HP SSD EX900 Pro M.2

Product Specification

Capacity: 256GB, 512GB, 1TB,

Components: 3D NAND/ DRAM Cache

Read and Write IOPS

(Iometer* Queue Depth 32)

— 256 GB

Random 4 KB reads: Up to 167 K IOPS

Random 4 KB writes: Up to 133 K IOPS

—512GB

Random 4 KB reads: Up to 176 K IOPS

Random 4 KB writes: Up to 144 K IOPS

—1TB

Random 4 KB reads: Up to 178 K IOPS

Random 4 KB writes: Up to 155 K IOPS

Bandwidth Performance

— 256 GB

Sustained sequential read: Up to 1800 MB/s

Sustained sequential write: Up to 1040 MB/s

— 512 GB

Sustained sequential read: Up to 1900 MB/s

Sustained sequential write: Up to 1740 MB/s

— 1TB

Sustained sequential read: Up to 1920 MB/s

Sustained sequential write: Up to 1780 MB/s

PCIe Gen 3(8Gb/s) x 4, NVMe 1.3 interface

— Compliant with PCI-Express 3.1

— Dual ARM Cortex R5 CPU @ 5000Hz

— NVMe 1.3 register interface and

　　command set

— Data set management command

　　Trim attribute

Form Factor: Full-sized M.2 2280   SSD

— Dimensions: 80 mm x 22 mm

— Thickness: <=2.4 mm

— Weight: ≤5.5 grams

Power Management

— 3.3V M.2 SSD power supply

—M.2 SSD interface power management

Power (Mobile Mark* 2007 Workload)

— Idle: 670 mW (TYP)

— max: 4.38W (TYP)

Temperature

— Operating: 0℃ to 70℃

— Non-Operating: -40℃ to 85℃

Shock (operating and non-operating)

— 100 G/6 msec

Vibration(operating and non-operating)

—3.1G RMS (2-500 Hz)

HP SSD EX900 Pro M.2

Latency

—256 GB

Read: 0.029ms (TYP)

Write: 0.042ms (TYP)

—512 GB

Read: 0.21ms (TYP)

Write: 0.024ms (TYP)

—1TB

Read: 0.021ms (TYP)

Write: 0.027ms (TYP)

Reliability

— Uncorrectable Bit Error Rate (UBER):

1 sector in 10^{16} bits read

— Mean Time Between Failures (MTBF):

2,000,000 hours

Certifications and Declarations

— CB

— cTUVus & FCC

— CE & RoHS

Contents

1.0 Overview

HP SSD EX900 Pro M.2 Series delivers compact storage and optimized performance for traditional and innovative small-form-factor and embedded platforms in 3 capacity sizes: 256GB 、 512GB and 1TB.

By combining advanced NAND Flash controller with PCIe Gen 3(8Gb/s) x 4, NvMe 1.3 interface and 3D NAND Flash, PCIe M.2 delivers sequential read speed up to 1900MB/s and sequential write speed up to 1700MB/s, which makes it a ideal solution for computing device, such as, notebook, thin-and-light systems, mini- and sub-notebooks, all in-one computers, and embedded platforms.

As compared to standard mobile HDDs, HP SSD EX900 Pro M.2 Series offers these key features:

• High performance

• Low power

• Increased system responsiveness

• High reliability

• Small form-factor

• Minimum weight

• Enhanced ruggedness

• High data Integrity and Security

2.0 Architecture

HP SSD EX900 Pro M.2 Series utilizes a cost-effective, high-performance HP PCIe-to-NAND controller to manage a full PCIe Gen 3(8Gb/s) x 4 bandwidth with the host while managing multiple NAND flash memory devices on 8 channels.

