LEGAL NOTICE:

© Copyright 2007 - 2021 NVM Express, Inc. ALL RIGHTS RESERVED.
This erratum to the NVM Express Base Specification revision 2.0 is proprietary to the NVM Express, Inc. (also referred to as "Company") and/or its successors and assigns.

NOTICE TO USERS WHO ARE NVM EXPRESS, INC. MEMBERS: Members of NVM Express, Inc. have the right to use and implement this erratum to the NVM Express revision 1.4 specification subject, however, to the Member's continued compliance with the Company's Intellectual Property Policy and Bylaws and the Member's Participation Agreement.

NOTICE TO NON-MEMBERS OF NVM EXPRESS, INC.: If you are not a Member of NVM Express, Inc. and you have obtained a copy of this document, you only have a right to review this document or make reference to or cite this document. Any such references or citations to this document must acknowledge NVM Express, Inc. copyright ownership of this document. The proper copyright citation or reference is as follows: **"© 2007 - 2021 NVM Express, Inc. ALL RIGHTS RESERVED."** When making any such citations or references to this document you are not permitted to revise, alter, modify, make any derivatives of, or otherwise amend the referenced portion of this document in any way without the prior express written permission of NVM Express, Inc. Nothing contained in this document shall be deemed as granting you any kind of license to implement or use this document or the specification described therein, or any of its contents, either expressly or impliedly, or to any intellectual property owned or controlled by NVM Express, Inc., including, without limitation, any trademarks of NVM Express, Inc.

LEGAL DISCLAIMER:

THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN IS PROVIDED ON AN "**AS IS**" BASIS. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, NVM EXPRESS, INC. (ALONG WITH THE CONTRIBUTORS TO THIS DOCUMENT) HEREBY DISCLAIM ALL REPRESENTATIONS, WARRANTIES AND/OR COVENANTS, EITHER EXPRESS OR IMPLIED, STATUTORY OR AT COMMON LAW, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, VALIDITY, AND/OR NONINFRINGEMENT.

All product names, trademarks, registered trademarks, and/or servicemarks may be claimed as the property of their respective owners.

The NVM Express® design mark is a registered trademark of NVM Express, Inc.
PCI-SIG®, PCI Express®, and PCIe® are registered trademarks of PCI-SIG.
InfiniBand™ is a trademark and servicemark of the InfiniBand Trade Association.

NVM Express Workgroup
c/o VTM Group
3855 SW 153rd Drive
Beaverton, OR 97003 USA
info@nvmexpress.org

NVM Express™ Technical Errata

Errata ID	104
Revision Date	9/21/2021
Affected Spec Ver.	NVM Express™ NVM Command Set Specification Revision 1.0a
Corrected Spec Ver.	

Errata Author(s)

Name	Company
Judy Brock, Mike Allison	Samsung

Errata Overview

This ECN:
- adds fields to the NVM Command Set specification as defined in TP 4068c.

Revision History

Revision Date	Change Description
7/08/2021	Initial version – added STCR and STCRS fields, additional editorial changes
08/24/2021	Post-member-review (comments resolved): Integration draft - Removed changes to Descriptor Format field in Command Dword 12 of the Copy command as changes to this field are being addressed in ECN 002 instead - Changed ECN filename to adhere to new format requirements
9/20/2021	Integrated into the NVMe NVM Command Set Specification, Revision 1.0a.
9/21/2021	Correct the Navigation pane by removing blank lines.

Incompatible Changes

Added two new bits: STCR (in Copy command) and STCRS (in NVM Command Set I/O Command Set specific Identify Namespace data structure).

Description of Changes

NVM Express® NVM Command Set:
As defined in TP 4068c:
- Added Storage Tag Check Read (STCR) bit to Copy command.
- Added Support bit (STCRS) for Storage Tag Check Read bit.

Editorial changes to Figure 34 and Figure 35 (Source Range Entries Descriptor Formats 0h and 1h)

Editor's Note: **BLACK** text indicates unchanged text; **RED** text indicates deleted text; **BLUE** text indicates new text; **GREEN** text indicates editor notes.

Description of NVM Express® NVM Command Set changes

Modify several figures in section 3.3.3 as follows:

3.2.2 Copy command

...

