



Intel® Virtual RAID on CPU (Intel® VROC)

6.1 PV Release

Customer Release Notes

May 2019

Revision 1.0



Revision History

Revision	Description	Date
1.0	Intel VROC 6.1 PV Initial Release	May 2019



Legal Notices and Disclaimers

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined". Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

Intel disclaims all express and implied warranties, including without limitation, the implied warranties of merchantability, fitness for a particular purpose, and non-infringement, as well as any warranty arising from course of performance, course of dealing, or usage in trade.

Benchmark results were obtained prior to implementation of recent software patches and firmware updates intended to address exploits referred to as "Spectre" and "Meltdown". Implementation of these updates may make these results inapplicable to your device or system.

Tests document performance of components on a particular test, in specific systems. Differences in hardware, software, or configuration will affect actual performance. Consult other sources of information to evaluate performance as you consider your purchase. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

All documented performance test results are obtained in compliance with JESD218 Standards; refer to individual sub-sections within this document for specific methodologies. See www.jedec.org for detailed definitions of JESD218 Standards. Intel does not control or audit the design or implementation of third party benchmark data or Web sites referenced in this document. Intel encourages all of its customers to visit the referenced Web sites or others where similar performance benchmark data are reported and confirm whether the referenced benchmark data are accurate and reflect performance of systems available for purchase.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

For copies of this document, documents that are referenced within, or other Intel literature please contact your Intel representative.

Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

*Other names and brands may be claimed as the property of others. Copyright © 2019 Intel Corporation. All rights reserved.



Contents

1	Introduction	6
	1.1 Overview	6
	1.2 Defect Submission Support	6
	1.3 Supported Operating Systems	7
	1.4 Operating Systems Not Supported In This Release	7
	1.5 Supported Platforms	8
2	Supported PCIe NVMe SSDs List.....	9
	2.1 Non-Intel PCIe NVMe SSDs supported in Intel 6.0:	9
3	New in Intel VROC 6.1 PV	10
	3.1 Microsoft* .NET and Intel ASM No Longer Included	10
	3.2 Windows* 7-64bit Support	10
	3.2.1 Windows* 7-64bit .NET Limitations	11
4	Features Introduced with Intel VROC 6.0 PV.....	12
	4.1 Intel VROC 6.0.0.1359 Release Package	12
	4.2 Introduced in Intel® VROC 6.0.0.1357 is the support for the Purley Refresh platform ...	12
	4.3 Intel RSTe Name Changes	13
	4.4 Intel VROC Support for Windows 10 RS5 / Server 2019	13
5	Features Introduced In Intel RSTe 5.5	14
	5.1 Intel VROC and Intel RSTe SATA LED Management in HII BIOS	14
	5.2 Intel VMD Advanced Error Reporting (AER) Logging for Windows	14
	5.3 New Fields added for UEFI Intel VROC Device Info Protocol.....	15
	5.4 Support of Older Platforms	15
	5.5 Intel Accelerated Storage Manager (Intel® ASM) REST API Plug in Availability	16
	5.6 Intel VROC UEFI Driver Backward Compatibility for Microsoft* Windows* 8.1 and newer OS	16
	5.7 Ability to Change Controller Default Values	16
	5.8 Warning Message added for RAID Volume Creation	16
	5.9 Support for UEFI Driver Health Protocol.....	16
6	Features Introduced In Intel RSTe 5.4	18
	6.1 Intel VMD and Intel VROC Surprise Hot Plug for Microsoft* Windows* Operating Systems	18
	6.2 Continuous IO during Hot Plug.....	18
	6.3 Increase the number of NVMe devices supported to 48	18
	6.4 New API for the Private UEFI Intel VROC Device Info Protocol with new field for BLOCKIO Protocol for Pass Thru devices	18
	6.5 Customizable LED Management	19
	6.6 Performance Improvements for 4K Queue Depth	19
7	Drivers, Images and Utilities	20
8	Intel VROC Limitations	23



8.1	Microsoft .NET Framework Removal	23
8.2	Intel VROC (NonNVMe NVMe RAID) Support	24
8.3	Surprise Hot Plug Limitations.....	24
8.4	Expect Longer Rebuild Times for RAID 5	24
8.5	Intel VROC Command Line Interface	24
8.6	Intel VROC Trial Version Limitations	24
8.7	Intel VROC PreOS UEFI Driver Uninstall limitations	25
8.8	Intel NVMe Wear Leveling Recommendations.....	26
8.9	Must use F6 Install Method	27
8.10	Intel C620 and C422 series chipset Port Limitations	27
8.11	Intel VROC Key Removal/Upgrade Limitation	28
8.12	NVMe Port Assignment by Intel VROC	28
8.13	Windows* 10 RS5/Server 2019	28
8.13.1	Idle Power increased	28
8.13.2	Intel VROC Support for Windows 10 RS5 / Server 2019	28
8.14	Intel VROC 6.0 on Windows* Server 2012 R2	29
9	Known Issues in this Release	30
10	Issues Resolved in 6.1 PV	32
11	Issues Resolved in 6.0 PV	33
12	Issues Resolved in Intel VROC 5.5 PV	34
13	Issues Fixed in Intel VROC 5.4 PV	35



1 Introduction

1.1 Overview

The Intel Virtual RAID on CPU (Intel VROC) 6.1 Production Version (PV) release package is intended for all customers designing platforms that are based off of Intel's Purley Refresh design.

The Intel VROC 6.1 family of products provide enterprise RAID solutions for both NVMe SSD and SATA devices for enterprise servers and workstations. The product family includes the following three products.

1. Intel VROC (VMD NVMe RAID) – This product provides an enterprise RAID solution on Intel® Xeon® Scalable Family Platforms that support the Intel VMD technology.
2. Intel VROC (SATA RAID) – This product provides an enterprise RAID solution for SATA devices connected to SATA/sATA the Intel Platform Control Hub (PCH) configured for RAID mode.
3. Intel VROC (NonVMD NVMe RAID) – This product provides an enterprise RAID solution for Intel NVMe SSDs attached to PCIe slots managed by the Platform CPU. Intel VROC (NonVMD NVMe RAID) is not intended for, nor supports:
 - a. Non-Intel NVMe SSDs.
 - b. Platforms that have on Intel® Xeon® Scalable Family Platforms CPUs that contain Intel VMD technology (weather enabled or disabled).

Note: Intel VROC 6.1 is a high level blanket product reference for Intel VROC (VMD NVMe RAID), Intel VROC (SATA RAID) and Intel VROC (NonVMD NVMe RAID).