Figure 1. Block Diagram
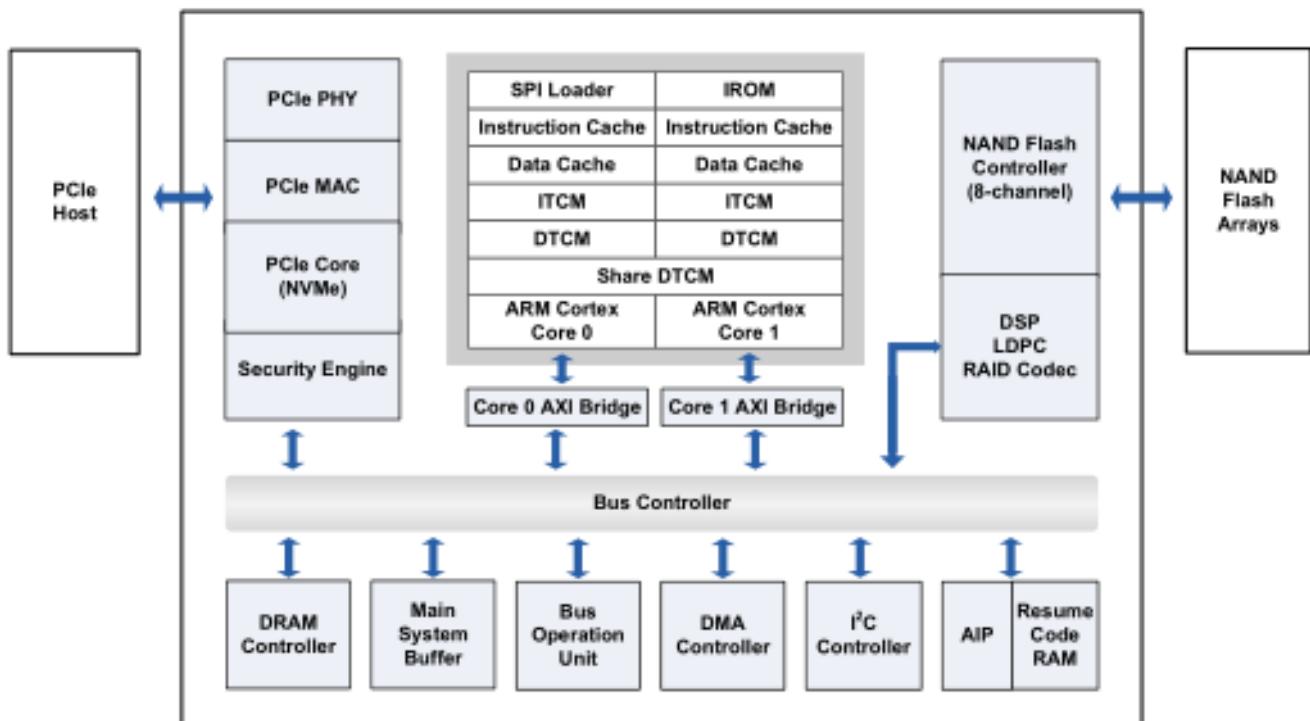
3.0 Product Specifications

This section provides details on HP SSD EX900 Pro M.2 Series product specifications.

3.1 Capacity

Table 1. User Addressable Sectors

Unformatted Capacity	256GB	512GB	1TB
Total User Addressable Sectors	500,118,192	1,000,215,216	2,000,409,264

Notes: LBA count shown represents total user storage capacity and will remain the same throughout the life of the drive.

The total usable capacity of the SSD may be less than the total physical capacity because a small portion of the capacity issued for NAND flash management and maintenance purposes.

1 GB = 1,000,000,000 bytes; 1 sector = 512 bytes.

3.2 Performance

Table 2. Read/Write IOPS, Bandwidth, Latency

Performance	256GB	512GB	1TB
Random Read/Write IOPS (Input / Output Operations per Second)(1)			
4K Read (Up to)	167,000	176,000	178,000
4K Write (Up to)	133,000	144,000	155,000
Maximum Sustained Read and Write Bandwidth(2)			
Sequential Read (Up to)	1800 MB/s	1900 MB/s	1920 MB/s
Sequential Write (Up to)	1040 MB/s	1740 MB/s	1780 MB/s
Latency(3)			
Read	0.029ms	0.021 ms	0.021 ms
Write	0.042 ms	0.024 ms	0.027 ms

Notes:

(1). Performance measured using Iometer with queue depth set to 32; Measurements are performed on 8 GB of LBA range. Write Cache enabled.

(2). Performance measured using Iometer with queue depth equal to 32.

Sequential performance measurements assume 1 MB/sec = 1,048,576 bytes/sec.

(3). Device measured using Iometer; Read/Write latency measured on sequential 4 K transfers with queue depth set to 1.

Write Cache Enabled.

Power On To Ready time measured from power rail rising edge to the first DRDY issued from the drive.

