

***BiTMICRO LLC v. Intel Corp.* – Civil Action No. 6:22-cv-00335-ADA**
Plaintiff's Preliminary Disclosure of Asserted Claims and Infringement Contentions
Appendix G – U.S. Patent No. 6,496,939 (“the ’939 Patent”)

BiTMICRO LLC (“Plaintiff” or “BiTMICRO”) hereby provides preliminary infringement contentions in support of its claim that Intel Corporation (“Defendant” or “Intel”) infringes the ’939 Patent. Plaintiff currently contends that Defendant infringes the following claims (“Asserted Claims”) of the ’939 Patent:

Claims 1, 2, 3, 6, 10, 11, 12, 15.

Defendant directly infringes (or has directly infringed) the Asserted Claims of the ’939 Patent under 35 U.S.C. § 271(a) by making, using, selling, offering for sale, and/or importing into the United States RAID Controllers, which include modules and adapters, along with RAID Maintenance Free Backup Units (RMFBU), including Intel’s Raid Controller RMSP3AD160F and the RMFBU AXXRMFBU and all reasonably similar products (“the ’939 Accused Instrumentalities”).

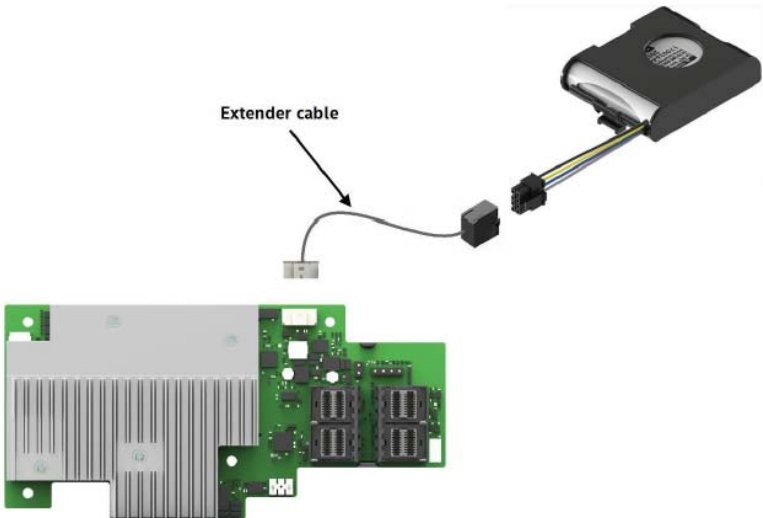
References to instrumentalities in this chart are exemplary only and should not be construed as limiting the scope of any claim of the ’939 Patent. The Intel ’939 Accused Instrumentalities satisfy each element of each Asserted Claim below literally. In addition, depending on the Court’s claim construction, and to the extent any of the elements of the Asserted Claims may later be determined not to be literally present, the doctrine of equivalents may also apply.

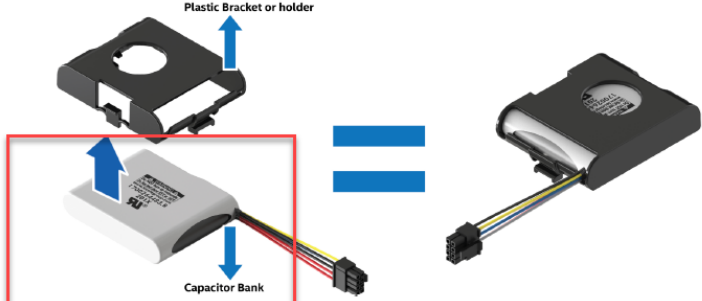
Because details of the structure and operation of the ’939 Accused Instrumentalities are not readily available for public inspection, and also because public documentation provides only a high level of abstraction aimed at customers, these contentions are intended to provide notice to Defendant regarding the subject matter to be explored in discovery. Details concerning the structure and manner of operation of the ’939 Accused Instrumentalities are expected to be found in internal Intel documentation.

Plaintiff’s contentions regarding infringement of specific claims will depend on the claim construction ultimately adopted by the Court. Because said construction has not yet occurred, Plaintiff’s contentions herein are preliminary, and subject to change based upon the Court’s construction. In addition, Plaintiff’s investigation and analysis of the ’939 Accused Instrumentalities are based upon information made publicly available by Defendant and the Plaintiff’s own investigations. Plaintiff reserves the right to amend these contentions based upon discovery of additional information from Defendant or third parties regarding the operation of the ’939 Accused Instrumentalities, or upon discovery of additional products or technologies of Defendant that infringe the ’939 Patent.

All ***bolded italics*** and/or **highlighting** are emphasis added unless noted otherwise.

Claim 1	Exemplary Infringement by Intel RAID Modules with RMFBU
1[Pre] A method for controlling data in a computer system when the computer system loses power, the computer system comprising a computing engine, comprising the steps of:	Intel makes, uses, sells, offers for sale, and imports into the United States RAID Controllers, which include modules and adapters, along with RAID Maintenance Free Backup Units (RMFBU). Intel's RAID Controllers offer RAID levels 0/1/10/5/50/6/60, with maintenance-free cache backup and disk encryption options. All products are available in a standard PCIe add-in and a module form factors. These controllers are designed and intended to be paired with RAID Maintenance Free Backup Units (RMFBU) and reasonably similar Smart Battery products to provide and perform the claimed features. See e.g., https://www.intel.com/content/www/us/en/products/details/servers/raid/raid-controllers.html; https://www.intel.com/content/www/us/en/support/articles/000007764/server-products/sasraid.html.  Intel® RAID Modules Pictured: RMSP3AD160F RMSP3CD080F RMSP3HD080E Intel® RAID Controllers for Select Intel® Xeon® Processor Based Server Solutions As big data continues to get bigger, so does the need for high-performance RAID solutions. Content and Web Hosting Appliances, Security Appliances, Financial Institutions, Cloud Service Providers, and Enterprise IT Customers are seeking high-uptime RAID solutions for mass storage, with maximum reliability and data integrity. Minimizing downtime and eliminating data loss are major priorities for these high-intensity workloads. The tri-mode families of Intel® RAID Controllers include modules and adapters, all support NVMe. Intel® RAID Controllers: Modules (RMSP3) vs. Adapters (RS3P4 & RSP3) See e.g., Intel Tri-mode Intel Storage Controllers supporting PCIe NVMe: Product Brief, at 1.

