

Dell Precision 3431 Small Form Factor

Service Manual



Notes, cautions, and warnings

 **NOTE:** A NOTE indicates important information that helps you make better use of your product.

 **CAUTION:** A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

 **WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

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Working on your computer

Topics:

- [Safety instructions](#)
- [Turning off your computer — Windows 10](#)
- [Before working inside your computer](#)
- [After working inside your computer](#)

Safety instructions

Use the following safety guidelines to protect your computer from potential damage and to ensure your personal safety. Unless otherwise noted, each procedure included in this document assumes that the following conditions exist:

- You have read the safety information that shipped with your computer.
- A component can be replaced or, if purchased separately, installed by performing the removal procedure in reverse order.

⚠ WARNING: Disconnect all power sources before opening the computer cover or panels. After you finish working inside the computer, replace all covers, panels, and screws before connecting to the power source.

⚠ WARNING: Before working inside your computer, read the safety information that shipped with your computer. For additional safety best practices information, see the [Regulatory Compliance Homepage](#)

⚠ CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

⚠ CAUTION: To avoid electrostatic discharge, ground yourself by using a wrist grounding strap or by periodically touching an unpainted metal surface at the same time as touching a connector on the back of the computer.

⚠ CAUTION: Handle components and cards with care. Do not touch the components or contacts on a card. Hold a card by its edges or by its metal mounting bracket. Hold a component such as a processor by its edges, not by its pins.

⚠ CAUTION: When you disconnect a cable, pull on its connector or on its pull-tab, not on the cable itself. Some cables have connectors with locking tabs; if you are disconnecting this type of cable, press in on the locking tabs before you disconnect the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before you connect a cable, ensure that both connectors are correctly oriented and aligned.

ⓘ NOTE: The color of your computer and certain components may appear differently than shown in this document.

⚠ CAUTION: System will shut down if side covers are removed while the system is running. The system will not power on if the side cover is removed.


⚠ CAUTION: System will shut down if side covers are removed while the system is running. The system will not power on if the side cover is removed.

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Turning off your computer — Windows 10

 **CAUTION:** To avoid losing data, save and close all open files and exit all open programs before you turn off your computer or remove the side cover.

- 1 Click or tap .
- 2 Click or tap  and then click or tap **Shut down**.

 **NOTE:** Ensure that the computer and all attached devices are turned off. If your computer and attached devices did not automatically turn off when you shut down your operating system, press and hold the power button for about 6 seconds to turn them off.


Before working inside your computer

To avoid damaging your computer, perform the following steps before you begin working inside the computer.

- 1 Ensure that you follow the [Safety Instruction](#).
- 2 Ensure that your work surface is flat and clean to prevent the computer cover from being scratched.
- 3 Turn off your computer.
- 4 Disconnect all network cables from the computer.

 **CAUTION:** To disconnect a network cable, first unplug the cable from your computer and then unplug the cable from the network device.

- 5 Disconnect your computer and all attached devices from their electrical outlets.
- 6 Press and hold the power button while the computer is unplugged to ground the system board.

 **NOTE:** To avoid electrostatic discharge, ground yourself by using a wrist grounding strap or by periodically touching an unpainted metal surface at the same time as touching a connector on the back of the computer.

After working inside your computer

After you complete any replacement procedure, ensure that you connect any external devices, cards, and cables before turning on your computer.

- 1 Connect any telephone or network cables to your computer.

 **CAUTION:** To connect a network cable, first plug the cable into the network device and then plug it into the computer.

- 2 Connect your computer and all attached devices to their electrical outlets.
- 3 Turn on your computer.
- 4 If required, verify that the computer works correctly by running **ePSA diagnostics**.

Technology and components

This chapter details the technology and components available in the system.

Topics:

- Processor
- DDR4
- USB features
- USB Type-C
- HDMI 2.0
- Advantages of DisplayPort over USB Type-C

Processor

NOTE: Processor numbers are not a measure of performance. Processor availability is subject to change and may vary by region/country.

Table 1. 9th Generation Intel Core Processor specifications

Type	UMA Graphics
Intel Core Processor i3 - 9100 (4 Cores/6MB/4T/up to 4.2GHz/65W)	Intel UHD Graphics 630
Intel Core Processor i3 - 9300 (4 Cores/8MB/4T/up to 4.3GHz/65W)	Intel UHD Graphics 630
Intel Core Processor i5 - 9400 (6 Cores/9MB/6T/up to 4.1GHz/65W)	Intel UHD Graphics 630
Intel Core Processor i5 - 9500 (6 Cores/9MB/6T/up to 4.4GHz/65W)	Intel UHD Graphics 630
Intel Core Processor i5 - 9600 (6 Cores/9MB/6T/up to 4.6GHz/95W)	Intel UHD Graphics 630
Intel Core Processor i7 - 9700 (8 Cores/12MB/8T/up to 4.9GHz/95W)	Intel UHD Graphics 630
Intel Core Processor i9 - 9900 (8 Cores/16MB/16T/up to 5.0GHz/95W)	Intel UHD Graphics 630

Table 2. 8th Generation Intel Core Processor specifications

Type	UMA Graphics
Intel Xeon E Processor E-2174G (4 Core HT, 8MB Cache, 3.8GHz, 4.7GHz)	Intel UHD Graphics 630
Intel Xeon E Processor E-2146G (6 Core HT, 12MB Cache, 3.5GHz, 4.5GHz)	Intel UHD Graphics 630
Intel Xeon E Processor E-2136 (6 Core HT, 12MB Cache, 3.3GHz, 4.5GHz)	NA

Type	UMA Graphics
Intel Xeon E Processor E-2124G (4 Core, 8MB Cache, 3.4GHz, 4.5GHz)	Intel UHD Graphics 630
Intel Xeon E Processor E-2124 (4 Core, 8MB Cache, 3.4GHz, 4.5GHz)	NA
Intel Core Processor i7-8700 (6 Core, 12MB Cache, 3.20GHz, 4.6GHz)	Intel UHD Graphics 630
Intel Core Processor i5-8600 (6 Core, 9MB Cache, 3.1GHz, 4.3GHz)	Intel UHD Graphics 630
Intel Core Processor i5-8500 (6 Core, 9MB Cache, 3.0GHz, 4.1GHz)	Intel UHD Graphics 630
Intel Core Processor i3-8100 (4 Core, 6MB Cache, 3.6GHz)	Intel UHD Graphics 630
Intel Gold G5400 (2 Core, 4MB Cache, 3.7GHz)	Intel UHD Graphics 630

DDR4

DDR4 (double data rate fourth generation) memory is a higher-speed successor to the DDR2 and DDR3 technologies and allows up to 512 GB in capacity, compared to the DDR3's maximum of 128 GB per DIMM. DDR4 synchronous dynamic random-access memory is keyed differently from both SDRAM and DDR to prevent the user from installing the wrong type of memory into the system.

DDR4 needs 20 percent less or just 1.2 volts, compared to DDR3 which requires 1.5 volts of electrical power to operate. DDR4 also supports a new, deep power-down mode that allows the host device to go into standby without needing to refresh its memory. Deep power-down mode is expected to reduce standby power consumption by 40 to 50 percent.

DDR4 Details

There are subtle differences between DDR3 and DDR4 memory modules, as listed below.

Key notch difference

The key notch on a DDR4 module is in a different location from the key notch on a DDR3 module. Both notches are on the insertion edge but the notch location on the DDR4 is slightly different, to prevent the module from being installed into an incompatible board or platform.

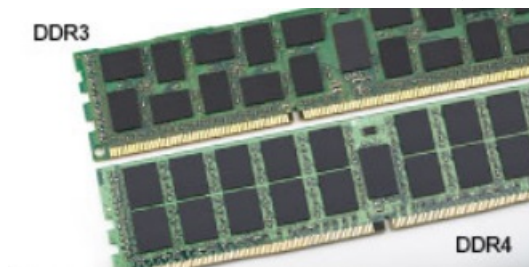


Figure 1. Notch difference

Increased thickness

DDR4 modules are slightly thicker than DDR3, to accommodate more signal layers.

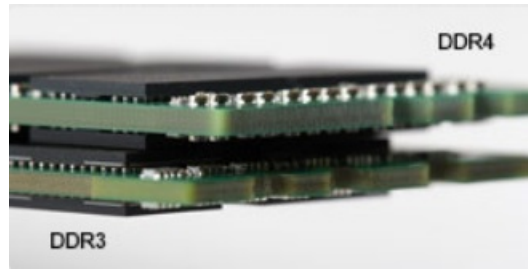


Figure 2. Thickness difference

Curved edge

DDR4 modules feature a curved edge to help with insertion and alleviate stress on the PCB during memory installation.



Figure 3. Curved edge

Memory Errors

Memory errors on the system display the new ON-FLASH-FLASH or ON-FLASH-ON failure code. If all memory fails, the LCD does not turn on. Troubleshoot for possible memory failure by trying known good memory modules in the memory connectors on the bottom of the system or under the keyboard, as in some portable systems.

NOTE: The DDR4 memory is imbedded in board and not a replaceable DIMM as shown and referred.

USB features

Universal Serial Bus, or USB, was introduced in 1996. It dramatically simplified the connection between host computers and peripheral devices like mice, keyboards, external drivers, and printers.

Let's take a quick look on the USB evolution referencing to the table below.

Table 3. USB evolution

Type	Data Transfer Rate	Category	Introduction Year
USB 2.0	480 Mbps	High Speed	2000
USB 3.0/USB 3.1 Gen 1Port	5 Gbps	Super Speed	2010
USB 3.1 Gen 2	10 Gbps	Super Speed	2013

USB 3.0/USB 3.1 Gen 1 (SuperSpeed USB)

For years, the USB 2.0 has been firmly entrenched as the de facto interface standard in the PC world with about 6 billion devices sold, and yet the need for more speed grows by ever faster computing hardware and ever greater bandwidth demands. The USB 3.0/USB 3.1 Gen 1 finally has the answer to the consumers' demands with a theoretically 10 times faster than its predecessor. In a nutshell, USB 3.1 Gen 1 features are as follows:

- Higher transfer rates (up to 5 Gbps)
- Increased maximum bus power and increased device current draw to better accommodate power-hungry devices
- New power management features
- Full-duplex data transfers and support for new transfer types
- Backward USB 2.0 compatibility
- New connectors and cable

The topics below cover some of the most commonly asked questions regarding USB 3.0/USB 3.1 Gen 1.

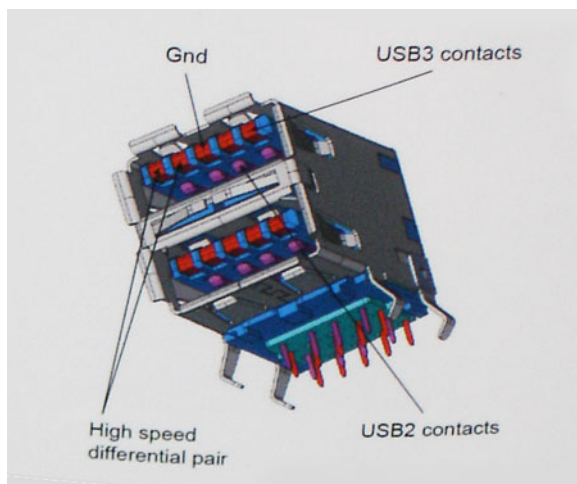


Speed

Currently, there are 3 speed modes defined by the latest USB 3.0/USB 3.1 Gen 1 specification. They are Super-Speed, Hi-Speed and Full-Speed. The new SuperSpeed mode has a transfer rate of 4.8Gbps. While the specification retains Hi-Speed, and Full-Speed USB mode, commonly known as USB 2.0 and 1.1 respectively, the slower modes still operate at 480Mbps and 12Mbps respectively and are kept to maintain backward compatibility.

USB 3.0/USB 3.1 Gen 1 achieves the much higher performance by the technical changes below:

- An additional physical bus that is added in parallel with the existing USB 2.0 bus (refer to the picture below).
- USB 2.0 previously had four wires (power, ground, and a pair for differential data); USB 3.0/USB 3.1 Gen 1 adds four more for two pairs of differential signals (receive and transmit) for a combined total of eight connections in the connectors and cabling.
- USB 3.0/USB 3.1 Gen 1 utilizes the bidirectional data interface, rather than USB 2.0's half-duplex arrangement. This gives a 10-fold increase in theoretical bandwidth.



With today's ever increasing demands placed on data transfers with high-definition video content, terabyte storage devices, high megapixel count digital cameras etc., USB 2.0 may not be fast enough. Furthermore, no USB 2.0 connection could ever come close to the 480Mbps

theoretical maximum throughput, making data transfer at around 320Mbps (40MB/s) — the actual real-world maximum. Similarly, USB 3.0/USB 3.1 Gen 1 connections will never achieve 4.8Gbps. We will likely see a real-world maximum rate of 400MB/s with overheads. At this speed, USB 3.0/USB 3.1 Gen 1 is a 10x improvement over USB 2.0.

Applications

USB 3.0/USB 3.1 Gen 1 opens up the laneways and provides more headroom for devices to deliver a better overall experience. Where USB video was barely tolerable previously (both from a maximum resolution, latency, and video compression perspective), it's easy to imagine that with 5-10 times the bandwidth available, USB video solutions should work that much better. Single-link DVI requires almost 2Gbps throughput. Where 480Mbps was limiting, 5Gbps is more than promising. With its promised 4.8Gbps speed, the standard will find its way into some products that previously weren't USB territory, like external RAID storage systems.

Listed below are some of the available SuperSpeed USB 3.0/USB 3.1 Gen 1 products:

- External Desktop USB 3.0/USB 3.1 Gen 1 Hard Drives
- Portable USB 3.0/USB 3.1 Gen 1 Hard Drives
- USB 3.0/USB 3.1 Gen 1 Drive Docks & Adapters
- USB 3.0/USB 3.1 Gen 1 Flash Drives & Readers
- USB 3.0/USB 3.1 Gen 1 Solid-state Drives
- USB 3.0/USB 3.1 Gen 1 RAIDs
- Optical Media Drives
- Multimedia Devices
- Networking
- USB 3.0/USB 3.1 Gen 1 Adapter Cards & Hubs

Compatibility

The good news is that USB 3.0/USB 3.1 Gen 1 has been carefully planned from the start to peacefully co-exist with USB 2.0. First of all, while USB 3.0/USB 3.1 Gen 1 specifies new physical connections and thus new cables to take advantage of the higher speed capability of the new protocol, the connector itself remains the same rectangular shape with the four USB 2.0 contacts in the exact same location as before. Five new connections to carry receive and transmitted data independently are present on USB 3.0/USB 3.1 Gen 1 cables and only come into contact when connected to a proper SuperSpeed USB connection.

Windows 8/10 will be bringing native support for USB 3.1 Gen 1 controllers. This is in contrast to previous versions of Windows, which continue to require separate drivers for USB 3.0/USB 3.1 Gen 1 controllers.

Microsoft announced that Windows 7 would have USB 3.1 Gen 1 support, perhaps not on its immediate release, but in a subsequent Service Pack or update. It is not out of the question to think that following a successful release of USB 3.0/USB 3.1 Gen 1 support in Windows 7, SuperSpeed support would trickle down to Vista. Microsoft has confirmed this by stating that most of their partners share the opinion that Vista should also support USB 3.0/USB 3.1 Gen 1.

USB Type-C

USB Type-C is a new, tiny physical connector. The connector itself can support various exciting new USB standards like USB 3.1 and USB power delivery (USB PD).

Alternate Mode

USB Type-C is a new connector standard that is very small. It is about a third the size of an old USB Type-A plug. This is a single connector standard that every device should be able to use. USB Type-C ports can support a variety of different protocols using “alternate modes,” which allows you to have adapters that can output HDMI, VGA, DisplayPort, or other types of connections from that single USB port

USB Power Delivery

The USB PD specification is also closely intertwined with USB Type-C. Currently, smartphones, tablets, and other mobile devices often use a USB connection to charge. A USB 2.0 connection provides up to 2.5 watts of power — that'll charge your phone, but that's about it. A laptop might require up to 60 watts, for example. The USB Power Delivery specification ups this power delivery to 100 watts. It's bi-directional, so a device can either send or receive power. And this power can be transferred at the same time the device is transmitting data across the connection.

This could spell the end of all those proprietary laptop charging cables, with everything charging via a standard USB connection. You could charge your laptop from one of those portable battery packs you charge your smartphones and other portable devices from today. You could plug your laptop into an external display connected to a power cable, and that external display would charge your laptop as you used it as an external display — all via the one little USB Type-C connection. To use this, the device and the cable have to support USB Power Delivery. Just having a USB Type-C connection doesn't necessarily mean they do.

USB Type-C and USB 3.1

USB 3.1 is a new USB standard. USB 3's theoretical bandwidth is 5 Gbps, while USB 3.1's is 10 Gbps. That's double the bandwidth, as fast as a first-generation Thunderbolt connector. USB Type-C isn't the same thing as USB 3.1. USB Type-C is just a connector shape, and the underlying technology could just be USB 2 or USB 3.0. In fact, Nokia's N1 Android tablet uses a USB Type-C connector, but underneath it's all USB 2.0 — not even USB 3.0. However, these technologies are closely related.

Thunderbolt over USB Type-C

Thunderbolt is a hardware interface that combines data, video, audio, and power in a single connection. Thunderbolt combines PCI Express (PCIe) and DisplayPort (DP) into one serial signal, and additionally provides DC power, all in one cable. Thunderbolt 1 and Thunderbolt 2 use the same connector as miniDP (DisplayPort) to connect to peripherals, while Thunderbolt 3 uses a USB Type-C connector.

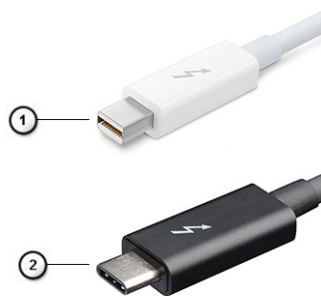


Figure 4. Thunderbolt 1 and Thunderbolt 3

- 1 Thunderbolt 1 and Thunderbolt 2 (using a miniDP connector)
- 2 Thunderbolt 3 (using a USB Type-C connector)

Thunderbolt 3 over USB Type-C

Thunderbolt 3 brings Thunderbolt to USB Type-C at speeds up to 40 Gbps, creating one compact port that does it all - delivering the fastest, most versatile connection to any dock, display or data device like an external hard drive. Thunderbolt 3 uses a USB Type-C connector/port to connect to supported peripherals.

- 1 Thunderbolt 3 uses USB Type-C connector and cables - It is compact and reversible

- 2 Thunderbolt 3 supports speed up to 40 Gbps
- 3 DisplayPort 1.2 – compatible with existing DisplayPort monitors, devices and cables
- 4 USB Power Delivery - Up to 130W on supported computers

Key Features of Thunderbolt 3 over USB Type-C

- 1 Thunderbolt, USB, DisplayPort and power on USB Type-C on a single cable (features vary between different products)
- 2 USB Type-C connector and cables which are compact and reversible
- 3 Supports Thunderbolt Networking (*varies between different products)
- 4 Supports up to 4K displays
- 5 Up to 40 Gbps

 **NOTE:** Data transfer speed may vary between different devices.

Thunderbolt Icons



Protocol	USB Type-A	USB Type-C	Notes
Thunderbolt	Not Applicable		Will use industry standard icon regardless of port style (i.e., mDP or USB Type-C)
Thunderbolt w/ Power Delivery	Not Applicable		Up to 130 Watts via USB Type-C

Figure 5. Thunderbolt Iconography Variations

HDMI 2.0

This topic explains the HDMI 2.0 and its features along with the advantages.

HDMI (High-Definition Multimedia Interface) is an industry-supported, uncompressed, all-digital audio/video interface. HDMI provides an interface between any compatible digital audio/video source, such as a DVD player, or A/V receiver and a compatible digital audio and/or video monitor, such as a digital TV (DTV). The intended applications for HDMI TVs, and DVD players. The primary advantage is cable reduction and content protection provisions. HDMI supports standard, enhanced, or high-definition video, plus multichannel digital audio on a single cable.

HDMI 2.0 Features

- **HDMI Ethernet Channel** - Adds high-speed networking to an HDMI link, allowing users to take full advantage of their IP-enabled devices without a separate Ethernet cable
- **Audio Return Channel** - Allows an HDMI-connected TV with a built-in tuner to send audio data "upstream" to a surround audio system, eliminating the need for a separate audio cable
- **3D** - Defines input/output protocols for major 3D video formats, paving the way for true 3D gaming and 3D home theater applications
- **Content Type** - Real-time signaling of content types between display and source devices, enabling a TV to optimize picture settings based on content type
- **Additional Color Spaces** - Adds support for additional color models used in digital photography and computer graphics
- **4K Support** - Enables video resolutions far beyond 1080p, supporting next-generation displays that will rival the Digital Cinema systems used in many commercial movie theaters
- **HDMI Micro Connector** - A new, smaller connector for phones and other portable devices, supporting video resolutions up to 1080p
- **Automotive Connection System** - New cables and connectors for automotive video systems, designed to meet the unique demands of the motoring environment while delivering true HD quality

Advantages of HDMI

- Quality HDMI transfers uncompressed digital audio and video for the highest, crispest image quality.
- Low -cost HDMI provides the quality and functionality of a digital interface while also supporting uncompressed video formats in a simple, cost-effective manner
- Audio HDMI supports multiple audio formats from standard stereo to multichannel surround sound
- HDMI combines video and multichannel audio into a single cable, eliminating the cost, complexity, and confusion of multiple cables currently used in A/V systems
- HDMI supports communication between the video source (such as a DVD player) and the DTV, enabling new functionality

Advantages of DisplayPort over USB Type-C

- Full DisplayPort audio/video (A/V) performance (up to 4K at 60Hz)
- Reversible plug orientation and cable direction
- Backwards compatibility to VGA, DVI with adaptors
- SuperSpeed USB (USB 3.1) data
- Supports HDMI 2.0a and is backwards compatible with previous versions

Removing and Installing components

Topics:

- Recommended tools
- Screw size list
- Motherboard layout
- Side cover
- Expansion card
- Coin cell battery
- Hard drive assembly
- Front Bezel
- Hard drive and optical drive module
- Optical drive
- Memory module
- Heat sink and fan
- Intrusion switch
- Power switch
- Processor
- M.2 PCIe Solid State Drive -SSD
- Intel Optane card
- SD card reader - optional
- Internal Antenna - optional
- External Antenna - optional
- M.2 2230 WLAN card - optional
- Power supply unit
- Speaker
- System fan
- System board

Recommended tools







The procedures in this document require the following tools:

- Phillips #0 screwdriver
- Phillips #1 screwdriver
- Philips #2 screwdriver
- Plastic scribe
- T-30 torx screwdriver

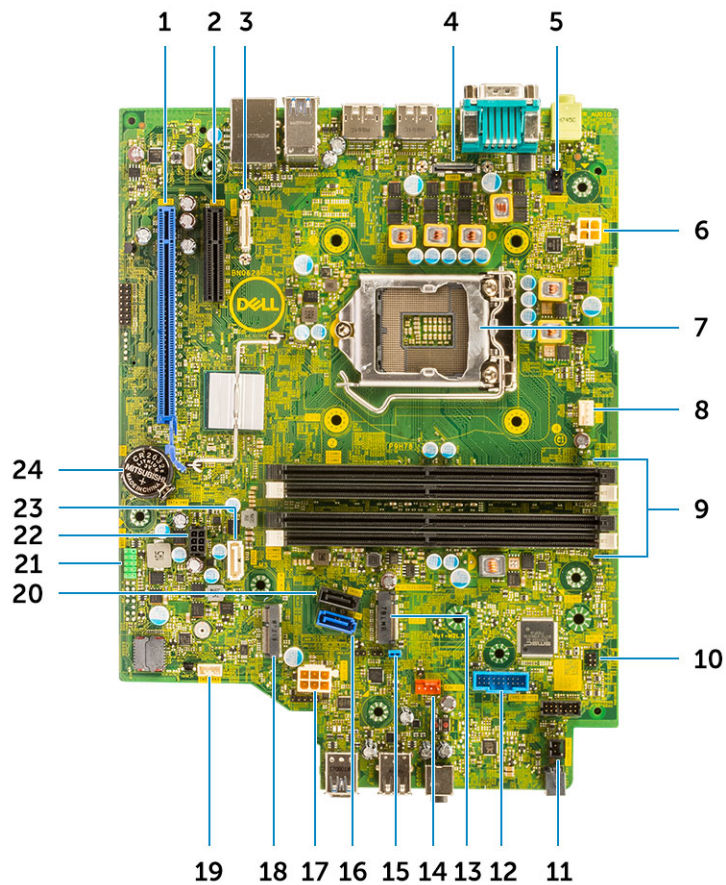
 **NOTE:** The #0 screw driver is for screws 0-1 and the #1 screw driver is for screws 2-4

Screw size list

Table 4. Screw size list

Component	#6.32x1.4 	#6-32 	M3x6 	M3x5 	M3x3 	M2x3.5 
System board	5	1	1			
SSD card screw nut		1				
Hard disk drive caddy			1			
Power supply unit	3					
Front IO bracket	1					
SD card reader				2		
Type C/HDMI/DP module					2	
Internal antenna					2	
Wifi card						1
SSD card						1

Motherboard layout



- | | | | |
|----|---|----|---|
| 1 | PCI-e x16 connector (slot 2) | 2 | PCI-e x4 connector (slot1—open ended x4 to support x16) |
| 3 | USB Type-C connector | 4 | Video connector |
| 5 | Intrusion switch connector (Intruder) | 6 | CPU power connector (ATX_CPU) |
| 7 | Processor socket (CPU) | 8 | CPU fan connector |
| 9 | Memory slots (DIMM1, DIMM2, DIMM3, DIMM4) | 10 | Power switch connector (PWR_SW) |
| 11 | Remote PWR switch connector | 12 | Media card reader connector (Card_reader) |
| 13 | M.2 SSD card/Intel Optane connector | 14 | System fan connector |
| 15 | Clear password jumper (PASSWORD_CLR) | 16 | SATA 0 connector |
| 17 | PSU connector | 18 | M.2 WLAN connector |
| 19 | Internal speaker connector (INT_SPKR) | 20 | SATA 3 connector |
| 21 | Internal USB connector (FRONT_USB) | 22 | SATA power connector (SATA_PWR) |
| 23 | SATA 2 connector | 24 | Coin cell battery |

Side cover

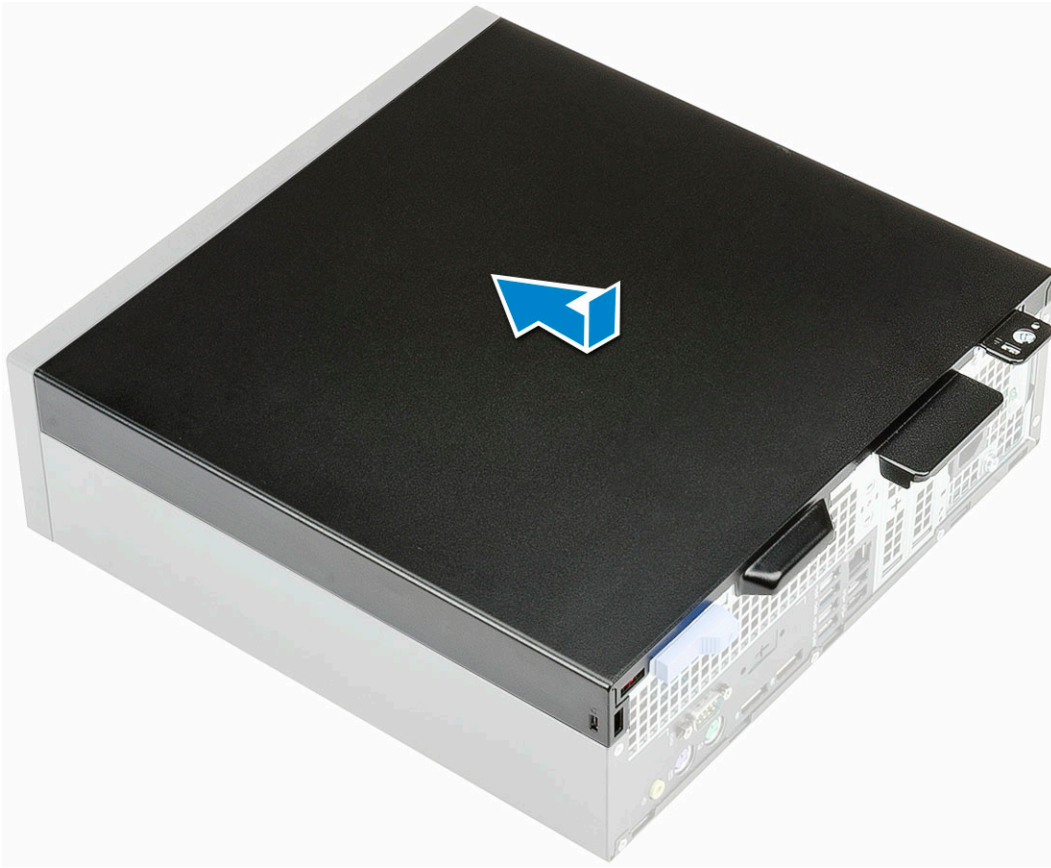
Removing the side cover

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 To remove the cover:
 - a Slide the release latch on the back side of your system until it gives a click sound to unlock the side cover [1].
 - b Slide and lift the side cover from the system [2].



Installing the side cover

- 1 Place the cover on the system and slide the cover until it clicks into place.
- 2 The release latch automatically locks the side cover to the system.

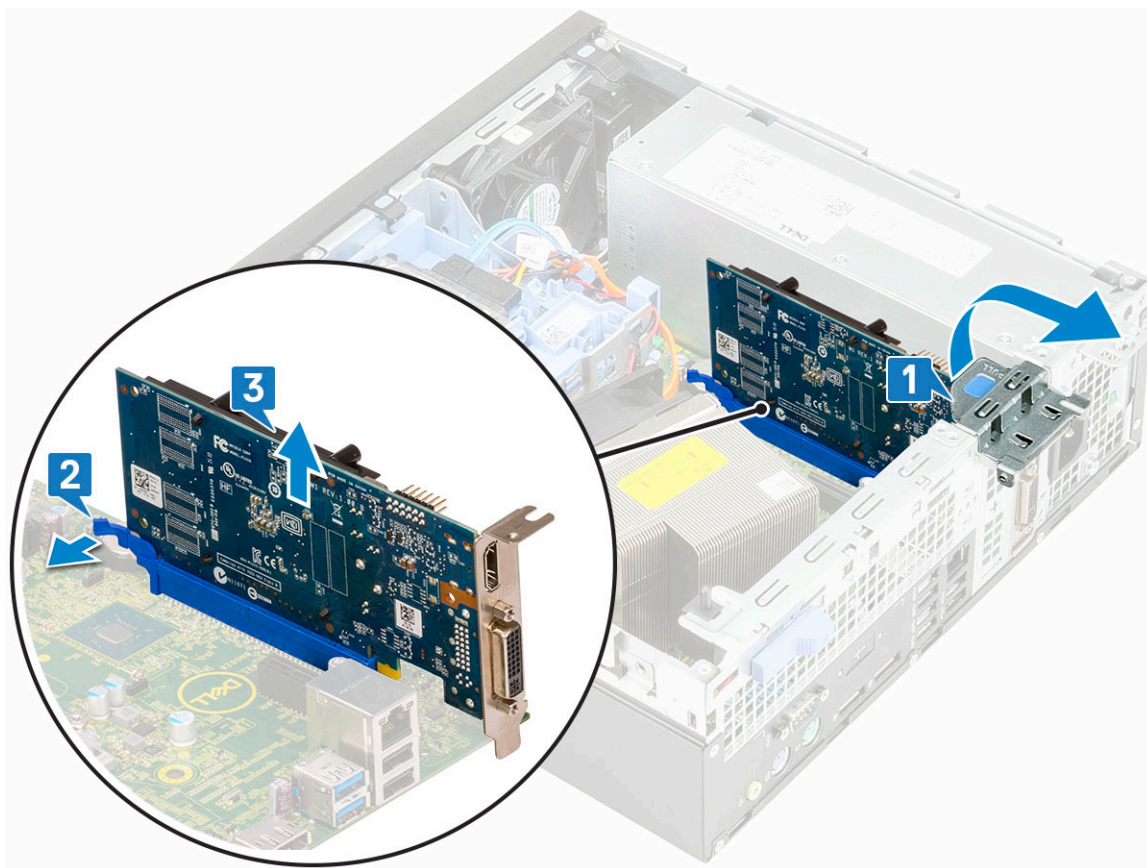


- 3 Follow the procedure in [After working inside your computer](#)

Expansion card

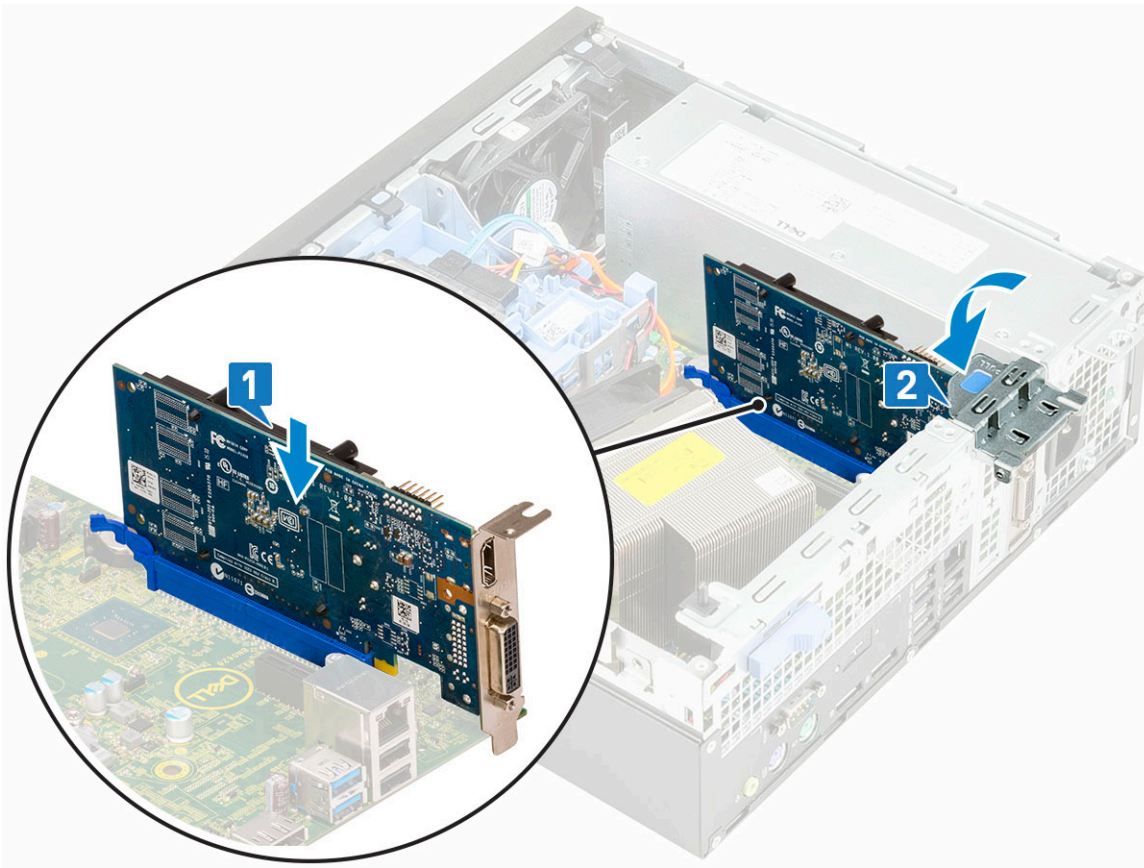
Removing expansion card

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the [Side cover](#).
- 3 To remove the expansion card:
 - a Pull the metal tab to open the expansion card latch [1].
 - b Pull the release tab at the base of the expansion card [2].
 - c Disconnect and lift the expansion card away from the connector on the system board [3].



Installing the expansion card

- 1 Insert the expansion card into the connector on the system board.
- 2 Press the expansion card until it clicks into place [1].
- 3 Close the expansion card latch and press it until it clicks into place [2].

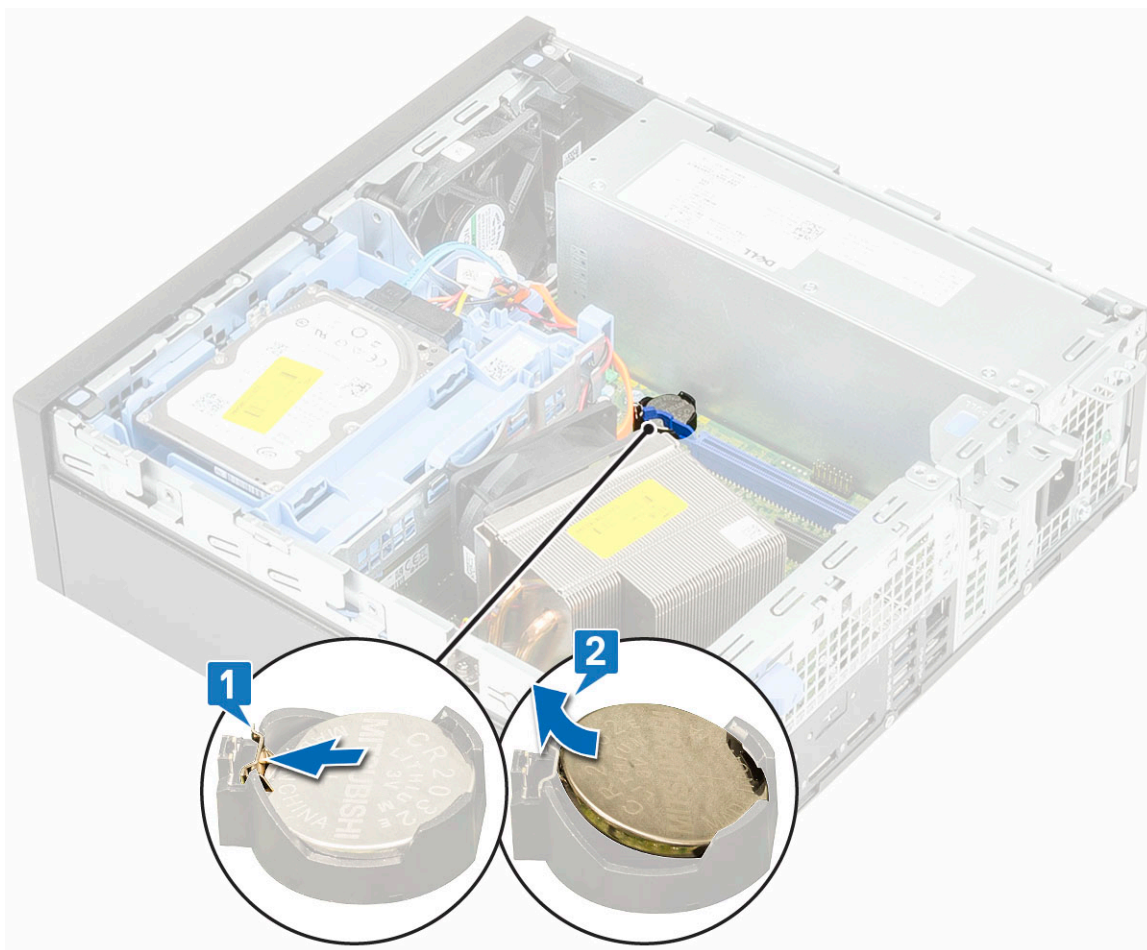


- 4 Install the [Side cover](#).
- 5 Follow the procedure in [After working inside your computer](#).

Coin cell battery

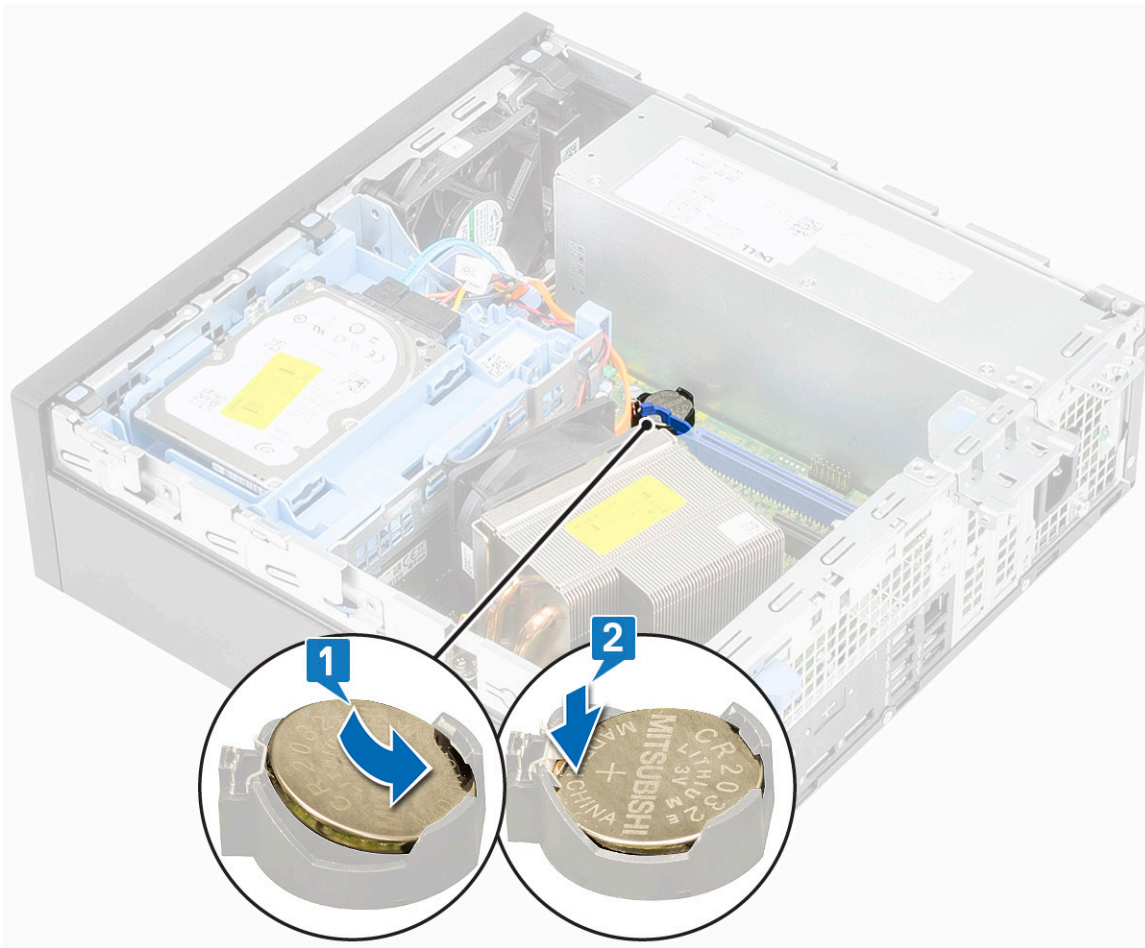
Removing coin cell battery

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the [Side cover](#).
- 3 To remove the coin cell battery:
 - a Using a plastic scribe press the release latch until the coin cell battery pops out [1].
 - b Remove the coin cell battery from the system [2].



Installing the coin cell battery

- 1 Place the coin cell battery in its slot on the system board [1].
- 2 Press the battery into the connector until it locks into place [2].

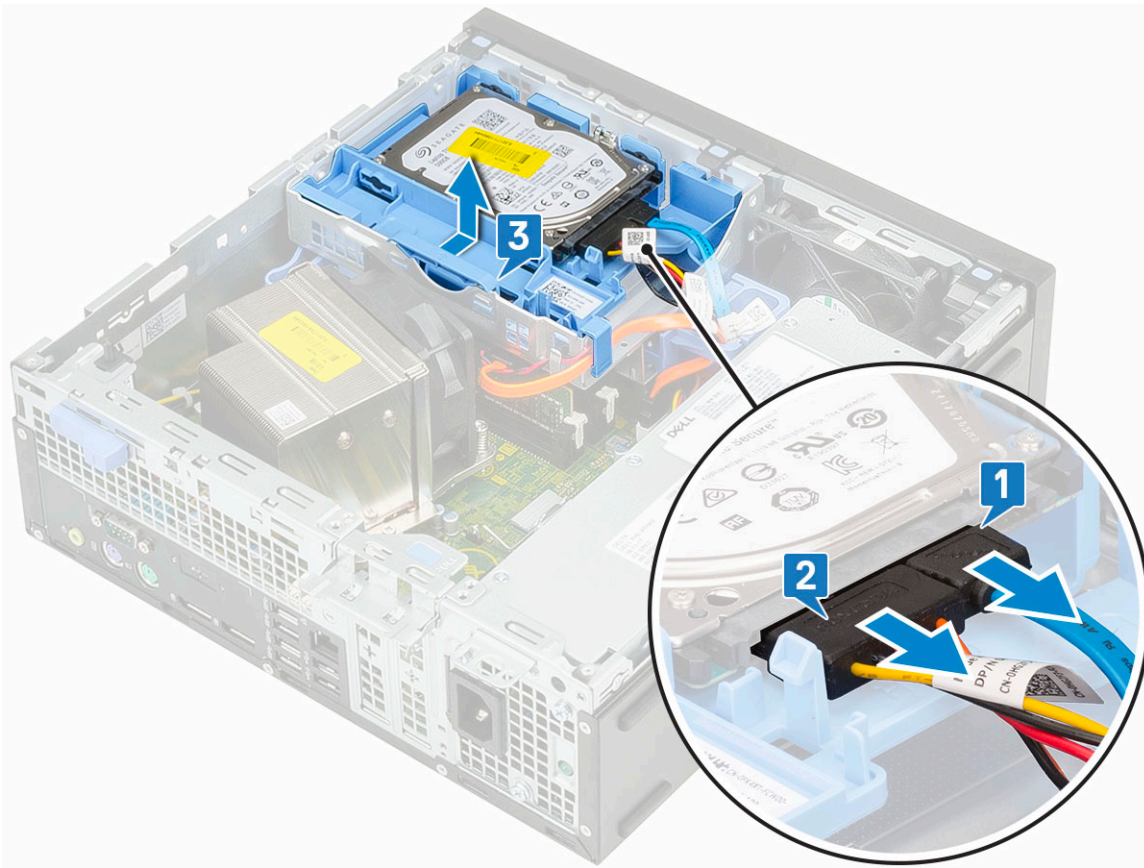


- 3 Install the [Side cover](#).
- 4 Follow the procedure in [After working inside your computer](#).

Hard drive assembly

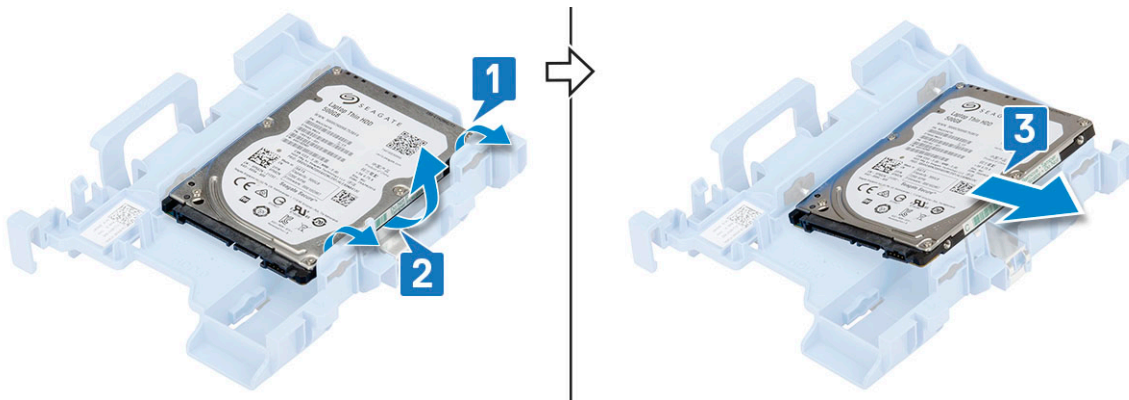
Removing the hard drive assembly

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the [Side cover](#).
- 3 To remove the hard drive assembly:
 - a Disconnect the hard drive data cable and power cable from the connectors on the hard drive [1, 2].
 - b Push the release tab and lift the hard drive assembly from the system [3].



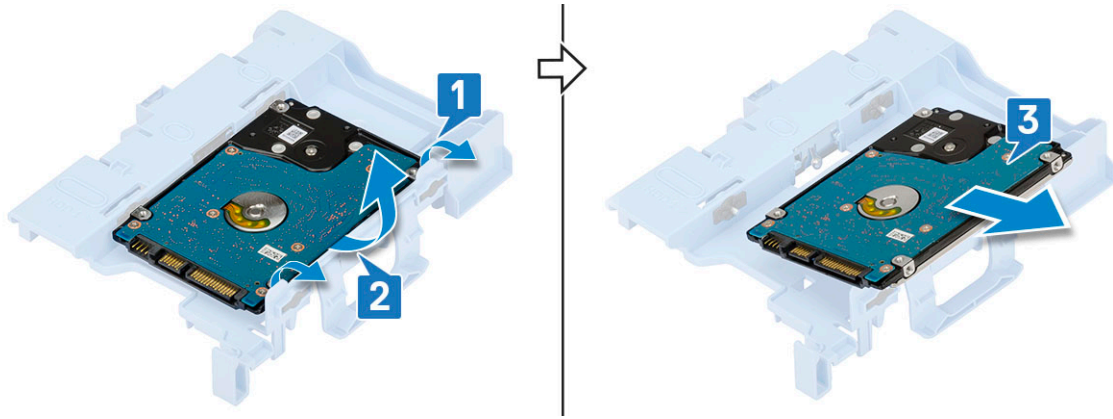
4 To remove the 2.5 inch hard drive from the assembly bracket:

- a Pull one side of the hard drive bracket to disengage the pins on the bracket from the slots on the hard drive [1,2].
- b Lift the hard drive out of the hard drive bracket [3].



5 To remove the 3.5 inch hard drive from the assembly bracket:

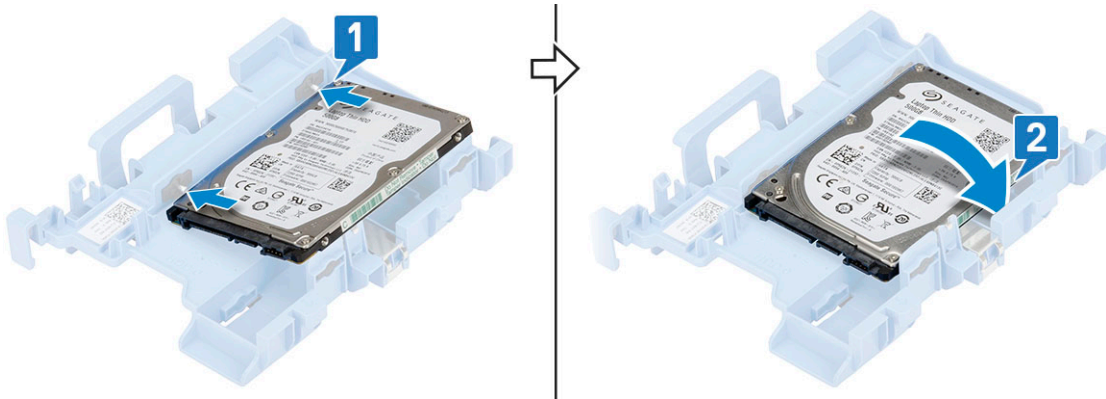
- a Pull one side of the hard drive bracket to disengage the pins on the bracket from the slots on the hard drive [1,2].
- b Lift the hard drive out of the hard drive bracket [3].



