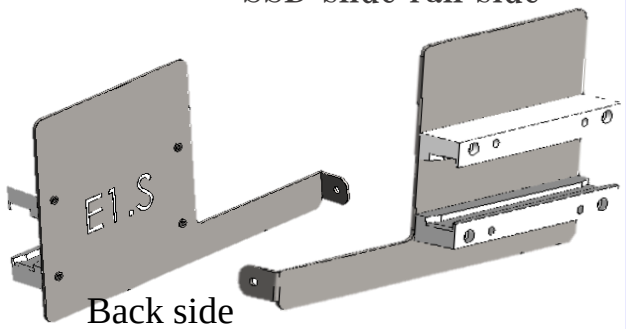
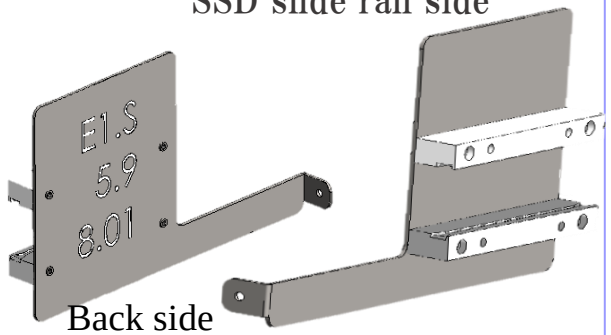
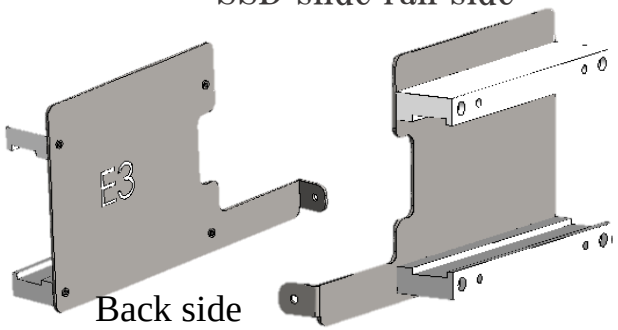


E3.S

Connection image with adapter



【SSD Hold Metal】

E1. L Thickness: 9.5mm & 18mm	E1. S Thickness: 9.5mm & 25mm	E1. S Thickness: 5.9mm & 8.01mm	E3. S Thickness: 16.8mm
SSD slide rail side  Back side	SSD slide rail side  Back side	SSD slide rail side  Back side	SSD slide rail side  Back side

※ Various adapters can be used on all ports.　Various adapters for 4 ports are standard accessories.　Housing material：Stainless steel (SUS430) without painting.

SMART TESTER for PCIe G3 Variation

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➢ Control Unit

User can select various combinations of the Drive Unit for control unit.

Size：W250 x D330 x H140mm
Size：Not include protrusions

EDSFF Drive Unit connection image.

➢ Drive Unit (Fixture) Lineup

【 Horizontal Insertion Type 】

Standard：Add in Card
Option ：M.2, U.2, CFexpress card

~Not include conversion adapter ~

Size：W250 x D230 x H160mm

【 Multi Angle Type 】

Size：W370 x D312 x H520mm

【 M.2 Type 】

for M.2 SSD(2230-22110)

Size：W395 x D158 x H47mm

【 EDSFF Type 】

for E1.S, E1.L, E3.S

Size：W300 x D440 x H300mm

Customer introduction

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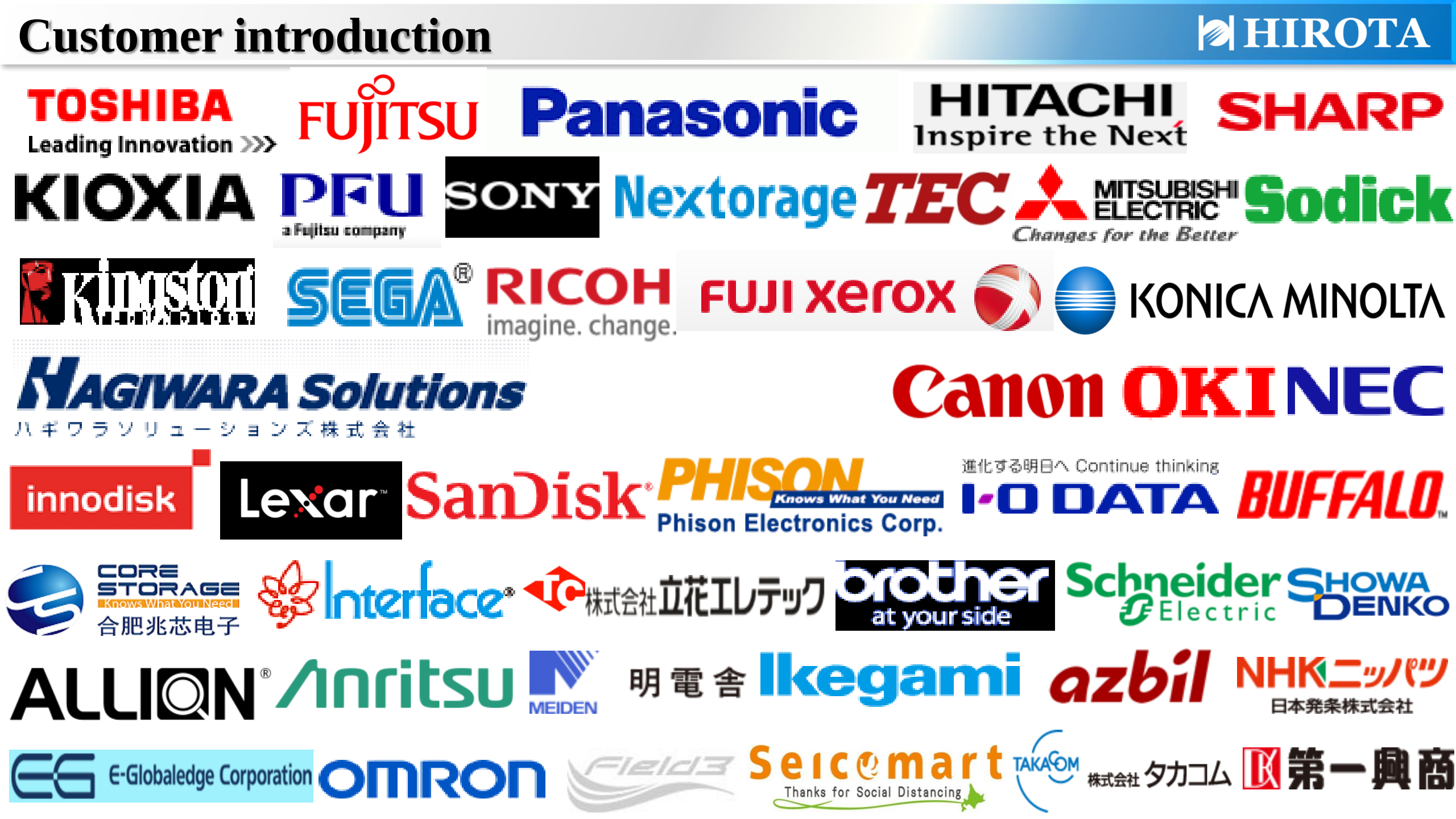

Access Work Load & Evaluation

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Issue a corresponding command for each protocol and execute flexible combination evaluation.