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	 Figure 23. Connecting the FBU345 to the RAID module using the extender cable See e.g., Intel RAID Modules, Hardware User Guide (Rev. 1.4, September 2020), at 42. The RAID Controllers/RMFBU comprise the claimed computer system and include the RAID Controller, which comprises the computing engine. The Controller further includes at least one RAID RAM (volatile memory) and at least one SSD cache (non-volatile memory). <table><tr><th colspan="4">Intel® Raid Module Specifications (RMSP3 family)</th></tr><tr><th></th><th>RMSP3AD160F</th><th>RMSP3CD080F</th><th>RMSP3HD080E</th></tr><tr><td>I/O Processor</td><td>Broadcom, SAS3516 ROC</td><td>Broadcom, SAS3508 ROC</td><td>Broadcom, SAS3408 IOC</td></tr><tr><td>RAID Levels</td><td colspan="2">0/1/10/5/50/6/60</td><td>0/1/10/5</td></tr><tr><td>JBOD Mode</td><td colspan="2">Yes</td><td>Yes</td></tr><tr><td>Cache Memory</td><td colspan="2">4GB DDR4</td><td>N/A</td></tr><tr><td>Mini-SAS-HD (SFF8643) connectors</td><td>4 Internal</td><td>2 Internal</td><td>2 Internal</td></tr><tr><td>Operating Temperature</td><td colspan="2">Maximum ambient: 55C</td><td>Maximum ambient: 55C</td></tr><tr><td>Maximum Physical Devices (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>63</td></tr><tr><td>Maximum Direct-Attach NVMe Devices</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maximum Array Volumes (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>32</td></tr><tr><td>Maximum Array Volumes (NVMe)</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maintenance Free Backup Unit</td><td colspan="2">AXXRMFBU7 (backup unit sold separately)</td><td>N/A</td></tr><tr><td>Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)</td><td colspan="2">AXXRPFKDE2 (upgrade key sold separately)</td><td>N/A</td></tr></table>	Intel® Raid Module Specifications (RMSP3 family)					RMSP3AD160F	RMSP3CD080F	RMSP3HD080E	I/O Processor	Broadcom, SAS3516 ROC	Broadcom, SAS3508 ROC	Broadcom, SAS3408 IOC	RAID Levels	0/1/10/5/50/6/60		0/1/10/5	JBOD Mode	Yes		Yes	Cache Memory	4GB DDR4		N/A	Mini-SAS-HD (SFF8643) connectors	4 Internal	2 Internal	2 Internal	Operating Temperature	Maximum ambient: 55C		Maximum ambient: 55C	Maximum Physical Devices (SAS/SATA)	64 or 240 (Profile Dependent)		63	Maximum Direct-Attach NVMe Devices	4		2	Maximum Array Volumes (SAS/SATA)	64 or 240 (Profile Dependent)		32	Maximum Array Volumes (NVMe)	4		2	Maintenance Free Backup Unit	AXXRMFBU7 (backup unit sold separately)		N/A	Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)	AXXRPFKDE2 (upgrade key sold separately)		N/A
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1[a] (a) activating a plurality of super capacitors to supply power to the computing engine based upon power being removed from the computer system;	The claimed method of the RAID Controllers/RMFBU includes activating a plurality of super capacitors to supply power to the computing engine based upon power being removed from the computer system. For example, the RMFBU includes a plurality of super capacitors to supply power to the computing engine, including but not limited to based upon power being removed from the computer system. 1. Place the Super Capacitor Module and the plastic holder front-side-up on a flat, clean, static-free surface. 2. Press the Super Capacitor Module into the plastic holder until the module clicks firmly into place, as shown in the following figure (note that the actual shape of the product may vary).  Figure 21. AXxRMFBU7 mounting assembly See e.g., Intel RAID Modules, Hardware User Guide, at 41.												

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	Figure 23. Connecting the FBU345 to the RAID module using the extender cable See <i>e.g.</i>, Intel RAID Modules, Hardware User Guide, at 42. As Intel explains in its documentation, the RMFBU monitors the voltage level of the DRAM of the Intel RAID controller module. During normal system operation, power is supplied from the external source (AC) power. However, if the voltage drops below a predefined level due to a power failure or brief power outage, the RAID Controller/RMFBU activates the plurality of super capacitors in the RMFBU to supply power to the computing engine, which protects the integrity of the cached data. During normal system operation, the RMFBU monitors the voltage level of the DRAM of the Intel® RAID Module or Intel® RAID Module. If the voltage drops below a predefined level due to an AC power failure or brief power outage, the RMFBU protects the integrity of the cached data by providing sufficient back-up power to offload the data from the RAID RAM to the NAND flash. When the voltage level returns to an acceptable level, the RAID RAM is recovered from flash, and all pending writes to storage devices are completed without losing any data. See <i>e.g.</i>, Intel RAID Modules, Hardware User Guide, at 38.

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	The cache memory available on Intel® RAID Modules and Intel® RAID Adapters can improve the overall system performance. Writing data to the module's cache memory is much faster than writing data to a storage device. Write operations appear to complete very quickly at the software application level. The Intel® RAID Module writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it is written to the storage device. This risk factor is eliminated when the Intel® RAID Module has an RMFBU installed. In addition, <i>See e.g., Intel RAID Modules, Hardware User Guide, at 38.</i> The AXXRMFBU7 RMFBU is a kit consisting of a FBU345 super capacitor bank, a plastic bracket to attach the super capacitor bank to the chassis, and two (2) extender cables, one 605 mm long and the other 930 mm long. The FBU345 consists of a bank of Electric Double-Layer Capacitors (EDLC) or super capacitors capable of storing a high amount of electric energy while active. In the event of a power failure, the FBU345 provides the power needed for the data offload. It also has an over-temperature detection circuitry and a discharge circuitry that discharges the capacitors while disconnected from the RAID module or when the system on which it is installed is turned off. <i>See e.g., Intel RAID Modules, Hardware User Guide, at 38.</i>

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1[b] (b) reconfiguring the data in the computing engine; and	The claimed method of the RAID Controllers/RMFBU includes reconfiguring the data in the computing engine. As Intel explains in its documentation, the RMFBU monitors the voltage level of the DRAM of the Intel RAID controller module. During normal system operation, power is supplied from the external source (AC) power. However, if the voltage drops below a predefined level due to a power failure or brief power outage, the RAID Controller/RMFBU activates the plurality of super capacitors in the RMFBU to supply power to the computing engine, which protects the integrity of the cached data.																												

