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## NVM Express Technical Proposal for New Feature

Technical Proposal ID	TP 4079 - Telemetry Log Size Change
Change Date	2020-07-09
Builds on Specification	NVM Express 1.4 draft

### Technical Proposal Author(s)

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This technical proposal requests to change the current size limitation of the Telemetry feature. The Telemetry Controller-Initiated Data Area 3 Last Block is a 2 byte field, such that it contains the value of the last block of Telemetry Controller-Initiated Data Area 3. As currently specifies, this log is limited to 32MB and the goal is to allow larger telemetry log sizes.

### Revision History

Revision Date	Change Description
2019-05-28	Initial version
2020-01-09	Add field in the Host Behavior Support data structure and modify the text accordingly
2020-01-24	Changed the controller behavior for writing to area 4 when the host doesn't support it
2020-01-30	Integrating Mike's comments on when the controller supports data area 4 and the host does not
2020-02-06	Accepted all changes and delete agreed comments
2020-02-21	Phase 3 version
2020-04-02	Member review comments
2020-04-27	Remove redundant text in the Extended Telemetry Data Area 4 Supported field.
2020-07-08	Integrated into the NVM Express Base Specification.
2020-07-09	Lower cased bullets in Telemetry Controller-Initiated section.

### Discussion

This technical proposal addresses following issues:

1. The existing NVMe 1.4 specification specifies the Telemetry feature to enable manufacturers to collect internal data logs. As currently specifies, this log is limited to 32MB. Device manufacture and host software could benefit if there would an optional way to collect data in the Telemetry log of a size that exceed this limitation.

### Description for NVMe Changes Document

1. Telemetry Controller-Initiated Data Area will be extended to 4 bytes in a new area 4



## Description of Specification Changes

**Modify portions of section 5.15.2.22 (5.21.1.22 16h) as shown below:**

**Host Behavior Support (Feature Identifier**

...

**Figure 316: Host Behavior Support – Data Structure**

Bytes	Description
00	<p><b>Advanced Command Retry Enable (ACRE):</b> If set to 1h, then the Command Interrupted status code is enabled (refer to Figure 129) and command retry delays are enabled. The controller may use the Command Interrupted status code and may indicate a command retry delay by setting the Command Retry Delay (CRD) field to a non-zero value in the Status field of a Completion Queue Entry, refer to Figure 127. A host that sets this field to 1h indicates host support for the command retry behaviors that are specified for both the Command Interrupted status code and non-zero values in the CRD field.</p> <p>If cleared to 0h, then both the Command Interrupted status code and command retry delays are disabled. The controller shall not use the Command Interrupted status code, and shall clear the CRD field to 0h in all CQEs.</p> <p>All values other than 0h and 1h are reserved.</p>
01	<p><b>Extended Telemetry Data Area 4 Supported (ETDAS):</b> If set to 1h, then Telemetry Host-Initiated Data Area 4 and Telemetry Controller-Initiated Data Area 4 are supported by the host. If Bit 6 of the Log Page Attributes field is set to '1', then the controller may populate Telemetry Host-Initiated Data Area 4 (refer to 5.14.1.7) and the Telemetry Controller-Initiated Data Area 4 (refer to 5.14.1.8).</p> <p>If cleared to 0h, then Telemetry Host-Initiated Data Area 4 and Telemetry Controller-Initiated Data Area 4 are not supported by the host.</p> <p>All values other than 0h and 1h are reserved.</p>
511:02	Reserved

**Modify portions of section 5.15.2.2 (5.15.2.2 Identify Controller data structure) as shown below:**

**Figure 250: Identify – Identify Controller Data Structure**

...		
260	M	<p><b>Firmware Updates (FRMW):</b> This field indicates capabilities regarding firmware updates. Refer to section 8.1 for more information on the firmware update process.</p> <p>Bits 7:5 are reserved.</p> <p>Bit 4 if set to '1' indicates that the controller supports firmware activation without a reset. If cleared to '0', then the controller requires a reset for firmware to be activated.</p> <p>Bits 3:1 indicate the number of firmware slots that the controller supports. This field shall specify a value from one to seven, indicating that at least one firmware slot is supported and up to seven maximum. This corresponds to firmware slots 1 through 7.</p> <p>Bit 0 if set to '1' indicates that the first firmware slot (i.e., slot 1) is read only. If cleared to '0', then the first firmware slot (i.e., slot 1) is read/write. Implementations may choose to have a baseline read only firmware image.</p>