Flexible combination

Professional function

Double Method Access

Standardization Test

- **TBW Test *(Enterprise & Client)***
  JEDEC218/219
  • Endurance • Data Retention • Read Disturb
- **SNIA SSS PTS *(Enterprise & Client)***
  Performance Test *for* Steady State

Vendor Unique Test

- **Flexibility Test**
  • Performance • Endurance • Power Management
  • Low Power Management
- **Visualization by graph display**
  • Performance • Power

Overview of the evaluation items

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Basic Function

- SMART Information (User threshold determination)
- Identify Infomation
- Secure erase(Enhanced)　Sanitize　TRIM
- Queuing Depth

Evaluation & Analysis

Display graph

Performance

- SNIA SSS PTS　Enterprise & Client
  Measurement and report generation
- Generation & Lane control Access
- Write & Read & Compare (Any access workload)

Display graph

Reliability

Power Management

- Voltage margin（Degradation control is possible）
- Limit of voltage drop
- Power on / off immunity
- Power shutdown（Guarantee of the write data）

Auto saved data(Summary & csv data)

The combination of workload can be changed freely

Endurance

- **TBW(JEDEC 218/219) Enterprise & Client Endurance, Read** disturb, **Data Retention**
- **Used percentage check**

Display graph

Power Efficient

Low Power Management

- **CLKREQ#　(L0, L1, L1.2)**
- **Consumption current measurement (Measurement resolution: µAmpere_OP)**

Tester Basic Specifications

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Item	SMART TESTER for PCIe (Generation 3)	SMART TESTER for PCIe G4 (Generation 4)		
Model	H4PR-P3F4	H4PC-P4	H4PS-P4	H4PE-P4
Interface	PCIe Gen-1 (2.5Gbps) ～ Gen-3 (8.0Gbps)	PCIe Gen-1 ～ Gen-4 (16Gbps) 4 Lane ～ Controllable ～		
Lane	4 Lane ～ Controllable ～			
Connect port	4port/Tester Expandable with Cascade Connection			
Protocol Ver.	NVMe1.3, AHCI	NVMe 1.4		
Memory	8GB/Tester, I/F buffer：64MB/port	32GB/Tester, I/F buffer：4GB/port		
SM Bus	－	○	○	○
Hot plug	○	○	○	○
UART	○	○	○	○
Foam Factor	Standard：Add in Card Type Connecter	OP：U.2, M.2(2230-22110), CFexpress card		EDSFF (L1.S, L1.L, E3.S)
Power Supply	AC95～242V 47/63Hz			
Environment	Ambient Temperature: 20℃～40℃, Ambient Humidity :20～80%RH, * No condensation exists.			
Outer Dimensions	W370*D310*H530mm (Multi angle model)	W420*D460*H350mm	Tester：W340*D325*H180mm D U：W282*D330*H300mm	Tester：W340*D325*H180mm DU：W300*D440*H300mm

【Memo】 1. Not include OP conversion adapter .
2. The FESFF Drive Unit is also available in Gen 3 Type. Please contact us for details.

～Specifications are subject to change without notice～

Control Power Management

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項目	概要
Drive Power Supply	+12V Variable range : 8.0V to 14.5V (20mV step pitch) Voltage accuracy : ±100mV Max current : 3.5A +3.3V Variable range : 2.0V to 4.0V (10mV step pitch) Voltage accuracy : ±50mV Max current : 4.2A
Detection of Excessive Drive Supply Voltage	+12V 15.2V± 3% +3.3V 4.6V± 3% Power off the detect port drive, when detect the overvoltage detection.
Measurement of Drive Power Supply Voltage	+12V measure range 0.0V to 15.0V measure accuracy ±3%F.S +3.3V 0.0V to 5.0V measure accuracy ±3%F.S Resolution : 3.3V≒3.5mV 12V≒7.9mV Sampling rate 125µsec to 0.2sec (125µs step) Sampling memory 65,520 data / port
Measurement of Drive Power Supply Current	+12V measure range 0.0A to 4.0A measure accuracy ±3%F.S +3.3V 0.0A to 5.0A measure accuracy ±3%F.S Resolution : 3.3V≒2.6mA 12V≒2.0mA Sampling rate 125µsec to 0.2sec (125µs step) Sampling memory 65,520 data / port
CLKREQ#	L1.2 level ⇒ Micro current measurement: µA(Option) (Power saving transition level: L0➢L1➢L1.2)

Example of Current & Voltage Measurement

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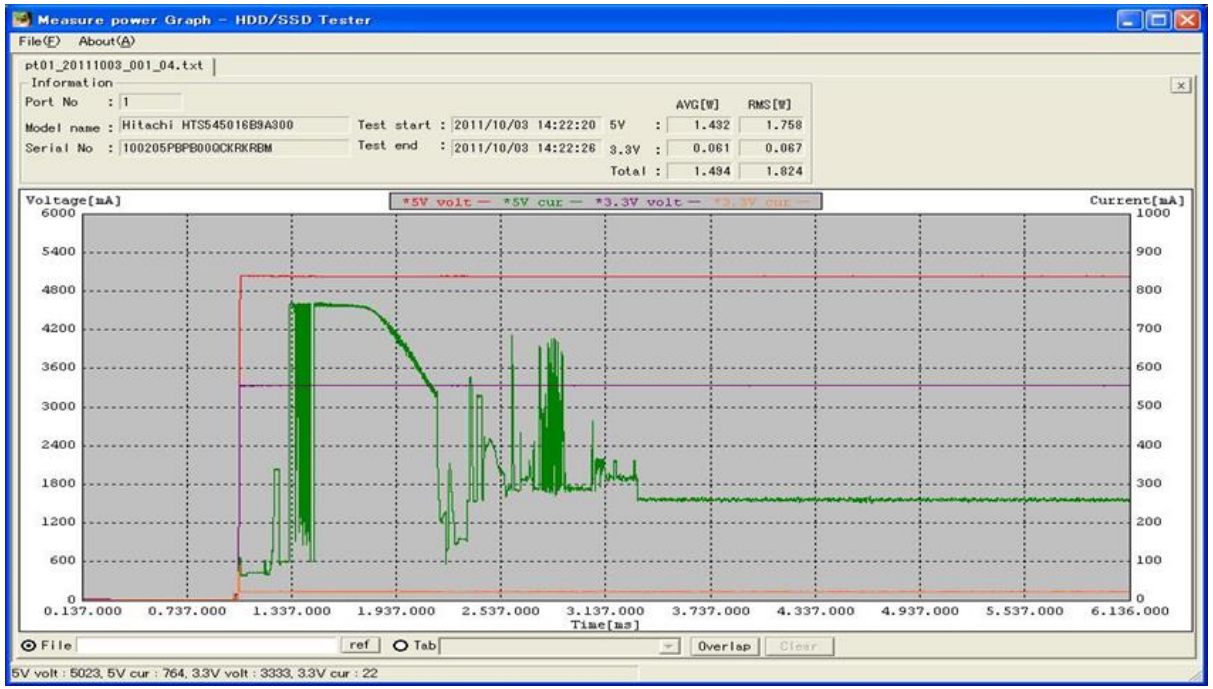
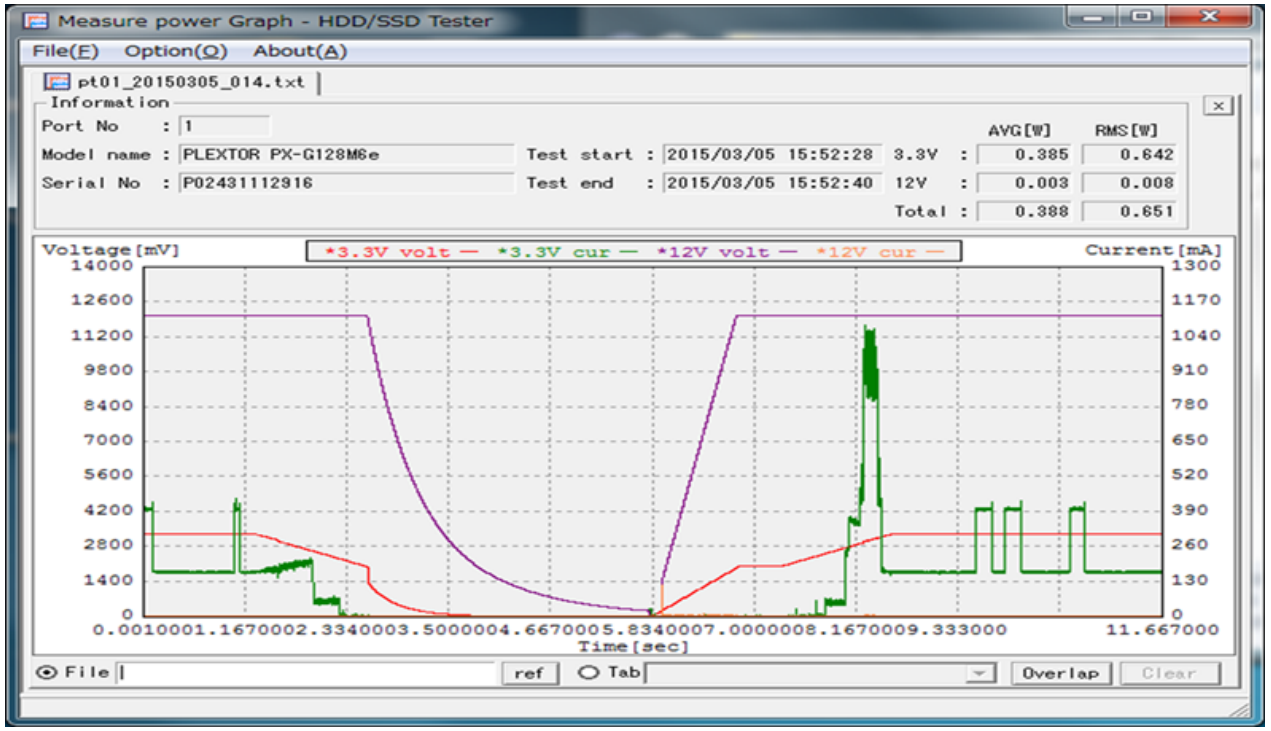