Installing the hard drive assembly

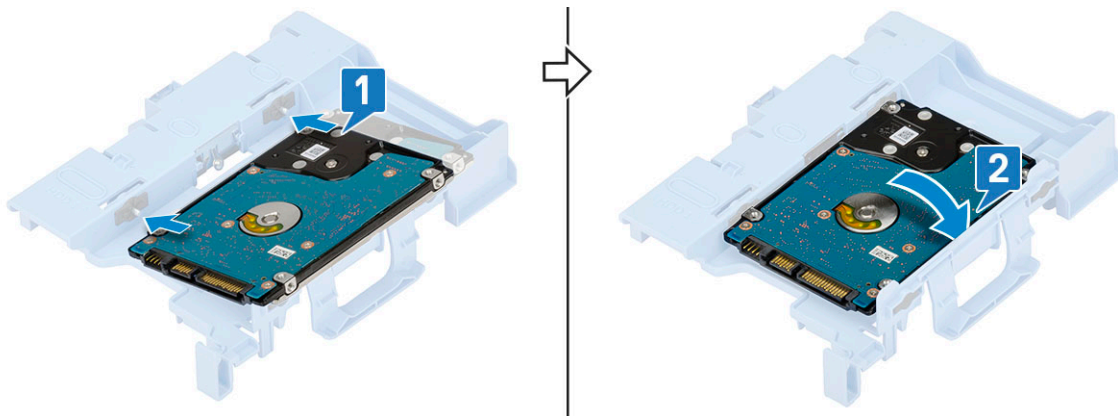
1 To replace the 2.5 inch hard drive from the assembly bracket:

- Align the tabs on the hard drive with the slots on the hard drive assembly at a 30 degree angle [1].
- Press the hard drive so that it gets secured to the hard drive assembly bracket [2].



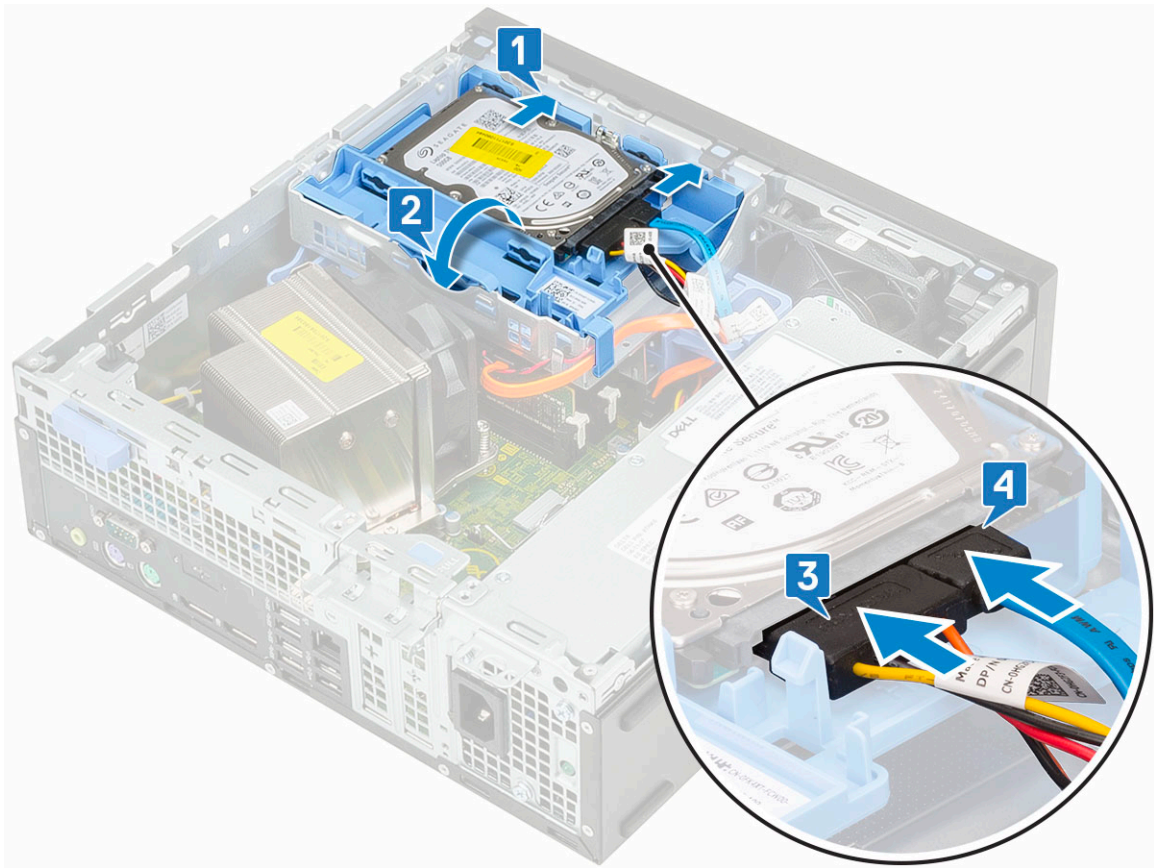
2 To replace the 3.5 inch hard drive from the assembly bracket:

- Align the tabs on the hard drive with the slots on the hard drive assembly at a 30 degree angle [1].
- Press the hard drive so that it gets secured to the hard drive assembly bracket [2].



3 To replace the hard drive assembly:

- Insert the hard drive assembly into the slot on the system [1,2].
- Connect the power cable and hard drive cable to the connectors on the hard drive [3,4].

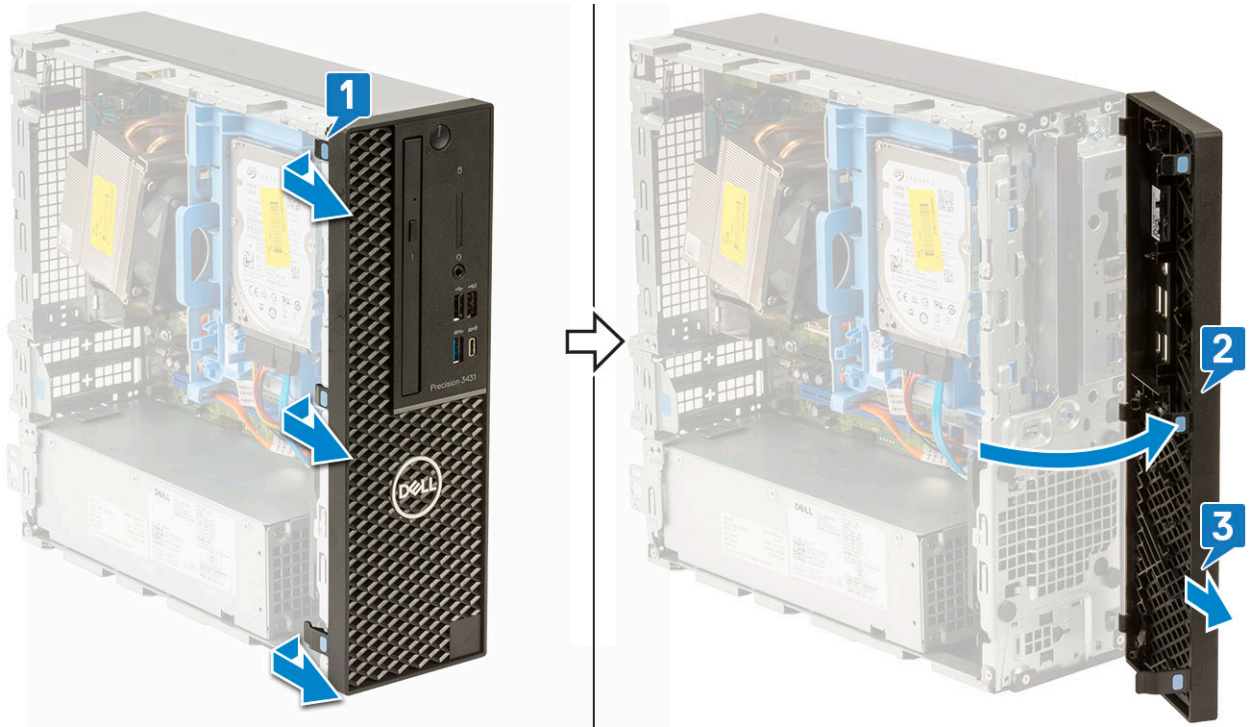


- 4 Install the [Side cover](#).
- 5 Follow the procedure in [After working inside your computer](#).

Front Bezel

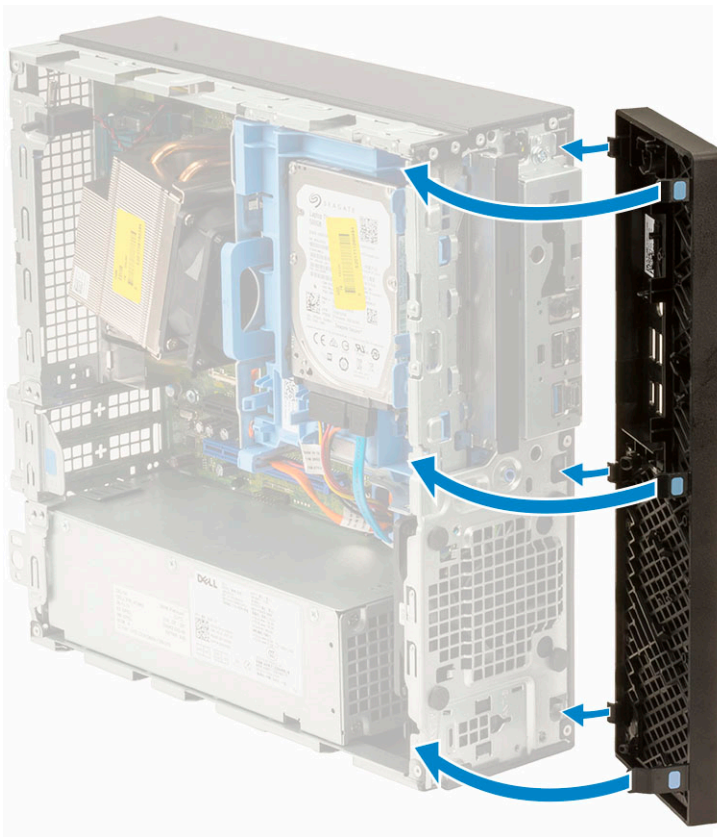
Removing front bezel

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the [Side cover](#).
- 3 To remove the front bezel:
 - a Pry the retention tabs to release the front bezel from the system [1] and pull to release the hooks on the front bezel from the front-panel slots [2].
 - b Remove the front bezel from the system [3].



Installing front bezel

- 1 Align the bezel and insert the retention tabs on the bezel into the slots on the system.
- 2 Press the bezel until the tabs clicks into place.

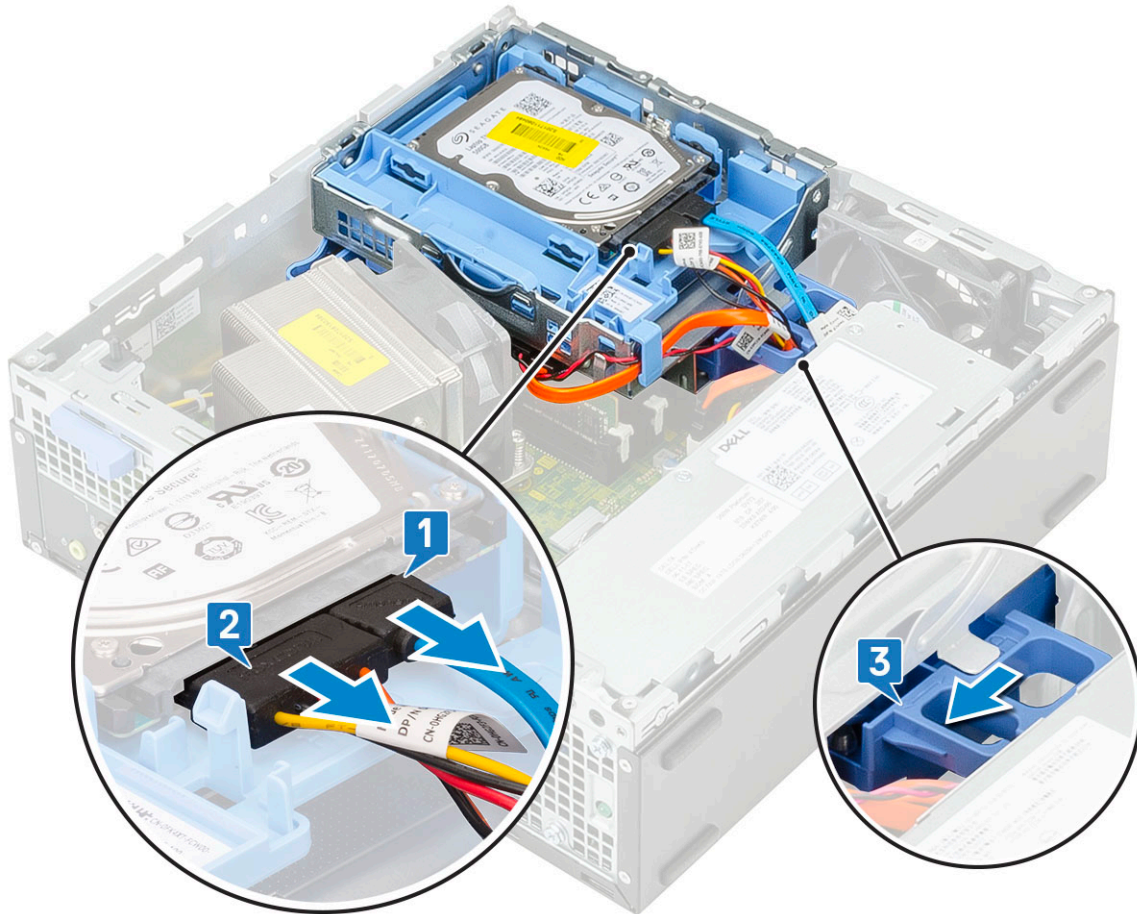


- 3 Install the [Side cover](#).
- 4 Follow the procedure in [After working inside your computer](#).

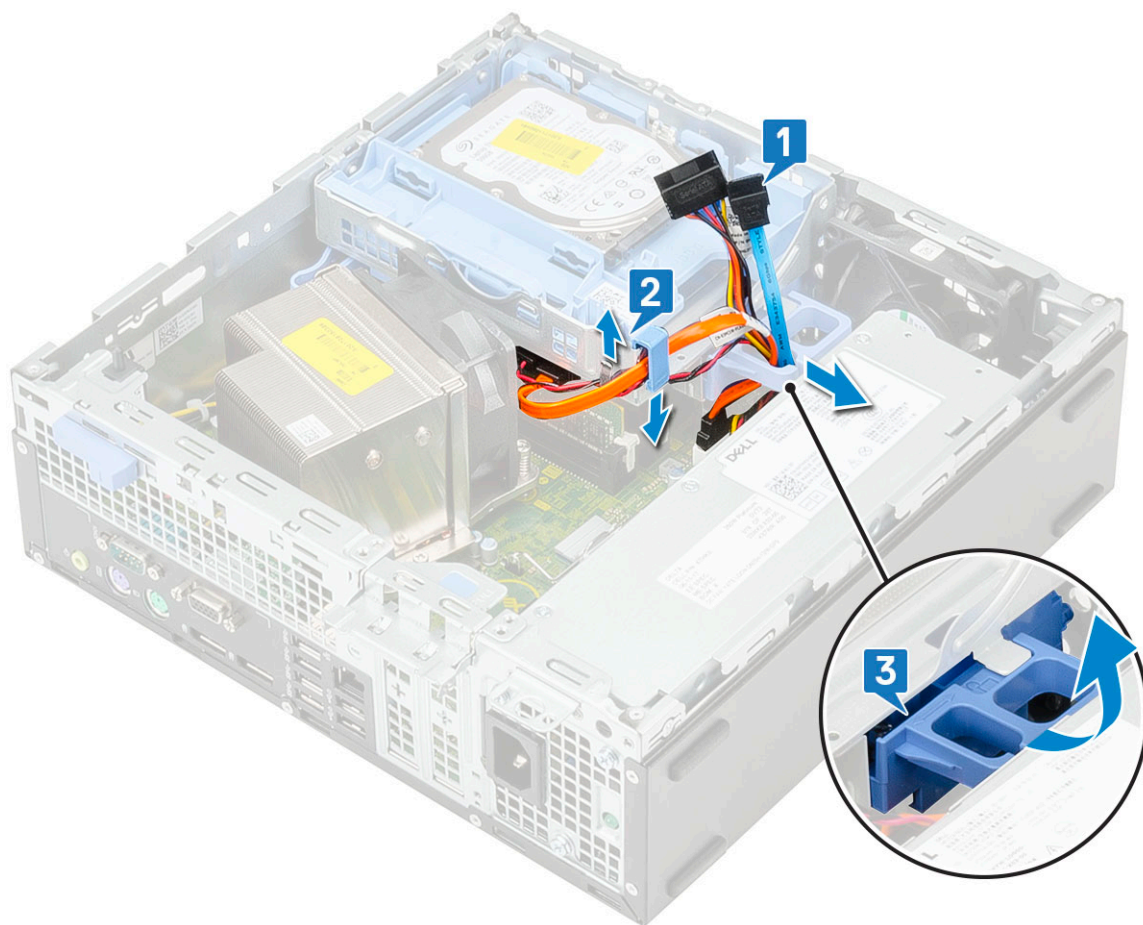
Hard drive and optical drive module

Removing the hard drive and optical drive module

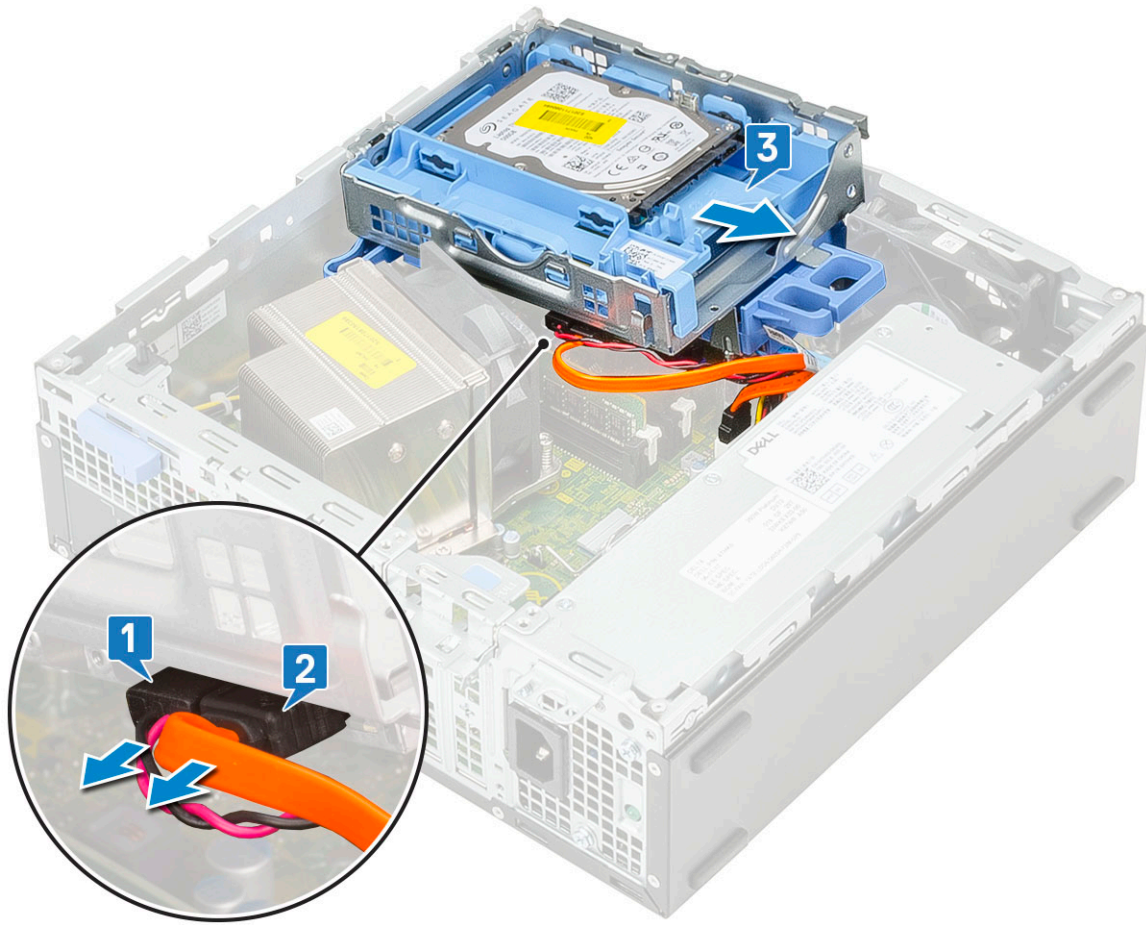
- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
- 3 To release the hard drive and optical drive module:
 - a Disconnect the hard drive data cable and power cable from the connectors on the hard drive [1, 2].
 - b Slide the release tab to unlock the hard drive and optical module [3].



- c Unroute the hard drive cables [1] and optical drive cables [2] through the retention clip and HDD-ODD release tab respectively.
- d Lift the hard drive and optical module [3]

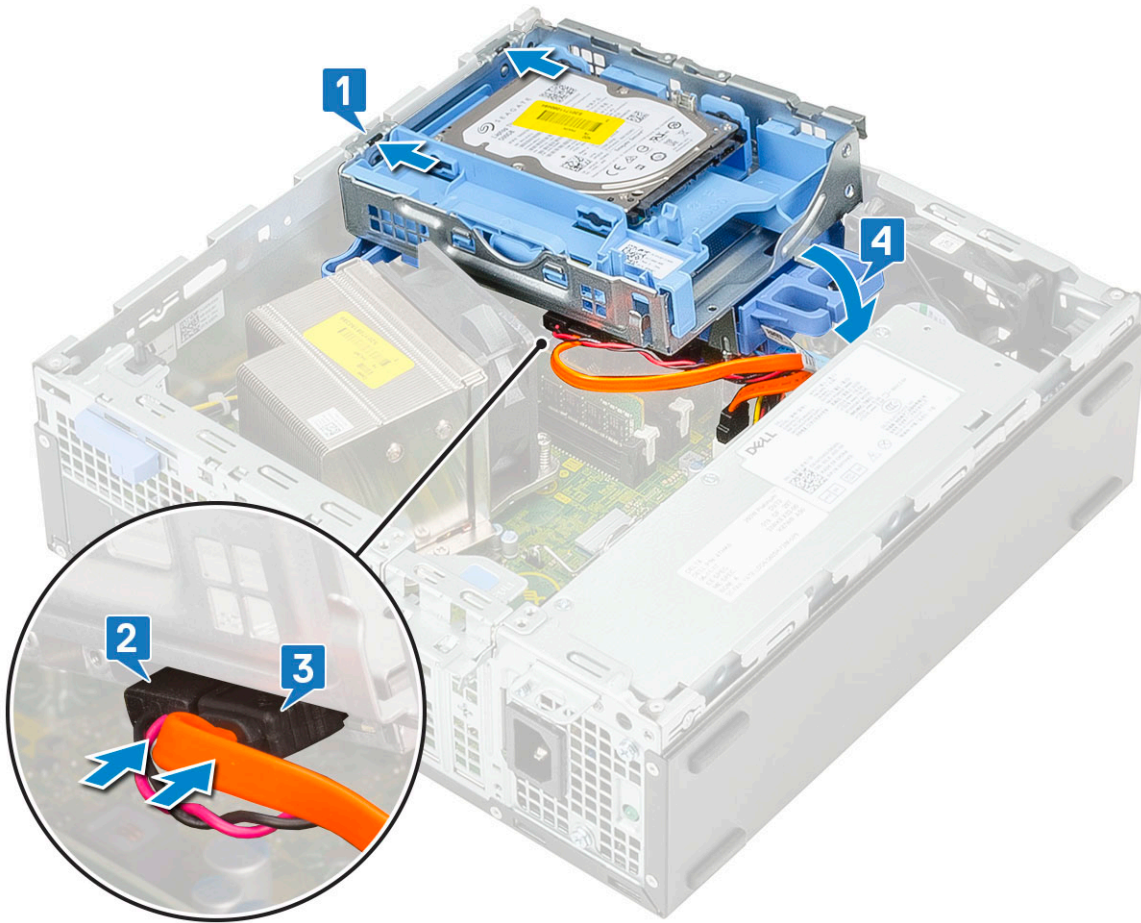


- 4 To remove the hard drive and optical drive module:
- a Disconnect the optical drive data cable and optical drive power cable from the connectors on the optical drive [1, 2].
 - b Slide and lift the hard drive and optical drive module from the system [3].

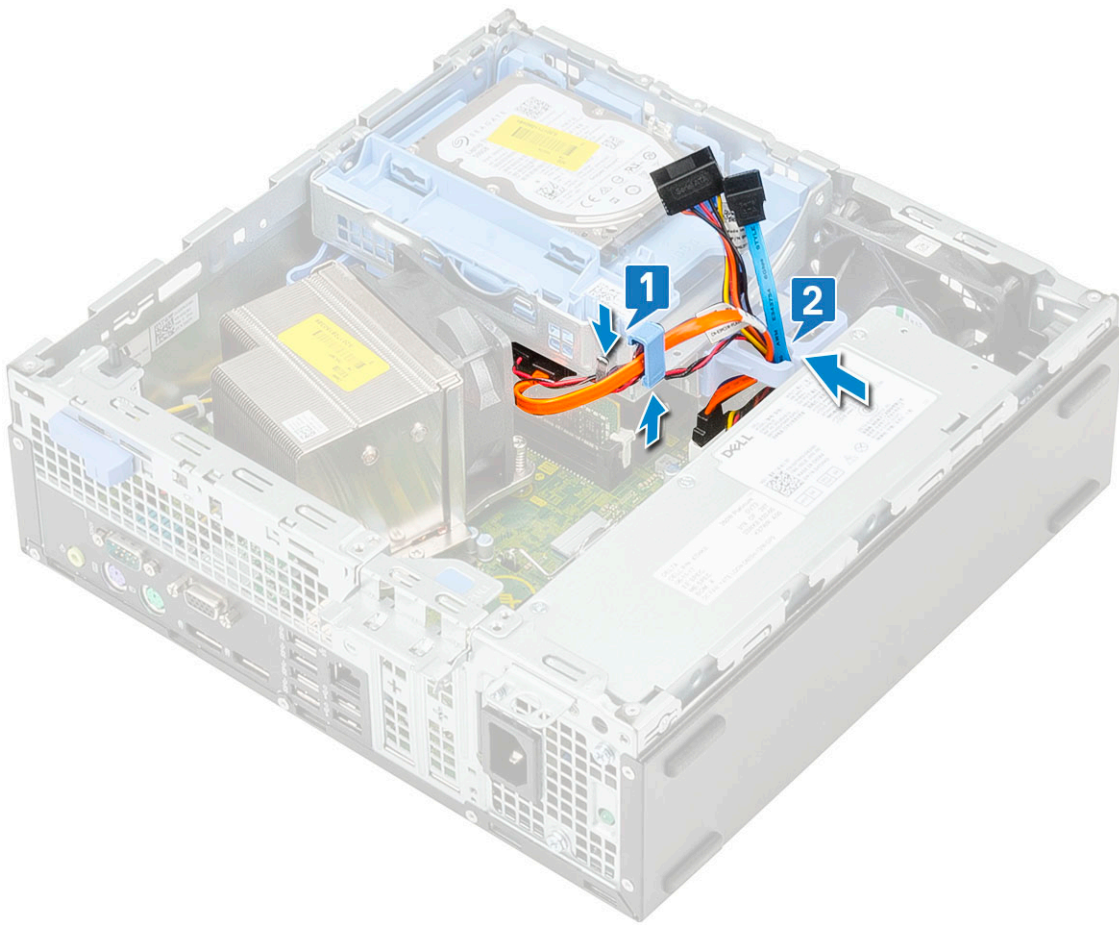


Installing the hard drive and optical drive module

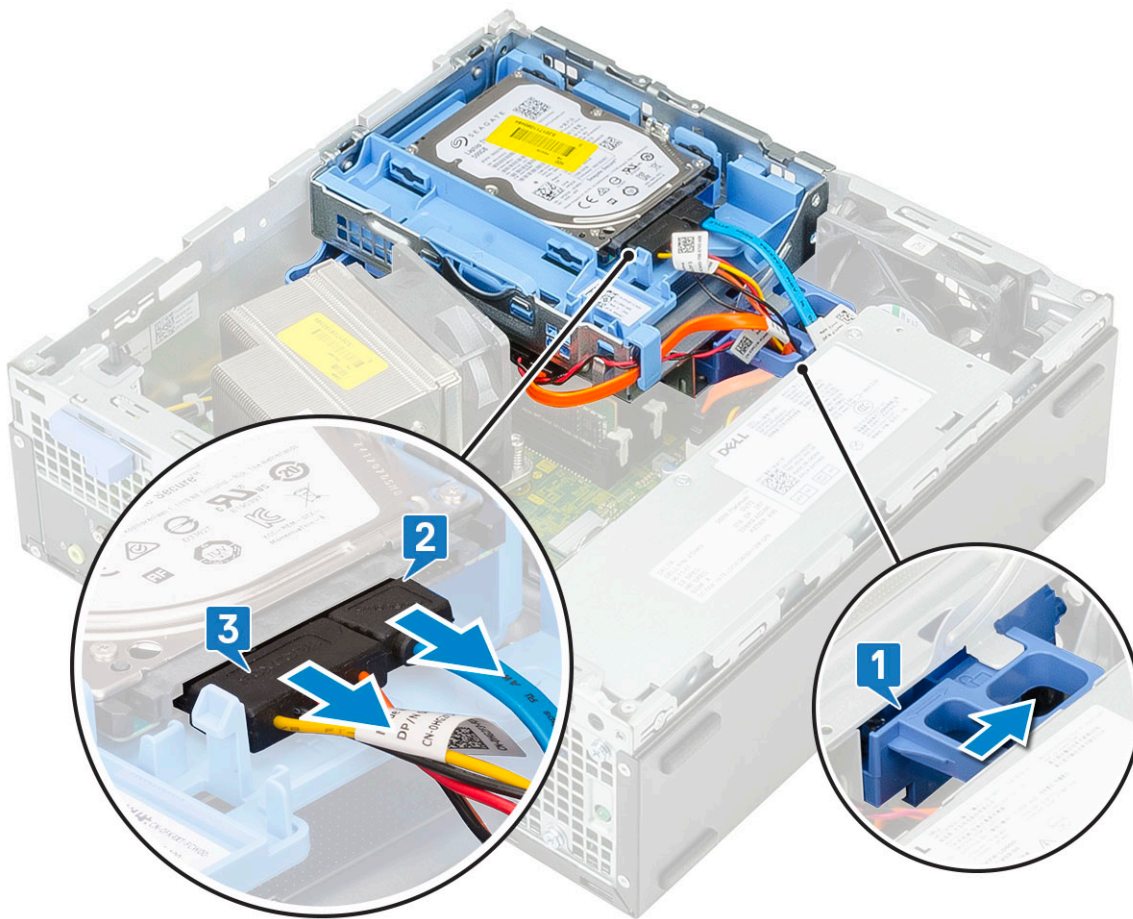
- 1 Insert the tabs on the hard drive and optical drive module into the slot on the system at a 30 degree angle [1].
- 2 Connect the optical drive data cable and power cable to the connectors on the optical drive [2, 3].
- 3 Lower the hard drive and optical drive module so that it is placed in its slot [4].



- 4 Route the optical drive data cable and power cable through the retention clips [1].
- 5 Route the hard drive data and power cables through the HDD-ODD release tab [2].



- 6 Slide the release tab to lock the module [1].
- 7 Connect the hard drive data cable and power cable from the connectors on the hard drive [2, 3].

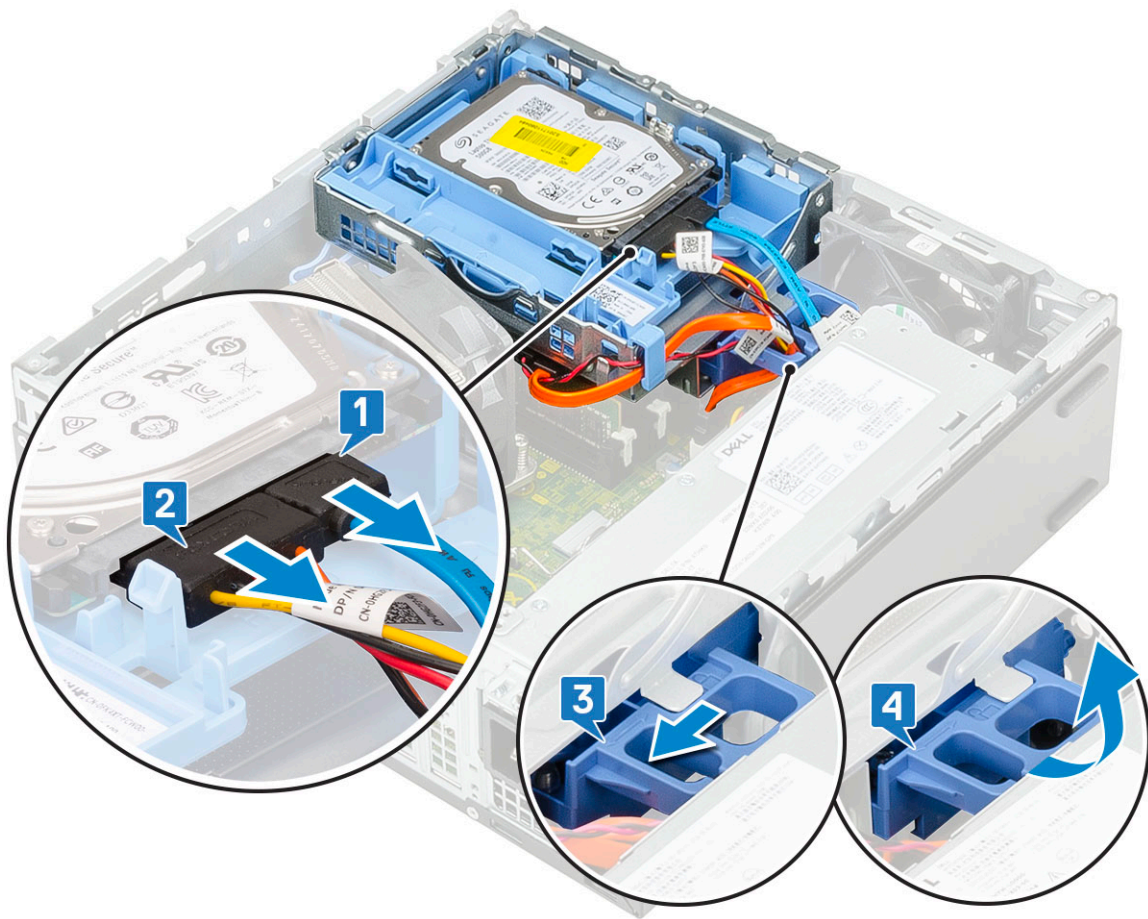


- 8 Install the:
 - a [Front bezel](#)
 - b [Side cover](#)
- 9 Follow the procedure in [After working inside your computer](#).

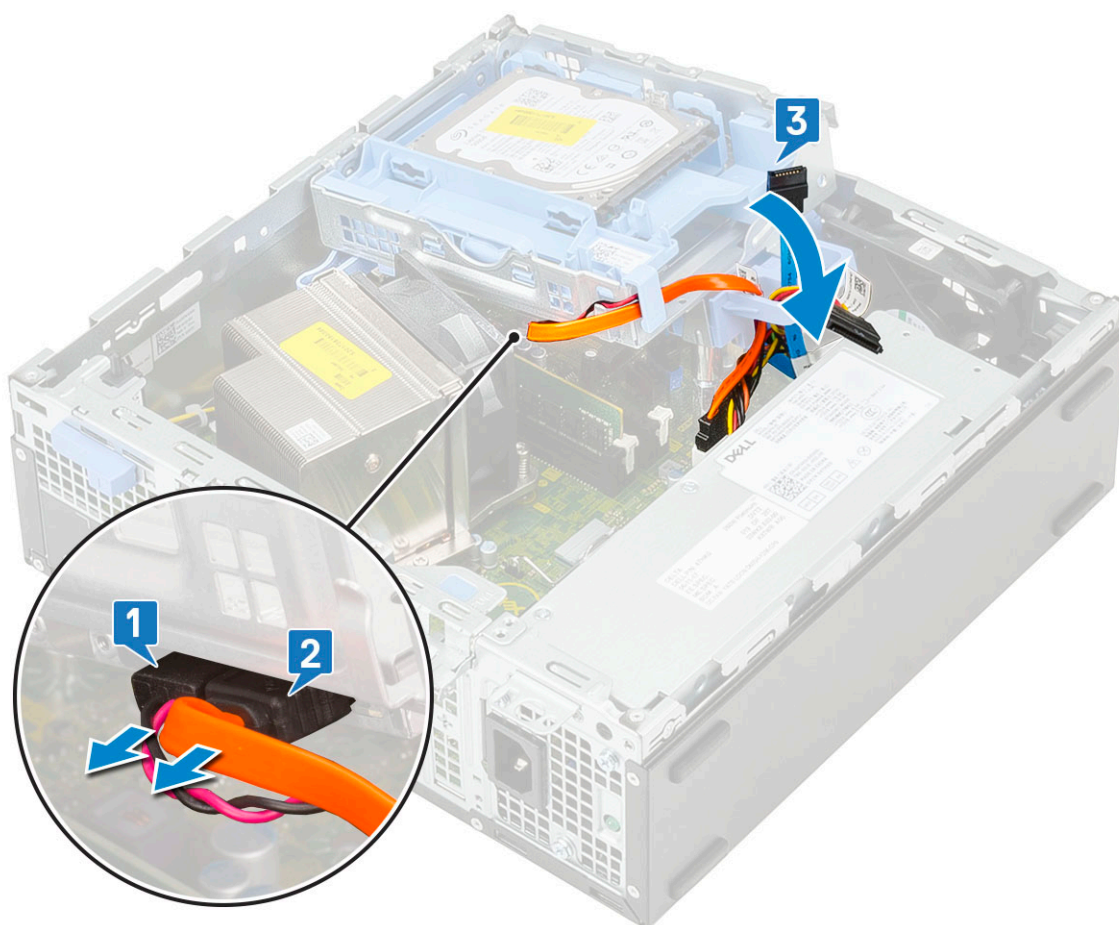
Optical drive

Removing the optical drive

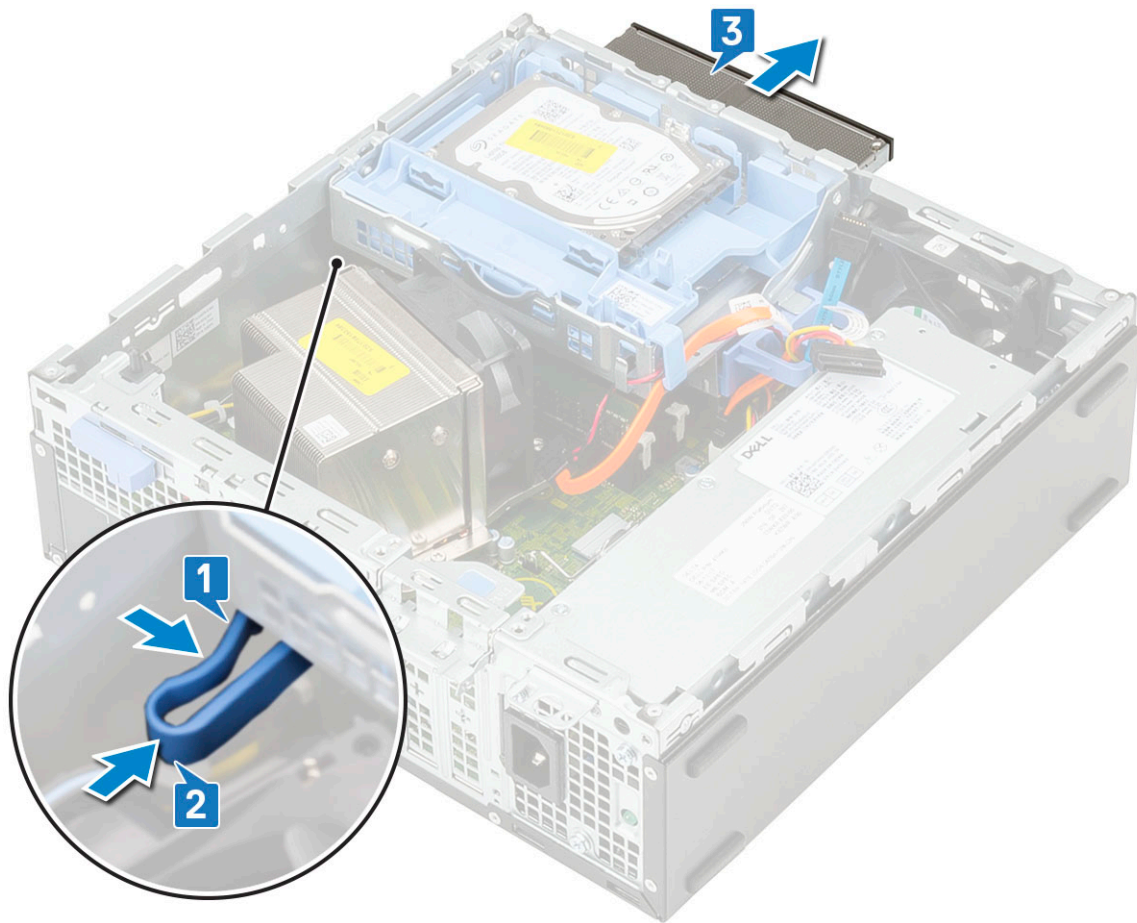
- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
- 3 To remove the optical drive:
 - a Disconnect the hard drive data cable and power cable from the connectors on the hard drive [1, 2].
 - b Slide the release tab to unlock the hard drive and optical module [3].
 - c Lift the hard drive and optical module [4].



- d Disconnect the optical drive data cable and optical drive power cable from the connectors on the optical drive [1, 2] and lower the hard drive and optical module until it is seated [3].

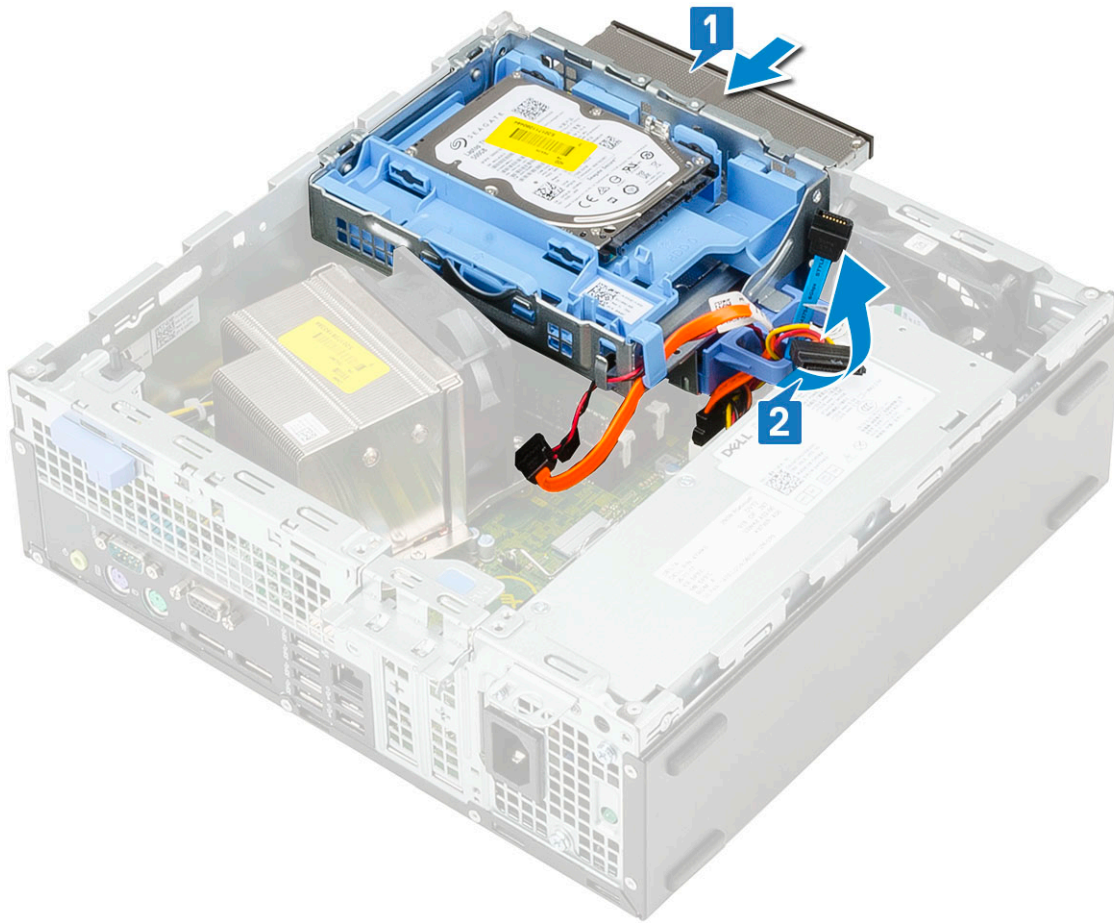


- e Press and push the release latch on the optical drive [1,2] and pull the optical drive out from the system [3].

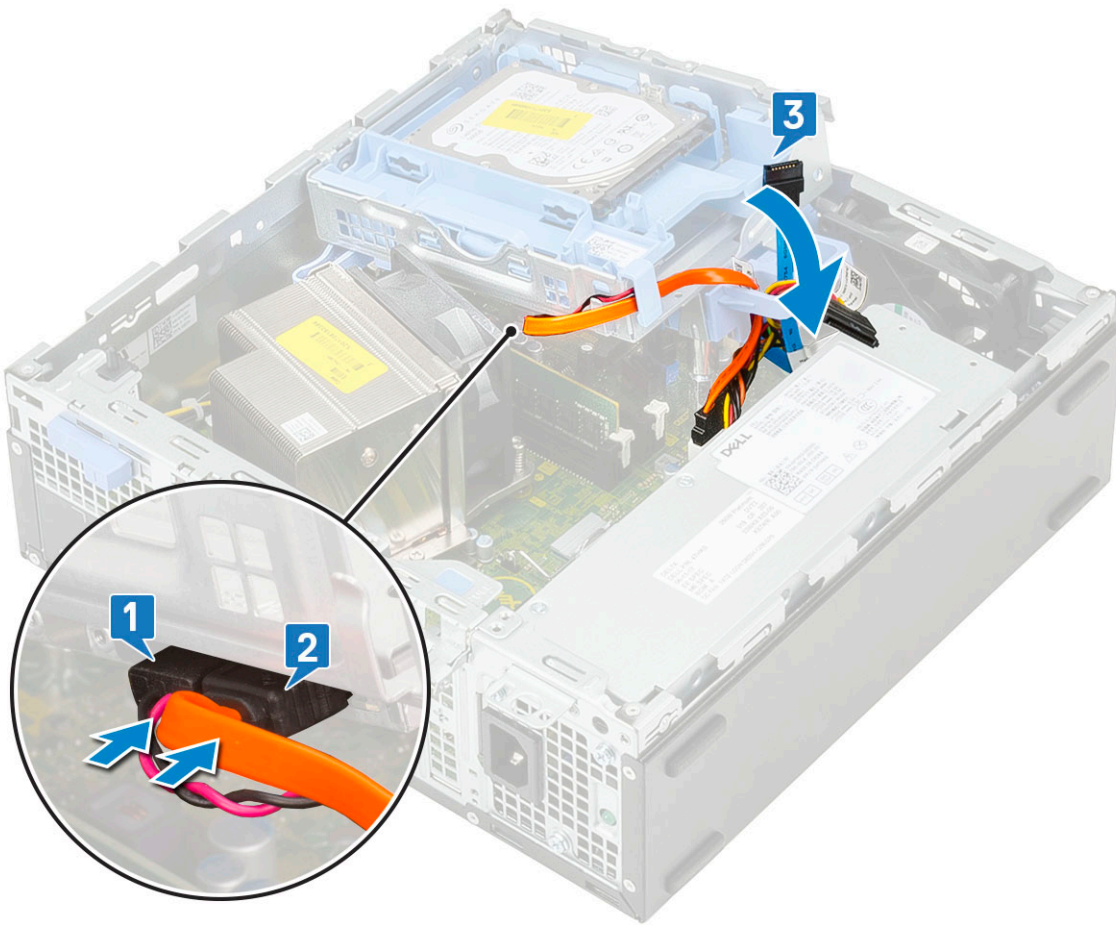


Installing the optical drive

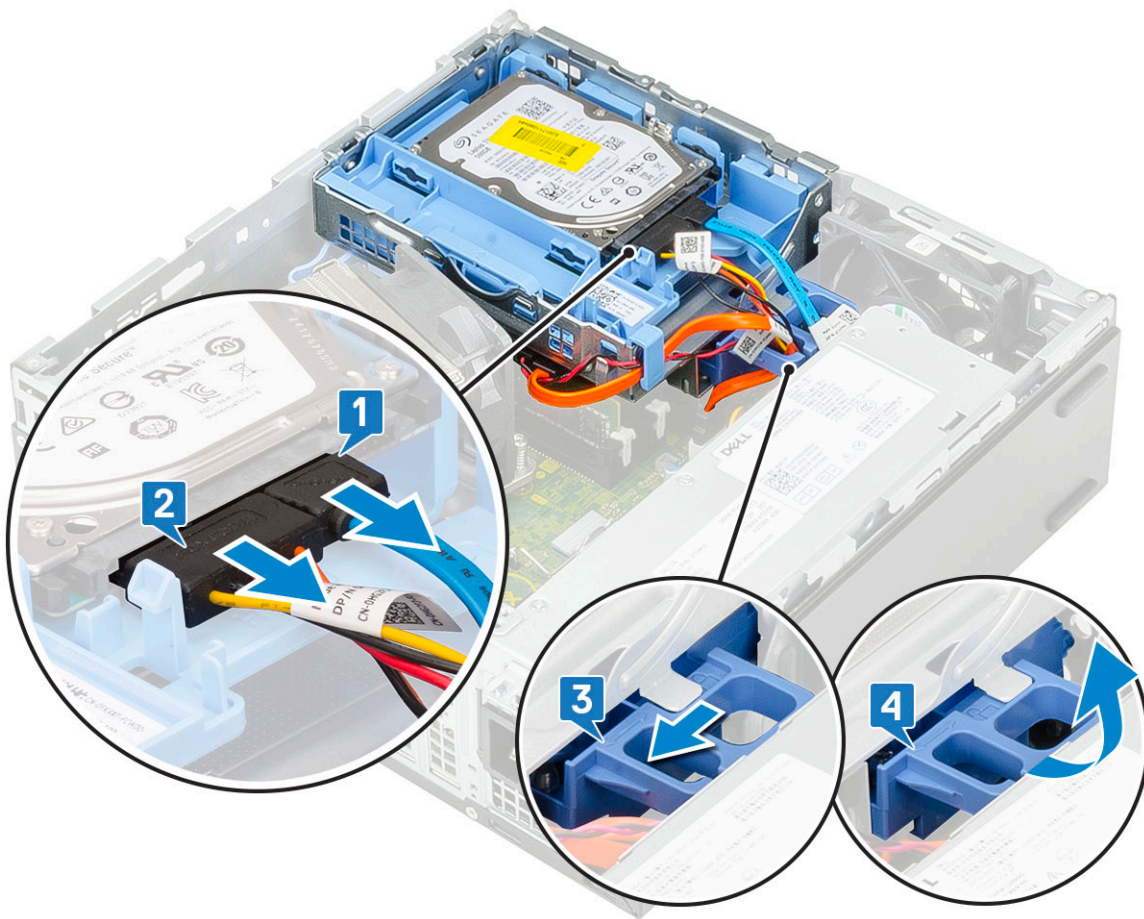
- 1 Slide the optical drive into its slot in the system [1].
- 2 Lift the hard drive and optical module [2].