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	During normal system operation, the RMFBU monitors the voltage level of the DRAM of the Intel® RAID Module or Intel® RAID Module. If the voltage drops below a predefined level due to an AC power failure or brief power outage, the RMFBU protects the integrity of the cached data by providing sufficient back-up power to offload the data from the RAID RAM to the NAND flash. When the voltage level returns to an acceptable level, the RAID RAM is recovered from flash, and all pending writes to storage devices are completed without losing any data. See e.g., Intel RAID Modules, Hardware User Guide, at 38. The cache memory available on Intel® RAID Modules and Intel® RAID Adapters can improve the overall system performance. Writing data to the module's cache memory is much faster than writing data to a storage device. Write operations appear to complete very quickly at the software application level. The Intel® RAID Module writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it is written to the storage device. This risk factor is eliminated when the Intel® RAID Module has an RMFBU installed. In addition, See e.g., Intel RAID Modules, Hardware User Guide, at 38. The AXSRMFBU7 RMFBU is a kit consisting of a FBU345 super capacitor bank, a plastic bracket to attach the super capacitor bank to the chassis, and two (2) extender cables, one 605 mm long and the other 930 mm long. The FBU345 consists of a bank of Electric Double-Layer Capacitors (EDLC) or super capacitors capable of storing a high amount of electric energy while active. In the event of a power failure, the FBU345 provides the power needed for the data offload. It also has an over-temperature detection circuitry and a discharge circuitry that discharges the capacitors while disconnected from the RAID module or when the system on which it is installed is turned off. See e.g., Intel RAID Modules, Hardware User Guide, at 38. The RAID Controller/RMFBU reconfigures the data in the cache of the Controller by transferring that data from the RAID RAM (volatile memory) to NAND Flash (non-volatile memory). On information and belief, the RAID Controller/RMFBU also transfers some or all of that data to other non-volatile storage, including but not limited to the solid-state storage drives (SSD) and hard disk drives (HDD).
1[c] (c) deactivating the plurality of super capacitors to cut off power to the computing engine based upon the plurality of	The claimed method of the RAID Controllers/RMFBU includes deactivating the plurality of super capacitors to cut off power to the computing engine based upon the plurality of super capacitors discharging to a predetermined level. For example, when all the data in the RAID RAM (volatile memory) has been transferred and/or when the super capacitors in the RMFBU's capacity (shown below) are at or near depletion state, the RAID Controllers/RMFBU deactivates the super capacitors to cut off power to the computing engine.