Wave at Power ON

Wave at Power OFF - ON



Efficient power evaluation

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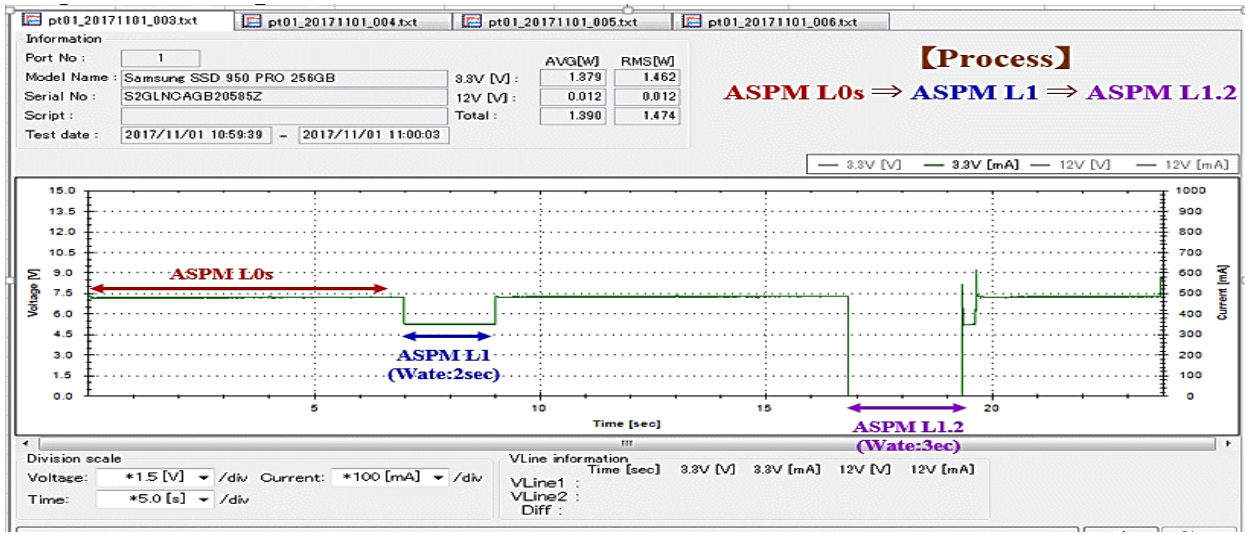
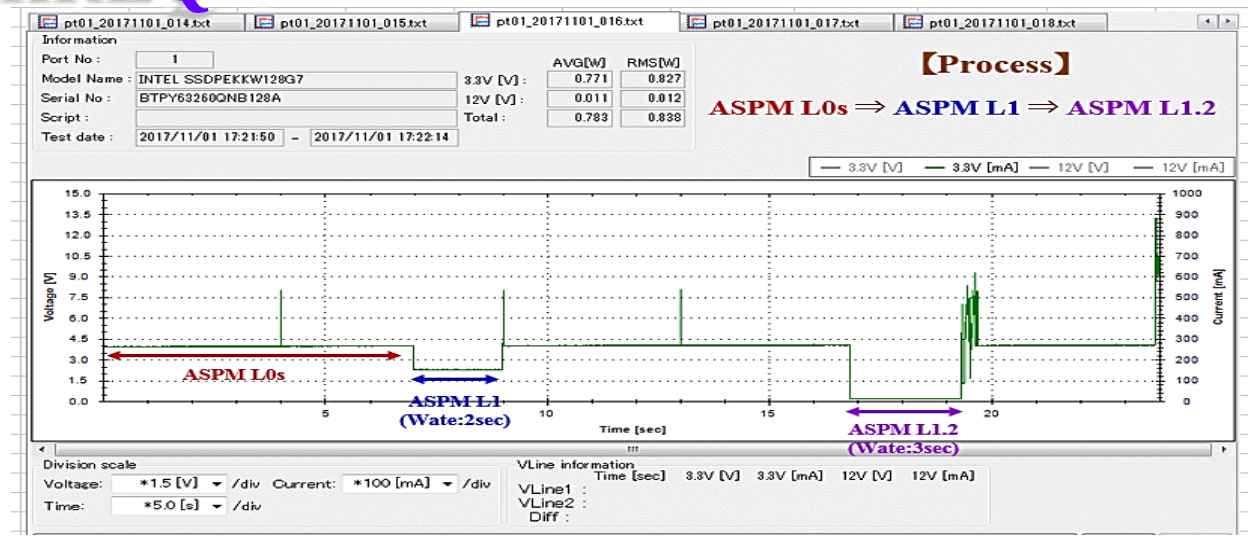
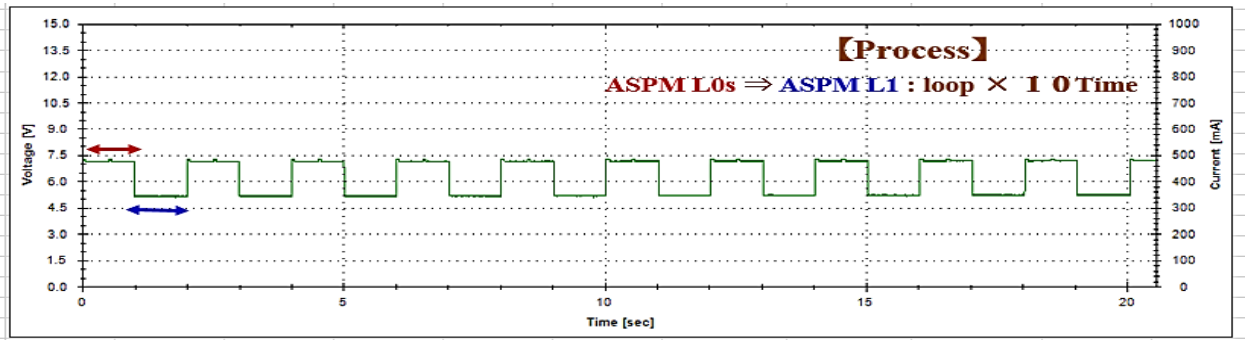
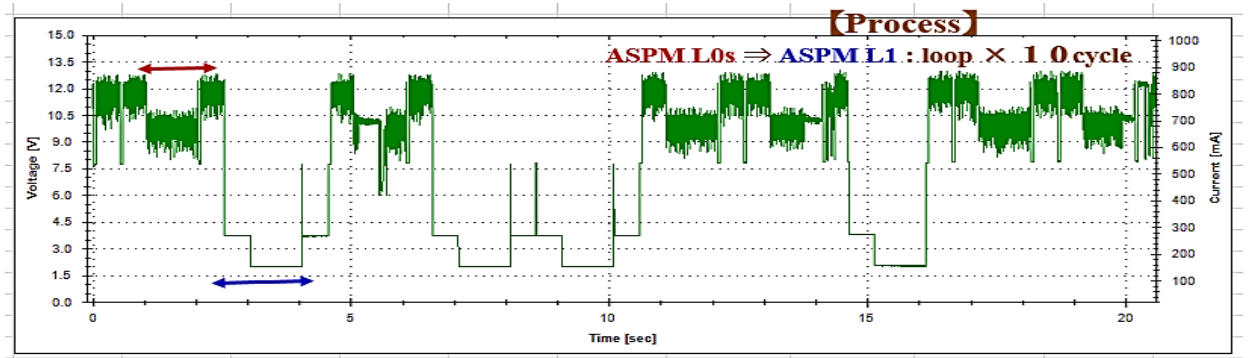
Low Power Measurement 【Sample】 CLKREQ

