PROFINET
Automated RT Tester with ETS-IDK

Title: Product Documentation

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1   Introduction

The goal of the Automated RT Tester is to provide a test environment to validate the functionality of PROFINET Devices and Controllers.

1.1   Conventions

Keyword   Keywords provide easier recognition while reading the text

EDIT   Menus and dialogs of the graphical user interface (GUI)

[CANCEL]   User input via keyboard or mouse

2 Definitions and Abbreviations

- ART   Automated RT-Tester
- ETS   Embedded Test System
- ETS HW   Embedded Test System Hardware
- IDK   TI TMDX654IDKEVM industrial development kit
- DUT   Device under Test
- DAP   Device Access Point
- GSD   General Station Description
- TSN   Time Sensitive Network

3 Installation

3.1 System requirements

The test system 'Automated RT Tester' is designed for computers with the operating system Windows10®
- 64 Bit Professional, Version 22H2.

To comply with TSN standard for communication with the DUT the ETS-HW is needed. This ETS-HW must
be connected to the PC. Please see the ETS-HW manual.pdf for further information about the ETS board.

3.1.1 Hardware

- At least 500 MB free space on hard disk.

- At least 1024 MB RAM.

3.1.2 Standard Test Setup Restrictions

- Device B must be one of Scalance X204 IRT/ Scalance X202-2P IRT as mentioned in *GSDML-V2.33-Siemens-002A-SCALANCE_X200-20171009.xml*

- Device D/E must be an ET200SP or ET200MP as mentioned in *GSDML-V2.34-Siemens-ET200MP-20180629.xml* or *GSDML-V2.34-Siemens-ET200SP-20190130.xml*

- **NOTE:** The FW version 5.3.0 of the Scalance X204IRT or Scalance X202-2P IRT does **NOT** have a PROFINET certificate. Please do not use this version for certification, as no warranty can be given.

3.2 Installation

To install the 'Automated RT Tester', execute '*AutomatedRTTester_<version>_Setup.exe*' on the installation disk and follow the setup instructions. All the required software is installed with the 'Automated RT Tester' setup. Administrator privileges are required to install the 'Automated RT Tester'.

4 System configuration (not needed for ETS Device Tests)

4.1   Configuration of VLAN-Tag stripping

The 'Automated RT Tester' requires that the VLAN-Tags included in incoming Ethernet frames are not stripped out by the network card driver. Almost all network card drivers remove the VLAN-Tags by default but provide an option to disable the removal of those tags.

This is a general description of how to disable the removal of VLAN-Tags. It should fit many network card drivers but may not be suited for all card drivers available. If it does not work as described here, please refer to the network card driver manual, or the network card manufacturer.

To disable the removal of VLAN-Tags complete the following steps:
1. Open the Windows Device Manager (**Control Panel -> System -> Device Manager**)
2. Expand the node called **'Network Adapters'**
3. Right click on that adapter, where the PROFINET test setup is connected and choose **'Properties'**.
4. Switch to the tab called **'Advanced'**.
5. In the Property list, select **Packet Priority & VLAN** (this might not be the same for all network card drivers)
6. In the drop-down list, select **Packet Priority & VLAN Disable**
7. Apply by pressing the **'OK'** button.
8. On most systems it should work correctly now. If it is set to disable and still does not work, please reboot the system and try again.
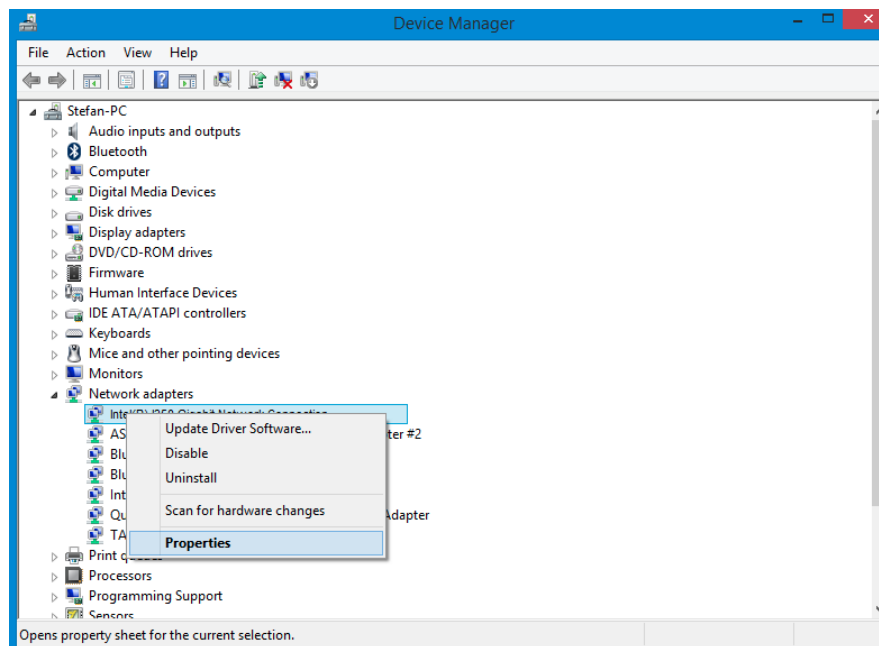
Figure 1 - Device Manager
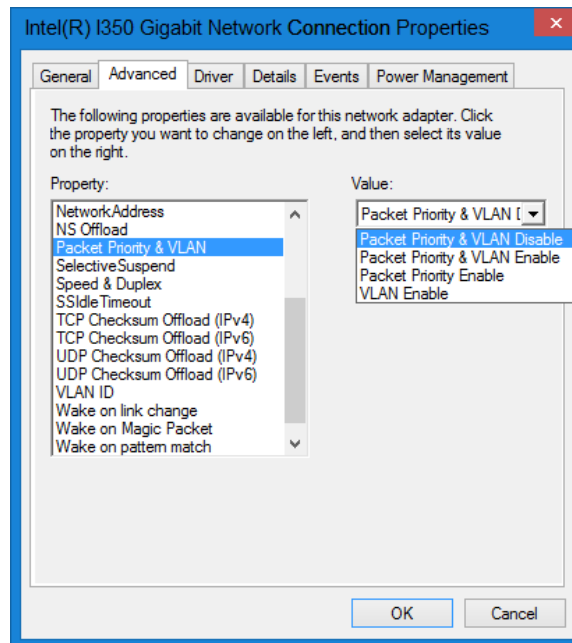
Figure 2 - Advanced network card driver settings

4.2 Configuration of Intel Driver for usage with system redundancy

As a precondition for the following steps, the Intel network card driver (current version V12.18.9.7, part of Intel® Network Connections V25.1.1.0) must be downloaded and installed. You may have to restart your computer.

Now change to the device manager, select the network adapters of the I350-T2/T4, and double click it. Afterwards select the Advanced Tab.
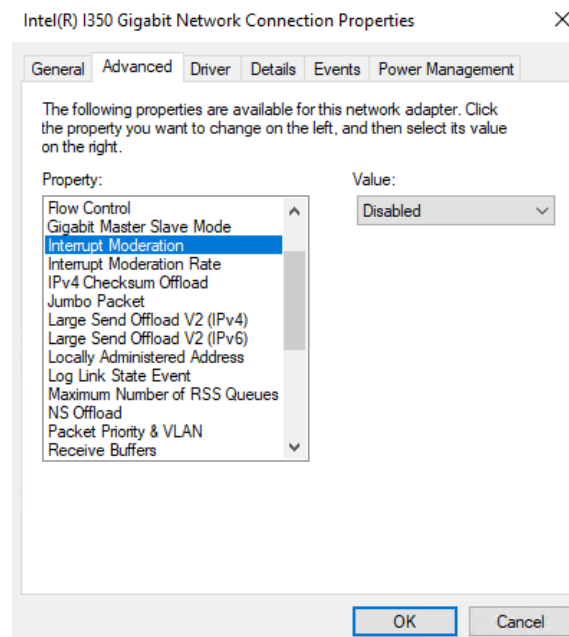
Figure 3 - Selected Advanced Tab of an Intel I350-T2/T4 NIC (1)

Now select the property Interrupt-Moderation (German: "Interrupt-Drosselung") and set it to disabled. The exact look for this property is dependent on the installed driver version. There maybe not only the variants Enabled / Disabled shown, but in some cases (as of driver version 22.2 and before) there are also only shown numbers reaching from 0 to 127. In this case use zero as value for this property. This will also disable the interrupt offloading (default value would be 3).

