# LENOVO DIAGNOSTICS EVOLUTION V5.18.1 USER GUIDE

LSBD - Laboratório de Sistemas e Banco de Dados



# LENOVO DIAGNOSTICS EVOLUTION USER GUIDE

Title: Author: Date: Platform: Lenovo Diagnostics Evolution User Guide Carolina Vasconcelos Jan 13, 2025 Windows

# **REVISION HISTORY**

| Revision | Author                  | Revision History  | Date            |
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|     |             | Section  |             |
|     |             | <ul> <li>Not allowed characters in the</li> </ul>                              |             |
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|     |             | Memory Section   |             |
|     |             | <ul> <li>Mouse Device Module description</li> </ul>                            |             |
|     |             | on Mouse Devices Section   |             |
|     |             | <ul> <li>GPS Interactive Test image on</li> </ul>                              |             |
|     |             | Sensors Section  |             |
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|     |             | Section<br>Becognition Test images on  |             |
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|     |             | <ul> <li>Fingerprint Section</li> <li>GPS Interactive Test image on</li> </ul> |             |
|     |             | <ul> <li>GPS Interactive Test Image on<br/>Sensors Section</li> </ul>          |             |
|     |             | - Removed:   |             |
|     |             | <ul> <li>3dnow! Test from Processor</li> </ul>                                 |             |
|     |             | Section  |             |
|     |             | Occuon   |             |

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LENOVO DIAGNOSTICS EVOLUTION V5.18.1

**USER GUIDE** 

# 1. LENOVO DIAGNOSTICS OVERVIEW

Lenovo Diagnostics Evolution is a diagnostic tool that diagnosis different components in Lenovo computers providing feedback to the users about their machine's health.

Lenovo Diagnostics Evolution is composed of Modules that allows performing diagnostics for a group of devices and provides Tools to assist in checking devices information, checking previous diagnostics executions, trying to recover defective HDD and SSD, as well creating, and running custom diagnostics.

# **1.1 Data Collection**

Lenovo Diagnostics Evolution collects anonymous data regarding tests execution for the purpose of improving Hardware's diagnostics. You can enable or disable that function according to your preferences.

By opening the Lenovo Diagnostics tool for the first time, the application will display a message asking if you agree or not with Lenovo Product Privacy Statement.

| Lenovo  | Diagnostics Evolution |  |           | - 🗆 ×                         |
|---------|-----------------------|--|-----------|-------------------------------|
| L       | Lenovo<br>DIAGNOS     | STICS  |           | <b>•)</b> 🕸 (?)               |
|         | Home                  |  | Search by | r modules, tools or co ۹      |
| Ша<br>Ч | dia                   | Diagnostics Tools<br>PRIVACY NOTICE<br>Privacy Policy  Diagnostic results data may contain confidential or devi identification data, such as: Serial Number, MAC Addres Connected Wifi Network Name and Nearby Bluetooth I | 55,       | * *                           |
|         | Audic                 | Name. The data will be stored and collected only with the approval. Do you agree with Lenovo's Product Privacy Statement data collection? You can turn off data collection in Settings. DENY                               | he user's | Bluetooth<br>©                |
|         | Camera                | Display Fingerpr   |           | Wired Ethernet                |
| »       | C REFRESH             | (  | SCRIPT    |                               |
| 🗸 Seri  | ial number: TH6BER3   | ✓ Model: ThinkPad T440p ✓ MTM: J8G4EK9   |           | Copyright © 2011, 2024 Lenovo |

Figure 1: Lenovo Privacy Statement Pop-up

Lenovo Diagnostics Evolution -× Lenovo 章 ⑦ DIAGNOSTICS Settings Home со... Q = Swich to dark mode Privacy Settings Diagnostics Tools F. Software Update Ę, Д Д Д ? ? ? ? \* 0 Audio Audio Controller Battery Bluetooth Д Д Д Д ? ? ? ? ۵ Camera Display Fingerprint Wired Ethernet  $\gg$ C REFRESH SCRIPTS TOOL 🔄 RUN ALL ber: TH6BER3 ht © 2011, 2024 Lend MTM:

You also may change this option at any time by clicking on the Settings icon

t

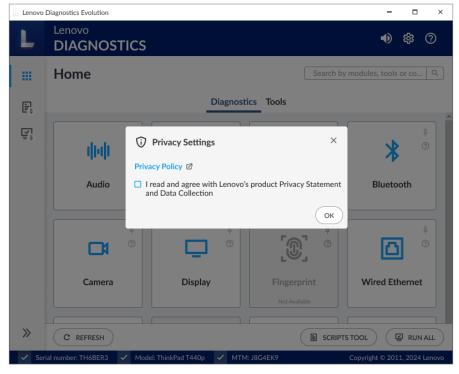


Figure 2: Lenovo Privacy Statement Settings

# 2. APPLICATION INTERFACE

# 2.1 Lenovo Diagnostics Evolution Main screen

By opening the Lenovo Diagnostics Evolution, you will see the main screen containing the following items:

- Top bar with icons for enabling/disabling Sound Notice, change Settings, access Help Menu.
- Sidebar with home screen icon and following tools pinned by default, Script tool, and Run All.
- Footer with the buttons: Refresh, Scripts Tool, and Run All.

On this screen, you can also see the search field and the tabs Diagnostics and Tools.

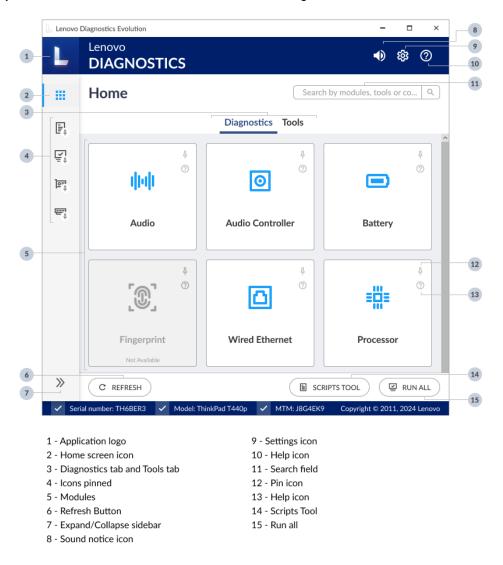


Figure 3: Home Screen

### **Application logo**

The application logo is displayed in the upper left corner of the screen.

#### Home screen icon

The home screen icon is located in the sidebar. You can access the home screen at any time from other tools or modules.

# **Diagnostics tab and Tools tab**

### • Tab Diagnostics

You can see the modules provided by Lenovo Diagnostics Evolution and select one of them to perform tests. The modules will not be enabled if no device is supported by the module.

• Tab Tools

Through this tab you can access tools that can help you in the diagnostic process, such as seeing detailed information about each device (System Information), consulting and exporting result log tests performed in a machine (Log History), scanning HDD/SATA SSD devices for bad sectors (Recover Bad Sectors), and inspect the thermal information of major hardware devices (Thermal Monitor Tool).

### Export tools logs button

On the Tools tab, you can quickly export the logs from System Information including the general machine information plus the available modules information and the current temperatures of the supported devices on Thermal Monitor Tool by clicking in the button shown in the image bellow:

| Leno                  | vo Diagnostics Evolution               |                             | - 🗆 ×   |
|-----------------------|--|-----------------------------|---|
| L                     | Lenovo<br>DIAGNOSTICS                  |                             | <ul> <li>(a)</li> <li>(b)</li> <li>(c)</li> <li>(c)</li></ul> |
|                       | Home                                   | Search by modules, tools or | components   Q  |
| F                     |  | Diagnostics Tools           | ٠   |
| $\psi^h_\varphi$      |  | ļ<br>()                     |   |
| ≓ș                    |  |                             |   |
| ল্ <u>র</u>           | System Information                     | Log History Tool            | Recover Bad Sectors   |
| G.                    |  |                             |   |
| er,                   | <b>8</b> ° 💿                           |                             |   |
|                       | Thermal Monitor Tool                   |                             |   |
|                       |  |                             |   |
| >>                    | C REFRESH                              |                             |   |
| <ul> <li>✓</li> </ul> | Serial number: TH6BER3 🗸 Model: Thinkl | Pad T440p 🗸 MTM: J8G4EK9    | Copyright © 2011, 2024 Lenovo   |

1 - Quick export tools logs

Figure 4: Quick Export Tools Logs

#### **Icons pinned**

In the sidebar, you can add a shortcut to modules and tools by clicking on each card's pin icon on the Home Screen or by clicking the pin icon located on the sidebar elements, which is displayed when you hover over it.

#### Modules

On the home screen, all application modules are shown. A module contains a set of tests that can be performed for a type of device. It is enabled in the application only if the tested machine has at least one device supported by the module. When the module is not supported, the module card is grayed out, and with the label "Not Available".

#### **Refresh Button**

You can refresh the Home Screen after plugging or unplugging any device by clicking on the Refresh button displayed at the lower-left corner of the screen.

#### Expand/Collapse sidebar

By clicking on the Collapse/Expand icon, you can collapse or expand the sidebar.

If the sidebar is collapsed, only the home screen icon and pinned or open elements are displayed. You can also pin or unpin sidebar elements by clicking the pin icon displayed on each of those elements.

If the sidebar is expanded, the icons and name of the elements will be displayed, and if a tool or module is open, you can close them via the X icon.

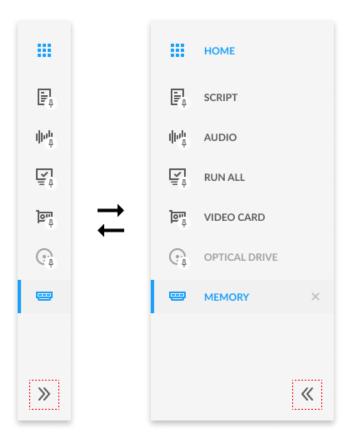


Figure 5: Sidebar

# Sound notice icon

When the execution is finished, the application plays a sound notice, where two short 0.5 second beeps mean that no test has returned a failed status and a long 1-second beep means that at least 1 test has returned failed status. You can enable/disable this sound notice by clicking on the sound notice icon located at the top of the application.

# Settings icon

By clicking on the Settings icon, you will see the following options:

- Switch to the dark mode or switch to standard mode;
- Enable or disable the Lenovo Product Privacy Statement and Data Collection.
- Check for software update

# Help icon

By clicking on the Help icon, you will see the following options:

- See About
- See User Guide

# Search field

You can search by module or tool name, or by components and the application will return related results as shown in the example below.

| Lenovo Diagnostics Evolution |   | – 🗆 ×                                  |
|------------------------------|---|--|
| Lenovo<br>DIAGNOSTI          | cs  | <ul> <li>\$\$</li> <li>\$\$</li> </ul> |
| НОМЕ                         | Home  | SSD Q                                  |
| ନ୍ଧି STORAGE                 | Diagnostics   | 1 Tools 2                              |
|                              | <ul> <li>All results related to "SSD" in Diagnosti</li> <li> </li> <li></li></ul> | cs                                     |
| *                            | C REFRESH   | SCRIPTS TOOL                           |
| ✓ Serial number: TH6BER3 ✓   | Model: ThinkPad T440p 🗸 MTM: J8G4EK9  | Copyright © 2011, 2024 Lenovo          |

Figure 6: Search Field Example

# Pin icon

The pin icon  $\frac{1}{2}$  will allow you to pin modules and tools to the sidebar, which means that the module can be accessed from any screen you are on, as it will always be visible on the sidebar. In the image below, the user is viewing the Processor module but can access the Run All or Scripts Tool at any time, as it is pinned in the sidebar.

| 📙 Lenovo | Diagnostics Evolution                                       | - 🗆 ×                         |
|----------|---|-------------------------------|
| L        | Lenovo<br>DIAGNOSTICS                                       | ● 蓉 ⑦                         |
|          | Processor   | : ×                           |
| F.       | Quick Selection: 🗹 Quick Tests 🗹 Extended Tests             |                               |
|          | Select All [6/6]  |                               |
| Ξą.      | ^ ☑ Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz [6/6] ③        |                               |
| =ä=      | ∧ Z Quick Tests [5/5] <sup>(</sup> )                        |                               |
|          | ☑ BT Instruction Test ③                                     |                               |
|          | ✓ x87 Floating Point Test ③                                 |                               |
|          | MMX Test ①  |                               |
|          | SSE Test 🛈  |                               |
|          | AES Test ①  |                               |
|          | ∧ Z Extended Tests [1/1] ③                                  |                               |
|          | ☑ Stress Test ③   |                               |
|          |   |                               |
|          | Iterations: 1 ⑦ Estimated Time: 00:10:05 ⑦                  | S BACK TO HOME START          |
| 🗸 Sei    | rial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 | Copyright © 2011, 2024 Lenovo |

Figure 7: Sidebar Example

# Help icon

By clicking in the Help icon ⑦ of each card, you can see a brief description of the respective element.

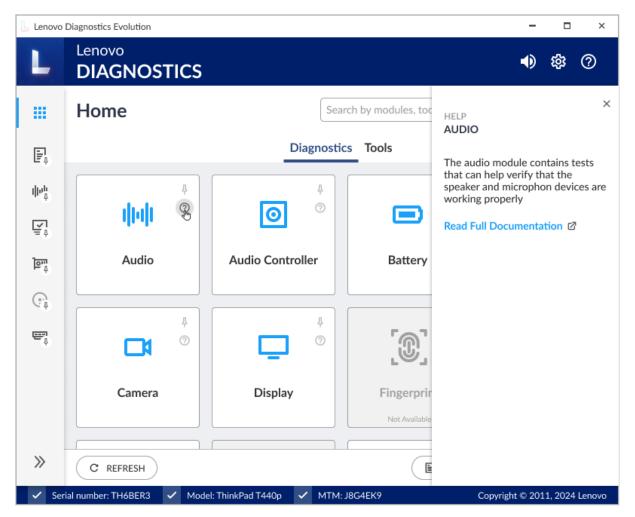


Figure 8: Module's Help

# Scripts Tool

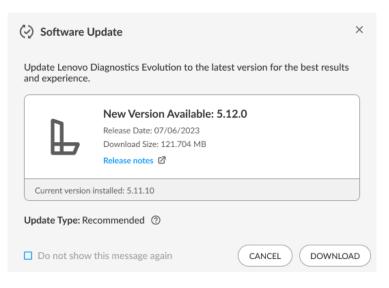
You can access the Scripts Tool by clicking on the Scripts Tool button located at the bottom of the screen on the right side.

#### Run All

You can access the Run All by clicking on the Run All button located at the lower-right corner of the screen.

# 2.2 Software Update

When a new Lenovo Diagnostic Evolution version is available, the pop-up below will be shown as soon as the system starts, informing that there is a new version to be installed. You can install it immediately by clicking on the "Download" button.



#### Figure 9: New Version Available

System updates are categorized into:

| Update Type | Description  |  |  |
|-------------|--|--|--|
| Optional    | Optional updates are not required for the system, but may be useful when resolving     |  |  |
|             | issues.  |  |  |
| Recommended | Driver updates keep your computer running at optimal performance.                      |  |  |
| Critical    | Update can prevent significant problems, major malfunctions, hardware failure, or data |  |  |
|             | corruption.  |  |  |

If the update type is "Optional" or "Recommended", you will be able to close the pop-up and continue using the application normally. In this case, you can update the version at any time by clicking on "Software Update" in the Settings icon located in the header.

Until the application isn't updated to the latest version, the system will automatically show a notification in the Settings icon reminding you that an update is available.

| \$@                      | \$\$                               |
|--------------------------|------------------------------------|
| Settings                 | Settings                           |
| Swich to dark mode       | Swich to dark mode                 |
| Privacy Settings         | i Privacy Settings                 |
| Software Update          | C Software Update                  |
|                          |                                    |
| Regular settings options | Settings with a notification alert |

Figure 10: Software Updates Notification

If the update type is "Critical", you must update the version to continue using Lenovo Diagnostic Evolution.

Note: Internet connection is required to check software updates.

# 3. PERFORMING DIAGNOSTICS IN LENOVO DIAGNOSTICS

# **EVOLUTION**

# 3.1 Understanding the diagnostics

Each module contains tests that may be performed under one or more devices, resulting in a diagnostic. This structure is displayed in the image below:

| Select a module  |   | Check the available device | es and choo           | ose te          | ests for each device |                       |               |
|--|---|----------------------------|-----------------------|-----------------|----------------------|-----------------------|---------------|
|  | ∂<br>2<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | $\rightarrow$              | SSD                   |                 |                      |                       |               |
|  |   |                            | Targeted Read Test    |                 |                      | Targeted Read Test    |               |
|  |   |                            | Random Seek Test      |                 |                      | Random Seek Test      |               |
|  |   |                            | Funnel Seek Test      |                 |                      | Funnel Seek Test      |               |
|  |   |                            | SMART Short Self Test |                 |                      | SMART Short Self Test |               |
|  |   |                            | SMART Status Test     |                 |                      | SMART Status Test     |               |
|  |   |                            | SMART Wearout Test    |                 |                      | SMART Wearout Test    |               |
|  |   |                            | Linear Read Test      |                 |                      | Linear Read Test      |               |
|  |   |                            | Full Disk Scan        |                 |                      | SMART Drive Self Test |               |
|  |   |                            |                       |                 |                      | Full Disk Scan        |               |
|  |   |                            |                       |                 |                      |                       |               |
| Diagnostic I   | Result  |                            |                       |                 |                      |                       |               |
|  | SMART Status 1  | est                        | Passed (Os) 🕑         | $\bigcirc$      | Target               | ted Read Test         | Passed (Os) 🥑 |
| SSD  | Linear Read Tes   | t                          | Passed (Os) 🥏         | X               | Rando                | om Seek Test          | Passed (Os) 🥑 |
|  | Full Disk Scan  |                            | Passed (Os) 🥏         | _               | Funne                | l Seek Test           | Passed (Os) 🥑 |
|  |   |                            |                       |                 | SMAR                 | RT Status Test        | Passed (Os) 오 |
| Result Code WHD0001O900000000-UI7VEG Result Code WHD0000001U0000000-UI7VEG |   |                            |                       |                 |                      |                       |               |
| Final Result Code: W3D4J7L1JBMK-PFQH1Q                                     |   |                            |                       |                 |                      |                       |               |
|  |   |                            | Pass                  | n Result<br>Sed |                      |                       |               |
|  |   |                            |                       |                 |                      |                       |               |

Figure 11: Diagnostics Flow

When a diagnostic is finished, Lenovo Diagnostics displays the results for each performed test and creates two codes to resume the test execution: Result Code and Final Result Code.

| Result Code       | Contains information about the machine serial number, system platform, and test execution status and date. This code is generated for each tested device.                                     |
|-------------------|---|
| Final Result Code | Contains information about the machine serial number, system platform, and execution date. This code reports also the module where the tests were performed and the tests with failed status. |

The tests on Lenovo Diagnostics may have the following status:

| 0                       | Passed  | When the test algorithm is executed, and no failure is found.  |  |  |
|-------------------------|---|--|--|--|
| $\overline{\mathbf{x}}$ | Section 2012 Failed When the test identifies the diagnosed device as defective. |  |  |  |
| 0                       | Warning   | When the test indicates the diagnosed device may have some defect, but the result is not conclusive.   |  |  |
| •                       | Canceled  | When the test is canceled in the middle of test execution.   |  |  |
| 0                       | Not Applicable  | When the test is not applicable to the selected device, for example, the device does not meet some minimum requirement for the test to be performed. |  |  |

# 3.2 Performing diagnostics

The diagnostic for a module in Lenovo Diagnostics Evolution is based on the following steps:

# 3.2.1 Select Devices and Tests

By selecting a module in the Diagnostics tab, you will be redirected to a screen where you can select which devices and tests will be performed.

On this step, all devices and tests supported by the selected module are displayed and you may select one or more of them to perform the tests.

**Iterations**: It is also possible to select the number of times to run the set of tests in a range from 1 to 999 times.

**Estimated time:** You can see an estimate for the diagnostic run time. The time is based on previous simulations on devices with similar specifications.

| L               | Lenovo IIAGNOSTICS  |
|-----------------|---|
|                 | Storage : ×   |
| F.              | Quick Selection: Quick tests Extended Tests   |
|                 | Select All [9/18]   |
| ψ¢              | ∧ ■ Kingston SA400S37480G - 447.13 GBs[ 9/9] ③  |
|                 | ∧ ☑ Quick Tests [6/6] ③   |
| _               | ✓ Targeted Read Test ③  |
| <sub>দ</sub> ্র | Random Seek Test 🛈  |
| G               | ✓ Funnel Seek Test ③  |
|                 | SMART Short Self Test 🛈   |
| Ø               | SMART Status Test 🛈   |
|                 | SMART Wearout Test 🛈  |
|                 | ✓ ✓ Extended Tests [3/3] ①  |
|                 | ☑ Linear Read Test ① 錄  |
|                 | SMART Conveyance Self Test ①  |
|                 | ✓ Full Disk Scan ③ 徽  |
|                 | ✓         ■         KINGSTON SA2000M8 - 465.76 GBs [0/7] ①         ■         Parallel       |
| >>              | Iterations: 1 ③ Estimated Time: 00:42:35 ③  |
| ✓ 5             | ierial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 Copyright © 2011, 2024 Lenovo |
|                 |   |

- 3 Define number of iterations for the execution
- 4 Estimated time for execution
- 5 Module Options
- 6 Close the module

- 8 Device information
- 9 Test description
- 10 Customize parameters
- 11 Back to home screen
- 12 Start the diagnostic

Figure 12: Devices and Tests Selection Screen

By clicking to see **Device Information**, you can view detailed information about the device. The properties displayed depend on the selected module.