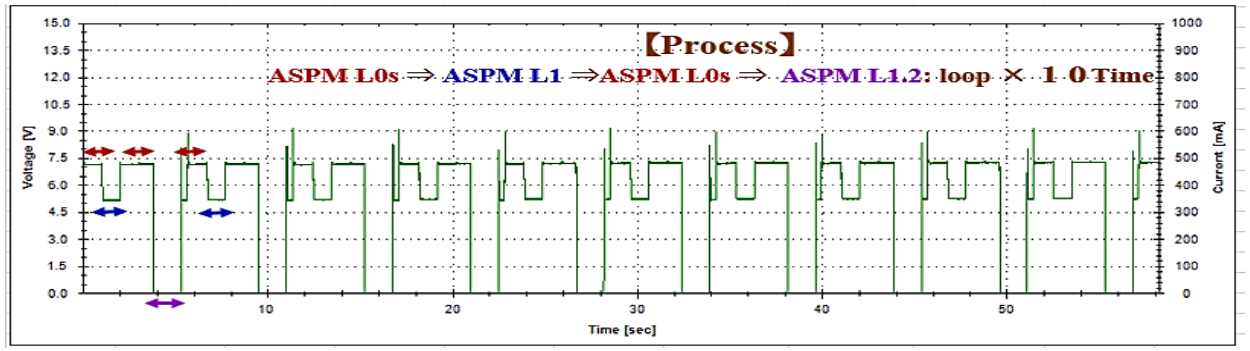
PCIe Type

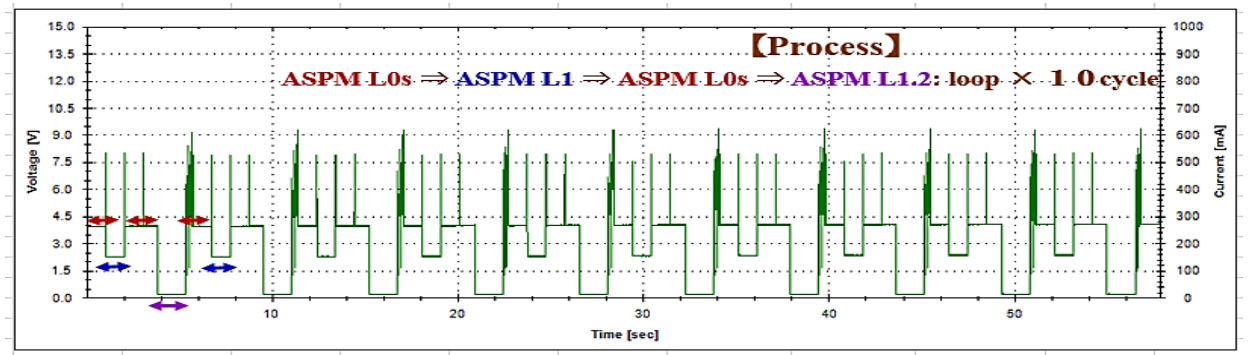












Efficient power evaluation

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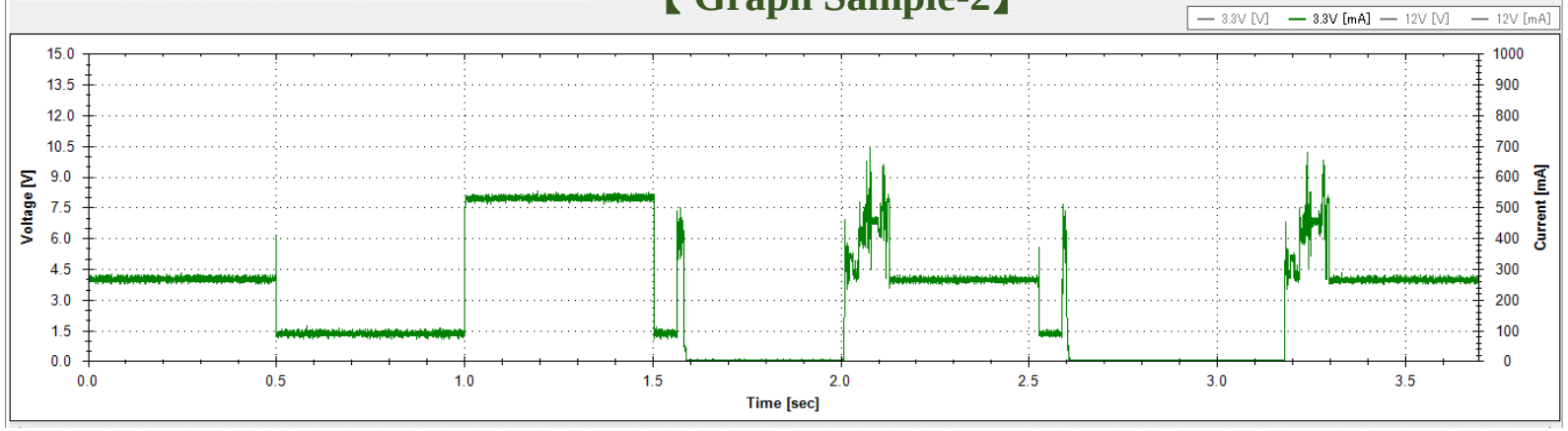
【処理内容】 Idle ⇒ L1 ⇒ L1.1 ⇒ L1.2 ステートの遷移と電流値を確認

Resolution：μA

Information

			AVG[W]	RMS[W]
Port No :	5			
Model Name :	INTEL SSDPEKKW128G7	3.3V [V] :	0.698	0.919
Serial No :	BTPY63260QNB128A	12V [V] :	0.023	0.034
Script :	130_check_link_state_uA	Total :	0.721	0.953
Test date :	2019/10/23 17:12:38 -	2019/10/23 17:12:41		

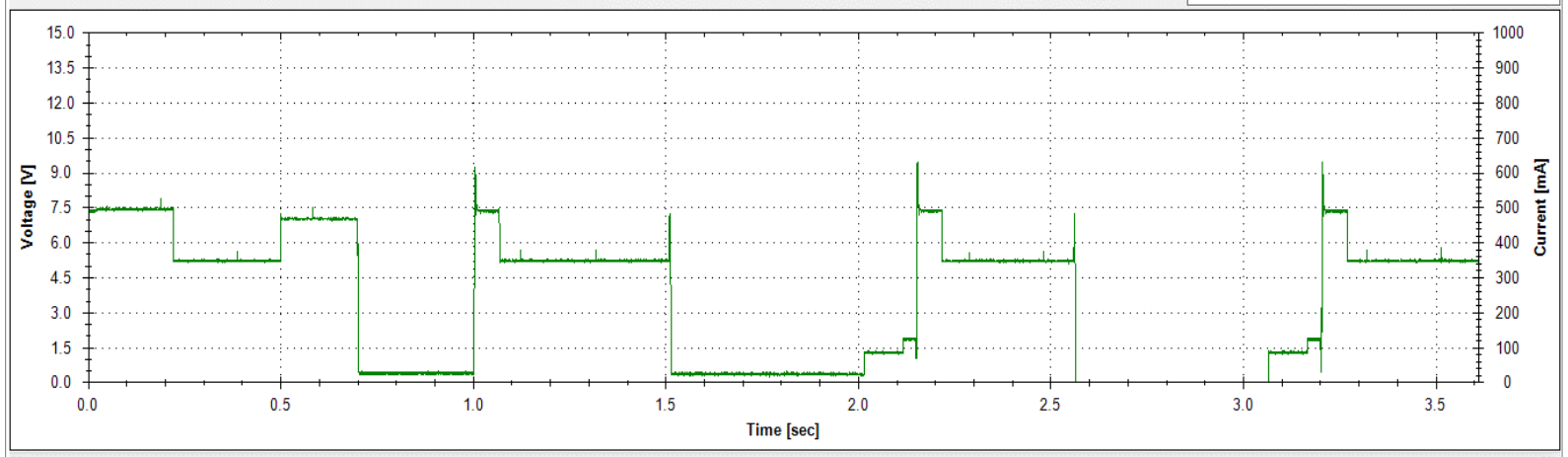
【 Graph Sample-2】



Information

			AVG[W]	RMS[W]
Port No :	8			
Model Name :	Samsung SSD 960 EVO 250GB	3.3V [V] :	0.765	0.982
Serial No :	S3ESNX0J200284V	12V [V] :	0.013	0.020
Script :	130_check_link_state_uA	Total :	0.778	1.002
Test date :	2019/10/23 17:12:55 -	2019/10/23 17:12:59		