If your driver version provides a way to set the properties "Receive Side Scaling" and "Receive Side Scaling Queues" (German: "Max. Anzahl RSS-Warteschlangen"), please disable Receive Side Scaling (see figure 4) and set the value of Maximum Number of RSS queues to "1 queue" (German: "1 Warteschlange"). (see figure below).
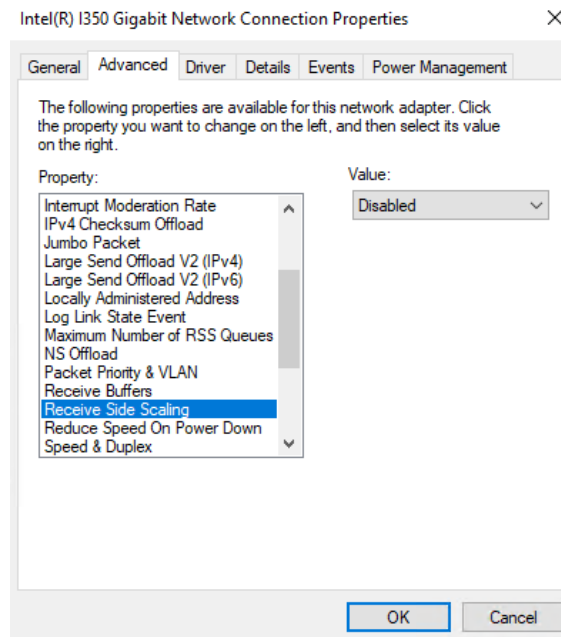
Figure 4 - Selected Advanced Tab of an Intel I350-T2/T4 NIC (2)
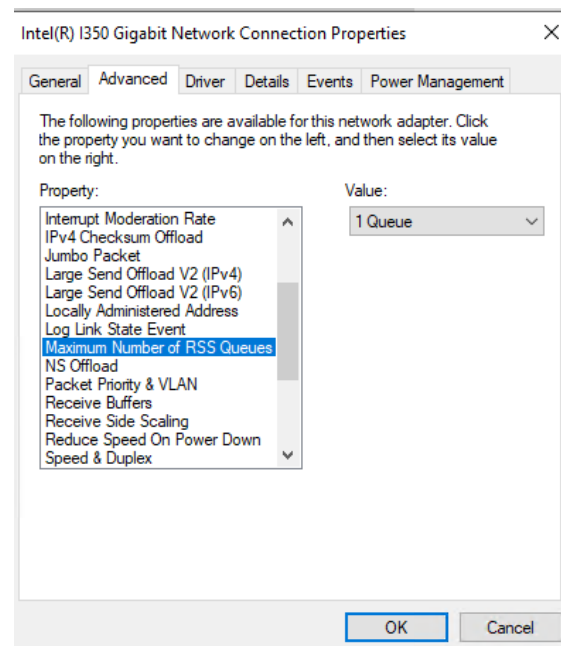
Figure 5 - Selected Advanced Tab of an Intel I350-T2/T4 NIC (3)

4.3 IP-Address settings for multiple network cards

Please make sure to connect only those network cards to the 192.168.0.* subnet that are necessary for the test setup that you are currently using. Additional network cards in this subnet might lead to issues with SNMP traffic due to timeouts caused by the windows UDP stack.

This applies also to connections within other networks (e.g. a company network) that uses the same subnet.

The additional network card for SystemRedundancy S2 testing must be physically unplugged for all test setups except the S2 TestSetup.

4.4 IP-Address settings for host pc

For the IP-address settings of the pc please use the Test specification provided with this test bundle.

5 Quick start

A project has to be opened either by creating a new one or loading an existing project before any test case can be executed. A new project can be created by selecting *FILE -> NEW.* An existing project can be opened by selecting *FILE -> OPEN.*

5.1 Creating a new Project (ETS Device Test)

Selecting *FILE -> NEW -> NEW ETS DEVICE PROJECT* will open a new dialogue which will guide you through the initial project setup to create a new ETS device test project.
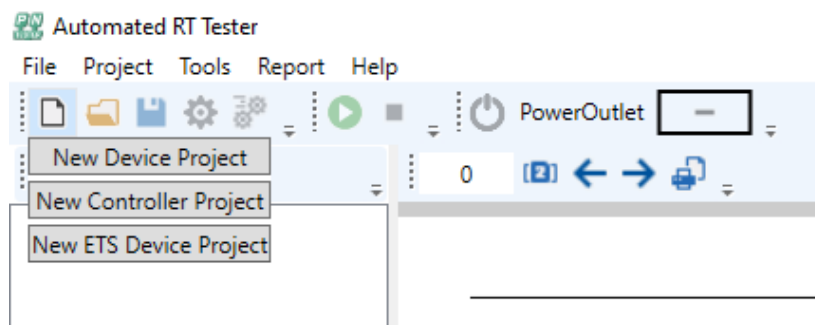
Figure 6 - Project type selection for new test project

5.1.1 *Project Settings*

The project name and the folder must be set up. The project file, the Wireshark dump files and the report files are saved to this folder. In order to save your project, a new project folder can be created or the files can be saved directly to the given path.
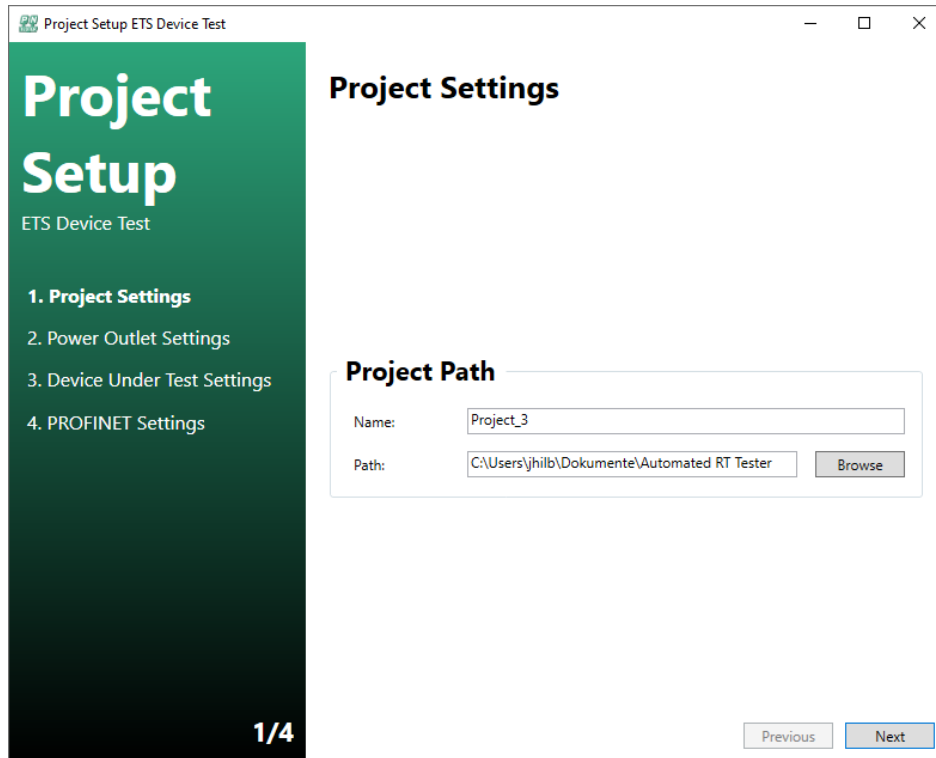
Figure 7 - New Project Wizard - Project Settings (ETS Device Test)

5.1.2   *Power Outlet Settings*

In this step, the settings for the Power Outlet must be set.

If the Anel power outlet is used, choose it from the drop-down menu. If 'None' is selected, a message box will appear whenever a switch OFF or switch ON of any component in the PROFINET test setup is required. In this case the user is responsible for switching the stated device off or on. If the Power Outlet is selected, all components of the PROFINET test setup are switched on and off automatically.

The network card that the Power Outlet is connected to must be chosen. The list of available devices can be refreshed by selecting *REFRESH DEVICES*.

The host IP and power outlet IP address must be entered. The IP addresses must be in the same subnet but must be different.

It is also possible to use a custom Power Outlet. For further information on this topic, please refer to the 'UserManualPowerOutlet.pdf' in the 'Documents'-folder of the Automated RT Tester.

Figure 8 - New Project Wizard - Power Outlet Settings (ETS Device Test)

5.1.3   Device Under Test Settings

Now, enter the MAC address of the DUT into the box in the centre of the screen. If the ETS test setup is already running and connected to the PC, you may also use the button GET MAC ADDRESS to retrieve the MAC address from the DUT automatically.

Figure 9 - New Project Wizard - Device Under Test Settings (ETS Device Test)

5.1.4   PROFINET Settings

Finally, the DUT engineering must be completed. First, the GSD file for the DUT must be loaded by selecting OPEN GSD.
If the GSD file is compatible with the test system, the DAPs which are stated in the GSD file, are shown in the drop-down box. The correct DAP for the DUT must be selected from the drop-down box.
After selecting the DAP, the modules / submodules that are compatible with this DAP will appear in the list below the DAP selection box. On the right side, the actual status of the DUT engineering can be seen. Every module/submodule from the list of available modules can be selected and added to the engineering of the DUT.
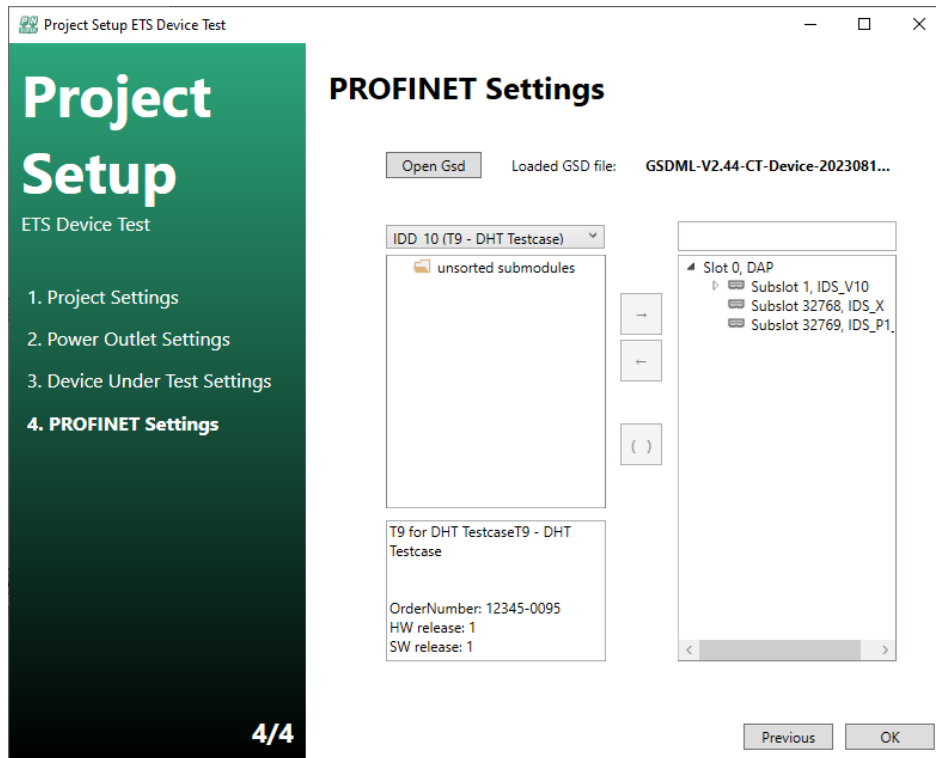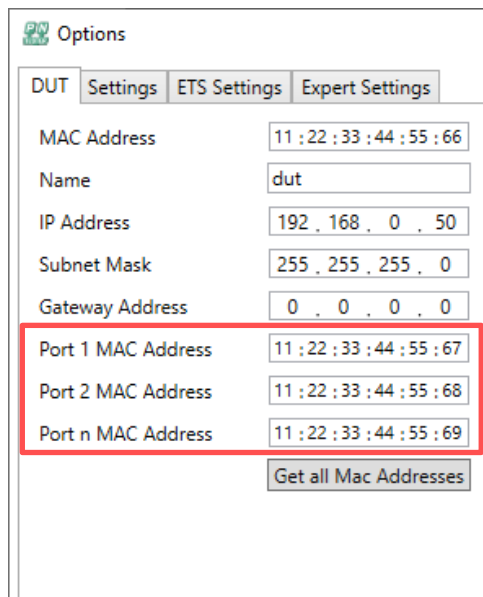
Figure 10 - New Project Wizard - PROFINET Settings (ETS Device Test)