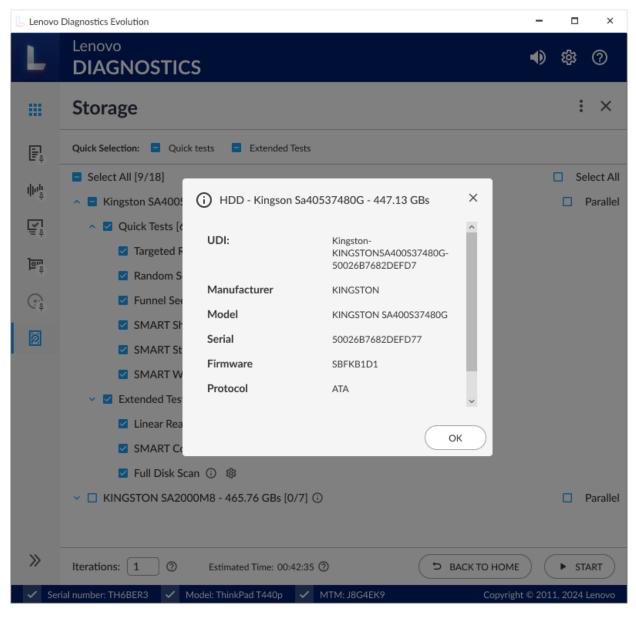


Figure 13: Device Information

By clicking to see the **Test Description**, you can view a brief description of the test and the estimated time to run the test, like the screen below.

| 📙 Lenovo     | Diagnostics Evolution   | - 🗆 ×   |
|--------------|---|---|
| L            | Lenovo<br>DIAGNOSTICS   | ● 韓 ⑦   |
|              | Storage   | : ×   |
| Ē,           | Quick Selection: 🗧 Quick tests 🗧 Extended Tests   |   |
| ille‡        | <ul> <li>Select All [9/18]</li> <li>Kingston SA400S37480G - 447.13 GBs[ 9/9] <sup>(1)</sup></li> </ul>  | <ul><li>Select All</li><li>Parallel</li></ul> |
| هُنْ<br>مُنْ | <ul> <li>Quick Te</li> <li>Targe</li> <li>Rand</li> <li>Checks eletrical and mechanical component status as well as the reading ability of the device</li> <li>Funn</li> <li>SMA</li> <li>SMA</li> <li>SMA</li> <li>SMA</li> <li>OK</li> <li>SMA</li> <li>SMA</li> <li>OK</li> <li>SMART revealour rest ()</li> <li>Extended Tests [3/3] ()</li> <li>Linear Read Test () ()</li> <li>SMART Conveyance Self Test ()</li> <li>Full Disk Scan () ()</li> </ul> |   |
|              | KINGSTON SA2000M8 - 465.76 GBs [0/7] ①  | Parallel                                      |
| >>>          | Iterations: 1 ② Estimated Time: 00:42:35 ③ ⊃ BACK TO HOL  | ME START                                      |
| 🗸 Sei        | rial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 Copyr   | ight © 2011, 2024 Lenovo                      |

Figure 14: Test Description

By clicking to see the **Module Options**, you can view the following options: Pin/Unpin from the sidebar, and Help.

| 📙 Lenovo             | Diagnostics Evolution   | - 🗆 ×                                  |
|----------------------|---|--|
| L                    | Lenovo<br>DIAGNOSTICS   | <ul> <li>\$\$</li> <li>\$\$</li> </ul> |
|                      | Storage   | :×                                     |
| F,                   | Quick Selection: Cuick tests  | Pin to sidebar<br>Help                 |
| $\psi_{\varphi}^{h}$ | <ul> <li>Select All [9/18]</li> <li>Kingston SA400S37480G - 447.13 GBs[ 9/9] <sup>(1)</sup></li> </ul>                  | Select All                             |
| l<br>≡ ₿             | <ul> <li>✓ Quick Tests [6/6] ①</li> </ul>   |  |
| ্<br>নূ              | <ul><li>✓ Targeted Read Test <sup>(i)</sup></li><li>✓ Random Seek Test <sup>(i)</sup></li></ul>                         |  |
| G <sub>\$</sub>      | <ul> <li>✓ Funnel Seek Test <sup>(3)</sup></li> <li>✓ SMART Short Self Test <sup>(3)</sup></li> </ul>                   |  |
| Ø                    | ✓ SMART Status Test ①   |  |
|                      | <ul> <li>SMART Wearout Test (i)</li> <li>Extended Tests [3/3] (i)</li> </ul>  |  |
|                      | ☑ Linear Read Test ① 戀  |  |
|                      | <ul> <li>✓ SMART Conveyance Self Test <sup>(1)</sup></li> <li>✓ Full Disk Scan <sup>(1)</sup> <sup>(2)</sup></li> </ul> |  |
|                      | ✓ ☐ KINGSTON SA2000M8 - 465.76 GBs [0/7] <sup>①</sup>   | Parallel                               |
| >>                   | Iterations: 1 ⑦ Estimated Time: 00:42:35 ⑦  | S BACK TO HOME START                   |
| 🗸 Ser                | ial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9  | Copyright © 2011, 2024 Lenovo          |

Figure 15: Modules Option

You also can close the module by clicking on "X" located next to the module options. When you close a module, you will be returned to the home screen.

### 3.2.2 Run Test

After configuring the execution of the tests and clicking Start, you will be directed to the Execution screen.

See in the image below that all devices selected in the previous steps are displayed with their respective tests.

You can follow each test execution by tracking the individual test progress, seeing the test status of each one, the overall test progress, and the time that reports the progress for all devices and tests selected. You also can see in real-time the number of tests for each status and the current status of the iteration.

| L                 | Lenovo<br>DIAGNOSTICS                                      | •) \$ (?)                   |
|-------------------|--|-----------------------------|
|                   | Storage  | : ×                         |
| F,                | Available Diagnostic   Custom Diagnostic                   |                             |
| ماه ماه           | Execution Overview ⑦                                       |                             |
| ψe <mark>k</mark> | Estimated Time: 00:42:20 Run Time: 00:01:03                | ITERATION:1/1               |
| <b>▼</b><br>= \$  | Progress 13%   | Current Status: • 1/5 Tests |
| <u>کم</u>         | Executing 2 Passed 1 8 Failed                              | • Warning                   |
| G.                | Show Details V   |                             |
| < †               | Diagnostic Execution ⑦                                     |                             |
| 2                 | Storage  |                             |
|                   | KINGSTON SA400S37480G - 447.13 GBs                         |                             |
|                   | 05/05/2024 11:12: 41 24/03/2022 11:55:58 - Targeted Read T | Fest Passed (3s) 🥏 —        |
|                   | SMART Status Test  | 23%                         |
|                   | Random Seek Test   | Pending (3s)                |
|                   | SMART Short Self Test                                      | Pending (3s)                |
|                   | SMART Wearout Test   | Pending (3s)                |
| $\gg$             |  | ち BACK ■ ABORT -            |

- 1 Estimated time for the execution
- 2 Run time of the execution
- 3 Iteration overall progress
- 4 Execution summary
- 5 More details about the summary
- 6 Module Name
- 7 Device name
- 8 Test in progress
- 9 Enable auto-scroll

- 10 Current iteration/ Total iteration
- 11 Preview of the iteration overall status
- 12 Number of executed tests/Total of tests
- 13 Test Status
- 14 Test progress
- 15 Abort the execution
- 16 Back to test selection screen

Figure 16: Execution Screen

**Execution summary**: You can see the tests according to the status during the execution, just by clicking on the tab that represents the status you want to see. The image below displays all tests that returned "passed" status.

|   | 📙 Lenovo  | Diagnostics Evolution  | - 🗆 ×   |  |  |  |  |
|---|-----------|--|---|--|--|--|--|
|   | L         | Lenovo<br>DIAGNOSTICS  | <ul> <li>Image: Image: Im</li></ul> |  |  |  |  |
|   |           | Storage  | : ×   |  |  |  |  |
|   | F.        | Available Diagnostic    Custom Diagnostic  |   |  |  |  |  |
|   | i∥eh<br>t | Execution Overview ③   |   |  |  |  |  |
|   | Ţ.        | -  | ITERATION:1/1 rent Status: 1/5 Tests  |  |  |  |  |
|   | ূর্ত্র    | 13%       Image: Securiting Image: Securitin | • Warning   |  |  |  |  |
| 1 | (;)<br>į  | Storage<br>05/05/2024 11:12: 41 KINGSTON SA400S37480G - 447.13 GBs - Targeted Read Test  | Passed (3s) 🗸   |  |  |  |  |
| 3 | 2         | Hide Details ~   |   |  |  |  |  |
|   |           | Diagnostic Execution ⑦   |   |  |  |  |  |
|   |           | Storage  |   |  |  |  |  |
|   |           | KINGSTON SA400537480G - 447.13 GBs   |   |  |  |  |  |
|   |           | 05/05/2024 11:12: 41 24/03/2022 11:55:58 - Targeted Read Test  | Failed (3s) 🥑   |  |  |  |  |
|   |           | SMART Status Test  | 23%   |  |  |  |  |
|   |           | Random Seek Test   | Pending (3s)  |  |  |  |  |
|   | »         | c)   | BACK ABORT  |  |  |  |  |
|   | 🗸 Ser     | ial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 C   | Copyright © 2011, 2024 Lenovo   |  |  |  |  |
|   |           |  |   |  |  |  |  |
|   |           | ule name<br>ce name  |   |  |  |  |  |
|   | 3 - Test  |  |   |  |  |  |  |

Figure 17: Show Details Example

If you want to abort the whole test execution, you can click on Abort. In this case, the current test and all tests waiting for execution are canceled, including those from the next iterations. In the same way, the overall status for the current iteration and all next iterations will be changed to Canceled.

After all tests to being finished, the Lenovo Diagnostics Evolution generates a log with detailed information about the devices and their test results.

# This log is composed of the following sections:

| Lenovo Diagnostics Evolution |   |                            |                     | -   | □ ×            |
|------------------------------|---|----------------------------|---------------------|---|----------------|
| L                            | Lenovo<br>DIAGNOSTICS                       |                            |                     |   | 舉 ⑦            |
|                              | Storage                                     | Storage                    |                     |   |                |
| E.                           | Available Diagnostics • Custom Dia          | gnostic • Diagnos          | stic Result         |   |                |
| Εş                           | Diagnostic Result ⑦                         |                            |                     |   |                |
| 地                            |   |                            | ]                   |   |                |
| ₹                            | Passed                                      |                            |                     | < 1 of 1  | 8 >            |
| _                            | Final Result Code: W3TPMSD775               | VE-LHFGPB                  |                     |   |                |
| 한                            | Model:                                      | ThinkPad T440p             |                     |   |                |
|                              | Serial Number:                              | TH6BER3                    |                     | 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 |                |
| C.                           | BIOS Version:                               | MJ1UZD65 (1.1              |                     |   |                |
| 1921                         | Application Version:<br>Machine Type-Model: | Lenovo Diagnosi<br>J8G4EK9 | tics Windows 5.10.0 | -2.65-216-2-2<br>3.52,257-248   |                |
| 2                            | Wired Ethernet MAC Address 1:               | CB-FD-FF-7F-0              | 2-4R                | 国际特殊教育  |                |
|                              | Wireless MAC Address 1:                     | D3-C2-9F-67-A              |                     |   |                |
|                              | Test Start Time & Date:                     | 10/10/2022 14:             |                     |   |                |
|                              | Test End Time & Date:                       | 10/10/2022 14:             | 20:00               |   |                |
|                              | Executed 5                                  | Passed 5                   | 😣 Failed            | <ol> <li>Warning</li> </ol>   | • >            |
|                              | MODULE RESULTS                              |                            |                     | SHOW  | ALL TESTS      |
|                              | Storage                                     |                            |                     |   | ~              |
| >>                           |   |                            | c                   | BACK  |                |
| ✓ Ser                        | ial number: TH6BER3 🗸 Model: Th             | hinkPad T440p              | MTM: J8G4EK9        | Copyright © 2011  | l, 2024 Lenovo |

- 1 Iteration Result
- 2 General information
- 3 Test Result
- 4 Export Log



**General information**: contains information about the machine, test date, and final result. This section also displays a QR Code containing that information.

| Passed                        |                                   | < 1 of 18 > |
|-------------------------------|-----------------------------------|-------------|
| Final Result Code: W3TPMSD775 | VE-LHFGPB                         |             |
| Model                         | ThinkPad T440p                    |             |
| Serial Number                 | TH6BER3                           |             |
| BIOS Version                  | MJ1UZD65 (1.16)                   |             |
| Application Version           | Lenovo Diagnostics Windows 5.10.0 |             |
| Machine Type-Model            | J8G4EK9                           |             |
| Wired Ethernet MAC Address 1  | CB-FD-FF-7F-03-4B                 |             |
| Wireless MAC Address 1        | D3-C2-9F-67-AF-1A                 |             |
| Test Start Time & Date        | 10/10/2022 14:00:00               |             |
| Test End Time & Date          | 10/10/2022 14:20:00               |             |
|                               |                                   |             |

Figure 19: General Information Example

**Test Results**: displays the results and execution time of each performed test. To see the test results, you need to click on **SHOW ALL TESTS**.

| Executed 5                  | Passed 5              | 😣 Failed | Warning | Cancel             | Ø Not App >       |
|-----------------------------|-----------------------|----------|---------|--------------------|-------------------|
| MODULE RESULTS              |                       |          |         |                    | SHOW ALL TESTS    |
| Storage                     |                       |          |         |                    | ~                 |
|                             |                       |          |         |                    |                   |
|                             |                       | Ļ        |         |                    |                   |
| Executed 5                  | Passed 5              | 🛿 Failed | Warning | Cancel             | Not Appl >        |
| MODULE RESULTS              |                       |          | SHOW DE | VICE INFORMATION   | HIDE ALL TESTS    |
| <ul> <li>Storage</li> </ul> |                       |          |         |                    | ^                 |
| KINGSTON SA40053            | 37480G - 447.13 GBs   |          | F       | esult Code: WAC000 | 0700000-UO7V0D    |
| 10/10/2022 11:55:58 - 7     | Targeted Read Test    |          |         |                    | Passed (3s) 🛛 🥑   |
| 10/10/2022 12:15:50 - F     | Random Seek Test      |          |         |                    | Passed (52s) 🥝    |
| 10/10/2022 12:15:57 - 5     | Stress test           |          |         |                    | Passed (236s) 🛛 🥑 |
| 10/10/2022 12:15:57 - 5     | SMART Wearout Test    |          |         |                    | Passed (236s) 🛛 🥑 |
| 10/10/2022 12:16:04 - 5     | SMART Short Self Test |          |         |                    | Passed (3s) 🛛 🖉   |

Figure 20: Show All Tests Example

**Device Information**: once the test results are being displayed, you can click to **SHOW DEVICE INFORMATION**. Device information is the technical details of each tested device.

| Executed 5   | Passed 5   | 😣 Failed | 🕛 Warning | Cancel               | Not App >                       |
|--|--|----------|-----------|----------------------|---------------------------------|
| MODULE RESULTS   |  |          | SHOW DE   | VICE INFORMATION     | HIDE ALL TESTS                  |
| Storage  |  |          |           |                      | ^                               |
| KINGSTON SA40053   | 37480G - 447.13 GBs  |          | F         | Result Code: WAC0000 | 700000-UO7V0D                   |
| 10/10/2022 11:55:58 - 7  | argeted Read Test  |          |           |                      | Passed (3s) <                   |
| 10/10/2022 12:15:50 - F  | Random Seek Test   |          |           |                      | Passed (52s) <                  |
| 10/10/2022 12:15:57 - 5  | ötress test  |          |           |                      | Passed (236s) 🥝                 |
| 10/10/2022 12:15:57 - 5  | SMART Wearout Test   |          |           |                      | Passed (236s) 🛛 🤡               |
| 10/10/2022 12:16:04 - 5  | MART Short Self Test   |          |           |                      | Passed (3s) 🥝                   |
|  |  | ţ        |           |                      |                                 |
| Executed 5   | Passed 5   | 😣 Failed | Warning   | Cancel               | 🙆 Not App 🗦                     |
| MODULE RESULTS   |  |          | HIDE DE   | VICE INFORMATION     | HIDE ALL TESTS                  |
| Storage  |  |          |           |                      | ^                               |
| KINGSTON SA400S3   | 37480G - 447.13 GBs  |          | F         | Result Code: WAC0000 | 700000-UO7V0D                   |
| Model<br>Manufacturer<br>Driver Version<br>Firmware<br>Serial<br>Mount Points<br>Logical Sectors<br>Logical Sectors Size<br>Phisical Sector Size<br>Protocol | KINGSTON SA4005374<br>KINGSTON<br>10.019041789<br>2BA30002<br>S0026b782DEFD77<br>E:\ , D:\<br>93770388<br>512<br>512<br>512<br>ATA | 480G     |           |                      |                                 |
| 10/10/2022 11:55:58 - T<br>10/10/2022 12:15:50 - F   | -  |          |           |                      | Passed (3s) <<br>Passed (52s) < |
| 10/10/2022 12:15:57 - 5  | Stress test  |          |           |                      | Passed (236s) 🛛 🥑               |
| 10/10/2022 12:15:57 - 5  | MART Wearout Test  |          |           |                      | Passed (236s) <                 |
| 10/10/2022 12:16:04 - 5  | MART Short Self Test   |          |           |                      | Passed (3s) 🛛 🤡                 |

Figure 21: Show Device Information Example

Export Log: you can export the results to an HTML or PDF file. Just click the Export Log button.

| Lenovo   | Diagnostics Evolution           |                |                      | -                | □ ×            |
|----------|---------------------------------|----------------|----------------------|------------------|----------------|
| L        | Lenovo<br>DIAGNOSTICS           |                |                      | ◄)               | 章 ⑦            |
|          | Storage                         |                |                      |                  | : ×            |
| E.       | Available Diagnostics           |                |                      |                  |                |
| にす<br>伸張 | Diagnostic Result ⑦             |                |                      |                  |                |
| Ξ.       | Passed                          |                |                      | < 1 of 2         | 1 >            |
|          | Final Result Code: W3TPMSD775   | VE-LHFGPB      |                      |                  |                |
| ্র্র্    | Model:                          | ThinkPad T440  | p                    |                  |                |
|          | Serial Number:                  | TH6BER3        |                      |                  | 28 C           |
| G.       | BIOS Version:                   | MJ1UZD65 (1.1  | 16)                  |                  |                |
|          | Application Version:            | Lenovo Diagnos | stics Windows 5.10.0 |                  |                |
| 2        | Machine Type-Model:             | J8G4EK9        |                      |                  |                |
|          | Wired Ethernet MAC Address 1:   | CB-FD-FF-7F-0  | )3-4B                |                  |                |
|          | Wireless MAC Address 1:         | D3-C2-9F-67-A  |                      |                  |                |
|          | Test Start Time & Date:         | 16/08/2023 14  |                      |                  |                |
|          | Test End Time & Date:           | 16/08/2023 14  | :20:00               |                  |                |
|          | Executed 4                      | Passed 4       | Failed               | 🕛 Warning        | • >            |
|          | MODULE RESULTS                  |                |                      | SHOW             | ALL TESTS      |
|          | Storage                         |                |                      |                  | ~              |
|          |                                 |                |                      |                  |                |
| »        |                                 |                |                      | васк 🛃 е         |                |
| 🗸 Ser    | ial number: TH6BER3 🗸 Model: Th | ninkPad T440p  | ✓ MTM: J8G4EK9       | Copyright © 201: | l, 2024 Lenovo |

1 - Export Log

Figure 22: Export Log Example

| Lenovo Diagnostics Evolution  | - 🗆 ×                     |
|---|---------------------------|
| Lenovo<br>DIAGNOSTICS   | <ul> <li>● 韓 ⑦</li> </ul> |
| Save File   | × : ×                     |
| $\leftarrow \rightarrow \checkmark \uparrow$ > This PC > Documents > logs $\checkmark$ U Search logs  | م                         |
| Organize • New folder   | • 🔞                       |
| Pictures * ^ Name Date modified   | Тур                       |
| <ul> <li>Lenovo Diagnos</li> <li>Music</li> <li>script</li> <li>win_x64</li> <li>OneDrive</li> <li>This PC</li> <li>3D Objects</li> <li>Desktop</li> <li>Documents</li> </ul> |                           |
| File name: 18000069-2022-08-16-152627.html  | ~                         |
| Save as type: HTML(*.html)  A Hide Folders  Executed 4  Passed 4  Failed  Varra   | incel                     |
| » Эваск   | EXPORT LOG                |
| ✓ Serial number: TH6BER3 ✓ Model: ThinkPad T440p ✓ MTM: J8G4EK9 Copyrigh  | nt © 2011, 2024 Lenovo    |

Figure 23: Save the File Example

# 3.3 Parallelism

Lenovo Diagnostics Evolution application allows modules and devices to run in parallel with each other. By enabling parallelism, the user can take advantage of faster execution as diagnostics occur simultaneously on different components. There are two different types of parallelism available: parallelism among module and parallelism among devices.

# 3.3.1 Types of Parallelism

Lenovo Diagnostics Evolution has two types of parallelism: parallelism among modules and parallelism among devices.

Parallelism execution among modules: Multiple modules can be executed at the same time.

Some modules cannot run in parallel with others due the architecture limitations. All restrictions can be found in the Parallelism Rules section.