Figure 30: Copy – Command Dword 12

Bits	Description
31	**Limited Retry (LR):** If set to '1', the controller should apply limited retry efforts for the write portion of the copy operation. If cleared to '0', the controller should apply all available error recovery means to write the data to the NVM.
30	**Force Unit Access (FUA):** If set to '1', then for data and metadata, if any, associated with logical blocks specified by the write portion of the copy operation, the controller shall write that data and metadata, if any, to non-volatile media before indicating command completion. There is no implied ordering with other commands. If cleared to '0', then this bit has no effect.
29:26	**Protection Information Field Write (PRINFOW):** Specifies the protection information action and check field, as defined in Figure 9, to be used for the write portion of the copy operation.
25	~~Reserved~~**Storage Tag Check Read (STCR):** This bit specifies the Storage Tag field shall be checked as part of end-to-end data protection processing as defined in Figure 10, to be used for the read portion of the copy operation. If the Storage Tag Check Read Support (STCRS) bit (refer to Figure 100) is cleared to '0, then this bit is reserved.
24	**Storage Tag Check Write (STCW):** This bit specifies the Storage Tag field shall be checked as part of end-to-end data protection processing as defined in Figure 10, to be used for the write portion of the copy operation.
23:20	**Directive Type (DTYPE):** Specifies the Directive Type associated with the Directive Specific field (refer to the Directives section in the NVMe Base Specification) used for the write portion of the copy operation.
19:16	Reserved
15:12	**Protection Information Field Read (PRINFOR):** Specifies the protection information action and check field, as defined in Figure 9, to be used for the read portion of the copy operation specified by each Source Range Entries.
11:08	**Descriptor Format:** Specifies the format of the Source Range Entries as follows: {nested table}
07:00	**Number of Ranges (NR):** Specifies the number of Source Range Entries that are specified in the command. This is a 0's-based value.

Nested table within bits 11:08:

Code	Description	Reference
0h	The Source Range Entries specify starting LBA, number of logical blocks, and parameters associated with the read portion of the operation.	Figure 34
1h	The Source Range Entries specify starting LBA, number of logical blocks, and parameters associated with the read portion of the operation ~~when~~ PIF1 bit in the DPC field (refer to Figure 97) is set to '1'.	Figure 35
All Others	Reserved	

...

Figure 34: Copy – Source Range Entries Descriptor Format 0h

Range	Bytes	Description
Source Range 0	07:00	Reserved
	15:08	Starting LBA

Figure 34: Copy – Source Range Entries Descriptor Format 0h

Range	Bytes	Description		
	19:16	**Read Parameters** ~~as follows~~:		
			Bits	**Description**
			31:16	Reserved
			15:00	**Number of Logical Blocks (NLB):** This field indicates the number of logical blocks to be copied. This is a 0's based value.
	23:20	Reserved		
	27:24	This field specifies the variable sized Expected Logical Block Storage Tag (ELBST) and Expected Initial Logical Block Reference Tag (EILBRT), which are defined in section 5.2.1.4.1, to be used for the read portion of the copy operation for the LBAs specified in this Source Range entry. If the namespace is not formatted to use end-to-end protection information, then this field is ignored. Refer to section 5.1.		
	29:28	**Expected Logical Block Application Tag (ELBAT):** This field specifies the Application Tag expected value used for the read portion of the copy operation for the LBAs specified in this Source Range entry. If the namespace is not formatted to use end-to-end protection information, then this field is ignored. Refer to section 5.1.		
	31:30	**Expected Logical Block Application Tag Mask (ELBATM):** This field specifies the Application Tag Mask expected value used for the read portion of the copy operation for the LBAs specified in this Source Range entry. If the namespace is not formatted to use end-to-end protection information, then this field is ignored. Refer to section 5.1.		
Source Range 1	39:32	Reserved		
	47:40	Starting LBA		
	51:48	Read Parameters		
	55:52	Reserved		
	59:56	~~The variable sized~~ ELBST and EILBRT ~~fields~~		
	61:60	ELBAT		
	63:62	ELBATM		
		…		
Source Range 127	4071:4064	Reserved		
	4079:4072	Starting LBA		
	4083:4080	Read Parameters		
	4087:4084	Reserved		
	4091:4088	~~The variable sized~~ ELBST and EILBRT ~~fields~~		
	4093:4092	ELBAT		
	4095:4094	ELBATM		

...