Along with the above mentioned packages, included in this PV package are the Intel VROC 6.1 Pre-OS environment

1. Intel VROC (VMD NVMe RAID) UEFI drivers
2. Intel VROC (SATA RAID) UEFI drivers
3. Intel VROC (SATA RAID) Legacy OROM images are included.

Please see the **Supported Platforms** section for additional information on older platforms supported with this release.

Note: It is always recommended to update your system BIOS to the included PV release of Pre-OS drivers to take advantage of the most optimal and updated features of each Production Version release.

1.2 Defect Submission Support

With this release, Intel will accept and process issues reported by customers via the Intel Premier Support (IPS) portal.



To submit an issue, please use the Intel Premier Support (IPS) tool. Information, training and details can be found at the below website. Your local FAE can also provide you the necessary requirements to enable you to submit an IPS issue (also known as a “case”) including an account setup if you do not already have one.

<http://www.intel.com/content/www/us/en/design/support/ips/training/welcome.html>

When submitting a case, please include the following Fields in order to flag Intel VROC AE support for Intel® Xeon® Scalable platforms.

- Case Information -> Product = Purley
- Case Details -> Subject= <Add short title summary of issue>
- Case Details -> Case Description = <add description and how to reproduce error>
- Case Details -> Case Type = <fill in type of request>
- Case Details -> Severity = <fill in severity of issue>
- Case Details -> End Customer = <name of OEM>
- Case Details -> Issue Source = IPS Cloud
- Case Details -> Severity
- Product/Project Info -> Case Category = TechnologyInitiative
- Product/Project Info -> Case Subcategory = Intel® Virtual RAID on CPU (Intel® VROC)
- Environment Details -> Purley-PCH = lbg-4
- Environment Details -> Purley-CPU = skx-2s (or skx 4s)
- Environment Details -> BKC or SW Version = 6.0

1.3 Supported Operating Systems

Only 64bit OS support is available for the following OS versions

- Windows* Server 2012 R2 Enterprise (supported on Server platform only)
- Windows* 10 RS3 / RS4 / RS5 / 19H1 (supported on Workstations platforms only)
- Windows* Server 2016 Enterprise (supported on Server platform only)
- Windows* Server 2019 Enterprise (supported on Server platform only)

Note: Microsoft* Windows* 7 will not be supported in future releases

1.4 Operating Systems Not Supported In This Release

- Windows* Vista (Support/Updates concluded with 4.1.2.1011)
- Windows* Server 2003 (Support/Updates concluded with 4.0.2.1019)
- Windows* Server 2008 (Support/Updates concluded with 4.0.2.1019)
- Windows* 8 (Support/Updates concluded with 4.2.2.1005)
- Windows* Server 2012 (Support/Updates concluded with 4.2.2.1005)
- Windows* 8.1 (Support/Updates concluded with 4.7 PV)
- Windows* Server 2008 R2 (Support/Updates concluded with 4.7 PV)



- Windows* 10 RS1 / RS2 (Support / Updates concluded with 5.4 PV)
- Windows* 7 SP2 (supported on Workstations only) (Support / Updates concluded with 5.5 PV)

Intel C600 series chipset support/updates concluded with 4.5 PV

Any Showstopper issues reported in any of the above configurations will be addressed in their corresponding (identified) baselines.

1.5 Supported Platforms

Intel® Xeon® Scalable Platforms

- Intel® C620 series chipset
- Intel® C422 series chipset family

Intel® Xeon® Processor D-2100 Product Family

Intel VROC (NonVMD NVMe RAID) support on the following platforms:

- Intel® Xeon® Processor E5 v3, v4 Families with the Intel® C610 series chipset
- Intel® Xeon® Processor Families with the Intel® C220 series chipset
- Intel® Xeon® Processor E3 v5 Families with the Intel® C230 series chipset
- Intel® Xeon® E Processor Family with the Intel® C240 series Chipset

Note: It is strongly recommended to update your system BIOS to the 6.0 Pre-OS.

Please see the Intel VROC Technical Product Specification included in this release for specific details

Note: For answers to questions concerning the Intel PCH series chipsets support and/or to obtain other technical collateral, please contact your local Intel FAE.



2 Supported PCIe NVMe SSDs List

All shipping Intel® Data Center and Professional NVMe* SSDs are supported by Intel® VROC 6.1 PV, except dual port NVMe* SSDs.

2.1 Non-Intel PCIe NVMe SSDs supported in Intel 6.0:

Vendor	Model
Lenovo*	Atsani
Huawei*	ES3600P
Samsung*	SM951
Samsung*	SM961
Samsung*	PM961
Samsung*	PM953
Samsung*	PM963
Samsung*	PM983
Toshiba*	PX04PMB
Toshiba*	XG3
Toshiba*	XG5
Micron*	9100 Series
Micron*	9200 Series
Western Digital*	PC SN720



3 *New in Intel VROC 6.1 PV*

3.1 **Microsoft* .NET and Intel ASM No Longer Included**

To address functional and security updates, this version of the Intel® Virtual RAID on CPU (Intel® VROC) 6.1 PV Release Package has removed the Microsoft .NET Framework as well as the Intel Acceleration Storage Manager (ASM). Users should update to the latest version.

For the customer's convenience, the Intel VROC product installation application was designed to automatically install the Microsoft .NET Framework and provide an option to install the Intel Acceleration Storage Manager (ASM).

The .NET Framework was included because the Intel VROC user interface relies on the .NET Framework to operate properly. To ensure that customers are able to get the latest version available, Intel is no longer including .NET Framework in the Intel VROC production package. This is not needed because the supported Windows operating systems already include a version of .NET Framework. If the latest version of the .NET Framework is not installed, it can be obtained/downloaded either via a Web update or offline directly from <https://dotnet.microsoft.com/>.

In addition to removal of the .NET Framework installation, this release also removes the Intel ASM component. The Intel ASM installer has some dependencies on 3rd party libraries and Intel would like to reduce or eliminate these dependencies. Until this is accomplished, the Intel ASM component is being removed. Please contact your Intel FAE for future release details.

For more information please refer to Technical Advisory Reference Number 610700.

3.2 **Windows* 7-64bit Support**

The Intel VROC 6.1 release package includes targeted support for Windows* 7-64bit. Within this package, is included Intel RSTe 5.6 specifically for Windows* 7-64bit. This was added back into the product packaging to support the older platforms.

On platforms that are installing Windows* 7-64bit, the Intel RSTe 5.6 driver from the F6 directory should be used. Once the OS is successfully installed, running the Intel VROC 6.1 installation application will install the Intel RSTe 5.6 GUI and middleware and update/install the driver.