Below you can check an example of an execution among modules via Run All screen. In this case, Processor and Video Card modules are running in parallel.

| 📙 Ler   | novo Di | agnostics Evolution  |                                   |                       |         | - 🗆 ×   |
|---------|---------|--|-----------------------------------|-----------------------|---------|---|
| L       | -       | Lenovo<br>DIAGNOST   | ICS                               |                       |         | <ul> <li>Image: Image: Im</li></ul> |
|         |         | Run All Diag   | gnostics Tool                     |                       |         | : ×   |
| F       | 1       | Available Diagnostic •   | Custom Diagnostic                 |                       |         |   |
|         |         | Execution Overview   | 0                                 |                       |         |   |
| 4et     | ₽.      | Estimated Time: 00:4   | 2:20 Run Time: 00:01:03           |                       |         | ITERATION:1/1   |
| ¥.      | 4       | Progress   |                                   | 13%                   |         | Current Status:      0/2 Tests  |
| ূর্ত্র  | n,      | ② Executing 2  | Passed                            | I 3%                  | Warning | Cancel  |
|         |         | Checking O   |                                   | Show Details V        |         |   |
| G       | 4<br>)  |  |                                   |                       |         |   |
| Ø       |         | Diagnostic Execution   | า 🕐                               |                       |         |   |
|         |         | Diagnostic Execution<br>Processor  | n @                               |                       |         |   |
|         |         | Processor  | າ ⑦<br>i5-8250U CPU @ 1.60GF      | Ηz                    |         |   |
|         |         | Processor  |                                   | Ηz                    |         | 23%   |
|         |         | Processor<br>Intel(R) Core(TM)   |                                   | Ηz                    |         | 23%   |
|         |         | Processor<br>Intel(R) Core(TM)<br>Stress Test<br>Video Card<br>Intel(R) UHD Grap | i5-8250U CPU @ 1.60GF             | Ηz                    |         | 23%   |
|         |         | Processor<br>Intel(R) Core(TM)<br>Stress Test<br>Video Card                      | i5-8250U CPU @ 1.60GF             | Ηz                    |         | 23%   |
| <br>>>> | •<br>•  | Processor<br>Intel(R) Core(TM)<br>Stress Test<br>Video Card<br>Intel(R) UHD Grap | i5-8250U CPU @ 1.60GF<br>hics 620 | -Hz<br>✓ MTM: J8G4EK9 |         |   |

Figure 24: Parallelism among modules

**Parallelism execution among devices:** Multiple devices from a module can be executed at the same time. For example, on the storage module, you can select to run a full disk scan test in an HDD device and in an NVME device at the same time. Some modules doesn't have multiple device, thus, the Parallelism isn't supported. All restrictions can be found in the Parallelism Rules section.

| 📙 Len                          | Lenovo Diagnostics Evolution – |                       |                   |                             |   |  |  |  |  |  |
|--------------------------------|--------------------------------|-----------------------|-------------------|-----------------------------|---|--|--|--|--|--|
| L                              | Lenovo<br>DIAGNOSTIC           | S                     |                   |                             | <ul> <li>Image: Image: Im</li></ul> |  |  |  |  |  |
|                                | Storage                        |                       |                   |                             | : ×   |  |  |  |  |  |
| F,                             | Available Diagnostic • Cust    | om Diagnostic         |                   |                             |   |  |  |  |  |  |
|                                | Execution Overview (?)         |                       |                   |                             |   |  |  |  |  |  |
| ψe                             | Estimated Time: 00:42:20       | Run Time: 00:01:03    |                   |                             | ITERATION:1/1   |  |  |  |  |  |
|                                | Progress                       |                       | 13%               |                             | Current Status:      0/2 Tests  |  |  |  |  |  |
| ূর্ত্র                         | ② Executing 2                  | Passed                | Eailed            | <ol> <li>Warning</li> </ol> | Cancel  |  |  |  |  |  |
|                                |                                |                       | Show Details 💙    |                             |   |  |  |  |  |  |
| Q                              | Diagnostic Execution ②         |                       |                   |                             |   |  |  |  |  |  |
| 2                              | Storage                        |                       |                   |                             |   |  |  |  |  |  |
|                                | ST100LMD35 - 1RK12             | 72 - 931.51 GBs       |                   |                             |   |  |  |  |  |  |
|                                | Full Disk Scan                 |                       |                   |                             | 23%   |  |  |  |  |  |
| KINGSTON SA2000M8 - 465.76 GBs |                                |                       |                   |                             |   |  |  |  |  |  |
|                                | Full Disk Scan                 |                       |                   |                             | 67%   |  |  |  |  |  |
|                                |                                |                       |                   |                             |   |  |  |  |  |  |
| >>                             |                                |                       |                   | c                           | BACK ABORT  |  |  |  |  |  |
| ~                              | Serial number: TH6BER3 🗸 N     | 1odel: ThinkPad T440p | ✓ MTM: J8G4EK9    |                             | Copyright © 2011, 2024 Lenovo   |  |  |  |  |  |
|                                |                                | Figure 25: Pa         | rallelism among d | evices                      | Figure 25: Parallelism among devices  |  |  |  |  |  |

#### 3.3.2 How to Enable and Disable Parallelism

The user must be able to enable and disable the parallel execution during the selection of the tests. By default, the parallel execution is disabled.

The parallel execution among modules and devices can be configured on the following flows: **Run All, Scripts Tool**, and **Via Module**.

# Run All

|    | 📙 Lenovo | Diagnostics Evolution   | - 🗆 ×                                     |
|----|----------|---|---|
|    | L        | Lenovo<br>DIAGNOSTICS   | ● 錄 ⑦                                     |
|    |          | Run All Diagnostics Tool  | : ×                                       |
|    | F.       | Preset Diagnostics ⑦  |   |
| 1- | վահ      | Settings Unattended Only Parallel Execution   |   |
|    | ¥.       | QUICK DIAGNOSTIC ⑦<br>③ 0 ~ 30 Minutes  | FULL DIAGNOSTIC     ⑦       ③ 0 ~ 5 Hours |
|    | শূর্ণ    | Custom Diagnostic ⑦   |   |
|    | C.       | Filter only unattended tests     Quick Selection:     Quick Tests                                       | Extended Tests                            |
|    | e,       | <ul> <li>Select All [0/120]</li> <li>Audio [0/2]</li> <li>Audio playback test <sup>(i)</sup></li> </ul> | Select All  Parallel                      |
| 2  |          | <ul> <li>Microphone Interactive Test (i)</li> <li>Audio Controller [0/4]</li> </ul>                     | Parallel                                  |
|    |          | <ul> <li>CORB Status Test (i)</li> <li>Output Stream Test (i)</li> </ul>                                |   |
|    |          | Iterations: 1 ② Estimated Time: 00:00:00 ③  | ► START                                   |
|    | >>       | C REFRESH   | S BACK TO HOME                            |
|    | 🗸 Ser    | ial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9  | Copyright © 2011, 2024 Lenovo             |

- 1 Select this option to run Quick and Full Diagnostics in parallel
- 2 Selected Modules
- 3 Select the parallel option to run modules in parallel

Figure 26: Parallelism on Run All Screen

# Scripts

| 📙 Lenovo         | Lenovo Diagnostics Evolution   |                           |
|------------------|--|---------------------------|
| L                | Lenovo<br>DIAGNOSTICS  | ● 韓 ⑦                     |
|                  | Scripts Tool   | : ×                       |
| P.               | Script List  Create Script Create Script                               |                           |
| $\psi_\varphi^h$ | Test Selection Advanced Settings                                       |                           |
|                  | Quick Selection: Quick Tests Extended Tests                            |                           |
| ्राच्            | Select all [0/138]   | Select All                |
| C.               | <ul> <li>Audio [0/2]</li> <li>Audio playback test (i)</li> </ul>       | Parallel                  |
| ۳.               | Microphone Interactive Test (i)  |                           |
|                  | <ul> <li>Audio Controller [0/4]</li> <li>CORB Status Test ①</li> </ul> | Parallel                  |
|                  | Output Stream Test   |                           |
|                  | Number of Executions     O Test Durat                                  | tion in Minutes 1         |
| >>               | D BACK   | SAVE SCRIPT               |
| 🗸 Se             | rial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 Copyr      | right © 2011, 2024 Lenovo |

- 1 Selected Modules
- 2 Select to run Modules in parallel

Figure 27: Parallelism on Scripts Screen

#### **Module Screen**

| Lenovo Diagnostics Evolution |                 | Diagnostics Evolution  | □ ×        |   |
|------------------------------|-----------------|--|------------|---|
|                              | L               | Lenovo<br>DIAGNOSTICS  | ¢ (        |   |
|                              |                 | Storage  | : ×        |   |
|                              | Ē.              | Quick Selection: Cuick Tests   |            |   |
|                              | .de.ab          | Select All [15/18]   | Select Al  | I |
|                              | ψe              | Kingston SA400S37480G - 447.13 GBs [6/9]   | Paralle    | I |
|                              | Ľ.              | ∧ ☑ Quick Tests [6/6] ①  |            |   |
|                              |                 | ✓ Targeted Read Test ③   |            |   |
|                              | <sup>ه</sup> .م | Z Random Seek Test 🛈   |            |   |
|                              | ()              | Funnel Seek Test ③   |            | 2 |
|                              |                 | SMART Short Self Test 🛈  |            |   |
| 1                            | 2               | SMART Status Test 🛈  |            |   |
|                              |                 | SMART Wearout Test 🛈   |            |   |
|                              |                 | ✓ □ Extended Tests [0/3] ③   |            |   |
|                              |                 | ✓ ✓ KINGSTON SA2000M8 - 465.76 GBs [9/9]   | Paralle    | I |
|                              | »               | Iterations: 1 ⑦ Estimated Time: 00:42:35 ⑦ SACK TO HOME                          | START      |   |
|                              | 🗸 Ser           | erial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 Copyright © 2011, 2 | 024 Lenovo |   |

- 1 Select devices and tests
- 2 Select to run the devices in parallel

Figure 28: Parallelism on Module Screen

#### 3.3.3 Parallelism Rules

The parallelism cannot be enabled for all modules and devices due architecture limitations. Below you may check all the rules that defines the parallelism support:

- The parallelism among modules is only available if the module contains at least one unattended test supported.
- The parallelism among modules is not supported if the module has at least one attended selected.
- The parallelism among devices it's only supported on Video Card and Storage module.
- The parallelism among modules and devices is not supported for Motherboard and Memory modules.

# 4. LENOVO DIAGNOSTICS EVOLUTION MODULES AND TESTS

This section provides information about all modules available in Lenovo Diagnostics Evolution and their respective tests. Here, you will understand the approach implemented by each test and how these tests should be performed to assure the correct diagnostic of your machine.

# 4.1 Audio 帅

The Audio module contains tests that can help verify that the speaker and microphone devices are working properly.

The Audio module is composed of the following tests:

| Test                        | Test type | Attendance |
|-----------------------------|-----------|------------|
| Audio Playback Test         | Quick     | Attended   |
| Microphone Interactive Test | Quick     | Attended   |

#### Audio Playback Test

The audio playback test plays random sounds through the audio hardware. The user must be able to listen and identify the sound played correctly.

Before starting the test, you can change the execution mode by clicking on the settings icon next to the test name, according to the image below:

| Z Audio Playback Test ①   |         | Select the settings option.   |
|---------------------------|---------|---|
| ţ                         |         |   |
| හි Audio Playback Test    | ×       | Select a execution mode to the test. <ul> <li>Default: Plays the audio in all channels</li> </ul>                       |
| Execution Mode: ⑦ Default | ~       | <ul> <li>simultaneously.</li> <li>Multichannel: Plays the audio in each channel individually, except the LFE</li> </ul> |
|                           | CONFIRM | (Low Frequency Effect) channel.   |

Figure 29: Audio Playback Settings

By selecting the Default Mode, the test execution is based on the workflow below.

Listen to the audio and identify the sound played.

| i) Audio Playback Test   | ×  |
|--|----|
| Check if the audio output device is working properly   |    |
| <ul> <li>Listen to the audio and identify the sound played.</li> <li>Press "FAILED" if the audio output device is experiencing issues or if no sound is heard.</li> <li>Please note, sound may be loud since the volume will be set to 50% during the test.</li> </ul> |    |
| Execution Mode: Default ⑦  |    |
| PLAY     Output Device     Conexant SmartAudio HD  |    |
| Select the option that corresponds to the sound you heard:   |    |
| FI MUSIC   |    |
|  |    |
| CANCEL FAILED CONFI  | RM |

Select the option that corresponds to the sound you heard.

| ) Audio Playback Test   |                                  | ×              |
|---|----------------------------------|----------------|
| Check if the audio output devi  | ce is working properly           |                |
| <ul> <li>Listen to the audio and identi</li> <li>Press "FAILED" if the audio or</li> <li>Please note, sound may be log</li> </ul> | utput device is experiencing iss |                |
| Execution Mode: Default ⑦   |                                  |                |
| PLAY     Output Dev     Conexant  | <sup>ice</sup><br>SmartAudio HD  |                |
| Select the option that correspo   | onds to the sound you hear       | rd:            |
| П мизіс   | CAT                              | 🚫 WATER        |
| ل<br>Dog  | D BELLS                          |                |
|   | CANCEL                           | FAILED CONFIRM |

If necessary, you can listen to the audio multiple times. Press "CONFIRM" to validate the answer or "FAILED" if there are any issues.

Figure 30: Audio Playback Test – Default Execution Mode

By selecting the Multichannel Mode, the test execution is based on the workflow below, and the steps is shown according to the channels available:

Listen to the audios and identify the sound played on each channel.

| ) Audio Playback Test   |   |  |
|---|---|--|
| <ul> <li>Listen to the audios and i</li> <li>Press "FAILED" if the aud</li> </ul> | levice and its channels are working properly<br>dentify the sound played on each channel.<br>io output device is experiencing issues or if no sound is heard.<br>le loud since the volume will be set to 50% during the test. |  |
| Execution Mode: Multichar<br>Step 1 of 3: All Channels                            | nnel (Stereo) 💿   |  |
| PLAY     Output     Conexe  | Device<br>ant SmartAudio HD   |  |
| Select the option that corre  | esponds to the sound you heard:   |  |
| FI MUSIC  | CAT 🖉 WATER   |  |
| Dog   |   |  |
|   |   |  |

In each step, select the option that corresponds to the sound you heard. Press "CONTINUE" to proceed to the next step and repeat the listening and selection process until the end of test.

| Audio Playback Test  |   | ×   |
|--|---|---|
| Check if the audio output devi<br>• Listen to the audios and iden<br>• Press "FAILED" if the audio o<br>• Please note, sound may be lo | tify the sound played on each o<br>utput device is experiencing is: | channel.<br>sues or if no sound is heard. |
| Execution Mode: Multichanne<br>Step 1 of 3: All Channels   |   |   |
| Select the option that correspo  | conds to the sound you hea  | rd:                                       |
|  |   |   |
|  | CANCEL  |   |

If necessary, you can listen to the audio multiple times.

Press "CONTINUE" to validate the answers, in the last step press "CONFIRM". Press "FAILED" if there are any issues.

Figure 31: Audio Playback Test – Multichannel Execution Mode

# **Microphone Interactive Test**

This test helps to identify if the microphone is capable of capturing sound properly.

The microphone interactive test is performed according to the following workflow:

# Press record and speak or make any sound on the microphone. The record will have 5 seconds of duration.

| (i) Microphone Interactive Test  | × | (i) Microphone Interactive Test  |
|--|---|--|
| Check if the microphone is working properly  Record any sound for 5 seconds and check its content.  Press "PASSED" If the microphone functions properly, or "FAILED" if there are any issues.  Please note, sound may be loud since the volume will be set to 50% during the test. |   | Check if the microphone is working properly  • Record any sound for 5 seconds and check its content. • Press 'PASSED' If the microphone functions properly, or 'FAILED' if there are any issues. • Please note, sound may be loud since the volume will be set to 50% during the test. |
| Input Device Output Device Microphone Array (Intel® Smart Sou  Output Device Speakers (Realtek(R) Audio)   |   | Input Device Output Device Speakers (Realtek(R) Audio)   |
| PLAY   |   | RECORD     PLAY  |
| Sound not recorded   |   | 00:04 O<br>Recording   |
| CANCEL FAILED PASSE  |   | CANCEL FAILED PASSED   |

Listen the recorded audio and check if the content played corresponds to the expected.

| (i) Microphone Interactive Test  | ×        | (i) Microphone Interactive Test X   |
|--|----------|---|
| Check if the microphone is working properly<br>• Record any sound for 5 seconds and check its content.<br>• Press "PASSED" if the microphone functions properly, or "FAILED" if there are any issues.<br>• Please note, sound may be loud since the volume will be set to 50% during the test. |          | Check if the microphone is working properly <ul> <li>Record any sound for 5 seconds and check its content.</li> <li>Press "PASSED" if the microphone functions properly, or "FAILED" if there are any issues.</li> <li>Please note, sound may be loud since the volume will be set to 50% during the test.</li> </ul> |
| Input Device Output Device Speakers (Realtek(R) Audio)   | <b>_</b> | Input Device Output Device Microphone Array (Intel® Smart Sou Speakers (Realtek(R) Audio)   |
|  |          |   |
|  |          | CANCEL FAILED PASSED  |

If necessary, you can record again and listen to the audio multiple times. If there are multiple audio outputs, you can also switch the output device. Press "PASSED" if the microphone functions properly, or "FAILED" if there are any issues.

Figure 32: Microphone Interactive Test Flow

4.2 Audio Controller 🧿

The Audio Controller module contains tests that can verify that the audio controllers are working properly.

The Audio Controller module is composed of the following tests:

| Test                      | Test type | Attendance |
|---------------------------|-----------|------------|
| CORB Status Test          | Quick     | Unattended |
| Output Stream Test        | Quick     | Unattended |
| Input Stream Test         | Quick     | Unattended |
| Bidirectional Stream Test | Quick     | Unattended |

#### **CORB Status Test**

This test checks the status of the Command Outbound Ring Buffer (CORB) mechanism.

#### **Output Stream Test**

This test checks the status of the output streams. Before starting the test, Lenovo Diagnostics advises you that a short audio tune will be played as displayed in the image below.

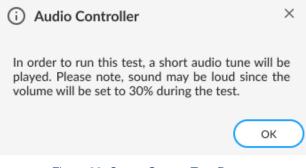


Figure 33: Output Stream Test Pop-up

#### **Input Stream Test**

This test checks the status of the input streams.

#### **Bidirectional Stream Test**

This test checks the status of the bidirectional streams.

# 4.3 Battery

The Battery module contains tests that help verify that the battery devices are working properly.

The Battery module is composed of the following tests:

| Test                     | Test type | Attendance |
|--------------------------|-----------|------------|
| Battery Health Test      | Quick     | Unattended |
| Battery Temperature Test | Quick     | Unattended |
| Battery Discharge Test   | Extended  | Attended   |
| Battery Charge Test      | Extended  | Attended   |

#### **Battery Health Test**

Battery Health Test checks the device charge capacity and other important battery properties to evaluate the device's health.

#### **Battery Temperature Test**

The Temperature test evaluates if the battery temperature is too high, which may prevent it from charging properly.

#### **Battery Discharge Test**

Battery Discharge Test checks the device charge capacity and other important battery properties to evaluate the device's health. If there is an AC cable plugged in, you must unplug it before proceeding to the test as displayed below.

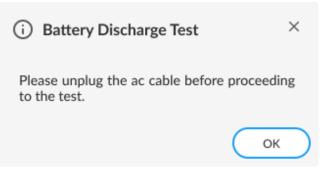


Figure 34: Battery Discharge Test Pop-up

Before starting the test, you can change the duration of the test by clicking on the settings icon next to the test name, according to the image below:

| ☑ Battery Discharge Test ① 🕸    |         | Select the settings option.      |
|---------------------------------|---------|----------------------------------|
| ţ                               |         |                                  |
| 袋 Battery Discharge Test        | ×       | Adjust the duration of the test. |
| Test Duration (minutes) ⑦<br>10 |         |                                  |
|                                 | CONFIRM |                                  |

Figure 35: Customizable Parameter for the Battery Discharge Test

Note: This test requires the remaining battery charge must be greater than 20%.

# **Battery Charge Test**

The test checks if the battery charge increases while the AC cable is connected. If there is no AC cable plugged you should connect it before proceeding to the test.

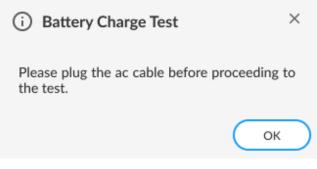


Figure 36: Battery Charge Test Pop-up

Before starting the test, you can change the duration of the test by clicking on the settings icon next to the test name, according to the image below:

| ☑ Battery Charge Test ① 🛞       |         | Select the settings option.     |
|---------------------------------|---------|---------------------------------|
| Ļ                               |         |                                 |
| 🐼 Battery Charge Test           | ×       | Adjust the duration of the test |
| Test Duration (minutes) ⑦<br>10 |         |                                 |
|                                 | CONFIRM |                                 |

Figure 37: Customizable Parameter for the Battery Charge Test

Note: This test requires the battery charge must be less than or equal to 93%.

# 4.4 Bluetooth 🔧

The Bluetooth module contains tests that can verify that the Bluetooth is working properly.

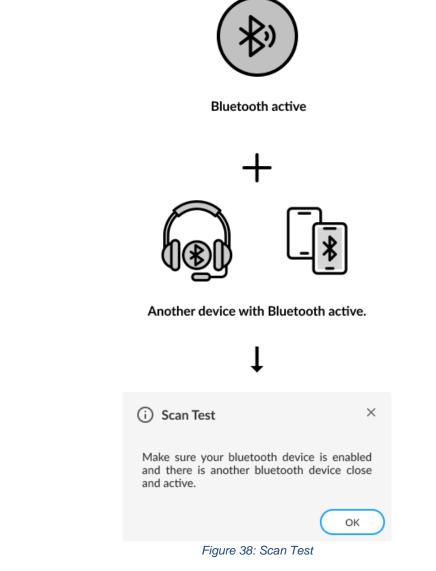
The Bluetooth module is composed of the following test:

| Test      | Test type | Attendance |
|-----------|-----------|------------|
| Scan Test | Quick     | Unattended |

#### Scan Test

Scan for nearby active Bluetooth devices.

The test starts by asking you to make sure the Bluetooth device is enabled and there is another Bluetooth close and active.



# 4.5 Camera

The Camera module contains tests that can help verify that the camera devices are working properly.

