



LEGAL NOTICE:

© **Copyright 2008 to 2022 NVM Express®, Inc. ALL RIGHTS RESERVED.**

This Technical Proposal 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 Technical Proposal 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: “© 2008 to 2022 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.

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

NVM Express® Technical Proposal

Technical Proposal ID	TP4140 Format Index Mismatch Protection
Revision Date	2022-08-15
Builds on Specification(s)	NVM Express NVM Command Set Specification 1.0b
References	TP4095a Namespace Capability Reporting

Technical Proposal Author(s)

Name	Company
Judy Brock, Mike Allison, Bill Martin	Samsung

Technical Proposal Overview

This proposal updates the NVM Command Set Specification by updating the definition of the LBA Format Extension Enable (LBAFEE) field to abort any Format NVM command or I/O command to a namespace that was formatted with a Format Index that is greater than number of LBA Formats reported by the controller in the Identify Namespace data structure.

An example of this use case is an NVM subsystem which has created namespaces using a Format Index greater than 15 which is subsequently inserted into a host that does not support more than 16 Format Indexes (i.e., does not comprehend extended LBA Formats and does not set LBAFEE to '1').

Revision History

Revision Date	Change Description
2022.01.24	Initial draft:
2022.02.01	Phase 3 draft: Incorporated WG Phase 3 feedback; moved most of the text in the LBAFEE field definition itself into the body of section 4.1.3.4.
2022.02.23	Modify the LBAFEE field to limit conditional prohibitions around re-formatting of namespaces to apply only when an individually specified namespace is targeted (i.e., prohibitions do not apply to when Format NVM command seeks to format multiple namespaces at the same time)
2022.03.22	Moved guts of definition of LBAFEE field into new 5.LBAFEE.NEW section; simplified it. Added cross-reference in Format NVM command section
2022.04.04	Intended to be 30 day review candidate. Minor changes due to WG feedback during 3/31 walkthrough – lower-cased “command” in Format NVM command; added missing strikethrough on one word; added comment noting final placement of new section 5 text still TBD; split two sentences in new LBAFEE section into bullet list as requested.
2022.07.27	Integrated
2022.07.29	Minor editorial changes per Mike Allison
2022.08.15	Minor editorial changes per Mike Allison

Description for Changes Document for:

NVM Express NVM Command Set Specification 1.0b

Feature Enhancements:

- **New requirement / incompatible change**
 - Update the definition of the LBAFEE bit in the Host Behavior Support data structure to return error on commands which attempt to either Format or perform I/O on namespaces currently formatted with a Format Index greater than the currently-reported total number of LBA formats supported (in NLBAF + NULBAF (if it exists) from TP 4095a)
- **References**
 - Technical Proposal TP4140

Markup Conventions:

Black:	Unchanged (however, hot links are removed)
Red Strikethrough:	Deleted
Blue:	New
Green:	Moved
Blue Highlighted:	TBD values, anchors, and links to be inserted in new text.
<Purple Bracketed>:	Notes to editor
Orange	From TP 4095a

Description of NVM Express NVM Command Set specification 1.0b changes

Modify Section 4.1.2 as shown below:

4.1.2 Format NVM command

The Format NVM command operates as defined in the NVMe Base Specification. The Format Index indicates a valid User Data Format from the LBA Format field in the Identify Namespace data structure. Other NVM Command Set specific fields are defined in Figure 78.

For the NVM Command Set, if the Format NVM command results in a change of the logical block size for the namespace, then the resulting namespace size (i.e., NSZE) (refer to Figure 97) and the namespace capacity (i.e., NCAP) (refer to Figure 97) may differ from the values indicated prior to the processing of the Format NVM command.

If the LBA Format Extension Enable (LBAFEE) field is not set to 1h in the Host Behavior Support feature (refer to the Host Behavior Support section in the NVMe Base Specification), then the controller aborts a Format NVM command with a status code of Invalid Namespace or Format that specifies a format (refer to section 5.2.1) of, [or specifies an individual namespace formatted with,:](#)

- a) 16b Guard Protection Information with the STS field set to a non-zero value;
- b) 32b Guard Protection Information; or
- c) 64b Guard Protection Information.