This configuration is the exception to the backwards compatibility of the Intel VROC PreOS. Meaning, that after the platform BIOS has been updated to include the Intel VROC 6.1 PreOS, the Intel RSTe 5.6 package (for Windows 7-64bit) will be supported. Table 1 shows the Intel VROC PreOS versions to Intel RSTe 5.6 OS version support.

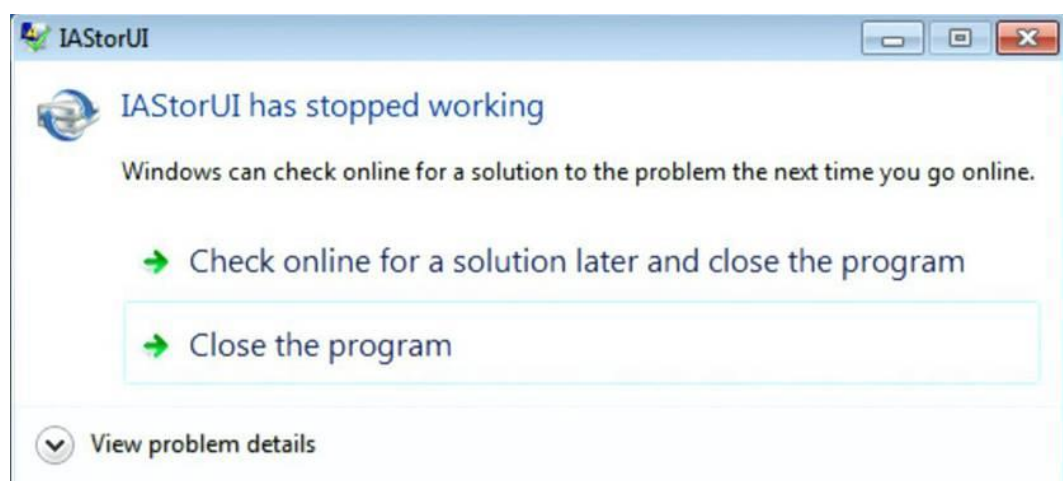


Table 1: Intel VROC Compatibility Matrix

	Intel VROC PreOS 5.5	Intel VROC PreOS 6.0	Intel VROC PreOS 6.1
Intel RSTe 5.6 Win7-64bit	Supported	Not Supported	Supported

3.2.1 Windows* 7-64bit .NET Limitations

When installing Intel VROC 6.1 onto a platform with Win7 the following message may be displayed after the package installation reboot:



To resolve this issue, the Microsoft .NET Framework needs to be updated to version 4.5.1. The following link can be used to download:

<https://www.microsoft.com/en-us/download/details.aspx?id=40779>

Note: For all other supported operating systems, please download the latest version of .NET Framework.



4 *Features Introduced with Intel VROC 6.0 PV*

4.1 **Intel VROC 6.0.0.1359 Release Package**

To address functional and security updates, this version of the Intel® Virtual RAID on CPU (Intel® VROC) 6.0.0.1359 PV Release Package has been updated to remove the Microsoft .NET Framework as well as the Intel Acceleration Storage Manager (ASM). Users should update to the latest version.

For the customer's convenience, the Intel VROC product installation application was designed to automatically install the Microsoft .NET Framework and provide an option to install the Intel Acceleration Storage Manager (ASM).

The .NET Framework was included because the Intel VROC user interface relies on the .NET Framework to operate properly. To ensure that customers are able to get the latest version available, Intel is no longer including .NET Framework in the Intel VROC production package. This is not needed because the supported Windows operating systems already include a version of .NET Framework. If the latest version of the .NET Framework is not installed, it can be obtained/downloaded either via a Web update or offline directly from <https://dotnet.microsoft.com/>.

In addition to removal of the .NET Framework installation, this release also removes the Intel ASM component. The Intel ASM installer has some dependencies on 3rd party libraries and Intel would like to reduce or eliminate these dependencies. Until this is accomplished, the Intel ASM component is being removed. Please contact your Intel FAE for future release details.

For this release, the device drivers and internal tools have not been updated.

For more information please refer to Technical Advisory Reference Number 610700. For information on how to manage the impacts of these changes, please refer to section [Microsoft .NET Framework Removal](#) in this document.

4.2 **Introduced in Intel® VROC 6.0.0.1357 is the support for the Purley Refresh platform**

This section features Intel's commitment to excellence; always improving and listening to our customers' needs.



4.3 Intel RSTe Name Changes

The Intel VROC 6.0 family of products provide enterprise RAID solutions for both NVMe SSD and SATA devices for enterprise servers and workstations. The product family includes the following three products.

1. Intel VROC (VMD NVMe RAID) – This product provides an enterprise RAID solution on Intel® Xeon® Scalable Family Platforms that support the Intel VMD technology. In previous releases, this was simply referred to as Intel VROC.
2. Intel VROC (SATA RAID) – This product provides an enterprise RAID solution for SATA devices connected to SATA/sSATA the Intel Platform Control Hub (PCH) configured for RAID mode. In previous releases, this was simply referred to as Intel Rapid Storage Technology enterprise (Intel RSTe).
3. Intel VROC (NonVMD NVMe RAID) – This product provides an enterprise RAID solution for Intel NVMe SSDs attached to PCIe slots managed by the Platform CPU. Intel VROC (NonVMD NVMe RAID) is not intended for, nor supports:
 - a. Non-Intel NVMe SSDs.
 - b. Platforms that have on Intel® Xeon® Scalable Family Platforms CPUs that contain Intel VMD technology (weather enabled or disabled).

In previous releases, this was simply referred to as Intel RSTe NVMe.

4.4 Intel VROC Support for Windows 10 RS5 / Server 2019

Intel VROC 6.0.0.1357 release package includes support for Windows* 10 RS5 and Windows* Server 2019.

Note: There is a known issue trying to install Windows* 10 RS5 / Server 2019. Installing Windows* 10 RS5 or Server 2019 onto an Intel VMD managed device is limited to a single CPU. For more information please see the Known Issues section below.

Note: It may be noticed that installing Intel VROC 6.0 when installing or using Windows* 10 RS5 /Server 2019 that installation may take longer than previous OS versions. This is being investigated.