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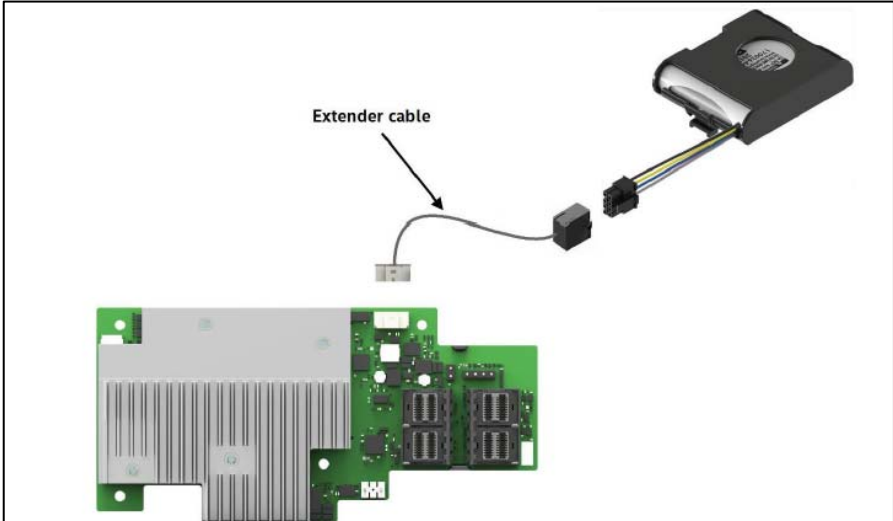
Claim 2	Exemplary Infringement by Intel RAID Modules with RMFBU																																																																																				
2 The method of claim 1 wherein the computing engine comprises a least one volatile memory and at least one non-volatile memory.	See claim 1. The RAID Controllers/RMFBU include a least one volatile memory and at least one non-volatile memory. The RAID Controllers/RMFBU comprise the claimed computer system and include the RAID Controller, which comprises the computing engine. The Controller further includes at least one RAID RAM (volatile memory) and at least one SSD cache (non-volatile memory). Intel® Raid Module Specifications (RMSP3 family) <table><tr><th></th><th>RMSP3AD160F</th><th>RMSP3CD080F</th><th>RMSP3HD080E</th></tr><tr><td>I/O Processor</td><td>Broadcom, SAS3516 ROC</td><td>Broadcom, SAS3508 ROC</td><td>Broadcom, SAS3408 IOC</td></tr><tr><td>RAID Levels</td><td colspan="2">0/1/10/5/50/6/60</td><td>0/1/10/5</td></tr><tr><td>JBOD Mode</td><td colspan="2">Yes</td><td>Yes</td></tr><tr><td>Cache Memory</td><td colspan="2">4GB DDR4</td><td>N/A</td></tr><tr><td>Mini-SAS-HD (SFF8643) connectors</td><td>4 Internal</td><td>2 Internal</td><td>2 Internal</td></tr><tr><td>Operating Temperature</td><td colspan="2">Maximum ambient: 55C</td><td>Maximum ambient: 55C</td></tr><tr><td>Maximum Physical Devices (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>63</td></tr><tr><td>Maximum Direct-Attach NVMe Devices</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maximum Array Volumes (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>32</td></tr><tr><td>Maximum Array Volumes (NVMe)</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maintenance Free Backup Unit</td><td colspan="2">AXXRMFBU7 (backup unit sold separately)</td><td>N/A</td></tr><tr><td>Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)</td><td colspan="2">AXXRPFKDE2 (upgrade key sold separately)</td><td>N/A</td></tr></table> See e.g., Intel Tri-mode Intel Storage Controllers supporting PCIe NVMe: Product Brief, at 2. 2.5 Intel® Tri-Mode RAID Module Feature Set The following table describes the feature set of the Intel Tri-Mode RAID modules. Table 1. Intel® Tri-Mode RAID module comparative feature set <table><tr><th>Feature</th><th>RMSP3AD160F</th><th>RMSP3CD080F</th><th>RMSP3HD080E</th></tr><tr><td>I/O Processor</td><td>Avago* SAS3516 PCIe* RAID On-Chip (ROC)</td><td>Avago* SAS3508 PCIe* RAID On-Chip (ROC)</td><td>Avago* SAS3508 PCIe* RAID On-Chip (ROC)</td></tr><tr><td>RAID Levels</td><td>0,1,5,6,10, 50, 60</td><td>0,1,5,6,10, 50, 60</td><td>0,1,5,10,50</td></tr><tr><td>JBOD Mode or Pass through Mode (SAS/SATA)</td><td>Yes</td><td>Yes</td><td>Yes</td></tr><tr><td>Cache Memory</td><td>4 GB DDR4 at 2133 MHz</td><td>4 GB DDR4 at 2133 MHz</td><td>N/A</td></tr><tr><td>Form Factor</td><td>Modular Mezzanine</td><td>Modular Mezzanine</td><td>Modular Mezzanine</td></tr><tr><td>Drive Interface Connectors</td><td>4</td><td>2</td><td>2</td></tr><tr><td>PCIe* Interface</td><td>x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane</td><td>x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane</td><td>x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane</td></tr></table>		RMSP3AD160F	RMSP3CD080F	RMSP3HD080E	I/O Processor	Broadcom, SAS3516 ROC	Broadcom, SAS3508 ROC	Broadcom, SAS3408 IOC	RAID Levels	0/1/10/5/50/6/60		0/1/10/5	JBOD Mode	Yes		Yes	Cache Memory	4GB DDR4		N/A	Mini-SAS-HD (SFF8643) connectors	4 Internal	2 Internal	2 Internal	Operating Temperature	Maximum ambient: 55C		Maximum ambient: 55C	Maximum Physical Devices (SAS/SATA)	64 or 240 (Profile Dependent)		63	Maximum Direct-Attach NVMe Devices	4		2	Maximum Array Volumes (SAS/SATA)	64 or 240 (Profile Dependent)		32	Maximum Array Volumes (NVMe)	4		2	Maintenance Free Backup Unit	AXXRMFBU7 (backup unit sold separately)		N/A	Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)	AXXRPFKDE2 (upgrade key sold separately)		N/A	Feature	RMSP3AD160F	RMSP3CD080F	RMSP3HD080E	I/O Processor	Avago* SAS3516 PCIe* RAID On-Chip (ROC)	Avago* SAS3508 PCIe* RAID On-Chip (ROC)	Avago* SAS3508 PCIe* RAID On-Chip (ROC)	RAID Levels	0,1,5,6,10, 50, 60	0,1,5,6,10, 50, 60	0,1,5,10,50	JBOD Mode or Pass through Mode (SAS/SATA)	Yes	Yes	Yes	Cache Memory	4 GB DDR4 at 2133 MHz	4 GB DDR4 at 2133 MHz	N/A	Form Factor	Modular Mezzanine	Modular Mezzanine	Modular Mezzanine	Drive Interface Connectors	4	2	2	PCIe* Interface	x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane	x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane	x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane
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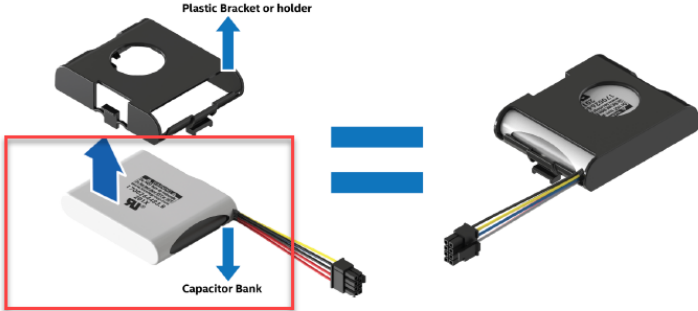
Claim 2	Exemplary Infringement by Intel RAID Modules with RMFBU
	<i>See e.g.</i>, Intel RAID Modules, Hardware User Guide, at 12. During normal system operation, the RMFBU monitors the voltage level of the DRAM of the Intel® RAID Module or Intel® RAID Module. If the voltage drops below a predefined level due to an AC power failure or brief power outage, the RMFBU protects the integrity of the cached data by providing sufficient back-up power to offload the data from the RAID RAM to the NAND flash. When the voltage level returns to an acceptable level, the RAID RAM is recovered from flash, and all pending writes to storage devices are completed without losing any data. <i>See e.g.</i>, Intel RAID Modules, Hardware User Guide, at 38. The cache memory available on Intel® RAID Modules and Intel® RAID Adapters can improve the overall system performance. Writing data to the module's cache memory is much faster than writing data to a storage device. Write operations appear to complete very quickly at the software application level. The Intel® RAID Module writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it is written to the storage device. This risk factor is eliminated when the Intel® RAID Module has an RMFBU installed. In addition, <i>See e.g.</i>, Intel RAID Modules, Hardware User Guide, at 38.

Claim 3	Exemplary Infringement by Intel RAID Modules with RMFBU
3 The method of claim 2 wherein the reconfiguring step (b) further comprises: (b1) allowing all data to be transferred from the at least one volatile memory to the at least one non-volatile memory.	The claimed method of the RAID Controllers/RMFBU includes allowing all data to be transferred from the at least one volatile memory to the at least one non-volatile memory. <i>See claim 1, 2.</i>

Claim 6	Exemplary Infringement by Intel RAID Modules with RMFBU
6[Pre] The method of claim 3 wherein the activating step (a) further comprises:	See claim 1, 2, 3.
6[a] (a1) reversing the flow of current between the computing engine and the plurality of super capacitors; and	The claimed method of the RAID Controllers/RMFBU includes reversing the flow of current between the computing engine and the plurality of super capacitors. See claim 1[a].
6[b] (a2) discharging current from the plurality of super capacitors to the computing engine.	The claimed method of the RAID Controllers/RMFBU includes discharging current from the plurality of super capacitors to the computing engine. See claim 1[a].