After finishing the project wizard, the project settings are saved on the specified location on the hard disk. Additionally, the selected GSD file is copied to the project location.

5.1.5 Mac Address Setup of the DUT ports

To run an ETS Device Test, it is mandatory to configure the MAC addresses for all ports of the DUT that are connected to the ETS. The settings can be found under *Tools->OPTIONS->DUT* as shown in the Figure below. Here the button GET MAC ADDRESS may be used as well to retrieve the MAC addresses automatically, if the ETS setup is already running and connected to the PC.

Figure 11 - Mac address settings for ETS device tests

5.2   Creating a new Project (Device Test)

Selecting *FILE -> NEW -> NEW DEVICE PROJECT* will open a new dialogue which will guide you through the initial project setup to create a new standard device test project.

Figure 12 - Project type selection for new test project

5.2.1   Project Settings

The project name and the folder must be set up. The project file, the Wireshark dump files and the report files are saved to this folder. In order to save your project, a new project folder can be created or the files can be saved directly to the given path.

Figure 13 - New Project Wizard - Project Settings (Device Test)

5.2.2   Host Settings

Next, the network card that is connected to the PROFINET test setup must be chosen. The list of available devices can be refreshed by selecting REFRESH DEVICES.

Figure 14 - New Project Wizard - Host Settings (Device Test)

5.2.3   *Power Outlet Settings*

In this step, the settings for the Power Outlet must be set.

If the Anel power outlet is used, choose it from the drop-down menu. If 'None' is selected, a message box will appear whenever a switch OFF or switch ON of any component in the PROFINET test setup is required. In this case the user is responsible for switching the stated device off or on. If the Power Outlet is selected, all components of the PROFINET test setup are switched on and off automatically.

The network card that the Power Outlet is connected to must be chosen. The list of available devices can be refreshed by selecting REFRESH DEVICES.

The host IP and power outlet IP address must be entered. The IP addresses must be in the same subnet but must be different.

It is also possible to use a custom Power Outlet. For further information on this topic, please refer to the 'UserManualPowerOutlet.pdf' in the 'Documents'-folder of the Automated RT Tester.

Figure 15 - New Project Wizard - Power Outlet Settings (Device Test)

5.2.4   *Device Under Test Settings*

Now, enter the MAC address of the DUT into the box in the centre of the screen. If the test setup is already running and connected to the PC, you may also use the button GET MAC ADDRESS to retrieve the MAC address from the DUT automatically.
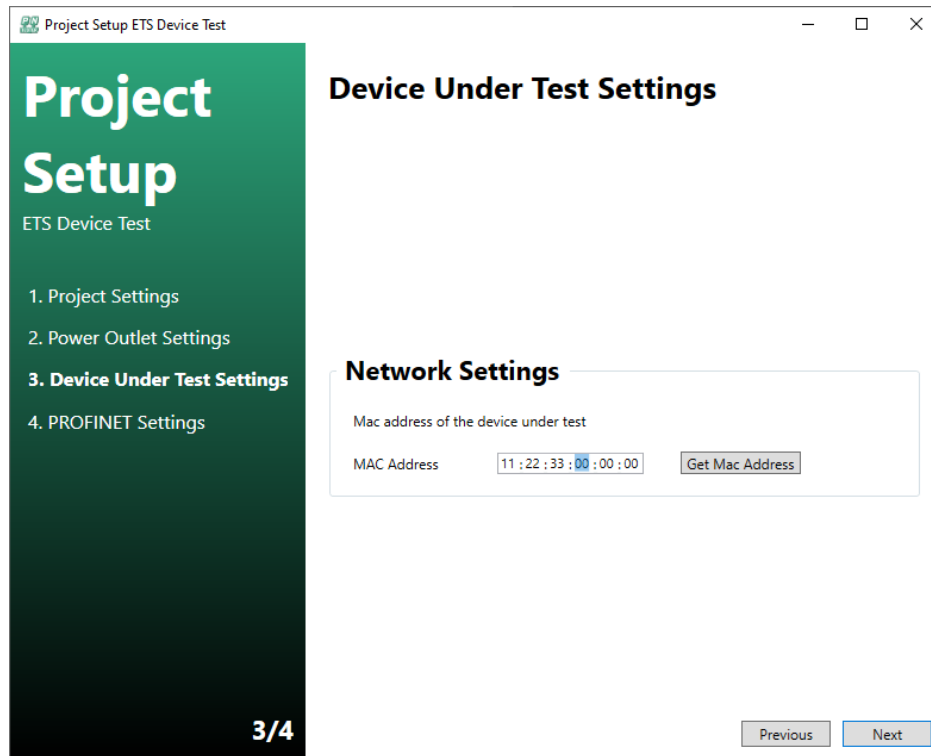

Figure 16 - New Project Wizard - Device Under Test Settings (Device Test)

5.2.5 PROFINET Settings

Finally, the DUT engineering must be completed. First, the GSD file for the DUT must be loaded by selecting OPEN GSD.

If the GSD file is compatible with the test system, the DAPs which are stated in the GSD file, are shown in the drop-down box. The correct DAP for the DUT must be selected from the drop-down box.

After selecting the DAP, the modules / submodules that are compatible with this DAP will appear in the list below the DAP selection box. On the right side, the actual status of the DUT engineering can be seen. Every module/submodule from the list of available modules can be selected and added to the engineering of the DUT.

Figure 17 - New Project Wizard - PROFINET Settings (Device Test)

After finishing the project wizard, the project settings are saved on the specified location on the hard disk. Additionally, the selected GSD file is copied to the project location.

5.3   Creating a new Project (Controller test)

Selecting FILE -> NEW -> NEW DEVICE PROJECT will open a new dialogue which will guide you through the initial project setup to create a new standard device test project.
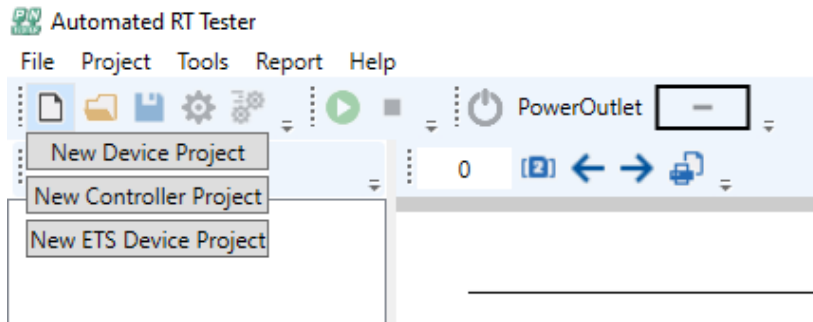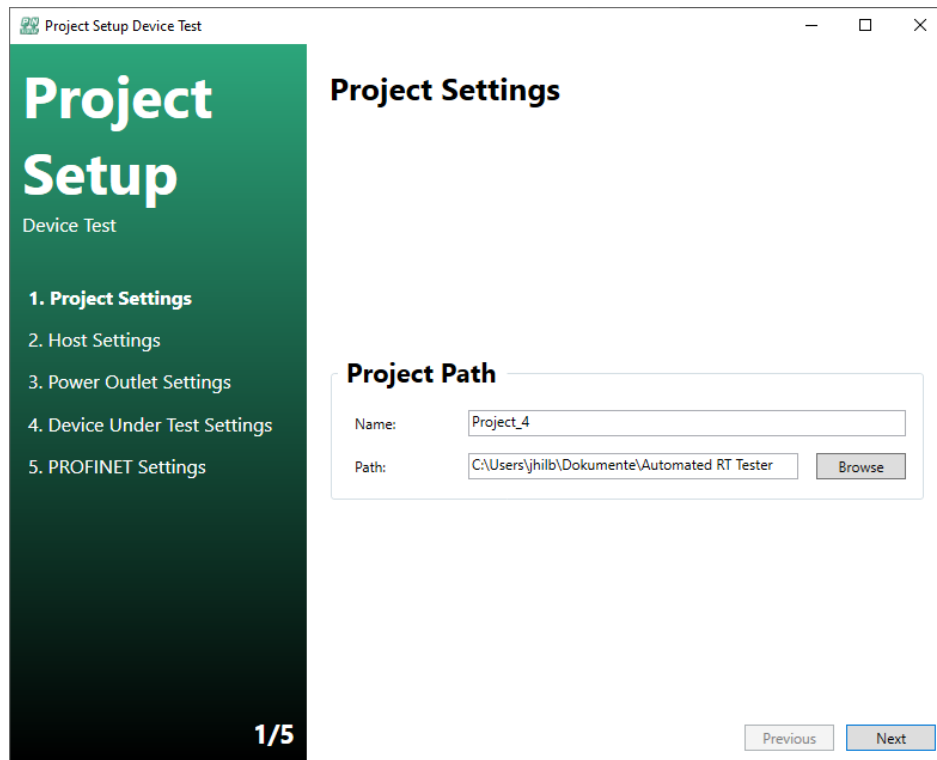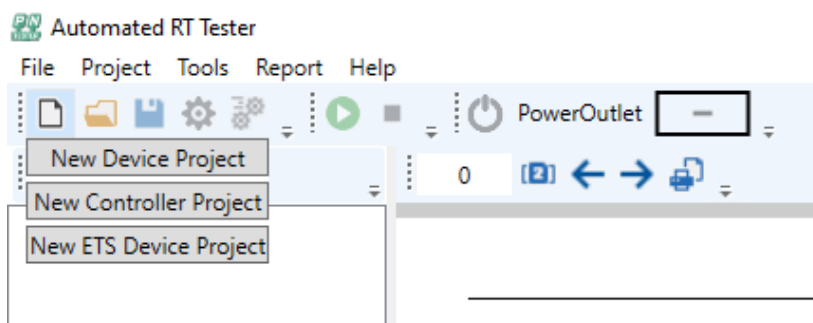