Figure 35: Copy – Source Range Entries Descriptor Format 1h

Range	Bytes	Description		
Source Range 0	07:00	Reserved		
	15:08	Starting LBA		
	19:16	Read Parameters ~~as follows~~:		
			Bits	**Description**
			31:16	Reserved
			15:00	**Number of Logical Blocks (NLB):** This field indicates the number of logical blocks to be copied. This is a 0's based value.
	25:20	Reserved		

Figure 35: Copy – Source Range Entries Descriptor Format 1h

Range	Bytes	Description
	35:26	This field specifies variable sized Expected Logical Block Storage Tag (ELBST) and Expected Initial Logical Block Reference Tag (EILBRT) fields, which are defined in section 5.2.1.4.1, to be used for the read portion of the copy operation. If the namespace is not formatted to use end-to-end protection information, then this field is ignored.
	37:36	**Expected Logical Block Application Tag (ELBAT):** This field specifies the Application Tag expected value used for the read portion of the copy operation for the LBAs specified in this Source Range entry. If the namespace is not formatted to use end-to-end protection information, then this field is ignored. Refer to section 5.1.
	39:38	**Expected Logical Block Application Tag Mask (ELBATM):** This field specifies the Application Tag Mask expected value used for the read portion of the copy operation for the LBAs specified in this Source Range entry. If the namespace is not formatted to use end-to-end protection information, then this field is ignored. Refer to section 5.1.
Source Range 1	47:40	Reserved
	55:48	Starting LBA
	59:56	Read Parameters
	65:60	Reserved
	75:66	~~The variable sized~~ ELBST and EILBRT
	77:76	ELBAT
	79:78	ELBATM
	…	
Source Range 101	4047:4040	Reserved
	4055:4048	Starting LBA
	4059:4056	Read Parameters
	4065:4060	Reserved
	4075:4066	~~The variable sized~~ ELBST and EILBRT
	4077:4076	ELBAT
	4079:4078	ELBATM
	4095:4080	Reserved

Modify a portion of Figure 100 in section 4.1.5.3 as follows:

4.1.5.3 I/O Command Set Specific Identify Namespace Data Structure (CNS 05h)

….

Figure 100: NVM Command Set I/O Command Set Specific Identify Namespace Data Structure (CSI 00h)

Bytes	O/M [1]	Description
7:0	O	**Logical Block Storage Tag Mask (LBSTM):** Identifies the mask for the Storage Tag field for the protection information (refer to section 5.1). The size of the mask contained in this field is defined by the STS field. If the size of the mask contained in this field is less than 64 bits, the mask is contained in the least-significant bits of this field. If end-to-end protection is not enabled in the namespace, then this field is ignored. If: a) end-to-end protection is enabled; b) 16b Guard Protection Information format is used; and c) the 16BPISTM bit is set to '1', then all bits in the mask shall be set to '1'.

Figure 100: NVM Command Set I/O Command Set Specific Identify Namespace Data Structure (CSI 00h)

Bytes	O/M [1]	Description
8	O	**Protection Information Capabilities (PIC):** This field indicates the capabilities for the protection information formats. <table><tr><th>Bits</th><th>Description</th></tr><tr><td>7:2 3</td><td>Reserved</td></tr><tr><td>2</td><td>**Storage Tag Check Read Support (STCRS):** If set to '1', then the controller supports the Storage Tag Check Read (STCR) bit in the Copy command (refer to Figure 30). If cleared to '0', the controller does not support the Storage Tag Check Read bit in the Copy command. If the 16b Guard Protection Information Storage Tag Support (16BPISTS) bit is set to '1', then this bit shall be set to '1'.</td></tr><tr><td>1</td><td>**16b Guard Protection Information Storage Tag Mask (16BPISTM):** If set to '1', then the LBSTM field shall have all bits set to '1' for the 16b Guard Protection Information. If cleared to '0', then the Logical Block Storage Tag Mask field is allowed to have any bits set to '1' for the 16b Guard Protection Information.</td></tr><tr><td>0</td><td>**16b Guard Protection Information Storage Tag Support (16BPISTS):** If set to '1', then the end-to-end protection 16b Guard Protection Information format (refer to section 5.2.1.1) supports a non-zero value in the STS field. If cleared to '0', then the end-to-end protection 16b Guard Protection Information format support requires that the STS field be cleared to 0h (i.e., the Storage Tag field is not supported). If the 32b Guard Protection Information or 64b Guard Protection Information is supported in any LBA format (refer to Figure 97 and Figure 100), then this bit shall be set to '1'.</td></tr></table>
11:9		Reserved