- 3 Connect the optical drive data cable and power cable to the connectors on the optical drive [1, 2].
- 4 Place the hard drive and optical module back on the system [3].



- 5 Connect the hard drive data cable and hard drive power cable to the connectors on the hard drive [1,2].
- 6 Slide the release tab to lock the module [3,4].

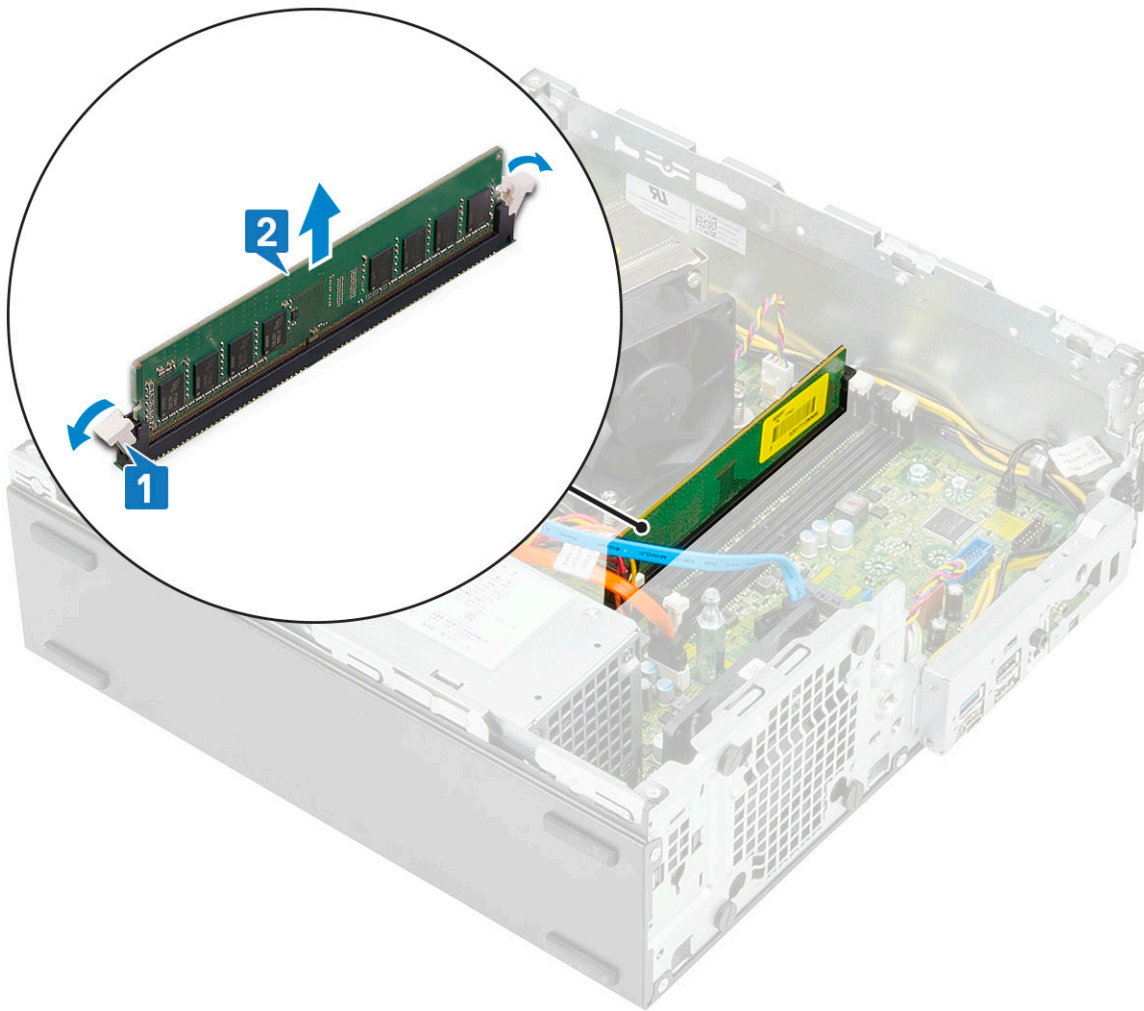


- 7 Install the:
 - a [Front bezel](#)
 - b [Side cover](#)
- 8 Follow the procedure in [After working inside your computer](#).

Memory module

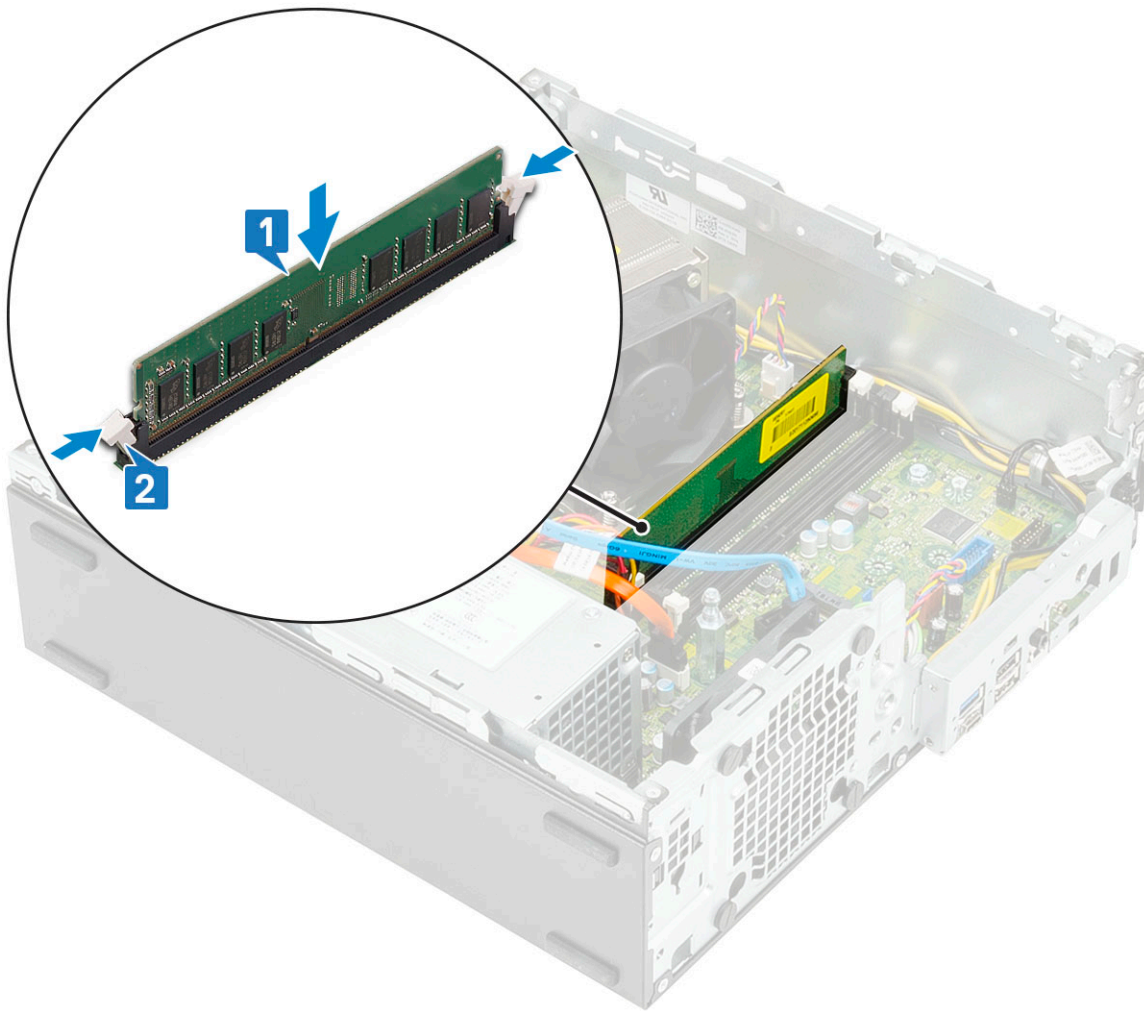
Removing memory module

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the memory module:
 - a Pry open the retention tabs from both sides to lift the memory module from the connector [1].
 - b Remove the memory module from the system board [2].



Installing the memory module

- 1 Align the notch on the memory module with the tab on the memory module connector.
- 2 Insert the memory module into the memory module socket [1].
- 3 Press the memory module until the memory module retention tabs click into place [2].



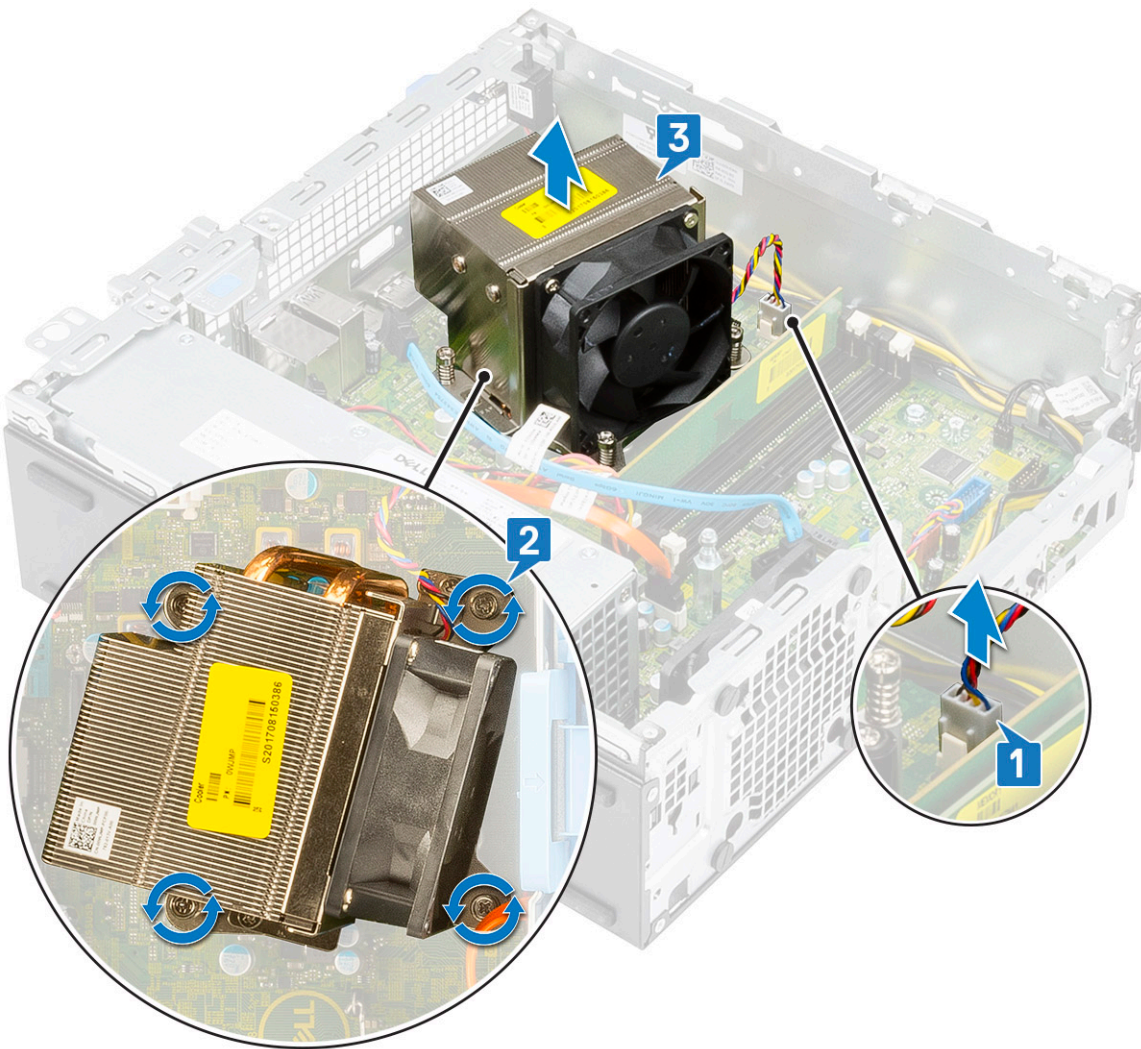
- 4 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 5 Follow the procedure in [After working inside your computer](#).

Heat sink and fan

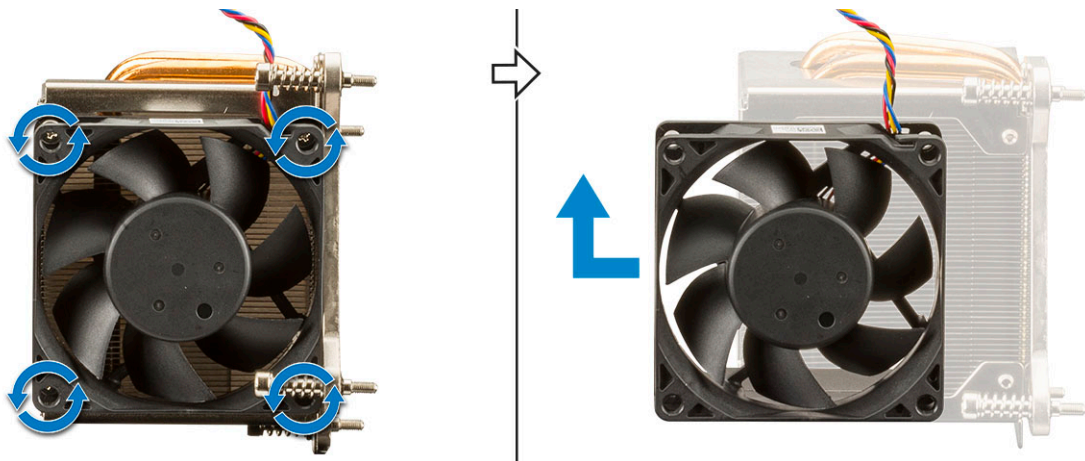
Removing heat sink and heat sink fan

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the heat sink with fan:
 - a Disconnect the heat sink fan cable from the system board [1].
 - b Loosen the 4 captive screws that secure the heat sink [2] and lift it away from the system [3].

① **NOTE:** Loosen the screws in a sequential order (1,2,3,4) as mentioned on the system board.



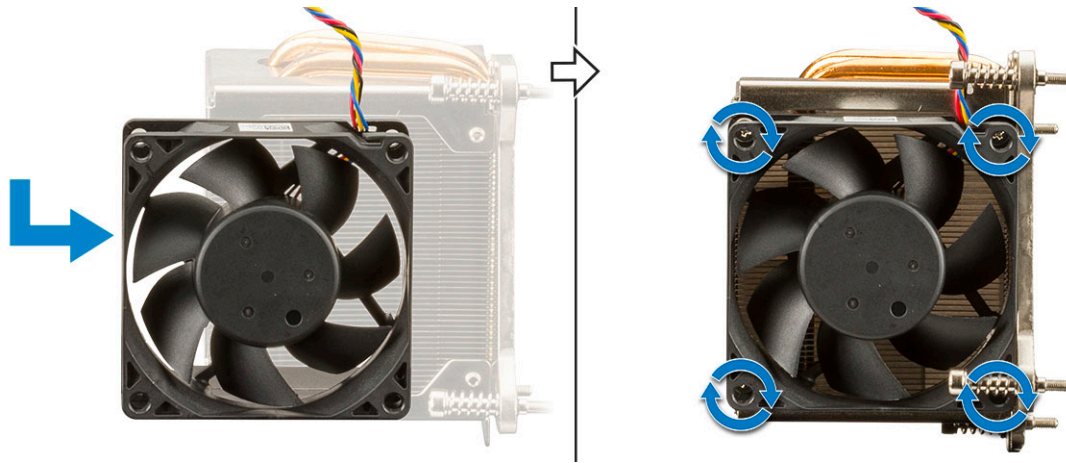
- 4 To remove the heat sink fan:
- a Remove the four screws from the fan and lift the fan away from the heat sink.



Installing heat sink and heat sink fan

- 1 To install the heat sink fan:

- a Align and place the slots on the fan to the slots on the heat sink module.
- b Replace the four screws to secure the heat sink fan to the heat sink.

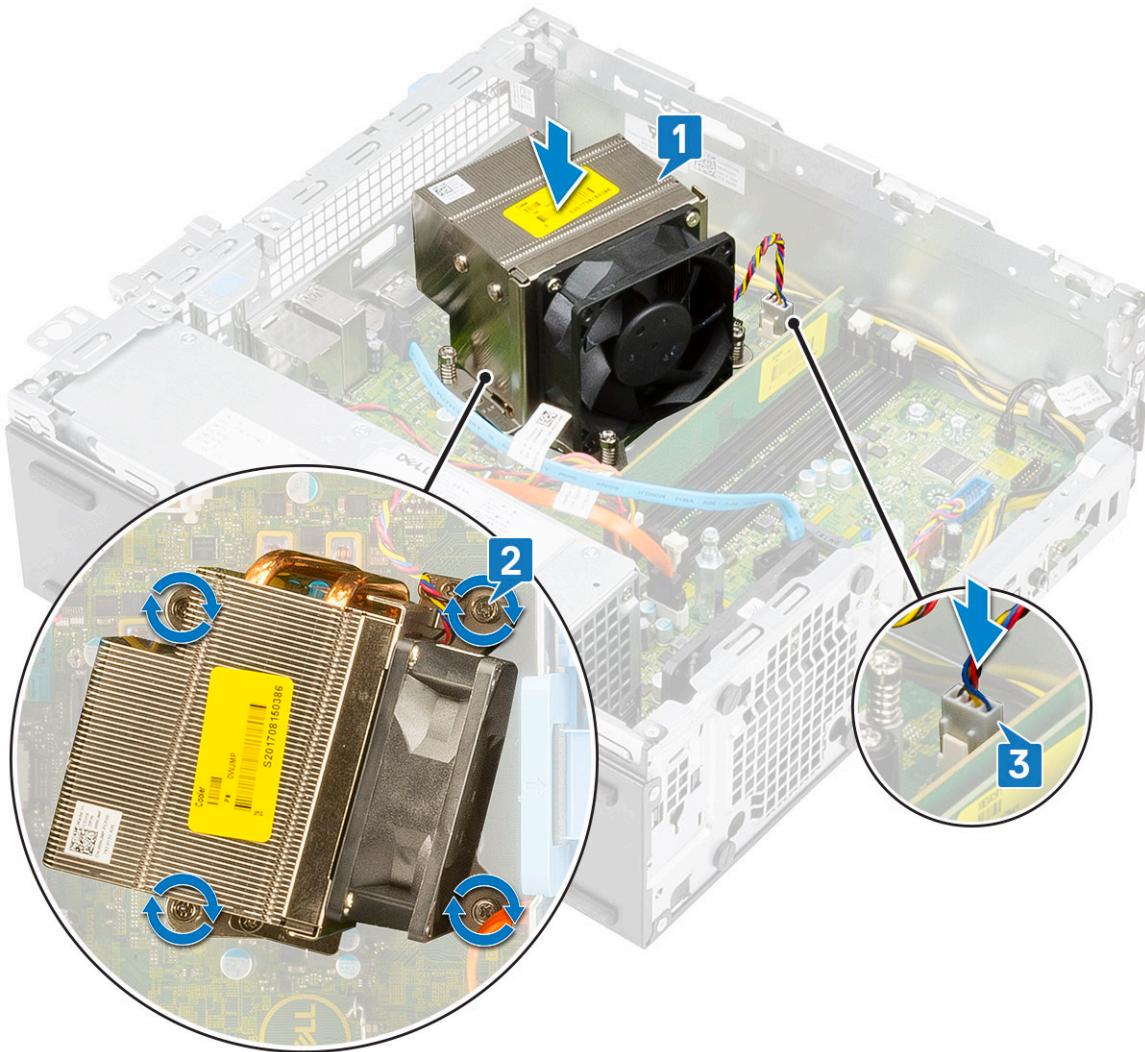


2 To replace the heat sink:

- a Align the heat sink onto the processor [1].
- b Tighten the 4 captive screws to secure the heat sink assembly to the system board [2].

NOTE: Tighten the screws in a sequential order (1,2,3,4) as mentioned on the system board.

- c Connect the heat sink fan cable to the slot on the system board [3].

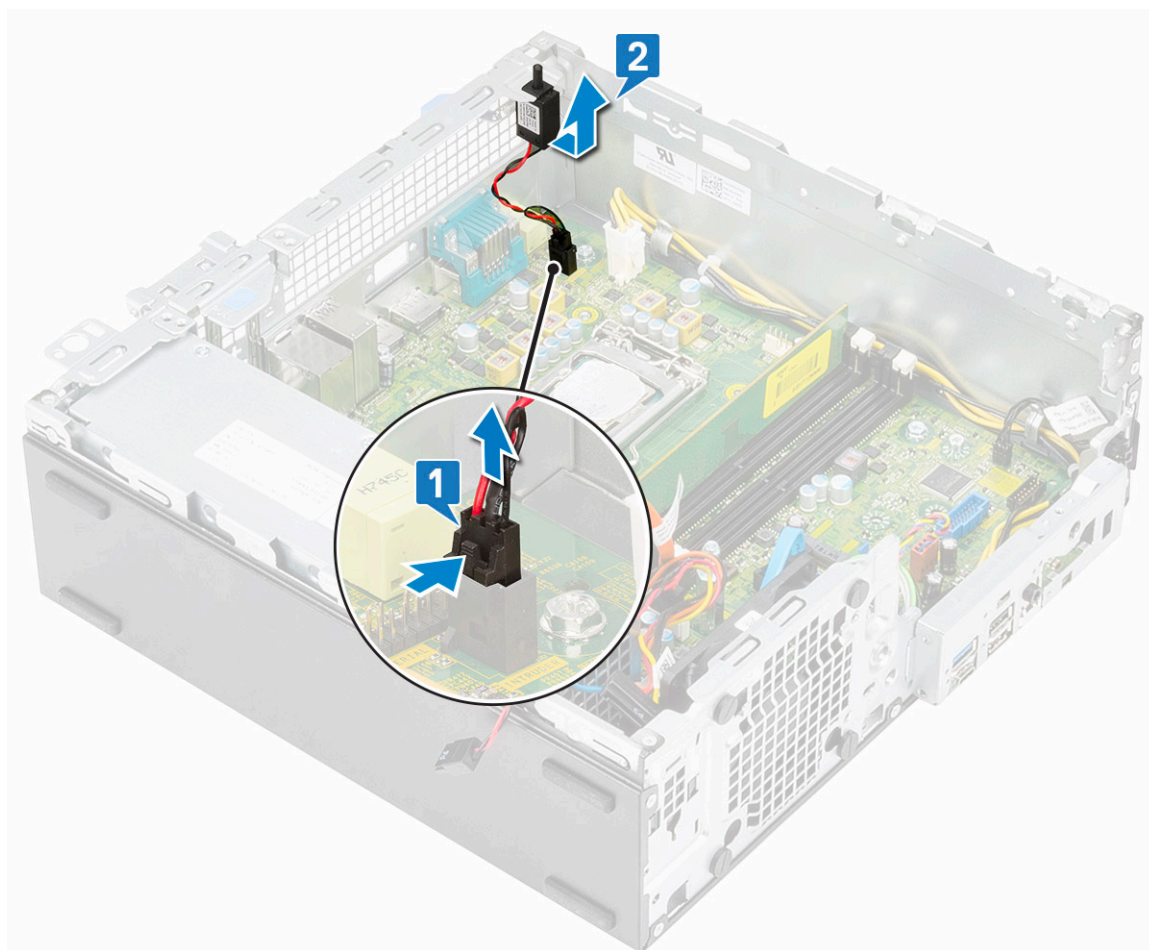


- 3 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 4 Follow the procedure in [After working inside your computer](#).

Intrusion switch

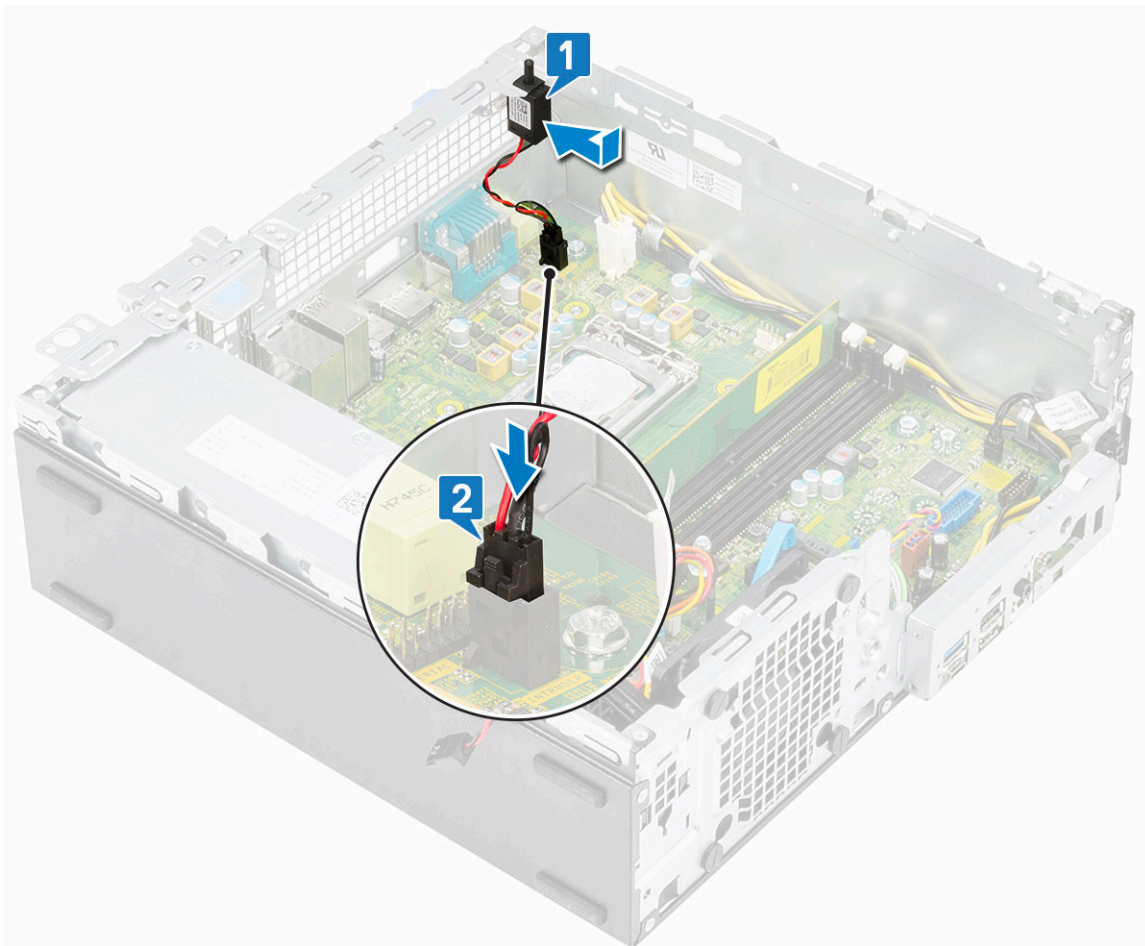
Removing intrusion switch

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
 - d [Heat sink and heat sink fan](#)
- 3 To remove the intrusion switch:
 - a Disconnect the intrusion switch cable from the connector on the system board [1].
 - b Slide the intrusion switch and lift it away from the system [2].



Installing the intrusion switch

- 1 Insert the intrusion switch into the slot on the chassis [1].
- 2 Connect the intrusion switch cable to the system board [2].



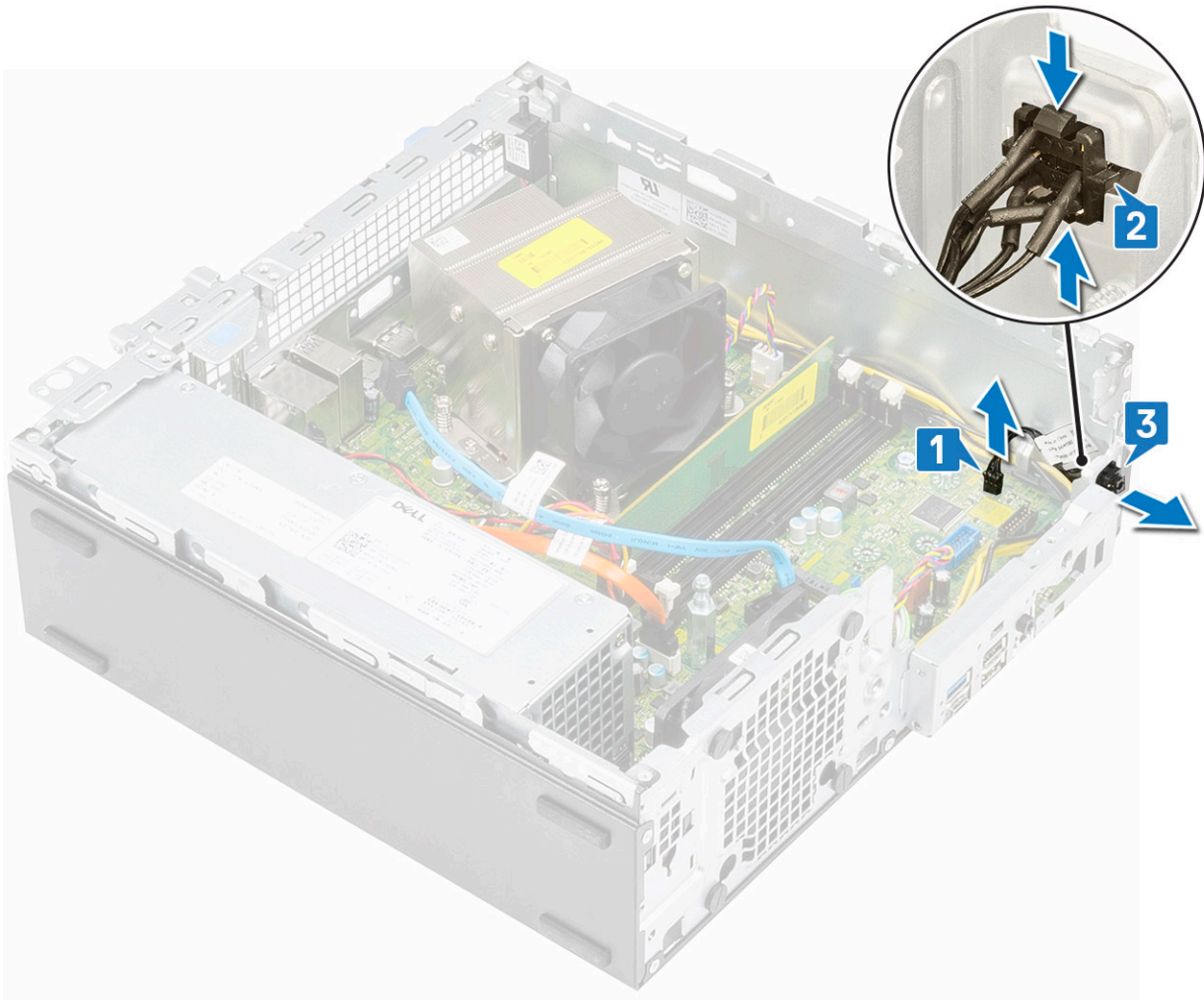
- 3 Install the:
 - a Heat sink and heat sink fan
 - b Hard drive and optical drive module
 - c Front bezel
 - d Side cover
- 4 Follow the procedure in [After working inside your computer](#).

Power switch

Removing power switch

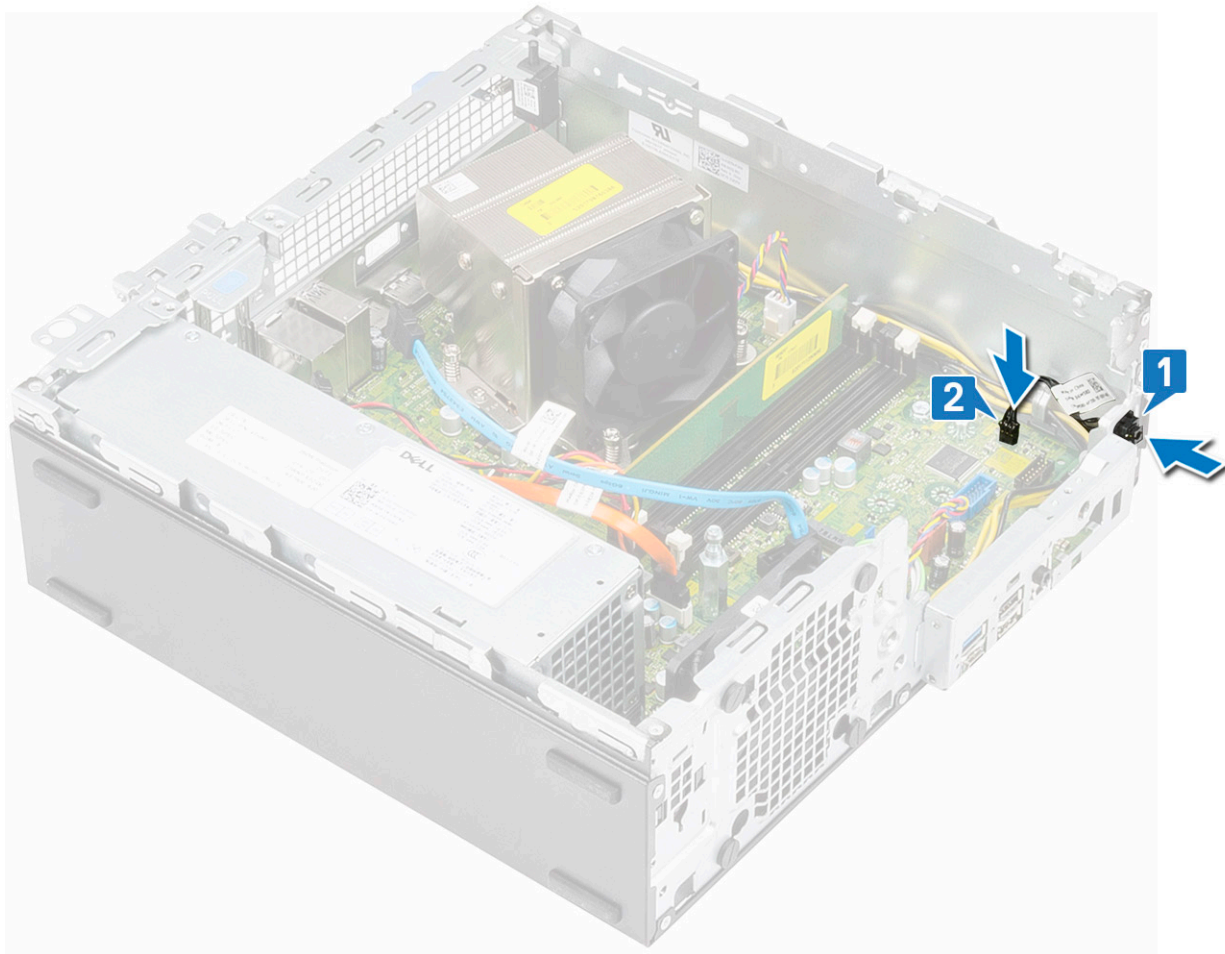
- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a Side cover
 - b Front bezel
 - c Hard drive and optical drive module
- 3 To remove the power switch:

- a Disconnect the power switch cable from the system board [1].
- b Press the power switch retention tabs and pull the power switch out from the system [2] [3].



Installing the power switch

- 1 Slide the power switch module into the slot on the chassis until it clicks into place [1].
- 2 Connect the power switch cable to the connector on the system board [2].

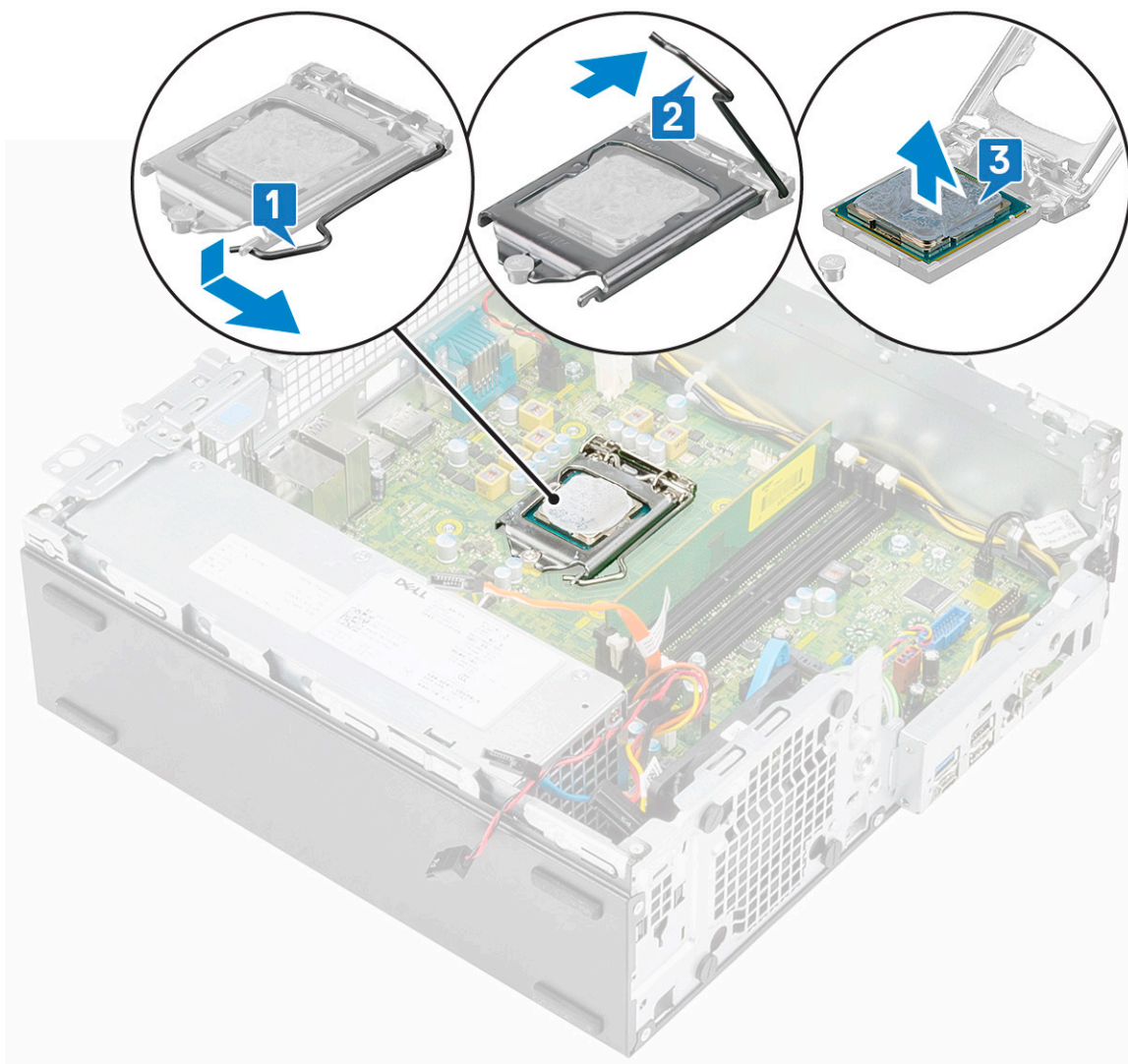


- 3 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 4 Follow the procedure in [After working inside your computer](#).

Processor

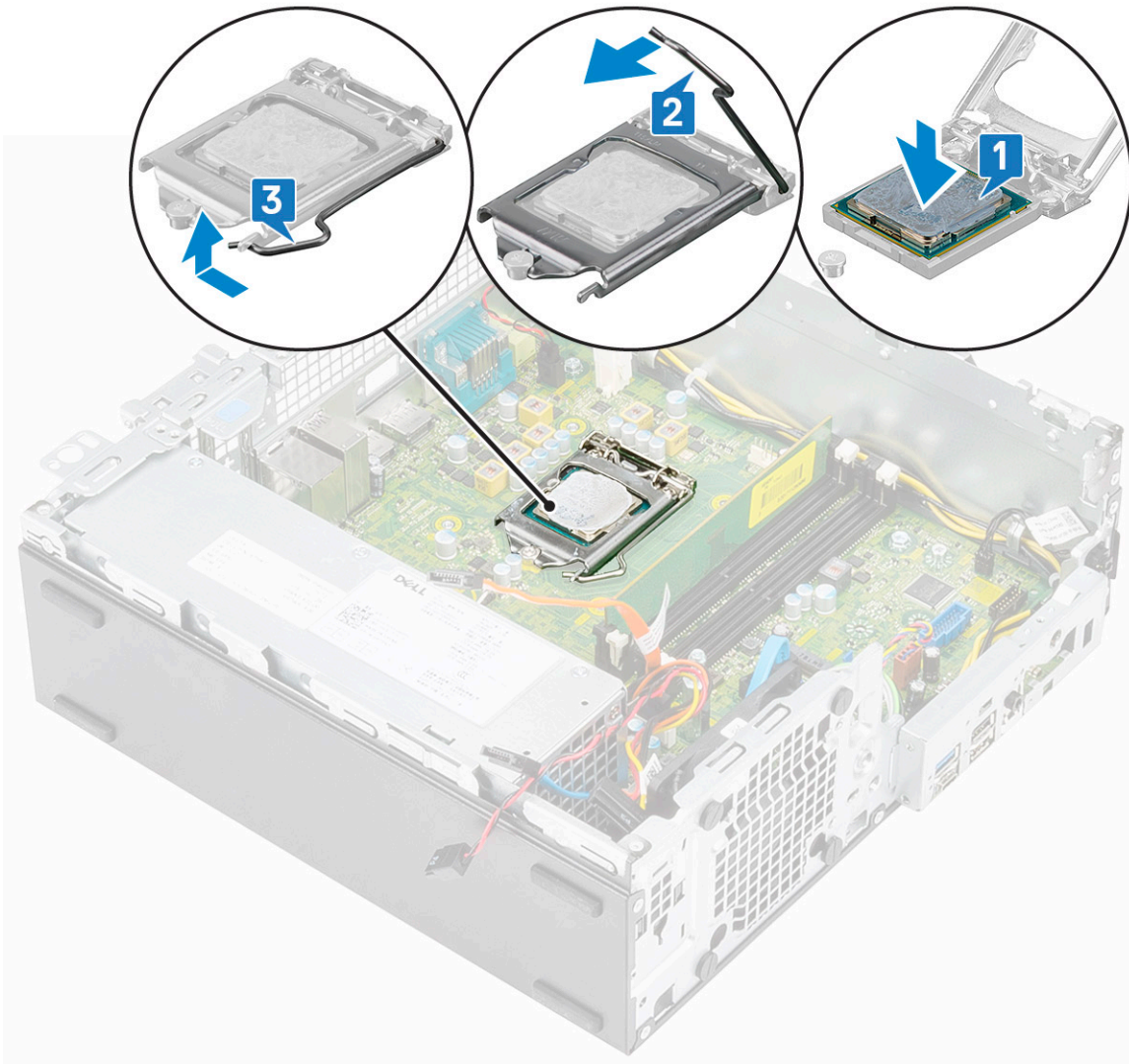
Removing processor

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
 - d [Heat sink and heat sink fan](#)
- 3 To remove the processor:
 - a Release the socket lever by pushing the lever down and out from under the tab on the processor shield [1].
 - b Lift the lever upward and lift the processor shield [2].
 - c Lift the processor out of the socket [3].



Installing the processor

- 1 Place the processor on the socket such that the slots on the processor align with the socket keys [1].
- 2 Close the processor shield by sliding it under the retention screw [2].
- 3 Lower the socket lever and push it under the tab to lock it [3].



- 4 Install the:
 - a Heat sink and heat sink fan
 - b Hard drive and optical drive module
 - c Front bezel
 - d Side cover
- 5 Follow the procedure in [After working inside your computer](#).

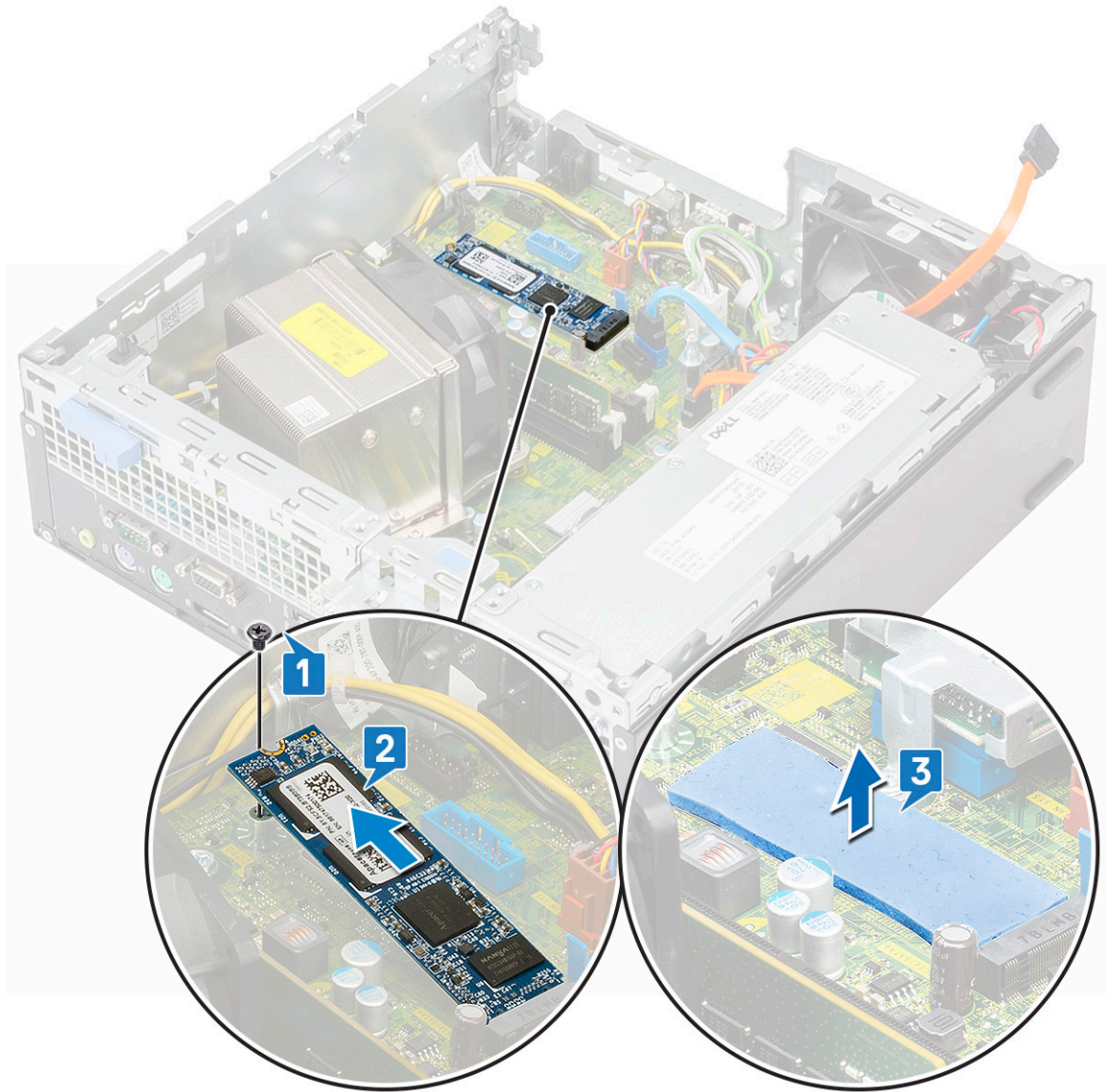
M.2 PCIe Solid State Drive -SSD

Removing the M.2 PCIe Solid State Drive -SSD

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a Side cover
 - b Front bezel
 - c Hard drive and optical drive module
- 3 To remove the M.2 PCIe SSD card:
 - a Remove the single (M2 x 3.5) screw that secures the M.2 PCIe SSD card to the system board [1].
 - b Lift and pull out the SSD card from its connector on the system board [2].

- c Peel the thermal pad from the system board [3].

NOTE: M.2 PCIe SSD with capacity over 512G(512G/1TB/2TB) must be installed with a thermal pad. M.2 SATA SSD and M.2 PCIe SSD with 128G and 256G does not require a thermal pad.

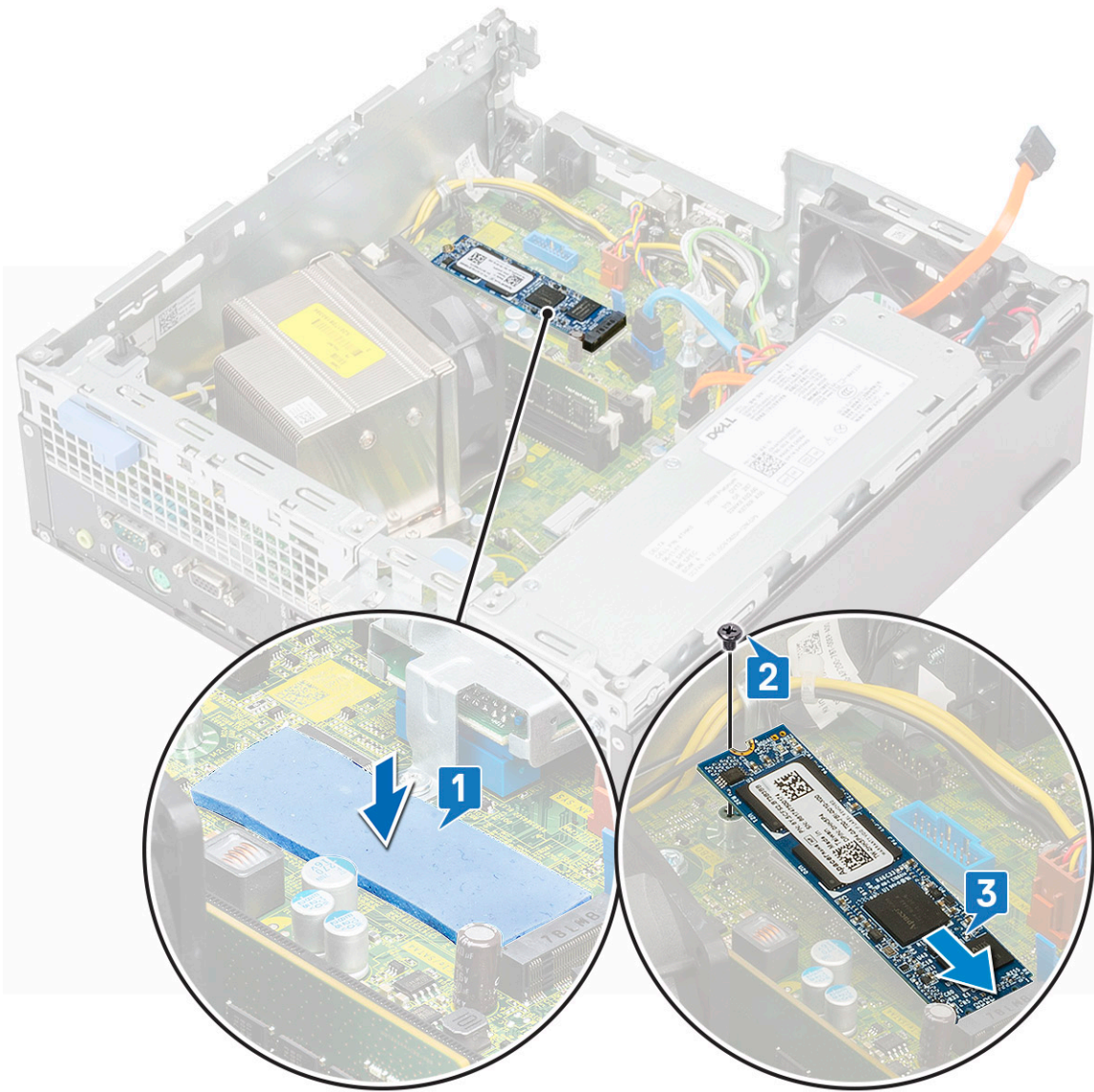


Installing the M.2 PCIe Solid State Drive -SSD

- 1 Place the thermal pad into the slot on the system board [1].