The Camera module is composed of the following test:

| Test                | Test type | Attendance |
|---------------------|-----------|------------|
| Camera Capture Test | Quick     | Attended   |
| Camera Barcode Test | Quick     | Attended   |

# **Camera Capture Test**

Verify if the camera device is working properly based on your feedback for the captured images. This test is performed according to the following workflow:

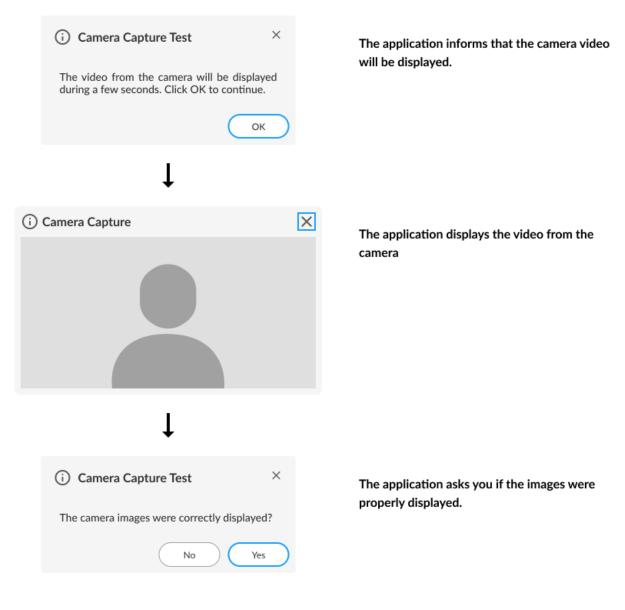


Figure 39: Camera Capture Test

#### **Camera Barcode Test**

Verifies if the camera device is properly working by checking if it can read a barcode. The test starts by asking you to point a QR code or a barcode to the camera.

For the test to be successfully completed, the Barcode/QR Code content must contain a maximum of 60 characters and be composed of only letters and numbers.

| i) Camera Barcode Capture                       |                   |                       |   | ×    |
|---|-------------------|-----------------------|---|------|
|   |                   | Barcode to the camera |   |      |
|   | Г                 |                       | ٦ |      |
|   | L                 |                       |   |      |
| Click on "Fail" if it is not possible to scan t | he Barcorde/QR-Co | de code               |   | Fail |

Figure 40: Barcode Test

# 4.6 Processor

The Processor module contains tests that can verify that the processor is working properly.

The Processor module is composed of the following tests:

| Test                    | Test type | Attendance |
|-------------------------|-----------|------------|
| BT Instruction Test     | Quick     | Unattended |
| x87 Floating Point Test | Quick     | Unattended |
| MMX Test                | Quick     | Unattended |
| SSE Test                | Quick     | Unattended |
| AES Test                | Quick     | Unattended |
| Stress Test             | Extended  | Unattended |

# **BT Instruction Test**

The test checks the processor support for BT instruction.

# x87 Floating Point Test

The test checks the processor support for x87 Floating Point instructions. If the processor does not support such a feature, the test returns unsupported.

# **MMX** Test

The test checks the processor support for MMX instructions. If the processor does not support such a feature, the test returns unsupported.

# SSE Test

The test checks the processor support for SSE Family (SSE, SSE2, SSE3, SSE3, SSE4.1, SSE4.2) instructions. If the processor does not support such a feature, the test returns unsupported.

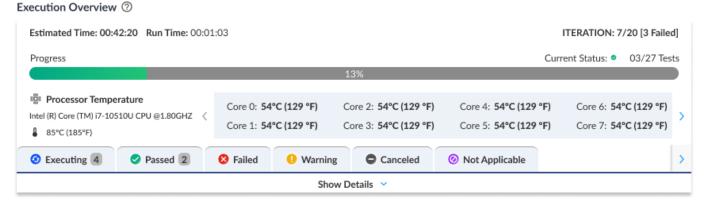
# **AES Test**

The test checks the processor support for AES instructions. If the processor does not support such a feature, the test returns unsupported.

# **Stress Test**

The stress test performs a sequence of continuous checks on all processor cores for 10 minutes. While running this test, the CPU temperature can increase considerably.

During the test you can check the CPU temperature, according to the image below:





# 4.7 Display

The Display module contains tests that can help verify that the display devices are working properly.

The Display module is composed of the following tests:

| Test                             | Test type | Attendance |
|----------------------------------|-----------|------------|
| Resolution Fitting Test          | Quick     | Unattended |
| Red Purity test                  | Quick     | Attended   |
| Green Purity test                | Quick     | Attended   |
| Blue Purity test                 | Quick     | Attended   |
| Black Purity test                | Quick     | Attended   |
| White Purity test                | Quick     | Attended   |
| Color Transition Test            | Quick     | Attended   |
| Monochromatic Mesh Test          | Quick     | Attended   |
| Inverted Monochromatic Mesh Test | Quick     | Attended   |
| Sharpness Test                   | Quick     | Attended   |
| Display Interactive Test         | Quick     | Attended   |

#### **Resolution Fitting Test**

This test checks if the system can take full advantage of the display's native resolution.

**Red Purity test** This test identifies any dead pixel or burn-in problem within the red channel.

| (i) Red Purity Test ×  | Warns that the screen will be filled with red color. |
|--|--|
| Your screen will be filled with the color red.<br>Try to identify any spot or stain distinct from<br>the red background. |  |
| ОК   |  |
| ţ  |  |
|  | Fill the screen with red color                       |
|  |  |
|  |  |
| Ļ  | -  |
| (i) Red Purity Test  | × Asks if the screen was displayed uniform and free  |
| Was the displayed screen uniform and free of spots and stains?   | of spots and stains.                                 |
| No Yes   | $\supset$  |

Figure 42: Red Purity Test

Green Purity test This test identifies any dead pixel or burn-in problem within the green channel.

| (i) Green Purity Test ×  |           | Warns that the screen will be filled with green color. |
|--|-----------|--|
| Your screen will be filled with the color green.<br>Try to identify any spot or stain distinct from<br>the green background. |           |  |
| ОК   | )         |  |
| ţ  |           |  |
|  |           | Fill the screen with green color                       |
|  |           |  |
|  |           |  |
| Ļ  |           |  |
| (i) Green Purity Test  | ×         | Asks if the screen was displayed uniform and free      |
| Was the displayed screen uniform and free of spots and stains?   |           | of spots and stains.                                   |
| No Yes   | $\supset$ |  |

Figure 43: Green Purity Test

Blue Purity test This test identifies any dead pixel or burn-in problem within the blue channel.

| (i) Blue Purity Test ×   |           | Warns that the screen will be filled with blue color. |
|--|-----------|---|
| Your screen will be filled with the color blue.<br>Try to identify any spot or stain distinct from<br>the blue background. |           |   |
| ОК   | )         |   |
| ţ  |           |   |
|  |           | Fill the screen with blue color                       |
|  |           |   |
|  |           |   |
| Ļ  |           |   |
| i Blue Purity Test   | ×         | Asks if the screen was displayed uniform and free     |
| Was the displayed screen uniform and free of spots and stains?   |           | of spots and stains.                                  |
| No Yes   | $\supset$ |   |

Figure 44: Blue Purity Test

Black Purity test This test identifies any dead pixel or burn-in problem within the black channel.

| (i) Black Purity Test ×  | Warns that the screen will be filled with black color.                 |
|--|--|
| Your screen will be filled with the color black.<br>Try to identify any spot or stain distinct from<br>the black background. |  |
| ОК   |  |
| ţ  |  |
|  | Fill the screen with black color                                       |
|  |  |
|  |  |
|  | 1  |
|  | ×  |
| Black Purity Test  | Asks if the screen was displayed uniform and free of spots and stains. |
| Was the displayed screen uniform and free of spots and stains?   |  |
| No Yes   |  |

Figure 45: Black Purity Test

White Purity test This test identifies any dead pixel or burn-in problem within the white channel.

| (i) White Purity Test $\times$   | Warns that the screen will be filled with white color. |
|--|--|
| Your screen will be filled with the color white.<br>Try to identify any spot or stain distinct from<br>the white background. |  |
| ОК   |  |
| Ţ  |  |
|  | Fill the screen with white color                       |
|  |  |
|  |  |
| Ļ  |  |
| (i) White Purity Test  | × Asks if the screen was displayed uniform and free    |
| Was the displayed screen uniform and free of spots and stains?   | of spots and stains.                                   |
| No Yes   |  |

Figure 46: White Purity Test

# **Color Transition Test**

This test identifies any problem with the display's color distinction.

| (i) Color Transition Test ×<br>Several shades of red, green, blue and gray<br>will be shown on your screen. Try to<br>distinguish all the sahdes from each other. | Warns that the screen will be filled with several shades of red, green, blue, and gray. |
|---|---|
| ОК  |   |
| Ļ   |   |
|   | Fill the screen with the shades.  |
|   |   |
|   |   |
|   |   |
| Ļ   |   |
| (i) Color Transition Test $\times$  | Asks if the screen was displayed uniform and free of                                    |
| Were you ablee to distinguish all the video shades?   | spots and stains.   |
| No Yes  |   |
|   |   |

Figure 47: Color Transition Test

### Monochromatic Mesh Test

This test identifies stuck pixels as they will be highlighted in contrast with the background.

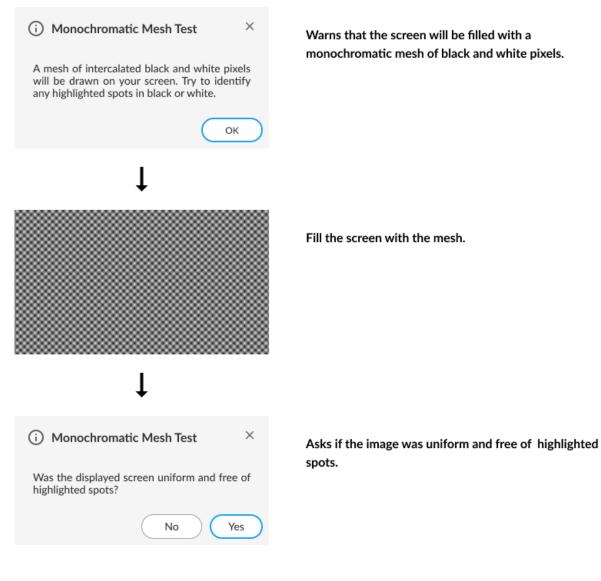


Figure 48: Monochromatic Mesh Test

#### **Inverted Monochromatic Mesh Test**

This test identifies stuck pixels as they will be highlighted in contrast with the background. In this test black and white pixels are inverted.

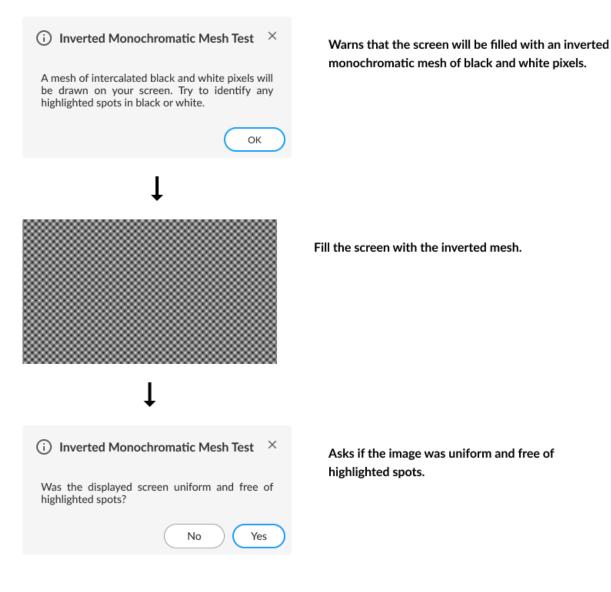


Figure 49: Inverted Monochromatic Mesh Test

#### **Sharpness Test**

This test identifies sharpness problems.

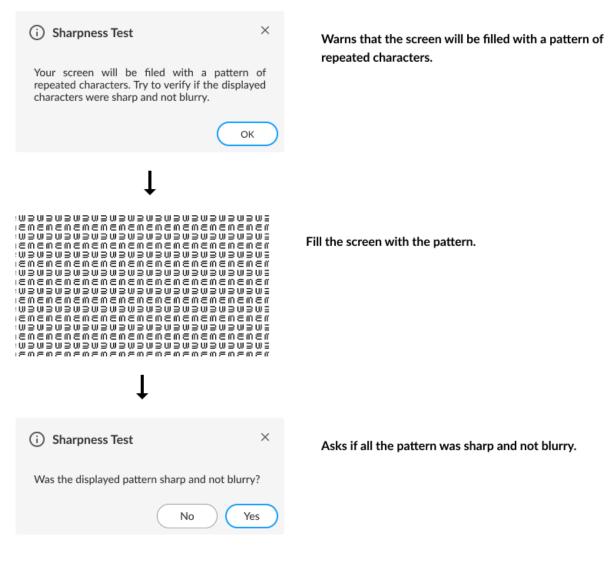


Figure 50: Sharpness Test

# **Display Interactive Test**

The Display Interactive Test is the combination of all purity tests. The purity tests aim to identify dead pixels or burnin problems in the channels: red, green, blue, black, and white. In additional you shall inform the number you are seeing on the screen.

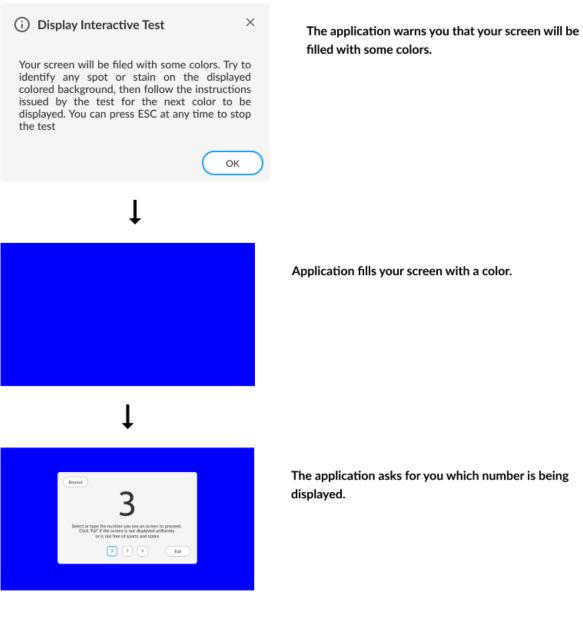


Figure 51: Display Interactive Test

# 4.8 Display Interface 💳

The Display Interface module contains tests that can verify that the communication with the monitors is working properly and that the EDID is consistent.

The Display module is composed of the following tests:

| Test                       | Test type | Attendance |
|----------------------------|-----------|------------|
| EDID Checksum Test         | Quick     | Unattended |
| Display Communication Test | Quick     | Unattended |

#### **EDID Checksum Test**

This test checks the integrity of the Extended Display Identification Data (EDID) checksum provided by the monitor.

# **Display Communication Test**

This test checks the communication with the monitor.



The Fan module contains tests that can verify that the fan is working properly on high speeds.

The Fan module is composed of the following test:

| Test         | Test type | Attendance |
|--------------|-----------|------------|
| Control Test | Quick     | Unattended |

#### **Control Test**

Checks if the fan controller is able to work on higher speeds according to predefined levels in the firmware.

# 4.10 Fingerprint Reader 🕲

The Fingerprint Reader module contains tests that can help verify that the fingerprint reader devices are working properly.

The Fingerprint module is composed of the following tests:

| Test             | Test type | Attendance |
|------------------|-----------|------------|
| Recognition Test | Quick     | Attended   |

# **Recognition Test**

The test prompts you to swipe or touch a finger on the fingerprint device. Before the test start, it's displayed the informational pop-up according to the image below:

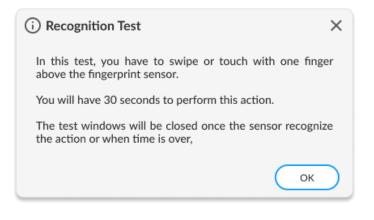
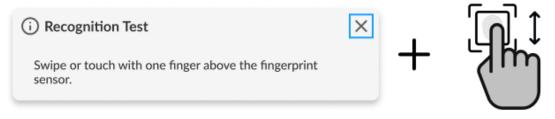


Figure 52: Recognition Test Pop-up

The test starts by asking you to swipe or touch your device.



#### Figure 53: Recognition Test

If you do not perform any action for 30 seconds, the following pop-up is displayed:

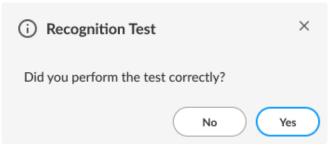


Figure 54: Recognition Test - Confirmation Pop-up

If you select "Yes", reporting that the test was performed according to the instructions, the test will fail. In this case, the application assumes that it was not possible to detect the device, indicating a bad working of it. If you select "No", the test is canceled because the actions required were not properly executed.

# 4.11 Keyboard

The Keyboard module contains tests that can help verify that the keyboard devices are working properly.

The Keyboard module is composed of the following tests:

| Test                      | Test type | Attendance |
|---------------------------|-----------|------------|
| PS2 Keyboard Test         | Quick     | Unattended |
| USB Keyboard Test         | Quick     | Unattended |
| Keycode Verification Test | Quick     | Attended   |
| Advanced Test             | Quick     | Attended   |
| Backlight Test            | Quick     | Attended   |

#### **PS2 Keyboard Test**

This test tries to identify any defective PS/2 keyboard detected on this machine.

| (i) PS/2 Keyboard Test   | ×         |
|--|-----------|
| Please refrain from using your mouse<br>keyboard while the test is running. If yo<br>experience problems after the test is complet<br>you may need to restart your system. | u         |
| ОК   | $\supset$ |

Figure 55: PS2 Keyboard Test Pop-up

#### **USB Keyboard Test**

This test tries to identify any defective USB keyboard detected on this machine.

#### **Keycode Verification Test**

Presents the latest pressed key to the user in a legible format and the current state of the toggle keys.

If you confirm that all keys that he has pressed were displayed, the test is finished as Passed. Otherwise, the test is finished as Failed.

|        | (i) Keycode Verification Test   | ×            |
|--------|---|--------------|
|        | The keycode verification test shows the user in a legible<br>format the last pressed key and the current state of<br>toggle keys. During the test, keyboard navigation will be<br>unavailable, requiring the use of a pointer to continue<br>executing the test. Press Continue to proceed with the<br>test execution or press Cancel to cancel the test. |              |
|        | Cancel Continue   | $\mathbf{D}$ |
|        | Ļ   |              |
| () К   | eycode Verification Test  | ×            |
| Feel   | free to use your keyboard and provide the test result when  | you finish.  |
|        | Last Pressed key:   |              |
|        | а   |              |
|        | Toggle Keys: 🛛 Num 🗌 Caps 🗌   | Scroll       |
| ls you | Ir keyboard behaving as expected? Yes   | No           |

Figure 56: Keycode Verification Test

# **Advanced Test**

Interactive test to verify the status of the keyboard keys.

The test will mark the pressed keys until you test all keys. You can select the most appropriate keyboard layout.

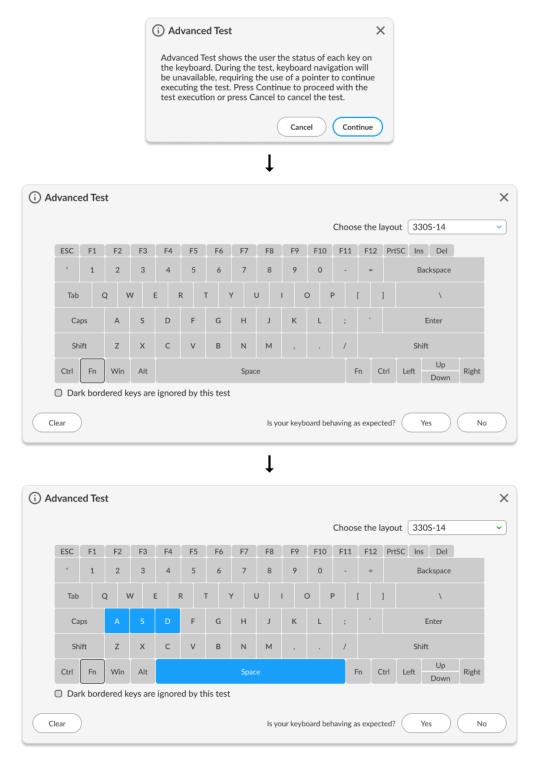


Figure 57: Advanced Test

# **Backlight Test**

Interactive test to verify if the keyboard backlight is working properly by controlling its intensity.

The test starts by asking if the keyboard has a backlight symbol. If you answer yes, the test will guide you on turning it on then asks if it worked.

| i) Backlight Test  | ×         |
|--|-----------|
| To continue with this test, make sure that your keyboard<br>has the backlight icon on the Spacebar or on the Esc Key.<br>Does your keyboard have this icon?  |           |
| NO   | YES       |
| Ļ  |           |
| (i) Backlight Test   | ×         |
| Press 'Fn + Spacebar' or 'Fn + Esc' and check<br>keyboard backlight turns on and changes its inte<br>each press. Is the keyboard backlight beha<br>expected? | ensity on |
| NO   | YES       |
|  |           |

Figure 58: Backlight Test

# 4.12 Memory 😑

The Memory module contains tests that can verify that the memory is working properly.

The Memory module is composed of the following tests:

| Test                          | Test type | Attendance |
|-------------------------------|-----------|------------|
| Quick Random Pattern Test     | Quick     | Unattended |
| Advanced Integrity Test       | Extended  | Unattended |
| Address Test                  | Extended  | Unattended |
| Bit Low Test                  | Extended  | Unattended |
| Bit High Test                 | Extended  | Unattended |
| Walking Ones Left Test        | Extended  | Unattended |
| Walking Ones Right Test       | Extended  | Unattended |
| Modulo-20 Test                | Extended  | Unattended |
| Moving Inversions 8Bit Test   | Extended  | Unattended |
| Moving Inversions 32 Bit Test | Extended  | Unattended |
| Random Pattern Test           | Extended  | Unattended |
| Random Number Sequence Test   | Extended  | Unattended |
| Block Move Test               | Extended  | Unattended |
| Nibble Move Test              | Extended  | Unattended |

**Note**: The memory tests allocate 80% of the available memory. Which implies high memory consumption, potentially causing performance issues including slowness.