Figure 18 - Project type selection for new test project

5.3.1 *Project Settings*

The project name and the folder must be set up. The project file, the Wireshark dump files and the report files are saved to this folder. In order to save your project, a new project folder can be created or the files can be saved directly to the given path.
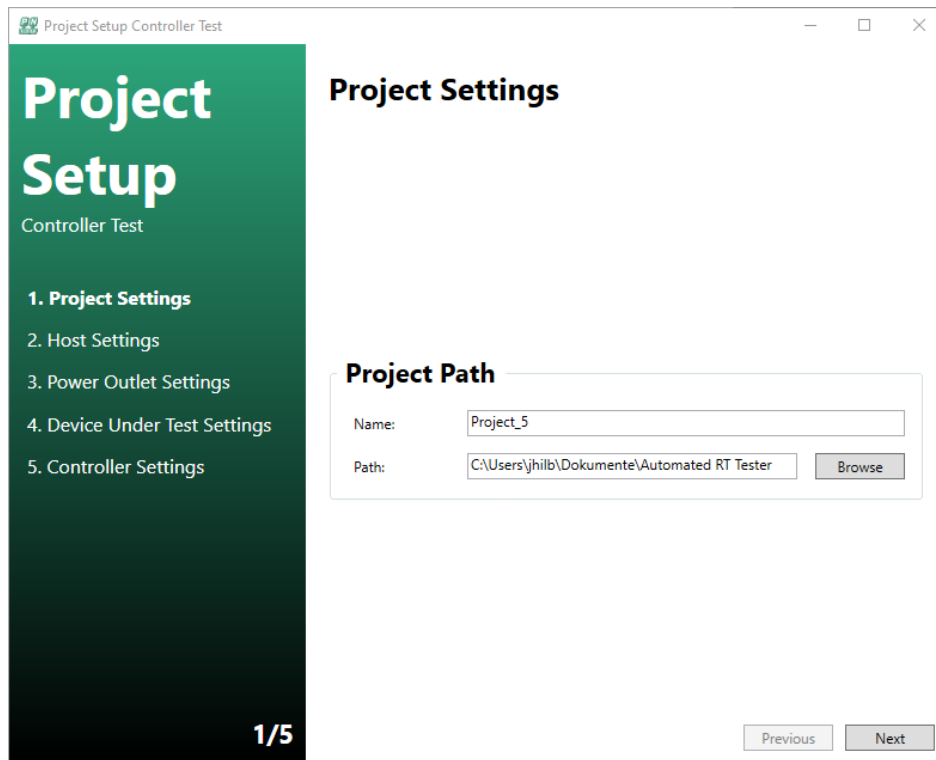
Figure 19 - New Project Wizard - Project Settings (Controller Test)

5.3.2   Host Settings

Next, the network card that is connected to the PROFINET test setup must be chosen. The list of available devices can be refreshed by selecting *REFRESH DEVICES*.
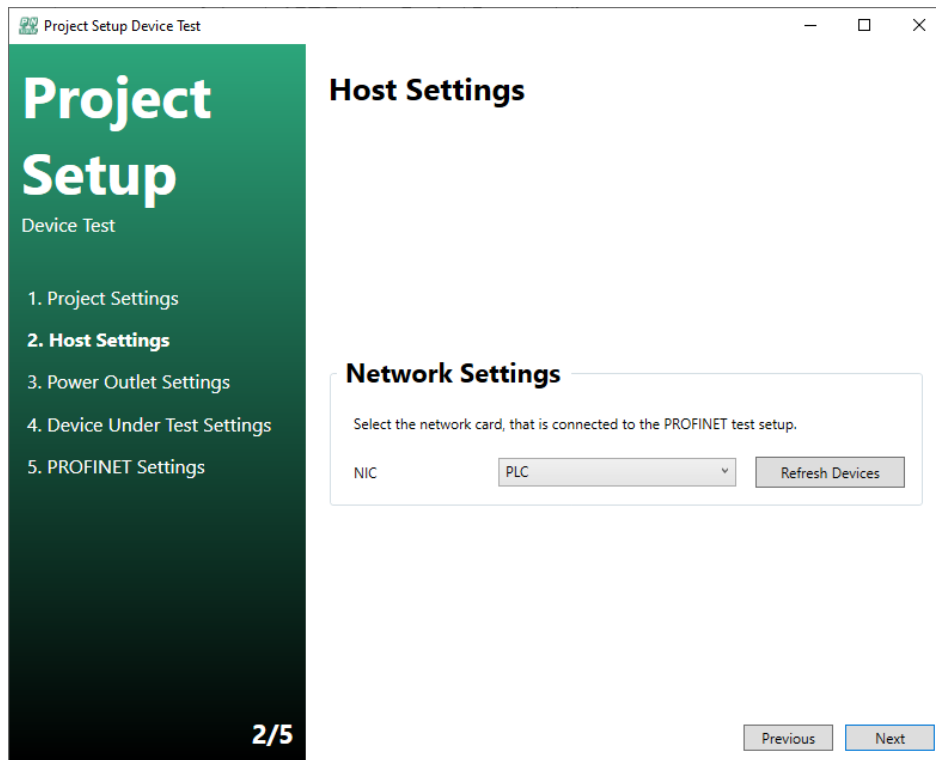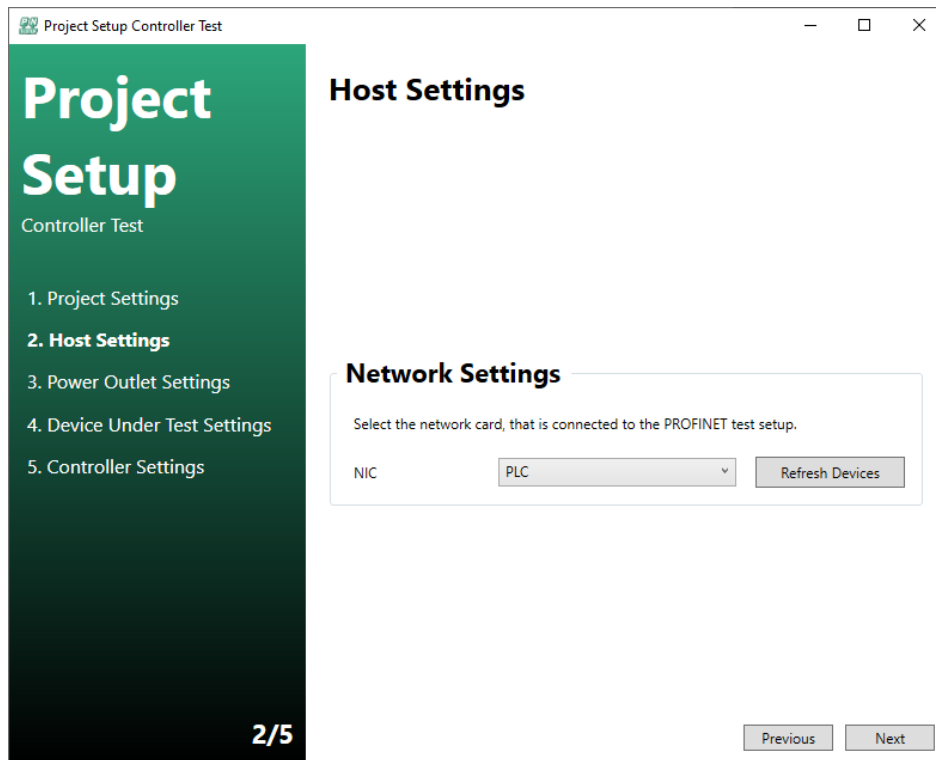

Figure 20 - New Project Wizard - Host Settings (Controller Test)

5.3.3   *Power Outlet Settings*

In this step, the settings for the Power Outlet must be set.

If the Anel power outlet is used, choose it from the drop-down menu. If 'None' is selected, a message box will appear whenever a switch OFF or switch ON of any component in the PROFINET test setup is required. In this case the user is responsible for switching the stated device off or on. If the Power Outlet is selected, all components of the PROFINET test setup are switched on and off automatically.

The network card that the Power Outlet is connected to must be chosen. The list of available devices can be refreshed by selecting REFRESH DEVICES.

The host IP and power outlet IP address must be entered. The IP addresses must be in the same subnet but must be different.