261	M	<p><b>Log Page Attributes (LPA):</b> This field indicates optional attributes for log pages that are accessed via the Get Log Page command.</p> <p>Bits 7 are reserved.</p> <p>Bit 6 if set to '1', then the controller supports Data Area 4 for the Telemetry Host-Initiated and Telemetry Controller-Initiated log. If cleared to '0', then the controller does not support Data Area 4 for the Telemetry Host-Initiated and Telemetry Controller-Initiated log pages.</p> <p>Bit 4 if set to '1', then the controller supports the Persistent Event log. If cleared to '0', then the controller does not support the Persistent Event log.</p> <p>Bit 3 if set to '1', then the controller supports the Telemetry Host-Initiated and Telemetry Controller-Initiated log pages and sending Telemetry Log Notices. If cleared to '0', then the controller does not support the Telemetry Host-Initiated and Telemetry Controller-Initiated log pages and Telemetry Log Notice events.</p> <p>Bit 2 if set to '1', then the controller supports extended data for the Get Log Page command (including extended Number of Dwords and Log Page Offset fields). Bit 2 if cleared to '0', then the controller does not support extended data for the Get Log Page command.</p> <p>Bit 1 if set to '1', then the controller supports the Commands Supported and Effects log page. Bit 1 if cleared to '0', then the controller does not support the Commands Supported and Effects log page.</p> <p>Bit 0 if set to '1', then the controller supports the SMART / Health Information log page on a per namespace basis. If cleared to '0', then the controller does not support the SMART / Health Information log page on a per namespace basis.</p>
262	M	<p><b>Error Log Page Entries (ELPE):</b> This field indicates the maximum number of Error Information log entries that are stored by the controller. This field is a 0's based value.</p>
...		

**Modify portions of section 5.14.1.7 (5.14.1.7 Telemetry Host-Initiated) as shown below:**

...

**Figure 204: Command Dword 10 – Log Specific Field**

Bits	Description
11:09	Reserved
08	<p><b>Create Telemetry Host-Initiated Data:</b> If set to '1', then the controller shall capture the Telemetry Host-Initiated Data representing the internal state of the controller at the time the associated Get Log Page command is processed. If cleared to '0', then the controller shall not update the Telemetry Host-Initiated Data. The Host-Initiated Data shall not change until the controller processes:</p> <ul style="list-style-type: none"> <li>a) a subsequent Telemetry Host-Initiated Log with this bit set to '1';</li> <li>b) a Firmware Commit command; or</li> <li>c) a power on reset</li> </ul>

The Telemetry Host-Initiated Data consists of:

- a) ~~Three~~ areas, if bit 6 of the Log Page Attributes field is cleared to '0': Telemetry Host-Initiated Data Area 1, Telemetry Host-Initiated Data Area 2, and Telemetry Host-Initiated Data Area 3; or
- b) Four areas, if bit 6 of the Log Page Attributes field is set to '1': Telemetry Host-Initiated Data Area 1, Telemetry Host-Initiated Data Area 2, Telemetry Host-Initiated Data Area 3 and Telemetry Host-Initiated Data Area 4.

All ~~three~~ areas start at Telemetry Host-Initiated Data Area Block 1. The last block of each area is indicated in Telemetry Host-Initiated Data Area y Last Block, respectively. The telemetry data captured and its size is implementation dependent.

~~The size of the log page is variable and may be calculated using the Telemetry Host-Initiated Data Area 3 Last Block field.~~

The size of the log page is variable and:

- If bit 6 is cleared to '0' in the Log Page Attributes field, the size may be calculated using the Telemetry Host-Initiated Data Area 3 Last Block field.
- If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is set to 1h in the Host Behavior Support feature (refer to section 5.21.1.22), then the size of the log page may be calculated using the Telemetry Host-Initiated Data Area 4 Last Block field.
- If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is cleared to 0h in the Host Behavior Support feature (refer to section 5.21.1.22), then the size of the log page may be calculated using the Telemetry Host-Initiated Data Area 3 Last Block field.