3.3 Electrical

Table 3. Operating Voltage and Power Consumption

Electrical Characteristics Operating Voltage for 3.3V (+/- 5%)	256GB	512GB	1TB
Min	3.0V		
Max	3.6V		
Power Consumption (Typical)			
Active1	3.22W	4.29W	4.38W
Idle	0.66W	0.67W	0.68W

Notes:

1. Active power measured during execution of MobileMark* 2007 with DIPM (Device Initiated Power Management) enabled.

2. Idle power defined as SSD at idle with DIPM enabled.

3.4 Environmental Conditions

Table 4. Temperature, Shock, Vibration

Temperature	Range
Ambient Temperature	
Operating	0 to 70 ℃
Non-operating	-40 to 85 ℃
Temperature Gradient(1)	
Operating	20 (Typical) ℃/hr
Non-operating	30 (Typical) ℃/hr
Humidity	
Operating	20%RH-95%RH
Non-operating	20%RH-95%RH
Shock, Vibration, Acoustics	Range
Shock(2)	
Operating	100 G/6 ms
Non-operating	100 G/6 ms
Vibration(3)	
Operating	3.1 GRMS (2-500 Hz)
Non-operating	3.1 GRMS (2-500 Hz)

Notes:

(1). Temperature gradient measured without condensation.

(2). Shock specifications assume the SSD is mounted securely with the input vibration applied to the drive-mounting screws.Stimulus may be applied in the X, Y or Z axis. Shock specification is measured using root mean square (RMS) value.

(3). Vibration specifications assume the SSD is mounted securely with the input vibration applied to the drive-mounting screws.

Stimulus may be applied in the X, Y or Z axis. The measured specification is in root mean squared form. Vibration specification is measured using RMS value.

3.5 Reliability

Table 5. Reliability Specifications

Parameter	Value
Uncorrectable Bit Error Rate (UBER) Unrecoverable read bit error rate will not exceed one sector in the specified number of bits read. In the extremely unlikely event of a no recoverable read error, the SSD will report it as a read failure to the host; the sector in error is considered corrupt and is not returned to the host.	1 sector in 10^{16} bits read, max
Mean Time Between Failure (MTBF) Mean time between failures (MTBFs) for the SSD can be predicted based on the component reliability data using the methods referenced in the Telcordia SR-332 reliability prediction procedures for electronic equipment.	2,000,000 hours
Power On/Off Cycles Power On/Off Cycles is defined as power being removed from HP SSD EX900 Pro M.2, and then restored. Most host systems remove power from the SSD when entering suspend and hibernate as well as on a system shutdown.	10,000 cycles

Table 6. Total Byte Written and Warranty

tem	256GB	512GB	1TB
Total byte written (Unit: TB)	160	320	650
Drive Writes Per Day (Unit: GB)	90	180	365
Warranty	5 Years		

4.0 Mechanical Information

Figure 2 shows the physical dimension of HP SSD EX900 Pro M.2 Series.

All dimensions are in millimeters.