#### **Quick Random Pattern Test**

The test consists of filling the memory with a randomly generated pattern and then checking that the pattern was correctly written. When checking, it writes the pattern's binary complement and checks again. The test is repeated twice. By default, 15 random patterns are used, therefore, the test runs once for each of these patterns.

#### **Advanced Integrity Test**

The test is based on the March C- enhanced algorithm. This test consists of filling the accessible memory with a pattern, checking it, writing its complement in an 8 bytes block size (64 bits), and then checking it again. This procedure is repeated twice, in the first time the pattern is addressed in the accessible memory from the highest position to the lowest and the second time by doing the inverse path. This test is intended to cover Stuck-At Faults and some Coupling Faults and Transition Faults.

#### **Address Test**

This test consists of writing to each memory address its own address. After that, the algorithm reads the memory previously written and checks if they still store their own address. This test is intended to cover any addressing fault in the accessible memory range.

#### **Bit Low Test**

This test consists of filling the memory buffer with a pattern where all bits are 0 and then checking it. When checking for this pattern, it writes its binary complement, and finally checks if the complement was stored accordingly. Such a process is repeated 4 times. This test is intended to identify the most serious Stuck-At Faults, some cases of Transition Faults, and some cases of reading Random Faults.

#### **Bit High Test**

This test consists of filling the memory buffer with a pattern where all bits are 1 and then checking it. When checking for this pattern, it writes its binary complement, and finally checks if the complement was stored accordingly. Such a process is repeated 4 times. This test is intended to identify the most serious Stuck-At Faults, some cases of Transition Faults, and some cases of reading Random Faults.

#### Walking Ones Left Test

The Walking Ones Left Test consists of writing a pattern where only the rightmost bit is set (e.g. 00000001), then shifting this pattern to the left (e.g. 00000010) until the end of the size of a byte, writing it again at the same memory address each time such pattern is shifted. Therefore, the test is intended to cover most of the Stuck-At Faults and some cases of Coupling Faults, and also test the data bus by confirming that every bit can be written.

#### Walking Ones Right Test

The Walking Ones Right Test consists of writing a pattern where only the leftmost bit is set (e.g. 1000000), then shifting this pattern to the right (e.g. 01000000) until the end of the size of a byte, writing it again at the same memory address each time such pattern is shifted. Therefore, such a test is intended to cover most of the Stuck-At Faults and some cases of Coupling Faults and also test the data bus by confirming that every bit can be written.

#### Modulo-20 Test

The test consists of writing into an interval of 20 memory locations for each block with a pattern and filling all other locations with its complement 6 times. Unlike the other tests, the Modulo-20 test is not affected by buffering or caching, so it can detect most of the Stuck-At Faults, Coupling Faults, Transition Faults and Read Random Faults that are not detected by other testing approaches.

#### **Moving Inversions 8Bit Test**

The test consists of filling the memory with the 8-bit wide pattern: 10000000 and then checking that the pattern was correctly written. When checking, it writes the pattern's binary complement (01111111) and checks it again. The procedure described earlier is repeated 8 times, one for each pattern right shifted: 10000000, 01000000, 00100000, 00010000, 00000010, 00000001.

#### **Moving Inversions 32 Bit Test**

This test fills all the accessible memory with a shifting pattern, that is, a value that is binary left shifted as it is written out through the accessible memory of every memory block. Once the pattern reaches 0x80000000 (a value with the left most bit set to 1 only) then the pattern is reset to 0x00000001. After that, it checks the written values and writes their binary complements, starting from the first memory address to the last one. Finally, the algorithm checks the memory for the complements written in the previous step, being this checking starting from the last element down to the first one. Such a process is repeated 2 times. This test presents a more thorough approach intended to cover most of the Stuck-At Faults and Transition Faults and some cases of Coupling Faults and Read Random Faults.

#### **Random Pattern Test**

The test consists of filling the memory with a randomly generated pattern and then checking that the pattern was correctly written. When checking, it writes the pattern's binary complement and checks it again. This process is repeated twice. By default, 50 random patterns are used, therefore the test runs once for each of these patterns.

#### **Random Number Sequence Test**

The test consists of filling the memory with one different random generated pattern for each memory address and then checking that the pattern was correctly written. To check it, the test must generate these numbers based on a seed that may be reset to reproduce the sequence. When checking, it writes the pattern's binary complement and it checks again. Such a process is repeated several times. This test is intended to cover most of the Stuck-At Faults, Coupling Faults, and some cases of Transition Faults and Read Random Faults.

#### **Block Move Test**

The test consists of moving memory data around within memory blocks. The movements are repeated 64 times moving 64-bit blocks. Finally, the test checks every memory address to verify if it is consistent.

#### **Nibble Move Test**

This test consists of writing to a nibble (a nibble is a group of four bits) a pattern value in each memory address, then it validates every nibble individually. It repeats this process until all nibbles in every address are checked.

# 4.13 Motherboard

The Motherboard module contains tests that can verify that the motherboard components are working properly.

The Motherboard module is composed of the following tests:

| Test           | Test type | Attendance |
|----------------|-----------|------------|
| Chipset Test   | Quick     | Unattended |
| PCI/PCI-e Test | Quick     | Unattended |
| RTC Test       | Quick     | Unattended |
| USB Test       | Quick     | Unattended |

# **Chipset Test**

The test checks the status registers of the controllers that form the foundation of the motherboard chipset. These controllers are EHCI, OHCI, xHCI, and SATA.

# PCI/PCI-e Test

The PCI/PCI-e Test checks if all PCI Express devices are recognized, communicate with the system, and check the status registers for unexpected errors or power failure.

# **RTC Test**

The test checks the following RTC (Real Time Clock) properties: accuracy and rollover. The test attempts to guarantee the correct operation of these properties.

#### **USB** Test

The test checks the status of USB devices. If any errors are indicated, the test fails.

#### 4.14 Mouse Devices (')

The Mouse Devices module contains tests that can help verify that the mouse and TrackPoint devices are working properly.

The Mouse Devices module is composed of the following tests:

| Test                 | Test type | Attendance |
|----------------------|-----------|------------|
| Click Test           | Quick     | Attended   |
| Precision Test       | Quick     | Attended   |
| Press Precision Test | Quick     | Attended   |

#### **Click Test**

It does a check on the device's buttons, issuing you to perform some actions regarding them. The Click Test execution is based on the workflow below.

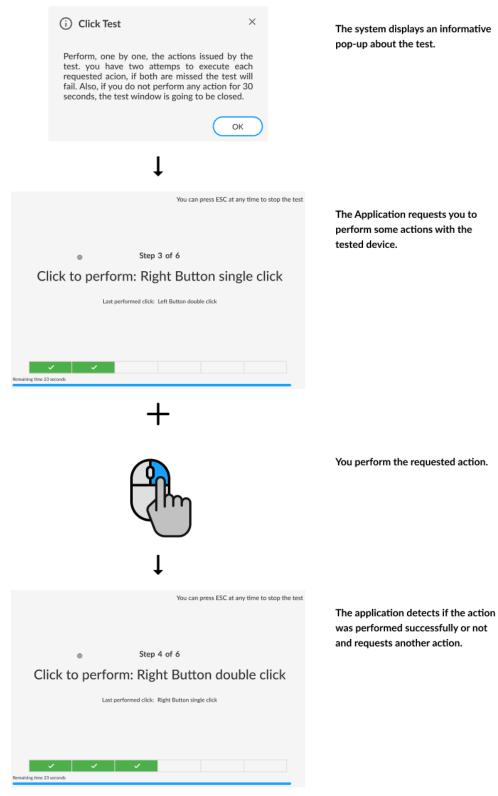


Figure 59: Mouse Click Test

You must perform one by one, the actions issued by the test. Note that the actions requested depend on the numbers and types of buttons present in your pointing device.

You have two attempts to execute each requested action. If the requested action was detected by the application, it is considered as passed. Otherwise, the action is considered as "Failed". The Click Test is considered as "Passed" if all actions required are passed.

If you do not perform any action for 30 seconds, the following pop-up is displayed:

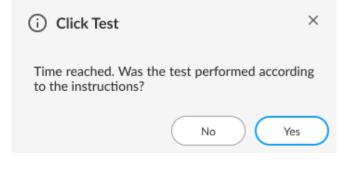
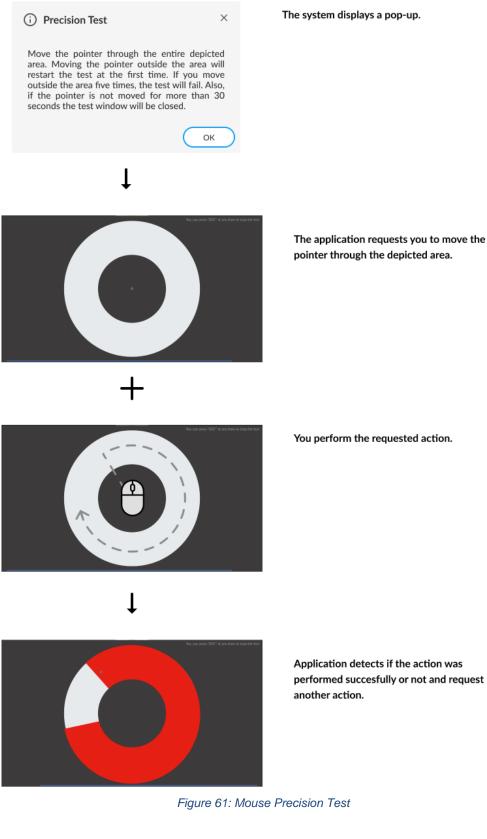


Figure 60: Mouse Click Test Confirmation Pop-up

If you select "Yes", reporting that the test was performed according to the instructions the test will fail. In this case, the application assumes that it was not possible to detect the device, indicating a bad working of it. If you select "No", the test is canceled because the actions required were not properly executed.

# **Precision Test**

Tests the device movement precision. The Precision Test execution is based on the following workflow:



If you get to move the pointer through the entire depicted area without reaching the outside area the test is finished as passed. If the outside area was reached five times the test will fail. If the pointer is not moved for more than 30 seconds the test window is going to be closed and the following message is displayed to you:

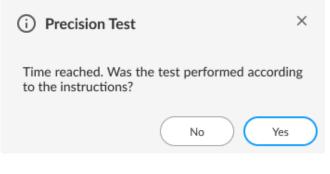
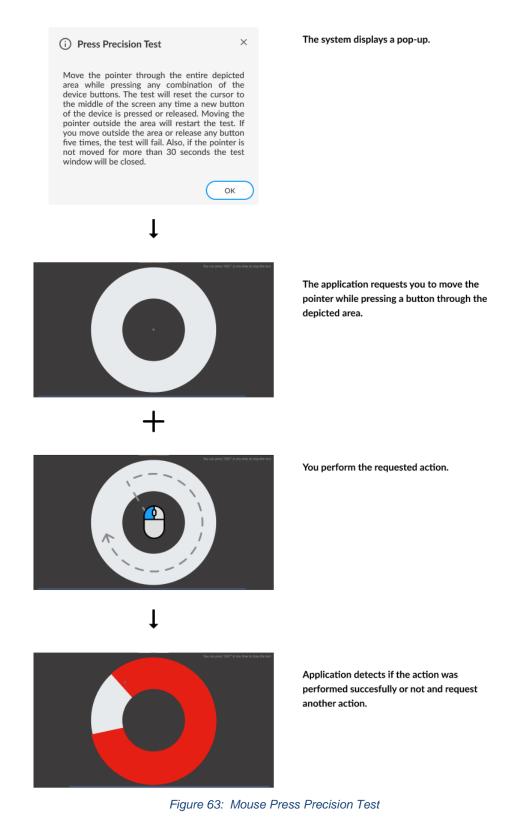


Figure 62: Mouse Precision Test Confirmation Pop-up

If you select "Yes", reporting the test was performed according to the instructions, the test will be finished as "failed". In this case, the application assumes that it was not possible to detect the device movement, indicating a bad working of the device. If you select "No", the test is canceled because the required actions were not properly executed.

# **Press Precision Test**

Tests the device movement precision while any combination of mouse buttons is pressed. The Press Precision Test execution is based on the following workflow:



If you press the button and get to move the pointer through the entire depicted area without reaching the outside area the test is finished as passed. If the outside area was reached five times or the pressed button release at least five times the test will fail. If the pointer is not moved for more than 30 seconds the test window is going to be closed and the following message is displayed to you:

| i Press Precision Test  | ×         |
|---|-----------|
| Time reached. Was the test performed according to the instructions? | ng        |
| No Yes  | $\supset$ |
|   |           |

Figure 64: Mouse Press Precision Test Confirmation Pop-up

If you select "Yes", reporting the test was performed according to the instructions, the test will be finished as "failed". In this case, the application assumes that it was not possible to detect the device movement, indicating a bad working of the device. If you select "No", the test is canceled because the required actions were not properly executed.

# 4.15 Optical Drive 💿

The Optical Drive module contains tests that can help verify that the optical drive devices are working properly.

The Optical Drive module is composed of the following tests:

| Test                         | Test type | Attendance |
|------------------------------|-----------|------------|
| Media-Less Optical Self-Test | Quick     | Unattended |
| Linear Seek Test             | Quick     | Attended   |
| Random Seek Test             | Quick     | Attended   |
| Funnel Seek Test             | Quick     | Attended   |
| Read and Compare Test        | Quick     | Attended   |
| Write Test                   | Quick     | Attended   |

#### **Media-Less Optical Self-Test**

Checks the optical drive's internal components. This test requires that no media is inserted into the drive. Therefore if any media was detected into the drive the application displays the following message:

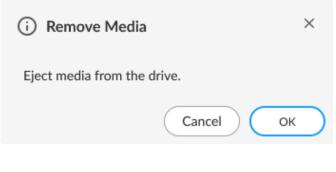


Figure 65: Media-Less Optical Self-Test Pop-up

#### **Linear Seek Test**

Checks the integrity of the optical drive's mechanism by continuously moving the drive's head all around the media. To execute this test you must have a media containing at least the following amount of data written on it according to its type: CD (210 MB), DVD (1000 MB), Blu-Ray (4000 MB).

#### **Random Seek Test**

Checks the integrity of the optical drive's transmission mechanism by moving the drive's head through random positions on the media. For executing this test you must have a media containing at least the following amount of data written on it according to its type: CD (210 MB), DVD (1000 MB), Blu-Ray (4000 MB).

#### **Funnel Seek Test**

Checks the integrity of the optical drive's mechanism by moving the drive's head in a funnel pattern. For executing this test you must have a media containing at least the following amount of data written on it according to its type: CD (210 MB), DVD (1000 MB), Blu-Ray (4000 MB).

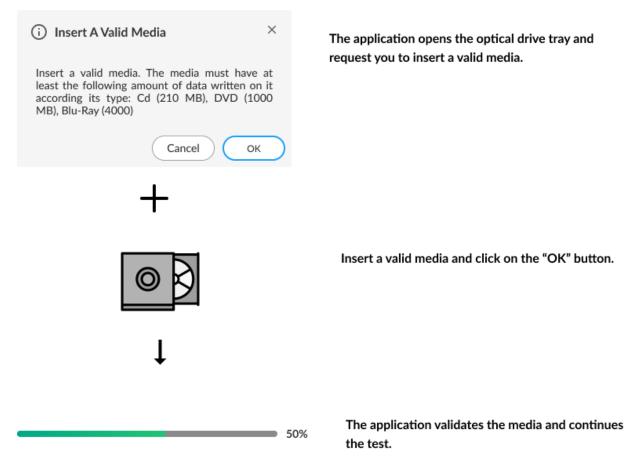
#### **Read and Compare Test**

Checks the driver's ability to make correct read operations. Performs two linear read operations and compares the information obtained from the two reads. For executing this test you must have a media containing at least the following amount of data written on it according to its type: CD (210 MB), DVD (1000 MB), Blu-Ray (4000 MB).

#### Write Test

Checks the capability of the drive to write correctly to optical media. For executing this test you must have blank media (CDR, CD-RW, DVD-R, DVD-RW, BD-R, BD-RE).

Linear Seek Test, Random Seek Test, Funnel Seek Test, Read and Compare Test and Write Test are performed according to the following workflow:





## 4.16 RAID 📴

The RAID module contains tests that can verify the health of the RAID controller.

The RAID module is composed of the following tests:

| Test                        | Test type | Attendance |
|-----------------------------|-----------|------------|
| Battery Status Test         | Quick     | Unattended |
| Enclosure Status Test       | Quick     | Unattended |
| Logical Drive Status Test   | Quick     | Unattended |
| RAID Status Test            | Quick     | Unattended |
| RAID Controller Status Test | Quick     | Unattended |
| Consistency Check           | Extended  | Attended   |

#### **Battery Status Test**

Checks the health of the controller's BBU (Battery Backup Unit)

#### **Enclosure Status Test**

Checks the status of the enclosures used by a RAID controller

#### Logical Drive Status Test

Checks the status of each logical drive in the RAID controller

#### **RAID Status Test**

Checks the status of each RAID volume in the RAID controller

#### **RAID Controller Status Test**

Checks the status of each RAID controller itself.

#### **Consistency Check**

Checks the consistency of each controller's logical drive. This test might take a few hours to run depending on how many logical and physical drives are present in the RAID controller.

## 4.17 Storage 🙋

The Storage module contains tests that can verify that the storage devices are working properly.

The Storage module is composed of the following tests:

| Test                        | Test type | Attendance | Supported On  |
|-----------------------------|-----------|------------|---|
| SMART Status Test           | Quick     | Unattended | HDD/SSD SATA, SAS, UFS  |
| Targeted Read Test          | Quick     | Unattended | HDD/SSD SATA  |
| Random Seek Test            | Quick     | Unattended | HDD/SSD SATA, SAS, UFS  |
| Funnel Seek Test            | Quick     | Unattended | HDD/SSD SATA, SAS, UFS  |
| SMART Short Self Test       | Quick     | Unattended | HDD/SSD SATA, SAS, UFS  |
| SMART Drive Self Test       | Quick     | Unattended | HDD SATA  |
| Default Self Test           | Quick     | Unattended | SAS, UFS  |
| Device Read Test            | Quick     | Unattended | EMMC, NVME, OPTANE  |
| SMART Wearout Test          | Quick     | Unattended | EMMC, NVME, OPTANE  |
| NVME Controller Status Test | Quick     | Unattended | NVME, DISABLED OPTANE.<br>If the NVMe device is attached to a RAID<br>controller, the test won't be supported |
| NVME SMART Temperature Test | Quick     | Unattended | NVME, OPTANE  |
| NVME SMART Reliability Test | Quick     | Unattended | NVME, OPTANE  |
| NVME SMART Spare Space Test | Quick     | Unattended | NVME, OPTANE  |
| Extended Random Seek Test   | Extended  | Unattended | SAS, UFS  |
| Extended Funnel Seek Test   | Extended  | Unattended | SAS, UFS  |
| Extended Self Test          | Extended  | Unattended | SAS, UFS  |
| Device Write Test           | Extended  | Unattended | EMMC, NVME, DISABLED<br>OPTANE  |
| Linear Read Test            | Extended  | Unattended | HDD/SSD SATA, SAS, EMMC,<br>NVME, OPTANE, UFS   |
| SMART Conveyance Test       | Extended  | Unattended | HDD/SSD SATA  |
| Full Disk Scan Test         | Extended  | Unattended | HDD/SSD SATA, SAS, EMMC,<br>NVME, OPTANE, UFS   |

#### **SMART Status Test**

Checks the status reported by SMART to quickly identify whether a device is defective or not.

#### **Targeted Read Test**

Checks the sectors in the neighborhood of bad sectors reported in the SMART logs.

#### Random Seek Test

Checks the integrity of the servo mechanism of a device by checking sectors at several randomly chosen addresses.

#### **Funnel Seek Test**

Checks the integrity of the servo mechanism of a device by checking sectors following a "funnel" or "butterfly" pattern.

#### SMART Short Self Test

Checks electrical and mechanical component status as well as the reading ability of the device.

#### **SMART Drive Self Test**

Proprietary Lenovo Drive Self-Test (DST) that mixes sequential and random reads to the disk.

#### Default Self Test

Vendor specific test that runs a quick check.

#### Device Read Test

Tests if it is possible to correctly read sectors in different areas of the storage device.

#### **SMART Wearout Test**

SMART Wearout Test checks the wearout level of the attached SSD device by reading SMART attributes and informs whether the device is in good condition or has reached its wearout limit.

#### **NVME Controller Status Test**

This test detects if the device behaves as expected.

#### **NVME SMART Temperature Test**

This test detects if the current temperature for the device is in a critical state.

#### NVME SMART Reliability Test

This test detects if the device is still reliable based on SMART metrics.

#### **NVME SMART Spare Space Test**

This test detects if the spare space in the device is critically low.

#### **Extended Random Seek Test**

Works similar to the Quick Random Seek test, but the number of checked sectors is larger and it does not stop when the first bad sector is found.

#### **Extended Funnel Seek Test**

Works similar to a quick funnel test, but the number of checked sectors is larger and it does not stop when the first bad sector is found.

#### **Extended Self Test**

Works similar to a quick Short Self Test, but checks more sectors.

#### **Device Write Test**

The Storage Device Write Test will verify if it is possible to write data on different areas of the device and then read the data correctly."

#### **Linear Read Test**

Checks the integrity of the storage device by reading its sectors following a linear pattern.