【 Graph Sample-2】



【 Summary Sample-1 】

```
**********************************************************
 power management features support info
**********************************************************
    Number of Power States Support: 0x0004
    ASPM L0s :not support
    ASPM L1  :support
    ASPM L1.1:support
    ASPM L1.2:support
    PM L1.1  :support
    PM L1.2  :support
**********************************************************
 [sec.msec.usec] power management features operate log
**********************************************************
 [00.036.861] IDLE Stat Electric Current     :     266[mA]

 [00.536.894] ASPM L1.0 State In
 [00.787.671] ASPM L1.0 Electric Current     :      90[mA]
 [01.039.525] ASPM L1.0 State Out

 [01.540.441] ASPM L1.1 State In
 [01.794.063] ASPM L1.1 CLKREQ# Signal state:       1
 [01.794.524] ASPM L1.1 Electric Current     :    1673[uA]
 [02.047.183] ASPM L1.1 CLKREQ# Signal state:       0
 [02.047.198] ASPM L1.1 State Out

 [02.562.941] ASPM L1.2 State In
 [02.817.266] ASPM L1.2 CLKREQ# Signal state:       1
 [02.817.700] ASPM L1.2 Electric Current     :     987[uA]
 [03.216.873] ASPM L1.2 CLKREQ# Signal state:       0
 [03.216.889] ASPM L1.2 State Out
```

【 Summary Sample-2 】

```
**********************************************************
 power management features support info
**********************************************************
    Number of Power States Support: 0x0004
    ASPM L0s :not support
    ASPM L1  :support
    ASPM L1.1:support
    ASPM L1.2:support
    PM L1.1  :support
    PM L1.2  :support
**********************************************************
 [sec.msec.usec] power management features operate log
**********************************************************
 [00.036.872] IDLE Stat Electric Current     :     488[mA]

 [00.536.899] ASPM L1.0 State In
 [00.788.831] ASPM L1.0 Electric Current     :      25[mA]
 [01.045.932] ASPM L1.0 State Out

 [01.547.797] ASPM L1.1 State In
 [01.801.618] ASPM L1.1 CLKREQ# Signal state:       1
 [01.801.909] ASPM L1.1 Electric Current     :   22000[uA]
 [02.054.099] ASPM L1.1 CLKREQ# Signal state:       0
 [02.054.113] ASPM L1.1 State Out
 [02.598.307] ASPM L1.2 State In
 [02.851.765] ASPM L1.2 CLKREQ# Signal state:       1
 [02.852.253] ASPM L1.2 Electric Current     :     993[uA]
 [03.104.329] ASPM L1.2 CLKREQ# Signal state:       0
 [03.104.344] ASPM L1.2 State Out
```

Power stress Test script

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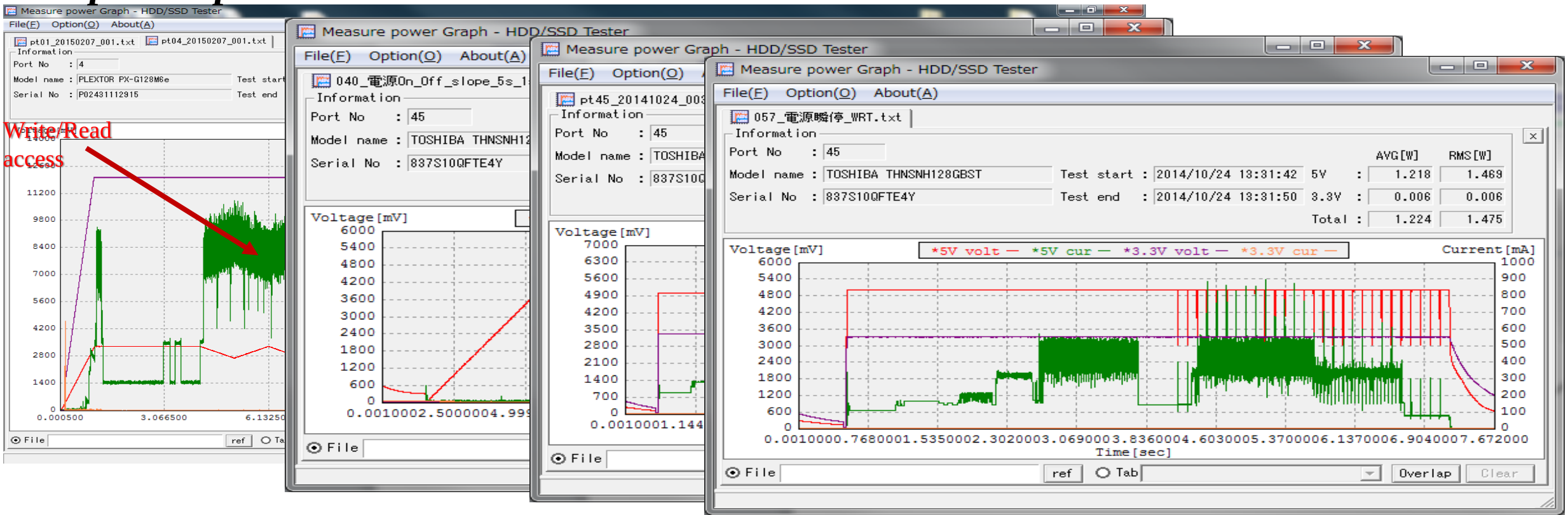
- Assume a bad power supply, oscillation, noise, etc., and execute a simulation test.
- Supports toggle function and up / down slope control function.
- The measured data can be graphed in real time and confirmed.

◆ Voltage margin +12V Variable range : 8.0V to 14.5V (20mV step pitch)
+3.3V Variable range : 2.0V to 4.0V (10mV step pitch)

Sample Graph



Example of Benchmarking Evaluation by Variable Voltage

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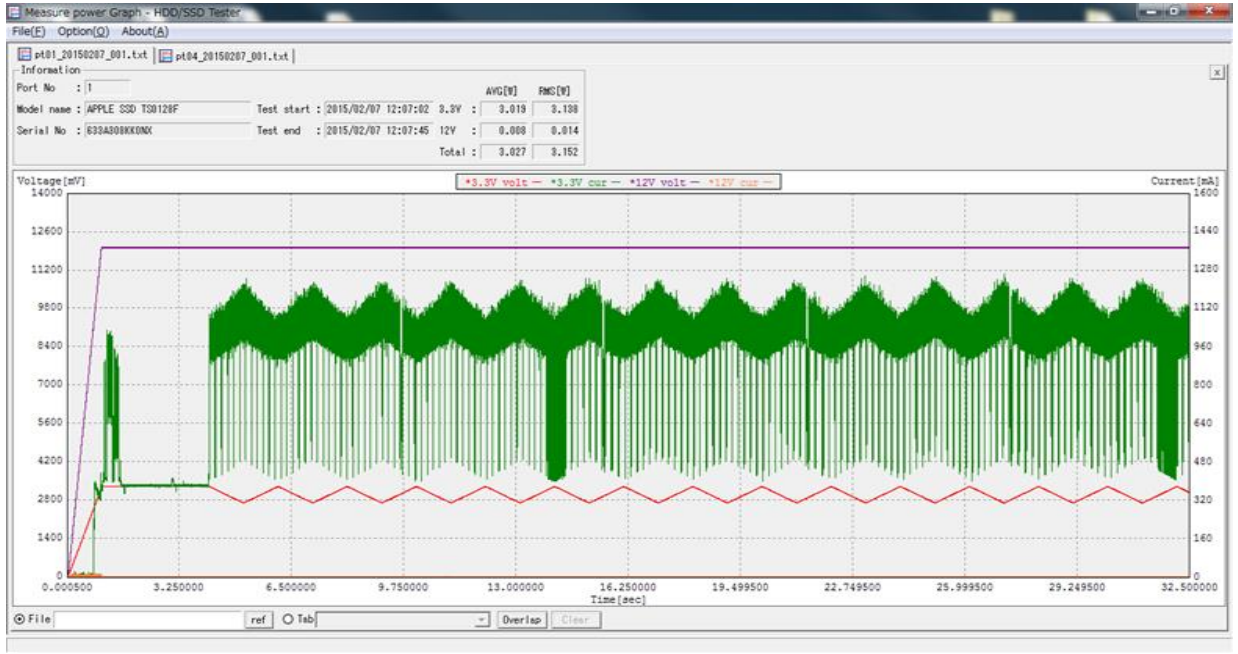
A Model

Benchmarking with the same condition

B Model Drive



Capable of measuring the current while varying the voltage.