Figure 2. HP SSD EX900 Pro M.2 Dimensions
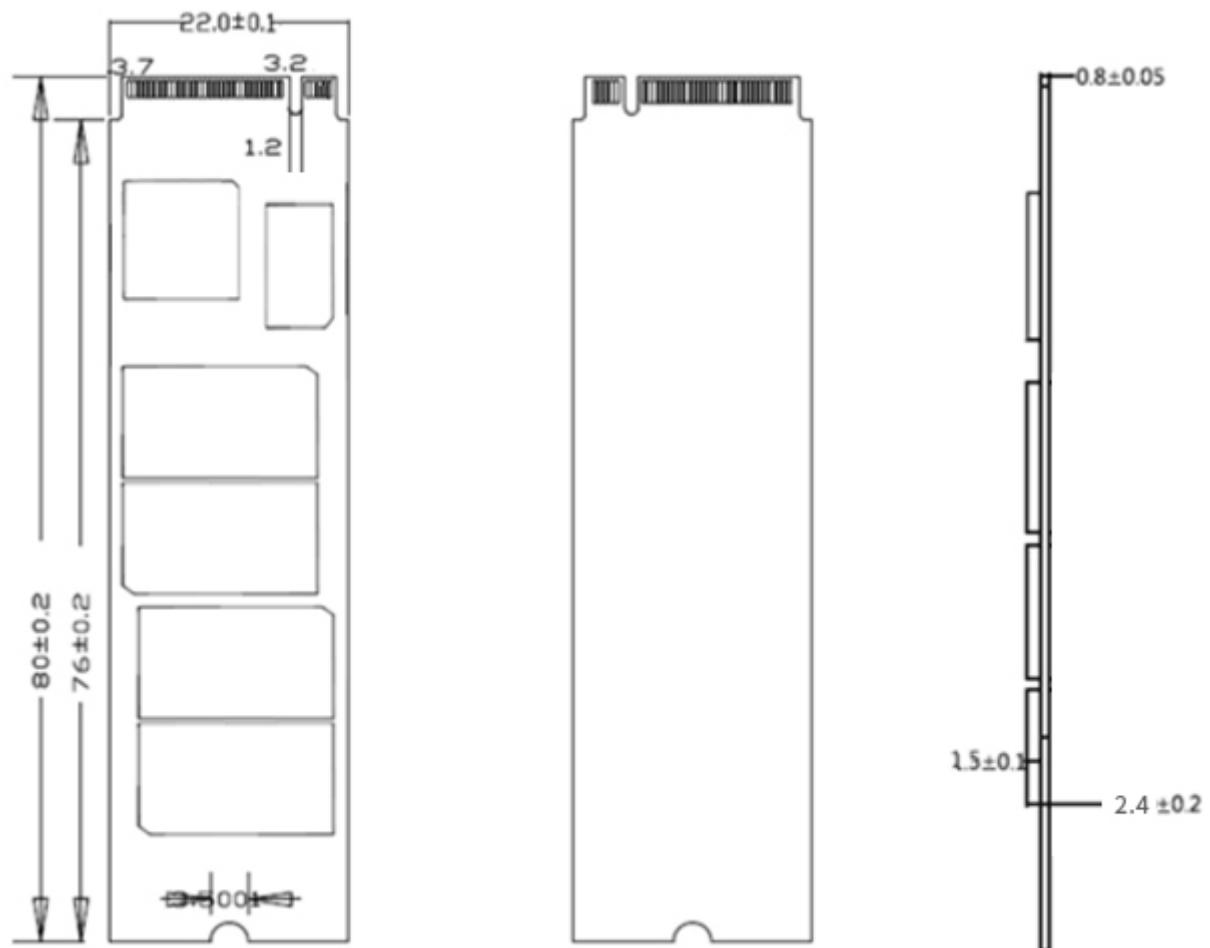
Figure 3. HP SSD EX900 Pro M.2 Interface Description
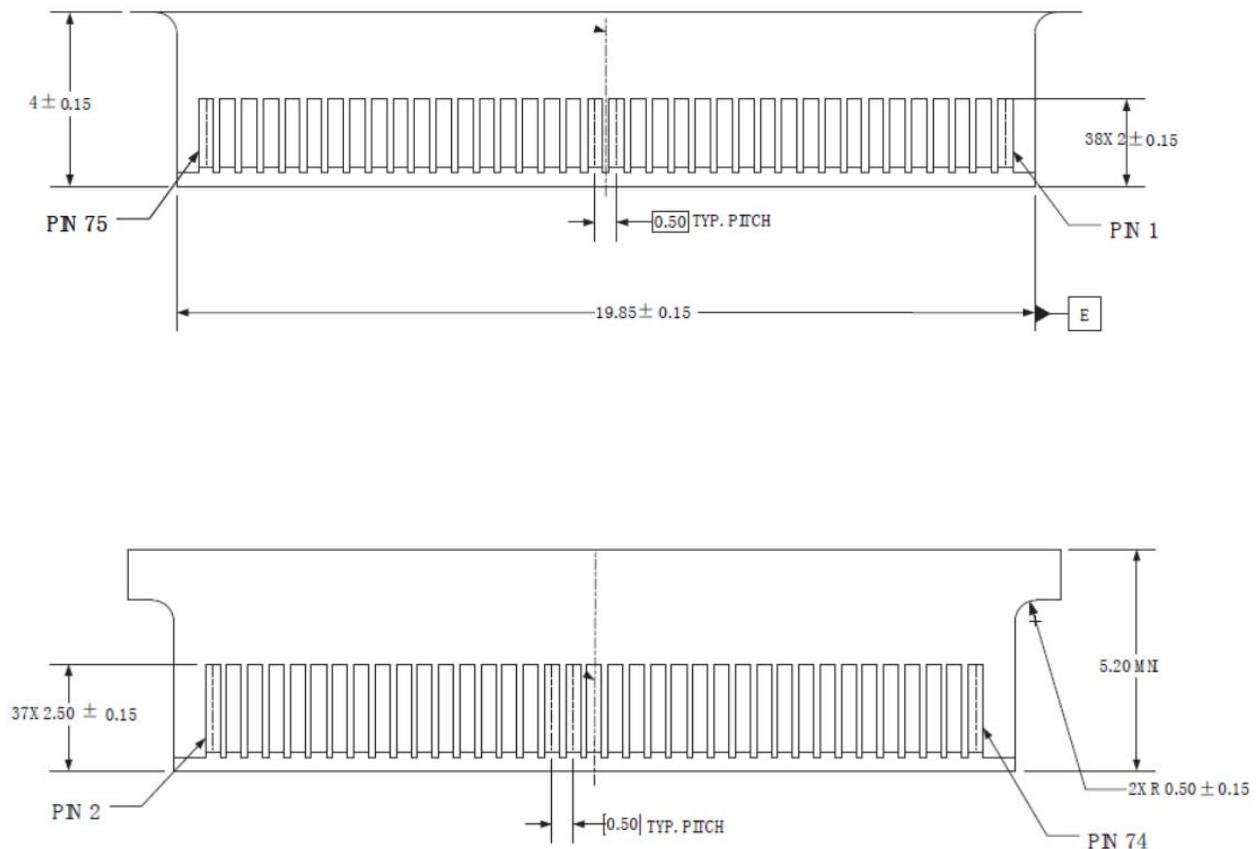
5.0 Pin and Signal Descriptions