The controller shall return data for all blocks requested:

- If bit 6 of the Log Page Attributes field is cleared to '0', then the data beyond the last block in Telemetry Host-Initiated Data Area 3 Last Block is undefined.
- If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is set to 1h in the Host Behavior Support feature, then the data beyond the last block in Telemetry Host-Initiated Data Area 4 Last Block is undefined.
- If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is cleared to 0h in the Host Behavior Support feature, then the data beyond the last block in Telemetry Host-Initiated Data Area 3 Last Block is undefined.

If the host requests a data transfer that is not a multiple of 512 bytes, then the controller shall return an error of Invalid Field in Command.

**Figure 205: Get Log Page – Telemetry Host-Initiated Log (Log Identifier 07h)**

Bytes	Description
00	<b>Log Identifier:</b> This field shall be set to 07h.
04:01	Reserved
07:05	<b>IEEE OUI Identifier (IEEE):</b> Contains the Organization Unique Identifier (OUI) for the controller vendor that is able to interpret the data. If cleared to 0h, no IEEE OUI Identifier is present. The OUI shall be a valid IEEE/RAC assigned identifier that is registered at <a href="http://standards.ieee.org/develop/regauth/oui/public.html">http://standards.ieee.org/develop/regauth/oui/public.html</a> .
09:08	<b>Telemetry Host-Initiated Data Area 1 Last Block:</b> Contains the value of the last block of Telemetry Host-Initiated Data Area 1. If the Telemetry Host-Initiated Data Area 1 does not contain data, then this field shall be cleared to 0h. If this field is not 0h, then Telemetry Host-Initiated Data Area 1 begins at block 1h and ends at the block indicated in this field.
11:10	<b>Telemetry Host-Initiated Data Area 2 Last Block:</b> Contains the value of the last block of Telemetry Host-Initiated Data Area 2. This value shall be greater than or equal to the value in the Telemetry Host-Initiated Data Area 1 Last Block field. If this field is not 0h, then Telemetry Host-Initiated Data Area 2 begins at block 1h and ends at the block indicated in this field.
13:12	<b>Telemetry Host-Initiated Data Area 3 Last Block:</b> Contains the value of the last block of Telemetry Host-Initiated Data Area 3. This value shall be greater than or equal to the value in the Telemetry Host-Initiated Data Area 2 Last Block field. If this field is not 0h, then Telemetry Host-Initiated Data Area 3 begins at block 1h and ends at the block contained in this field.
15:14	Reserved

**Figure 205: Get Log Page – Telemetry Host-Initiated Log (Log Identifier 07h)**

Bytes	Description
19:16	<b>Telemetry Host-Initiated Data Area 4 Last Block:</b> Contains the value of the last block of Telemetry Host-Initiated Data Area 4. If bit 6 of the Log Page Attributes field is set to '1', then this value shall be greater than or equal to the value in the Telemetry Host-Initiated Data Area 3 Last Block field.  If this field is not 0h, then Telemetry Host-Initiated Data Area 4 begins at block 1h and ends at the block contained in this field.
380:20	Reserved
381	<b>Telemetry Host-Initiated Data Generation Number:</b> Contains a value that is incremented each time the controller captures its internal controller state for this log page. If the value of this field is FFh, then the field shall be cleared to 0h when incremented (i.e., rolls over to 0h).
382	<b>Telemetry Controller-Initiated Data Available:</b> Contains the value of Telemetry Controller-Initiated Data Available field in the Telemetry Controller-Initiated log (refer to Figure 206).
383	<b>Telemetry Controller-Initiated Data Generation Number:</b> Contains the value of the Telemetry Controller-Initiated Data Generation Number field in the Telemetry Controller-Initiated log (refer to Figure 206).
511:384	<b>Reason Identifier:</b> Contains a vendor specific identifier that describes the operating conditions of the controller at the time of capture. The Reason Identifier field should provide an identification of unique operating conditions of the controller.
1023:512	<b>Telemetry Host-Initiated Data Block 1:</b> Contains Telemetry Data Block 1 for the Telemetry Host-Initiated Log.
1535:1024	<b>Telemetry Host-Initiated Data Block 2:</b> Contains Telemetry Data Block 2 for the Telemetry Host-Initiated Log.
...	...
( $n \times 512$ ):511:( $n \times 512$ )	<b>Telemetry Host-Initiated Data Block <math>n</math>:</b> Contains Telemetry Data Block $n$ for the Telemetry Host-Initiated Log.