It is also possible to use a custom Power Outlet. For further information on this topic, please refer to the 'UserManualPowerOutlet.pdf' in the 'Documents'-folder of the Automated RT Tester.

Figure 21 - New Project Wizard - Power Outlet Settings (Controller Test)

5.3.4   *Device Under Test Settings*

Now, enter the MAC address of the DUT into the box in the centre of the screen. If the test setup is already running and connected to the PC, you may also use the button GET MAC ADDRESS to retrieve the MAC address from the DUT automatically.
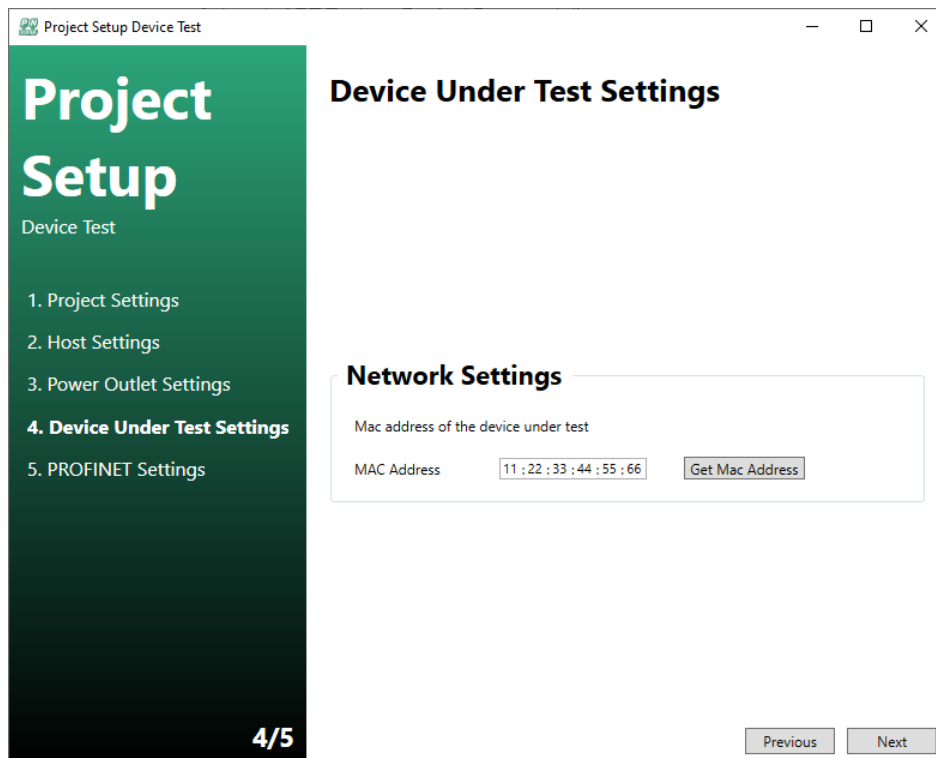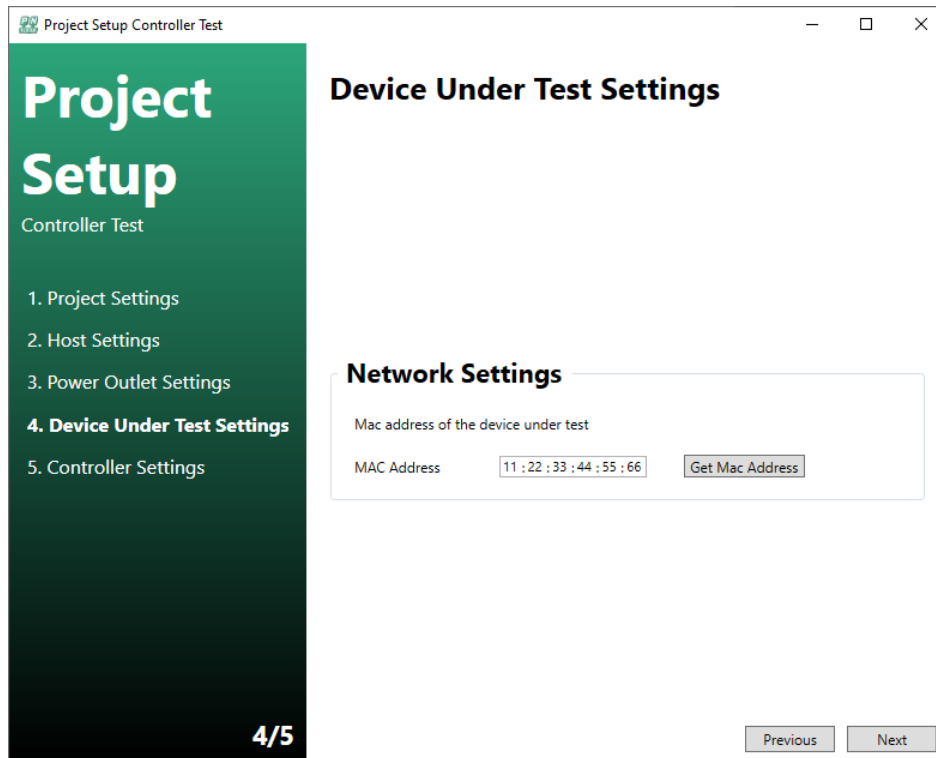

Figure 22 - New Project Wizard - Device Under Test Settings (Controller Test)

5.3.5   PROFINET Settings

To complete the DUT engineering, the CD file for the DUT must be loaded by selecting *OPEN CD FILE*. If the CD file is compatible with the test system, the OK-Button will change its state to active. Now the interface which shall be tested can be selected from the drop-down list.
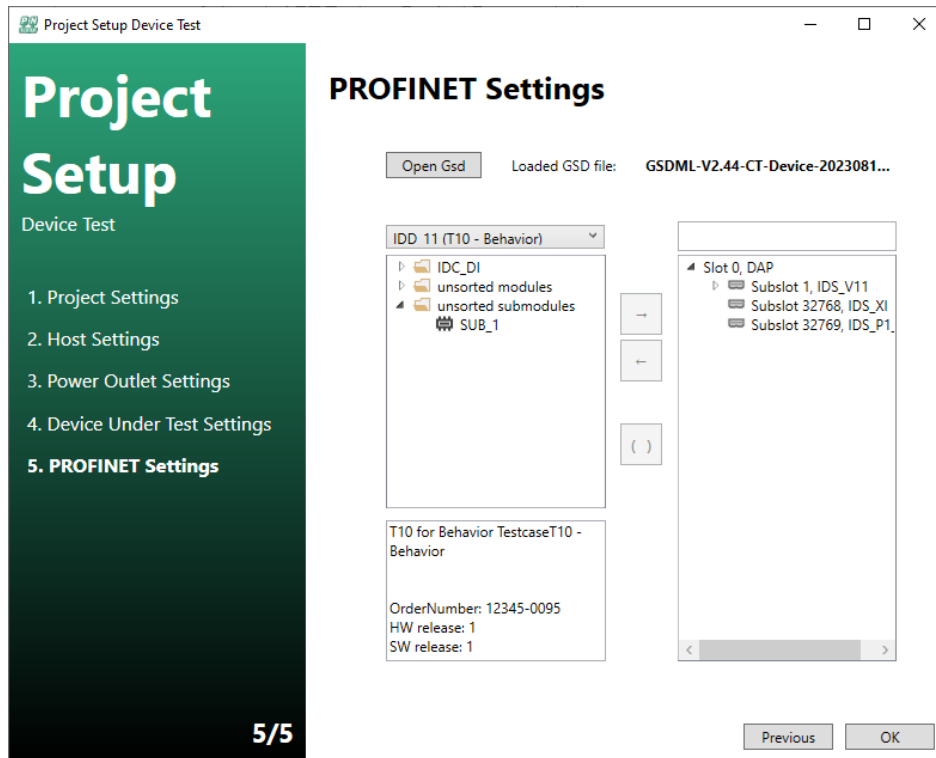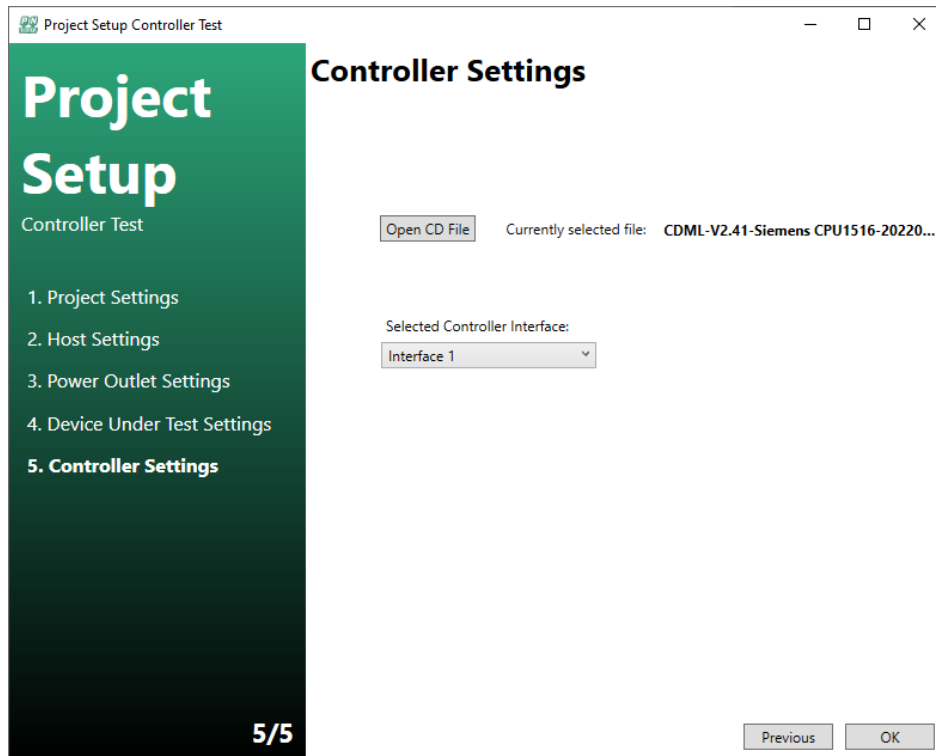

Figure 23 - New Project Wizard - Controller Settings (Controller Test)

After finishing the project wizard, the project settings are saved on the specified location on the hard disk. Additionally, the selected GSD file is copied to the project location.