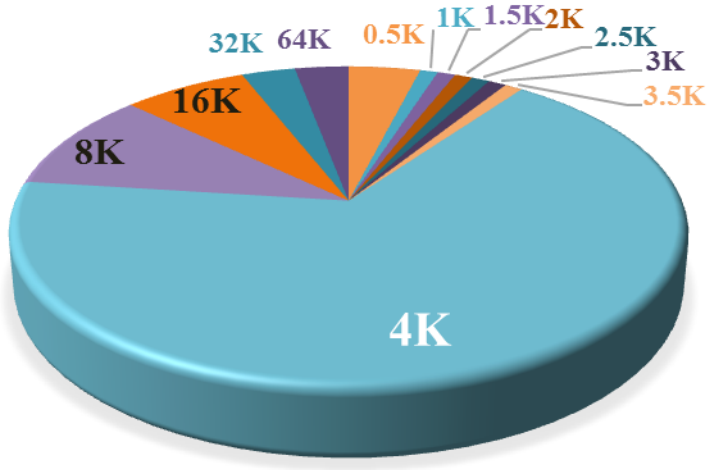
- **B Model was reset by the voltage drop under unstable voltage environment.**

◆ **Voltage margin** ・ +12V Variable range : 8.0V to 14.5V (20mV step pitch) ・ +3.3V Variable range : 2.0V to 4.0V (10mV step pitch)

Endurance Test

for Enterprise Model

Standard Ratio Access

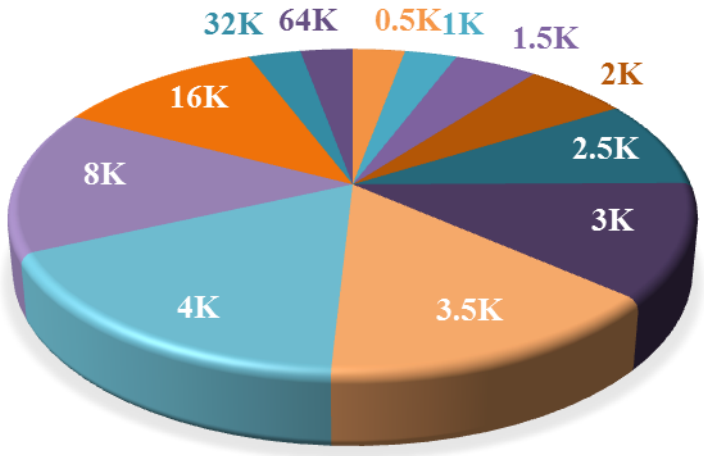


Access conditions are changeable.

- Transfer Brock Length
- Access share

(by random Access)

Flexible Ratio Access
(Original Script)



for Client Model

The test scripts are available in accordance with JEDEC Standard, 【JESD 218A】

Data Retention Test, Read Disturb Test, the script is already prepared.

【Ref】 Data Retention Test is keep it in a temperature control Chamber without power supply temperature: 125 ℃
Leave time: client SSD = 336 H Enterprise SSD = 504 H

Percentage Used vs Performance

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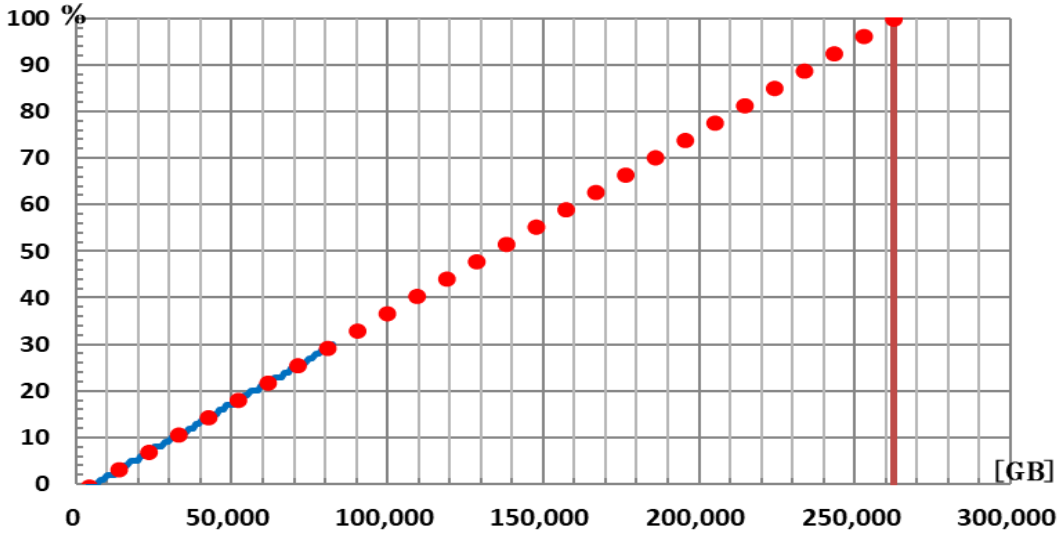
TBW Predictive Evaluation

****
* Running Log *
****

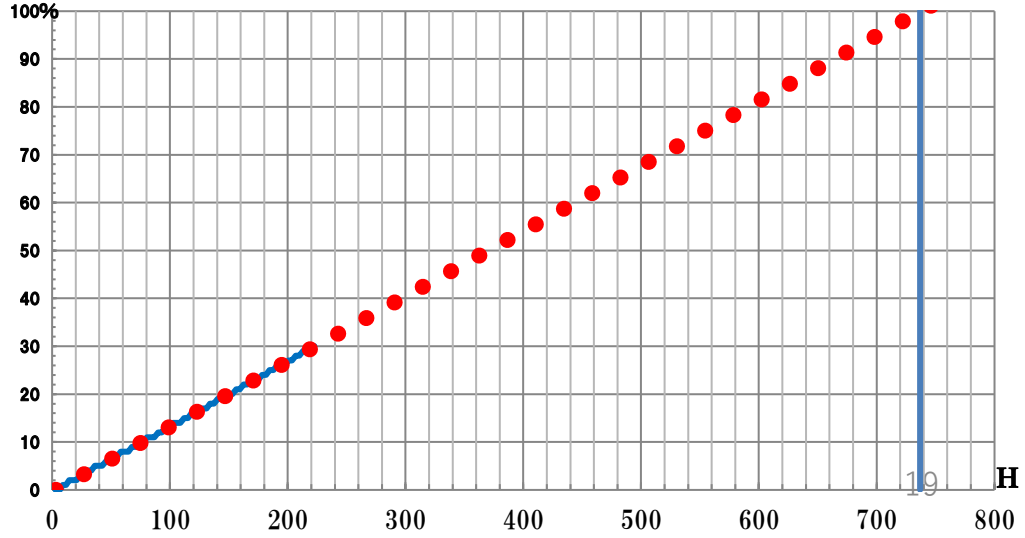
Elapsed Time [day:h:m:s]	Count	Endurance Indicator [%]	Total WR in test [TiB]	Written Statistics [TiB]	Rate [MB/s]
000:00:18:42	1	1	0.4	0	456
000:00:37:38	2	1	0.9	0	450
000:00:56:18	3	1	1.3	0	457
000:01:14:56	4	1	1.8	0	458
000:01:33:33	5	2	2.3	0	458
000:01:52:12	6	2	2.7	0	457
000:02:10:51	7	2	3.2	0	457
000:02:29:30	8	2	3.7	0	457
000:02:48:11	9	2	4.1	0	456
000:03:06:52	10	2	4.6	0	456
000:03:25:32	11	2	5.1	0	457
000:03:44:19	12	2	5.5	0	454
000:04:03:03	13	2	6.0	0	455
000:04:21:41	14	2	6.5	0	458
000:04:40:23	15	2	6.9	0	456
000:04:59:02	16	2	7.4	0	457
000:05:17:39	17	2	7.9	0	458
000:05:36:19	18	2	8.3	0	457
000:05:54:55	19	3	8.8	0	458
000:06:13:33	20	3	9.3	0	458
000:06:32:15	21	3	9.7	0	456
000:06:50:56	22	3	10.2	0	456
000:07:09:36	23	3	10.7	0	457
000:07:28:19	24	3	11.1	0	456
000:07:47:03	25	3	11.6	0	455
000:08:05:40	26	3	12.1	0	458
000:08:24:17	27	3	12.5	0	458
000:08:42:55	28	3	13.0	0	458
000:09:01:38	29	3	13.5	0	456
000:09:20:20	30	3	13.9	0	456
000:09:39:04	31	3	14.4	0	455
000:09:57:43	32	3	14.8	0	457
000:10:16:25	33	3	15.3	0	456
000:10:35:02	34	4	15.8	0	458
000:10:53:43	35	4	16.2	0	456
000:11:12:29	36	4	16.7	0	454