5.1 Pin Locations

Table7.Connector Pin Signal Definitions

Pin#	Assignment	Description	Pin#	Assignment	Description
1	GND	Ground	21	GND	Ground
2	3.3V	3.3V power	22	NC	No connect
3	GND	Ground	23	PERn2	Receiver differential pair, lane2
4	3.3V	3.3V power	24	NC	No connect
5	PETn3	Transmitter differential pair, Lane 3	25	PERp2	Receiver differential pair, Lane2
6	NC	No connect	26	NC	No connect
7	PETp3	Transmitter differential pair, Lane 3	27	GND	Ground
8	NC	No connect	28	NC	No connect
9	GND	Ground	29	PETn1	Transmitter differential pair, Lane 1
10	LED1#	Shows IO activity	30	NC	No connect
11	PERn3	Receiver differential pair, lane3	31	PETp1	Transmitter differential pair, Lane 1
12	3.3V	3.3V power	32	NC	No connect
13	PERp3	Receiver differential pair, lane3	33	GND	Ground
14	3.3V	3.3V power	34	NC	No connect
15	GND	Ground	35	PERn1	Receiver differentialpair,Lane1
16	3.3V	3.3V power	36	NC	No connect
17	PETn2	Transmitter differential pair, Lane 2	37	PERp1	Receiver differentialpair,Lane1
18	3.3V	3.3V power	38	DEVSLP	Device sleep（Not used）
19	PETp2	Transmitter differential pair, Lane 2	39	GND	Ground
20	NC	No connect	40	SMB_CLK	SMBus (System Management Bus) clock

5.2 Signal Descriptions

Pin#	Assignment	Description	Pin#	Assignment	Description
41	PETn0	Transmitter differential signals ,lane0	59	Module Key	Module Key
42	SMB_DATA	SMBus (System Management Bus) data	60	Module Key	Module Key
43	PETp0	Transmitter differential signals ,lane0	61	Module Key	Module Key
44	ALERT#	Alert（Not used）	62	Module Key	Module Key
45	GND	Ground	63	Module Key	Module Key
46	NC	No connect	64	Module Key	Module Key
47	PERn0	Receiver differentialpair,Lane0	65	Module Key	Module Key
48	NC	No connect	66	Module Key	Module Key
49	PERp0	Receiver differentialpair,Lane0	67	NC	No connect
50	PERST#	Fundamental reset	68	SUSCLK	Suspension 32.768 kHzclock（Notused）
51	GND	Ground	69	PEDET	PE detect（Not used）
52	CLKREQ#	Clock Request（Not used）	70	3.3V	3.3V power
53	REFCLKn	Reference Clock port n	71	GND	Ground
54	PEWAKE#	Signal for Link reactivation	72	3.3V	3.3V power
55	REFCLKp	Reference Clock port p	73	GND	Ground
56	MFG_DATA	Manufacturing Data line	74	3.3V	3.3V power
57	GND	Ground	75	GND	Ground
58	MFG_CLOCK	Manufacturing Clock line			

6.0 Supported Command Sets

supports PCIe (PCI-express) commands described in this section.