5.5   Test case execution

After the project setup has been finished, the main window shows all available test cases in the tree on the left. The test cases are separated based on their execution requirements:
The user must ensure that the correct PROFINET test setup is selected before the start of the test cases.

All selected test cases can be started by pressing the 'Play' button in the tool bar or by selecting *PROJECT->RUN*. If there is more than one test case, they will be executed consecutively without any further actions required from the user. The execution can be cancelled by pressing the 'Stop' button in the tool bar or by selecting *PROJECT->STOP*.

After the execution of a test case has finished, a report will be shown on the right side of the main window. This report can be exported in the format 'pdf' by selecting the 'Save' button in the toolbar above the report.

Information about the actual executed test step is displayed in the output towards the bottom of the window.

The execution progress of the test case can be seen in the status bar at the bottom right.
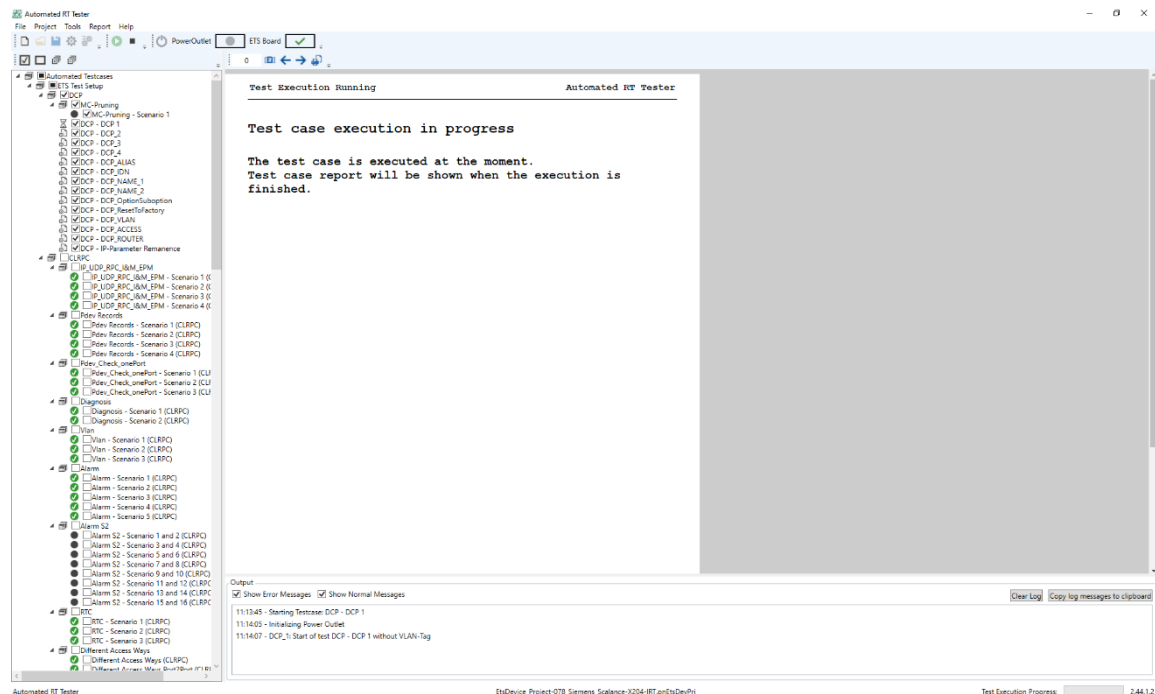
6 PROFINET PA Profile Tests

The PROFINET PA profile part of the bundle supports the development of PROFINET PA field devices. It can be used as a means of supplementary preparation for the mandatory certification for PROFINET devices with supported PA profile V 4.02MU1.

Each device must have passed the official PROFINET tests with the manufacturer instance before.

The required GSD version for the profile tests is V2.43 and the necessary Profile GSD files can be downloaded from the [PI website](#) (GSDML-V2.43-PA_Profile_V4.02-*-20230217.xml).

Important hint for execution: Please run all scenarios from the 'AddressingMapping' group first. If these are passed by the device, execute scenario 1 from test case 'ParameterAttributes'. After that you have to create the device specific PADataFiles from the generated template files. These files are necessary for all further test cases.

Generation and Adjustment of the PADataFile

For the execution of most PA profile test cases it is necessary to request default and write test values from the device manufacturer for some block parameters. This is necessary because the profile does not specify these values for all parameters.

The test case 'ParameterAttributes-Scenario1' (group 'ParameterAttributes') creates a template file for this purpose (Data_****_****_***_template.xml) in the subfolder "PaDataFiles" of the project folder.

All default and write test values not defined by the profile must be filled in by the manufacturer. The new file must be saved without the "_template" extension after editing. This file will then be used for further tests. An example of these two files is shown in the following image.

For support or feedback, please contact: [pn-ts-support(at)oth-aw(dot)de](#)

7 User Interface

7.1   Start of the test system

The test system is started either by double clicking the 'Automated RT Tester' icon on the desktop, or by selecting *[START->PROGRAMS->AUTOMATED RT TESTER->AUTOMATED RT TESTER]*.

7.2   Main Window

After the start of the 'Automated RT Tester' the main window will appear. The available test case can be selected as soon as a project is created or opened.
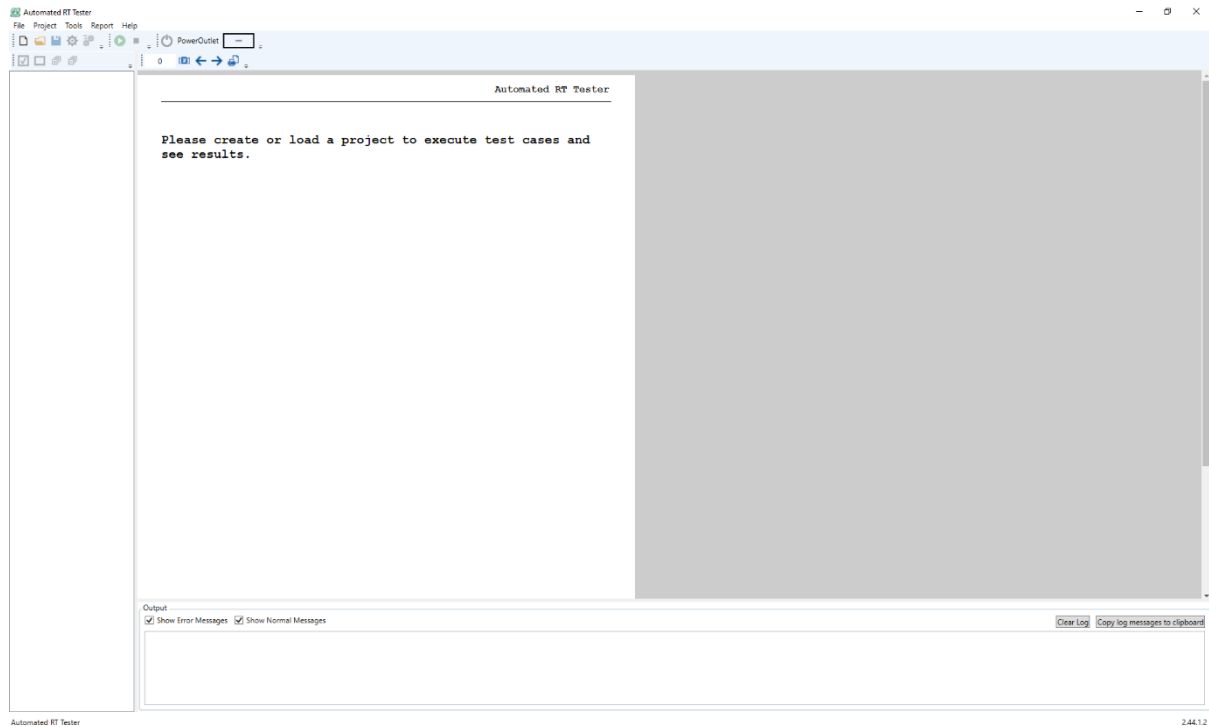
Figure 24 - Automated RT Tester main window
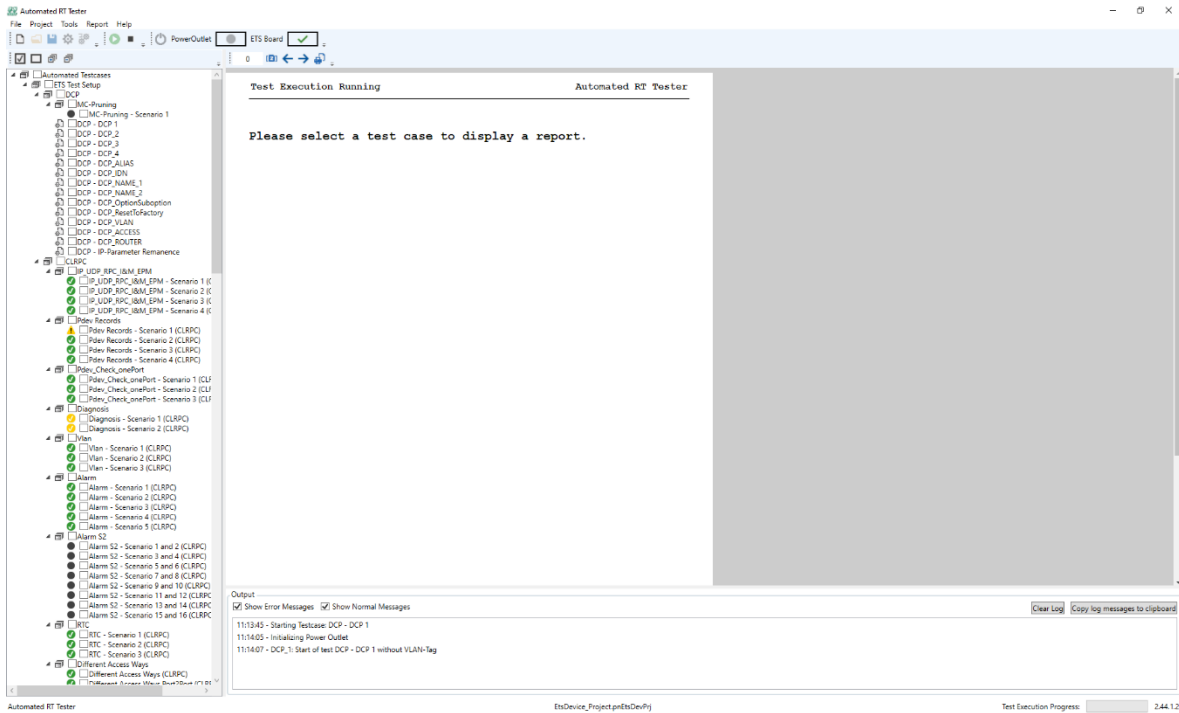
Figure 25 - Automated RT Tester main window with open project