**Modify portions of section 5.14.1.8 (5.14.1.8 Telemetry Controller-Initiated) as shown below:**

This log consists of a header describing the log and zero or more Telemetry Data Blocks (refer to section 8.14). All Telemetry Data Blocks are 512 bytes in size. This log is a controller initiated capture of the controller's internal state. The Telemetry Controller-Initiated Data for Data Area 1 through Data Area 3 shall persist across all resets. The Telemetry Controller-Initiated Data for Data Area 4 may persist across controller resets. If the host specifies a Log Page Offset Lower value that is not a multiple of 512 bytes in the Get Log Page command for this log, then the controller shall return an error of Invalid Field in Command. This log page is global to the controller.

The Telemetry Controller-Initiated Data consists of:

- a) three areas, if bit 6 of the Log Page Attributes field is cleared to '0': Telemetry Controller-Initiated Data Area 1, Telemetry Controller-Initiated Data Area 2, and Telemetry Controller-Initiated Data Area 3; or
- b) four areas, if bit 6 of the Log Page Attributes field is set to '1': Telemetry Controller-Initiated Data Area 1, Telemetry Controller-Initiated Data Area 2, Telemetry Controller-Initiated Data Area 3 and Telemetry Controller-Initiated Data Area 4.

All three areas start at Telemetry Controller-Initiated Data Block 1. The last block of each area is indicated in the Telemetry Controller-Initiated Data Area y Last Block, respectively. The telemetry data captured and its size is implementation dependent.

~~The size of the log page is variable and may be calculated using the Telemetry Controller-Initiated Data Area 3 Last Block field.~~

The size of the log page is variable and:

- If bit 6 is cleared to '0' in the Log Page Attributes field, the size may be calculated using the Telemetry Controller-Initiated Data Area 3 Last Block field.
- If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is set to 1h in the Host Behavior Support feature (refer to section 5.21.1.22), then the size of the log page may be calculated using the Telemetry Controller-Initiated Data Area 4 Last Block field.
- If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is cleared to 0h in the Host Behavior Support feature (refer to section 5.21.1.22), then the size of the log page may be calculated using the Telemetry Controller-Initiated Data Area 3 Last Block field.

The controller shall return data for all blocks requested:

- If bit 6 of the Log Page Attributes field is cleared to '0', then the data beyond the last block in Telemetry Controller-Initiated Data Area 3 Last Block is undefined.
- If bit 6 of the Log Page Attributes field is set to '1', then the data beyond the last block in Telemetry Controller-Initiated Data Area 4 Last Block is undefined. If the host requests a data transfer that is not a multiple of 512 bytes, then the controller shall return an error of Invalid Field in Command.
- If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is cleared to 0h in the Host Behavior Support feature, then the data beyond the last block in Telemetry Controller-Initiated Data Area 3 Last Block is undefined.

**Figure 206: Get Log Page – Telemetry Controller-Initiated Log (Log Identifier 08h)**

Bytes	Description
00	<b>Log Identifier:</b> This field shall be set to 08h.
04:01	Reserved
07:05	<b>IEEE OUI Identifier (IEEE):</b> Contains the Organization Unique Identifier (OUI) for the controller vendor that is able to interpret the data. If cleared to 0h, no IEEE OUI Identifier is present. The OUI shall be a valid IEEE/RAC assigned identifier that is registered at <a href="http://standards.ieee.org/develop/regauth/oui/public.html">http://standards.ieee.org/develop/regauth/oui/public.html</a> .
09:08	<b>Telemetry Controller-Initiated Data Area 1 Last Block:</b> Contains the value of the last block of Telemetry Controller-Initiated Data Area 1. If the Telemetry Controller-Initiated Data Area 1 does not contain data, then this field shall be cleared to 0h. If this field is not 0h, then Telemetry Controller-Initiated Data Area 1 begins at block 1 and ends at the block indicated in this field.
11:10	<b>Telemetry Controller-Initiated Data Area 2 Last Block:</b> Contains the value of the last block of Telemetry Controller-Initiated Data Area 2. This value shall be greater than or equal to the value in the Telemetry Controller-Initiated Data Area 1 Last Block field. If this field is not 0h, then Telemetry Controller-Initiated Data Area 2 begins at block 1h and ends at the block indicated in this field.
13:12	<b>Telemetry Controller-Initiated Data Area 3 Last Block:</b> Contains the value of the last block of Telemetry Controller-Initiated Data Area 3. This value shall be greater than or equal to the value in the Telemetry Controller-Initiated Data Area 2 Last Block field. If this field is not 0h, then Telemetry Controller-Initiated Data Area 3 begins at block 1h and ends at the block indicated in this field.
15:14	Reserved
19:16	<b>Telemetry Controller-Initiated Data Area 4 Last Block:</b> Contains the value of the last block of Telemetry Controller-Initiated Data Area 4. If bit 6 of the Log Page Attributes field is set to '1', then this value shall be greater than or equal to the value in the Telemetry Controller-Initiated Data Area 3 Last Block field.