NOTE: M.2 PCIe SSD with capacity over 512G(512G/1TB/2TB) must be installed with a thermal pad. M.2 SATA SSD and M.2 PCIe SSD with 128G and 256G does not require a thermal pad.

- 2 Insert the M.2 PCIe SSD card into the card slot on the system board [2].
3 Replace the single (M2 x 3.5) screw that secures the M.2 PCIe SSD card to the system board [3].



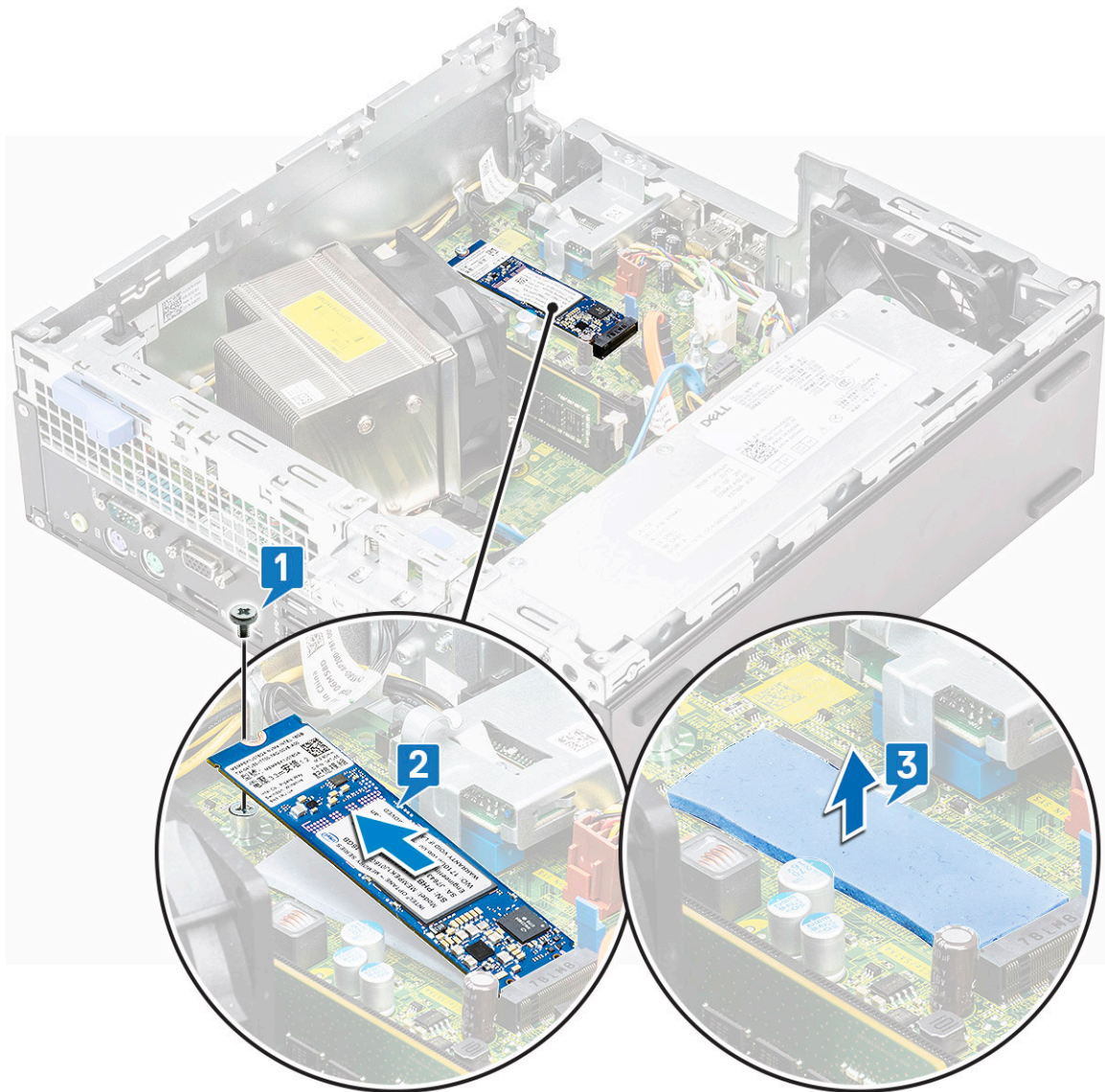
- 4 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 5 Follow the procedure in [After working inside your computer](#).

Intel Optane card

Removing the Intel Optane card

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the Intel Optane card:
 - a Remove the single (M2 x 3.5) screw that secures the Intel Optane card to the system board [1].

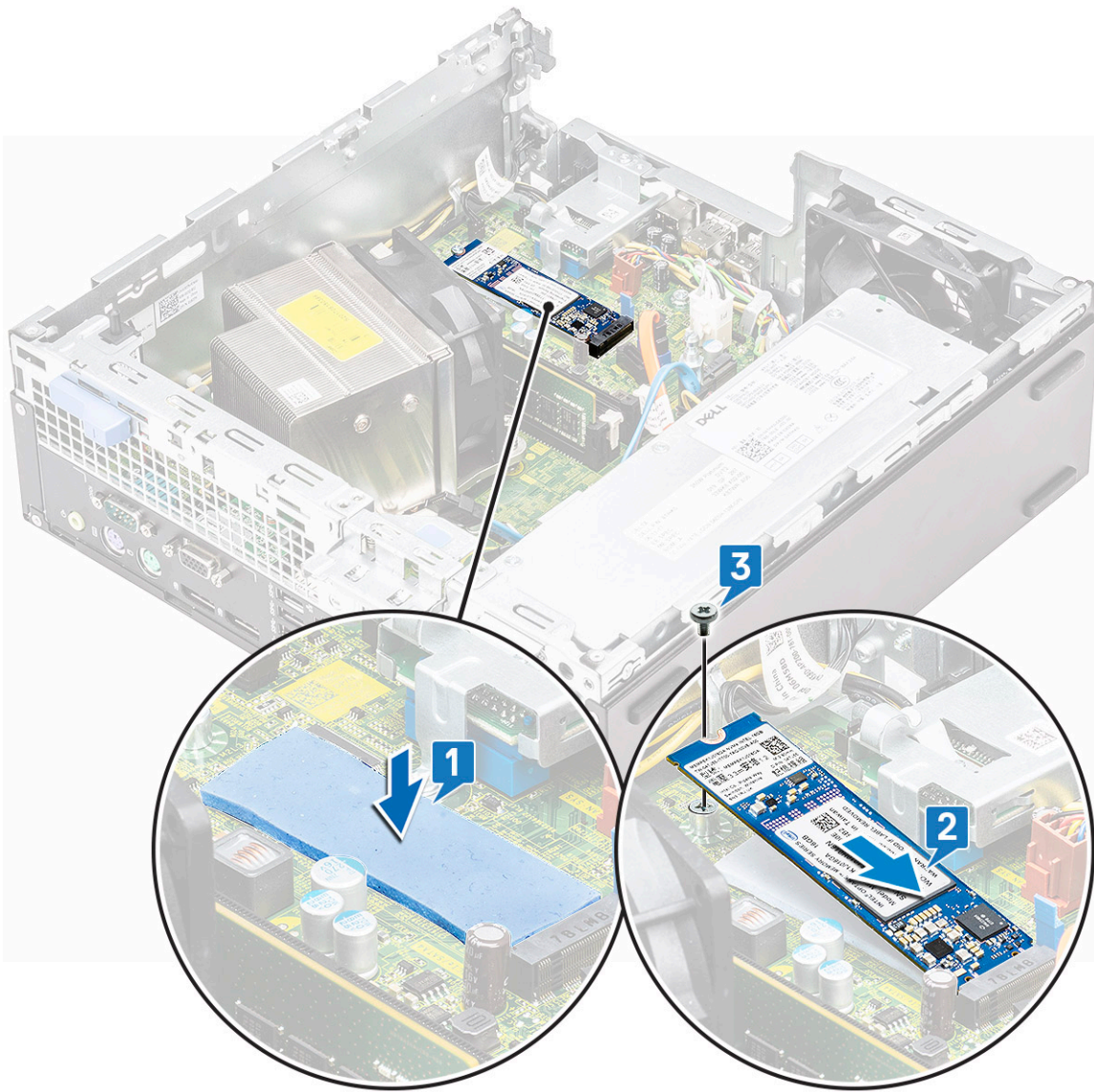
- b Lift and pull out the Intel Optane card from its connector on the system board [2].
- c Peel the thermal pad [3].



Installing the Intel Optane card

- 1 Place the thermal pad into the slot on the system board [1].
- 2 Insert the Intel Optane card into the card slot on the system board [2].
- 3 Replace the single (M2 x 3.5) screw that secures the Intel Optane card to the system board [3].

NOTE: Intel Optane modules must be installed with a thermal pad.



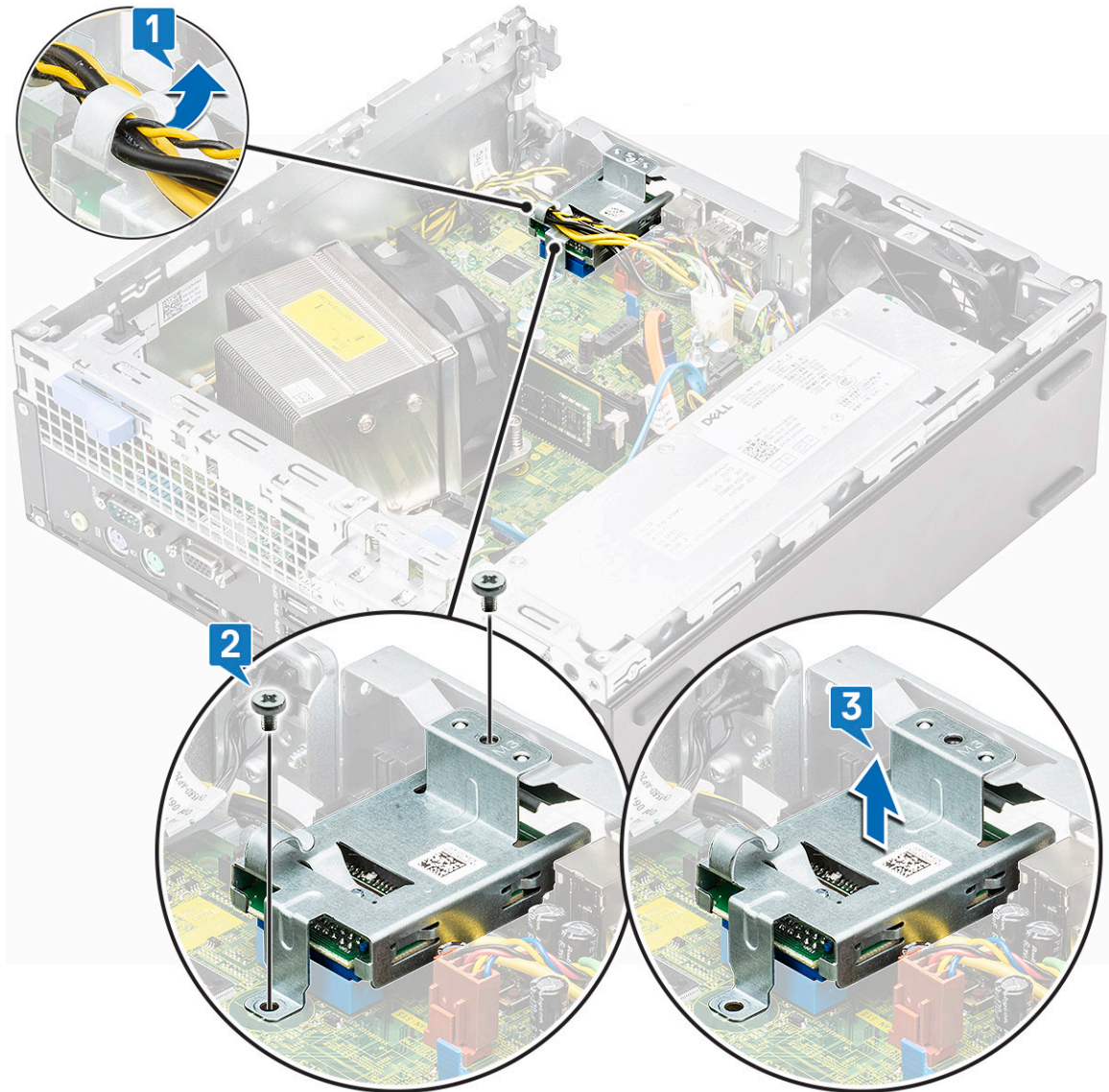
- 4 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 5 Follow the procedure in [After working inside your computer](#).

SD card reader - optional

Removing the SD card reader

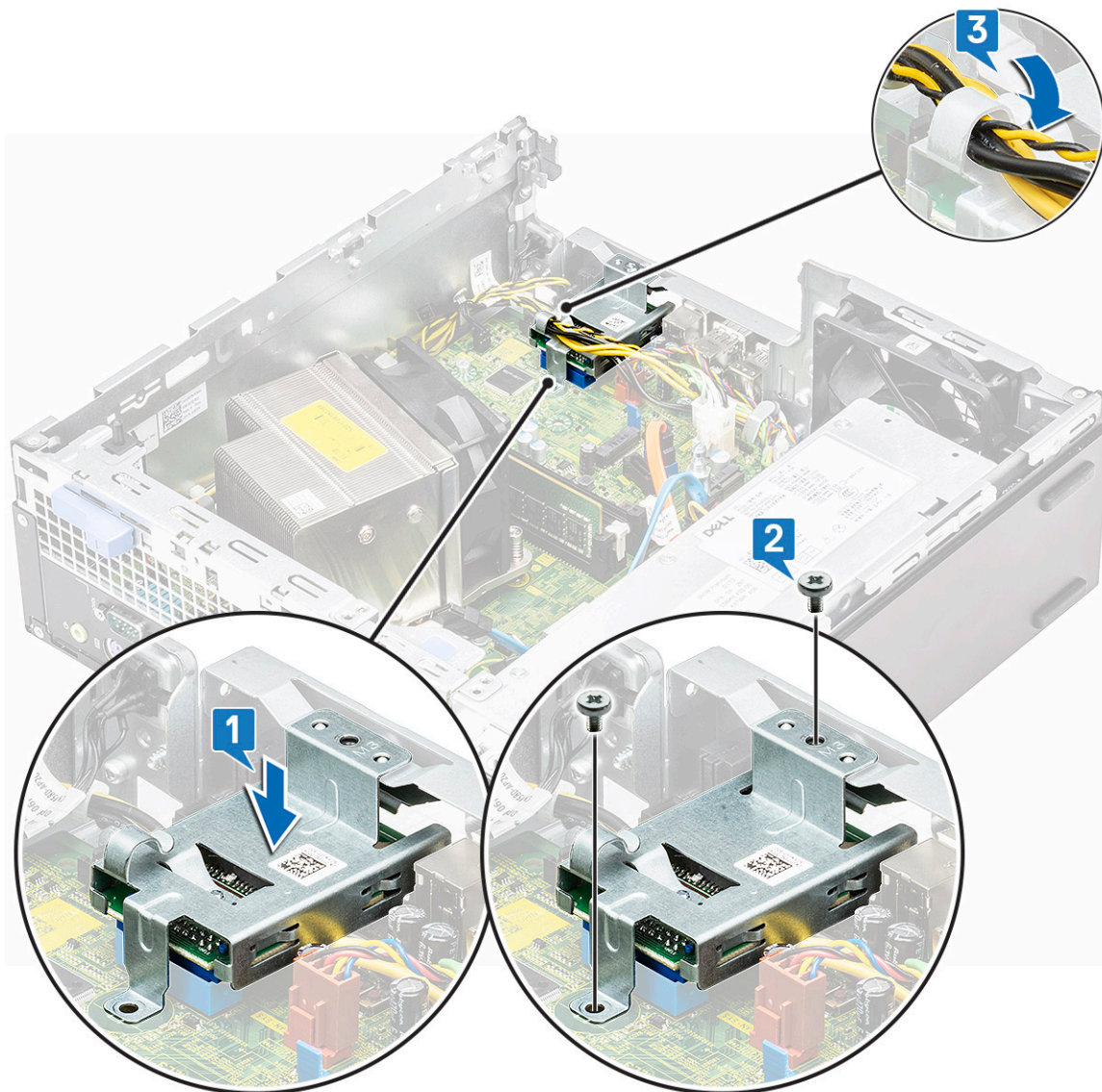
- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the SD card reader:

- a Unroute the power cables from the retention clip on the SD card reader [1].
- b Remove the two (M3) screws that secures the SD card reader to the I/O panel and the system board [2].
- c Lift the SD card reader from the slot on the system board [3].



Installing the SD card reader

- 1 Route the power cables back through the retention clip on the SD card reader [1].
- 2 Insert the SD card reader from the slot on the system board [2].
- 3 Replace the two (M3) screws that secures the SD card reader to the I/O panel and the system board [3].



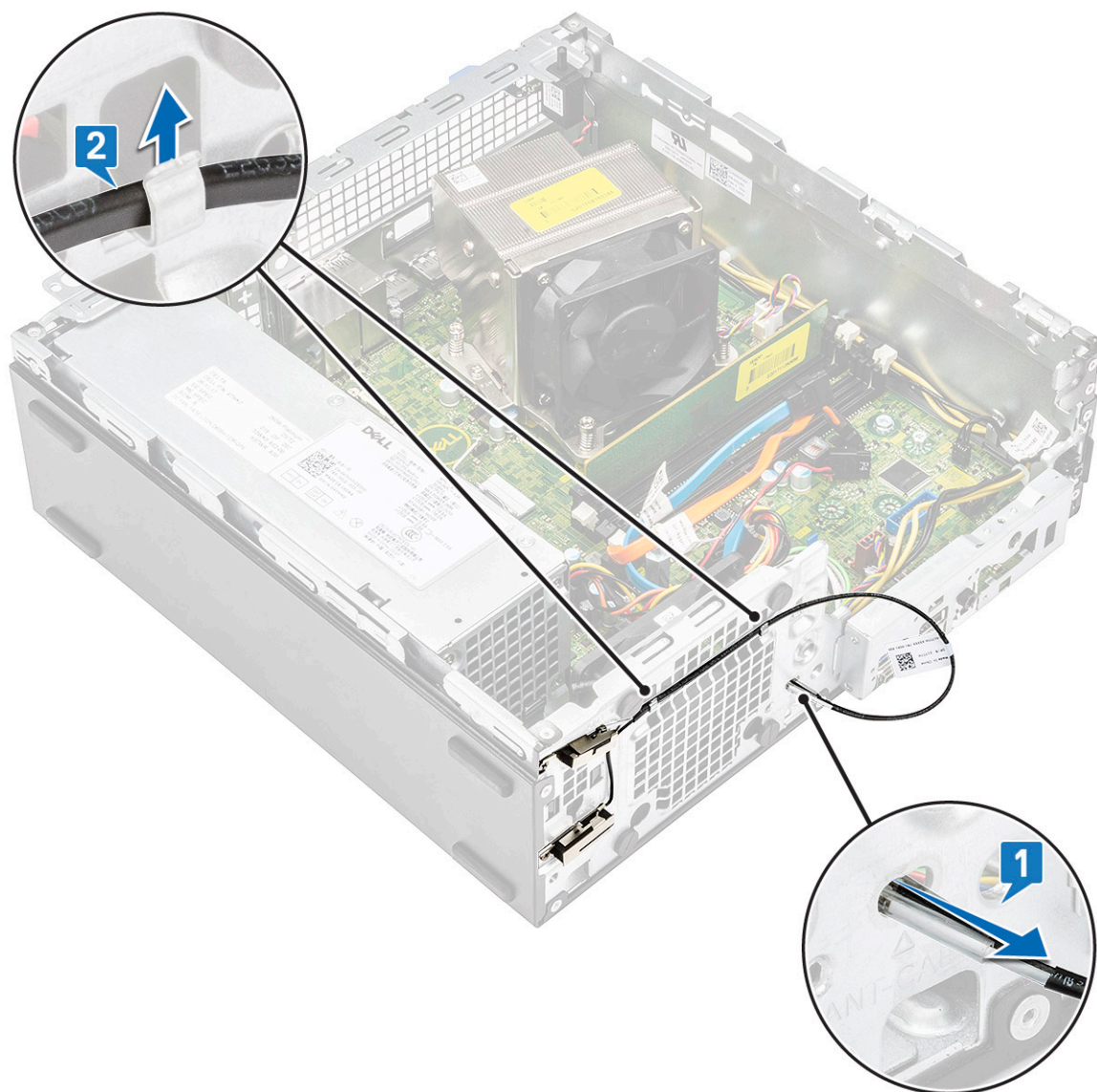
- 4 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 5 Follow the procedure in [After working inside your computer](#).

Internal Antenna - optional

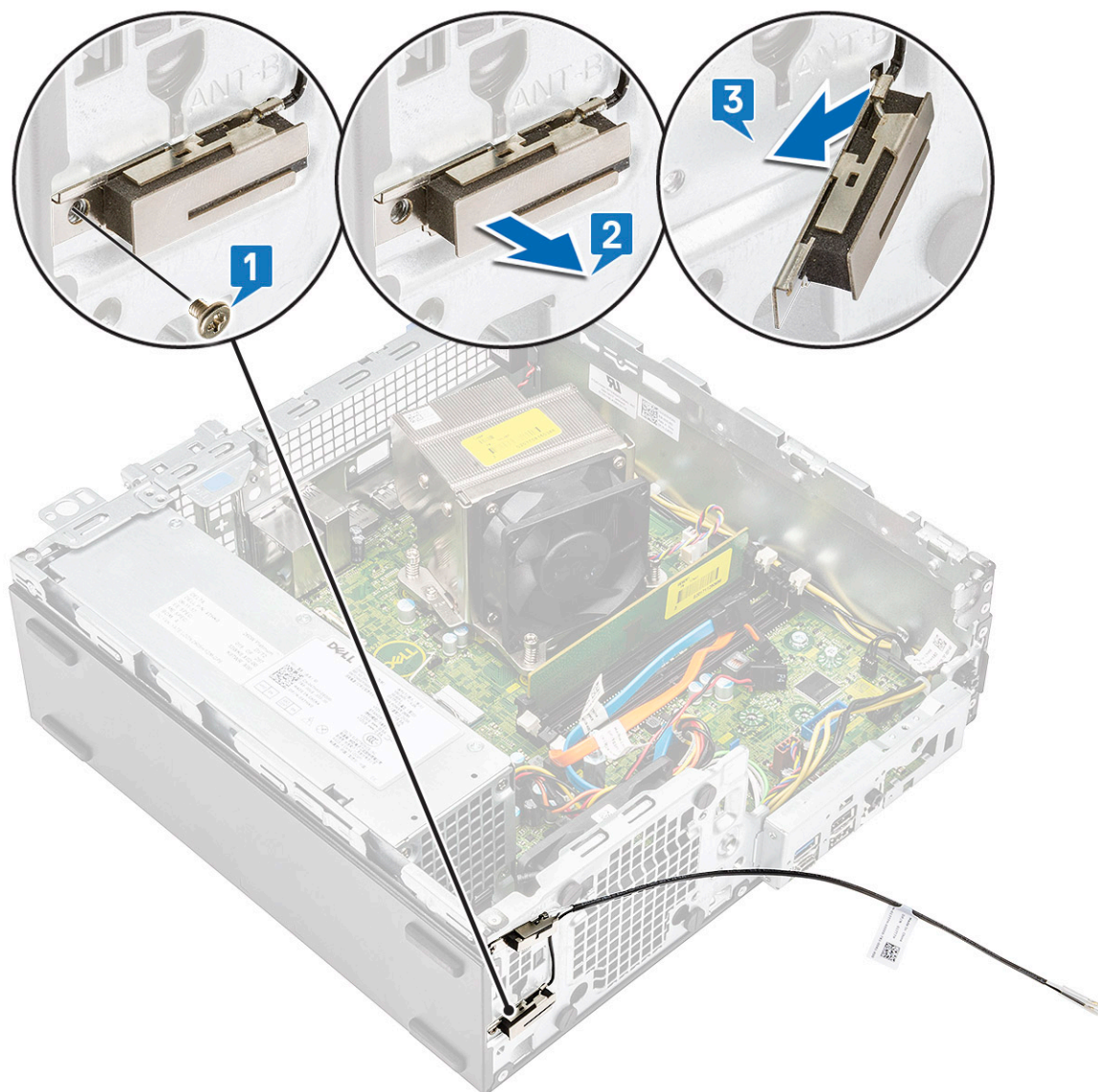
Removing the Internal Antenna

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the antenna from the system:

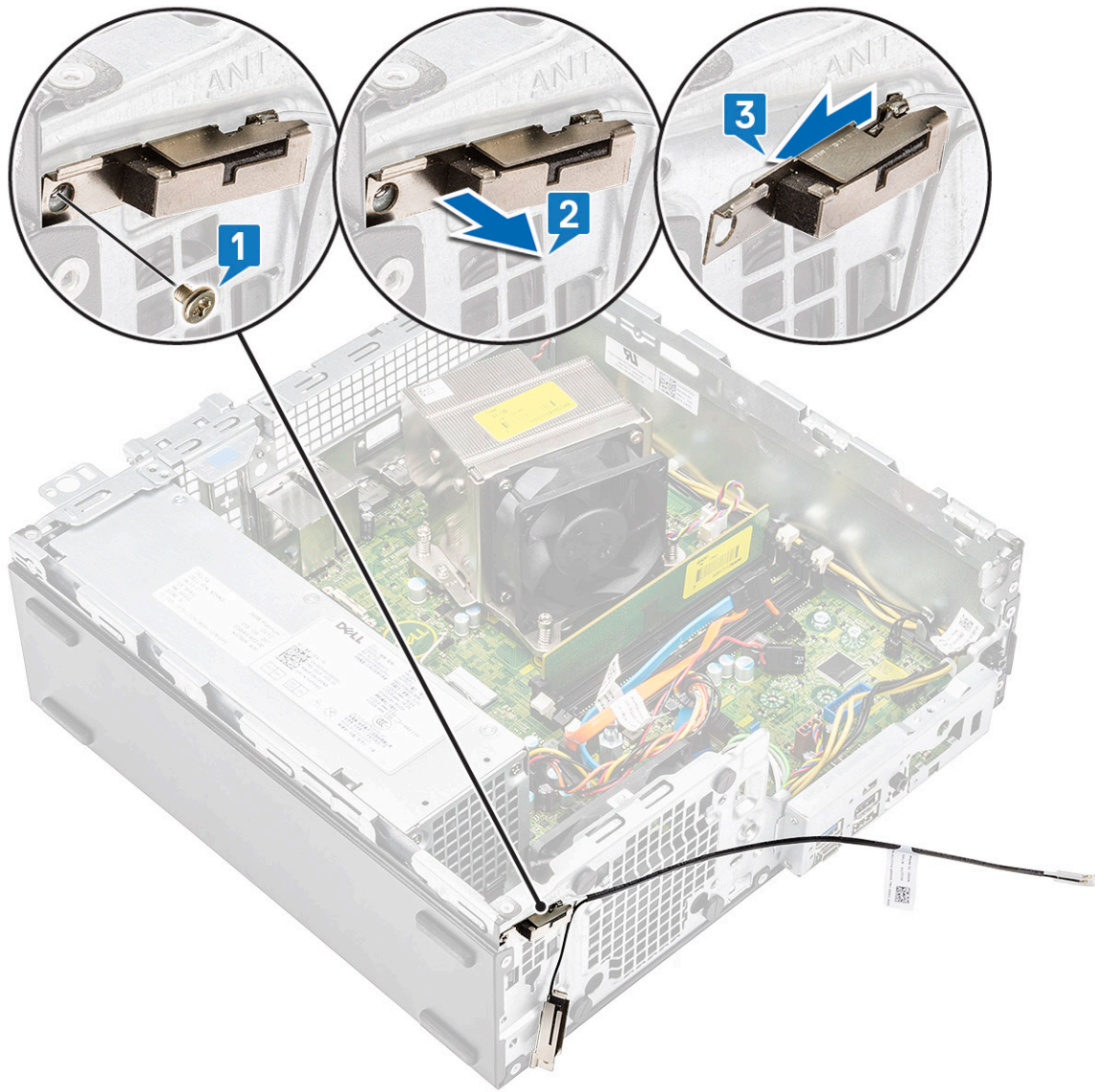
- a Unroute the antenna cable from the cable hole on the chassis [1].
- b Unroute the antenna cable from the two hooks on the chassis [2].



- c Remove the single screw that secures the antenna to the chassis [1].
- d Remove the black antenna cable from the ANT-B slot on the chassis [2,3].

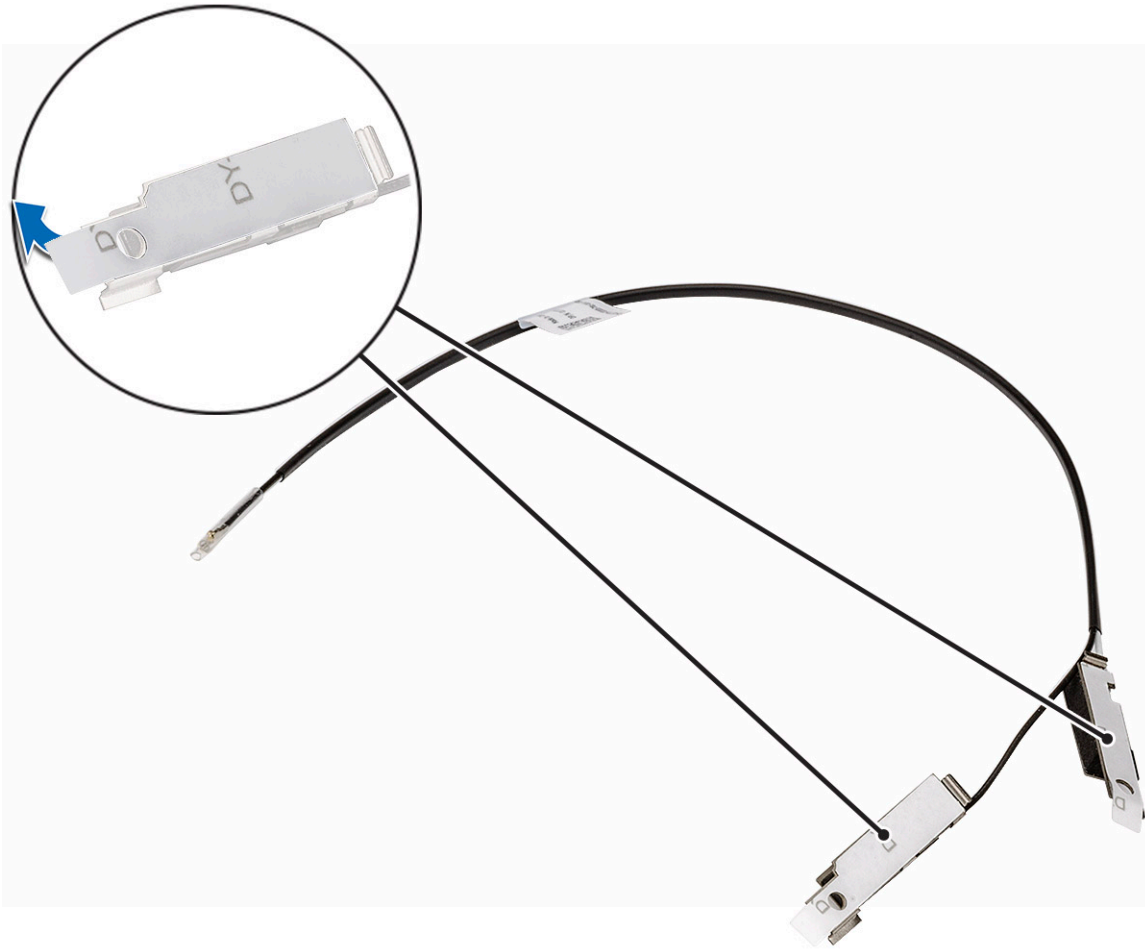


- e Remove the single screw that secures the antenna to the chassis [1].
- f Remove the white antenna cable from the ANT-W slot on the chassis [2,3].

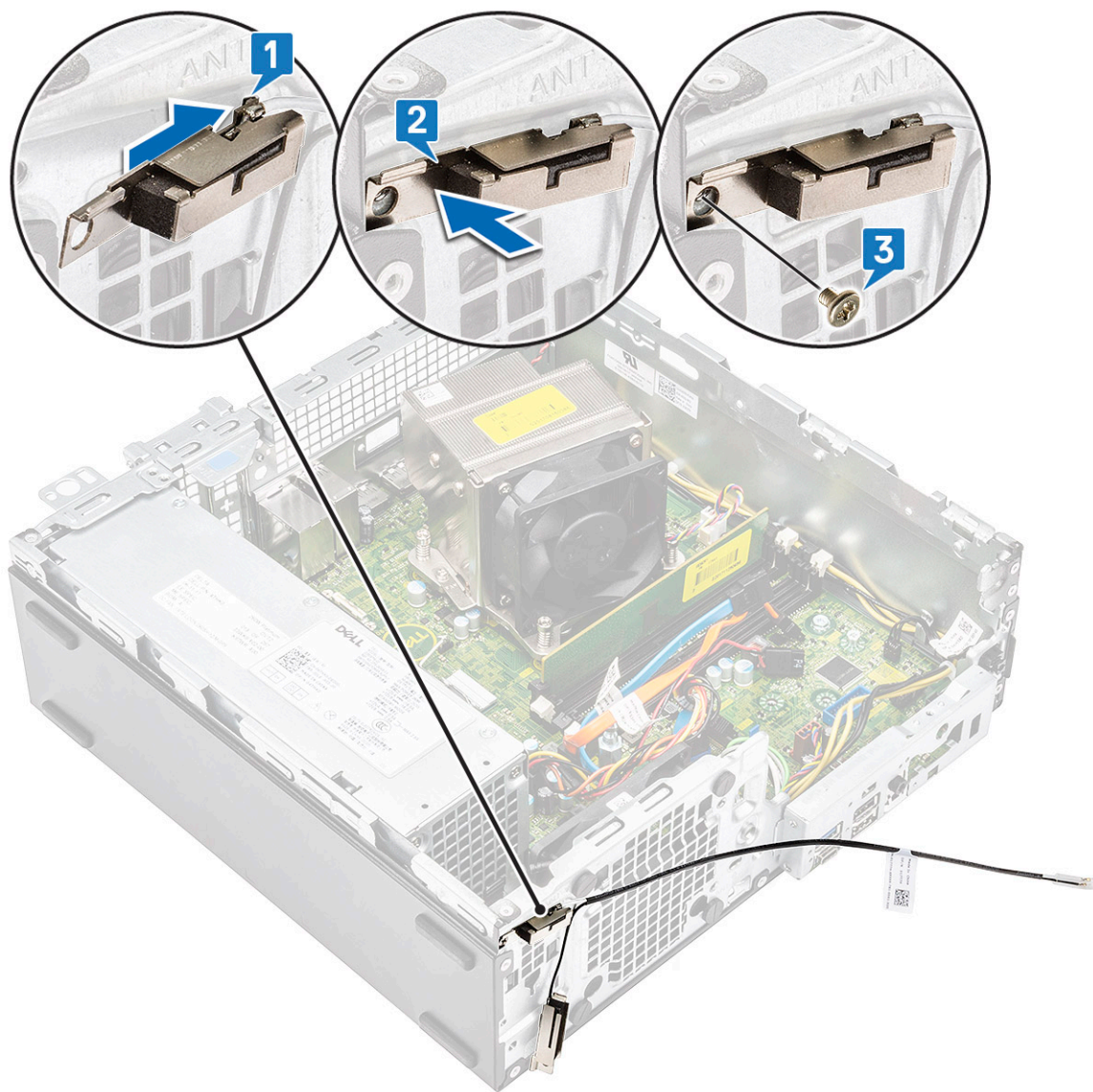


Installing the Internal Antenna

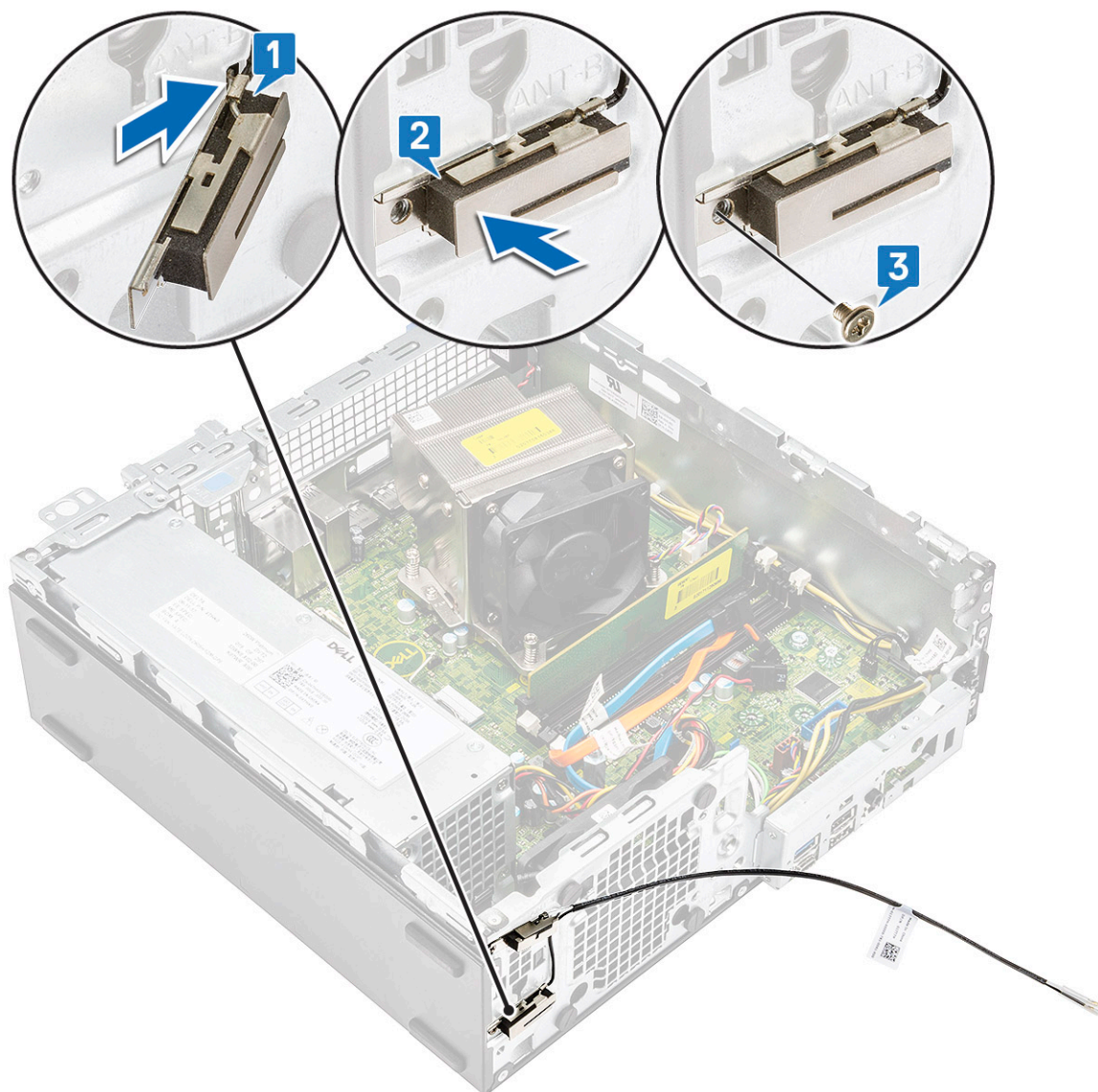
- 1 Peel off the mylar tape from internal antenna.



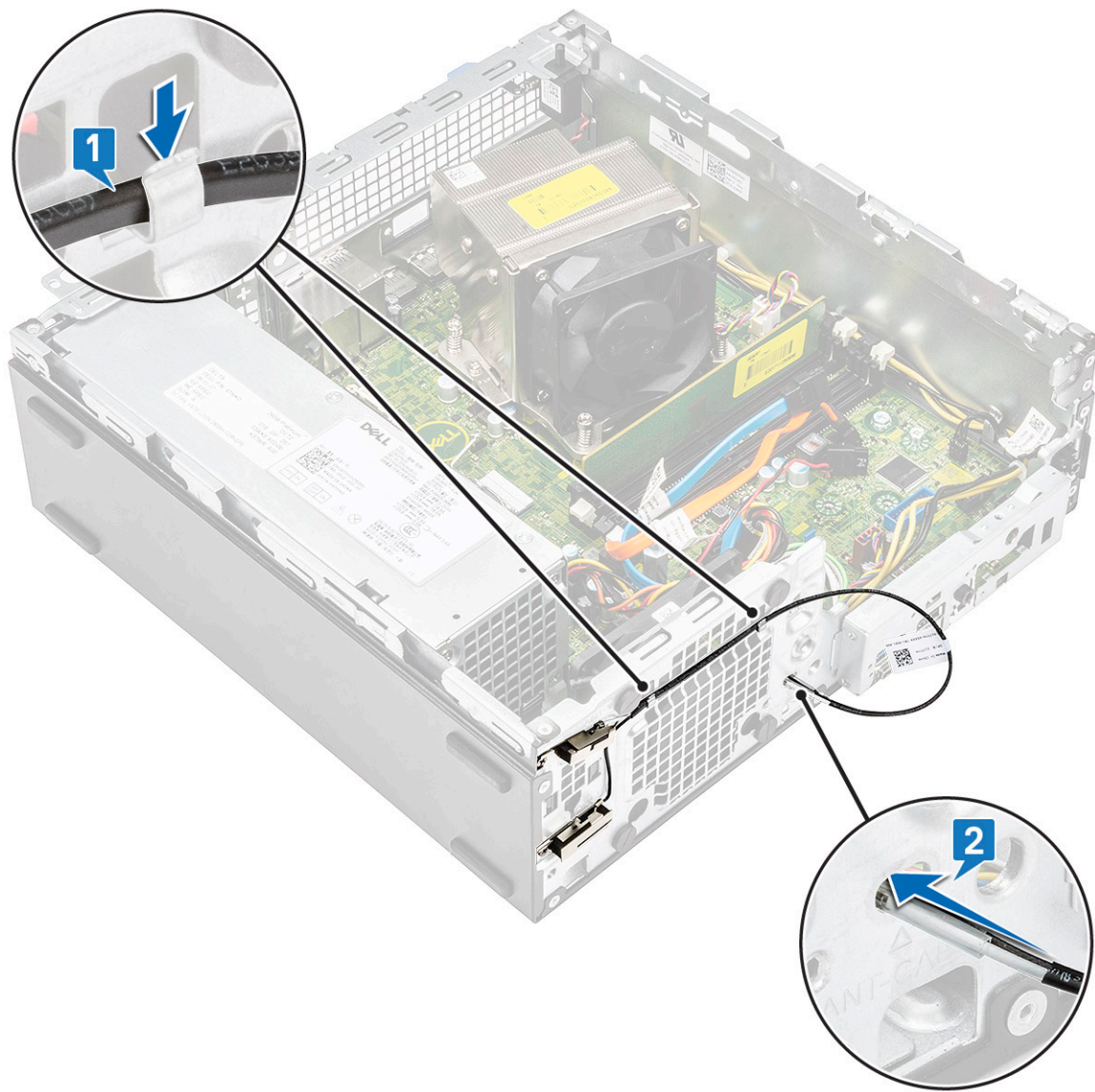
- 2 To install the antenna on the system:
 - a Align and insert the white antenna cable into the ANT-W slot on the chassis [1,2]
 - b Replace the single screw to secure the antenna to the chassis [3].



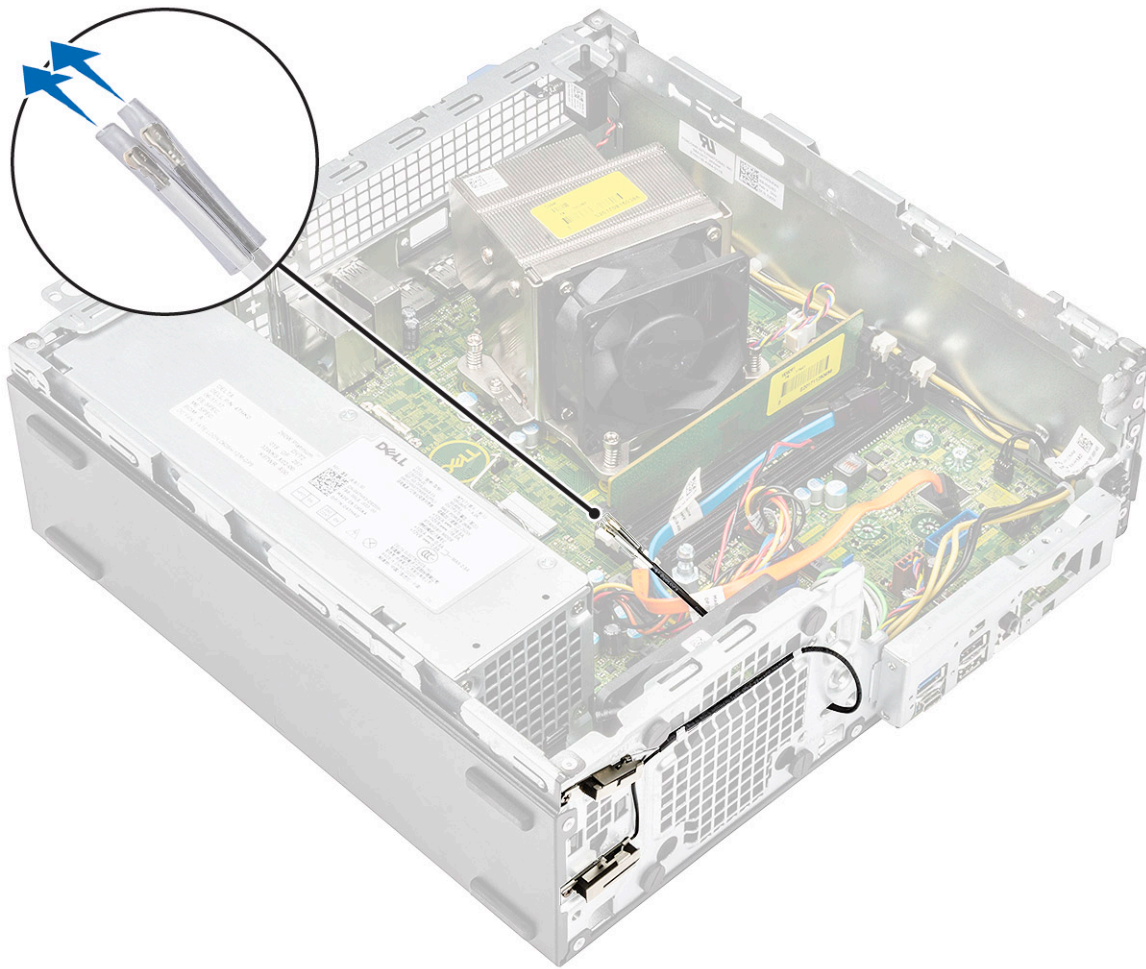
- c Align and insert the black antenna cable into the ANT-B slot on the chassis [1,2].
- d Replace the single screw to secure the antenna to the chassis [3].



- e Route the antenna cable across the two hooks [1].
- f Route the antenna cable through the cable hole on the chassis [2].



g Remove the plastic tube from internal antenna cable.

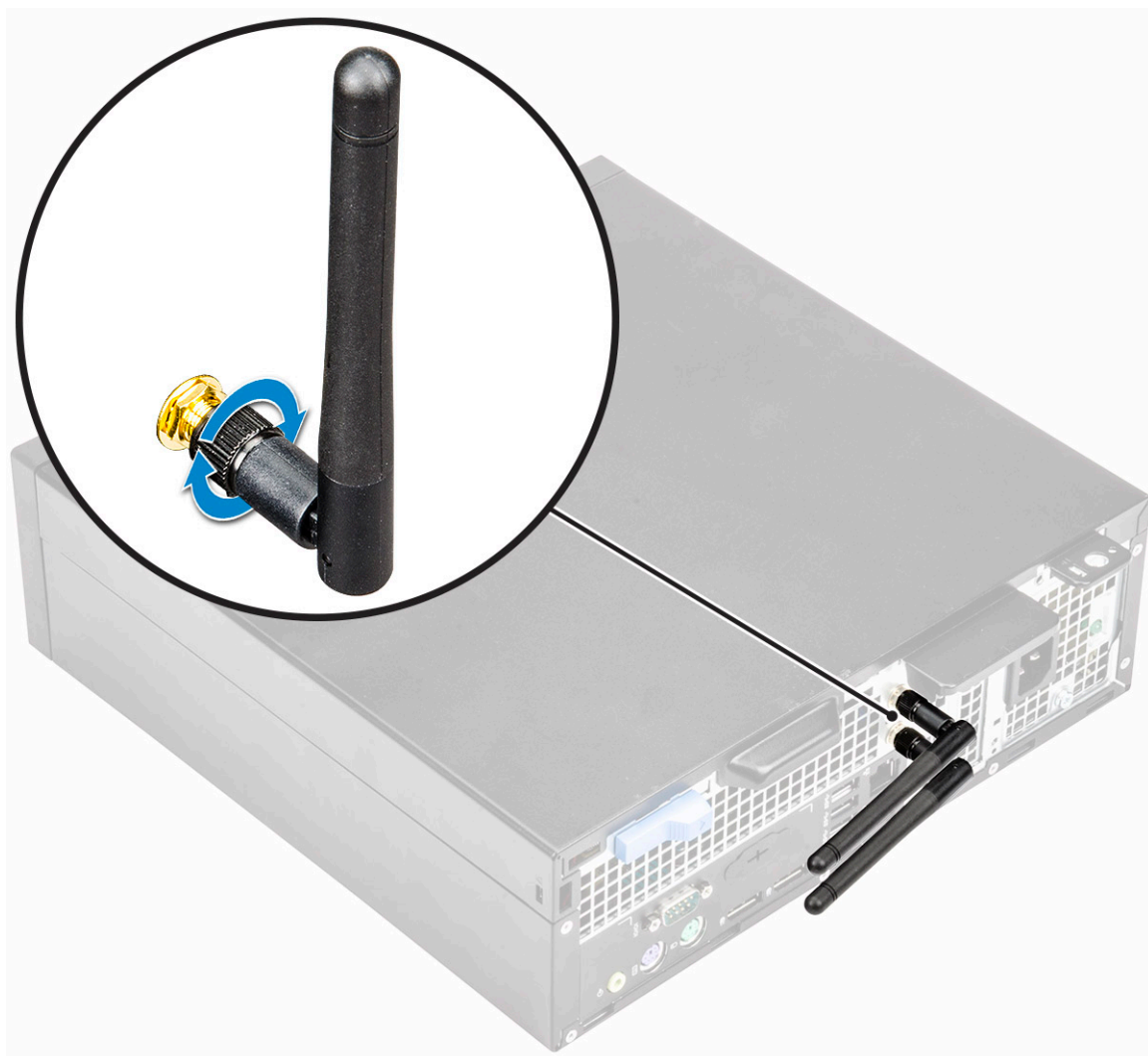


- 3 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 4 Follow the procedure in [After working inside your computer](#).