5 Features Introduced In Intel RSTe 5.5

5.1 Intel VROC and Intel RSTe SATA LED Management in HII BIOS

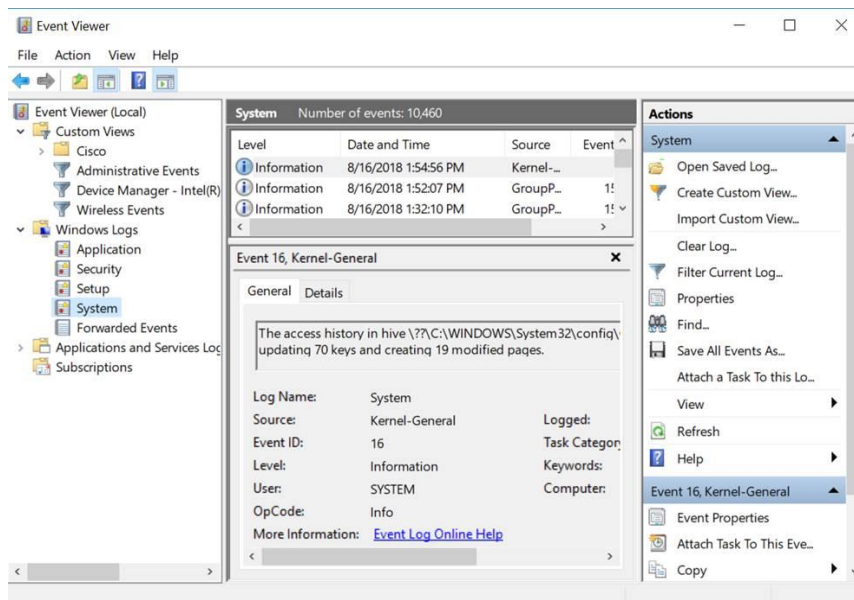
LED management support is now available in the Intel Virtual RAID on CPU UEFI HII BIOS Menu and in the PCH Intel RSTe HII BIOS menu. The LOCATE option is functional for each NVMe SSD with VMD enabled on its root port. A list of drives behind VMD is visible in a table to the user. The desired device can be selected to blink the LOCATE LED. When the drive is deselected, then the Blink pattern for this drive will be OFF. Upon boot into the RSTe UEFI BIOS HII, each drive discovered by the driver should be ON. Otherwise, the indicator LED should be OFF.

5.2 Intel VMD Advanced Error Reporting (AER) Logging for Windows

The Intel VMD component of the Intel VROC Windows Driver will log the following Non-fatal (0b) AER Errors:

- Poisoned TLP
- Completion Timeout
- Completer Abort
- Unexpected Completion
- ECRC Error
- Unsupported Request Error
- ACS Violation
- MC Blocked TLP
- Atomic Op Egress Blocked
- TLP Prefix Blocked

Example: Windows event viewer → Windows Logs → System, and choose to save all events to a file. Optionally choose to filter on “iavroc.sys” to see any VMD AER reporting events.



5.3 New Fields added for UEFI Intel VROC Device Info Protocol

Intel VROC UEFI Drivers add the following new fields to the UEFI Intel VROC Device Info Protocol to assist in device recognition during factory process when Intel VMD root port is enabled on NVMe SSDs.

- Deviceld
- SubsystemVendorId
- SubsystemId
- ClassCode
- RevisionId
- FirmwareRev
- OptionROMBar
- RootPortBusNum
- RootPortDeviceNum
- RootPortFunctionNum
- SegmentNum

Please see the *Intel(R)_VROC_UEFI_DEVICE_INFO_PROTOCOL.pdf* for implementation details and API.

5.4 Support of Older Platforms

Beginning with Intel RSTe version 5.5 PV, support for older platforms has been introduced. With the exception of platforms with the Intel C600 or C200 series chipset and includes the support for the Intel RSTe NVMe product as well.



Please see the Intel RSTe TPS for more details.

5.5 Intel Accelerated Storage Manager (Intel® ASM) REST API Plug in Availability

The Intel ASM Plug In is only available on Intel® Xeon® Scalable Family Platforms with Intel VROC capability. This RESTful API offers storage management through a web based interface configured as standalone or distributed across multiple servers.

The Intel ASM can be installed on Intel® Xeon® Scalable Family Platforms using the Intel RSTe 5.5 OS installer (SetupRSTe.exe).

For more details: refer to the Intel RSTe Technical Product Spec and the “Intel Accelerated Storage Manager Windows Administration Guide.pdf” included in this package.

5.6 Intel VROC UEFI Driver Backward Compatibility for Microsoft* Windows* 8.1 and newer OS

Beginning with this Intel VROC 5.5PV package, older UEFI Driver versions of 5.X will be compatible with Intel VROC Windows 5.5PV and newer. The exception will be Microsoft* Windows* 7, which must use the Intel VROC UEFI driver version 5.4 or newer on Intel Xeon® Scalable Platforms with switch attached NVMe SSDs.

5.7 Ability to Change Controller Default Values

This release of Intel RSTe 5.5PV introduces the ability to change controller default values for the following settings:

- Read Patrol
- Rebuild on hot insert

5.8 Warning Message added for RAID Volume Creation

Intel RSTe 5.5PV introduces a warning message if a RAID volume is created when:

- Drive size differences are greater than 10%
- Volume includes mix of SSDs and HDDs

5.9 Support for UEFI Driver Health Protocol

In the UEFI environment, the Intel VROC and Intel RSTe SATA UEFI drivers will support warning messages during system boot through UEFI Driver Health Protocol, when at least one of the following conditions is met:

- At least one RAID volume is degraded
- At least one RAID volume is failed
- At least one drive is in 'RAID unsupported' state (Intel VROC UEFI only)



- At least one drive is in 'Incompatible' state
- At least one drive is in 'Offline' state
- At least one drive is in 'Unknown' state



6 *Features Introduced In Intel RSTe 5.4*

6.1 **Intel VMD and Intel VROC Surprise Hot Plug for Microsoft* Windows* Operating Systems**

Intel VMD surprise hot plug for Windows enhancements in this Intel VROC 5.4 release will see improved times for hot insertion and hot removal for Intel VMD enabled NVMe devices. It is recommended to wait until device is reflected as removed / inserted in device manager for spacing surprise hot plug of devices in Windows.

6.2 **Continuous IO during Hot Plug**

With this release of Intel VROC 5.4 users will see that IO is continuous during hot plug when using Windows performance tools. When an NVMe device is removed or inserted, IO will be continuous to the remaining VMD enabled NVMe devices.

6.3 **Increase the number of NVMe devices supported to 48**

Intel VROC 5.4 will increase the number of devices supported on one platform from 24 to 48 NVMe devices supported. Please refer to the Intel VROC Technical Product Specification for changes to RAID volume and RAID arrays allowed with this change.

6.4 **New API for the Private UEFI Intel VROC Device Info Protocol with new field for BLOCKIO Protocol for Pass Thru devices**

Allows UEFI applications to retrieve information about each NVMe device on Intel VMD-enabled lanes

- Bus/device/function
- Socket Number
- VMD Domain
- Root Port Number
- Slot Number
- Vendor Id
- Serial Number
- Model Number
- Total Blocks
- Block Size
- Raid Device Member
- Root Port Offset
- **BLOCKIO Protocol (NEW in Intel VROC 5.4)**



Please refer to the Intel VROC UEFI Device Info Protocol document for structure API changes, included in the Intel VROC 5.4 release kit.