NVMe xxx Model 512GB Sample Graph

【Writing capacity prediction】



【Writing time prediction】



Performance (IOPS) vs Power measurement

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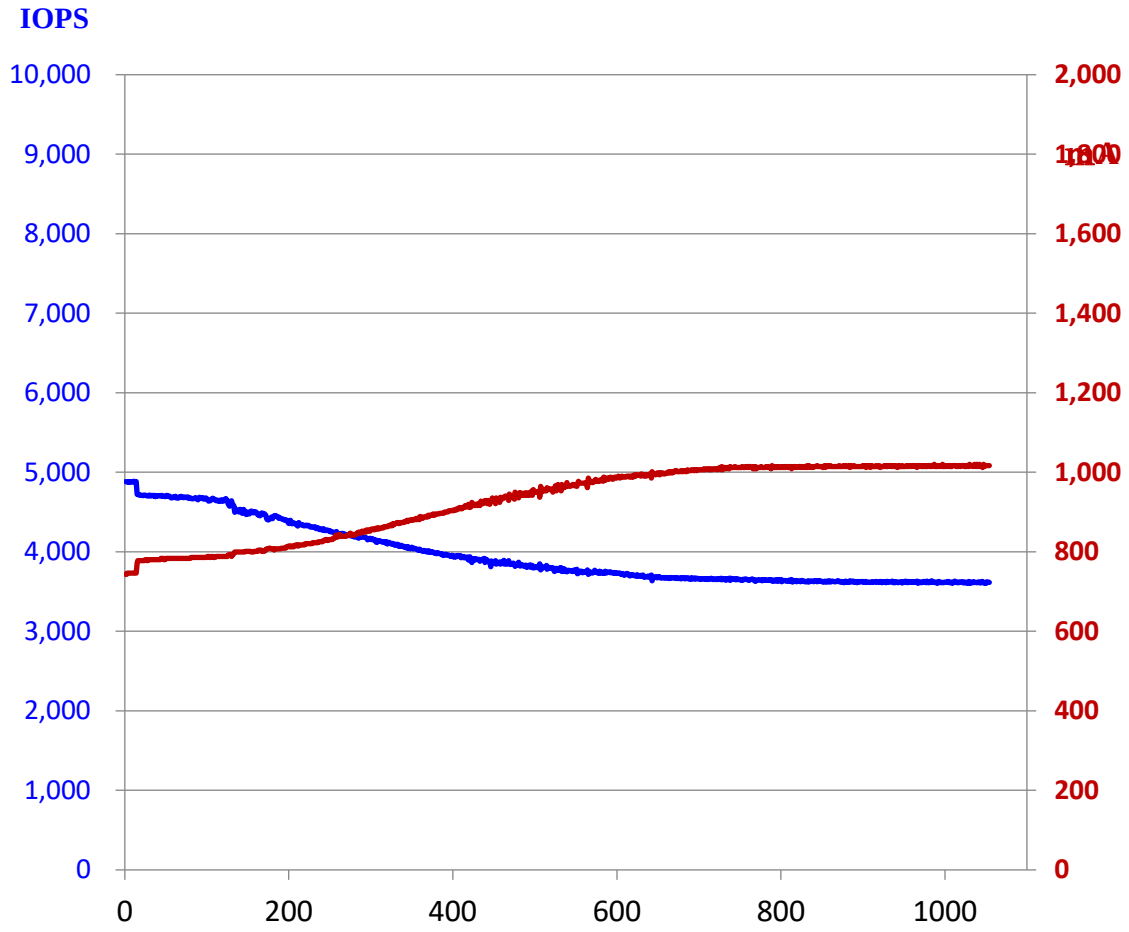
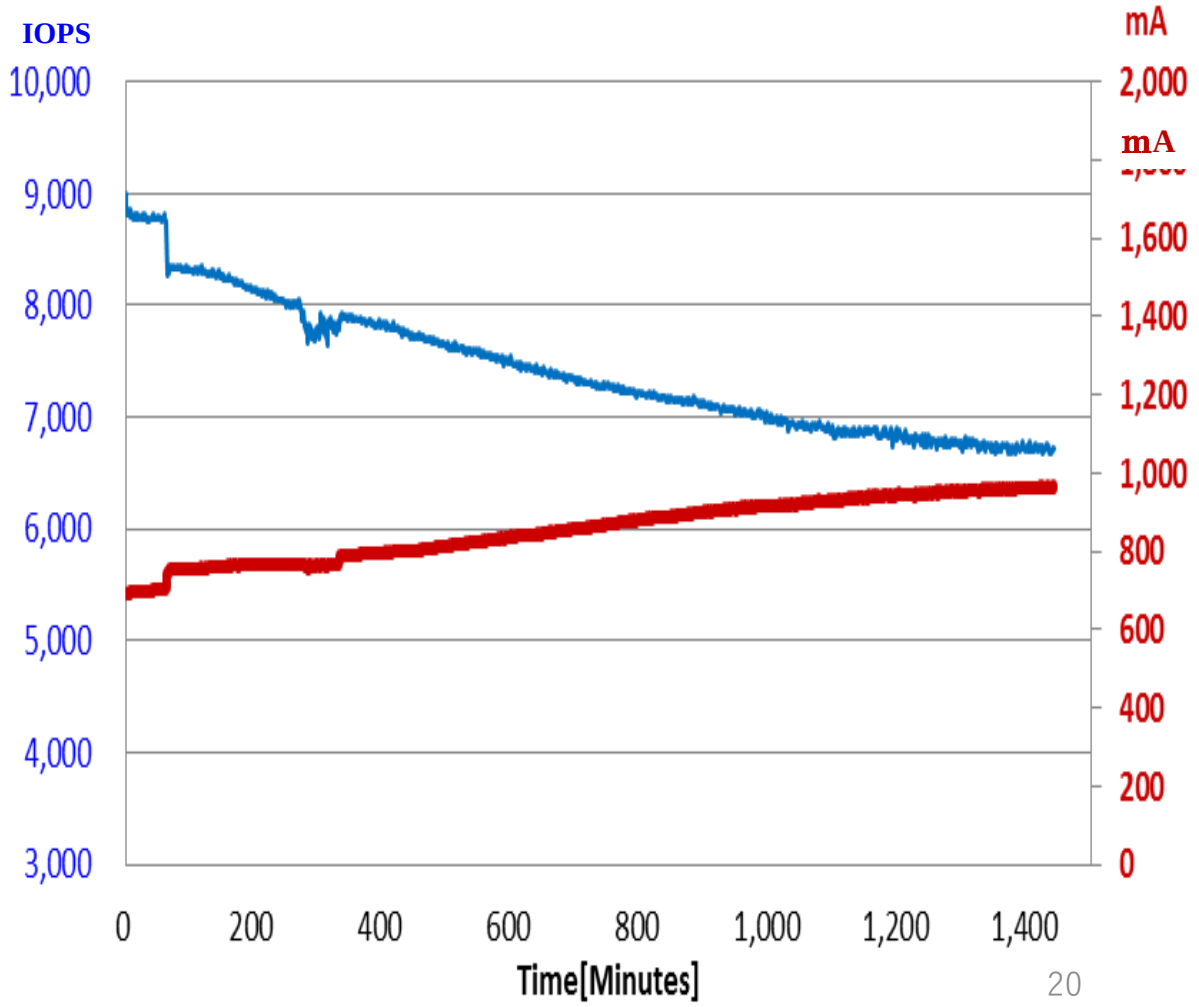
NVMe xxx Model Sample Graph



NVMe xxx Model Sample Graph



主な機能-9

SNIA SSS PTS

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テスト 項目	概　要
IOPS IOPS Test	We measure and analyze IOPS (Input / Output per second) down to Steady State based on seven kinds of Read/Write combinations and eight kinds access block sizes (=56 kinds combinations)
TP Throughput Test	We measure and analyze the throughput down to Steady state in two block sizes of 1024KiB and 128KiB.
Latency Latency Test	We measure and analyze the Average Latency and Maximum Latency in three kinds combinations of Read / write and three kinds access block sizes.
Write Saturation Write Saturation Test	We measure and analyze IOPS drop compare with writing time or TGBW(Total GiB Byte Written). The evaluation starts from 24 hours after FOB state or after achieved four times SSD capacity writing.
HIR Host Idle Recovery Test	We measure SSD performance affection of continuous writing performance in small blocks (4KiB Random) by host IDLE time.
XSR Cross Stimulus Recovery Test	We measure and analyze the performance affection at write access switch timing from SEQ(1024KiB) to RND(8KiB) and from RND(8KiB) to SEQ(1024KiB).
CBW Composite Block Size Workload Test	We measure the performance under mixed ten work loads which is not simple transfer length like RND 4KB.
DIRTH Demand Intensity / Response Time Histogram Test	We can create the histogram of IOPS vs operating time related to two kinds work loads.