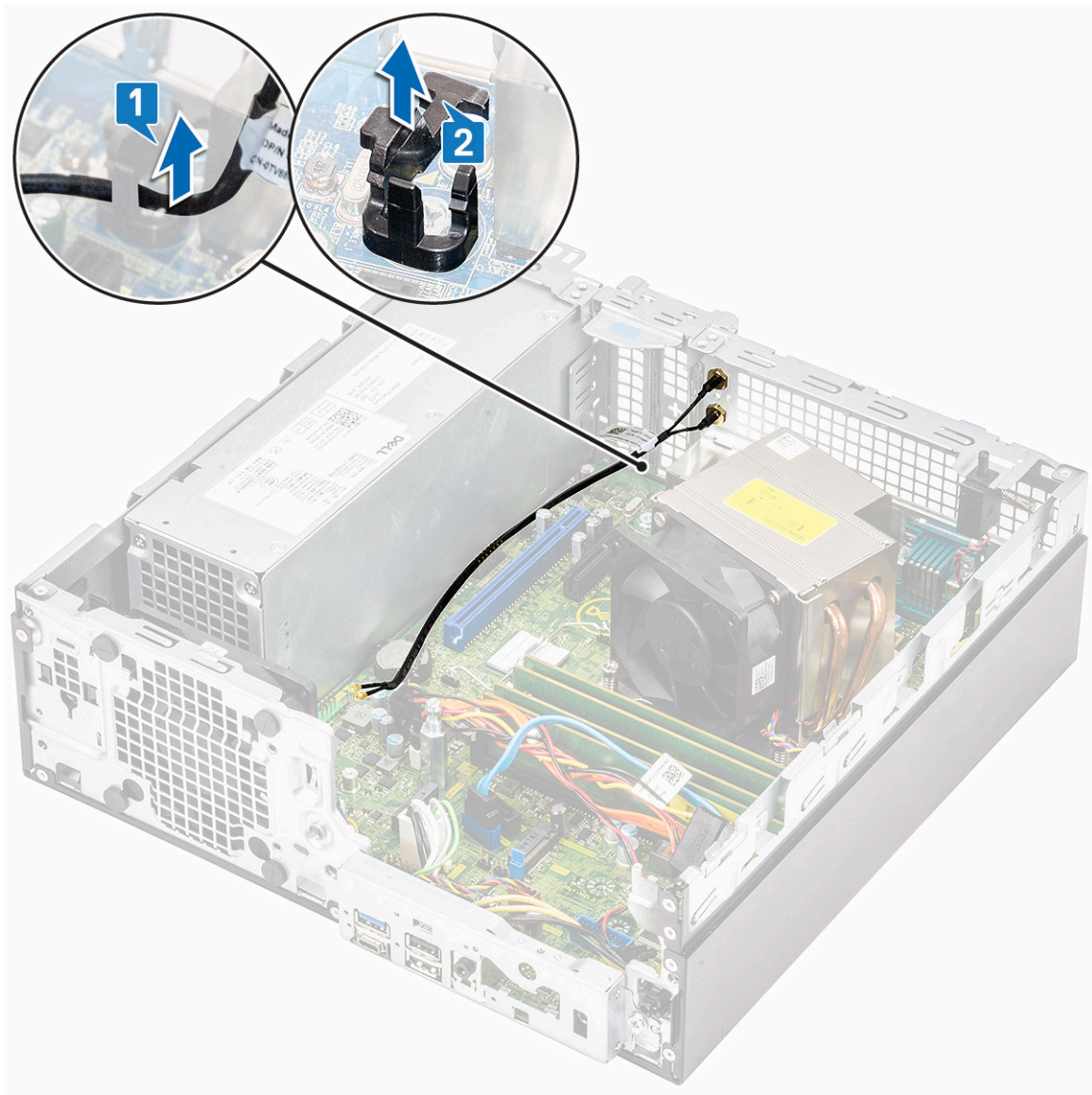
External Antenna - optional

Removing the External Antenna

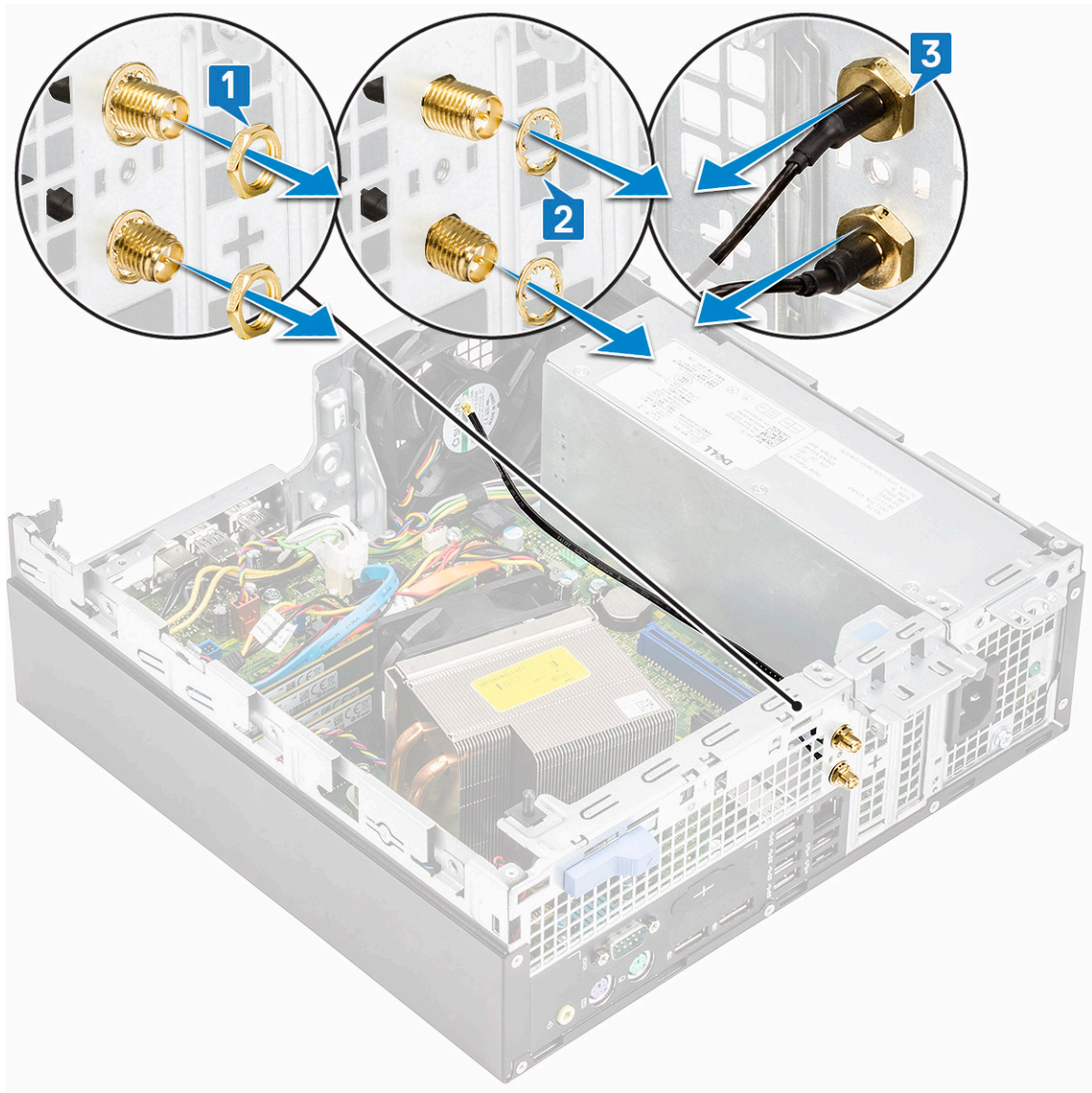
- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the antenna from the system:
 - a Loosen and remove the antenna screw that connects to the antenna cable connector screws.



- b Unroute the antenna cable from the retention clip on the chassis [1].
- c Remove the retention clip from the chassis[2].



- d Disconnect the antenna connectors from the connectors on the WLAN card.
- e Remove the nuts to secure the antenna connectors to the chassis [1].
- f Remove the metal washers on to the antenna connectors [2].
- g Remove the antenna cables from the antenna slot on the chassis [3].



Installing the External Antenna

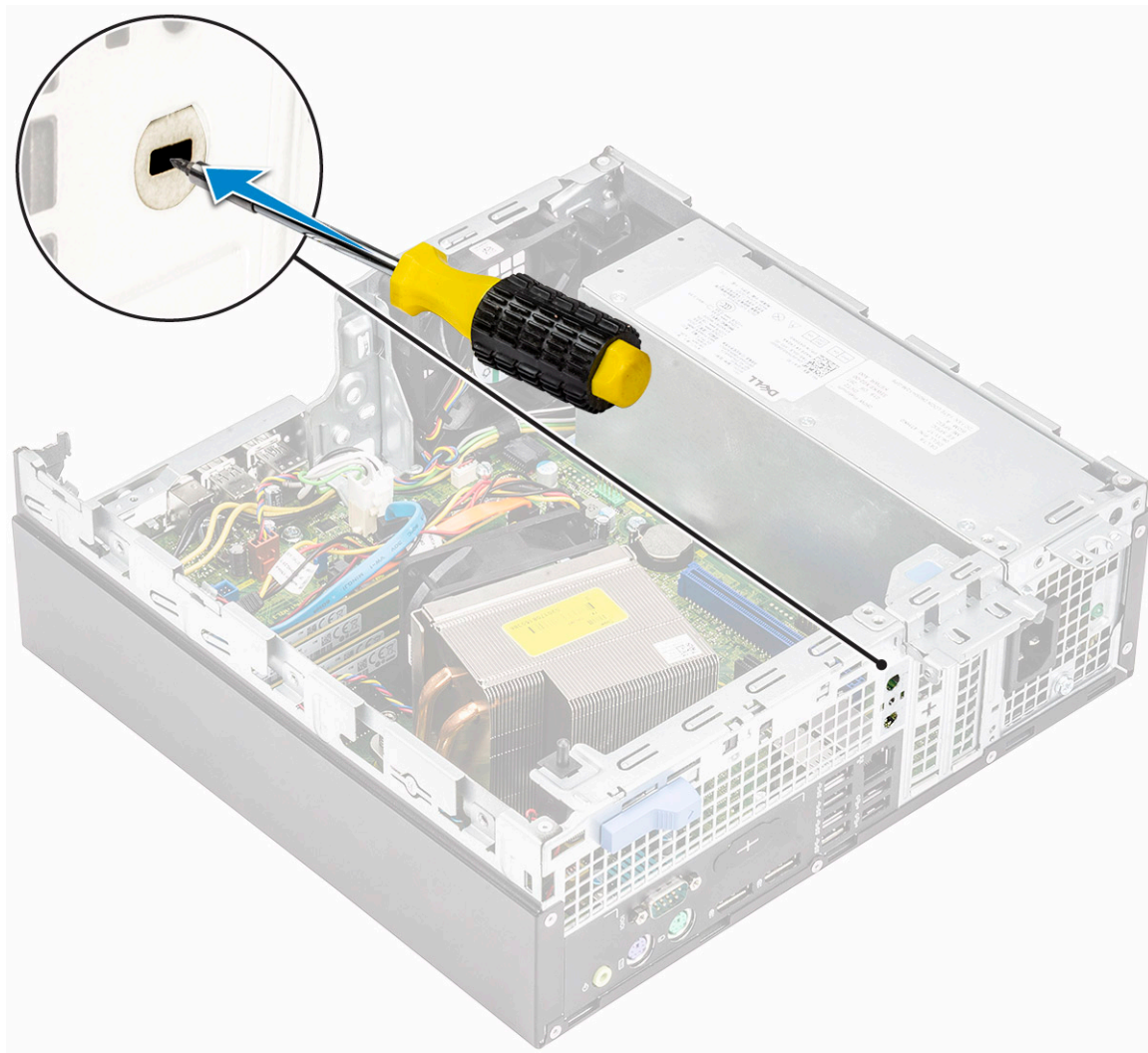
- 1 External antenna.



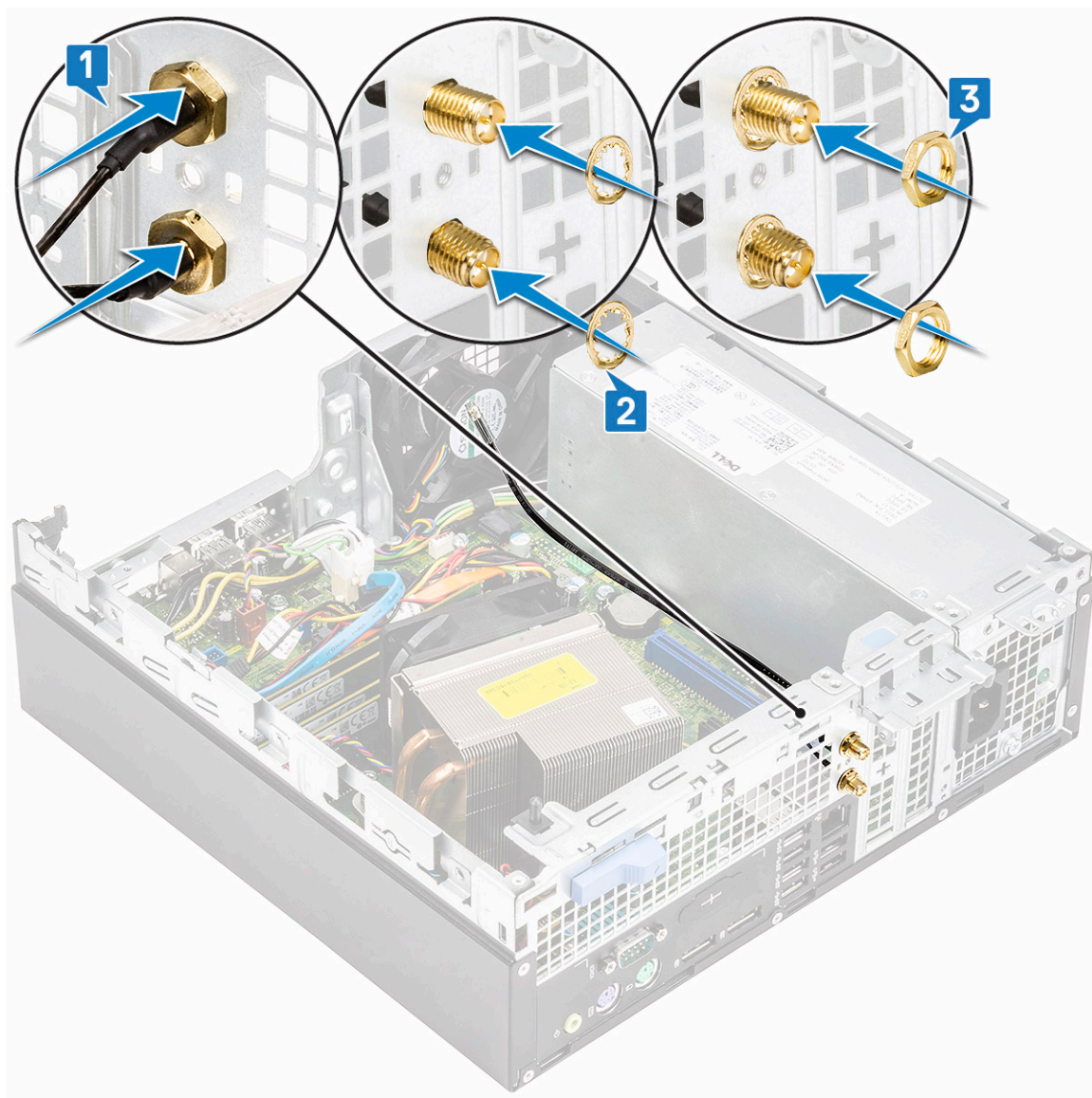
- 2 To install the antenna on the system:
- Remove the caps from the antenna cable [1].
 - Loosen and remove the nut [2].
 - Remove the metallic washer [3].



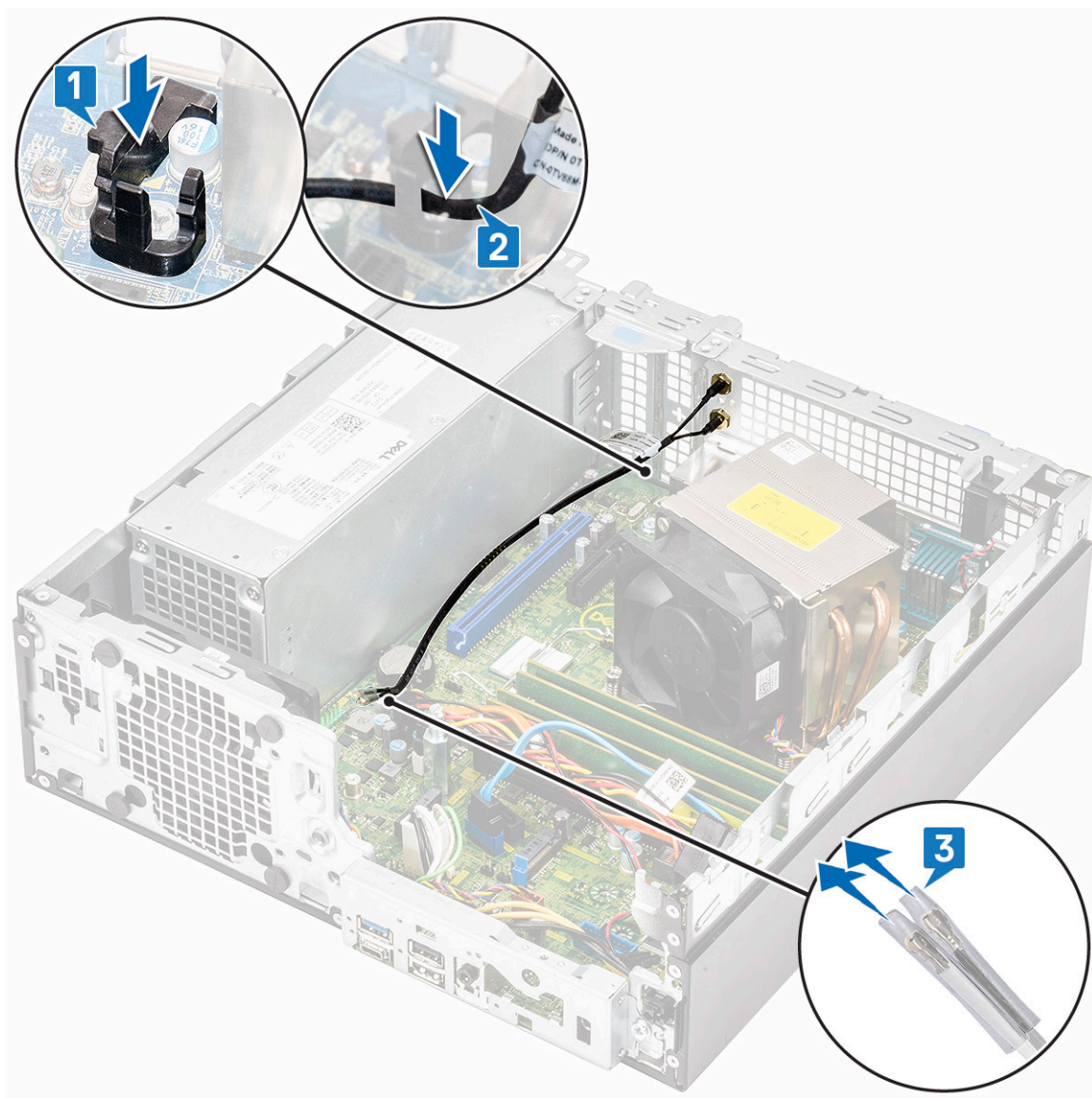
- d Push the blank filler with a screw driver.



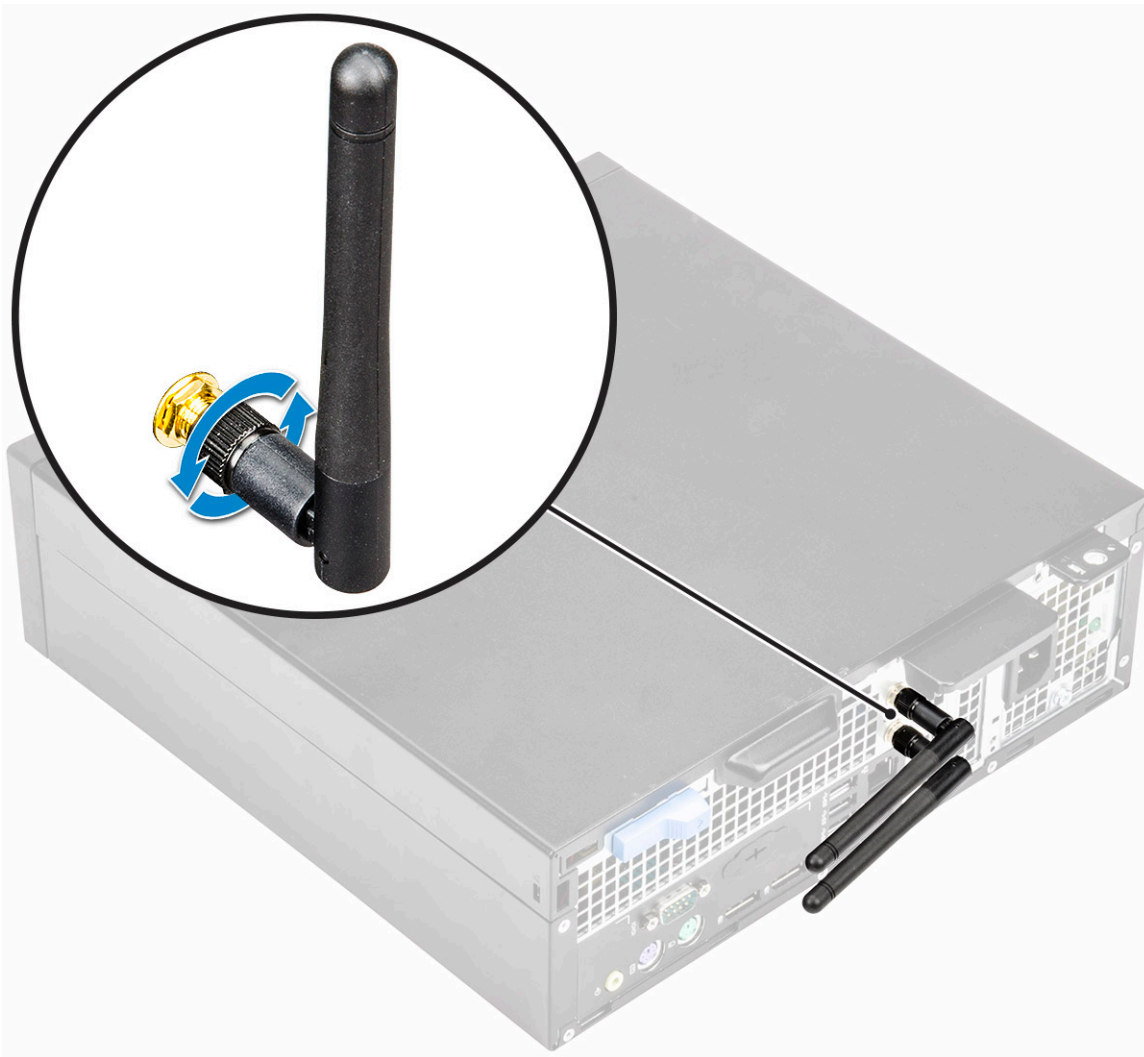
- e Insert the antenna cables into the antenna slot on the chassis [1].
- f Replace the metal washers on to the antenna connectors [2].
- g Replace the nuts to secure the antenna connectors to the chassis [3].



- h Affix the retention clip on the chassis as show in the image [1].
- i Route the antenna cable through the retention clip [2].
- j Pull off the insulation on the antenna cable connectors [3].



- k Connect the antenna connectors to the connectors on the WLAN card.
- l Tighten the antenna to the antenna cable connector screws.

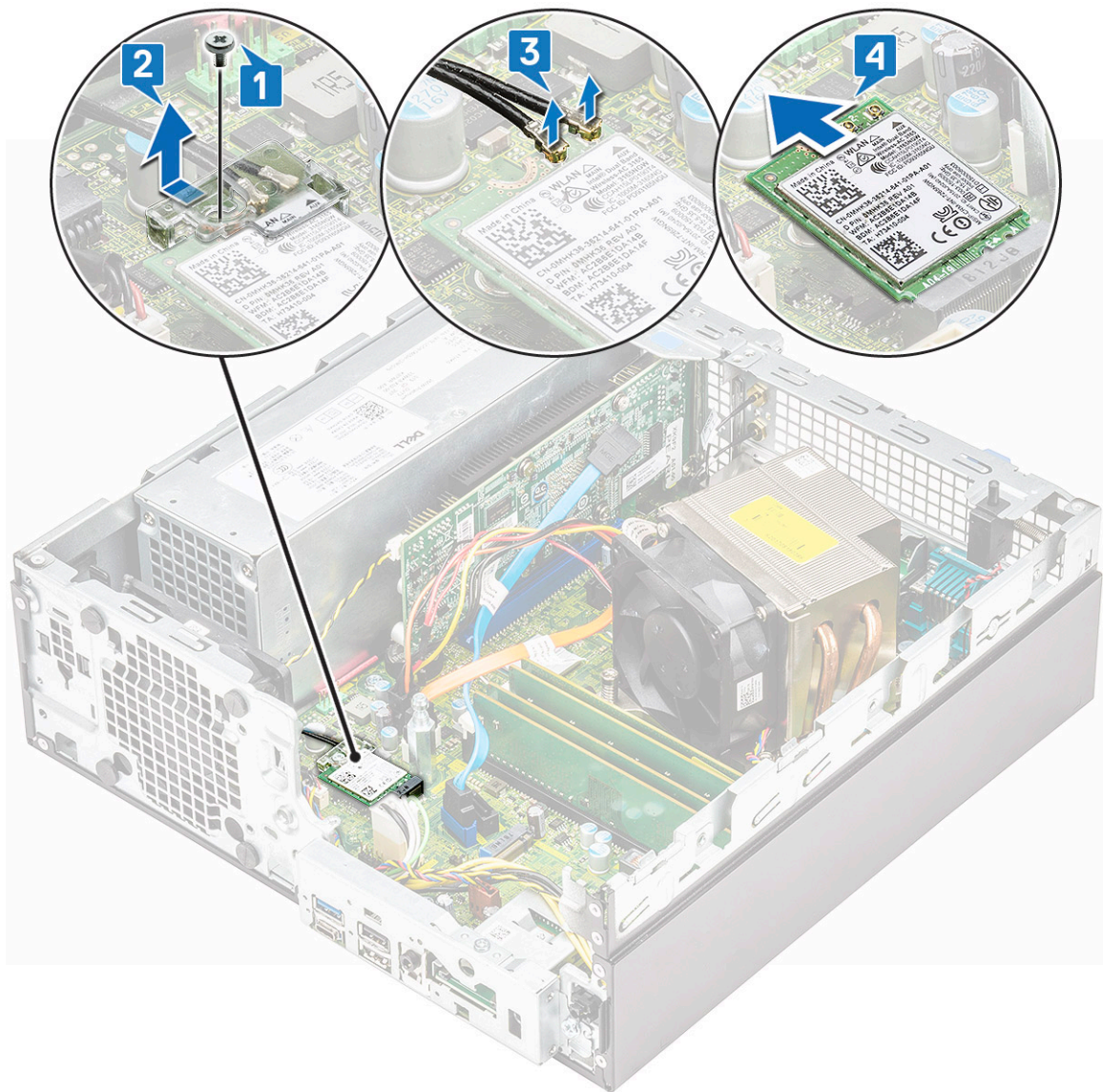


- 3 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 4 Follow the procedure in [After working inside your computer](#).

M.2 2230 WLAN card - optional

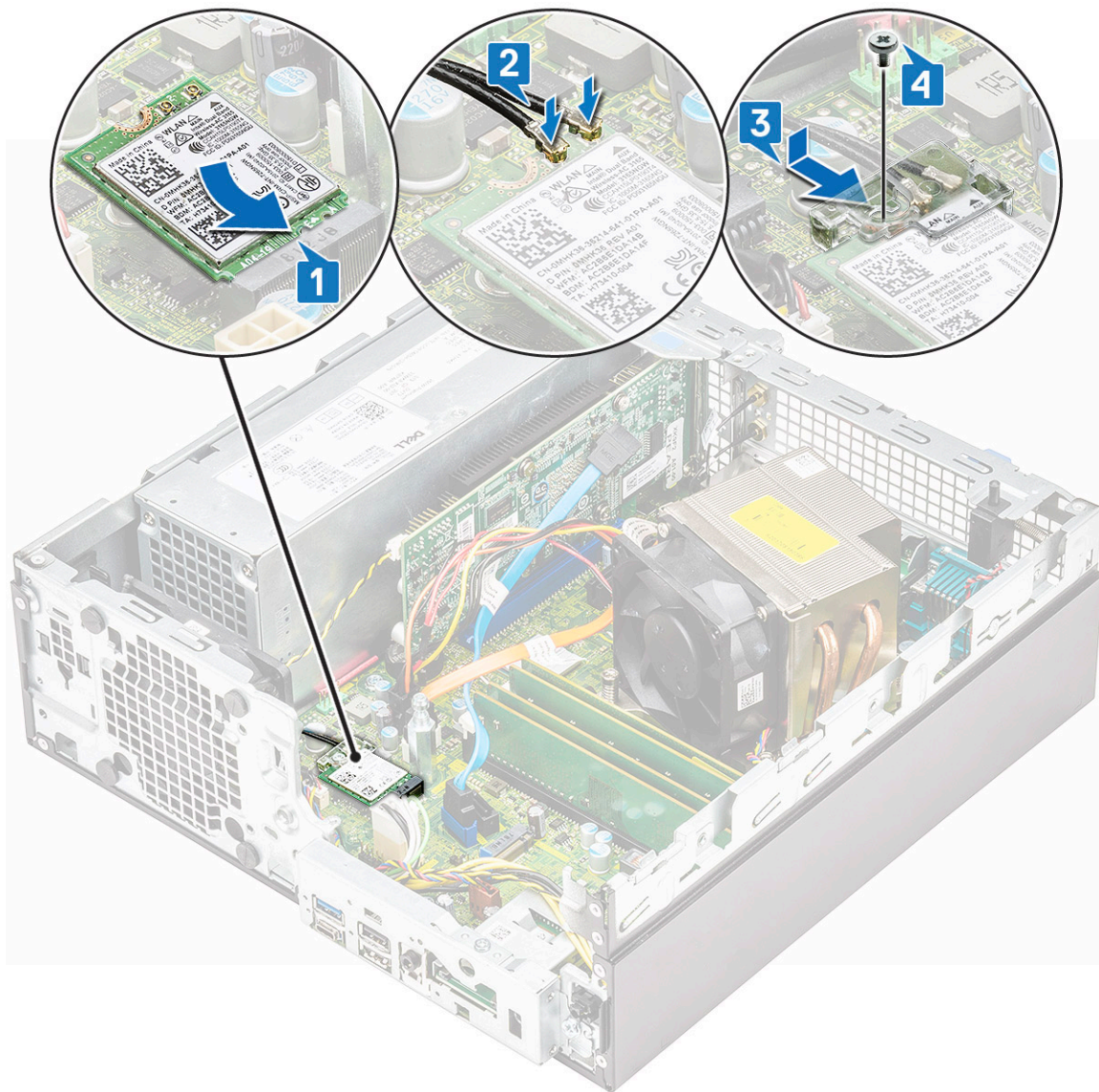
Removing the M.2 2230 WLAN card

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the M.2 2230 WLAN card:
 - a Remove the screw (M2) that secures the WLAN card bracket and the WLAN card to the system board [1].
 - b Slide and lift the WLANs card bracket off the WLAN card [2].
 - c Disconnect the antenna cables from the WLAN card [3].
 - d Slide and remove the WLAN card out of the WLAN card slot [4].



Installing the M.2 2230 WLAN card

- 1 To install the M.2 2230 WLAN card:
 - a Align and replace the WLAN card into the WLAN card slot [1].
 - b Connect the antenna cables to the WLAN card [2].
 - c Replace the WLAN card bracket on the WLAN card [3].
 - d Replace the screw (M2) that secures the WLAN card bracket and the WLAN to the system board [4].



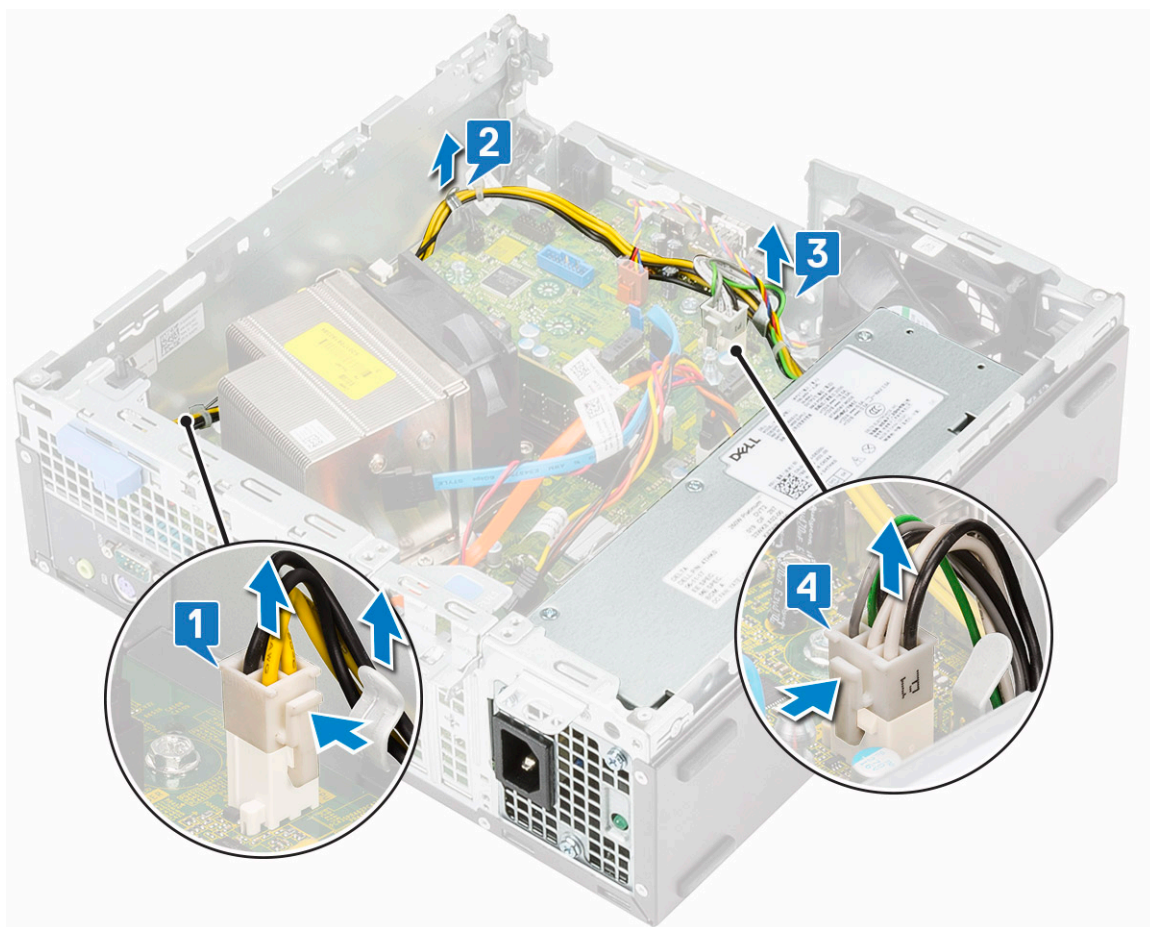
- 2 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 3 Follow the procedure in [After working inside your computer](#).

Power supply unit

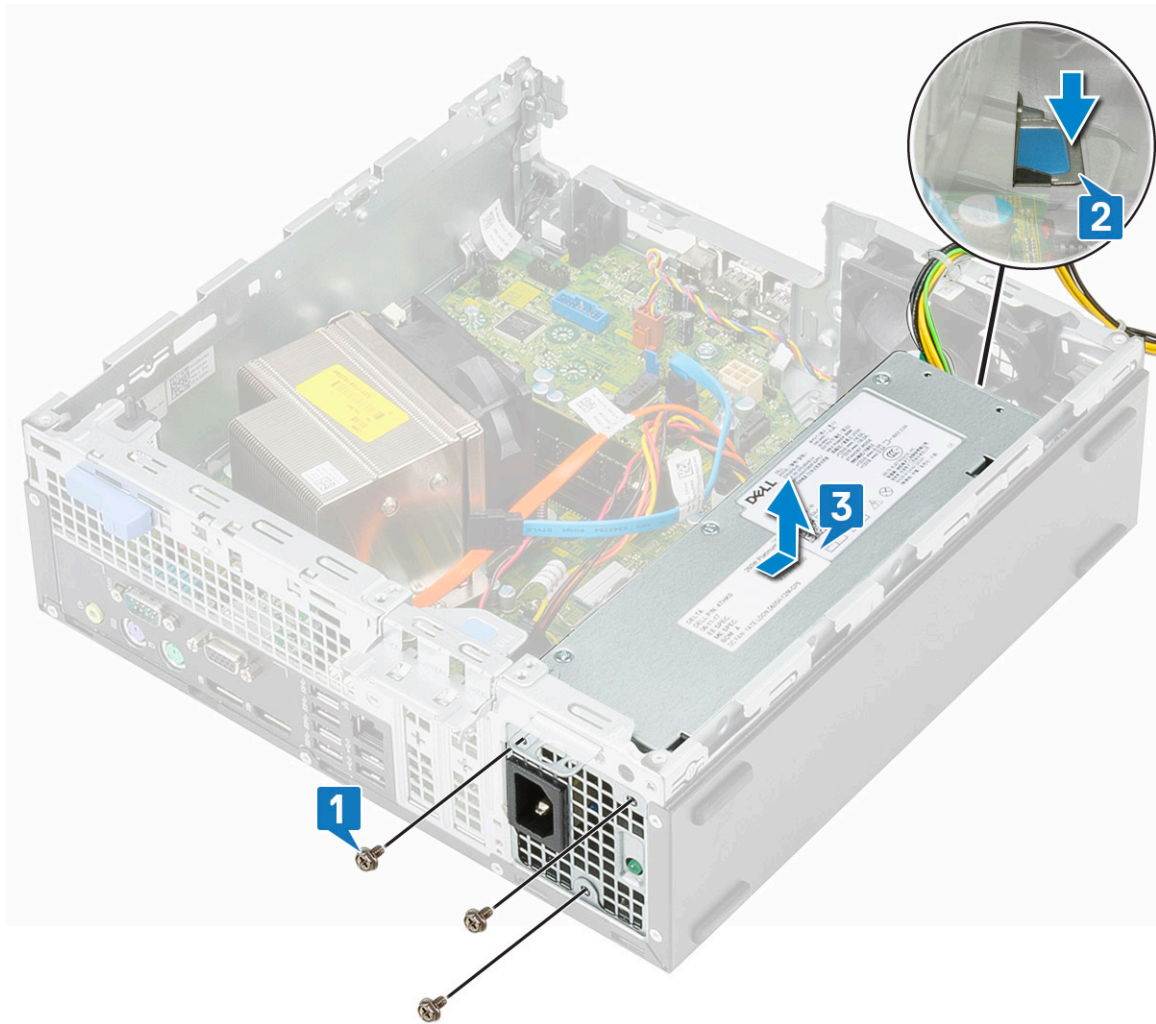
Removing power supply unit or PSU

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To release the PSU:
 - a Disconnect the CPU power cable from the connector on the system board [1].

- b Unroute the power cables from the retention clips on the chassis [2,3].
- c Disconnect the PSU power cable from the connector on the system board [4].

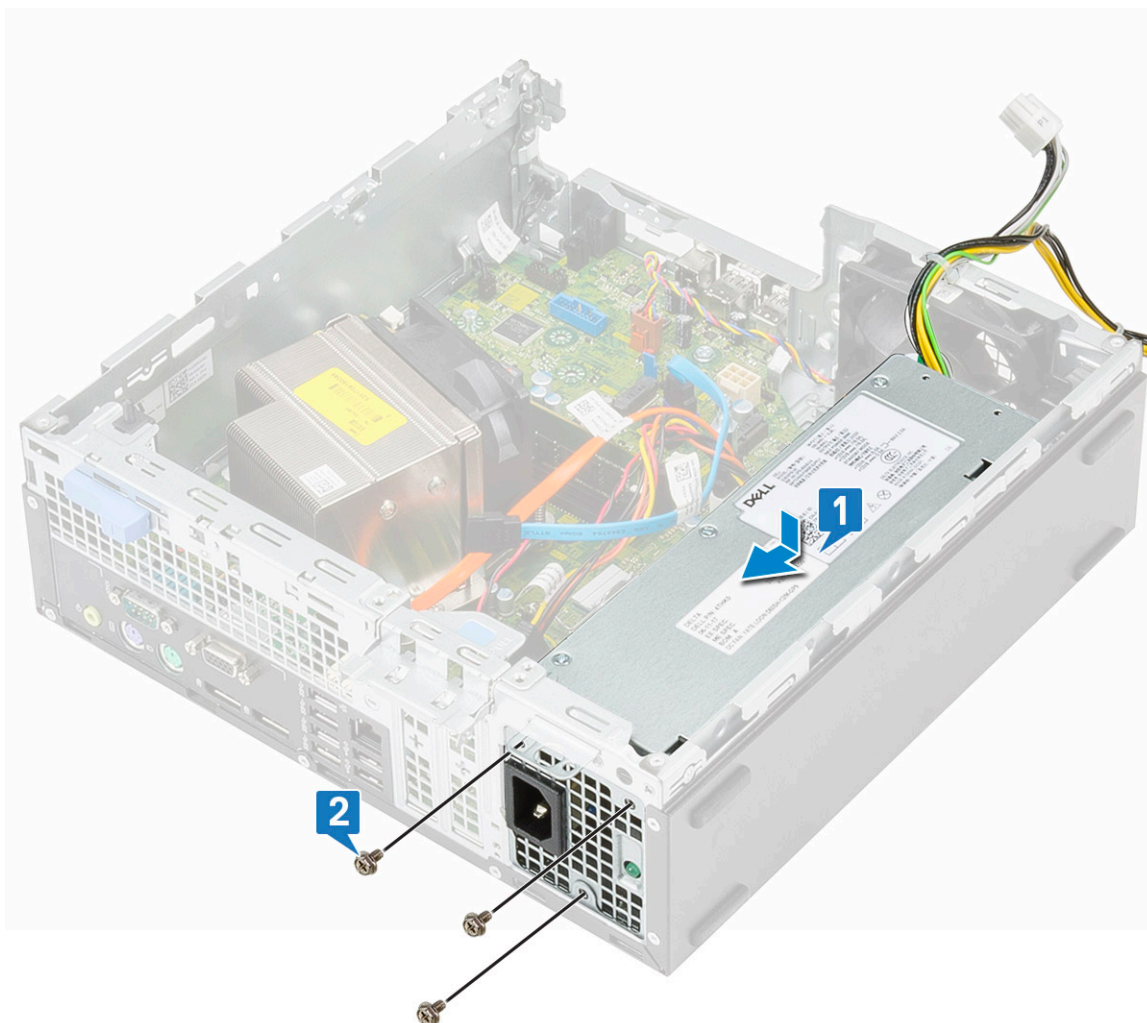


- 4 To remove the PSU:
- a Remove the 3 screws that secure the PSU to the system [1].
 - b Press the blue release tab [4] at the rear end of the PSU unit, slide the PSU and lift it away from the system [2].

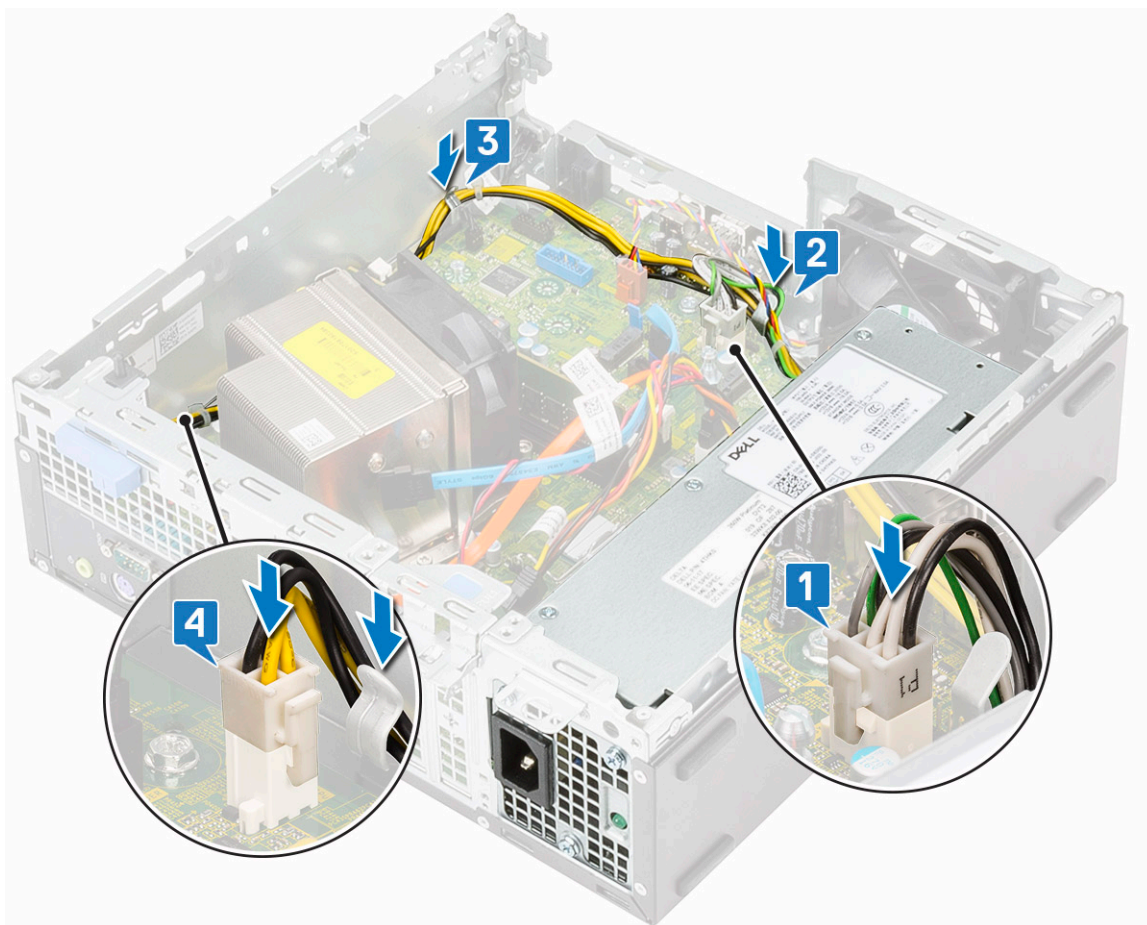


Installing the power supply unit or PSU

- 1 Insert the PSU in the chassis and slide it towards the back of the system to secure it [1].
- 2 Replace the screws to secure the PSU to the rear chassis of the system .



- 3 Connect the power cable to the connector on the system board [1].
- 4 Route the system power cable through the retention clips [2].
- 5 Route the CPU power cable through the retention clips [3].
- 6 Connect the CPU power cable to the connector on the system board [4].

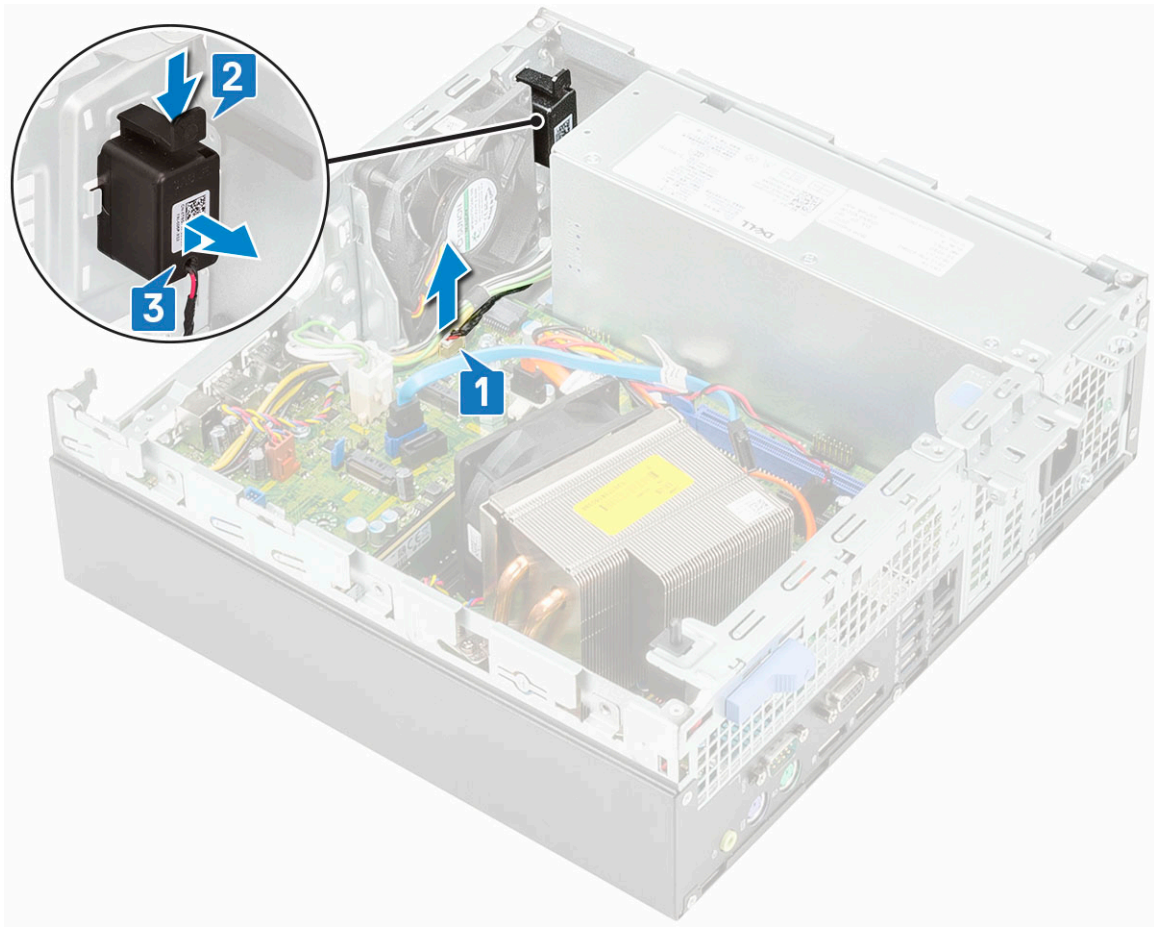


- 7 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 8 Follow the procedure in [After working inside your computer](#).