6.5 Customizable LED Management

Customers can customize LED management by modifying registry keys to change behavior for the following Blinking patterns:

- Locate – Blinking pattern time can be lengthened or shortened (default 12 seconds)
- FAIL – Blinking pattern can continue until another good drive is inserted, or stop when failed drive is removed (default is 0 – stop when drive is removed)
- Rebuild initializing - Blinking pattern on all drives in RAID volume (until initialization/verify/verify and fix finishes) – enable (0x1 default) or disable
- Rebuild – Blinking pattern on 1 drive or all drives in RAID volume – 0x0(default – 1 drive) or 0x1
- Rebuild Migration– Blinking pattern on all drives when migration occurs from one RAID type to another RAID type – enable (default = 0x01) or disable

Note: Please reference the Intel® VROC Technical Product Specification for details

6.6 Performance Improvements for 4K Queue Depth

Intel VROC has optimized performance for 4K queue depth by adding Storage Request Block for performance improvement in Intel VROC 5.4 release.

Intel VROC supports both STORAGE_REQUEST_BLOCKS and SCSI_REQUEST_BLOCKS. This is designed for implementation on windows OS >= Microsoft* Windows* 8, and allows device queue depth to 4k; delivering better performance for massive workloads with many concurrent workers.



7 Drivers, Images and Utilities

List of Modules supported on Intel® Xeon® based platforms delivered with Intel® VROC 6.1.0.1247 Release Package.

Feature	Notes
Intel UEFI Drivers	<ul style="list-style-type: none">• Intel® VROC UEFI Driver version 6.1.0.1017<ul style="list-style-type: none">○ VMDVROC_1.efi (HW key enforcement in effect)• Intel® VMD UEFI version 1.6.0.1001<ul style="list-style-type: none">○ VMDVROC_2.efi <p>Note: All of these images are required and intended to support Intel VMD and Intel VROC (SATA RAID) functionality as a combined installed package.</p> <ul style="list-style-type: none">• Intel® VROC (SATA RAID) SATA / sSATA UEFI Driver version 6.1.0.1017<ul style="list-style-type: none">○ SataDriver.efi○ sSataDriver.efi
Legacy OROM Images	<ul style="list-style-type: none">• Intel® VROC (SATA RAID) SATA OROM pre-OS image version 6.1.0.1017<ul style="list-style-type: none">○ SataOrom.bin○ sSataOrom.bin



Feature	Notes
Intel® VROC Windows* Drivers	<ul style="list-style-type: none"> • Intel® VROC Windows GUI version 6.1.0.1236 • Intel® VROC Windows GUI for Win7 version 5.6.0.1018 • Intel® VROC Windows Installer Package version 6.1_4.0.12 <ul style="list-style-type: none"> ◦ SetupVROC.exe (Multi-lingual) • Intel® VROC (VMD NVMe RAID) Windows F6 Driver version 6.1.0.1224– Win8 (Includes Intel VMD enabled NVMe Driver version 1.6.0.1004) <ul style="list-style-type: none"> ◦ \iaVROC.free.win8.64bit.6.1.0.1224\iaVROC • Intel® VROC (VMD NVMe RAID) Windows F6 Driver version 5.6.0.1016 – Win7 (Includes Intel VMD enabled NVMe Driver version 1.6.0.1004) <ul style="list-style-type: none"> ◦ \iaVROC.free.win7.64bit.5.6.0.1016\iaVROC • Intel® VROC (SATA RAID) Windows F6 Driver version 6.1.0.1226 - Win8 <ul style="list-style-type: none"> ◦ \iaStorE.free.win8.64bit.6.1.0.1226\iaStorE (SATA) ◦ \iaStorE.free.win8.64bit.6.1.0.1226\iaStorB (sSATA) • Intel® VROC (SATA RAID) Windows F6 Driver version 5.6.0.1006 – Win7 <ul style="list-style-type: none"> ◦ \iaVROC.free.win7.64bit.5.6.0.1006\iaStorE (SATA) ◦ \iaVROC.free.win7.64bit.5.6.0.1006\iaStorB (sSATA) • Intel® VROC (NonVMD NVMe RAID) Windows F6 Driver version 6.1.0.1224– Win8 <ul style="list-style-type: none"> ◦ \iaRNVMe.free.win8.64bit.6.1.0.1224\iaRNVMe ◦ \iaRNVMe.free.win8.64bit.6.1.0.1224\iaRNVMeVirt • Intel® VROC (NonVMD NVMe RAID) Windows F6 Driver version 5.6.0.1006 – Win7 <ul style="list-style-type: none"> ◦ \iaRNVMe.free.win7.64bit.5.6.0.1006\iaRNVMe ◦ \iaRNVMe.free.win7.64bit.5.6.0.1006\iaRNVMeVirt • Intel VROC CLI version 6.1.0.1247 – All supported OS except Win7-64bit • Intel RSTe CLI version 5.6.0.1018 – Win7-64bit
UEFI Based RAID Configuration Utility	<ul style="list-style-type: none"> • Intel® VROC version 6.1.0.1017 <ul style="list-style-type: none"> ◦ RCfgVROC.efi • Intel® VROC SATA / sSATA version 6.1.0.1017 <ul style="list-style-type: none"> ◦ RCfgSata.efi ◦ RCfgsSata.efi Note: Secure Boot must be disabled to use this tool
DOS Based RAID Configuration Utility	<ul style="list-style-type: none"> • Intel® VROC SATA / sSATA version 6.1.0.1017 <ul style="list-style-type: none"> ◦ RCfgSata.exe ◦ RCfgsSata.exe