SNIA SSS PTS

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【About SNIA】

SNIA is Storage Networking Industry Association which is the largest storage network industry association.

【SSS PTS】

SSS PTS : Solid State Storage Performance Test Specification

Measure the performance of the SSD that reached steady state with the specified workload.

Outputs the obtained measurement result in specified report format.

【Merit】

- Objective comparative evaluation of SSDs with world standard specifications
- It can see the marginal performance of the SSD in just one day
- It can objectively compare and evaluate SSD according to the prescribed method
- Automated by dedicated script and it can be evaluated efficiently
- Various result report such as three dimensional graph can be issued automatically

SNIA SSS PTS の評価事例

Benchmark

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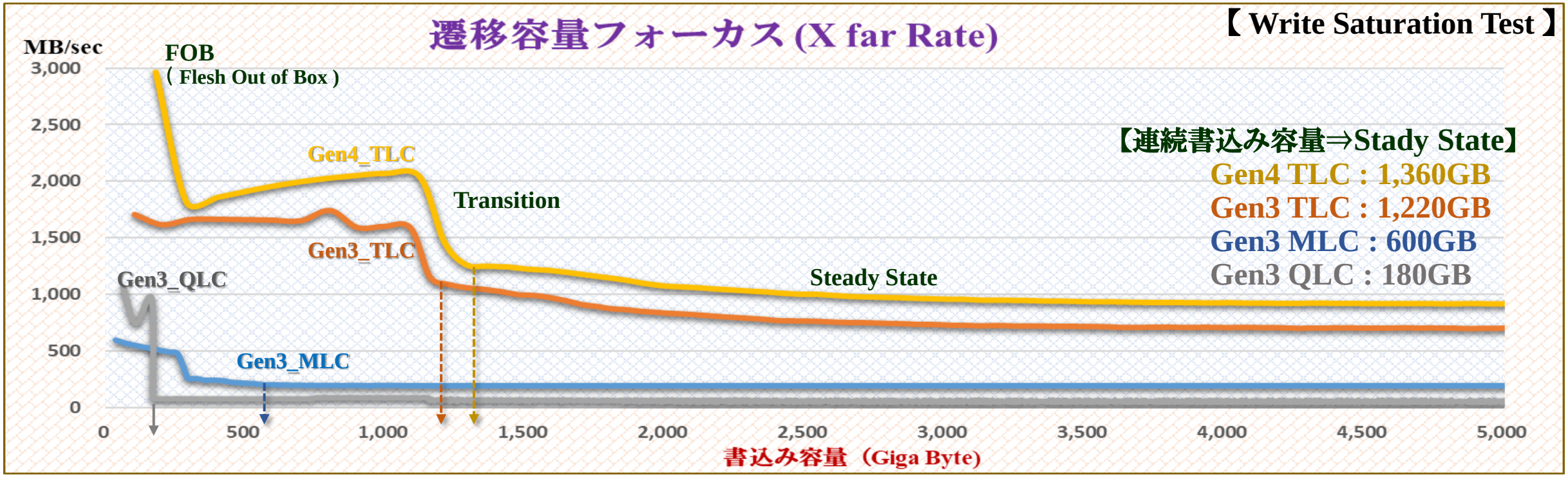
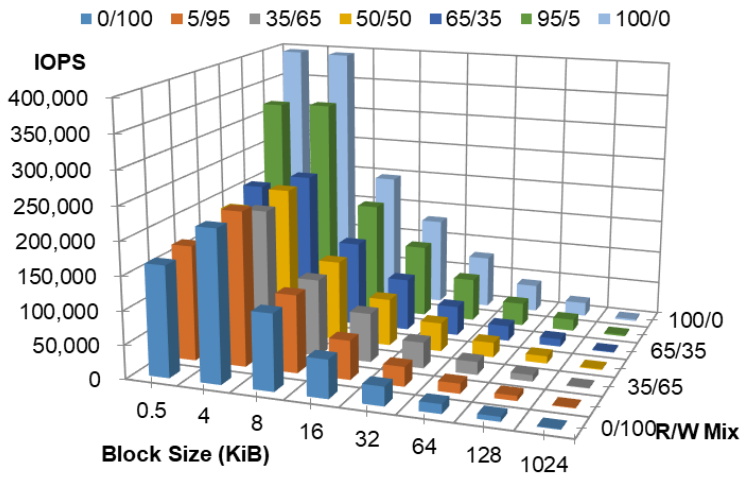
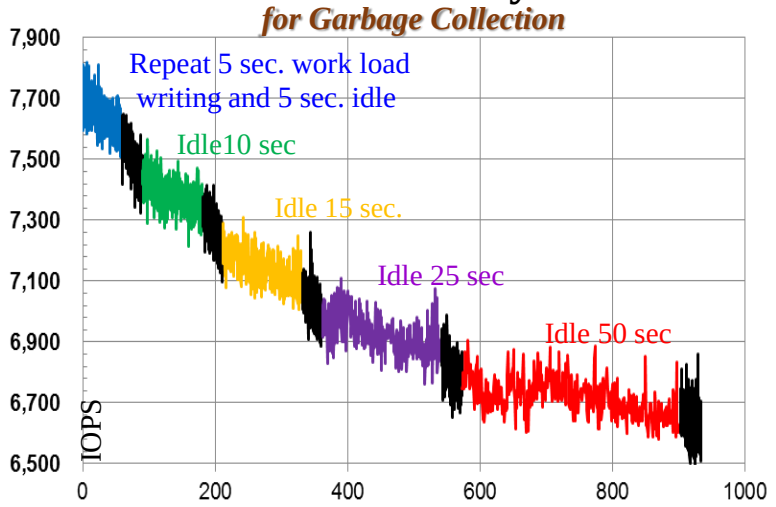
【 Write Saturation Test 】



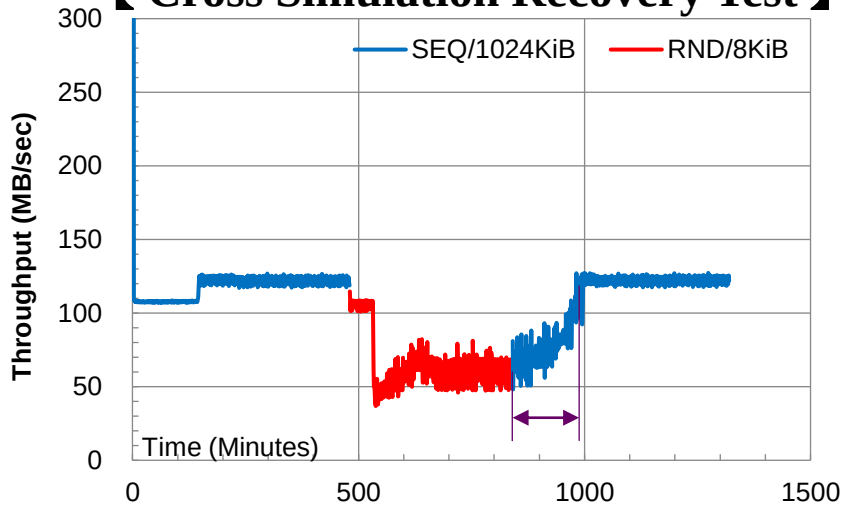
【 IOPS Test 】



【 Host Idle Recovery Test 】



【 Cross Simulation Recovery Test 】



Thank you.

Please feel free to contact us.

【 Sales representative 】

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High Quality & Total Technology

HIROTA

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