Claim 10	Exemplary Infringement by Intel RAID Modules with RMFBU
10[Pre] A system for controlling data in a computer system when the computer system loses power, the computer system comprising a computer engine, comprising:	Intel makes, uses, sells, offers for sale, and imports into the United States RAID Controllers, which include modules and adapters, along with RAID Maintenance Free Backup Units (RMFBU). Intel's RAID Controllers offer RAID levels 0/1/10/5/50/6/60, with maintenance-free cache backup and disk encryption options. All products are available in a standard PCIe add-in and a module form factors. These controllers are designed and intended to be paired with RAID Maintenance Free Backup Units (RMFBU) and reasonably similar Smart Battery products to provide and perform the claimed features. See e.g., https://www.intel.com/content/www/us/en/products/details/servers/raid/raid-controllers.html; https://www.intel.com/content/www/us/en/support/articles/000007764/server-products/sasraid.html. See e.g., Intel, Tri-mode Intel Storage Controllers supporting PCIe NVMe: Product Brief, at 1.

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	 Figure 23. Connecting the FBU345 to the RAID module using the extender cable See e.g., Intel RAID Modules, Hardware User Guide (Rev. 1.4, September 2020), at 42. The RAID Controllers/RMFBU comprise the claimed computer system and include the RAID Controller, which comprises the computing engine. The Controller further includes at least one RAID RAM (volatile memory) and at least one SSD cache (non-volatile memory). Intel® Raid Module Specifications (RMSP3 family) <table><thead><tr><th></th><th>RMSP3AD160F</th><th>RMSP3CD080F</th><th>RMSP3HD080E</th></tr></thead><tbody><tr><td>I/O Processor</td><td>Broadcom, SAS3516 ROC</td><td>Broadcom, SAS3508 ROC</td><td>Broadcom, SAS3408 IOC</td></tr><tr><td>RAID Levels</td><td colspan="2">0/1/10/5/50/6/60</td><td>0/1/10/5</td></tr><tr><td>JBOD Mode</td><td colspan="2">Yes</td><td>Yes</td></tr><tr><td>Cache Memory</td><td colspan="2">4GB DDR4</td><td>N/A</td></tr><tr><td>Mini-SAS-HD (SFF8643) connectors</td><td>4 Internal</td><td>2 Internal</td><td>2 Internal</td></tr><tr><td>Operating Temperature</td><td colspan="2">Maximum ambient: 55C</td><td>Maximum ambient: 55C</td></tr><tr><td>Maximum Physical Devices (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>63</td></tr><tr><td>Maximum Direct-Attach NVMe Devices</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maximum Array Volumes (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>32</td></tr><tr><td>Maximum Array Volumes (NVMe)</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maintenance Free Backup Unit</td><td colspan="2">AXXRMFBU7 (backup unit sold separately)</td><td>N/A</td></tr><tr><td>Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)</td><td colspan="2">AXXRPFKDE2 (upgrade key sold separately)</td><td>N/A</td></tr></tbody></table>		RMSP3AD160F	RMSP3CD080F	RMSP3HD080E	I/O Processor	Broadcom, SAS3516 ROC	Broadcom, SAS3508 ROC	Broadcom, SAS3408 IOC	RAID Levels	0/1/10/5/50/6/60		0/1/10/5	JBOD Mode	Yes		Yes	Cache Memory	4GB DDR4		N/A	Mini-SAS-HD (SFF8643) connectors	4 Internal	2 Internal	2 Internal	Operating Temperature	Maximum ambient: 55C		Maximum ambient: 55C	Maximum Physical Devices (SAS/SATA)	64 or 240 (Profile Dependent)		63	Maximum Direct-Attach NVMe Devices	4		2	Maximum Array Volumes (SAS/SATA)	64 or 240 (Profile Dependent)		32	Maximum Array Volumes (NVMe)	4		2	Maintenance Free Backup Unit	AXXRMFBU7 (backup unit sold separately)		N/A	Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)	AXXRPFKDE2 (upgrade key sold separately)		N/A
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Claim 10	Exemplary Infringement by Intel RAID Modules with RMFBU												
	See e.g., Intel, Tri-mode Intel Storage Controllers supporting PCIe NVMe: Product Brief, at 2. <table border="1"> <thead> <tr> <th colspan="2">Tri-mode Intel® RAID Modules</th></tr> </thead> <tbody> <tr> <td>Form Factor</td><td>Mezzanine</td></tr> <tr> <td>PCIe Interface</td><td>x8 PCI Express 3.0</td></tr> <tr> <td>Drive Types</td><td>PCIe NVMe, SAS 12Gb/s and lower, SATA 6Gb/s and lower</td></tr> <tr> <td>Operating System/Driver Support</td><td>Microsoft Windows, VMware, Linux (SLES, RHEL)</td></tr> <tr> <td>Warranty</td><td>3 years standard (AWR optional)</td></tr> </tbody> </table> See e.g., Intel, Tri-mode Intel Storage Controllers supporting PCIe NVMe: Product Brief, at 3. The RAID Controllers/RMFBU include the claimed system for controlling data in a computer system when the computer system loses power, with the aforementioned components playing a role therein.	Tri-mode Intel® RAID Modules		Form Factor	Mezzanine	PCIe Interface	x8 PCI Express 3.0	Drive Types	PCIe NVMe, SAS 12Gb/s and lower, SATA 6Gb/s and lower	Operating System/Driver Support	Microsoft Windows, VMware, Linux (SLES, RHEL)	Warranty	3 years standard (AWR optional)
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10[a] means for activating a plurality of super capacitors to supply power to the computing engine based upon power being removed from the computer system;	The RAID Controllers/RMFBU system includes means for activating a plurality of super capacitors to supply power to the computing engine based upon power being removed from the computer system. For example, the RMFBU includes a plurality of super capacitors to supply power to the computing engine, including but not limited to based upon power being removed from the computer system. 1. Place the Super Capacitor Module and the plastic holder front-side-up on a flat, clean, static-free surface. 2. Press the Super Capacitor Module into the plastic holder until the module clicks firmly into place, as shown in the following figure (note that the actual shape of the product may vary).  Figure 21. AXXRMBU7 mounting assembly See e.g., Intel RAID Modules, Hardware User Guide, at 41.												