Feature	Notes
UEFI Based Comply Utility	<ul style="list-style-type: none"> • Intel® VROC version 6.1.0.1017 <ul style="list-style-type: none"> ○ RcmpVROC.efi • Intel® VROC SATA / sSATA version 6.1.0.1017 <ul style="list-style-type: none"> ○ RCmpSata.efi ○ RCmpsSata.efi <p>Note: Secure Boot must be disabled to use this tool</p>
DOS Based Comply Utility	<ul style="list-style-type: none"> • Intel® VROC SATA / sSATA version 6.1.0.1017 <ul style="list-style-type: none"> ○ RCmpSata.exe ○ RCmpsSata.exe
UEFI based SATA SGPIO/LED Test utility	<ul style="list-style-type: none"> • Intel® VROC SATA / sSATA version 6.1.0.1017 <ul style="list-style-type: none"> ○ LedToolSata.efi ○ LedToolsSata.efi <p>Note: Secure Boot must be disabled to use this tool</p>
UEFI based Intel VROC LED Test utility	<ul style="list-style-type: none"> • Intel® VROC version 6.1.0.1017 <ul style="list-style-type: none"> ○ LedToolVROC.efi <p>Note: This tool can be used to exercise LEDs for NVMe disks behind VMD</p>
UEFI Based Clear Metadata Utility	<ul style="list-style-type: none"> • Intel® VROC SATA / sSATA version 6.1.0.1017 <ul style="list-style-type: none"> ○ RClrSata.efi ○ RClrsSata.efi
UEFI Based Intel VROC HW Key Checker	<ul style="list-style-type: none"> • Intel® VROC Activation Key Checker <ul style="list-style-type: none"> ○ HWKeyCheckVROC.efi <p>Note: This tool will check for the presence and type of the HW key</p>



8 Intel VROC Limitations

8.1 Microsoft .NET Framework Removal

As previously described, the Intel VROC product installation application has removed the Microsoft .NET Framework as well as the Intel ASM component.

The following table shows how the removal of the Microsoft .NET Framework may impact the launching of the Intel VROC GUI, based off the Windows operating system installed:

	Server 2k12 R2	Server 2k16	Windows 2k19	Win 10 RS3	Win 10 RS4	Win 10 RS5	Win 10 19H1
VROC 6.0	Install Latest .NET Framework	Install Latest .NET Framework	No Impact	Install Latest .NET Framework	No Impact	No Impact	No Impact

If the system configuration requires the .NET Framework version to be updated and the system has internet access, a web installer can be used, which should go out and install the latest version. For example: (<https://support.microsoft.com/en-us/help/4054531/microsoft-net-framework-4-7-2-web-installer-for-windows>).

If the system is not connected to the Internet, then an offline version must be downloaded, moved to and installed on the system. The following are some additional instruction to help in this process:

1. Download the latest version of .NET Framework from Microsoft
2. Compress the downloaded image (to avoid potential undesirable side effect as outlined in <https://docs.microsoft.com/en-us/dotnet/framework/install/troubleshoot-blocked-installations-and-uninstallations#compat>)
3. Copy the compressed file to a USB drive
4. Copy the compressed file from the USB drive to the Download directory of the platform being configured
5. Uncompressed the file
6. Run the executable file as administrator

For more information please refer to <https://dotnet.microsoft.com/>.



Once the latest version of the .NET Framework is installed, rerun the Intel RSTe product installation application. This helps ensure that all components will start properly.

8.2 Intel VROC (NonNVMe NVMe RAID) Support

Intel VROC (NonVMD NVMe RAID) support is included in the Intel VROC 6.0 release package. This package supports only Intel NVMe SSDs and does not support (nor can be installed on) platforms that support Intel VMD. Intel VROC (NonVMD NVMe RAID) supports DATA RAID. Boot support is not available. For more information, please refer to the Intel VROC TPS included with this package.

NOTE: This functionality is not supported on Purley Refresh platforms

8.3 Surprise Hot Plug Limitations

Due to Microsoft* Windows* time restrictions for resuming from S3 and S4, and Intel VMD device identification requirements, Hot Plug of Intel VMD enabled NVMe devices is not supported during S3 and S4 states.

Surprise removal of multiple NVMe SSDs at one time are not supported. The user must wait until a device is reflected as removed / inserted in device manager for spacing surprise hot plug of Intel VMD enabled PCIe NVMe SSDs in Microsoft* Windows*.

Due to these limitations, Intel strongly discourages performing Hot Plugs during an S3 power state change.

8.4 Expect Longer Rebuild Times for RAID 5

On a RAID 5 volume, disk cache is being turned off when a volume is degraded. Due to this, the rebuilding times have increased expectedly until the rebuild is completed, and disk cache is enabled again.

This extends to drives being added to a RAID 5 volume as well.

8.5 Intel VROC Command Line Interface

The Intel VROC Command Line Interface (CLI) does not support the RAID Volume name beginning with blank space.

8.6 Intel VROC Trial Version Limitations

Data RAID Only (No Boot Support)

Data RAID must be installed on same make/model of NVMe devices



Once an Intel VROC Upgrade Key has been inserted into the system, the trial version is concluded. Removing the upgrade key does not re-enable the trial version. As a result, any existing RAID volumes present while the upgrade key was installed, won't be seen and could be in an unknown state.

When creating a RAID volume using the Trial version, don't mix NVMe vendors. Mixing vendors may result in unexpected behavior.

Please refer to the Intel VROC Trial Version section in the Intel VROC Technical Product Specification for 5.4PV for more details

8.7 Intel VROC PreOS UEFI Driver Uninstall limitations

The Intel VROC UEFI RAID drivers comply with UEFI Specifications for PCI Driver Model for PCI Device Drivers (Section 13.3.3) and may return Status Code "access denied" from UninstallProtocolInterface routine from Boot services (spec. 6.3). This is expected behavior.



8.8 Intel NVMe Wear Leveling Recommendations

NVMe SSD Wear Leveling refers to techniques used to prolong the service life of NVMe drives. This section outlines recommendations to maximize Wear Leveling on RAID 5 volumes.

Strip Size No of drives	4	8	16	32	64	128
3	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
4	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal
5	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
6	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
7	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
8	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal
9	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
10	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
11	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
12	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal
13	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
14	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
15	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
16	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal
17	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
18	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
19	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
20	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal
21	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
22	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
23	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
24	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal

Note: It is left to the customer to determine the most effective combination of parameters (number of drives vs. strip size) to achieve their desired performance goals, usage models and drive endurance.



8.9 Must use F6 Install Method

The use of the included Intel VROC F6 drivers are required to install an OS onto an Intel VROC managed device(s). There is no Microsoft “inbox” driver that supports Intel VROC 6.0.

The supported Microsoft Operating Systems for this product include inbox drivers that support the Intel® C620 and C422 series chipset Platform Controller Hub (PCH) when configured for RAID mode. It is strongly recommended that the Intel VROC (SATA RAID) F6 drivers included in this release be used instead of the available “inbox” driver. The provided “inbox” driver is intended only for those customers who may not have the Intel VROC (SATA RAID) F6 drivers readily available and ONLY for installing to a single drive (NOT to a RAID volume). Once the OS is installed, it is strongly recommended that the Intel VROC 6.0 installer package be installed immediately. At that point, it will be safe to migrate the SATA system disk into a RAID Volume (using the Intel VROC GUI).