Before starting the test, you can define the start range and stop range of the test area, also you can define the coverage of the test area, and the maximum number of errors allowed during execution by clicking on the settings icon next to the test name:

| ☑ Linear Read Test ① 🕸 |         | Select the settings option. |
|------------------------|---------|-----------------------------|
|                        |         |                             |
| Ļ                      |         |                             |
|                        |         |                             |
| 袋: Linear Read Test    | ×       | Adjust the settings         |
| -                      |         | Aujust the settings         |
| Start Range (%)        |         |                             |
| 0                      |         |                             |
|                        |         |                             |
| Stop Range (%)         |         |                             |
| 100                    |         |                             |
|                        |         |                             |
| Coverage area (%) ⑦    |         |                             |
| 20                     |         |                             |
|                        |         |                             |
| Error Limit ⑦          |         |                             |
| 1                      |         |                             |
|                        |         |                             |
|                        | CONFIRM |                             |
|                        |         |                             |

Figure 67: Customizable Parameters for the Linear Read Test

#### **SMART Conveyance Test**

Checks the device's integrity through the status returned by the SMART Conveyance test.

#### Full Disk Scan Test

This test performs a full verification of the disk.

Before starting the test, you can define the maximum number of errors allowed during execution by clicking on the settings icon next to the test name:

| ✓ Full Disk Scan ③ |         | Select the settings option. |
|--------------------|---------|-----------------------------|
| Ļ                  |         |                             |
| 段 Full Disk Scan   | ×       | Adjust the settings         |
| Error Limit ⑦      |         |                             |
|                    | CONFIRM |                             |

Figure 68: Customizable Parameter for the Full Disk Scan Test

### 4.18 Video Card 📴

The Video Card module contains tests that can verify that the video card devices are working properly.

The Video Card module is composed of the following tests:

| Test   | Test type | Attendance |
|--|-----------|------------|
| Video Memory Test                                      | Quick     | Unattended |
| CUDA Memory Fault Test                                 | Quick     | Unattended |
| CUDA Address Test                                      | Quick     | Unattended |
| CUDA Moving Inversion Test                             | Quick     | Unattended |
| CUDA Block Move Test                                   | Quick     | Unattended |
| CUDA Random Number Sequence Test                       | Quick     | Unattended |
| CUDA Modulo X Test                                     | Quick     | Unattended |
| DirectCompute Standard Mathematical<br>Operations Test | Quick     | Unattended |
| DirectCompute Advanced Mathematical<br>Operations Test | Quick     | Unattended |
| CUDA Standard Mathematical Operations<br>Test          | Quick     | Unattended |
| CUDA Advanced Mathematical Operations<br>Test          | Quick     | Unattended |
| Texture Pipeline Test                                  | Quick     | Unattended |
| Extended Video Memory Test                             | Extended  | Unattended |
| Stress Test  | Extended  | Unattended |
| Wireframe Stress Test                                  | Extended  | Unattended |

Video card devices can run concurrently during the execution of the tests, except the Stress or Wireframe Stress tests that are executed in serial.

#### Video Memory Test

Verifies if some data patterns are consistently read from and written to video card memory.

#### **CUDA Memory Fault Test**

This test executes the March C- algorithm on memory GPU. This test detects Stuck-at-Faults (SAF), Address Faults (AF), Transition Faults (TF), and Coupling Faults (CF).

#### **CUDA Address Test**

This test loads each memory location with its own address and then checks for consistency, to detect addressing errors.

#### **CUDA Moving Inversion Test**

This test detects memory errors by writing a pattern and checking if each memory location holds this pattern.

#### **CUDA Block Move Test**

Blocks of memory are initialized with 8-bytes shifting patterns that are moved to different locations to detect memory errors.

#### **CUDA Random Number Sequence Test**

This test generates a random sequence and fills the GPU memory with it, then checks if these blocks still hold the same random pattern sequence.

#### **CUDA Modulo X Test**

This test detects faults due to the interaction of neighboring memory cells. A pattern is written for the addresses starting with an offset equal to zero and increasing by 20 until the end of the allocation. After, all the addresses not filled with the pattern are filled with its complement. The pattern is checked for the addresses they are supposed to be written and this process starts another iteration adding the offset by 1. This process is repeated until all memory locations are tested.

#### **DirectCompute Standard Mathematical Operations Test**

Performs several standard mathematical operations in order to test that the video card processing units are in good condition using DirectCompute.

#### **DirectCompute Advanced Mathematical Operations Test**

Performs several advanced mathematical operations in order to test that the video card processing units are in good condition using DirectCompute.

#### **CUDA Standard Mathematical Operations Test**

Performs several standard mathematical operations in order to test that the video card processing units are in good condition using CUDA.

#### **CUDA Advanced Mathematical Operations Test**

Performs several advanced mathematical operations in order to test that the video card processing units are in good condition using CUDA.

#### **Texture Pipeline Test**

Sends texture patterns to be rendered by the graphics pipeline and checks for loss of data when comparing input and output

#### **Extended Video Memory Test**

Similar to Video Memory Test, but performs an extended analysis with more data patterns

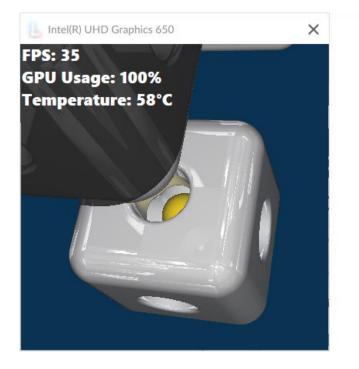
#### **Stress Test**

Executes heavy operations on the video card for the purpose of stressing the GPU and verifying that the results remain reliable under stress. Before starting the test, you can change the duration of the test and the window size of the animation by clicking on the settings icon next to the test name:

|   |                           |         | <b>C</b> lick on the settings button              |
|---|---------------------------|---------|---|
| Street  | ess Test 🛈 🥵              |         | Click on the settings button                      |
|   |                           |         |   |
|   | Ļ                         |         |   |
|   |                           |         |   |
| ស៊េ ទ   | tress Test                | ×       |   |
| -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- |                           |         | Adjust the time duration and the windows<br>size. |
|   | Test duration (minutes) ⑦ |         | size.   |
|   | 5                         |         |   |
|   |                           |         |   |
|   | Windows size ⑦            |         |   |
|   | 400x400                   | ~       |   |
|   | -1002-100                 | -       |   |
|   |                           |         |   |
|   |                           | CONFIRM |   |
|   |                           |         |   |

Figure 69: Customizable Parameters for the Video Card Stress Test

During the test execution, an animation is displayed and information of the FPS, GPU, and temperature are shown.



During the execution, is displayed an animation and are shown information about the FPS, GPU, and temperature.

Figure 70: Video Card Stress Test Animation

#### Wireframe Stress Test

Executes heavy wireframe operations on the video card for the purpose of stressing the GPU and verifying that the results remain reliable under stress. Before starting the test, you can change the duration of the test by clicking on the settings icon next to the test name, according to the image below:

| ✓ Wireframe Stress Test ③ | Click on the settings button.  |
|---------------------------|--------------------------------|
| Ļ                         |                                |
| 袋 Wireframe Stress Test   | imes Adjust the time duration. |
| Test duration (minutes) ⑦ |                                |
| CONF                      | IRM                            |

Figure 71: Customizable Parameter for the Wireframe Stress Test

## 4.19 Wired Ethernet

The Wired Ethernet module contains tests that can help verify that the ethernet network devices are working properly.

The Wired Ethernet module is composed of the following tests:

| Test                     | Test type | Attendance |
|--------------------------|-----------|------------|
| Internet Connection Test | Quick     | Unattended |
| Link Test                | Quick     | Attended   |

#### Internet Connection Test

Tests the internet connection by initiating a TCP connection with an external host, sending an HTTP request, and waiting for the host's reply. The test is canceled if the tested device has no wired connection using IPv4 to network.

## Link Test

The Link Test will verify if the Ethernet network device is faulty based on its operational status. The test starts by asking you if the network device is connected to a network.

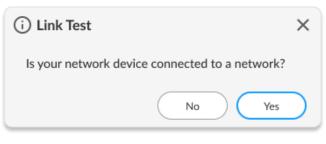


Figure 72: Link Test Confirmation Pop-up

The test is performed according to your answer. If you selected "Yes", the test tries to establish a network link and if you select "No" the test verifies if the device has, indeed, no network link.

### 4.20 Wireless 🛜

The Wireless module contains tests that can verify that the wireless devices are working properly.

The Wireless module is composed of the following tests:

| Test                 | Test type | Attendance |
|----------------------|-----------|------------|
| Radio Enabled Test   | Quick     | Unattended |
| Network Scan Test    | Quick     | Unattended |
| Signal Strength Test | Quick     | Unattended |

#### **Radio Enabled Test**

Verifies that the wireless is turned on.

#### **Network Scan Test**

Verifies that the wireless adapter can detect available networks. Make sure that there is a properly configured router or access point nearby before running this test.

#### **Signal Strength Test**

Tests the wireless connection quality for the wireless adapter. Make sure that there is a properly configured router or access point nearby before running this test.

#### 4.21 Touchpad Devices 🗔

The Touchpad Devices module contains tests that can help verify that the touchpad devices are working properly.

The Touchpad Devices module is composed of the following tests:

| Test                 | Test type | Attendance |
|----------------------|-----------|------------|
| Click Test           | Quick     | Attended   |
| Precision Test       | Quick     | Attended   |
| Press Precision Test | Quick     | Attended   |

#### **Click Test**

It does a check on the device's buttons, issuing you to perform some actions regarding them. The Click Test execution is based on the workflow below.

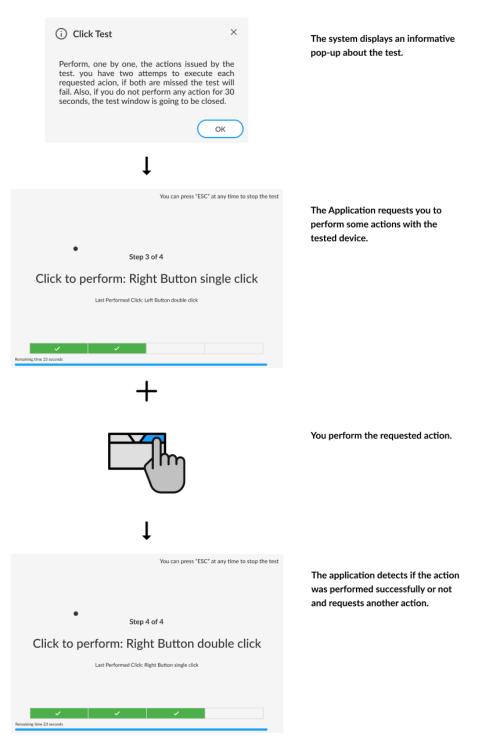


Figure 73: Touchpad Click Test

You must perform one by one, the actions issued by the test. Note that the actions requested depends on the numbers and types of buttons present in your touchpad device.

You have two attempts to execute each requested action. If the requested action was detected by the application, it is considered as passed. Otherwise, the action is considered as "Failed". The Click Test is considered as "Passed" if all actions required are passed.

If you do not perform any action for 30 seconds, the following pop-up is displayed:

| (i) Click Test  | ×         |
|---|-----------|
| Time reached. Was the test performed accordi to the instructions? | ng        |
| No Yes  | $\supset$ |

Figure 74: Touchpad Click Test Confirmation Pop-up

If you select "Yes", reporting that the test was performed according to the instructions the test will fail. In this case, the application assumes that it was not possible to detect the device, indicating a bad working of it. If you select "No", the test is canceled because the actions required were not properly executed.

#### **Precision Test**

Tests the device movement precision. The Precision Test execution is based on the following workflow:

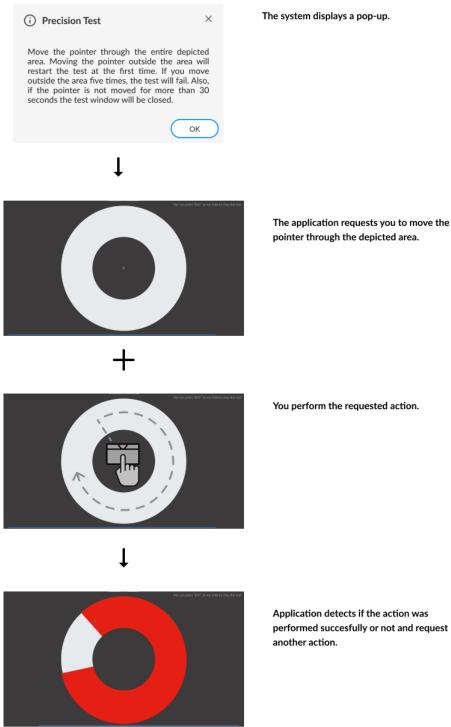


Figure 75: Touchpad Precision Test

If you get to move the pointer through the entire depicted area without reaching the outside area the test is finished as passed. If the outside area was reached five times the test will fail. If the pointer is not moved for more than 30 seconds the test window is going to be closed and the following message is displayed for you:

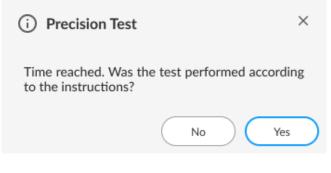
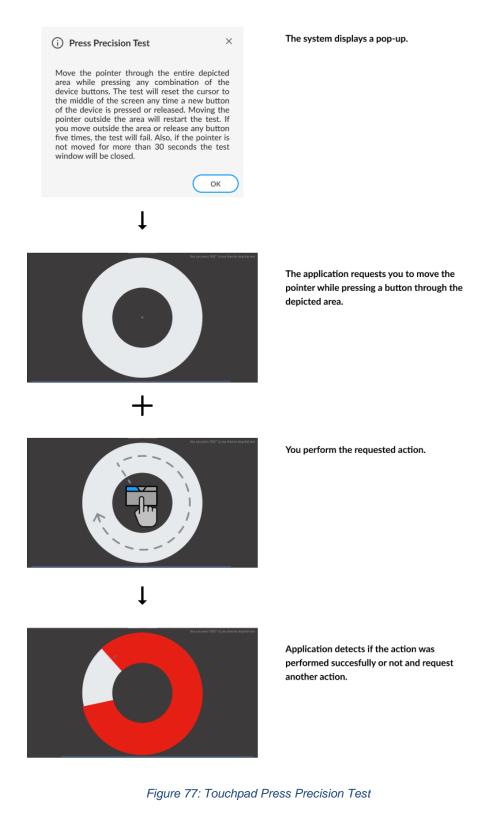


Figure 76: Touchpad Precision Test Confirmation Pop-up

If you select "Yes", reporting the test was performed according to the instructions, the test will be finished as "failed". In this case, the application assumes that it was not possible to detect the device movement, indicating a bad working of the device. If you select "No", the test is canceled because the required actions were not properly executed.

#### **Press Precision Test**

Tests the device movement precision while any combination of touchpad buttons is pressed. The Press Precision Test execution is based on the following workflow:



If you press the button and get to move the pointer through the entire depicted area without reaching the outside area the test is finished as passed. If the outside area was reached five times or the pressed button release at least five times the test will fail. If the pointer is not moved for more than 30 seconds the test window is going to be closed and the following message is displayed to you:

| (i) Press Precision Test  | ×      |
|---|--------|
| Time reached. Was the test performed according to the instructions? | ording |
| No  | Yes    |

Figure 78: Touchpad Press Precision Test Confirmation Pop-up

If you select "Yes", reporting the test was performed according to the instructions, the test will be finished as "failed". In this case, the application assumes that it was not possible to detect the device movement, indicating a bad working of the device. If you select "No", the test is canceled because the required actions were not properly executed.

## 4.22 Touchscreen

The Touchscreen module comprises display devices with touchscreens.

The Touchscreen module is composed of the following tests:

| Test             | Test type | Attendance |
|------------------|-----------|------------|
| Basic Touch Test | Quick     | Attended   |
| Accuracy Test    | Quick     | Attended   |
| Diagonal Test    | Quick     | Attended   |
| Grid Test        | Quick     | Attended   |
| Multi-touch Test | Quick     | Attended   |

**Note:** If the screen reader (example: Window Narrator) is enabled, Touchscreen tests will be canceled automatically.

#### **Basic Touch Test**

The Basic touch test will verify if the system is receiving touch events. This test is based on the following workflow:

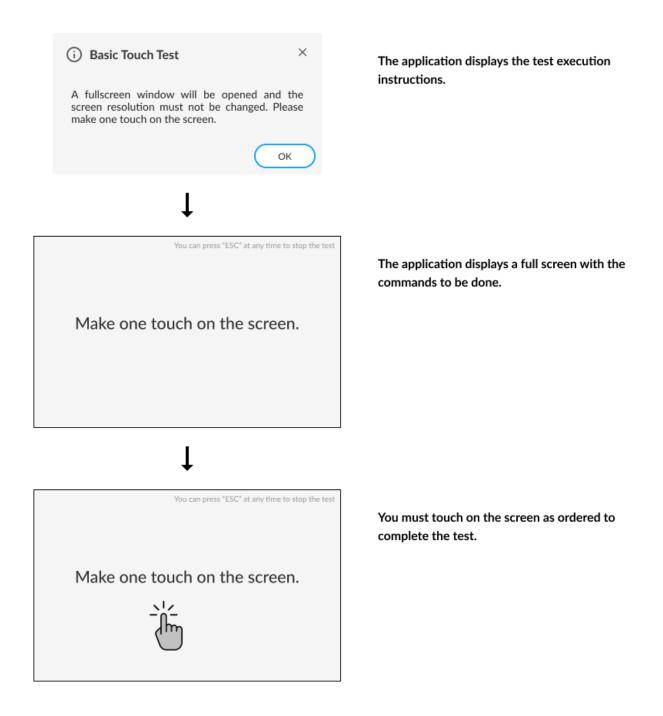


Figure 79: Basic Touch Test

#### Accuracy test

The Accuracy test will verify if the touchpoints are accurate with the screen mapping. This test is based on the following workflow:

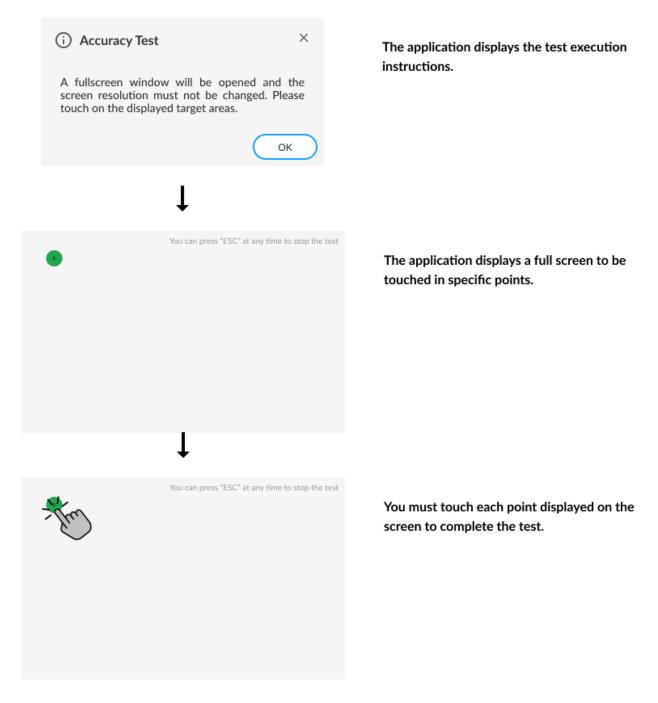
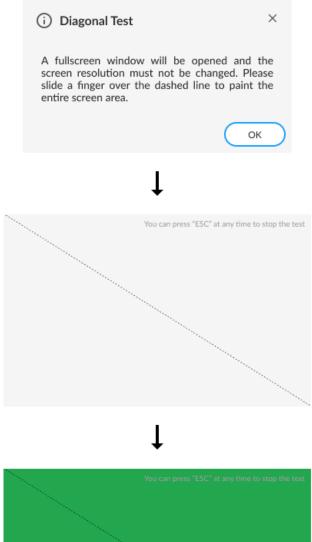


Figure 80: Accuracy Test

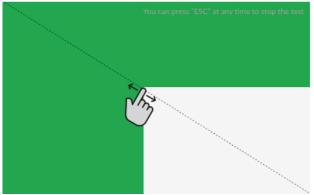
#### **Diagonal Test**

The Diagonal test will verify if rows and columns of the touchscreen are sensing through a diagonal gesture on the screen. This test is based on the following workflow:



The application displays the test execution instructions.

The application displays a full screen to be touched in a diagonal direction

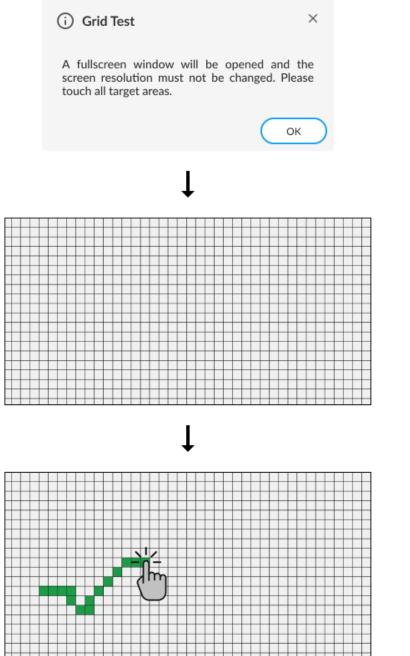


You must slide a finger over the dashed line to complete the test.

Figure 81: Diagonal Test

#### Grid test

The Grid test will verify if any areas of the touchscreen are not able to receive touch events. This test is based on the following workflow:



The application displays the test execution instructions.

The application displays a full screen with a grid to be fulfilled.

You must touch the target areas to complete the test.