Claim 10	Exemplary Infringement by Intel RAID Modules with RMFBU
	Figure 23. Connecting the FBU345 to the RAID module using the extender cable See <i>e.g.</i>, Intel RAID Modules, Hardware User Guide, at 42. As Intel explains in its documentation, the RMFBU monitors the voltage level of the DRAM of the Intel RAID controller module. During normal system operation, power is supplied from the external source (AC) power. However, if the voltage drops below a predefined level due to a power failure or brief power outage, the RAID Controller/RMFBU activates the plurality of super capacitors in the RMFBU to supply power to the computing engine, which protects the integrity of the cached data. During normal system operation, the RMFBU monitors the voltage level of the DRAM of the Intel® RAID Module or Intel® RAID Module. If the voltage drops below a predefined level due to an AC power failure or brief power outage, the RMFBU protects the integrity of the cached data by providing sufficient back-up power to offload the data from the RAID RAM to the NAND flash. When the voltage level returns to an acceptable level, the RAID RAM is recovered from flash, and all pending writes to storage devices are completed without losing any data. See <i>e.g.</i>, Intel RAID Modules, Hardware User Guide, at 38.

Claim 10	Exemplary Infringement by Intel RAID Modules with RMFBU
	The cache memory available on Intel® RAID Modules and Intel® RAID Adapters can improve the overall system performance. Writing data to the module's cache memory is much faster than writing data to a storage device. Write operations appear to complete very quickly at the software application level. The Intel® RAID Module writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it is written to the storage device. This risk factor is eliminated when the Intel® RAID Module has an RMFBU installed. In addition, <i>See e.g., Intel RAID Modules, Hardware User Guide, at 38.</i> The AXXRMFBU7 RMFBU is a kit consisting of a FBU345 super capacitor bank, a plastic bracket to attach the super capacitor bank to the chassis, and two (2) extender cables, one 605 mm long and the other 930 mm long. The FBU345 consists of a bank of Electric Double-Layer Capacitors (EDLC) or super capacitors capable of storing a high amount of electric energy while active. In the event of a power failure, the FBU345 provides the power needed for the data offload. It also has an over-temperature detection circuitry and a discharge circuitry that discharges the capacitors while disconnected from the RAID module or when the system on which it is installed is turned off. <i>See e.g., Intel RAID Modules, Hardware User Guide, at 38.</i>

Claim 10	Exemplary Infringement by Intel RAID Modules with RMFBU																												
	7.2 FBU345 Specifications and Layout The Table 8. FBU345 specifications shows the specifications for the FBU 345 Supercap. The Figure 19. FBU345 layouts same device followed by its dimensions and pin description. <table> <tr> <th>Item</th><th>Value</th></tr> <tr> <td>Super Capacitor Module Operating Temperature</td><td>0°C to 55°C</td></tr> <tr> <td>Super Capacitor Module Storage Temperature</td><td>0°C to 70°C</td></tr> <tr> <td>Rated Voltage</td><td>13.5 VDC</td></tr> <tr> <td>Surge Voltage</td><td>14.25 VDC</td></tr> <tr> <td>Super Capacitor Module Capacity</td><td>7.6 F</td></tr> <tr> <td>Capacity Tolerance</td><td>65 mm x 52 mm</td></tr> <tr> <td>RMFBU5 Cache Off-load Module Mechanical</td><td>-0%, +30%</td></tr> <tr> <td>Rated Energy</td><td>0.04 Wh</td></tr> <tr> <td>Super Capacitor Module Charge Time</td><td>Approximately 2 minutes</td></tr> <tr> <td>Super Capacitor Module Shelf Life</td><td>3 years</td></tr> <tr> <td>Super Capacitor Module Operational Life</td><td>Intel provides a three-year warranty on the Intel® RMFBU AXRMFBU7.</td></tr> <tr> <td>Maximum Equivalent Series Resistance (ESR)</td><td>190 mOhm</td></tr> <tr> <td>Weight</td><td>46 g</td></tr> </table> <i>See e.g., Intel RAID Modules, Hardware User Guide, at 39.</i>	Item	Value	Super Capacitor Module Operating Temperature	0°C to 55°C	Super Capacitor Module Storage Temperature	0°C to 70°C	Rated Voltage	13.5 VDC	Surge Voltage	14.25 VDC	Super Capacitor Module Capacity	7.6 F	Capacity Tolerance	65 mm x 52 mm	RMFBU5 Cache Off-load Module Mechanical	-0%, +30%	Rated Energy	0.04 Wh	Super Capacitor Module Charge Time	Approximately 2 minutes	Super Capacitor Module Shelf Life	3 years	Super Capacitor Module Operational Life	Intel provides a three-year warranty on the Intel® RMFBU AXRMFBU7.	Maximum Equivalent Series Resistance (ESR)	190 mOhm	Weight	46 g
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10[b] means for reconfiguring the data in the computing engine; and	The RAID Controllers/RMFBU system includes means for activating a plurality of super capacitors to supply power to the computing engine based upon power being removed from the computer system. As Intel explains in its documentation, the RMFBU monitors the voltage level of the DRAM of the Intel RAID controller module. During normal system operation, power is supplied from the external source (AC) power. However, if the voltage drops below a predefined level due to a power failure or brief power outage, the RAID Controller/RMFBU activates the plurality of super capacitors in the RMFBU to supply power to the computing engine, which protects the integrity of the cached data.																												