Speaker

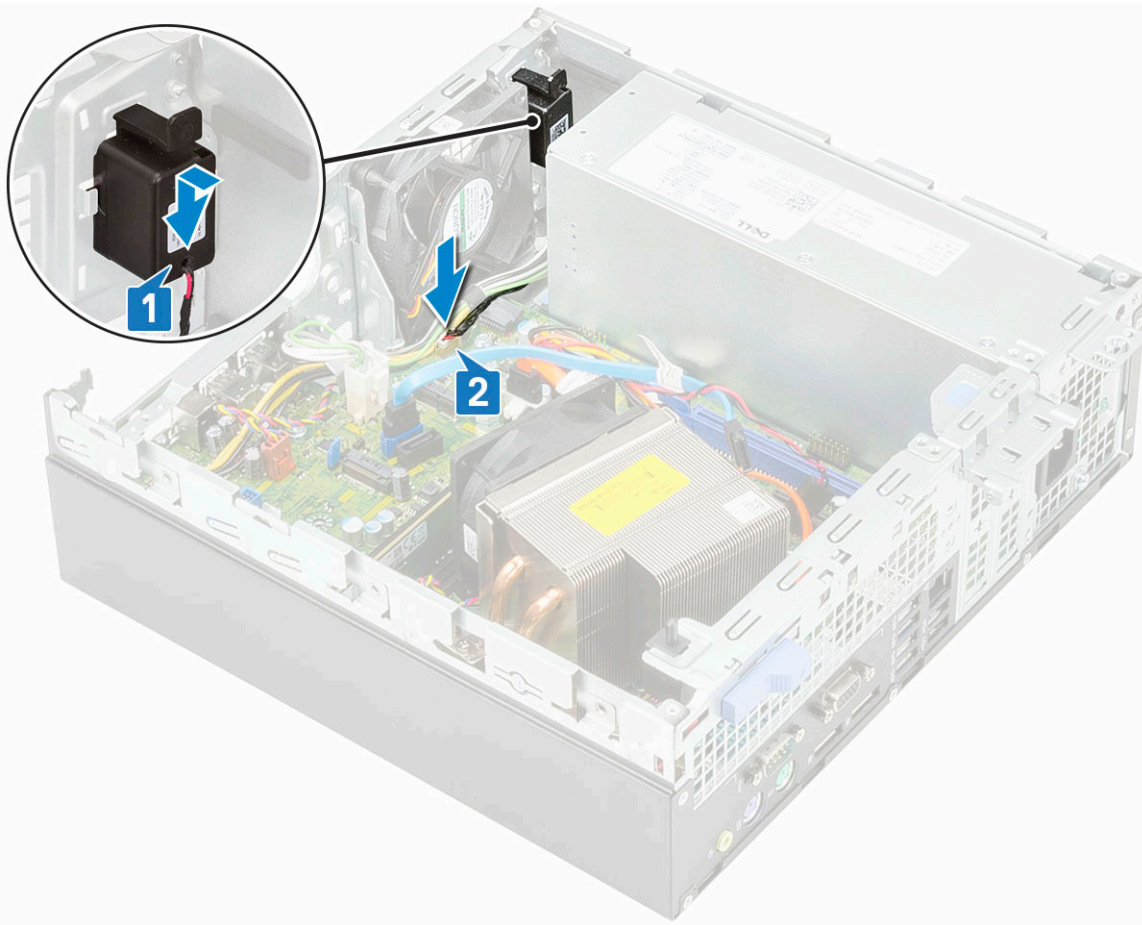
Removing speaker

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the speaker:
 - a Disconnect the speaker cable from the connector on the system board [1].
 - b Press the release tab [2] and pull the speaker out from the system [3].



Installing the speaker

- 1 Insert the speaker into the slot on the system chassis and press it until it clicks into place [1].
- 2 Connect the speaker cable to the connector on the system board [2].

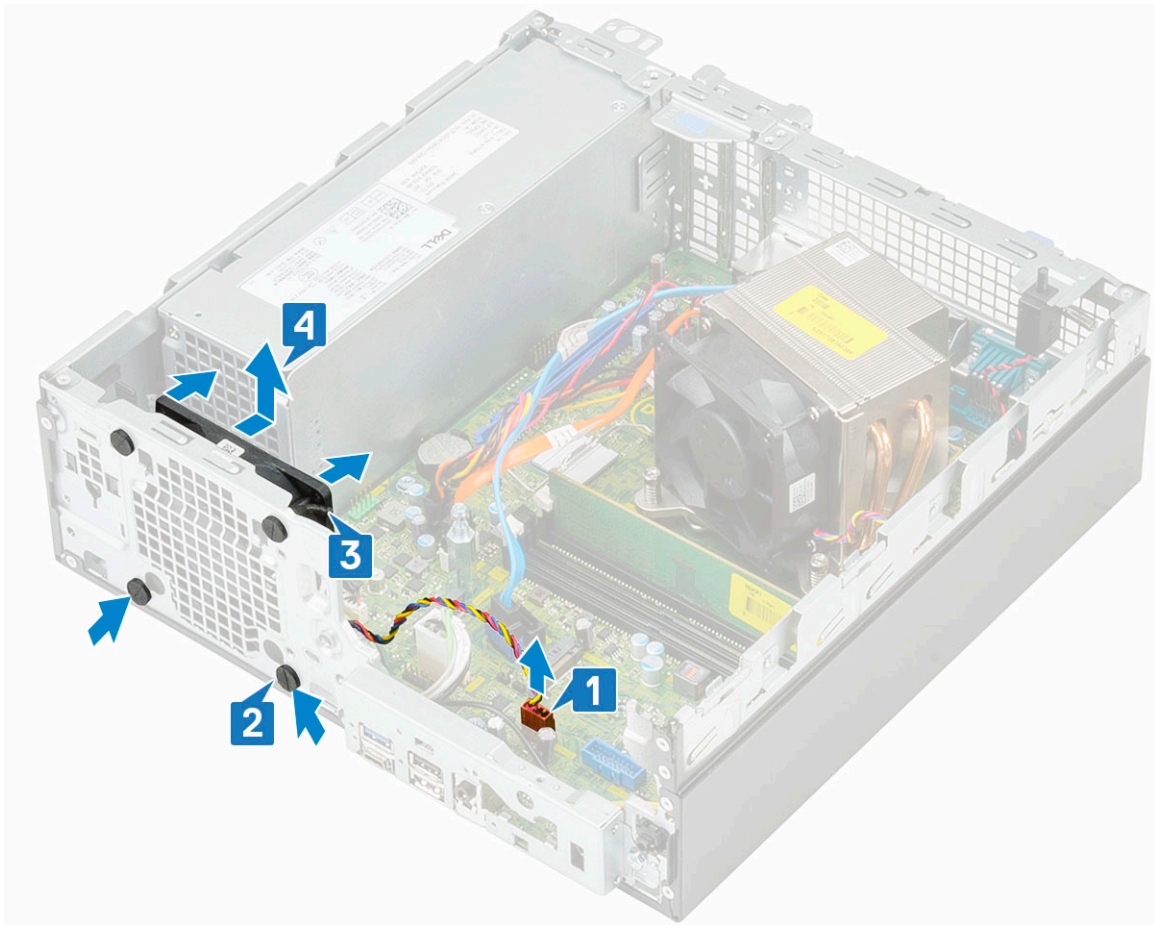


- 3 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 4 Follow the procedure in [After working inside your computer](#).

System fan

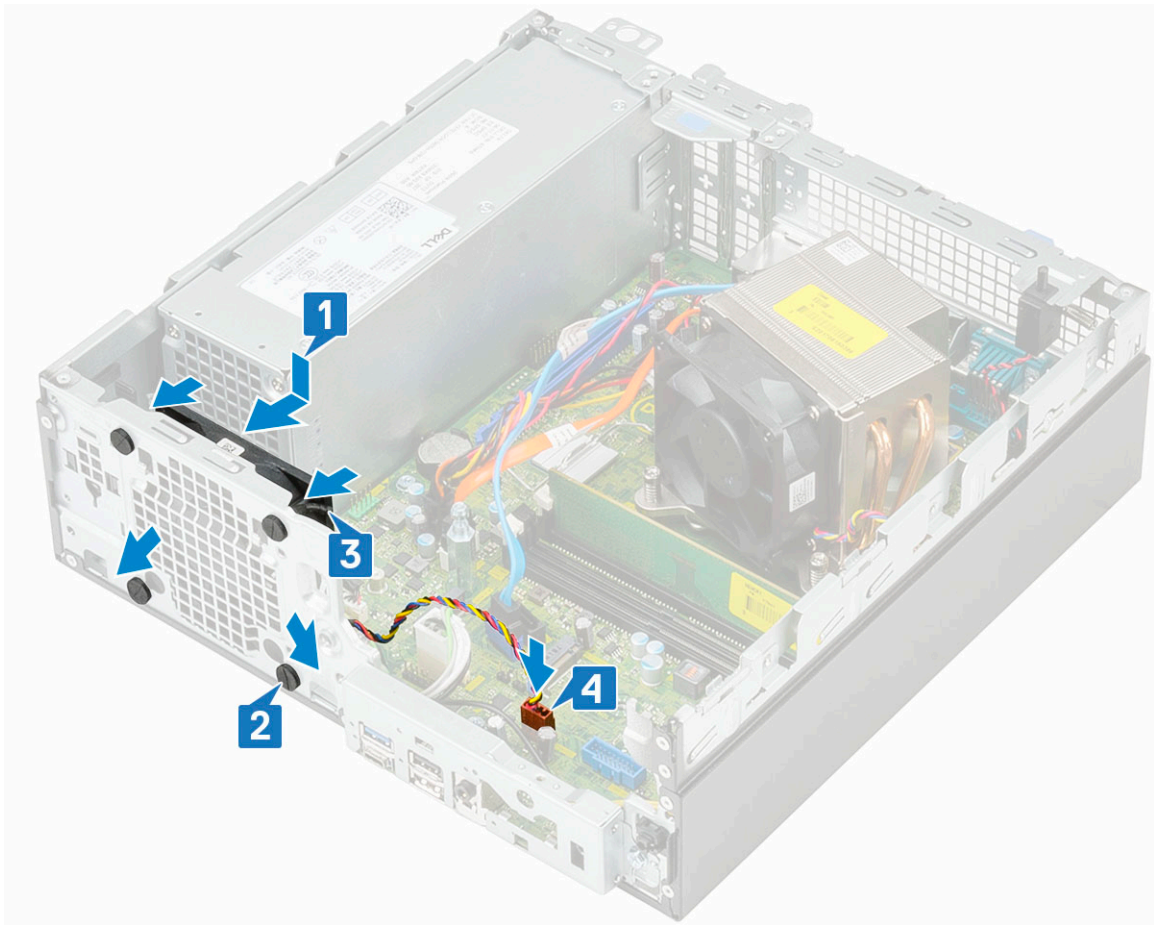
Removing the system fan

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
- 3 To remove the system fan:
 - a Disconnect the system fan cable from the system board [1].
 - b Slide the fan grommets towards the slot on the back of the fan chassis [2].
 - c Lift the fan away from the system [3, 4].



Installing the system fan

- 1 To replace the system fan:
 - a Align and place the system fan in the system chassis [1].
 - b Pass the grommets through the chassis and slide outward along the groove to secure it in place [2,3].
 - c Connect the system fan cable to the system board [4].



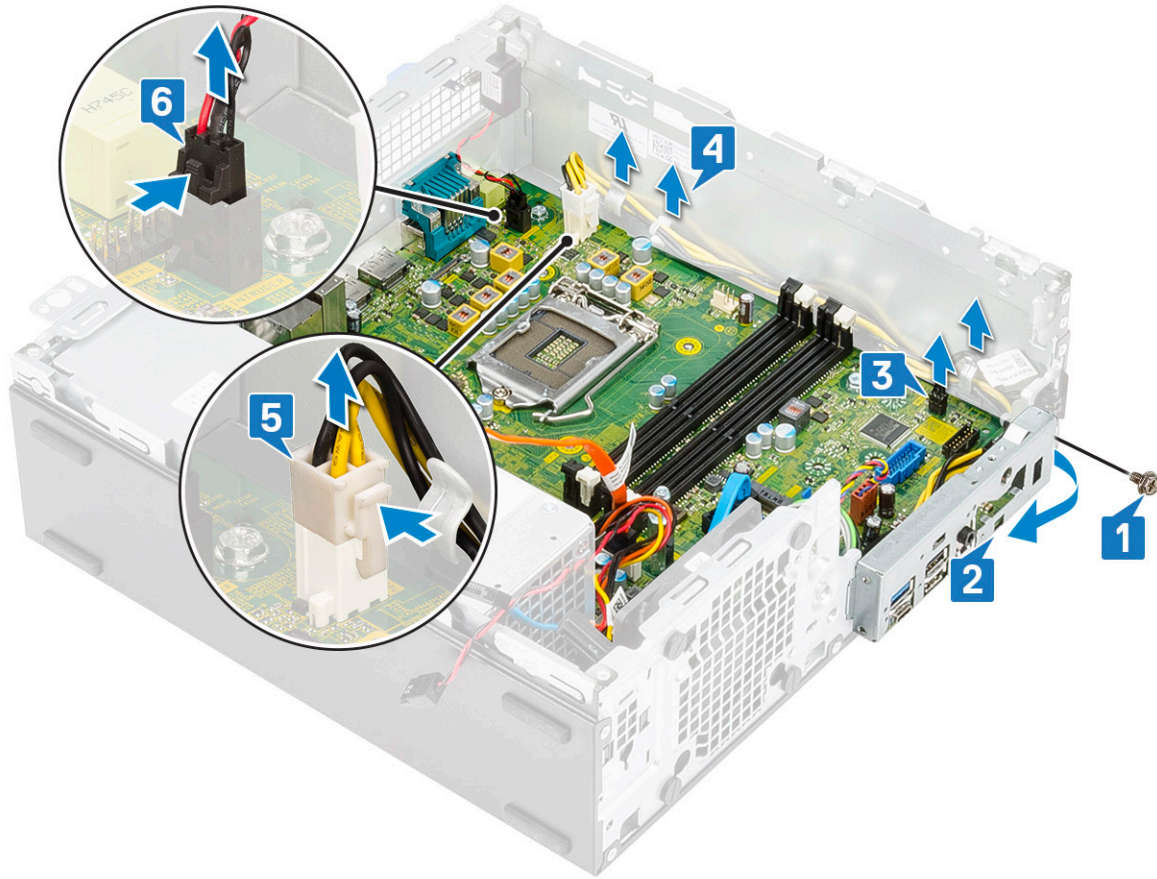
- 2 Install the:
 - a [Hard drive and optical drive module](#)
 - b [Front bezel](#)
 - c [Side cover](#)
- 3 Follow the procedure in [After working inside your computer](#).

System board

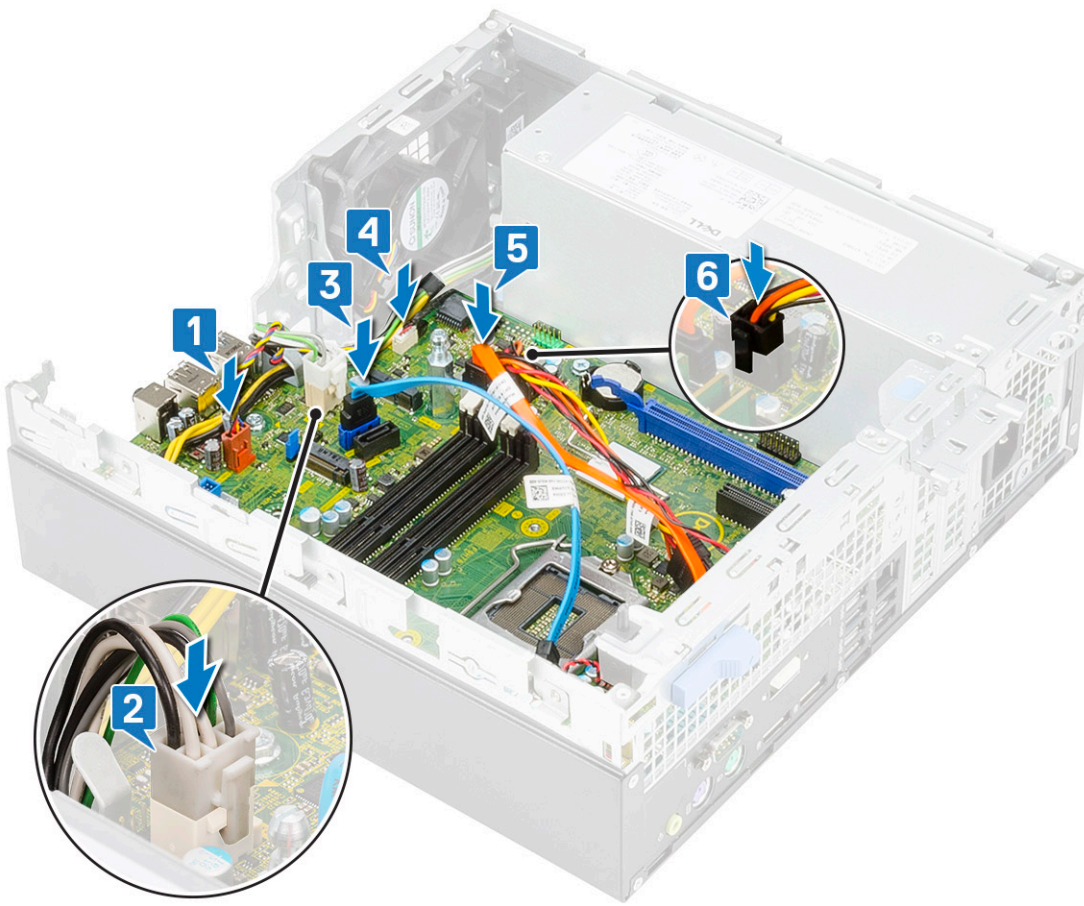
Removing system board

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the:
 - a [Side cover](#)
 - b [Front bezel](#)
 - c [Hard drive and optical drive module](#)
 - d [Heat sink and heat sink fan](#)
 - e [Processor](#)
 - f [Memory module](#)
 - g [M.2 PCIe SSD card](#)
 - h [Intel Optane card](#)
 - i [SD card reader](#)
 - j [M.2 2230 WLAN card](#)
- 3 To remove the I/O panel:
 - a Remove the screw that secures the I/O panel [1].

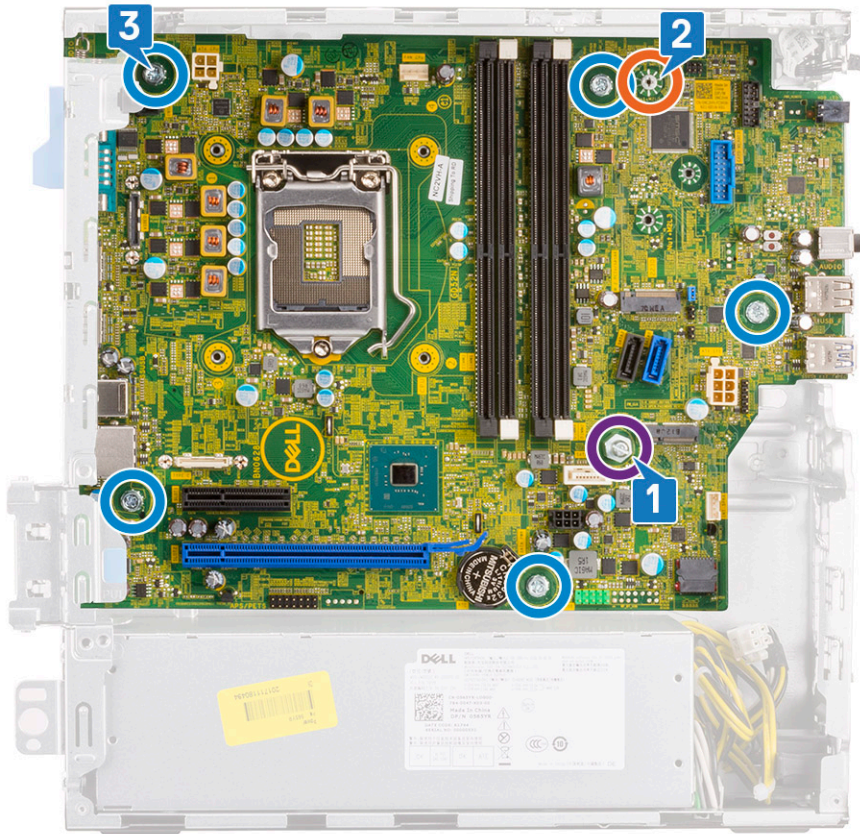
- b Rotate the I/O panel and remove it from the system [2].
- c Disconnect the power switch cable [3], unroute the power cable from the retention clips on the chassis [4], psu cable [5] and, intrusion switch cable [6] from the connectors on the system board.



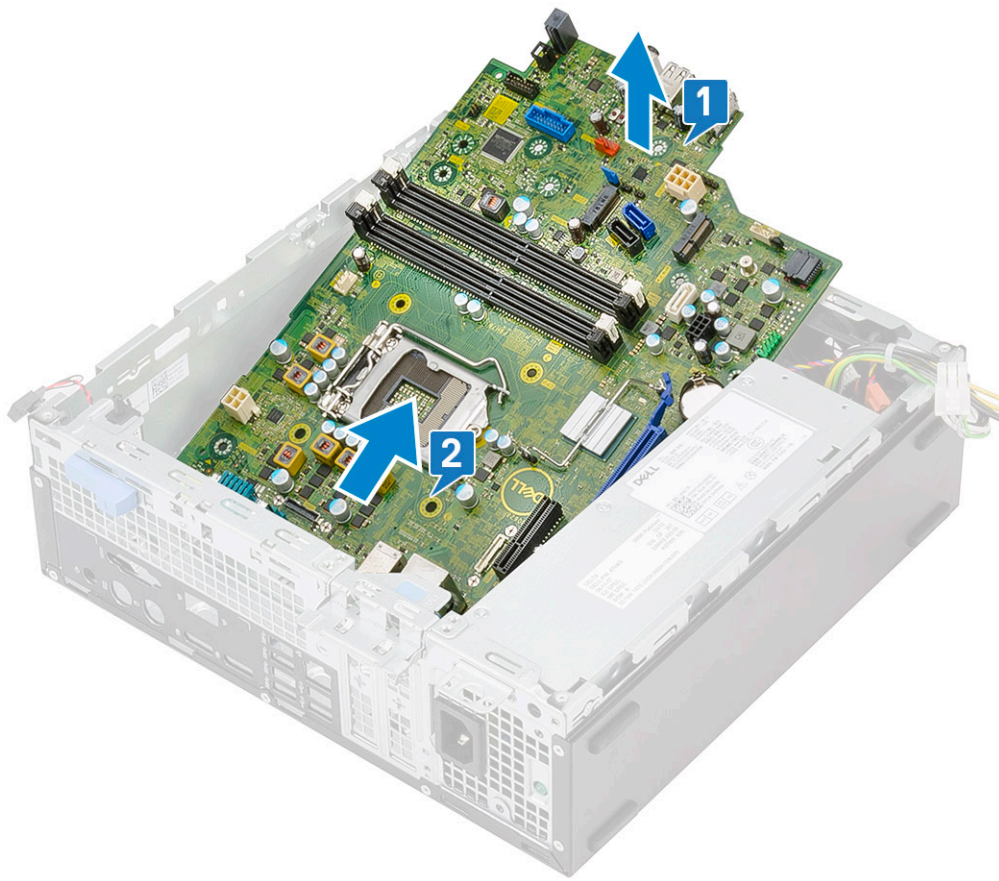
- 4 Disconnect the intrusion switch cable [1], PSU power cable [2], data cable [3], system fan cable [4], SATA cable [5], SATA power cable [6]



- 5 To remove the screws from the system board:
- a Remove the standoff single (#6-32) screw and single (M3x6) caddy screw that secures the system board to the system [1,2].
 - b Remove the 5 screws that secure the system board to the chassis [3].

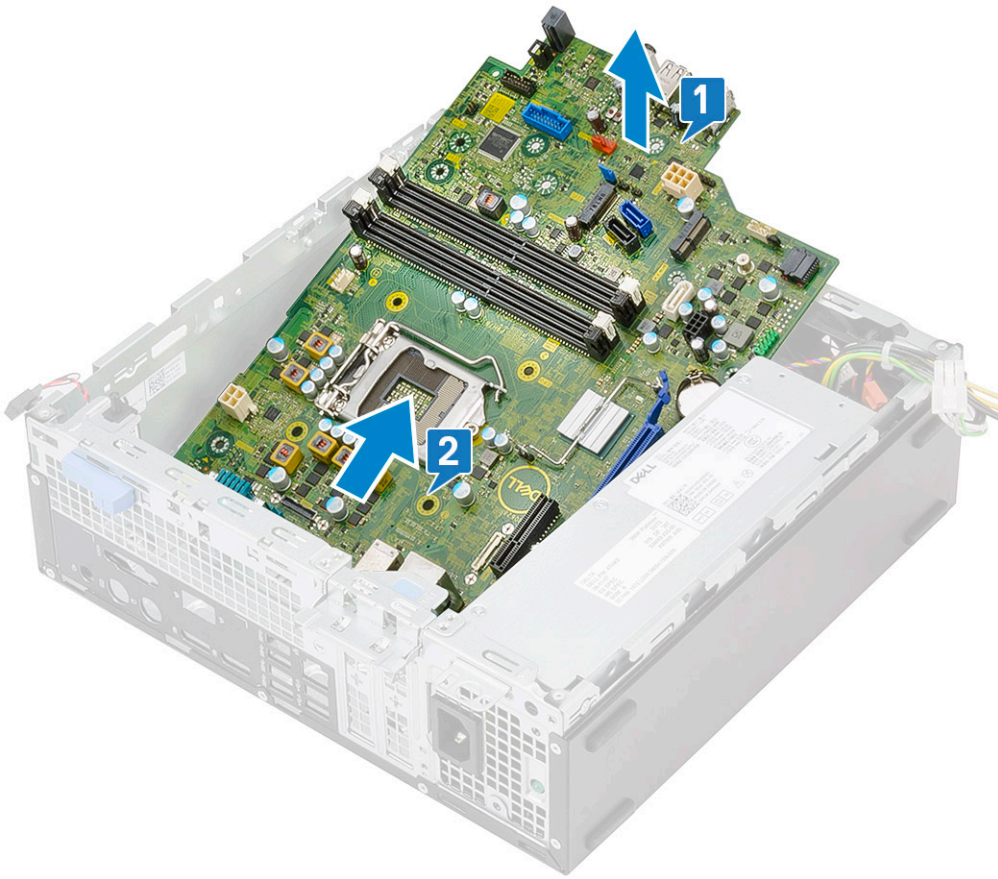


- 6 To remove the system board:
- a Lift and slide the system board away from the system [1, 2].

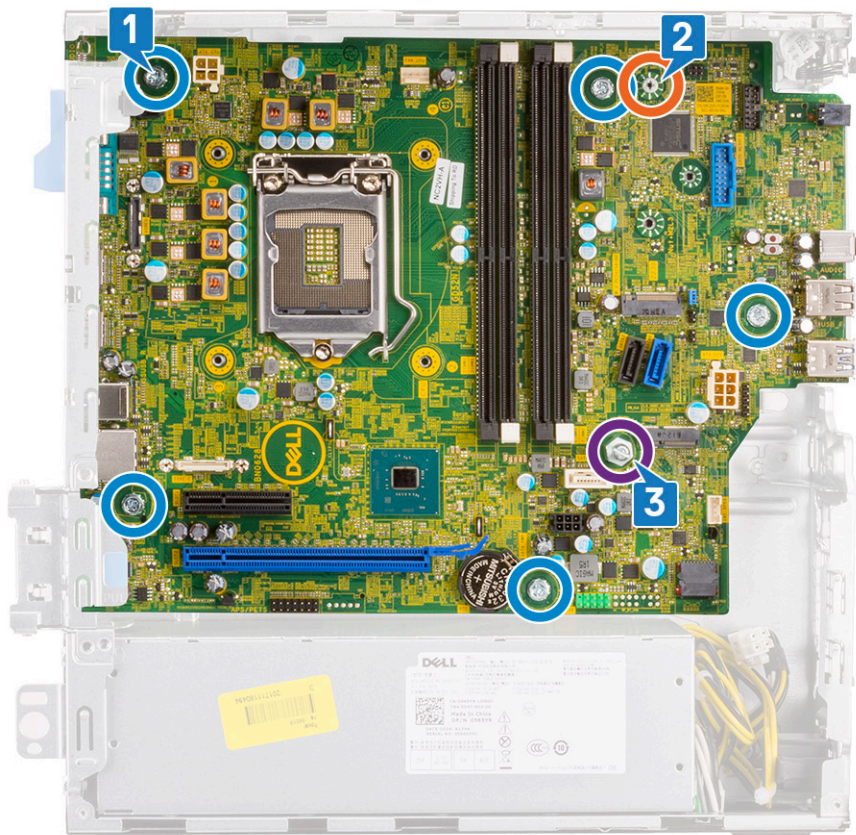


Installing the system board

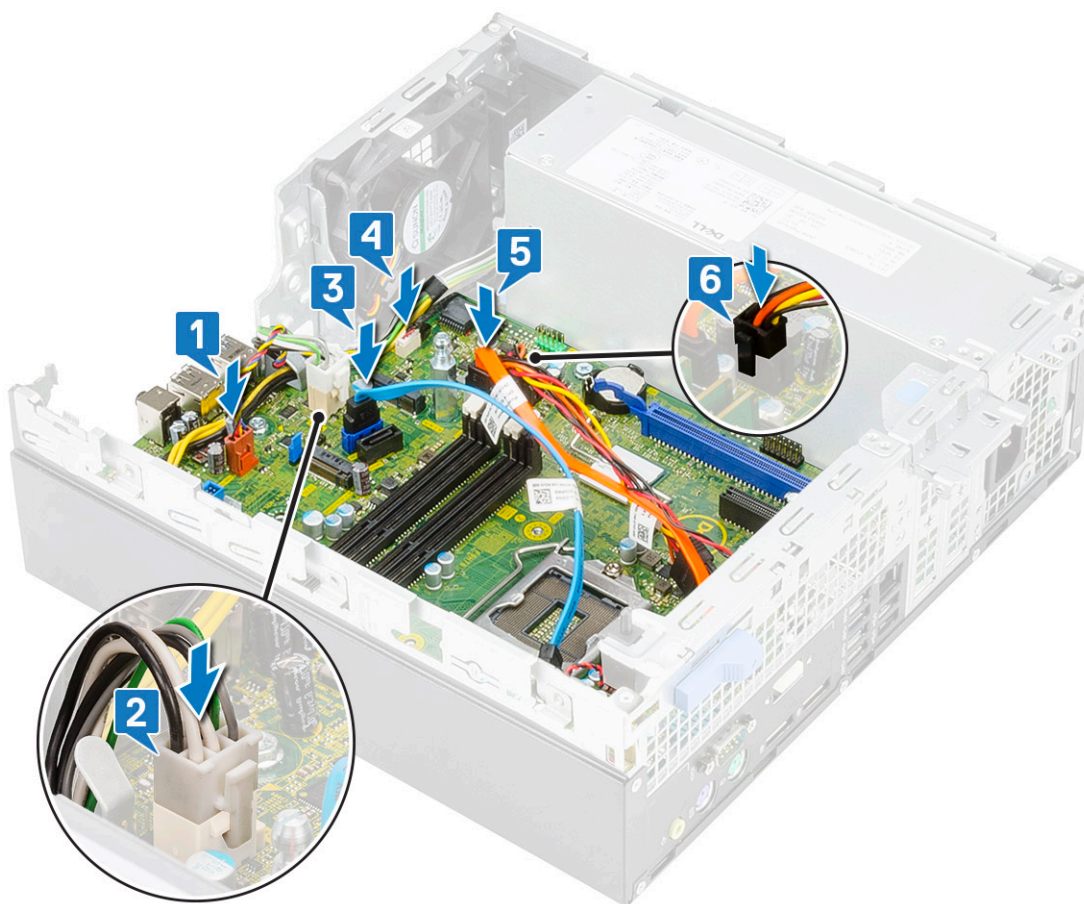
- 1 Hold the system board by its edges, and align it towards the back of the system.
- 2 Lower the system board into the system chassis until the connectors at the back of the system board align with the slots on the chassis, and the screw holes on the system board align with the standoffs on the system chassis [1,2].



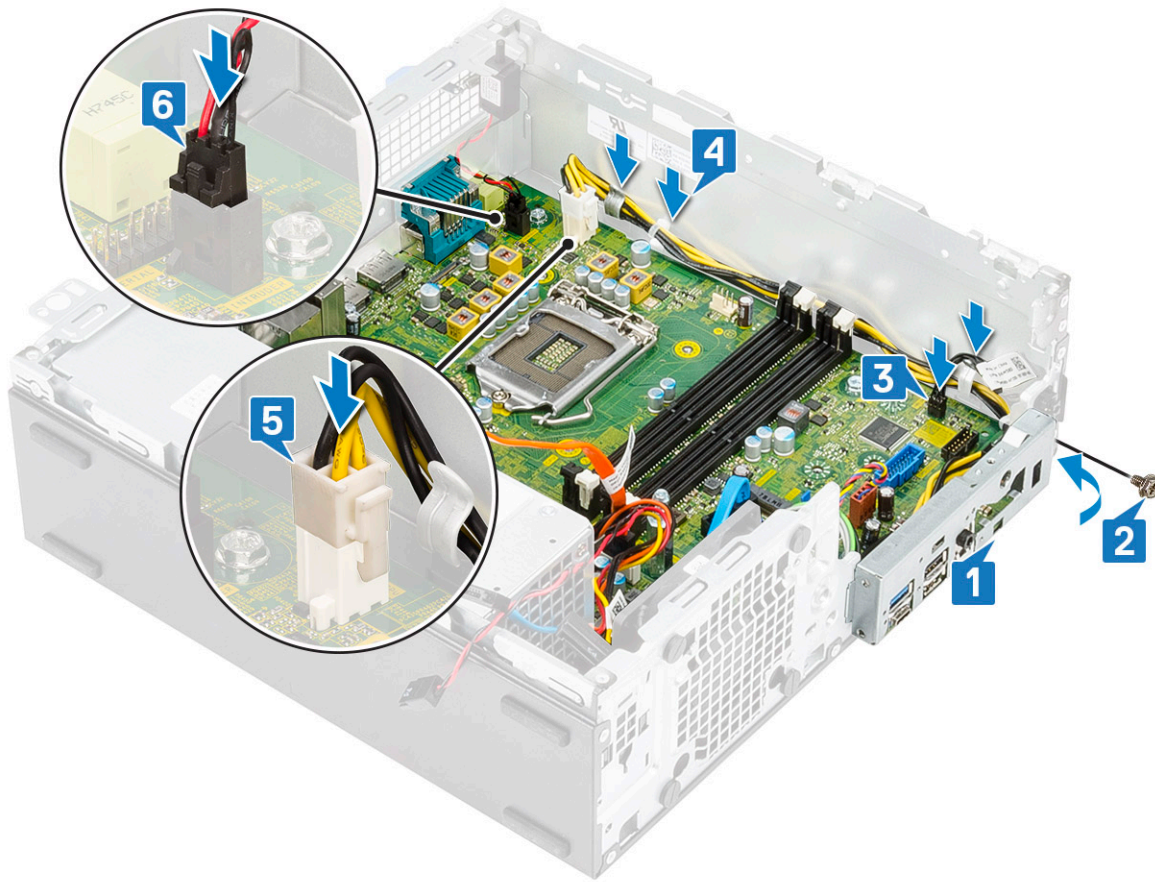
- 3 Replace the 5 screws that secure the system board to the system [1], the single (M3x5) screw [2], and the single (#6-32) screw [3].



- 4 Align the cables with the pins on connectors on the system board and connect intrusion switch cable [1], PSU power cable [2], data cable [3], system fan cable [4], SATA cable [5], SATA power cable [6] to the system board:



- 5 Insert the hook on the I/O panel into the slot on the chassis and rotate to close the I/O panel [1].
- 6 Replace the screw to secure the I/O panel to the chassis [2].
- 7 Connect the power switch cable [3], route the power cable through the retention clips on the chassis [4], psu cable [5] and, intrusion switch cable [6] from the connectors on the system board.



- 8 Install the:
 - a [M.2 2230 WLAN card](#)
 - b [SD card reader](#)
 - c [Intel Optane card](#)
 - d [M.2 PCIe SSD card](#)
 - e [Memory module](#)
 - f [Processor](#)
 - g [Heat sink and heat sink fan](#)
 - h [Hard drive and optical drive module](#)
 - i [Front bezel](#)
 - j [Side cover](#)
- 9 Follow the procedure in [After working inside your computer](#).

Troubleshooting your computer

You can troubleshoot your computer using indicators like diagnostic lights, beep codes, and error messages during the operation of the computer.

Enhanced Pre-Boot System Assessment — ePSA diagnostics

The ePSA diagnostics (also known as system diagnostics) performs a complete check of your hardware. The ePSA is embedded with the BIOS and is launched by the BIOS internally. The embedded system diagnostics provides a set of options for particular devices or device groups allowing you to:

The ePSA diagnostics can be initiated by the FN+PWR buttons while powering on the computer.

- Run tests automatically or in an interactive mode
- Repeat tests
- Display or save test results
- Run thorough tests to introduce additional test options to provide extra information about the failed device(s)
- View status messages that inform you if tests are completed successfully
- View error messages that inform you of problems encountered during testing

NOTE: Some tests for specific devices require user interaction. Always ensure that you are present at the computer terminal when the diagnostic tests are performed.

Running the ePSA Diagnostics

Invoke diagnostics boot by either of the methods that are suggested below:

- 1 Power on the computer.
- 2 As the computer boots, press the F12 key when the Dell logo is displayed.
- 3 In the boot menu screen, use Up/Down arrow key to select the **Diagnostics** option and then press **Enter**.

NOTE: The Enhanced Pre-boot System Assessment window displays, listing all devices detected in the computer. The diagnostics starts running the tests on all the detected devices.

- 4 Press the arrow in the lower-right corner to go to the page listing.
The detected items are listed and tested.
- 5 To run a diagnostic test on a specific device, press Esc and click **Yes** to stop the diagnostic test.
- 6 Select the device from the left pane and click **Run Tests**.
- 7 If there are any issues, error codes are displayed.
Note the error code and contact Dell.
or
- 8 Shut down the computer.
- 9 Press and hold the Fn key, while pressing the power button, and then release both.
- 10 Repeat steps 3–7 above.

Diagnostics

The computer POST (Power On Self Test) ensures that it meets the basic computer requirements and the hardware is working appropriately before the boot process begins. If the computer passes the POST, the computer continues to start in a normal mode. However, if the computer fails the POST, the computer emits a series of LED codes during the start-up. The system LED is integrated on the Power button.

The following table shows different light patterns and what they indicate.

Table 5. Power LED summary

Amber LED state	White LED state	System state	Notes
Off	Off	S5	
Off	Blinking	S3, no PWRGD_PS	
Previous State	Previous State	S3, no PWRGD_PS	This entry provides for the possibility of a delay from SLP_S3# active to PWRGD_PS inactive.
Blinking	Off	S0, no PWRGD_PS	
Steady	Off	S0, no PWRGD_PS, Code fetch = 0	
Off	Steady	S0, no PWRGD_PS, Code fetch = 1	This indicates that the host BIOS has started to execute and the LED register is now writable.

Table 6. Amber LED blinking failures

Amber LED state	White LED state	System state	Notes
2	1	Bad MBD	Bad MBD - Rows A, G, H, and J from table 12.4 of SIO Spec - Pre-Post indicators [40]
2	2	Bad MB, PSU or cabling	Bad MBD, PSU or PSU cabling - Rows B, C and D of table 12.4 SIO spec [40]
2	3	Bad MBD, DIMMS, or CPU	Bad MBD, DIMMS or CPU - Rows F and K from table 12.4 of SIO spec [40]
2	4	Bad coin cell	Bad coin cell - Row M of table 12.4 in SIO spec [40]

Table 7. States Under Host BIOS Control

Amber LED state	White LED state	System state	Notes
2	5	BIOS state 1	BIOS Post code (Old LED pattern 0001) Corrupt BIOS.
2	6	BIOS state 2	BIOS Post code (Old LED pattern 0010) CPU config or CPU failure.
2	7	BIOS state 3	BIOS Post code (Old LED pattern 0011) MEM config in

Amber LED state	White LED state	System state	Notes
			process. Appropriate mem modules detected but failure has occurred.
3	1	BIOS state 4	BIOS Post code (Old LED pattern 0100) Combine PCI device config or failure with video sub sytem config or failure. BIOS to eliminate 0101 video code.
3	2	BIOS state 5	BIOS Post code (Old LED pattern 0110) Combine storage and USB config or failure. BIOS to eliminate 0111 USB code.
3	3	BIOS state 6	BIOS Post code (Old LED pattern 1000) MEM config, no memory detected.
3	4	BIOS state 7	BIOS Post code (Old LED pattern 1001) Fatal Motherboard error.
3	5	BIOS state 8	BIOS Post code (Old LED pattern 1010) Mem config, modules incompatible or invalid config.
3	6	BIOS state 9	BIOS Post code (Old LED pattern 1011) combine "Other pre-video activity and resource configuration codes. BIOS to eliminate 1100 code.
3	7	BIOS state 10	BIOS Post code (Old LED pattern 1110) Other pre-post activity, routine subsequent to video init.

Diagnostic error messages

Table 8. Diagnostic error messages

Error messages	Description
AUXILIARY DEVICE FAILURE	The touchpad or external mouse may be faulty. For an external mouse, check the cable connection. Enable the Pointing Device option in the System Setup program.
BAD COMMAND OR FILE NAME	Ensure that you have spelled the command correctly, put spaces in the proper place, and used the correct path name.
CACHE DISABLED DUE TO FAILURE	The primary cache internal to the microprocessor has failed. Contact Dell
CD DRIVE CONTROLLER FAILURE	The optical drive does not respond to commands from the computer.
DATA ERROR	The hard drive cannot read the data.
DECREASING AVAILABLE MEMORY	One or more memory modules may be faulty or improperly seated. Reinstall the memory modules or, if necessary, replace them.

Error messages	Description
DISK C: FAILED INITIALIZATION	The hard drive failed initialization. Run the hard drive tests in Dell Diagnostics .
DRIVE NOT READY	The operation requires a hard drive in the bay before it can continue. Install a hard drive in the hard drive bay.
ERROR READING PCMCIA CARD	The computer cannot identify the ExpressCard. Reinsert the card or try another card.
EXTENDED MEMORY SIZE HAS CHANGED	The amount of memory recorded in non-volatile memory (NVRAM) does not match the memory module installed in the computer. Restart the computer. If the error appears again, Contact Dell
THE FILE BEING COPIED IS TOO LARGE FOR THE DESTINATION DRIVE	The file that you are trying to copy is too large to fit on the disk, or the disk is full. Try copying the file to a different disk or use a larger capacity disk.
A FILENAME CANNOT CONTAIN ANY OF THE FOLLOWING CHARACTERS: \ / : * ? " < > -	Do not use these characters in filenames.
GATE A20 FAILURE	A memory module may be loose. Reinstall the memory module or, if necessary, replace it.
GENERAL FAILURE	The operating system is unable to carry out the command. The message is usually followed by specific information. For example, <i>Printer out of paper</i> . Take the appropriate action.
HARD-DISK DRIVE CONFIGURATION ERROR	The computer cannot identify the drive type. Shut down the computer, remove the hard drive, and boot the computer from an optical drive. Then, shut down the computer, reinstall the hard drive, and restart the computer. Run the Hard Disk Drive tests in Dell Diagnostics .
HARD-DISK DRIVE CONTROLLER FAILURE 0	The hard drive does not respond to commands from the computer. Shut down the computer, remove the hard drive, and boot the computer from an optical drive. Then, shut down the computer, reinstall the hard drive, and restart the computer. If the problem persists, try another drive. Run the Hard Disk Drive tests in Dell Diagnostics .
HARD-DISK DRIVE FAILURE	The hard drive does not respond to commands from the computer. Shut down the computer, remove the hard drive, and boot the computer from an optical drive. Then, shut down the computer, reinstall the hard drive, and restart the computer. If the problem persists, try another drive. Run the Hard Disk Drive tests in Dell Diagnostics .
HARD-DISK DRIVE READ FAILURE	The hard drive may be defective. Shut down the computer, remove the hard drive, and boot the computer from an optical. Then, shut down the computer, reinstall the hard drive, and restart the computer. If the problem persists, try another drive. Run the Hard Disk Drive tests in Dell Diagnostics .
INSERT BOOTABLE MEDIA	The operating system is trying to boot to non-bootable media, such as an optical drive. Insert bootable media.
INVALID CONFIGURATION INFORMATION-PLEASE RUN SYSTEM SETUP PROGRAM	The system configuration information does not match the hardware configuration. The message is most likely to occur after a memory module is installed. Correct the appropriate options in the system setup program.

Error messages	Description
KEYBOARD CLOCK LINE FAILURE	For external keyboards, check the cable connection. Run the Keyboard Controller test in Dell Diagnostics .
KEYBOARD CONTROLLER FAILURE	For external keyboards, check the cable connection. Restart the computer, and avoid touching the keyboard or the mouse during the boot routine. Run the Keyboard Controller test in Dell Diagnostics .
KEYBOARD DATA LINE FAILURE	For external keyboards, check the cable connection. Run the Keyboard Controller test in Dell Diagnostics .
KEYBOARD STUCK KEY FAILURE	For external keyboards or keypads, check the cable connection. Restart the computer, and avoid touching the keyboard or keys during the boot routine. Run the Stuck Key test in Dell Diagnostics .
LICENSED CONTENT IS NOT ACCESSIBLE IN MEDIADIRECT	Dell MediaDirect cannot verify the Digital Rights Management (DRM) restrictions on the file, so the file cannot be played.
MEMORY ADDRESS LINE FAILURE AT ADDRESS, READ VALUE EXPECTING VALUE	A memory module may be faulty or improperly seated. Reinstall the memory module or, if necessary, replace it.
MEMORY ALLOCATION ERROR	The software you are attempting to run is conflicting with the operating system, another program, or a utility. Shut down the computer, wait for 30 seconds, and then restart it. Run the program again. If the error message still appears, see the software documentation.
MEMORY DOUBLE WORD LOGIC FAILURE AT ADDRESS, READ VALUE EXPECTING VALUE	A memory module may be faulty or improperly seated. Reinstall the memory module or, if necessary, replace it.
MEMORY ODD/EVEN LOGIC FAILURE AT ADDRESS, READ VALUE EXPECTING VALUE	A memory module may be faulty or improperly seated. Reinstall the memory module or, if necessary, replace it.
MEMORY WRITE/READ FAILURE AT ADDRESS, READ VALUE EXPECTING VALUE	A memory module may be faulty or improperly seated. Reinstall the memory module or, if necessary, replace it.
NO BOOT DEVICE AVAILABLE	The computer cannot find the hard drive. If the hard drive is your boot device, ensure that the drive is installed, properly seated, and partitioned as a boot device.
NO BOOT SECTOR ON HARD DRIVE	The operating system may be corrupted, Contact Dell .
NO TIMER TICK INTERRUPT	A chip on the system board may be malfunctioning. Run the System Set tests in Dell Diagnostics .
NOT ENOUGH MEMORY OR RESOURCES. EXIT SOME PROGRAMS AND TRY AGAIN	You have too many programs open. Close all windows and open the program that you want to use.
OPERATING SYSTEM NOT FOUND	Reinstall the operating system. If the problem persists, Contact Dell .
OPTIONAL ROM BAD CHECKSUM	The optional ROM has failed. Contact Dell .
SECTOR NOT FOUND	The operating system cannot locate a sector on the hard drive. You may have a defective sector or corrupted File Allocation Table (FAT) on the hard drive. Run the Windows error-checking utility to check the file structure on the hard drive. See Windows Help and Support for instructions (click Start > Help and Support). If a large number of sectors are defective, back up the data (if possible), and then format the hard drive.
SEEK ERROR	The operating system cannot find a specific track on the hard drive.

Error messages	Description
SHUTDOWN FAILURE	A chip on the system board may be malfunctioning. Run the System Set tests in Dell Diagnostics . If the message reappears, Contact Dell .
TIME-OF-DAY CLOCK LOST POWER	System configuration settings are corrupted. Connect your computer to an electrical outlet to charge the battery. If the problem persists, try to restore the data by entering the System Setup program, then immediately exit the program. If the message reappears, Contact Dell .
TIME-OF-DAY CLOCK STOPPED	The reserve battery that supports the system configuration settings may require recharging. Connect your computer to an electrical outlet to charge the battery. If the problem persists, Contact Dell .
TIME-OF-DAY NOT SET-PLEASE RUN THE SYSTEM SETUP PROGRAM	The time or date stored in the system setup program does not match the system clock. Correct the settings for the Date and Time options.
TIMER CHIP COUNTER 2 FAILED	A chip on the system board may be malfunctioning. Run the System Set tests in Dell Diagnostics .
UNEXPECTED INTERRUPT IN PROTECTED MODE	The keyboard controller may be malfunctioning, or a memory module may be loose. Run the System Memory tests and the Keyboard Controller test in Dell Diagnostics or Contact Dell .
X:\ IS NOT ACCESSIBLE. THE DEVICE IS NOT READY	Insert a disk into the drive and try again.

System error messages

Table 9. System error messages

System message	Description
Alert! Previous attempts at booting this system have failed at checkpoint [nnnn]. For help in resolving this problem, please note this checkpoint and contact Dell Technical Support	The computer failed to complete the boot routine three consecutive times for the same error.
CMOS checksum error	RTC is reset, BIOS Setup default has been loaded.
CPU fan failure	CPU fan has failed.
System fan failure	System fan has failed.
Hard-disk drive failure	Possible hard disk drive failure during POST.
Keyboard failure	Keyboard failure or loose cable. If reseating the cable does not solve the problem, replace the keyboard.
No boot device available	<p>No bootable partition on hard disk drive, the hard disk drive cable is loose, or no bootable device exists.</p> <ul style="list-style-type: none"> If the hard drive is your boot device, ensure that the cables are connected and that the drive is installed properly and partitioned as a boot device. Enter system setup and ensure that the boot sequence information is correct.
No timer tick interrupt	A chip on the system board might be malfunctioning or motherboard failure.


System message**Description**

NOTICE - Hard Drive SELF MONITORING SYSTEM has reported that a parameter has exceeded its normal operating range. Dell recommends that you back up your data regularly. A parameter out of range may or may not indicate a potential hard drive problem

S.M.A.R.T error, possible hard disk drive failure.

Getting help

Contacting Dell

 **NOTE:** If you do not have an active Internet connection, you can find contact information on your purchase invoice, packing slip, bill, or Dell product catalog.