8.10 Intel C620 and C422 series chipset Port Limitations

This limitation is in reference to platforms having a PCH that supports more than 6 SATA ports. The Intel C620 and C422 series chipset SATA controller supports 8 SATA ports. As referenced above, The Microsoft Windows Operating systems that contain the “inbox” drivers for the Intel® C620 and C422 series chipset Platform Controller Hub (PCH) when configured for RAID mode, only support 6 ports. Drives on ports 7 and/or 8 are not enumerated. For this reason, Intel recommends not using these 2 ports as part of the Windows* OS boot installation (as a pass-thru drive or as part of a RAID volume). However, if you do need to use these ports as part of your Windows* boot volume, the steps below can be used as a workaround.

Note: you will need a USB drive with the Intel VROC IntelVROCCLI.exe utility.

1. After you have created the desired RAID volume that includes ports 7 and/or 8 (which you intend to use as your Windows* boot volume) in the PreOS environment, begin the Windows* installation process. **Make note of the RAID volume name.**
2. Navigate to the Windows* disk selection window. At this point, select the Load Driver button and install the Intel VROC F6 driver (included in this package).
3. Attempt to continue installing the Windows OS onto the RAID volume. If the installation process does not continue, this error has been encountered.
4. Press f10 to invoke a CMD window.
5. If you have not already done so, please insert the USB drive into the system. Navigate to your USB drive with the RstCLI.exe utility.
6. Run command: IntelVROCCLI.exe --manage --normal-volume <volumeName>
7. This will reset the volume to a normal state.
8. Close the CMD window.
9. In the Windows* disk selection window, reload the Intel VROC f6 driver.
10. Once completed, Windows* should allow installation on the RAID volume.



8.11 Intel VROC Key Removal/Upgrade Limitation

With Microsoft* Windows* 10, Fast Startup is enabled by default. Disable Fast Startup prior to removing/upgrading the Intel VROC HW key. OR, perform a complete reboot when removing/inserting a HW key when Fast Startup is enabled.

8.12 NVMe Port Assignment by Intel VROC

In Windows and UEFI, the port number shown in the Intel VROC interfaces depends on disk enumeration order by the Intel VMD-enabled NVMe driver, which can be different on each platform. The port numbers shown does not reflect the physical PCIe slot. After each hot plug, there is an enumeration process which is NOT fixed.

Please see the **Intel® VROC Windows Technical Product Specification** for information on the new Intel VROC UEFI Device Info Protocol for unique NVMe physical slot locations.

8.13 Windows* 10 RS5/Server 2019

8.13.1 Idle Power increased

Installing Intel VROC 6.0 PV onto a platform running Windows* 10 RS5. In Windows and UEFI, the port number shown in the Intel VROC interfaces depends on disk enumeration order by the Intel VMD-enabled NVMe driver, which can be different on each platform. The port numbers shown does not reflect the physical PCIe slot. After each hot plug, there is an enumeration process which is NOT fixed.

Please see the **Intel® VROC for Windows Technical Product Specification** for information on the new Intel VROC UEFI Device Info Protocol for unique NVMe physical slot locations.

8.13.2 Intel VROC Support for Windows 10 RS5 / Server 2019

Intel VROC 5.5.0.2013 introduces support for Windows* 10 RS5 and Windows* Server 2019.

NOTE: There is a known issue trying to install Windows* 10 RS5 / Server 2019. Installing Windows* 10 RS5 or Server 2019 onto an Intel VMD managed device is limited to a single CPU. For more information please see the Known Issues section below.



8.14 Intel VROC 6.0 on Windows* Server 2012 R2

When installing Intel VROC 6.0 onto Windows* Server 2012 R2, the following Microsoft* updates must first be applied:

1. KB4054566
2. KB2999226
3. KB2919355
4. KB3172729



9 Known Issues in this Release

This section outlines the known issues that are being actively worked on with the Intel VROC 6.0 PV release

Internal Reference#	Title
1606900429	System Crach May Occurred when load Intel VROC (VMD NVMe RAID) F6 driver while the Intel VROC RAID is Under an Initialize State.
1409098352	BSOD with Surprise Hot-Plug After Removing 2nd Device and reinserting
1409080745	A System Crash may be Observed with Windows Install on a drive behind a Switch
1408968353	Intel VROC (VMD NVMe RAID) UEFI HII Menu May Cause the BIOS Setup Menu to be Improperly Displayed
1507139562	System May Encounter a System Failure Resuming from S3/S4 Power Management While a Migrating a RAID Volume
1409194760	Activity LED is not blinking when SATA drive in RAID mo
1306392182	System May Encounter a System Failure Resuming from S3/S4 Power Management While a Migrating a RAID Volume
1807345165	The CLI Tool May Not Properly Expand Existing RAID Volumes
1806588250	Creating a RAID5 System volume from a Pass-through System Disk (Windows 10 RS5/Server 2019) May Fail
1806559207	Installing the OS onto a RAID5 volume May Result in a Degraded Volume
1806534894	The Intel VROC CLI Tool May Allow Data Migration With a Smaller Drive
1806397184	Intel RSTe NVMe Pre-Purley Platform with 48 NVMe Drives and Max Volumes. Degraded RAID Volume May Encounter a System Failure While Booting
1805900436	Intel VROC F6 Drivers May Not Properly Load
1408610353	Title The Intel RSTe Upgrade (Uninstall/re-install) Process May Encounter a System Crash
1806782204	Intel VROC GUI may not Properly Open Unless "Run as Administrator"
1806411891	RAID Volume May Become Degraded After Reboot



Internal Reference#	Title
1807170210	An Intel VROC GUI Volume Creation Warnings Message May Overlay ontop of a Submenu
1807158496	The Intel VROC RWH Policy May Change from Journaling to Distributed after a Drive Hot Unplug
1807073364	Intel VROC GUI May Show a Pop-up Unknown Error Message when a RAID Volume Migration Begins
1806564426	Event Log May Not Properly Show "RAID volume {VolumeName} is normal" Message after a Rebuild Completes
1806564424	System May Fail to Start After an Unexpected Power Loss
1806564409	Platform May Not Properly Boot After a Dirty Shutdown with I/O on a RAID 4 volume (RWH Distributed)
1806522520	Drive Hot Insert May Report the Drive was Removed Followed by Detection
1806419240	Intel VROC (VMD RAID) NVMe Drive May be Marked as Available After Removal
1806397164	Intel RSTe NVMe Pre-Purley Platform with 48 NVMe Drives and 24 Volumes May Encounter a boot Failure
1506864660	non-RAID disks may not be displayed after creating SATA RAID in legacy SATA OROM
1506398660	RAID10, hot-plug two member disks, re-plugged second disk can't rebuilding.
1409108164	Title SATA RAID volume can't be create with combine internal and external drive
1407347823	RSTe RCfgRSTeRS.efi Disk IDs are not consistent and RAID 5 create with journaling drive hangs.
1807107325	When using the Intel VROC CLI Tool to Create RAID Volumes One of the Disks May Show a Disk Size of 0 GB after the Volume Creation Completes.
1409371408	Intel VROC GUI May Require the "Proceed with deleting data" Box be Selected when not Expected.