Claim 10	Exemplary Infringement by Intel RAID Modules with RMFBU
	During normal system operation, the RMFBU monitors the voltage level of the DRAM of the Intel® RAID Module or Intel® RAID Module. If the voltage drops below a predefined level due to an AC power failure or brief power outage, the RMFBU protects the integrity of the cached data by providing sufficient back-up power to offload the data from the RAID RAM to the NAND flash. When the voltage level returns to an acceptable level, the RAID RAM is recovered from flash, and all pending writes to storage devices are completed without losing any data. See e.g., Intel RAID Modules, Hardware User Guide, at 38. The cache memory available on Intel® RAID Modules and Intel® RAID Adapters can improve the overall system performance. Writing data to the module's cache memory is much faster than writing data to a storage device. Write operations appear to complete very quickly at the software application level. The Intel® RAID Module writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it is written to the storage device. This risk factor is eliminated when the Intel® RAID Module has an RMFBU installed. In addition, See e.g., Intel RAID Modules, Hardware User Guide, at 38. The AXXRMFBU7 RMFBU is a kit consisting of a FBU345 super capacitor bank, a plastic bracket to attach the super capacitor bank to the chassis, and two (2) extender cables, one 605 mm long and the other 930 mm long. The FBU345 consists of a bank of Electric Double-Layer Capacitors (EDLC) or super capacitors capable of storing a high amount of electric energy while active. In the event of a power failure, the FBU345 provides the power needed for the data offload. It also has an over-temperature detection circuitry and a discharge circuitry that discharges the capacitors while disconnected from the RAID module or when the system on which it is installed is turned off. See e.g., Intel RAID Modules, Hardware User Guide, at 38. The RAID Controller/RMFBU reconfigures the data in the cache of the Controller by transferring that data from the RAID RAM (volatile memory) to NAND Flash (non-volatile memory). On information and belief, the RAID Controller/RMFBU also transfers some or all of that data to other non-volatile storage, including but not limited to the solid-state storage drives (SSD) and hard disk drives (HDD).
10[c] means for deactivating the plurality of super capacitors to cut off power to the computing engine based upon the plurality of super capacitors	The RAID Controllers/RMFBU system includes means for deactivating the plurality of super capacitors to cut off power to the computing engine based upon the plurality of super capacitors discharging to a predetermined level. For example, when all the data in the RAID RAM (volatile memory) has been transferred and/or when the super capacitors in the RMFBU's capacity (shown below) are at or near depletion state, the RAID Controllers/RMFBU deactivates the super capacitors to cut off power to the computing engine.