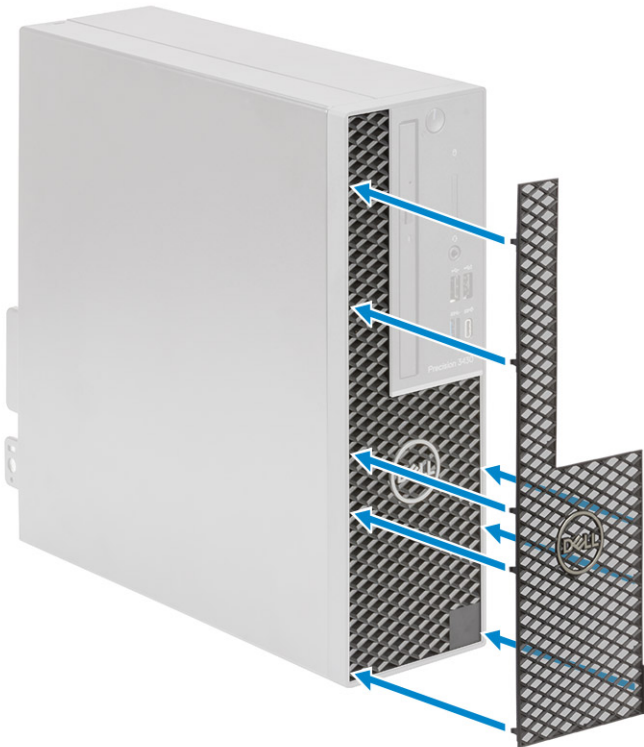
Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical support, or customer service issues:

- 1 Go to **Dell.com/support**.
- 2 Select your support category.
- 3 Verify your country or region in the **Choose a Country/Region** drop-down list at the bottom of the page.
- 4 Select the appropriate service or support link based on your need.

Dust Filter for Dell Precision 3431 Small Form Factor

The dust filter for the Dell Precision 3431 Small Form Factor helps protect the system from fine dust particles. After installation of the dust filter, the BIOS can be enabled to generate a preboot reminder to clean or replace the dust filter based on the time interval set. Follow these steps to install the dust filter:

- 1 Align the plastic tabs of the dust filter to the slots on the system chassis and gently press to ensure that the dust filter fits firmly onto the system.



- 2 To remove the dust filter:
 - a With the help of a plastic scribe, gently pry the edge from the bottom to loosen the dust filter [1].
 - b Remove the dust filter from the system chassis [2].



- 3 Restart the system and press **F2** to enter the BIOS Setup menu.
- 4 In the BIOS Setup menu, navigate to **System Configuration > Dust Filter Maintenance** and select from any of the following intervals: 15, 30, 60, 90, 120, 150, or 180 days.

NOTE: Default setting: Disabled.

NOTE: Alerts are generated only during a system reboot and not during normal OS operation.

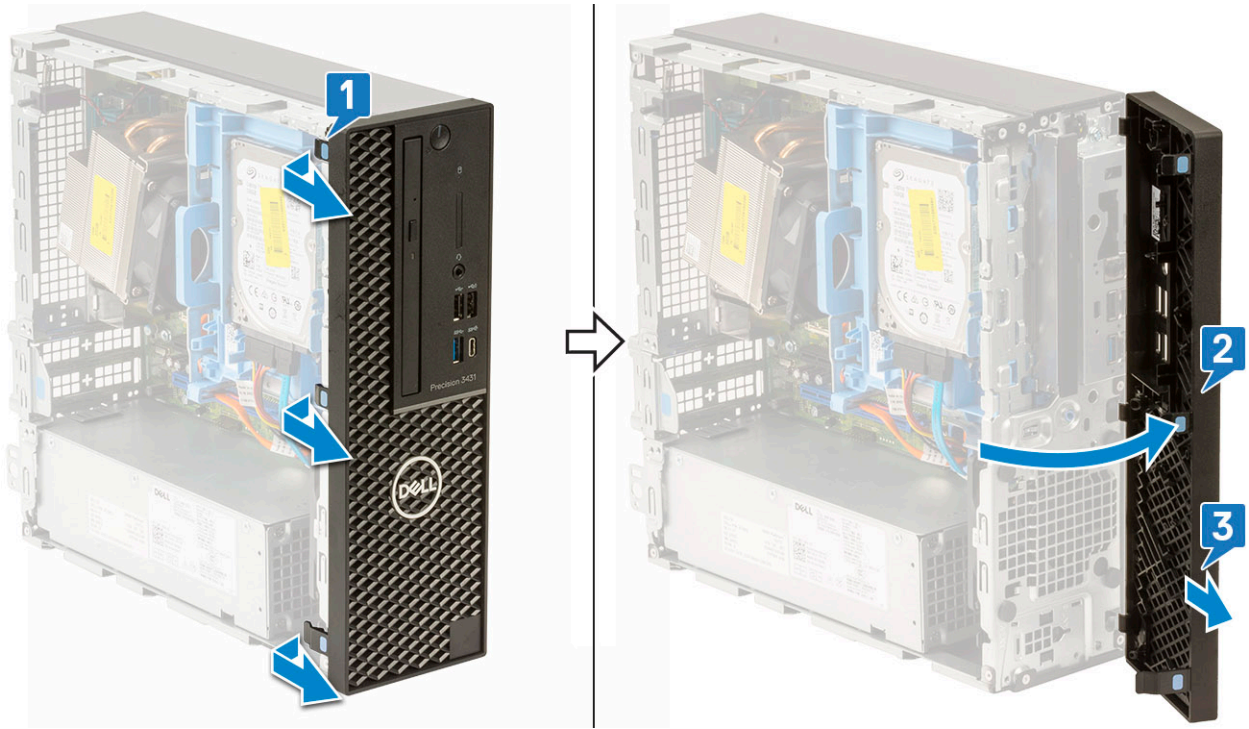
To clean the dust filter, brush or gently vacuum and then wipe down the external surfaces with a moist cloth.

Installing the USB Type-C card

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the side cover:
 - a Slide the release latch on the back panel of your system until it gives a click sound to unlock the side cover [1].
 - b Slide and lift the side cover from the system [2].

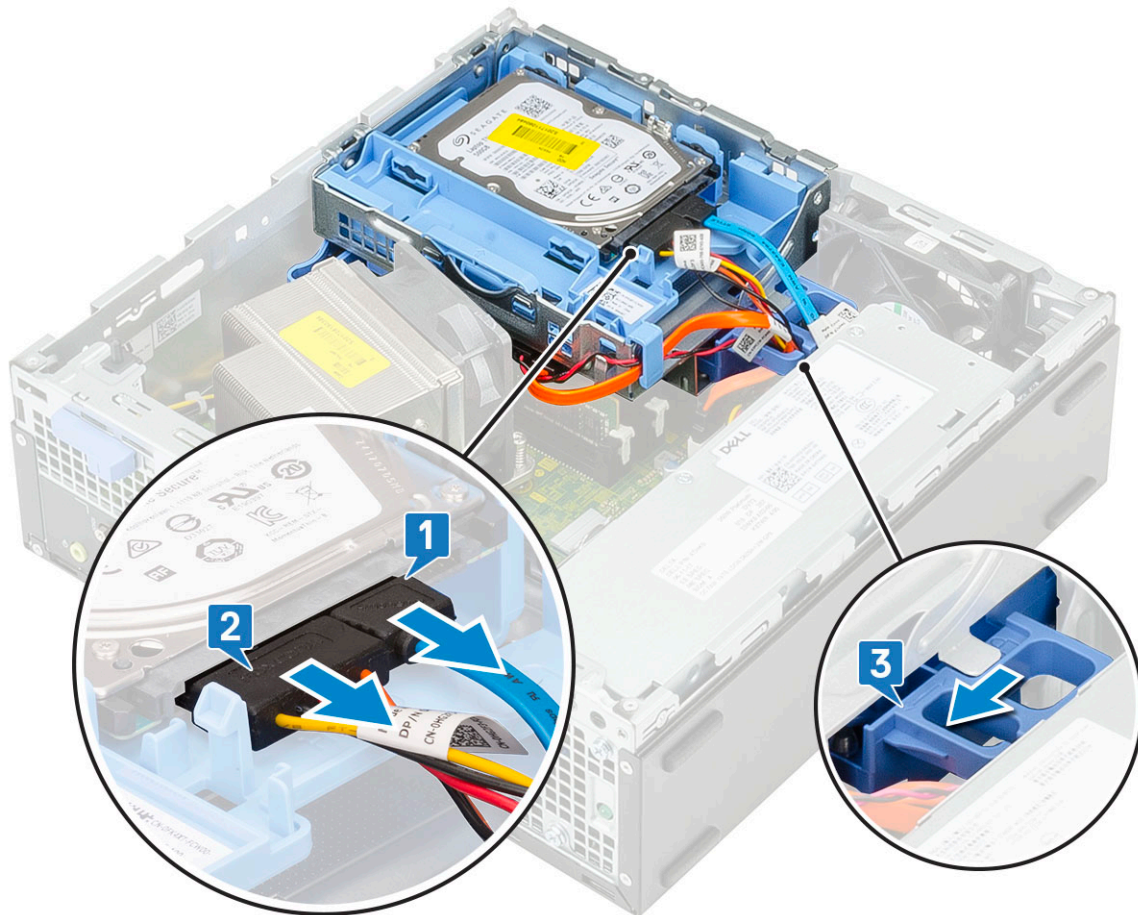


- 3 Remove the front bezel:
 - a Pry the retention tabs to release the front bezel from the system [1] and pull to release the hooks on the front bezel from the front-panel slots [2].
 - b Remove the front bezel from the system [3].



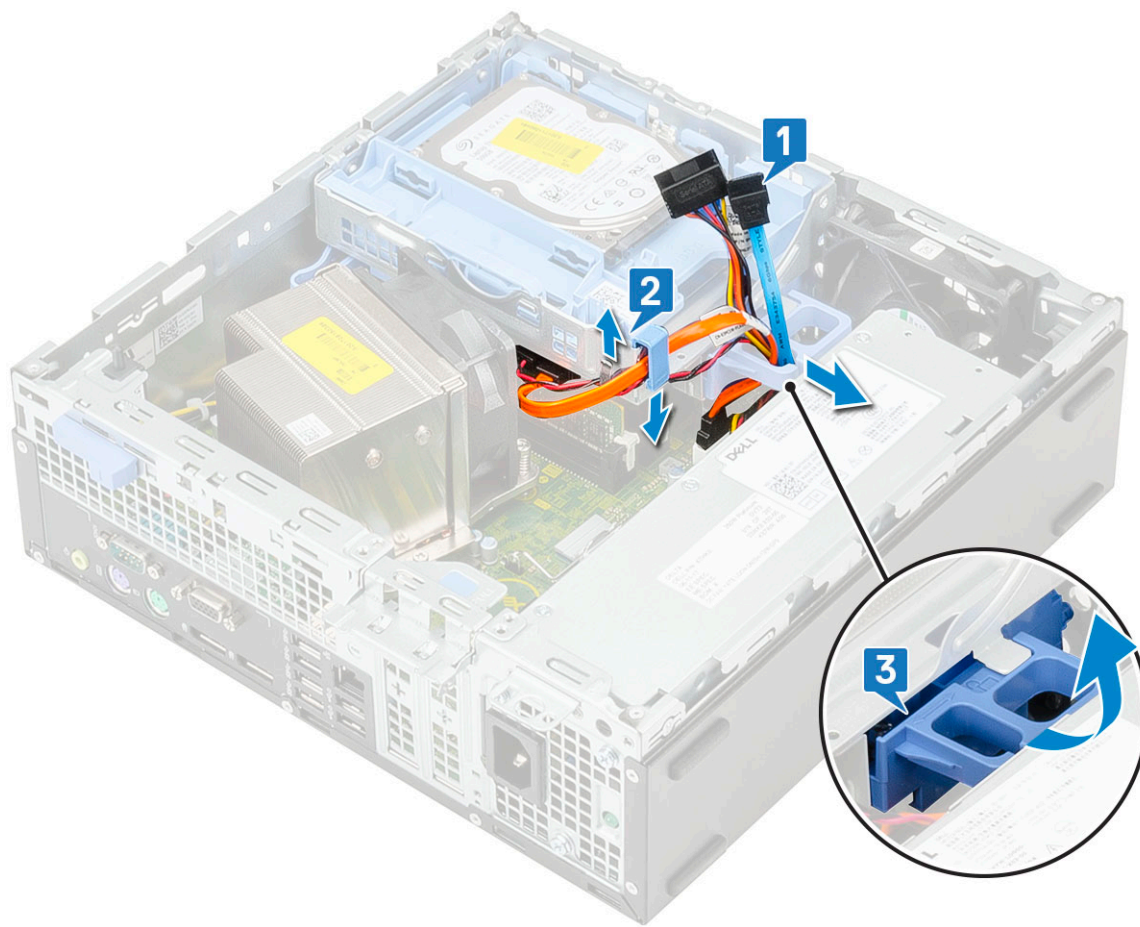
4 Release the hard drive and optical drive module:

- a Disconnect the hard drive data cable and power cable from the connectors on the hard drive [1, 2].
- b Slide the release tab to unlock the hard drive and optical module [3].

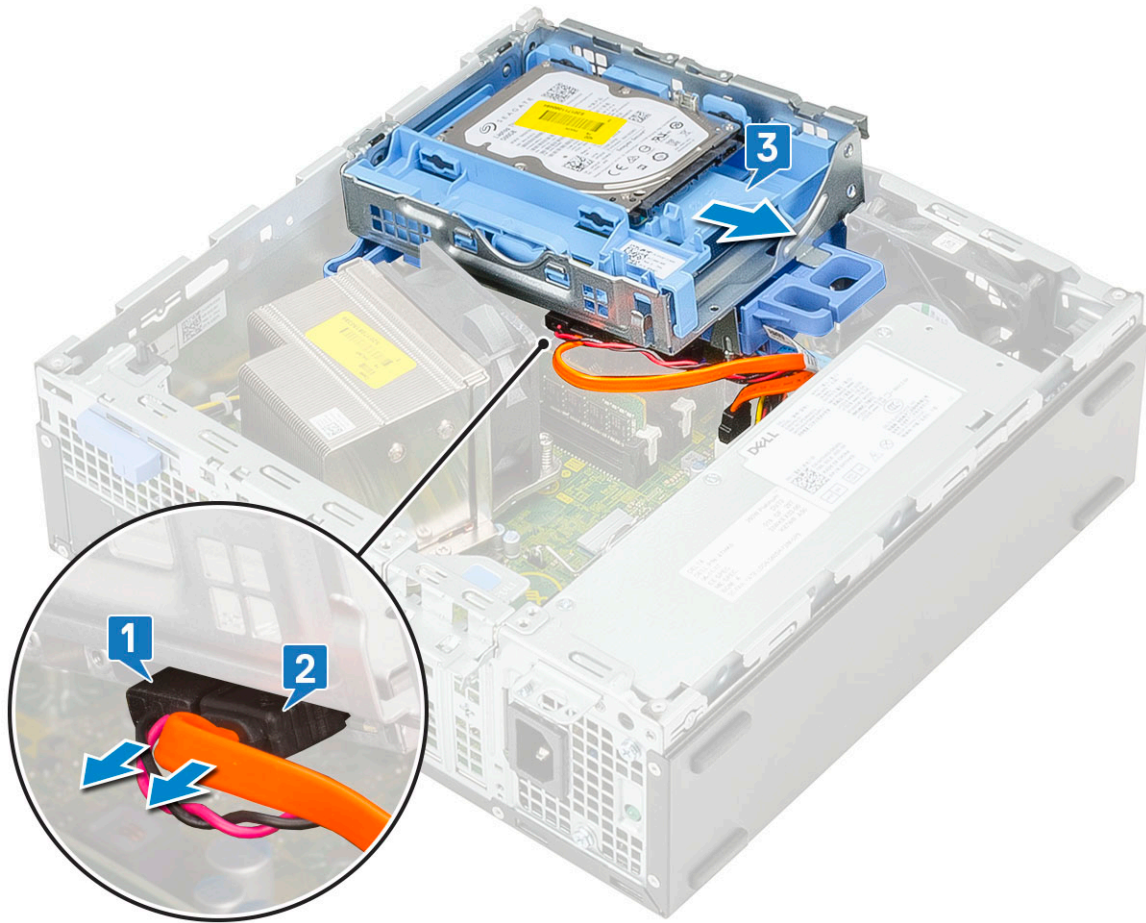


- c Unroute the hard drive cables [1] and optical drive cables [2] through the retention clip and HDD-ODD release tab respectively.

- d Lift the hard drive and optical module [3]



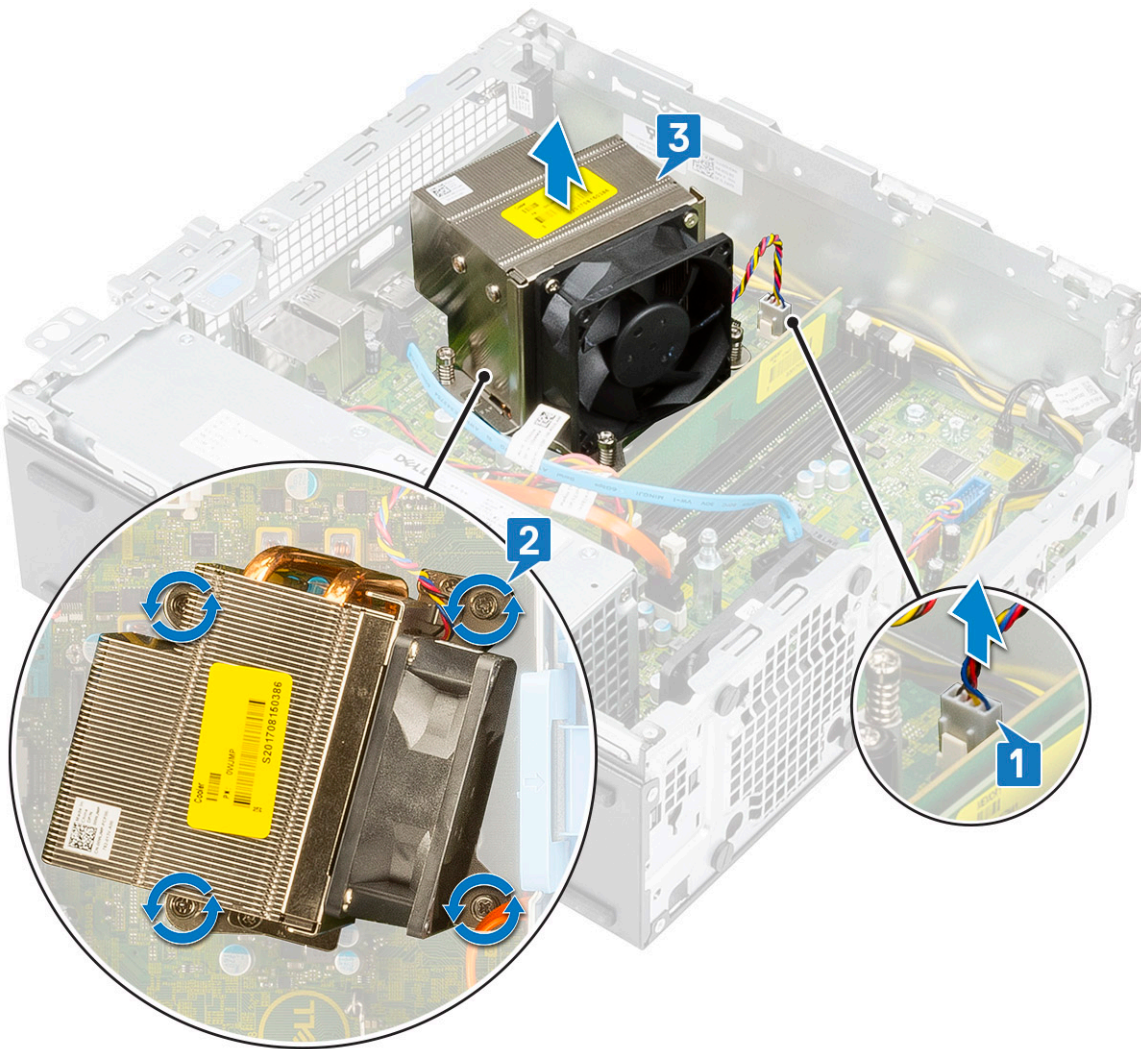
- 5 Remove the hard drive and optical drive module:
- a Disconnect the optical drive data cable and optical drive power cable from the connectors on the optical drive [1, 2].
 - b Slide and lift the hard drive and optical drive module from the system [3].



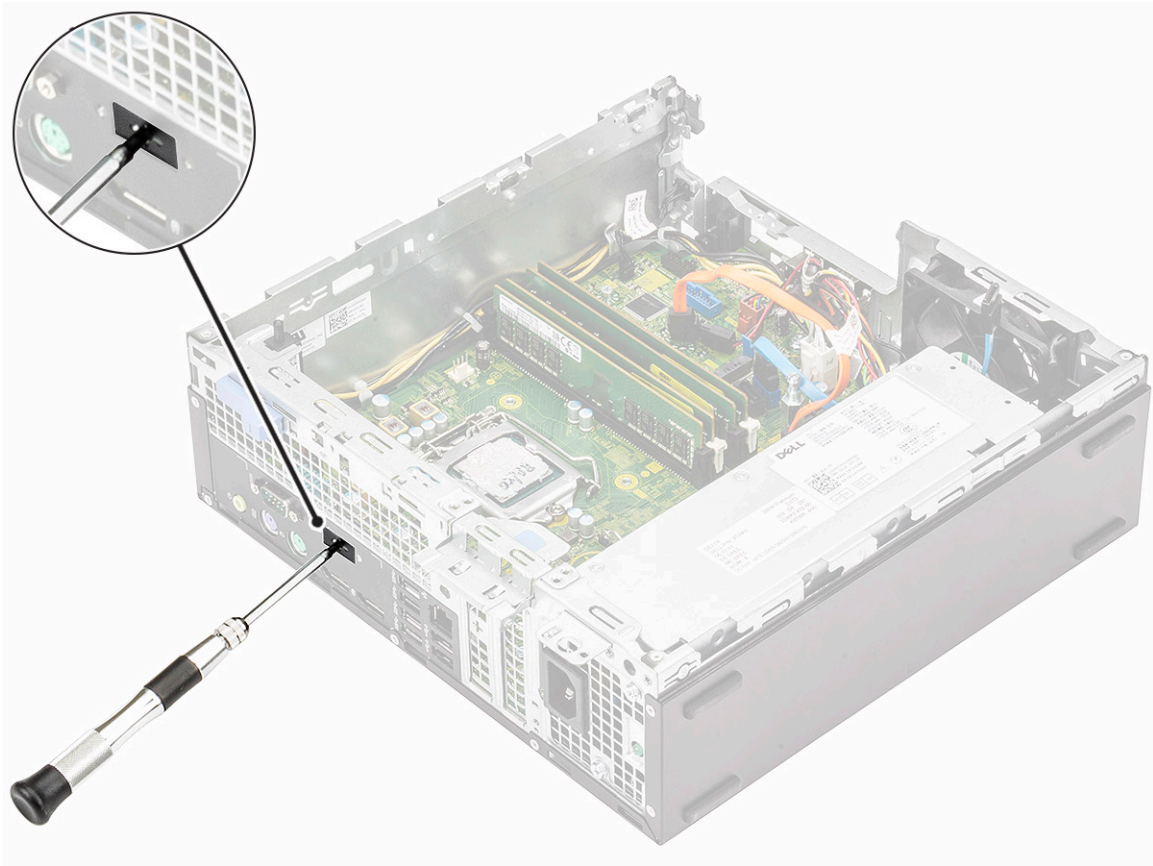
6 Remove the heat sink with fan:

- a Disconnect the heat sink fan cable from the system board [1].
- b Loosen the four captive screws that secure the heat sink [2] and lift it away from the system [3].

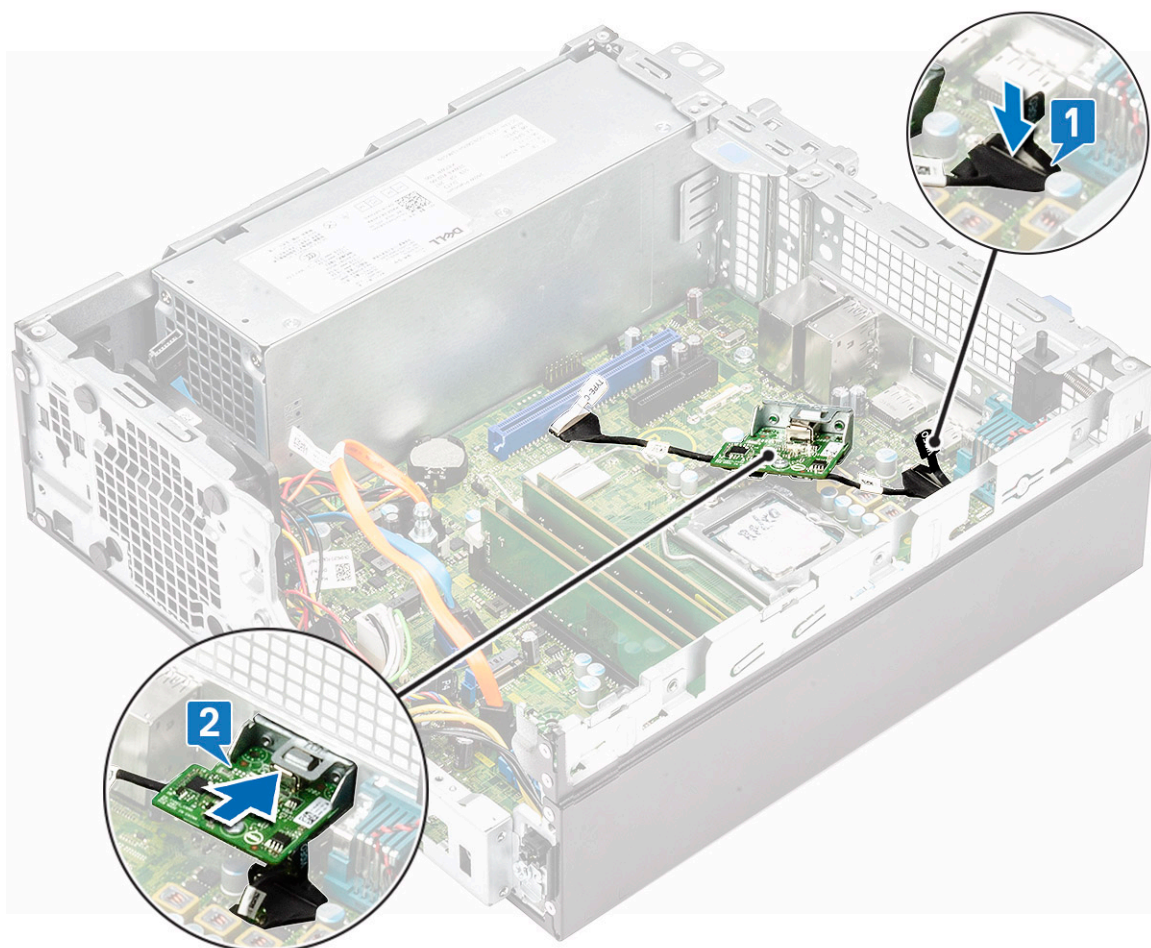
① **NOTE:** Loosen the screws in a sequential order (1,2,3,4) as mentioned on the system board.



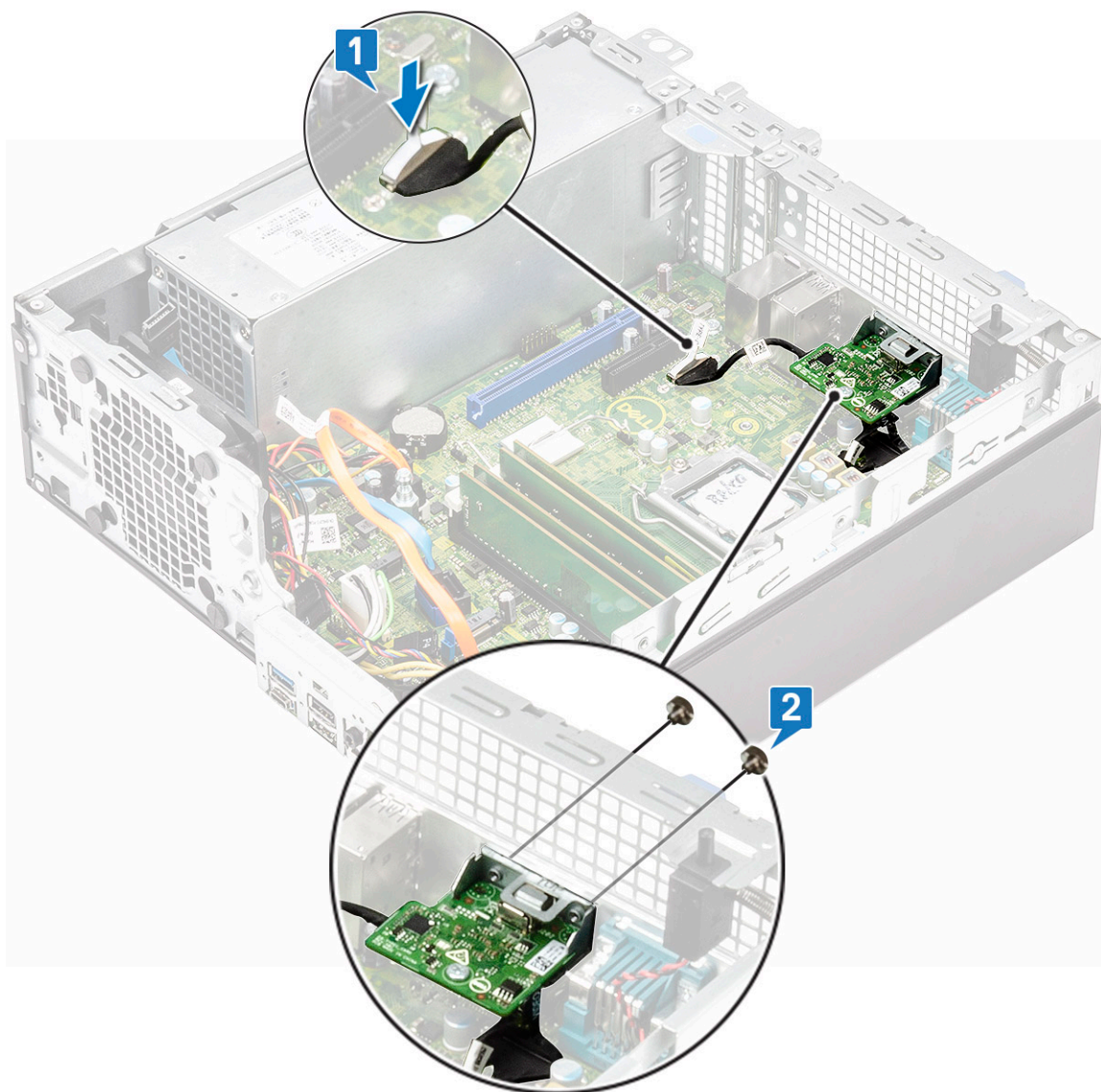
- 7 To install the USB Type-C card:
- a Remove the filler using a philips screwdriver.



- b Connect the USB Type-C card cable to the connector on the system board [1].
- c Align and place the USB Type-C card into the slot on the system chassis [2].



- d Connect the USB Type-C card cable to the connector on the system board [1].
- e Fasten the two screws to secure the USB Type-C card to the system chassis [2].

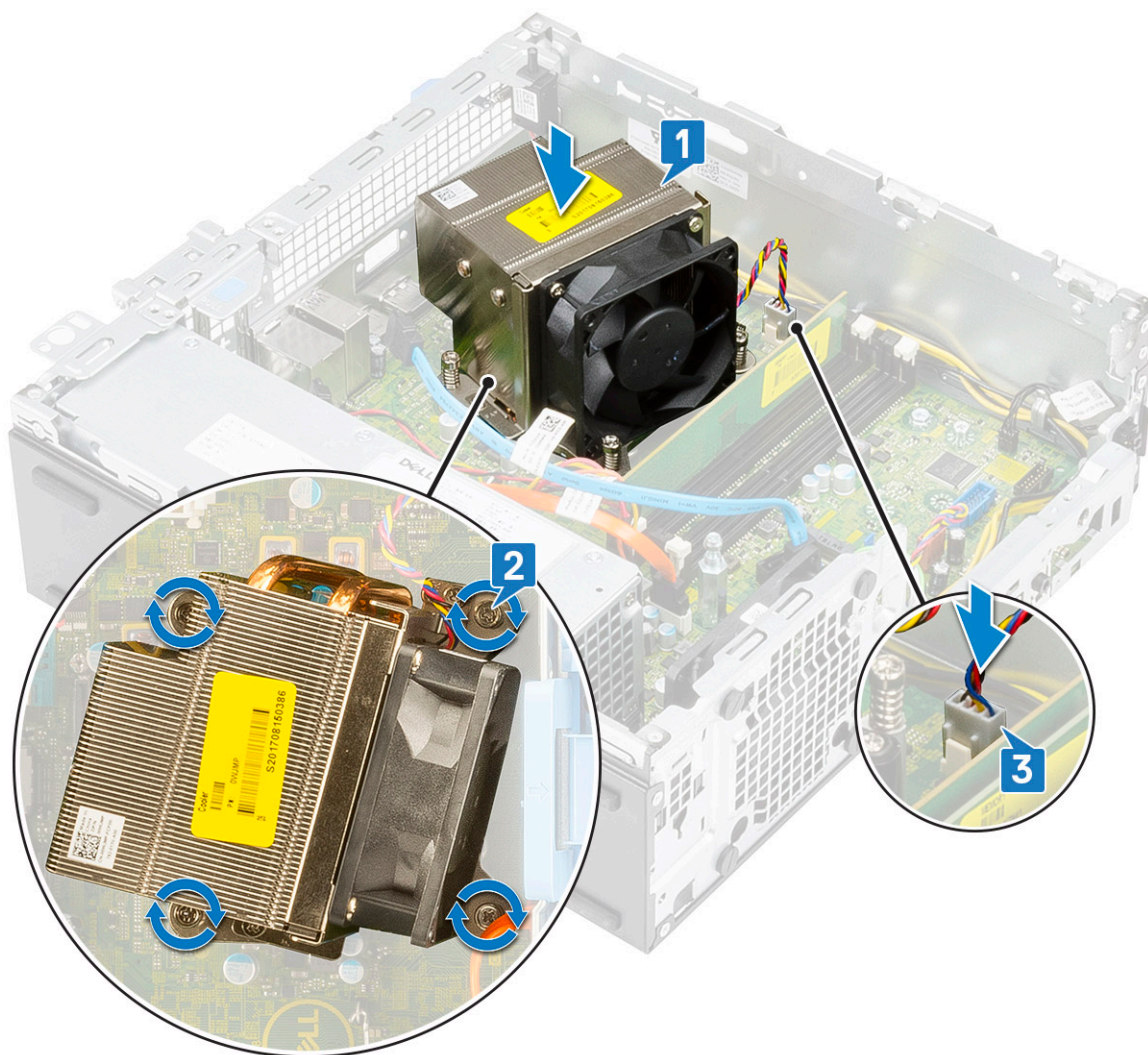


8 To install the heat sink:

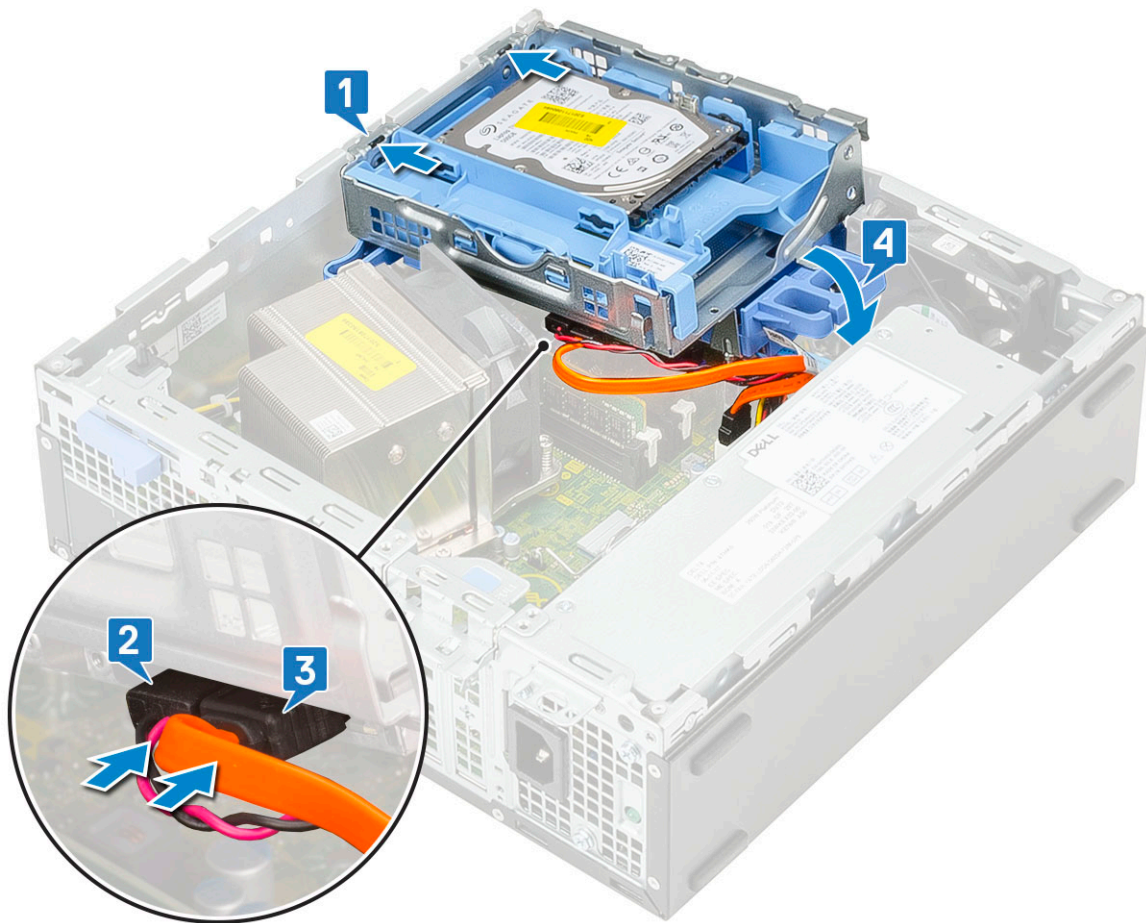
- a Align the heat sink onto the processor [1].
- b Tighten the four captive screws to secure the heat sink assembly to the system board [2].

NOTE: Tighten the screws in a sequential order (1,2,3,4) as mentioned on the system board.

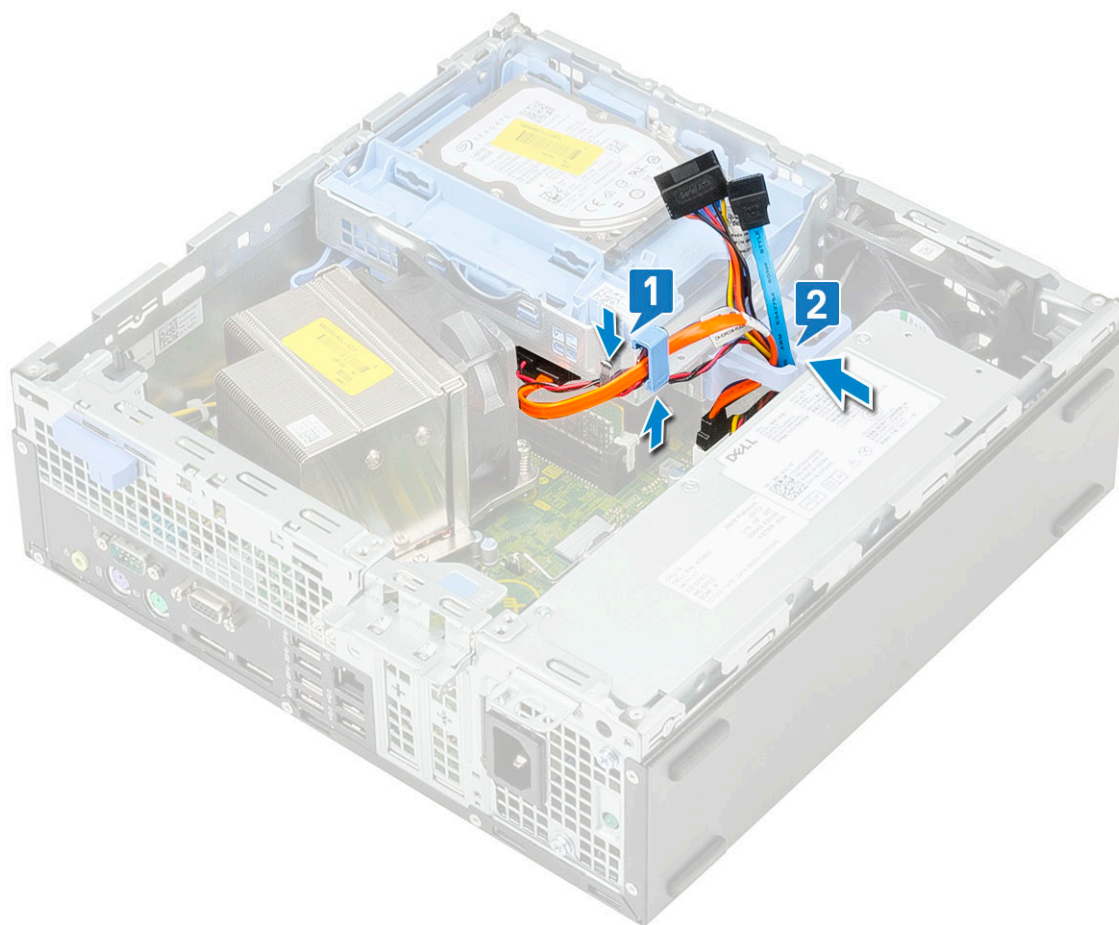
- c Connect the heat sink fan cable to the slot on the system board [3].



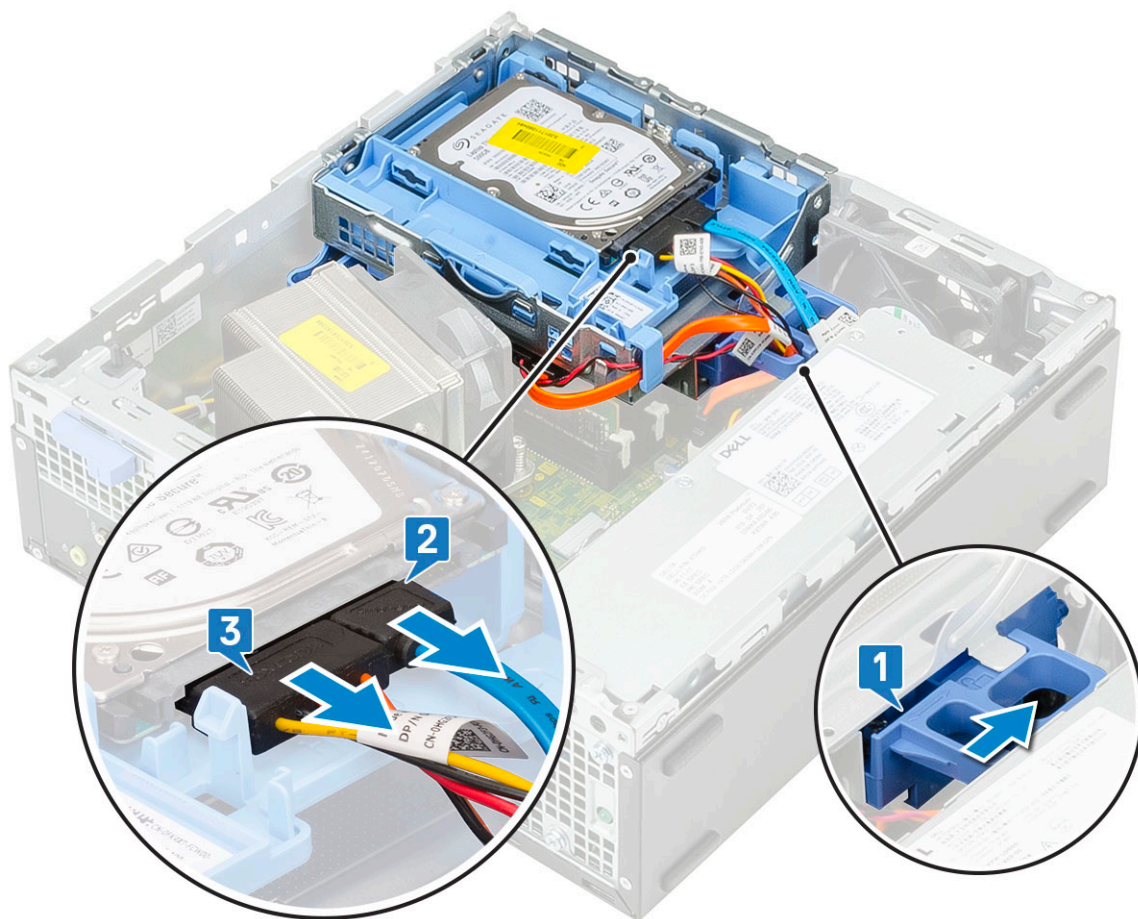
- 9 To install the hard drive and optical drive module:
- Insert the tabs on the hard drive and optical drive module into the slot on the system at a 30-degree angle [1].
 - Connect the optical drive data cable and power cable to the connectors on the optical drive [2, 3].
 - Lower the hard drive and optical drive module so that it is placed in its slot [4].



- d Route the optical drive data cable and power cable through the retention clips [1].
- e Route the hard drive data and power cables through the HDD-ODD release tab [2].



- f Slide the release tab to lock the module [1].
- g Connect the hard drive data cable and power cable from the connectors on the hard drive [2, 3].



- 10 To install the front bezel:
- a Align the bezel, and insert the retention tabs on the bezel into the slots on the system.
 - b Press the bezel until the tabs clicks into place.



- 11 To install the side cover:
- a Place the cover on the system and slide the cover until it clicks into place.
 - b The release latch automatically locks the side cover to the system.

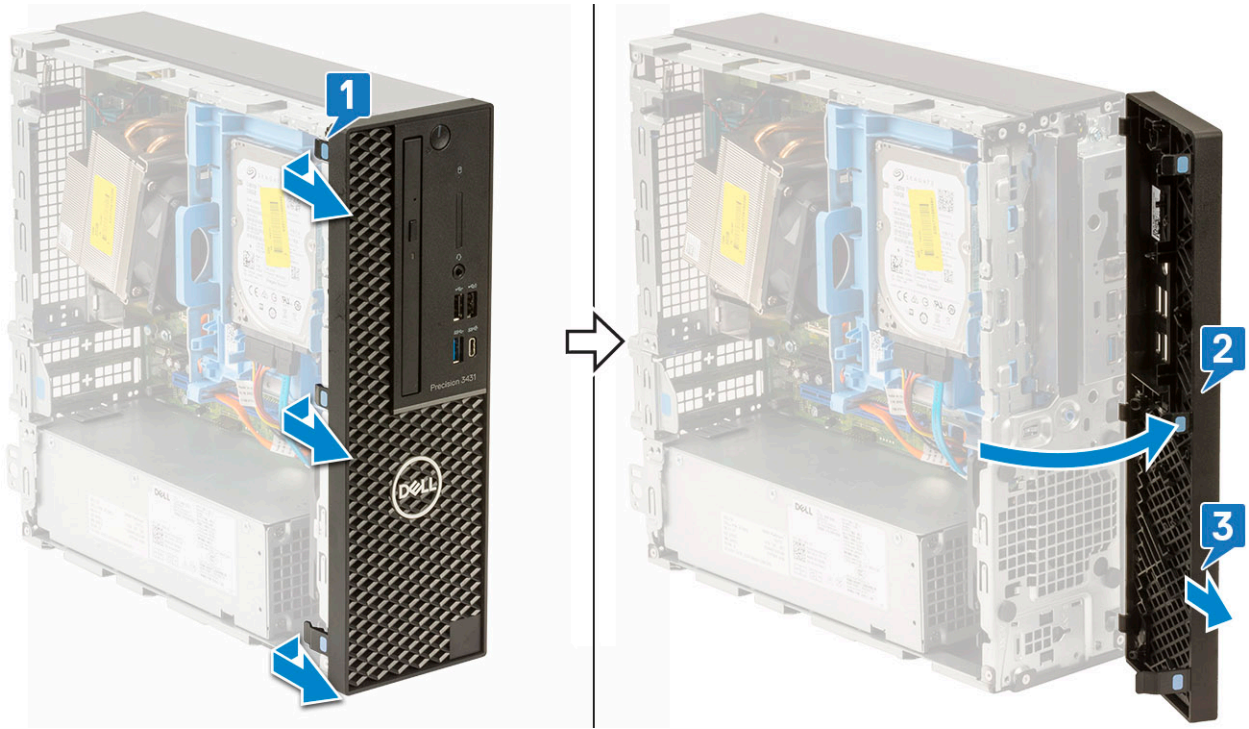


Installing the VGA card

- 1 Follow the procedure in [Before working inside your computer](#).
- 2 Remove the side cover:
 - a Slide the release latch on the back panel of your system until it gives a click sound to unlock the side cover [1].
 - b Slide and lift the side cover from the system [2].

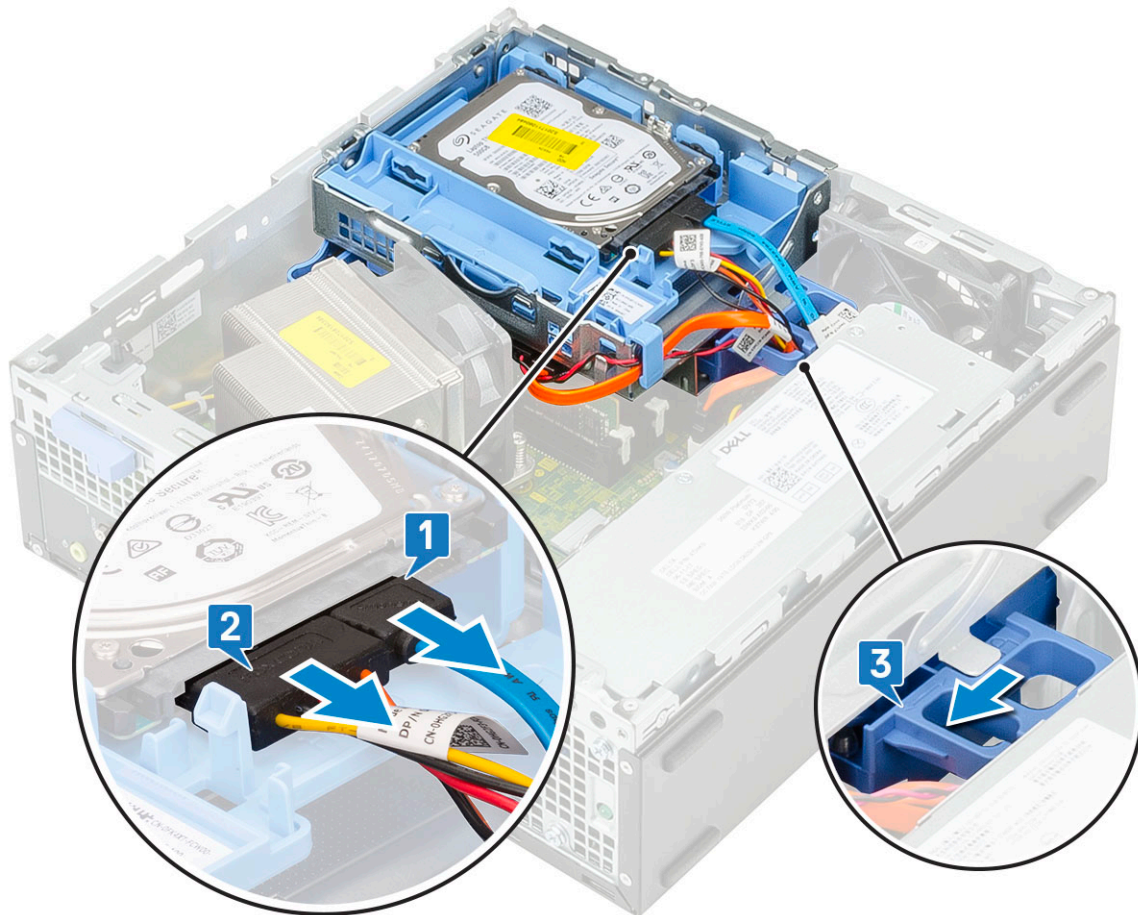


- 3 Remove the front bezel:
 - a Pry the retention tabs to release the front bezel from the system [1] and pull to release the hooks on the front bezel from the front-panel slots [2].
 - b Remove the front bezel from the system [3].