**Figure 206: Get Log Page – Telemetry Controller-Initiated Log (Log Identifier 08h)**

Bytes	Description
	If this field is not 0h, then Telemetry Controller-Initiated Data Area 4 begins at block 1h and ends at the block contained in this field.
381:20	Reserved
382	<b>Telemetry Controller-Initiated Data Available:</b> If this field is cleared to 0h, the log does not contain saved internal controller state. If this field is set to 1h, the log contains saved internal controller state. If this field is set to 1h, it shall not be cleared to 0h until a Get Log Page command with Retain Asynchronous Event bit cleared to '0' for the Telemetry Controller-Initiated log completes successfully. This value is persistent across power states and reset. Other values are reserved.
383	<b>Telemetry Controller-Initiated Data Generation Number:</b> Contains a value that is incremented each time the controller initiates a capture of its internal controller state into the Telemetry Controller-Initiated Data Blocks. If the value of this field is FFh, then the field shall be cleared to 0h when incremented (i.e., rolls over to 0h). This field is persistent across power on.
511:384	<b>Reason Identifier:</b> Contains a vendor specific identifier that describes the operating conditions of the controller at the time of capture. The Controller-Initiated Reason Identifier field should provide an identification of unique operating conditions of the controller.
1023:512	<b>Telemetry Controller-Initiated Data Block 1:</b> Contains Telemetry Data Block 1 for the Telemetry Controller -Initiated Log captured at a vendor specific time.
1535:1024	<b>Telemetry Controller-Initiated Data Block 2:</b> Contains Telemetry Data Block 2 for the Telemetry Controller -Initiated Log captured at a vendor specific time.
...	...
(n*512)+511:(n*512)	<b>Telemetry Controller-Initiated Data Block n:</b> Contains Telemetry Data Block n for the Telemetry Controller-Initiated log captured at a vendor specific time.

**Modify portions of section 8.14 (8.14 Telemetry) as shown below:**

Telemetry enables manufacturers to collect internal data logs to improve the functionality and reliability of products. The telemetry data collection may be initiated by the host or by the controller. The data is returned in the Telemetry Host-Initiated log page or the Telemetry Controller-Initiated log page (refer to section 5.14.1.7 and 5.14.1.8). The data captured is vendor specific. The telemetry feature defines the mechanism to collect the vendor specific data. The controller indicates support for the telemetry log pages **and for the Data Area 4 size** in the Log Page Attributes field in the Identify Controller data structure.

An important aspect to discovering issues by collecting telemetry data is the ability to qualify distinct issues that are being collected. The ability to create a one to one mapping of issues to data collections is essential. If a one to one mapping is not established, there is the risk that several payload collections appear distinct but are actually all caused by the same issue. Conversely, a single payload collection may have payloads caused by several issues mixed together creating additional complexity in determining the root cause. As a result, flexibility in size is provided in the collection of telemetry payloads and a three phase process is typically used.