A small icon to the left of every test case in the list shows the result of the test case the last time it was executed. The icons are colour coded.

Grey: Test case was not executed
Green: Test case passed
Yellow: Test case passed, but a hint message was printed which should be noted
Orange: Test case result is inconclusive, manual inspection required
Red: Test case failed or was cancelled
Black: Test case was skipped because it is not applicable for this DUT

7.3   Project Settings (ETS Device Test)

The project configuration can be changed by selecting *Tools->Options*. All the settings that were selected in the project setup wizard can be altered in the *Options* tab. The *Expert Mode* which can also be selected in the options window, enables changes to be made to the standard parameters for the ETS settings (port numbers, IP address), expert settings and host settings (IP parameters).

ATTENTION
Be aware, that if the standard parameters are altered, the test setup and test result will no longer follow the PROFINET test specifications.

Figure 26 - Options window – DUT settings (ETS Device Test)

Furthermore, there is the possibility to change GSD parameters manually. This is done by selecting the module and submodule for which the changes shall be done and then selecting the parameters to be changed. Clicking in the text field above will open a new window, where the data can be edited.
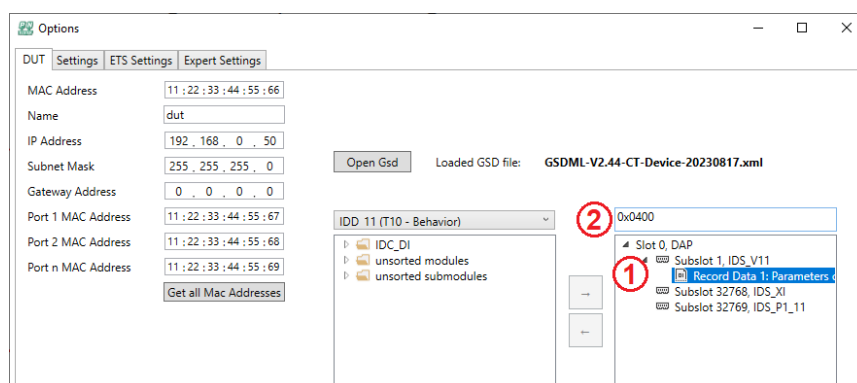
Figure 27 - Select the parameters to be changed.

Figure 28 - Changing the parameters.

In the *Settings* tab changes to the Host and the PowerSupply-Unit can be made. By clicking the *Refresh Devices* button, the Automated RT Tester detects the available devices automatically. IP – Addresses can be changed as shown in the Figure below.

Figure 29 - Options window – General settings (ETS Device Test)

The tab *ETS Settings* is shown once the checkbox *Show expert settings* at the bottom of the window is checked. Here the ETS-HW settings like IP Address, service port and API port can be changed.
It is also possible to switch from PTCP to PTP for the delay measurement of the link between DUT and ETS.
The figure below shows the *ETS Settings* tab with default values.

Figure 30 - Options window – ETS settings (ETS Device Test)

Additionally, when the checkbox *Show expert settings* is checked, various parameters which are used in the testcases can be changed.
Once *Show expert settings* is unchecked all parameters are automatically set to their default values.
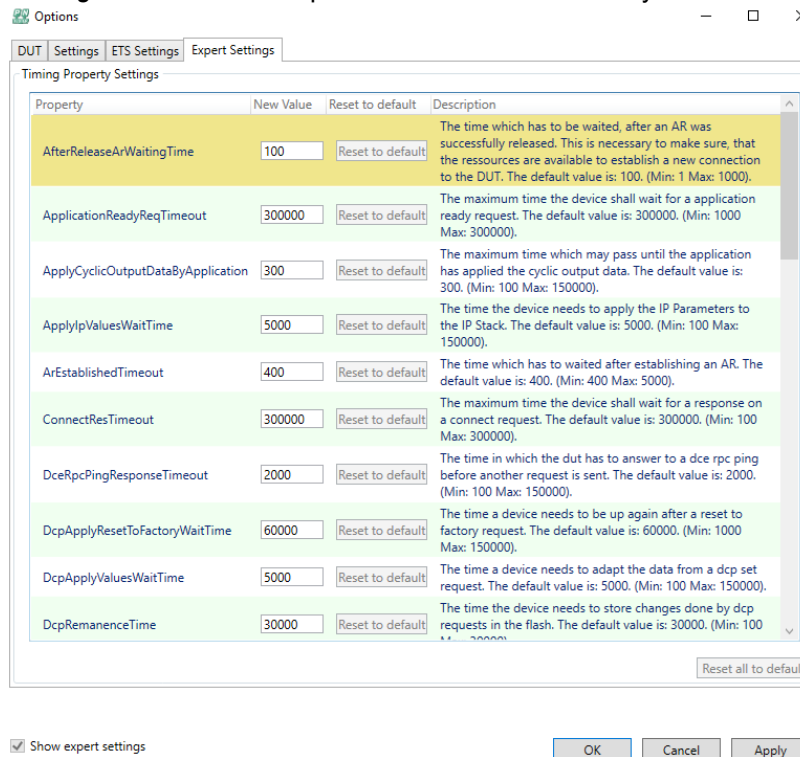
Figure 31 - Options window – Expert settings (ETS Device Test)

7.4   Project Settings (Device Test)

The project configuration can be changed by selecting *Tools->Options*. All the settings that were selected in the project setup wizard can be altered in the *Options* tab. The *Expert Mode* which can also be selected in the options window, enables changes to be made to the standard parameters for the test setup, expert settings and host settings.

ATTENTION

Be aware, that if the standard parameters are altered, the test setup and test result will no longer follow the PROFINET test specifications.
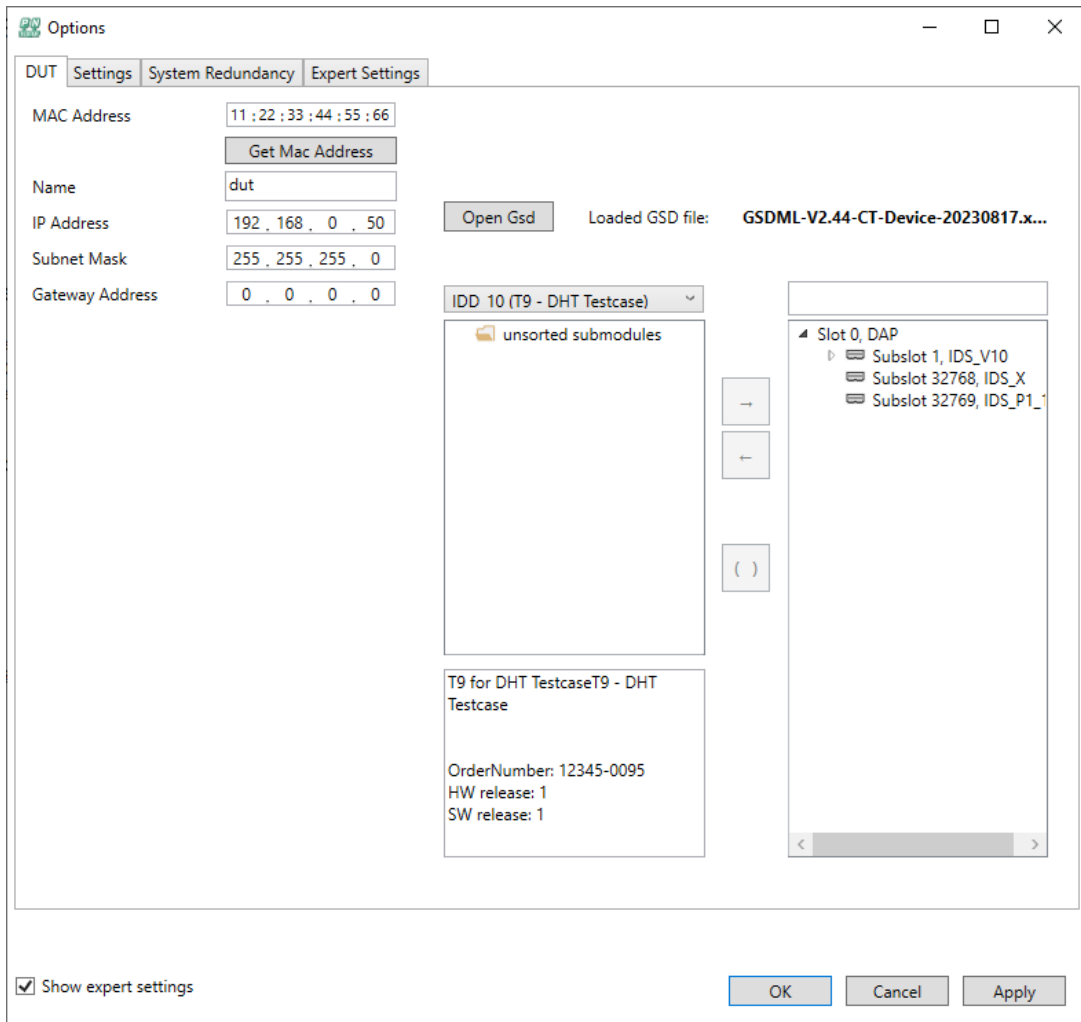
Figure 32 - Figure 1 -   Options window – DUT settings (Device Test)