10 *Issues Resolved in 6.1 PV*

Internal Reference#	Title
1506951451	BSOD 0x50 occurred sporadically when system run Win10 HLK test item "PNP/Sleep with IO Before and After"
1407931496	Intel VROC RAID Volumes May Not Properly Show in the BIO
1506852286	BSOD randomly occurs during RAID CFG migrating via RSTe APP
1407996572	The unit of RAID volume capacity may not display properly when creating SATA RAID in legacy SATA OROM



11 *Issues Resolved in 6.0 PV*

Internal Reference#	Title
2203448525	Intel SSD will have two duplicated HII entry created in F1 setup "System Settings -> Storage" page
1805474763	Intel VROC Driver Upgrade May Mark Volume as Initialized
1606761987	BSOD occurred after loading F6 driver during Win10 RS5 installation
1506077912	Intel VROC Negotiated Link Rate Reported May Not be Accurate
1406945370	NVMe LED blinking Issue on RAID when Locate sent after the Rebuild
1406654647	Hot Inserting a Drive into a RAID Volume with many ECC Errors May Cause a RAID Volume to Fail
1806427432	Intel VROC Negotiated Link Rate Reported May Not be Accurate
1806420960	Intel RSTe NVMe 5.5 on a Windows 7 64-bit Platform May Report the Incorrect Filter Driver Version Number
1506226285	Intel VROC mismatch error after changing RAID 5 RWH Values in BIOS setup
1504750338	Can Not Disable All RAID Levels in BIOS Setup



12 *Issues Resolved in Intel VROC 5.5 PV*

Internal Reference#	Title
2202860567	Windows 2016 stuck when hot-plug one of member drive on RAID5
1505288506	The issue was failing to create SATA HDD RAID via RSTe CLI command, there was no response after executed CLI command.
1407167497	Intel VROC UEFI HII Menu Should not Appear in BIOS when VMD is Disabled
1407138251	Data Loss May Occur if Writing to Disk During S4
1806291543	Intel VROC Enabled Platform May Not Properly Generate a System Failure dump file.
1806147003	Unresponsive HDD May Prevent OS Boot
1805624457	Performing an S4 on a degraded RAID 5 Volume May Result in a System Crash
1805245743	Windows 7 BSE When ODD is attached Resuming from S3/S4
1506414153	All Applications are gone after resume from S4
1506153616	Hot Removal of a Matrix RAID Member May Result in a System Failure
1505203256	Intel P905 NVMe SSD drive can't be recognized by 5.4 CLI tool
1504716895	CC_CSMI_SAS_GET_RAID_CONFIG cannot return correct information about RAID
1504685173	Black screen and 0x1E BSOD entering s4 via S3
1407931617	BSOD occurred after loading F6 driver during Win10 RS5 installation
1407320372	System Disk not Marked as System Volume in RSTe GUI
1406789629	Repeated System Restarts May Result in a 0x9F System Error
1305232413	Platform May hang Entering S4 if eSATA Device Connected
1806088107	Intel VROC UEFI Driver Returns Incorrect Values for SCT HII Test Case
1805901301	NVMe System Disk can be Selected as RAID 5 RWH Journaling Disk Drive After Hotplug
1604699889	Removing a Drive from a Spanned RAID Volume May Not be Properly Handled



13 Issues Fixed in Intel VROC 5.4 PV

Internal Reference#	Title
1504691800	SATA--quick hot plug in Windows cause disk always in failed status
1504659653	The System may not properly boot into the OS when the platform has an 18 Core CPU.
1504648956	SATA Hot Unplug in Windows causes RAID disk in failed stat
1504625142	IO stops when perform disk hot-plug
1504593125	Hot removal cause system BSOD
1406932725	Intel RSTe GUI May Not Start when OS is on an NVMe drive not managed by Intel VD
1805878310	VROC Windows RAID 5 hangs during "Scan for and attempt recovery"
1805778949	RSTCLI Mange Locate LED Function Does Not Work
1805245735	Windows* 7 Installed onto an Intel VROC RAID 1 Volume May Not Reboot Properly.
1604433815	SUT hangs at the second logo after change CPU Multi Core value to 1 in BIOS setu
1504705930	RSTe RSTCLI tool cannot Report SATA Disks if VMD is Disabled
1504702455	Intel VMD Error Happens in Windows* 7 OS installation
1504645681	VROC RAID can't create a RAID 1 volume on certain 3.2TB 3rd Party Device
1504597467	SATA drive in UEFI removal and access hang issue
1504579431	System Cannot Enter S4 Under VMD Mod
1504562166	SUT hangs at the second logo after change CPU Multi Core value to 1 in BIOS setu
1504529906	Windows 7 System Sporadic BSE during S3/S4 cycling VMD enabled
1407473581	Intel Firmware Upgrade Tool Does Not Support SATA RSTe RAID FW Update
1406924883	The RSTe GUI May Not Properly Start if OS is Installed on 3rd Party RAID controller



Internal Reference#	Title
1406591495	SCT UEFI tests failed for GetComponentName Protocol Test
1406523199	Intel VROC GUI may show Option to Rebuild Volume to Duplicates of the Same Device
2201294151	HII show wrong in journal disk
1805533485	Intel VROC may Display Incorrect Slot Numbers in UEFI/HII/rstcli
1805245779	Adding Disk to a 6 Disk RAID 0 May Not Add The Disk
1604586588	Inconsistent requirement of disk capacity for rebuilding a RAID volume in Windows
1504707246	RAID volume's capacity displays wrongly in PreOS when creating a RAID volume
1504687577	CLI -M -L command error
1504681547	A "Missing" disk remains in Windows RSTe UI after rebuilding of a degraded RAID volume to another disk completes.
1504681226	The definition of "Rebuild on Hot Insert" is incorrect in Windows RSTe Help page
1504679777	An additional "Unknown" disk is displayed in Windows RSTe UI after RAID rebuilding completes on a spare disk
1504644095	RSTCLI stop working when set a non-existent disk as spare
1504555607	Naming for the RAID in BIOS allows Special Characters
1406589463	Chinese Characters May Be present in RSTe GUI When Using Dutch Nederland
1504664587	Windows RSTe UI displays multiple copies of the same disk in the option menu when choosing a disk for rebuild