The first phase establishes that an issue exists and is best accomplished by collecting a minimum set of data to identify the issue as being distinct from other issues. Once the number of instances of an issue establish an investigation, another phase may be necessary to collect actionable information. In the second phase, a targeted collection of more in depth medium size payloads are gathered and analyzed to identify the source of the problem. ~~For rare issues that are not root caused by a small or medium sized telemetry data collection, a third phase may be employed to collect the largest and most complete payload to diagnose the issue.~~

If the small or medium sized telemetry data collection provides insufficient information, a third phase may be employed to collect additional details. If bit 6 is cleared to '0' in the Log Page Attributes field, then the

third phase provides the largest and most complete payload to diagnose the issue. If bit 6 is set to '1' in the Log Page Attribute and the Extended Telemetry Data Area 4 Supported (ETDAS) field is set to 1h in the Host Behavior Support feature (refer to section 5.21.1.22) then a fourth phase may be employed to collect the largest and most complete payload to diagnose the issue. If Data Area 4 is created, then Data Area 3 of non-zero length shall also be created and populated as part of data collection.

There are two telemetry data logs (i.e., Host-Initiated log and Controller-Initiated log) defined. Each telemetry data log is made up of a single set of Telemetry Data Blocks. Each Telemetry Data Block is 512 bytes in size. Telemetry data is returned (refer to section 5.14.1.7 and section 5.14.1.8) in units of Telemetry Data Blocks. Each telemetry data log is segmented into:

- a) ~~Three~~ Telemetry Data Areas (i.e., small, medium, and large), if bit 6 of the Log Page Attributes field is cleared to '0'; or
- b) Four Telemetry Data Areas (i.e., small, medium, large and extra-large) If bit 6 of the Log Page Attributes field is set to '1' and the Extended Telemetry Data Area 4 Supported (ETDAS) field is set to 1h in the Host Behavior Support feature (refer to section 5.21.1.22).

All telemetry data areas start at Telemetry Data Block 1.

Each Telemetry Data Area shall represent the controller's internal state at the time the telemetry data was captured.

Each Telemetry Data Area is intended to capture a richer set of data to aid in resolution of issues. Telemetry Data Area 1 is intended to have a small size payload (i.e., the first phase), Telemetry Data Area 2 is intended to have a medium size payload (i.e., the second phase), and Telemetry Data Area 3 is intended to have a large size payload (i.e., the third phase). ~~Telemetry Data Area 4 is intended to have an extra-large size payload (i.e. the fourth phase).~~ The size of each Telemetry Data Area is vendor specific and may change on each data collection. When possible, the host should retrieve the payload for all ~~three~~ Telemetry Data Areas to enable the best diagnosis of the issue(s).

The preparation, collection, and submission of telemetry data is similar for host-initiated and controller-initiated data; the primary difference is the trigger for the collection. The operational model for telemetry is:

1. The host identifies controller support for Telemetry log pages in the Identify Controller data structure;
2. ~~The host may indicate the support for the Telemetry Host-Initiated Data Area 4 and Telemetry Controller-Initiated Data Area 4 by setting the Extended Telemetry Data Area 4 Supported (ETDAS) field to 1h in the Host Behavior Support feature (refer to section 5.21.1.22);~~
3. The host prepares an area to store telemetry data if needed;
4. To receive notification that controller-initiated telemetry data is available, the host enables Telemetry Log Notices using the Asynchronous Event Configuration feature (refer to section 5.21.1.11); and
5. If the host decides to collect host-initiated telemetry data or the controller signals that controller-initiated telemetry data is available:
  - a. The host reads the appropriate blocks of the Telemetry Data Area from the host-initiated log (refer to section 5.14.1.7) or the controller-initiated log (refer to section 5.14.1.8). If possible, the host should collect Telemetry Data Area 1, 2, ~~and 3, and 4.~~ The host reads the log in 512 byte Telemetry Data Block units. The host should set the Retain Asynchronous Event bit to '1';
  - b. The host re-reads the header of the log page and ensures that Telemetry Host-Initiated Data Generation Number field from the host-initiated log or the ~~the~~ Telemetry Controller-Initiated Data Generation Number field in the controller-initiated log matches the original value read. If these values do not match, then the data captured is not consistent and should be re-read from the log page with the Retain Asynchronous Event bit set to '1';
  - c. If the host is reading the controller-initiated log, then the host reads any portion of that log page with the Retain Asynchronous Event bit cleared to '0' to indicate to the controller that the host has completed reading the controller-initiated log page; and

- d. When all telemetry data has been saved, the data should be forwarded to the manufacturer of the controller.