Modify a portion of figure 86 in section 4.1.3.4 as shown below:

4.1.3.4 Host Behavior Support (Feature Identifier 16h)

The Host Behavior Support feature operates as defined in the NVMe Base Specification. In addition to the requirements in the NVMe Base Specification, this specification provides NVM Command Set specific definitions.

Figure 86: Host Behavior Support – Data Structure

Bytes	Description
02	<p>LBA Format Extension Enable (LBAFEE): This field allows the host to specify support for the extended LBA formats (refer to the EBLAS field in the Identify Controller data structure in the NVMe Base Specification). Refer to section 5.LBAFEE.NEW for further details. All values other than 0h and 1h are reserved. If this field is set to 1h and the ELBAS field is set to '1', then the controller:</p> <ul style="list-style-type: none"> 1) shall report a maximum number that is less than or equal to 64 for: <ul style="list-style-type: none"> a. the number of LBA formats (refer to the NLBAF field in the Identify Namespace data structure in Figure 97); and b. the number of namespace granularity descriptors (refer to Figure 104); and 2) is enabled to create, format, and perform I/O commands on namespaces formatted with (refer to section 5.2.1): <ul style="list-style-type: none"> a. 16b Guard Protection Information with the STS field set to a non-zero value; b. 32b Guard Protection Information; and c. 64b Guard Protection Information; <p>the extended LBA formats (refer to Figure 101) define the actual protection information formats supported.</p> <p>If this field is cleared to 0h, then the controller:</p> <ul style="list-style-type: none"> 1) shall report a maximum that is less than or equal to 16 for: <ul style="list-style-type: none"> a. the number of LBA formats; and b. the number of namespace granularity descriptors; 2) shall not create, format, and perform I/O commands on namespaces formatted with (refer to section 5.2.1): <ul style="list-style-type: none"> a. 16b Guard Protection Information with the STS field set to a non-zero value; b. 32b Guard Protection Information; and c. 64b Guard Protection Information; <p>and commands requesting these restrictions shall be aborted with a status code of Invalid Namespace or Format.</p> <p>All values other than 0h and 1h are reserved.</p>

Add section 5.LBAFEE.NEW as shown below:

5.LBAFEE.NEW LBA Format Extensions

The LBA Format Extension Enable (LBAFEE) field in the Host Behavior Support feature (refer to section 4.1.3.4) allows the host to enable support for extended protection information formats (refer to section 5.2.1) and for LBA Formats with Format Indexes greater than or equal to 16.

If ~~this~~ the LBAFEE field is set to 1h and the ELBAS ~~field~~ bit (refer to the Identify Controller data structure in the NVM Express Base Specification) is set to '1', then the controller:

- a) shall report a maximum number that is less than or equal to 64 for:
 - a. the total number of LBA formats supported (refer to section 5.TBD ~~the NLBAF field in the Identify Namespace data structure in Figure 97~~); and
 - b. the number of namespace granularity descriptors (refer to Figure 104);
- and
- b) is enabled to create namespaces with, format namespaces with, and perform I/O commands on namespaces with extended protection formats that are supported by the controller.

If ~~this~~ the LBAFEE field is cleared to 0h, then the controller:

- a) shall report a maximum number that is less than or equal to 16 for:
 - a. the total number of LBA formats supported (refer to section 5.TBD); and
 - b. the number of namespace granularity descriptors;
- b) shall not create namespaces with, format namespaces with, or perform I/O commands on namespaces with extended protection information formats that are supported by the controller;
- c) shall not format an individually specified namespace (refer to the Format NVM command section in the NVM Express Base Specification) that is formatted with an extended protection information format; and
- d) shall not format or perform I/O commands on an individually specified namespace that is formatted with an LBA Format whose Format Index is greater than the reported total number of LBA formats supported (refer to section 5.TBD).

Commands ~~requesting~~ that violate these restrictions shall be aborted with a status code of Invalid Namespace or Format.