Figure 82: Grid Test

#### **Multi-touch Test**

The Multi-touch test will verify if the system is receiving multi-touch events. This test is based on the following workflow:

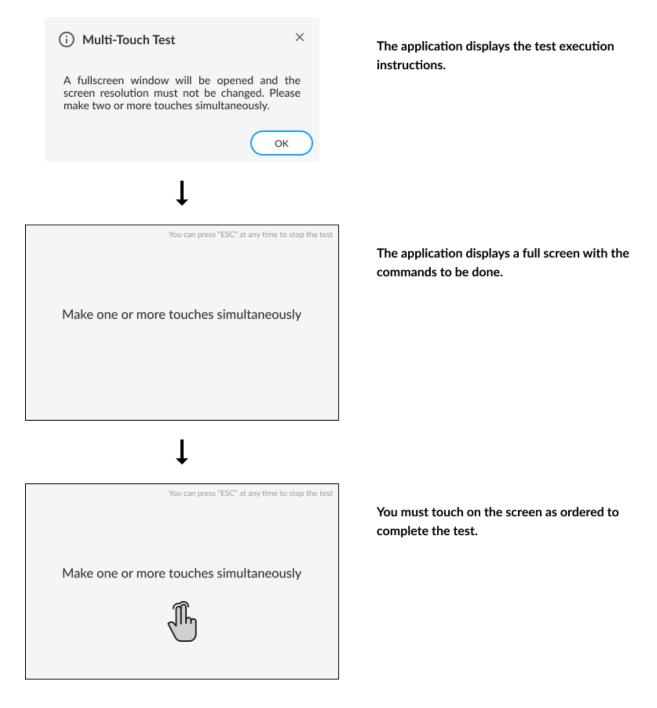


Figure 83: Multi-touch Test

## 4.23 Sensors -)

The Sensors module comprises the sensors devices of the machine, such as GPS, gyroscope, accelerometer, compass, and lid closing sensor.

The Sensors module is composed of the following tests:

| Test                           | Test type | Attendance |
|--------------------------------|-----------|------------|
| Accelerometer Noise Test       | Quick     | Unattended |
| Gyrometer Noise Test           | Quick     | Unattended |
| Compass Noise Test             | Quick     | Unattended |
| GPS Communication Test         | Quick     | Unattended |
| Accelerometer Interactive Test | Quick     | Attended   |
| Gyrometer Interactive Test     | Quick     | Attended   |
| Lid Closure Test               | Quick     | Attended   |
| GPS Interactive Test           | Extended  | Attended   |
| GPS Lock Test                  | Extended  | Unattended |

#### **Accelerometer Noise Test**

The Accelerometer Noise Test will verify the variation of the readings from the accelerometer over time and check if the noise detected is acceptable.

#### **Gyrometer Noise Test**

The Gyrometer Noise Test will verify the variation of the readings from the gyrometer over time and check if the noise detected is acceptable.

#### **Compass Noise Test**

The Compass Noise Test will verify the variation of the readings from the compass over time and check if the noise detected is acceptable.

#### **GPS Communication Test**

This test communicates with the GPS device and attempts to retrieve data. If data collection is successful within a specified time interval, the test returns Success.

### Accelerometer Interactive Test

The Accelerometer Interactive Test will check if the values returned by the accelerometer in different positions are correct.

| 1<br>(i) Sensors ×<br>Please hold the device with the screen<br>facing up and press OK.<br>OK  |  |
|--|--|
| Sensors      X  Please hold the device with the screen perpendicular to a flat surface with the Home Button on the bottom and press OK.      OK          |  |
| 3<br>(i) Sensors ×<br>Please hold the device with the screen<br>perpendicular to a flat surface with the<br>Home Button on the right and press OK.<br>OK |  |

| (i) Sensors<br>Please press OK and quickly place the<br>device face down for 10 seconds.  | ×<br> |  |
|---|-------|--|
| 5 (i) Sensors Please hold the device with the screen perpendicular to a flat surface with the Home Button on the top and press OK. OK | ×<br> |  |
| <b>6 6 6 9 19 19 19 19 19</b>   | ×<br> |  |

Figure 84: Accelerometer Interactive Test

**Gyrometer Interactive Test** The Gyrometer Interactive Test will check if the values returned by the gyrometer in different positions are correct.

| Sensors ×      Please leave the device facing up and press     OK, then immediately start rotating the     device clockwise until the next popup     displays.      OK   |  |
|--|--|
| Sensors     Please hold the device with the screen perpendicular to a flat surface with the Home Button on the bottom and press OK, then immediately start rotating the device clockwise until the next popup displays.     OK                     |  |
| 3<br>(i) Sensors ×<br>Please hold the device with the screen<br>perpendicular to a flat surface with the<br>Home Button on the right and press OK,<br>then immediately start rotating the device<br>clockwise until the next popup displays.<br>OK |  |

| (i) Sensors X<br>Please leave the device facing up and press<br>OK, then immediately start rotating the<br>device counterclockwise until the next<br>popup displays.  |  |
|---|--|
| 5<br>() Sensors X<br>Please hold the device with the screen<br>perpendicular to a flat surface with the<br>Home Button on the bottom and press OK,<br>then immediately start rotating the device<br>counterclockwise until the next popup<br>displays |  |
| 6<br>(i) Sensors X<br>Please hold the device with the screen<br>perpendicular to a flat surface with the<br>Home Button on the right and press OK,<br>then immediately start rotating the device<br>counterclockwise until the test finishes.<br>OK   |  |

Figure 85: Gyrometer Interactive Test

#### Lid Closure Test

This test verifies if the lid sensor is capturing the events of closing and opening the lid. The test will fail if these events are not captured.

The test will ask you to open and close the notebook lid.

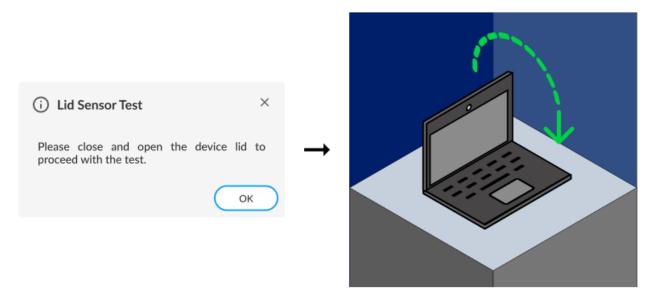


Figure 86: Lid Closure Test

#### **GPS Interactive Test**

This test communicates with the GPS sensor device and attempts to retrieve the current location coordinates. If the location coordinates collection is successful, a map is displayed of the current location.

The test will show a globe image indicating the current computer location.

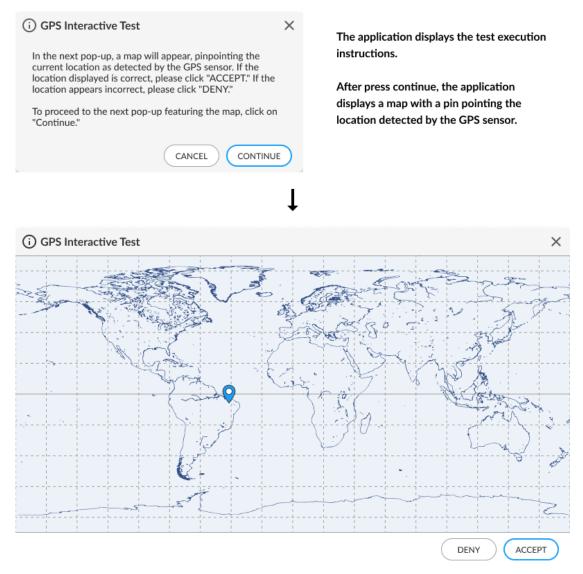


Figure 87: GPS Interactive Test

#### **GPS Lock Test**

This test verifies that the GPS is receiving signals of sufficient quality from enough satellites to calculate a location. If the GPS device does report a position fix within the specified time, the test returns Success. Before starting the test, you can define the timeout values of the test in the minutes by clicking on the settings icon next to the test name:

| 🗹 Gps Lock Test 🛈 🍇      |         | Click on the settings button |
|--------------------------|---------|------------------------------|
| ţ                        |         |                              |
| භී GPS Lock Test         | ×       | Adjust the time duration.    |
| Timeout Value (min) ⑦ 10 |         |                              |
|                          | CONFIRM |                              |

Figure 88: Customizable Parameter for the GPS Lock Test

## 4.24 SIM Card

The SIM Card module comprises the SIM and e-SIM card devices of the machine.

The SIM Card module is composed of the following tests:

| Test                 | Test type | Attendance |
|----------------------|-----------|------------|
| Network Scan Test    | Quick     | Unattended |
| Radio Enabled Test   | Quick     | Unattended |
| Signal Strength Test | Quick     | Unattended |

#### **Network Scan Test**

Checks if the device can identify mobile networks nearby.

#### **Radio Enabled Test**

Checks the radio connection state and informs if the SIM card is operating normally, or if it's blocked either by software or hardware.

#### **Signal Strength Test**

Checks if the signal intensity from the home provider network is above an acceptable limit.

# 5. EXPLORING LENOVO DIAGNOSTICS EVOLUTION TOOLS

## 5.1 Run All 🗹

Run All Tool allows performing all supported tests from all supported modules at the same execution. In this flow it is not possible to select devices, thus all devices will be tested.

|         | 📙 Lenovo      | Diagnostics Evolution   | - 🗆 ×                         |     |
|---------|---------------|---|-------------------------------|-----|
|         | L             | Lenovo<br>DIAGNOSTICS   | <ul> <li>● 錄 ⑦</li> </ul>     |     |
|         |               | Run All Diagnostics Tool  | ÷×                            |     |
|         | F,            | Preset Diagnostics ⑦  |                               |     |
| 1 - 2 - | վրդ           | Settings V Only Unattended Parallel Execution   |                               |     |
| 3       | Ę             | -0.0  | LL DIAGNOSTIC ⑦               | - 7 |
|         | <u></u> ূর্ণ্ | Custom Diagnostic ⑦   |                               |     |
| 4       | (;;           | Filter only unattended tests     Quick Selection:     Quick Tests     E                                 | extended Tests                |     |
| 5       |               | <ul> <li>Select All [0/120]</li> <li>Audio [0/2]</li> <li>Audio playback test <sup>(i)</sup></li> </ul> | Select All Parallel           | 8   |
|         |               | Microphone Interactive Test ③         Iterations:       1         ①       Estimated Time: 00:00:00 ⑦    | ► START                       | 9   |
| 6       | >>            | C REFRESH   | S BACK TO HOME                | 10  |
|         | 🗸 Sei         | rial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9   | Copyright © 2011, 2024 Lenovo |     |

- 1 Run only Unattended Tests
- 2 Enable parallelism among modules
- 3 Run quick diagnostics
- 4 Click to filter only unattended tests
- 5 Customize the execution
- 6 Refresh devices

- 7 Run all diagnostics
- 8 Enable this module to run in parallel with others
- 9 Start custom diagnostic
- 10 Back to home screen
- Figure 89: Run All Screen

#### **Preset Diagnostics**

This section contains predefined test sets that aim to diagnose all devices available in the same run. In this execution mode, it's possible to choose if the Attended Tests should be performed or not by clicking on "Only Unattended Tests", as well as to choose if the modules should be performed in parallel with each other by clicking on "Parallel Execution".

#### Quick

Click on Quick card to perform all quick tests according to your preferences defined in Preset Diagnostics settings.

#### • Full

Click on Full card to perform all tests (Quick + Extended) according to your preferences defined in Preset Diagnostics settings.

#### **Custom Diagnostics**

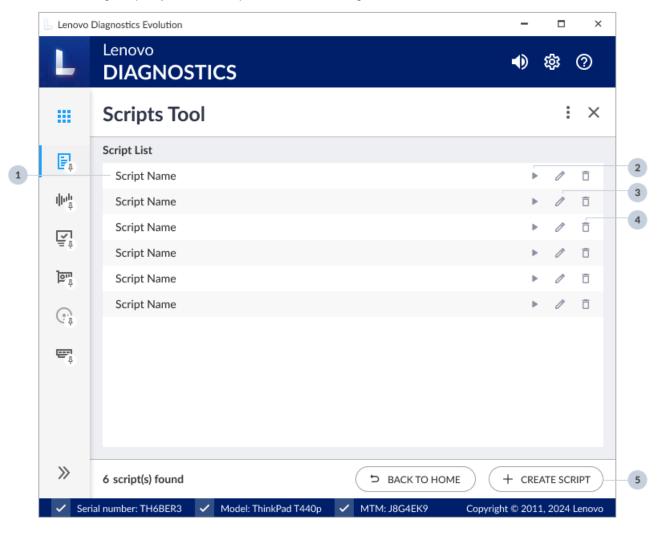
In this section, you can select any module/test to be run, choose which modules will run in parallel, enter the number of iterations, and filter the test list to display only unattended tests.

To filter by unattended tests, just to enable the "Filter only unattended tests" toggle. You also can use the "Quick Selection" to quickly select a set of tests.

## 5.2 Scripts Tool

The Scripts Tool allows you to create a custom list of tests from any module.

If there are existing scripts, you can also perform the following actions: Execute, edit, and delete.



- 1. Script Name
- 2. Execute Script
- 3. Edit Script
- 4. Delete Script
- 5. Create Script



#### 5.2.1 Create a diagnostic script

By clicking on the **Create Script** button, the screen below will be displayed. This screen allows selecting a set of tests to be performed from a list with all tests present in Lenovo Diagnostics Evolution. You can select the modules

to be run in parallel and define advanced settings for tests and modules. The tests not supported by the tested machine are marked with this warning icon  $\triangle$ 

| L            | Lenovo<br>DIAGNOSTICS                       |                     | <ul> <li>\$\$</li> </ul> | ?      |
|--------------|---|---------------------|--------------------------|--------|
|              | Scripts Tool                                |                     | :                        | ×      |
| F.           | Script List • Create Script                 |                     |                          |        |
| - <b>9</b>   | Create Script                               |                     |                          |        |
| hh<br>¢      | Tests Selection                             | Advanced Settings   |                          |        |
| Ť,           | Quick Selection: Quick Tests Extended Tests |                     |                          |        |
| _            | Select All [0/120]                          |                     | Sele                     | ct All |
| <sup>1</sup> | ∧ ☑ Audio [0/2]                             |                     | 🗖 Pa                     | rallel |
| G.           | ✓ Audio playback test ③                     |                     |                          |        |
|              | ✓ Microphone Interactive Test ③             |                     |                          |        |
| er,          | ∧ ■ Audio Controller [0/4]                  |                     | 🗖 Pa                     | rallel |
|              | CORB Status Test (i)                        |                     |                          |        |
|              | Output Stream Test ③                        |                     |                          |        |
|              | <ul> <li>Number of Execution</li> </ul>     | s 1 O Test Duration | in Minutes               | 1      |
| »            | 4 test(s) selected                          | ( Э васк) (         | SAVE SCF                 |        |

1. Select tests

1

- 2. Advanced settings for the script
- 3. Enable Parallel execution for all modules
- 4. Define the number of iterations for the script
- 5. Define the execution duration for the script
- 6. Save script

#### Figure 91: Scripts Tool (Script Creation)

It is also possible to configure the execution of these tests according to one of the following parameters:

**Number of Executions:** allows performing the tests according to a specific number of executions in a range from 1 to 999. In this case, the diagnostic will be finished when all iterations are completed.

**Test Duration in Minutes:** allows performing the tests according to a specific number of minutes in a range from 1 to 999. In this case, the diagnostic will be finished when this time is reached and all tests from the current iteration are finished.

Once you select at least 1 test, the advanced settings tab is enabled, and you can configure the following parameters:

**Module Execution Sequence:** This allows you to select the order in which the modules will be executed by dragging and dropping the modules and tests in the list.

Duplicate a test: This allows tests to be duplicated in the same execution.

Note: The script name cannot contain the following characters / \ : \* . ? ~ < > |

|   | Lenovo             | Lenovo                                     |                                     |                       | -        | ء<br>چ  | ×<br>? |   |
|---|--------------------|--|-------------------------------------|-----------------------|----------|---------|--------|---|
|   |                    | DIAGNOST<br>Scripts Tool                   |                                     |                       |          | :       | ×      |   |
|   | P.                 | Script List • Create Scri<br>Create Script | pt                                  |                       |          |         |        |   |
|   | $\  e^h_{\varphi}$ |  | Tests Selection                     | Advanced Settings     |          |         |        |   |
| 1 | ₹                  | - 🗄 🔺 Audio                                | test                                |                       |          |         |        | ^ |
|   | শূর্থ              | : Microphone Int                           | eractive Test                       |                       |          | ŧ       | Ō      | 2 |
|   | G <sub>4</sub>     | Microphone Int     Audio Controlle         |                                     |                       |          |         |        | 3 |
|   |                    | Bidirectional St                           |                                     |                       |          |         |        | 4 |
|   |                    |  | <ul> <li>Number of Execu</li> </ul> | tions 1 O Test Durati | on in Mi | nutes   | 1      | ~ |
|   | »                  | 4 test(s) selected                         |                                     | D BACK                |          | SAVE SC |        |   |

- 1. Click, drag and drop a test or modul
- 2. Duplicate a test
- 3. Delete duplicate test
- 4. Test not supported in that machine

Figure 92: Scripts Tool (Advanced Settings)

#### 5.2.2 Edit a diagnostic script

By clicking on the **Edit script** icon, a screen is displayed with the configuration from the selected diagnostic script.

Here it is possible to modify this configuration by changing the list of tests and which modules will be run in parallel, modifying the number of executions or duration minutes, and changing the advanced settings.

By clicking on the **Save Script** button all changes are saved in the current script and clicking on **Save as** it is possible to create a new script with the current configuration.

| 📙 Lenovo | Diagnostics Evolution   | -          |         | ×         |
|----------|---|------------|---------|-----------|
| L        | Lenovo<br>DIAGNOSTICS   |            | ŝ       | 0         |
|          | Scripts Tool  |            |         | ×         |
| E,       | Script List • Script Name • Edit Script<br>Edit script            |            |         |           |
| ψeh      | Tests Selection Advanced Settings                                 |            |         |           |
| I<br>≣ ≬ | Quick Selection:  Quick Tests Extended Tests                      |            |         |           |
| 100      | Select All [0/120]  |            | Sele    | ect All ^ |
| 다.<br>우  | ∧ ☑ Audio [0/2]   |            | D Pa    | arallel   |
| G.       | ☑ Audio playback test ③   |            |         | - 1       |
| _        | ✓ Microphone Interactive Test ⊙                                   |            |         | - 1       |
| -<br>-   | ∧ ■ Audio Controller [0/4]  |            | D Pa    | arallel   |
|          | CORB Status Test ①  |            |         | - 1       |
|          | Output Stream Test ③  |            |         |           |
|          | ✓ Input Stream Test ③   |            |         |           |
| -        | Number of Executions     O Test Duration                          | on in Mi   | nutes   | 1         |
| »        | 4 test(s) selected  | <b>D</b> 9 | AVE SC  |           |
| 🗸 Seri   | al number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 Copyrig | t © 201    | 1, 2024 | Lenovo    |

Figure 93: Scripts Tool (Edit Script)

## 5.2.3 Delete a diagnostic script

By clicking on the **Delete Script** button, the application will show a pop-up message to confirm the operation.

| Lenovo   | Diagnostics Evolution |  | -              |           | ×      |
|----------|-----------------------|--|----------------|-----------|--------|
| L        | Lenovo<br>DIAGNOS     | TICS   | 40             | ې<br>نې   | ?      |
|          | Scripts Too           | ol   |                | :         | ×      |
| F.       | Script List           |  |                |           |        |
| Εţ       | Script name           |  |                | ▶ Ø       | Ô      |
| ψh<br>\$ | Script name           |  |                | ▶ Ø       | Ō      |
|          | Script name           | A  | ×              | ▶ /       | Ō      |
| μĘ       | Script name           | \land Warning                                | ^              | ▶ //      | Ō      |
| শূর্ত্র  | Script name           | Are you sure you want to remove this script? |                | ▶ //      | Ō      |
| ()       | Script name           |  |                | ▶ Ø       | Ō      |
| Ċ.ţ      | Script name           | CANCEL                                       | DELETE         | ▶ Ø       | Ō      |
| e,       | Script name           |  |                | ▶ Ø       | Ō      |
|          | Script name           |  |                | ▶ Ø       | Ô      |
|          |                       |  |                |           |        |
|          |                       |  |                |           |        |
|          |                       |  |                |           |        |
|          |                       |  |                |           |        |
| >>       | 9 script(s) found     | с ва   | ск то номе + с | REATE SC  |        |
| 🗸 Ser    | ial number: TH6BER3   | ✓ Model: ThinkPad T440p ✓ MTM: J8G4EK9       | Copyright © 20 | )11, 2024 | Lenovo |

Figure 94: Scripts Tool (Delete Script)

#### 5.2.4 Execute a diagnostic script

By clicking on the **Execute Script** button or on the script row, a screen is displayed with the configuration from the selected diagnostic script.

All selected tests are listed and the not supported ones are marked with this warning icon  ${\mathbb A}$  .

| 📙 Lenovo | Diagnostics Evolution  | -        |         | ×      |
|----------|--|----------|---------|--------|
| L        | Lenovo<br>DIAGNOSTICS  | •        | ŝ       | 0      |
|          | Scripts Tool   |          | :       | ×      |
| P.       | Script List   Script Name Script Name                              |          |         |        |
| ψ¢.      | Tests Selection Advanced Settings                                  |          |         |        |
| Ţ<br>Ţ   | <ul> <li>Audio</li> <li>Audio playback test</li> </ul>             |          |         |        |
| ্র ব     | Microphone Interactive Test  |          |         |        |
| (;;      | <ul> <li>Audio Controller</li> <li>Input Stream Test</li> </ul>    |          |         |        |
| e,       | Bidirectional Stream Test 🛕  |          |         |        |
|          |  |          |         |        |
|          | Number of Executions     O Test Duration                           | on in Mi | nutes   | 1      |
| >>       | 4 test(s) selected   | K) (     | ► ST    | TART   |
| 🗸 Ser    | ial number: TH6BER3 🗸 Model: ThinkPad T440p 🗸 MTM: J8G4EK9 Copyrig | ht © 201 | 1, 2024 | Lenovo |

Figure 95: Scripts Tool (Script Summary)

By clicking on the **Start** button, the diagnostic script execution screen is displayed, and all supported tests are performed. The not supported tests that which don't have an associated device are filtered on this execution. It is possible to finish the execution any time by clicking on **Abort**.