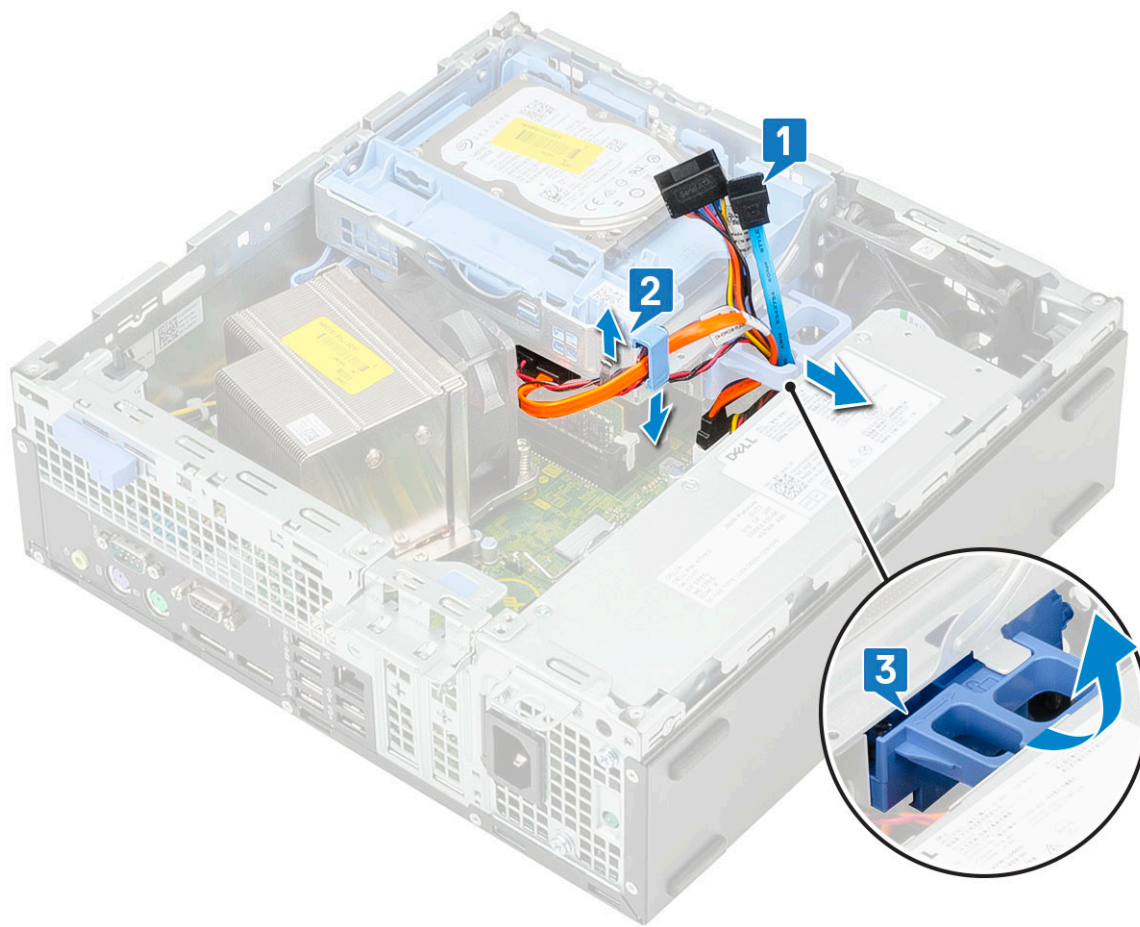
4 Release the hard drive and optical drive module:

- a Disconnect the hard drive data cable and power cable from the connectors on the hard drive [1, 2].
- b Slide the release tab to unlock the hard drive and optical module [3].



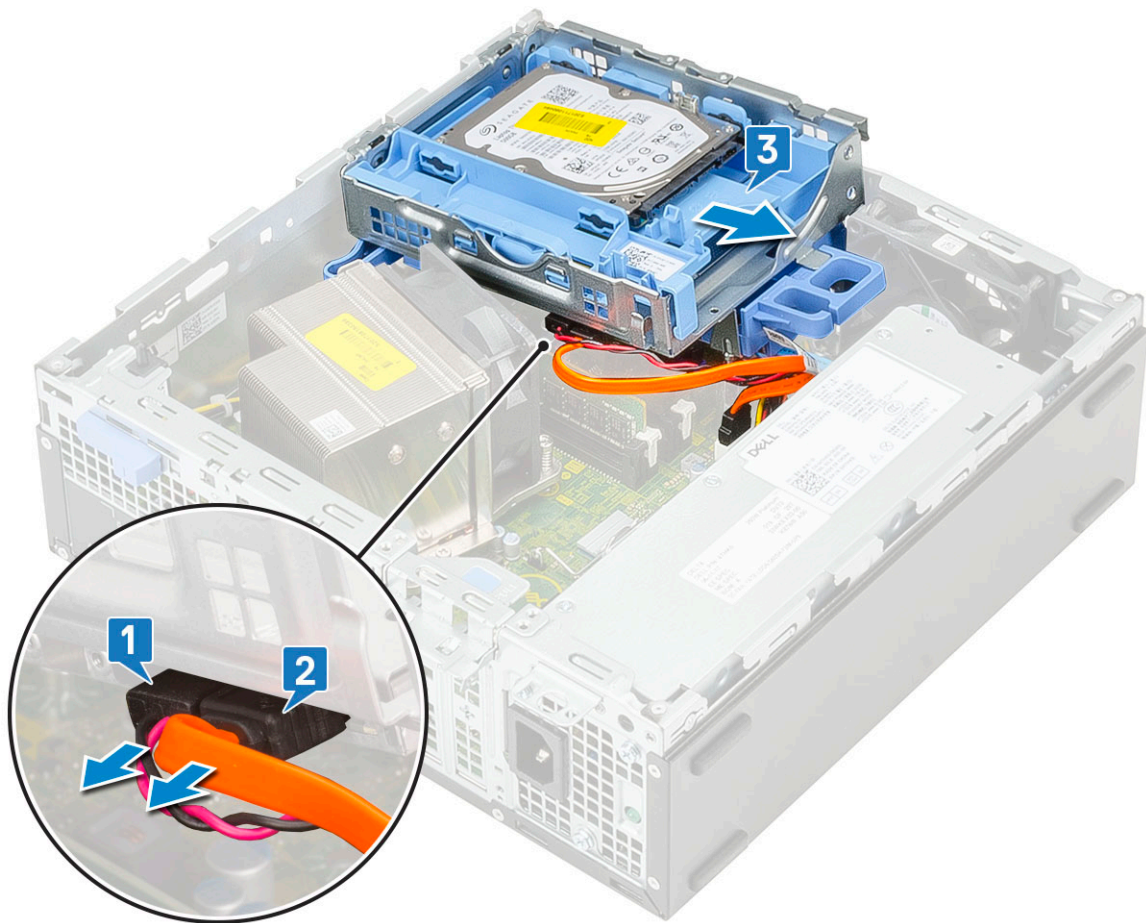
- c Unroute the hard drive cables [1] and optical drive cables [2] through the retention clip and HDD-ODD release tab respectively.

d Lift the hard drive and optical module [3]



5 Remove the hard drive and optical drive module:

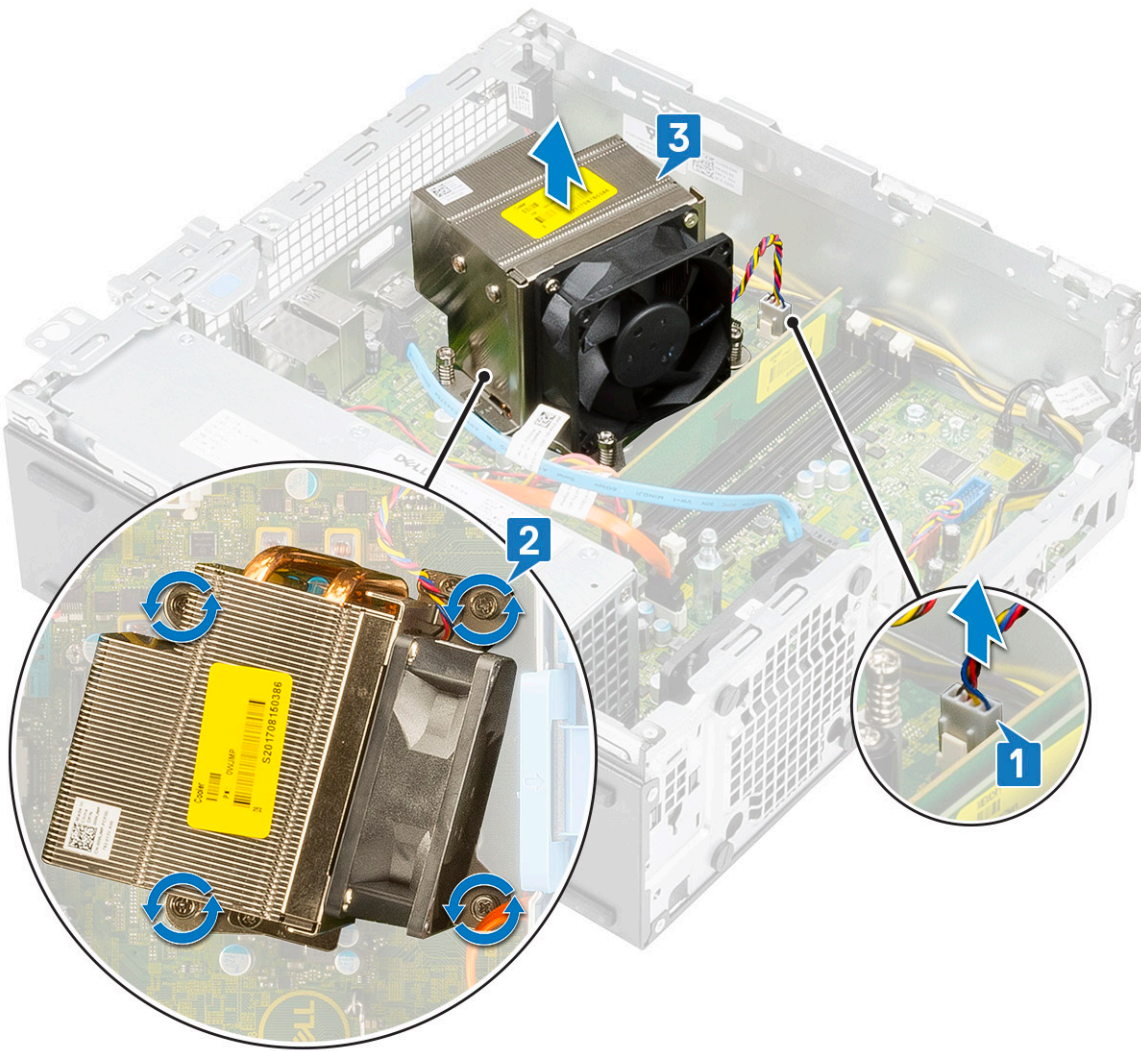
- a Disconnect the optical drive data cable and optical drive power cable from the connectors on the optical drive [1, 2].
- b Slide and lift the hard drive and optical drive module from the system [3].



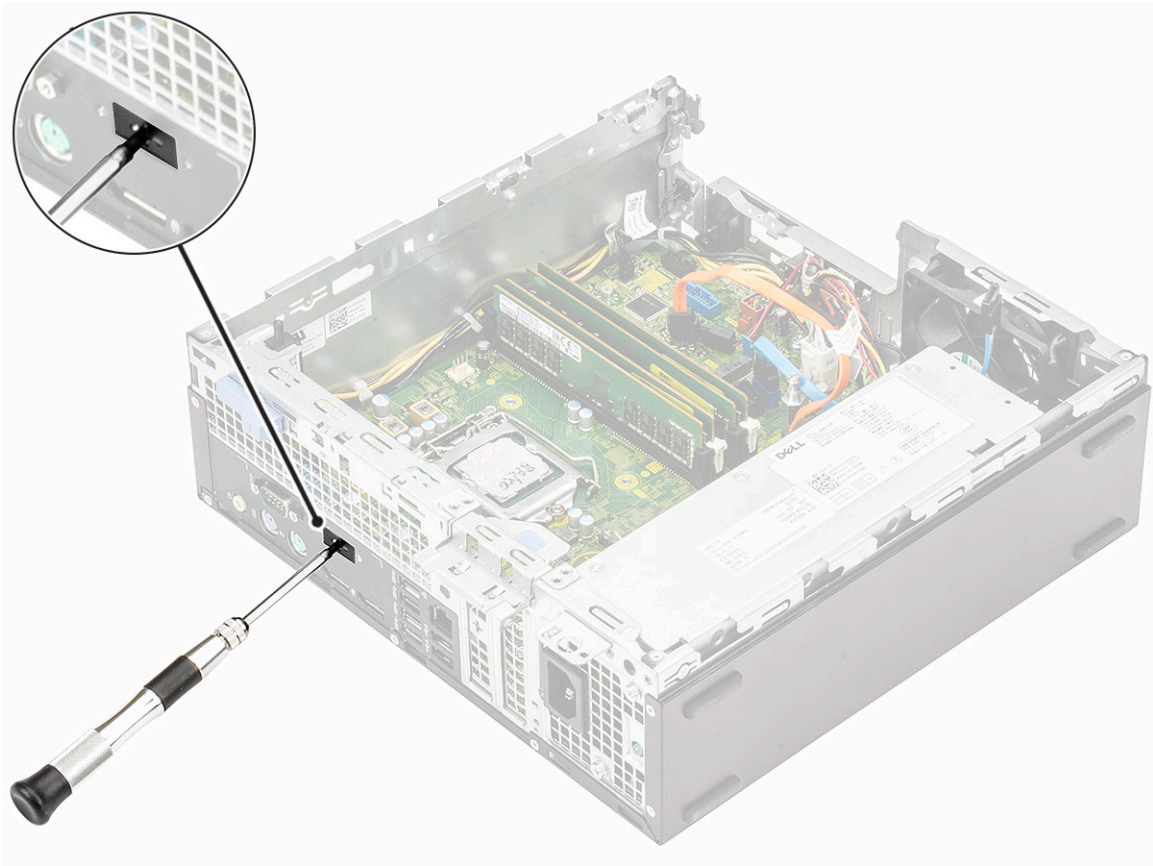
6 Remove the heat sink with fan:

- a Disconnect the heat sink fan cable from the system board [1].
- b Loosen the 4 captive screws that secure the heat sink [2] and lift it away from the system [3].

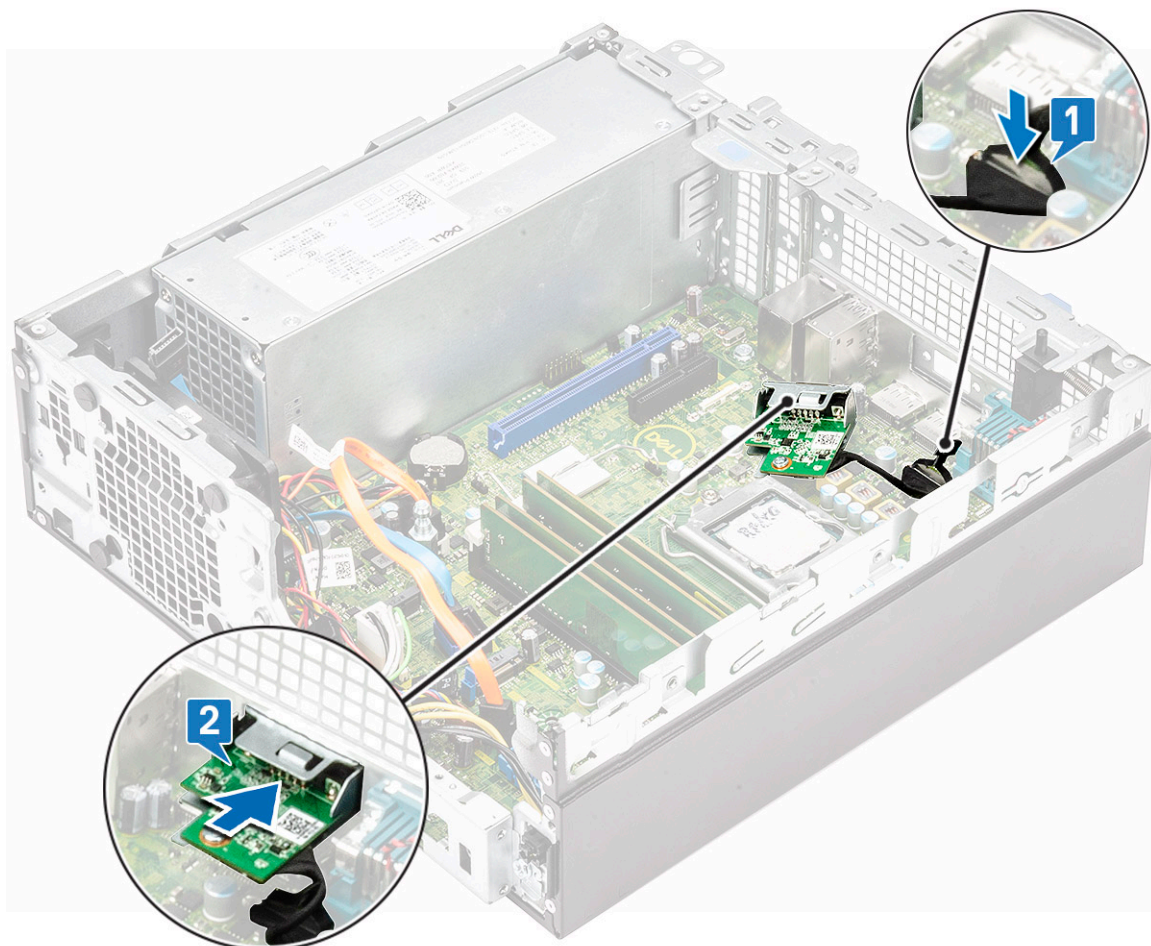
① **NOTE:** Loosen the screws in a sequential order (1,2,3,4) as mentioned on the system board.



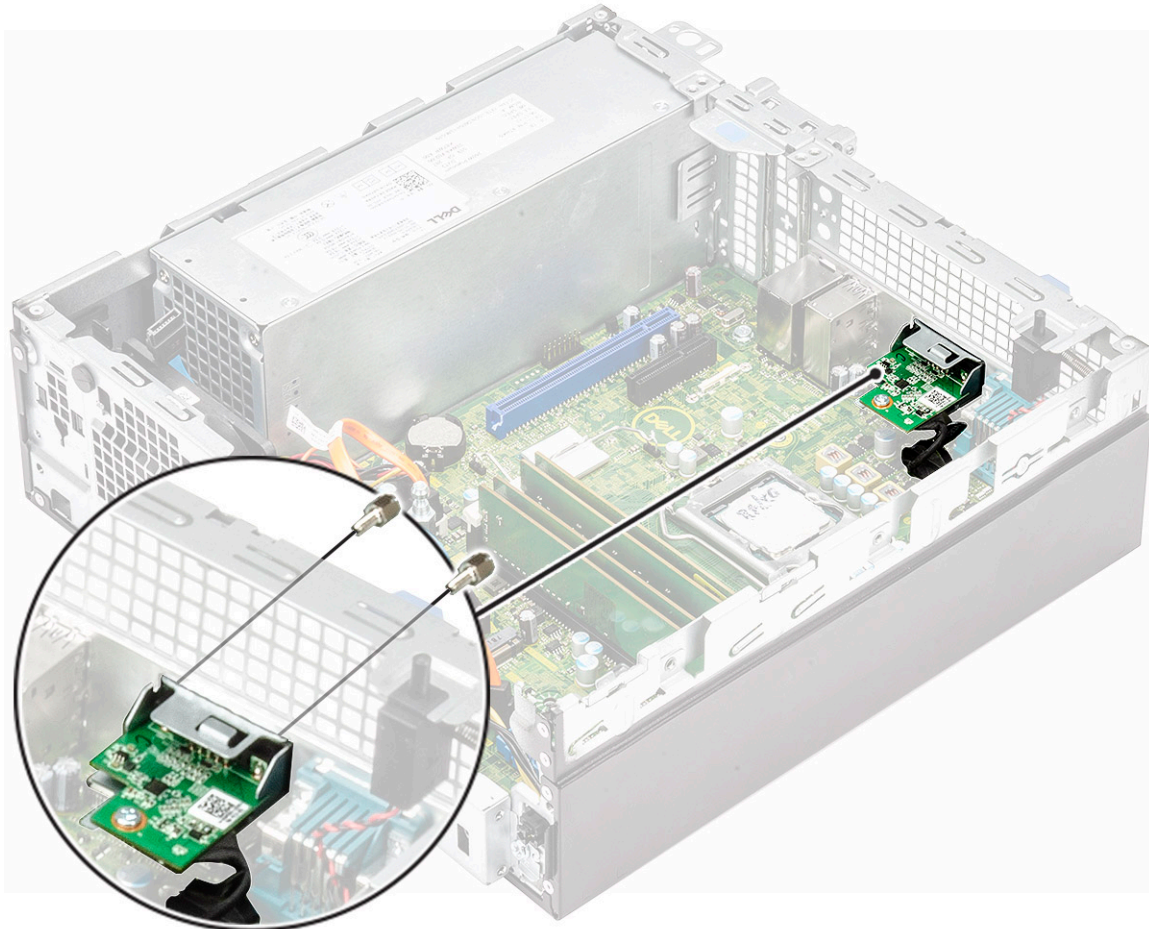
- 7 To install the VGA card:
- a Remove the filler using a philips screwdriver .



- b Connect the VGA card cable to the connector on the system board [1].
- c Align and place the VGA card into the slot on the system chassis [2].



- d Fasten the two screws to secure the VGA card to the system chassis [1].

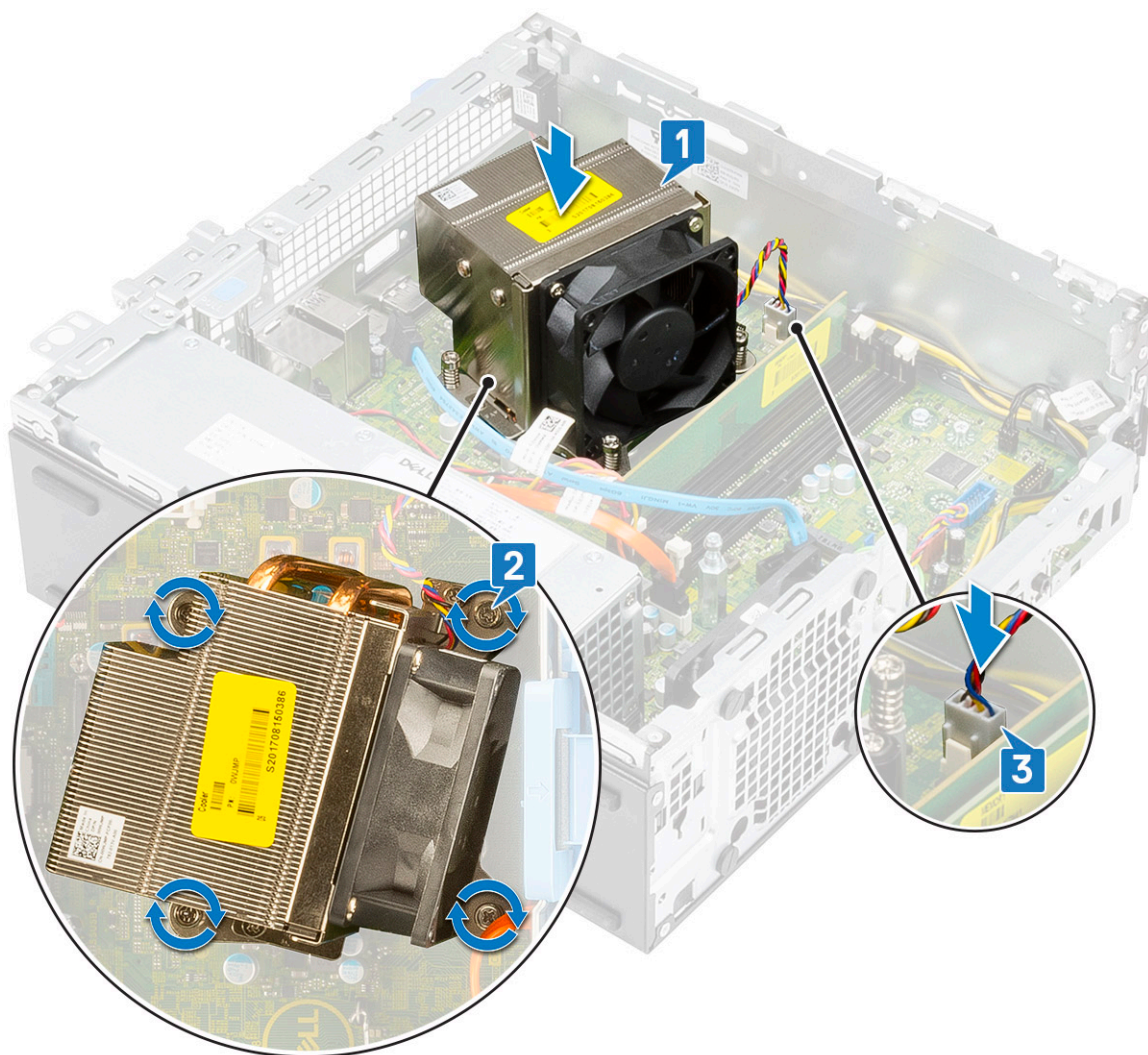


8 To install the heat sink:

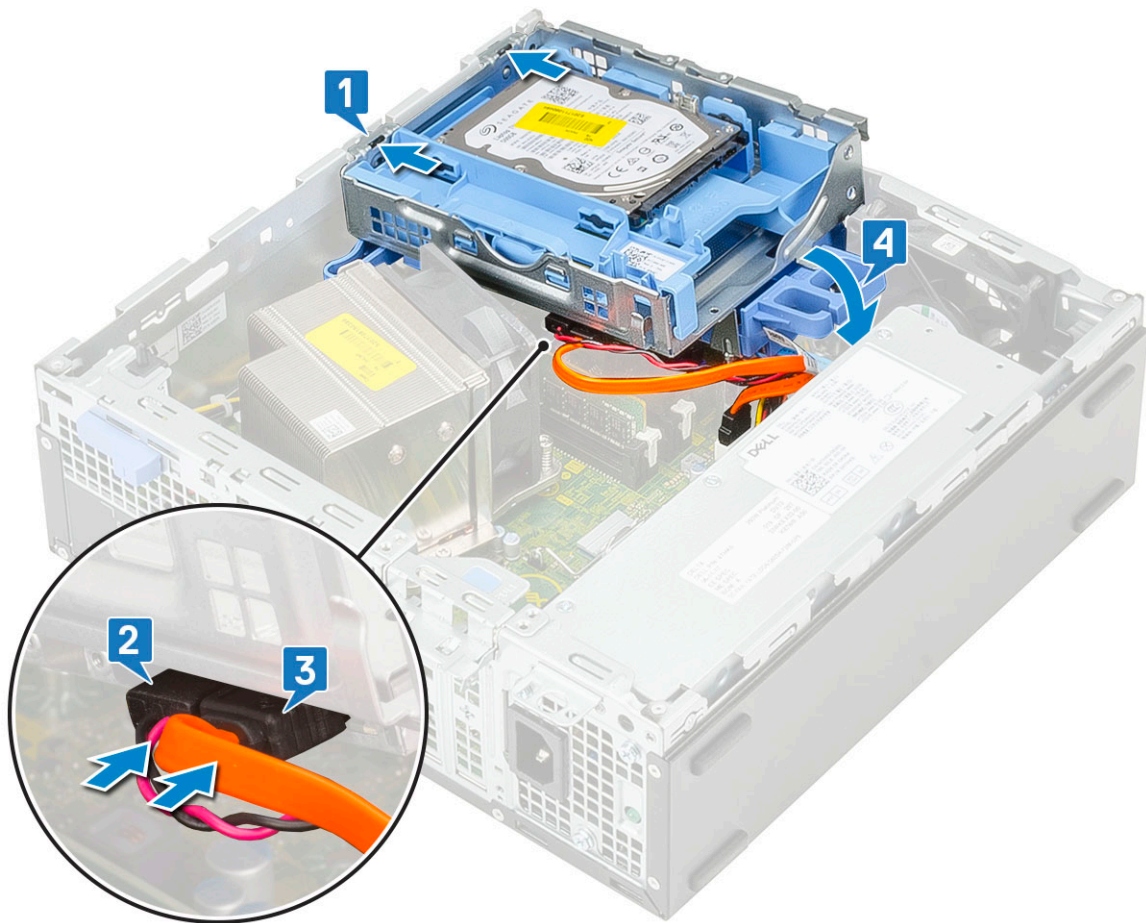
- a Align the heat sink onto the processor [1].
- b Tighten the four captive screws to secure the heat sink assembly to the system board [2].

NOTE: Tighten the screws in a sequential order (1,2,3,4) as mentioned on the system board.

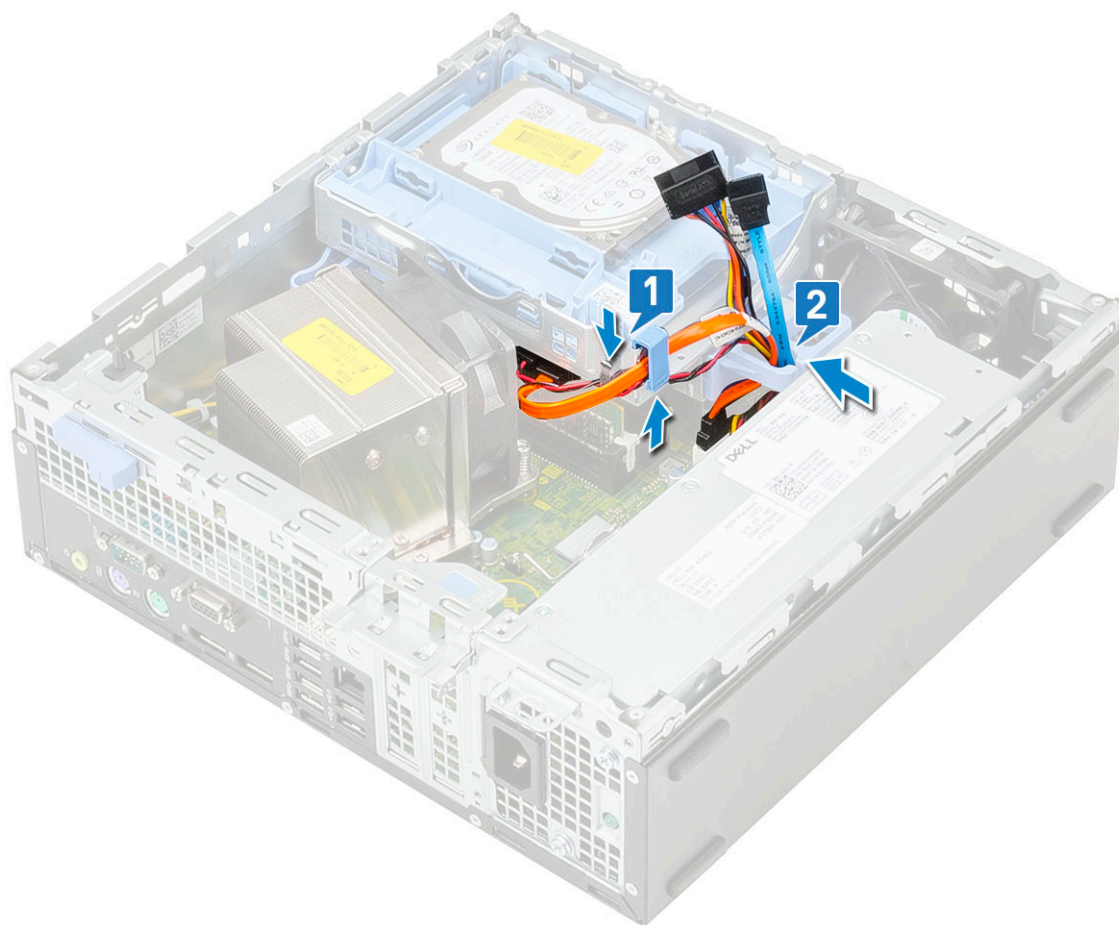
- c Connect the heat sink fan cable to the slot on the system board [3].



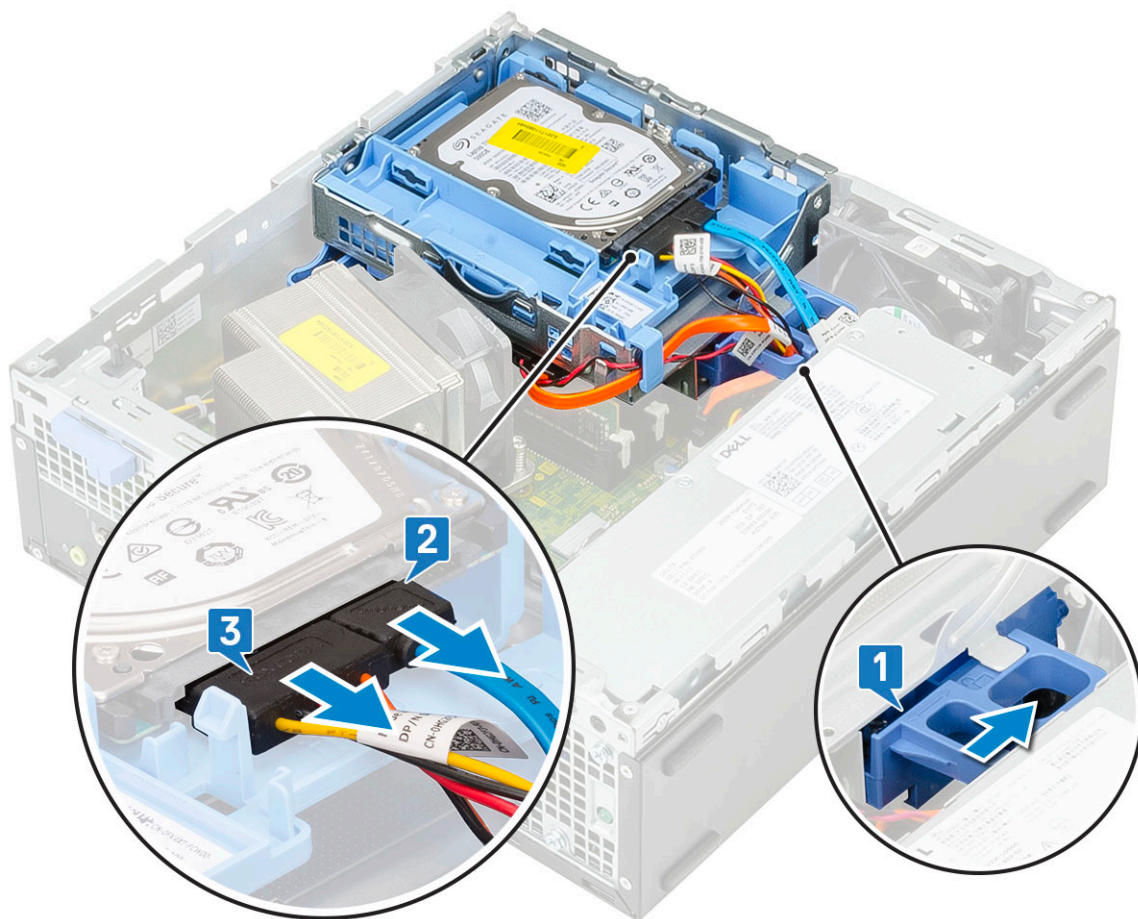
- 9 To install the hard drive and optical drive module:
- Insert the tabs on the hard drive and optical drive module into the slot on the system at a 30-degree angle [1].
 - Connect the optical drive data cable and power cable to the connectors on the optical drive [2, 3].
 - Lower the hard drive and optical drive module so that it is placed in its slot [4].



- d Route the optical drive data cable and power cable through the retention clips [1].
- e Route the hard drive data and power cables through the HDD-ODD release tab [2].



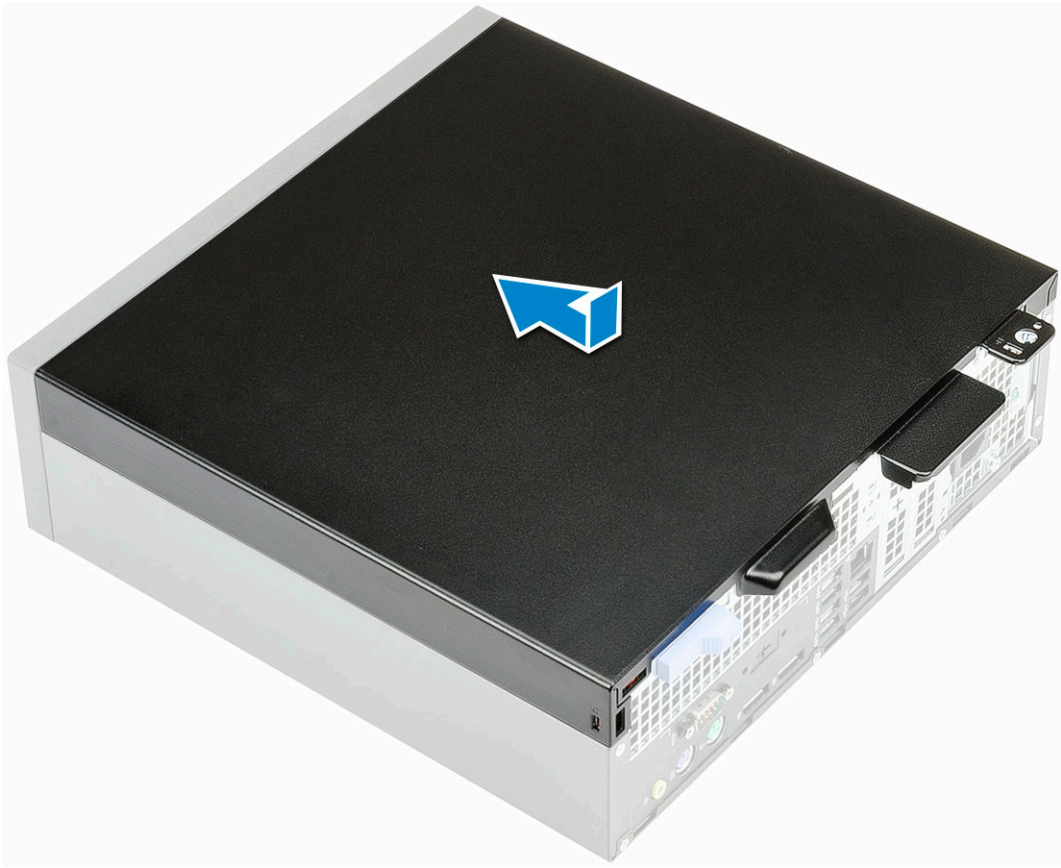
- f Slide the release tab to lock the module [1].
- g Connect the hard drive data cable and power cable from the connectors on the hard drive [2, 3].



- 10 To install the front bezel:
- a Align the bezel, and insert the retention tabs on the bezel into the slots on the system.
 - b Press the bezel until the tabs clicks into place.



- 11 To install the side cover:
- a Place the cover on the system and slide the cover until it clicks into place.
 - b The release latch automatically locks the side cover to the system.

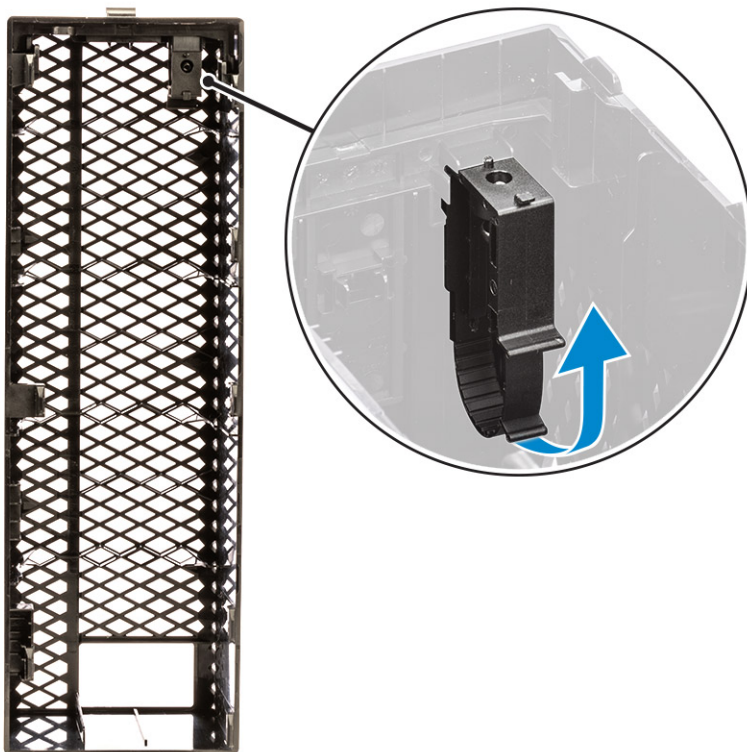


Cable cover for Dell Precision 3431 Small Form Factor

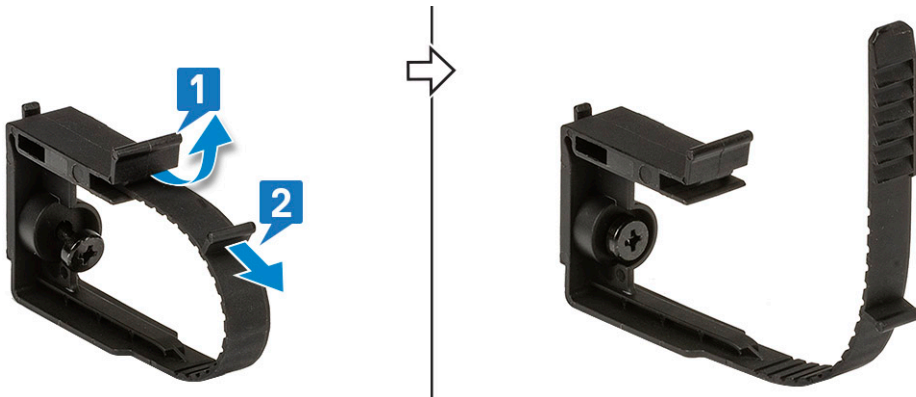
The cable cover for a Dell Precision 3431 Small Form Factor helps protect ports and cables connected to the system. Follow these steps to install the cable cover on the system chassis.

NOTE: Images shown below are for representation only and may vary depending on the system's configuration.

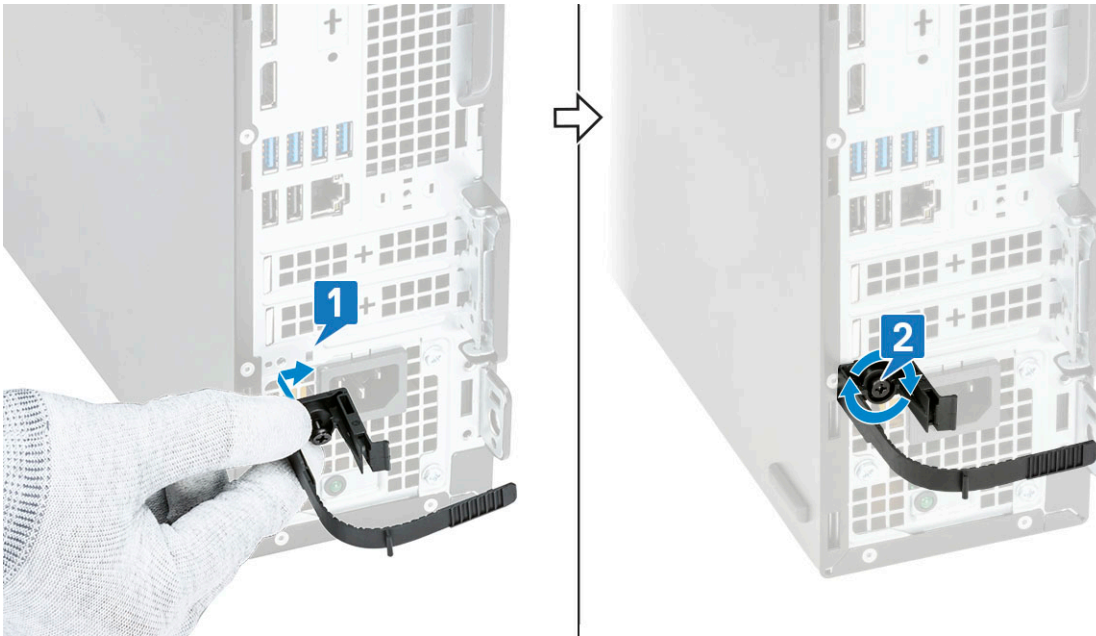
- 1 Slide the latch away from the chassis to unlock the cable cover.
- 2 Pull the tab on the cable release latch and lift the latch away from the cable cover.



- 3 Lift the tab [1], to release and pull the cable tie from the slot on the cable release latch [2].

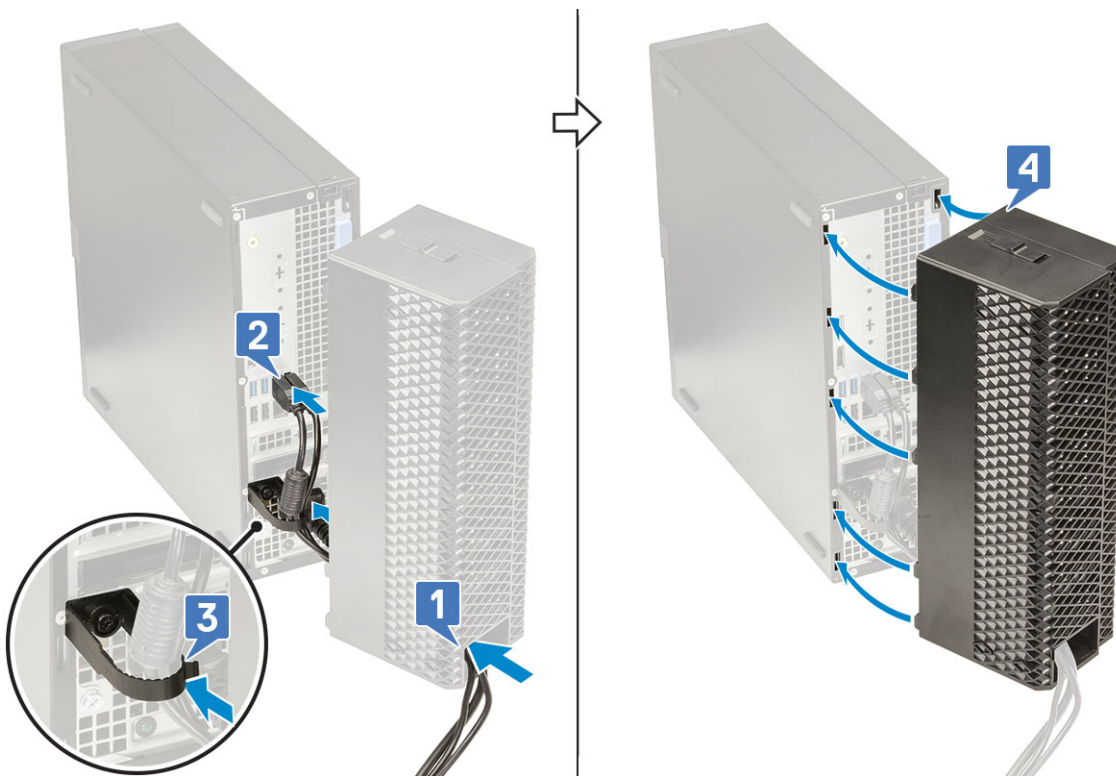


- 4 Align the cable release latch on the system chassis slot [1]. Tighten the single screw to secure the cable release latch to the system chassis [2].

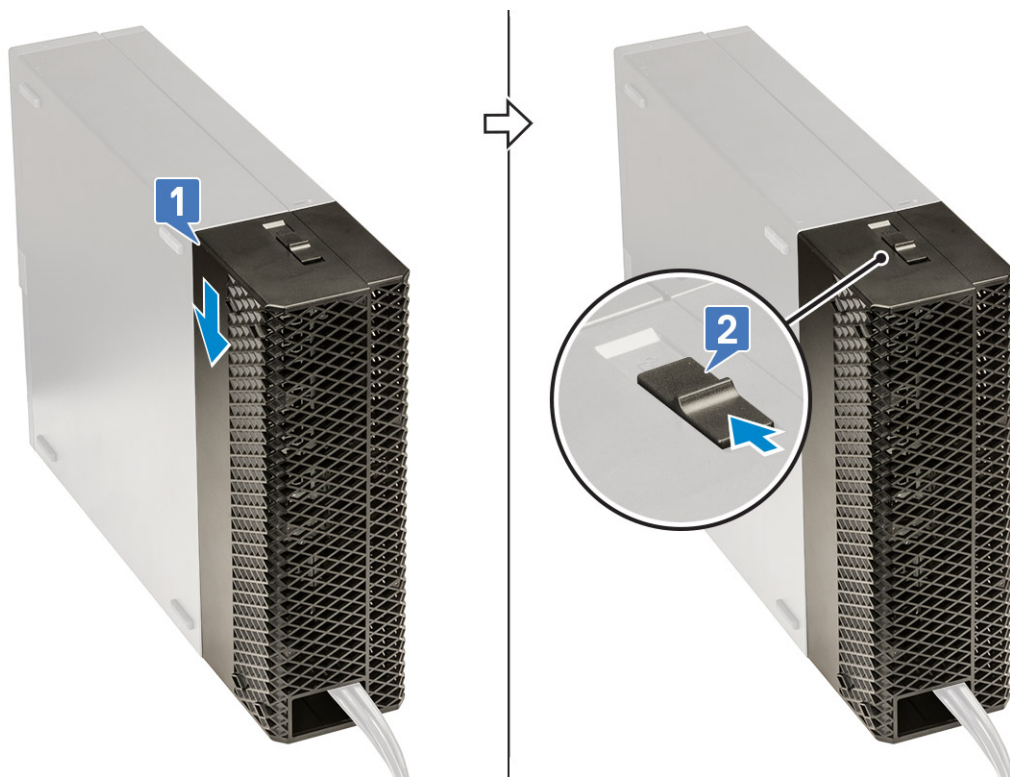


- 5 Route the cables through the slot of the cable cover [1], and connect them to their respective ports on the system (2). Secure the cable with the cable tie and lock the tab in place [3]. Align the plastic hooks of the cable cover to the slots on the system [4].

⚠ CAUTION: Take care not to break or bend the delicate plastic hooks.



- 6 Gently press down on the cable cover until it clicks into place (1). Slide the latch towards the chassis (2) to lock the cable cover in place.



① **NOTE:** For added security, use the Padlock ring to secure the system.

- 7 To remove the cable cover:
- Slide the latch away from the chassis to unlock the cable cover [1].
 - Lift the cable cover away from the system chassis [2].