6.1 PCIe General Feature Command Set

supports the PCIe General Feature command set (non-PACKET), which consists of:

· EXECUTE DEVICE DIAGNOSTIC

· FLUSH CACHE

· IDENTIFY DEVICE

· READ DMA

· READ SECTOR(S)

· READ VERIFY SECTOR(S)

· SEEK

· SET FEATURES

· WRITE DMA

· WRITE SECTOR(S)

· READ MULTIPLE

· SET MULTIPLE MODE

· WRITE MULTIPLE

 also supports the following optional commands:

· READ BUFFFER

· WRITE BUFFER

· NOP

· DOWNLOAD MICROCODE

6.2 Power Management Command Set

supports the Power Management command set, which consists of:

· CHECK POWER MODE

· IDLE

· IDLE IMMEDIATE

· SLEEP

· STANDBY

· STANDBY IMMEDIATE

6.3 Security Mode Feature Set

supports the Security Mode command set, which consists of:

· SECURITY SET PASSWORD

· SECURITY UNLOCK

· SECURITY ERASE PREPARE

· SECURITY ERASE UNIT

· SECURITY FREEZE LOCK

· SECURITY DISABLE PASSWORD

6.4 smart Command Set

supports the SMART command set, which consists of:

· SMART ENABLE OPERATIONS

· SMART DISABLE OPERATIONS

· SMART ENABLE/DISABLE AUTOSAVE

· SMART RETURN STATUS

also supports the following optional commands:

· SMART EXECUTE OFF-LINE IMMEDIATE

· SMART READ DATA

· SMART READ LOG

· SMART WRITE LOG

6.5 Data Set Management Command Set

supports the Data Set Management command set Trim attribute, which consists of:

· DATA SET MANAGEMENT EXT

6.6 Host Protected Area Command Set

supports the Host Protected Area command set:

· READ NATIVE MAX ADDRESS

· SET MAX ADDRESS

· READ NATIVE MAX ADDRESS EXT

· SET MAX ADDRESS EXT

also supports the following optional commands:

· SET MAX SET PASSWORD

· SET MAX LOCK

· SET MAX FREEZE LOCK

· SET MAX UNLOCK

6.7 48-Bit Address Command Set

supports the 48-bit Address command set, which consists of:

· FLUSH CACHE EXT

· READ DMA EXT

· READ NATIVE MAX ADDRESS EXT

· READ SECTOR(S) EXT

· READ VERIFY SECTOR(S) EXT

· SET MAX ADDRESS EXT

· WRITE DMA EXT

· WRITE MULTIPLE EXT

· WRITE SECTOR(S) EXT
· WRITE UNCORRECTABLE EXT

6.8 Device Configuration Overlay Command Set

supports the Device Configuration Overlay command set, which consists of:

· DEVICE CONFIGURATION FREEZE LOCK

· DEVICE CONFIGURATION IDENTITY

· DEVICE CONFIGURATION RESTORE

· DEVICE CONFIGURATION SET

6.9 General Purpose Log Command Set

supports the General Purpose Log command set, which consists of:

· READ LOG EXT

· WRITE LOG EXT

6.10 Native Command Queuing

supports the Native Command Queuing (NCQ) command as

· READ FPDMA QUEUED

· WRITE FPDMA QUEUED

Note: With a maximum queue depth equal to 32.

6.11 Software Settings Preservation

supports the SET FEATURES parameter to enable/disable the preservation of software settings.

6.12 Device Initiated Power Management (DIPM)

supports the SET FEATURES parameter to enable Device Initiated Power Management.

7.0 Certifications and Declarations

Table 8 describes the Device Certifications supported by HP SSD EX900 Pro M.2 .

Table 8. Device Certifications and Declarations

Certification	Description
CE Compliant	Indicates conformity with the essential health and safety requirements set out in European Directives Low Voltage Directive and EMC Directive.
FCC Certified	Underwriters Laboratories, Inc. Component Recognition FCC Part 15, Subpart B ICES-003 Issue 6:2016(updated April 2017)CAN/CSA-CISPR 22-10 CISPR 22: 2008.
RoHS Compliant	Restriction of Hazardous Substance Directive

8.0 Revision History

Date	Revision	Description
Dec. 2019	V1.0	Initial release