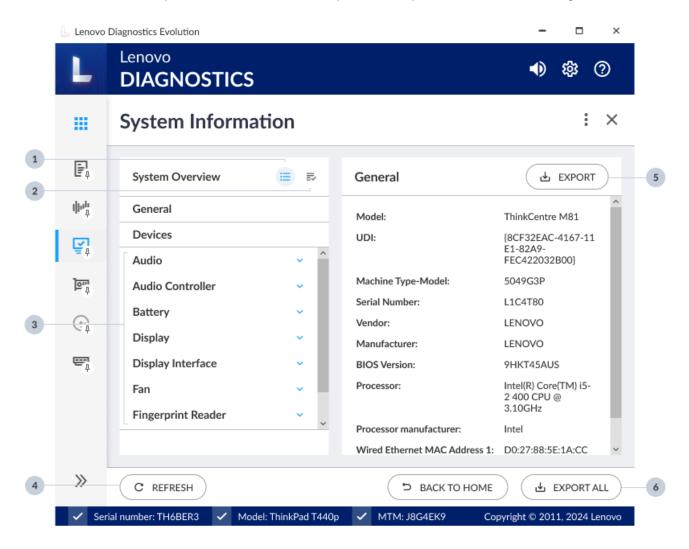
| 📙 Lenovo        | Diagnostics Evolution                             |              | -                 | □ ×           |
|-----------------|---|--------------|-------------------|---------------|
| L               | Lenovo<br>DIAGNOSTICS                             |              |                   | 攀 ⑦           |
|                 | Scripts Tool                                      |              |                   | : ×           |
| E.              | Scripts List • Executing Diagnostic               |              |                   |               |
|                 | Execution Overview ⑦                              |              |                   |               |
| ψe <sup>φ</sup> | Estimated Time: 00:15:00 Run Time: 00:01:03       |              | Iteration: 1/     | 1[0 Failed]   |
| ⊒‡              | Progress  |              | Current Status: 🧟 | 2/4 Tests     |
| ল্ <u>র</u>     | <ul> <li>Executing 1</li> <li>Passed 2</li> </ul> | 50% Failed   | Warning           | <b>C</b> >    |
| G               | Shov  | v Details 💙  |                   |               |
|                 | Diagnostic Execution ⑦                            |              |                   |               |
| ш,              | Audio   |              |                   |               |
|                 | 🖉 U28E590 (Intel(R) Display Audio) (22)           | Result Code  | e: WAC0000700000- | UO7V0D        |
|                 | 5/5/2024, 11:12:41 AM - Audio playback te         | est          | Pass              | ed (3s) 🥏     |
|                 | 5/5/2024, 11:12:42 AM - Microphone Inter          | active Test  | Pass              | ed (3s) 🥑     |
|                 | Audio Controller                                  |              |                   |               |
|                 | Input Stream Test                                 |              |                   | 23%           |
|                 | Bidirectional Stream Test                         |              |                   | Pending       |
| »               |   |              | Э ВАСК            | ABORT         |
| 🗸 Seri          | ial number: TH6BER3 🗸 Model: ThinkPad T440p       | MTM: FN773AA | Copyright © 2011  | , 2024 Lenovo |

Figure 96: Scripts Tool (Script Execution)

When the diagnostic is finished, the log of execution is displayed. It is possible to export each iteration to a PDF or HTML file by clicking on the **Export** button.

### 5.3 System Information Tool

The system information tool allows you to see general information about the system and the available module's devices. See in the screen below that it's possible to navigate between the modules and export the General Information, select multiple devices/modules to be exported, or export all information in a single click.



- 1 Device list
- 2 Select multiples devices/modules
- 3 Modules
- 4 Refresh devices
- 5 Export general machine information
- 6 Export information from all devices

Figure 97: System Information Screen

You also can export the information from a module, or a specific device.

| Lenovo         | Diagnostics Evolution                  |                         | - 0  | ×    |
|----------------|--|-------------------------|--|------|
| L              | Lenovo<br>DIAGNOSTICS                  |                         | <b>●)</b> 袋 (                                | 0    |
|                | System Information                     |                         | :  | ×    |
| Ē.             | System Overview 📃 🖘                    | Audio                   | L EXPORT                                     | )    |
| Щ <sup>ф</sup> | General<br>Devices                     | Speakers (2- Conexant   | SmartAudio HD) 🕹 -                           |      |
| Ξŝ             | Audio                                  | Driver name:            | wasapi                                       |      |
| ুৰ্ত্          | Speakers (2- Conexant S                | Driver version:         | 10.27.0.8                                    |      |
|                | U28E590 (Intel(R) Displa               | Number of channels:     | 2  |      |
| ()             | Audio Controller 🗸 🗸                   | Sample rate:<br>UDI:    | 22050<br>Speakers (2- Conexant SmartAudio HD | ))   |
| Ō              | Battery ~                              |                         |  |      |
|                | Display 🗸                              | U28E590 (Intel(R) Displ | ay Audio) (22) 🗳                             |      |
|                | Display Interface 🗸 🗸                  |                         |  |      |
|                | Fan 🗸 🗸                                | Driver name:            | wasapi                                       |      |
|                |  | Driver version:         | 10.27.0.8                                    | ~    |
| >>             | C REFRESH                              |                         | BACK TO HOME                                 |      |
| 🗸 Sei          | rial number: TH6BER3 🗸 Model: ThinkPad | T440p 🗸 MTM: J8G        | 4EK9 Copyright © 2011, 2024 Le               | novo |

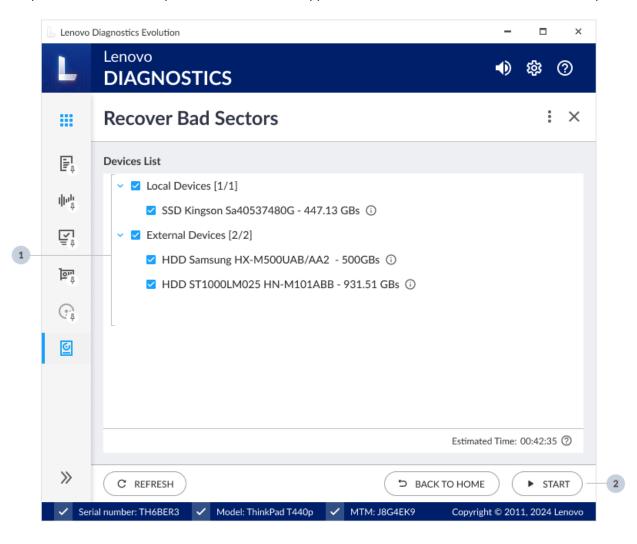
- 1 Export module information
- 2 Export device information

Figure 98: System Information (View Module Information)

### 5.4 Recover Bad Sectors Tool

The Recover Bad Sectors tool allows the user to scan HDD/SSD/SSHD SATA/NVMe devices for bad sectors and fix them whenever possible.

You can perform the tool on a specific device or all in supported devices. All devices will be executed sequentially.



- 1 List of supported devices
- 2 Click to start the execution

Figure 99: Recover Bad Sectors Screen

On the Recover Bad Sectors screen, you can see the **list of supported devices** on your machine. You can select one or more devices for the execution.

By clicking on the **Start** button, the Execution Screen is displayed. In it, you will be able to follow the evolution of the general progress and each device, as well as the amount of Bad Sectors Found, Fixed Sectors, and Non-Fixed Sectors.

| Lenovo<br>DIAGNOSTICS  |
|--|
| Recover Bad Sectors : ×  |
| Devices Available • Execution  |
| Execution Overview ②   |
| Estimated Time: 00:15:00 Run Time: 00:01:03                                      |
| Progress Current Status: • 2/3 Devices   |
| Diagnostic Execution ⑦ Bad Sectors found :3 Fixed Sectors :3 Non Fixed Sectors : |
| Local Devices  |
| SSD Kingson Sa40537480G - 447.13 GBs   |
| External Devices   |
| HDD Samsung HX-M500UAB/AA2 - 500GBs  |
| HDD ST1000LM025 HN-M101ABB - 931.51 GBs Pending                                  |
|  |
|  |
|  |

- 1 Device types
- 2 Device name
- 3 Number of bad sectors found
- 4 Number of fixed sectors
- 5 Number of non-fixed sectors

Figure 100: Recover Bad Sectors Execution

## 5.5 Log History Tool

The Log History Tool allows you to see and export all logs of executions performed in the machine via Run All, Script Tool, and Modules.

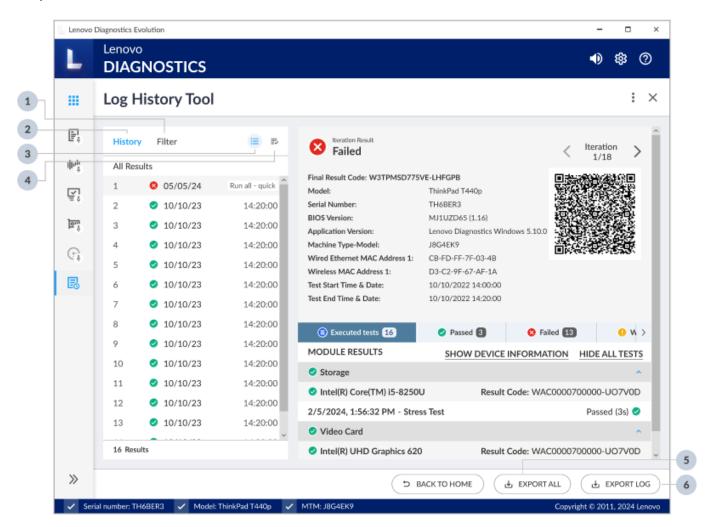


Figure 101: Log History Screen

By clicking on the **Filter tab**, you can filter the logs by date using the From and To fields, by Status, and by Execution Type.

|   | Lenovo  | Diagnostics Evolution   |  |  | - 🗆 ×  |
|---|---|---|--|--|--|
|   | L   | Lenovo<br>DIAGNOSTICS   |  |  | <ul> <li>\$\$</li> <li>\$\$</li> </ul>   |
|   |   | Log History Tool  |  |  | : ×  |
|   | Ē,  | History Filter  | Failed   |  | < Iteration >  |
| 1 | •<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>•<br>• | From ⑦<br>10/10/2022<br>To ⑦<br>11/12/2021<br>Status ⑦<br>All ~<br>Execution Type ⑦ | Final Result Code: W3TPMSD77<br>Model:<br>Serial Number:<br>BIOS Version:<br>Application Version:<br>Machine Type-Model:<br>Wired Ethernet MAC Address 1:<br>Wireless MAC Address 1:<br>Test Start Time & Date:<br>Test End Time & Date: | ThinkPad T440p<br>TH6BER3<br>MJ1UZD65 (1.16)<br>Lenovo Diagnostics Window<br>J8G4EK9 |  |
|   |   |   | Executed tests 16<br>MODULE RESULTS  | Passed  SHOW DEVICE INF  | S Failed     I     S |
|   |   |   | Storage  | SHOW DEVICE INF  | A ALL TESTS  |
|   |   |   | Intel(R) Core(TM) i5-825   | 0U Result Cod  | le: WAC0000700000-UO7V0D   |
| 2 |   | CLEAR   | 2/5/2024, 1:56:32 PM - Str   | ess Test   | Passed (3s) 🥏  |
| 3 |   | APPLY   | Video Card   |  | ^  |
| - |   |   | Intel(R) UHD Graphics 62   | 20 Result Cod  | le: WAC0000700000-UO7V0D 🗸   |
|   | >>  |   | ٩  | ВАСК ТО НОМЕ   | EXPORT ALL   |
|   | 🗸 Se  | erial number: TH6BER3 🗸 Model: ThinkPad T440p                                       | MTM: J8G4EK9   |  | Copyright © 2011, 2024 Lenovo  |

- 1 Fields to customize the filter
- 2 Click to clear filter fields
- 3 Click to apply filter

Figure 102: Log History (Filter Logs)

By clicking on the **Select Multiple Logs** icon, you can select one or more logs to be exported at the same time.

| L     | Lenovo<br>DIAGNOSTICS            |                 |   |   | <ul> <li>\$\$</li> <li>\$\$</li> </ul> |
|-------|----------------------------------|-----------------|---|---|--|
|       | Log History Too                  | I               |   |   | :                                      |
| Ē.    | History Filter                   | ≡ 🕞             | Failed  |   | < Iteration >                          |
| ψeh_b | All Results                      |                 |   |   | 1/18                                   |
|       | I 8 05/05/24                     | Run all - quick | Final Result Code: W3TPMSD775<br>Model:                           | VE-LHFGPB<br>ThinkPad T440p                         |  |
| Ξţ    | 2 2 10/10/23                     | 14:20:00        | Serial Number:  | TH6BER3   |  |
| n al  | 🗆 3 🥥 10/10/23                   | 14:20:00        | BIOS Version:<br>Application Version:                             | MJ1UZD65 (1.16)<br>Lenovo Diagnostics Windows 5.10. |  |
| ~     | □ 4 <ul><li>Ø 10/10/23</li></ul> | 14:20:00        | Machine Type-Model:   | J8G4EK9   |  |
| G     | 5 🔮 10/10/23                     | 14:20:00        | Wired Ethernet MAC Address 1:                                     | CB-FD-FF-7F-03-4B                                   | Electroscologica                       |
| R     | ☐ 6                              | 14:20:00        | Wireless MAC Address 1:<br>Test Start Time & Date:                | D3-C2-9F-67-AF-1A<br>05/05/2024 14:00:00            |  |
|       | □ 7 🥑 10/10/23                   | 14:20:00        | Test End Time & Date:   | 05/05/2024 14:20:00                                 |  |
|       | - 8 🥑 10/10/23                   | 14:20:00        |   |   |  |
|       | □ 9                              | 14:20:00        | Executed tests 16 MODULE RESULTS                                  |   | Failed 13 0 W >                        |
|       | 🗆 10 🥝 10/10/23                  | 14:20:00        |   | SHOW DEVICE INFORM                                  | ATION HIDE ALL TESTS                   |
|       | □ 11 🥥 10/10/23                  | 14:20:00        | Storage   |   | ^                                      |
|       | 12 🔮 10/10/23                    | 14:20:00        | Intel(R) Core(TM) i5-8250<br>0 (5 (000 1 4 5 ( 00 P) 4 - 0)       |   | AC0000700000-UO7V0D                    |
|       | 🗆 13 🥥 10/10/23                  | 14:20:00        | 2/5/2024, 1:56:32 PM - Stre                                       | ss lest   | Passed (3s) 🥏                          |
|       | 18 Results                       |                 | <ul> <li>Video Card</li> <li>Intel(R) UHD Graphics 620</li> </ul> | ) Result Code: W                                    | AC0000700000-UO7V0D                    |
| >>    |                                  |                 |   | 5 BACK TO HOME                                      |  |

- 1 Click to on the checkboxes to select the logs
- 2 Click to export selected logs

#### Figure 103: Log History (Select Multiple Devices)

You are able to **export** the logs of executions performed in the machine by clicking on the export buttons:

- **Export All Button**: by clicking on it, you can export all Logs found in the filter. The logs must be saved in HTML format inside a .zip folder.
- **Export Log Button**: by clicking on it, you can export only the log being displayed, in the HTML or PDF format for each run.
- **Export Selected Button**: by clicking on it, you can export only the selected logs. The logs must be saved in HTML format inside a .zip folder.

## 5.6 Thermal Monitor Tool 🚦

The Thermal Monitor Tool allows you to see the thermal information (temperature and fan speed) of some hardware devices in real-time.

On the **Devices Overview**, you can see the list of supported devices on your machine with their respective temperature. On the **Monitoring History Chart**, the charts show the device's thermal information collected over the last 60 seconds. See the description of each component in the image below.

| Devices Overview                                | <b></b>  | Monitoring History Chart ⑦ |       |
|---|----------|----------------------------|-------|
| Processor                                       |          | °C - Temperature           |       |
| Intel Core i5-8250U: 85°C                       | ~        | 90                         |       |
| Core 1: 83°C<br>Core 2: 82°C<br>Core 3: 85°C    |          |                            | Marko |
| _Core 4: 87°C<br>CPU Fan Speed: 4300 RPM        |          |                            |       |
| Storage   |          | 60                         |       |
| <ul> <li>Kingston SA400537480G: 40°C</li> </ul> |          | 50                         |       |
| ST1000LM025 HN-M101ABB: 39°C                    | ~        |                            |       |
| Video Card                                      |          | 40                         |       |
| Intel(R) UHD Graphics: 85°C                     |          | 30 59 seconds              |       |
| Nvidea GeForce MX330: 75°C                      | ~        | RPM - CPU Fan Speed        |       |
| Motherboard                                     |          | RPM - CPO Fan Speed        |       |
| ACPI: LENOVO ThinkPad E480: 52°C                | <b>.</b> | 6000                       |       |
| Battery   |          |                            |       |
| Battery: 46°C                                   | ~        | 3000                       |       |
| 7 Results                                       |          | 0 59 seconds               |       |
| C REFRESH                                       |          |                            | EXPOR |

- 3 Current device temperature
- 4 Current cores temperatures
- 5 Current CPU Fan Speed
- 6 Refresh the devices, charts and logs

#### Figure 104: Thermal Monitor Tool Overview

9 - Export detailed log information

Note: The cores temperature is only shown for Intel Processors.

By clicking on the Settings button, you are able to switch the temperature scale between Celsius and Fahrenheit.

By clicking on the Collapse/Expand icon, you can collapse or expand the thermal information to see the current, minimum, maximum, and average temperatures.

| Devices Overview                         | <b></b>  | Monitoring History Chart ⑦ |
|--|----------|----------------------------|
| Processor                                |          | °C - Temperature           |
| Intel Core i5-8250U: 85°C                |          | 90                         |
| ♣ 85°C @ 78°C @ 88°C ◆ 85°C Core 1: 83°C |          | 80 Martin Martin           |
| 4 83°C ● 80°C ● 90°C ◆ 87°C              |          | 70                         |
| Core 2: 82°C                             |          |                            |
| \$ 82°C                                  |          | 60                         |
| Core 3: 85°C                             |          | 50                         |
| ♣ 85°C   ● 82°C   ● 88°C   > 86°C        |          |                            |
| Core 4: 87°C                             |          | 40                         |
| \$ 87°C                                  |          | 30 59 seconds              |
| CPU Fan Speed: 4300 RPM                  |          |                            |
| # 4300RPM @ 1046RPM @ 4360 RPM           |          | RPM - CPU Fan Speed        |
| Storage<br>Kingston SA400537480G: 40°C   | ~        | 6000                       |
| ST1000LM025 HN-M101ABB: 39°C             |          |                            |
| Video Card                               |          | 3000                       |
| Intel(R) UHD Graphics: 85°C              | <b>~</b> |                            |

- 1 Collapse/Expand thermal information
- 2 Expanded device thermal information

Figure 105: Thermal Monitor Tool (Collapse/Expand thermal information)

By clicking on the **Selection Mode** icon, you can select one or more devices to be shown in the chart or to be exported at the same time.

| Devices Overview                 | ≡ ₹ | Monitoring History Chart ⑦ |
|----------------------------------|-----|----------------------------|
| Select all                       |     | °C - Temperature           |
| Processor                        |     | 90                         |
| ● ✓ Intel Core i5-8250U: 85°C    | ~   | 80 Ann Month               |
| Core 1: 83°C                     |     |                            |
| Core 2: 82°C<br>Core 3: 85°C     |     | 70                         |
| Core 4: 87°C                     |     | 60                         |
| CPU Fan Speed: 4300 RPM          |     |                            |
| Storage                          |     | 50                         |
| ● 🗹 Kingston SA400S37480G: 40°C  | ~   | 40                         |
| 🖻 🗹 ST1000LM025 HN-M101ABB: 39°C | ~   |                            |
| ✓ Video Card                     |     | 30 59 seconds 0            |
| ◉ 🗹 Intel(R) UHD Graphics: 85°C  | ~   | RPM - CPU Fan Speed        |
| ● 🗹 Nvidea GeForce MX330: 75°C   | ~   |                            |
| Motherboard                      |     | 6000                       |
| ACPI: LENOVO ThinkPad E480: 52°C | ~   |                            |
| ✓ Battery                        |     | 3000                       |
|                                  |     |                            |
| 🖲 🗹 Battery: 46°C                | ~   |                            |

1 - Click to on the check-boxes to select devices to show in the chart view

2 - Click to export selected devices

#### Figure 106: Thermal Monitor Tool (Selection Mode)

You are able to **export** the detailed log by clicking on the export buttons:

- **Export**: by clicking on it, you can export the log containing all devices thermal information.
- **Export Selection**: by clicking on it while in the **Selection Mode**, you can export only the selected devices thermal information.

The logs will be saved in HTML and TXT format inside a .zip file.

# 6. GLOSSARY

Attended test: It is a test that depends on some user action to be executed.

Extended Test: A type of test that can be performed in several minutes.

**Module**: a module contains a set of tests that can be performed for a type of device. It is enabled in the application only if the tested machine has at least one device supported by the module.

Quick test: A type of test that is performed in a few minutes.

Screen reader: A software program that read the text and elements displayed on the computer screen.

**Unattended test:** It is a test that does not depend on the user actions to be executed. All steps are performed automatically by the application

**TrackPoint:** Is a pointing stick, commonly found on ThinkPad laptops, that allows you to control the cursor on your screen. It is a small, red joystick-like nub located between the G, H, and B keys on the keyboard. You can use it to move the cursor smoothly and accurately without lifting your hands off the keyboard.

# 7. CONTACT SUPPORT

Do you need help or have any questions?

If you need assistance, have questions about our services, or wish to provide feedback for improvement, please do not hesitate to contact our support team via email at diagssupport@lenovo.com.

Thank you for choosing our services!