Claim 10	Exemplary Infringement by Intel RAID Modules with RMFBU																												
discharging to a predetermined level.	7.2 FBU345 Specifications and Layout The Table 8. FBU345 specifications shows the specifications for the FBU 345 Supercap. The Figure 19. FBU345 layouts same device followed by its dimensions and pin description. <table border="1"> <thead> <tr> <th>Item</th><th>Value</th></tr> </thead> <tbody> <tr> <td>Super Capacitor Module Operating Temperature</td><td>0°C to 55°C</td></tr> <tr> <td>Super Capacitor Module Storage Temperature</td><td>0°C to 70°C</td></tr> <tr> <td>Rated Voltage</td><td>13.5 VDC</td></tr> <tr> <td>Surge Voltage</td><td>14.25 VDC</td></tr> <tr> <td>Super Capacitor Module Capacity</td><td>7.6 F</td></tr> <tr> <td>Capacity Tolerance</td><td>65 mm x 52 mm</td></tr> <tr> <td>RMFBU5 Cache Off-load Module Mechanical</td><td>-0%, +30%</td></tr> <tr> <td>Rated Energy</td><td>0.04 Wh</td></tr> <tr> <td>Super Capacitor Module Charge Time</td><td>Approximately 2 minutes</td></tr> <tr> <td>Super Capacitor Module Shelf Life</td><td>3 years</td></tr> <tr> <td>Super Capacitor Module Operational Life</td><td>Intel provides a three-year warranty on the Intel® RMFBU AXRMFBU7.</td></tr> <tr> <td>Maximum Equivalent Series Resistance (ESR)</td><td>190 mOhm</td></tr> <tr> <td>Weight</td><td>46 g</td></tr> </tbody> </table> See e.g., Intel RAID Modules, Hardware User Guide, at 39.	Item	Value	Super Capacitor Module Operating Temperature	0°C to 55°C	Super Capacitor Module Storage Temperature	0°C to 70°C	Rated Voltage	13.5 VDC	Surge Voltage	14.25 VDC	Super Capacitor Module Capacity	7.6 F	Capacity Tolerance	65 mm x 52 mm	RMFBU5 Cache Off-load Module Mechanical	-0%, +30%	Rated Energy	0.04 Wh	Super Capacitor Module Charge Time	Approximately 2 minutes	Super Capacitor Module Shelf Life	3 years	Super Capacitor Module Operational Life	Intel provides a three-year warranty on the Intel® RMFBU AXRMFBU7.	Maximum Equivalent Series Resistance (ESR)	190 mOhm	Weight	46 g
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Claim 11	Exemplary Infringement by Intel RAID Modules with RMFBU																																																																																				
11 The system of claim 10 wherein the computing engine comprises a least one volatile memory and at least one non-volatile memory.	See claim 10. The RAID Controllers/RMFBU system includes a least one volatile memory and at least one non-volatile memory. The RAID Controllers/RMFBU comprise the claimed computer system and include the RAID Controller, which comprises the computing engine. The Controller further includes at least one RAID RAM (volatile memory) and at least one SSD cache (non-volatile memory). Intel® Raid Module Specifications (RMSP3 family) <table><tr><th></th><th>RMSP3AD160F</th><th>RMSP3CD080F</th><th>RMSP3HD080E</th></tr><tr><td>I/O Processor</td><td>Broadcom, SAS3516 ROC</td><td>Broadcom, SAS3508 ROC</td><td>Broadcom, SAS3408 IOC</td></tr><tr><td>RAID Levels</td><td colspan="2">0/1/10/5/50/6/60</td><td>0/1/10/5</td></tr><tr><td>JBOD Mode</td><td colspan="2">Yes</td><td>Yes</td></tr><tr><td>Cache Memory</td><td colspan="2">4GB DDR4</td><td>N/A</td></tr><tr><td>Mini-SAS-HD (SFF8643) connectors</td><td>4 Internal</td><td>2 Internal</td><td>2 Internal</td></tr><tr><td>Operating Temperature</td><td colspan="2">Maximum ambient: 55C</td><td>Maximum ambient: 55C</td></tr><tr><td>Maximum Physical Devices (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>63</td></tr><tr><td>Maximum Direct-Attach NVMe Devices</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maximum Array Volumes (SAS/SATA)</td><td colspan="2">64 or 240 (Profile Dependent)</td><td>32</td></tr><tr><td>Maximum Array Volumes (NVMe)</td><td colspan="2">4</td><td>2</td></tr><tr><td>Maintenance Free Backup Unit</td><td colspan="2">AXXRMFBU7 (backup unit sold separately)</td><td>N/A</td></tr><tr><td>Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)</td><td colspan="2">AXXRPFKDE2 (upgrade key sold separately)</td><td>N/A</td></tr></table> See e.g., Intel Tri-mode Intel Storage Controllers supporting PCIe NVMe: Product Brief, at 2. 2.5 Intel® Tri-Mode RAID Module Feature Set The following table describes the feature set of the Intel Tri-Mode RAID modules. Table 1. Intel® Tri-Mode RAID module comparative feature set <table><tr><th>Feature</th><th>RMSP3AD160F</th><th>RMSP3CD080F</th><th>RMSP3HD080E</th></tr><tr><td>I/O Processor</td><td>Avago* SAS3516 PCIe* RAID On-Chip (ROC)</td><td>Avago* SAS3508 PCIe* RAID On-Chip (ROC)</td><td>Avago* SAS3508 PCIe* RAID On-Chip (ROC)</td></tr><tr><td>RAID Levels</td><td>0,1,5,6,10, 50, 60</td><td>0,1,5,6,10, 50, 60</td><td>0,1,5,10,50</td></tr><tr><td>JBOD Mode or Pass through Mode (SAS/SATA)</td><td>Yes</td><td>Yes</td><td>Yes</td></tr><tr><td>Cache Memory</td><td>4 GB DDR4 at 2133 MHz</td><td>4 GB DDR4 at 2133 MHz</td><td>N/A</td></tr><tr><td>Form Factor</td><td>Modular Mezzanine</td><td>Modular Mezzanine</td><td>Modular Mezzanine</td></tr><tr><td>Drive Interface Connectors</td><td>4</td><td>2</td><td>2</td></tr><tr><td>PCIe* Interface</td><td>x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane</td><td>x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane</td><td>x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane</td></tr></table>		RMSP3AD160F	RMSP3CD080F	RMSP3HD080E	I/O Processor	Broadcom, SAS3516 ROC	Broadcom, SAS3508 ROC	Broadcom, SAS3408 IOC	RAID Levels	0/1/10/5/50/6/60		0/1/10/5	JBOD Mode	Yes		Yes	Cache Memory	4GB DDR4		N/A	Mini-SAS-HD (SFF8643) connectors	4 Internal	2 Internal	2 Internal	Operating Temperature	Maximum ambient: 55C		Maximum ambient: 55C	Maximum Physical Devices (SAS/SATA)	64 or 240 (Profile Dependent)		63	Maximum Direct-Attach NVMe Devices	4		2	Maximum Array Volumes (SAS/SATA)	64 or 240 (Profile Dependent)		32	Maximum Array Volumes (NVMe)	4		2	Maintenance Free Backup Unit	AXXRMFBU7 (backup unit sold separately)		N/A	Self-Encrypting Drive Support (enables hardware disk encryption services on capable drives)	AXXRPFKDE2 (upgrade key sold separately)		N/A	Feature	RMSP3AD160F	RMSP3CD080F	RMSP3HD080E	I/O Processor	Avago* SAS3516 PCIe* RAID On-Chip (ROC)	Avago* SAS3508 PCIe* RAID On-Chip (ROC)	Avago* SAS3508 PCIe* RAID On-Chip (ROC)	RAID Levels	0,1,5,6,10, 50, 60	0,1,5,6,10, 50, 60	0,1,5,10,50	JBOD Mode or Pass through Mode (SAS/SATA)	Yes	Yes	Yes	Cache Memory	4 GB DDR4 at 2133 MHz	4 GB DDR4 at 2133 MHz	N/A	Form Factor	Modular Mezzanine	Modular Mezzanine	Modular Mezzanine	Drive Interface Connectors	4	2	2	PCIe* Interface	x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane	x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane	x8 PCI Express* 3.0. PCIe Performance up to 8 GT/s per lane
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Claim 11	Exemplary Infringement by Intel RAID Modules with RMFBU
	<i>See e.g.</i>, Intel RAID Modules, Hardware User Guide, at 12. During normal system operation, the RMFBU monitors the voltage level of the DRAM of the Intel® RAID Module or Intel® RAID Module. If the voltage drops below a predefined level due to an AC power failure or brief power outage, the RMFBU protects the integrity of the cached data by providing sufficient back-up power to offload the data from the RAID RAM to the NAND flash. When the voltage level returns to an acceptable level, the RAID RAM is recovered from flash, and all pending writes to storage devices are completed without losing any data. <i>See e.g.</i>, Intel RAID Modules, Hardware User Guide, at 38. The cache memory available on Intel® RAID Modules and Intel® RAID Adapters can improve the overall system performance. Writing data to the module's cache memory is much faster than writing data to a storage device. Write operations appear to complete very quickly at the software application level. The Intel® RAID Module writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it is written to the storage device. This risk factor is eliminated when the Intel® RAID Module has an RMFBU installed. In addition, <i>See e.g.</i>, Intel RAID Modules, Hardware User Guide, at 38.

Claim 12	Exemplary Infringement by Intel RAID Modules with RMFBU
12 The system of claim 11 wherein the reconfiguring means further comprises: means for allowing all data to be transferred from the at least one volatile memory to the at least one non-volatile memory.	The RAID Controllers/RMFBU system includes means for allowing all data to be transferred from the at least one volatile memory to the at least one non-volatile memory. <i>See claim 10, 11.</i>

Claim 15	Exemplary Infringement by Intel RAID Modules with RMFBU
15[Pre] The system of claim 12 wherein the activating means further comprises:	See claim 12.
15[a] means for reversing the flow of current between the computing engine and the plurality of super capacitors; and	The RAID Controllers/RMFBU system includes means for reversing the flow of current between the computing engine and the plurality of super capacitors. See claim 10[a].
15[b] means for discharging current from the plurality of super capacitors to the computing engine.	The RAID Controllers/RMFBU system includes means for discharging current from the plurality of super capacitors to the computing engine. See claim 10[a].