Furthermore, there is the possibility to change GSD parameters manually. This is done by selecting the module and submodule for which the changes shall be done and then selecting the parameters to be changed. Clicking in the text field above will open a new window, where the data can be edited.
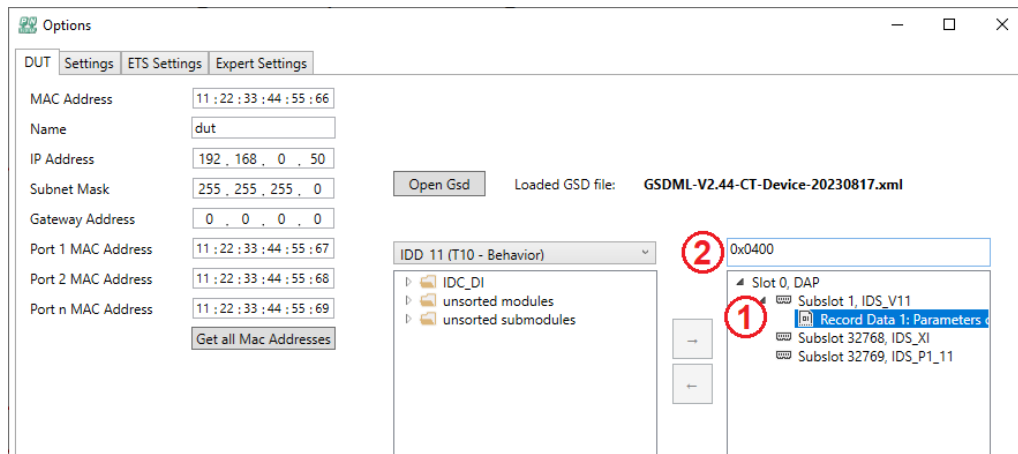
Figure 33 - Select the parameters to be changed
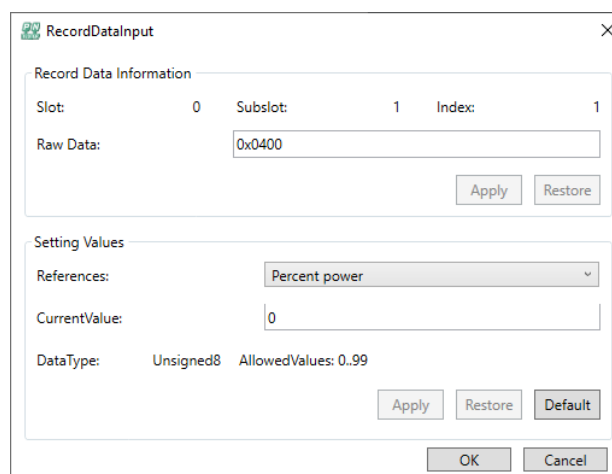
Figure 34 - Changing the parameters

In the *Settings* tab changes to the Host and the PowerSupply-Unit can be made. By clicking the *Refresh Devices* button, the Automated RT Tester detects the available devices automatically. IP – Addresses can be changed as shown in the Figure below.

Figure 35 - Options window – General settings (Device Test)

The *System Redundancy* settings are currently not used by any testcase for certification tests.

Additionally, when the checkbox *Show expert settings* is checked, various parameters which are used in the testcases can be changed.
Once *Show expert settings* is unchecked all parameters are automatically set to their default values.
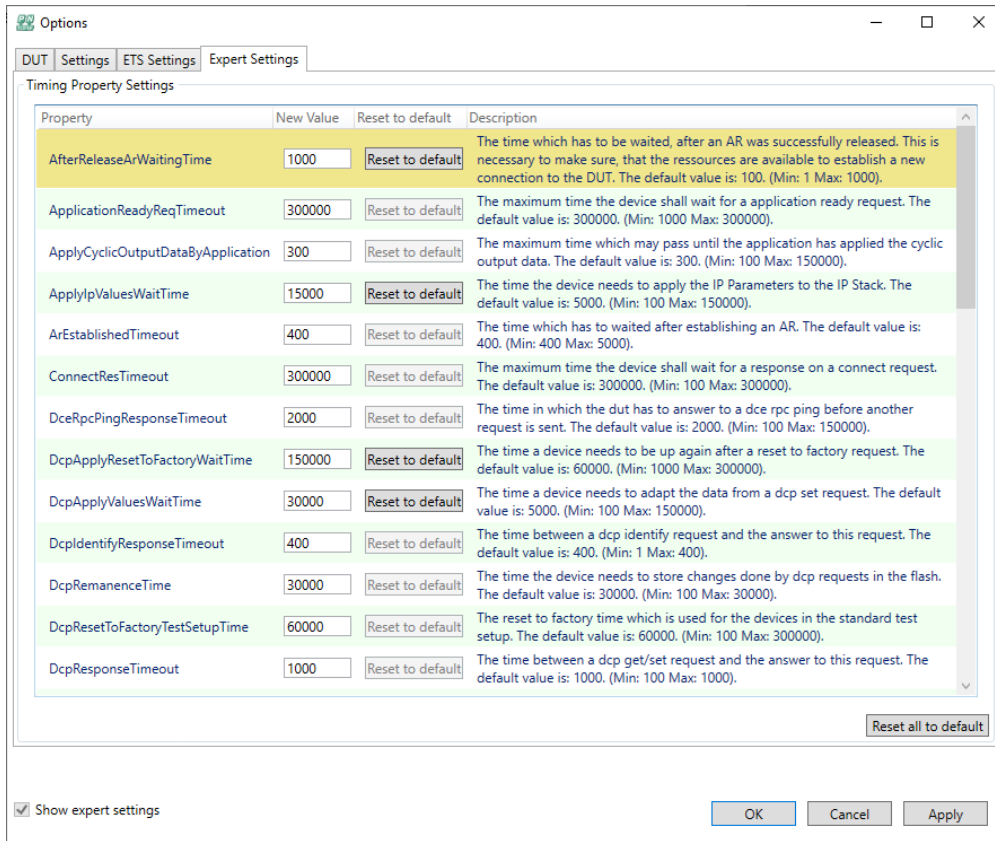
Figure 36 - Options window – Expert settings (Device Test)

7.5 Project Settings (Controller Test)

The project configuration can be changed by selecting *Tools->Options*. All the settings that were selected in the project setup wizard can be altered in the Options window.

ATTENTION

Be aware, that if the standard parameters are altered, the test setup and test result will no longer follow the PROFINET test specifications.
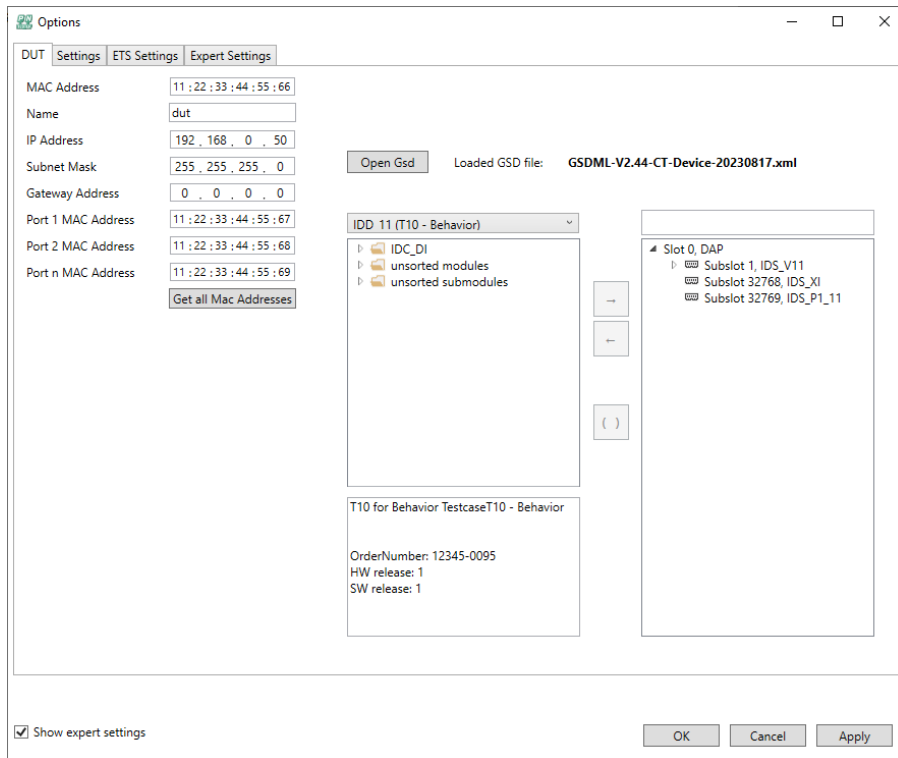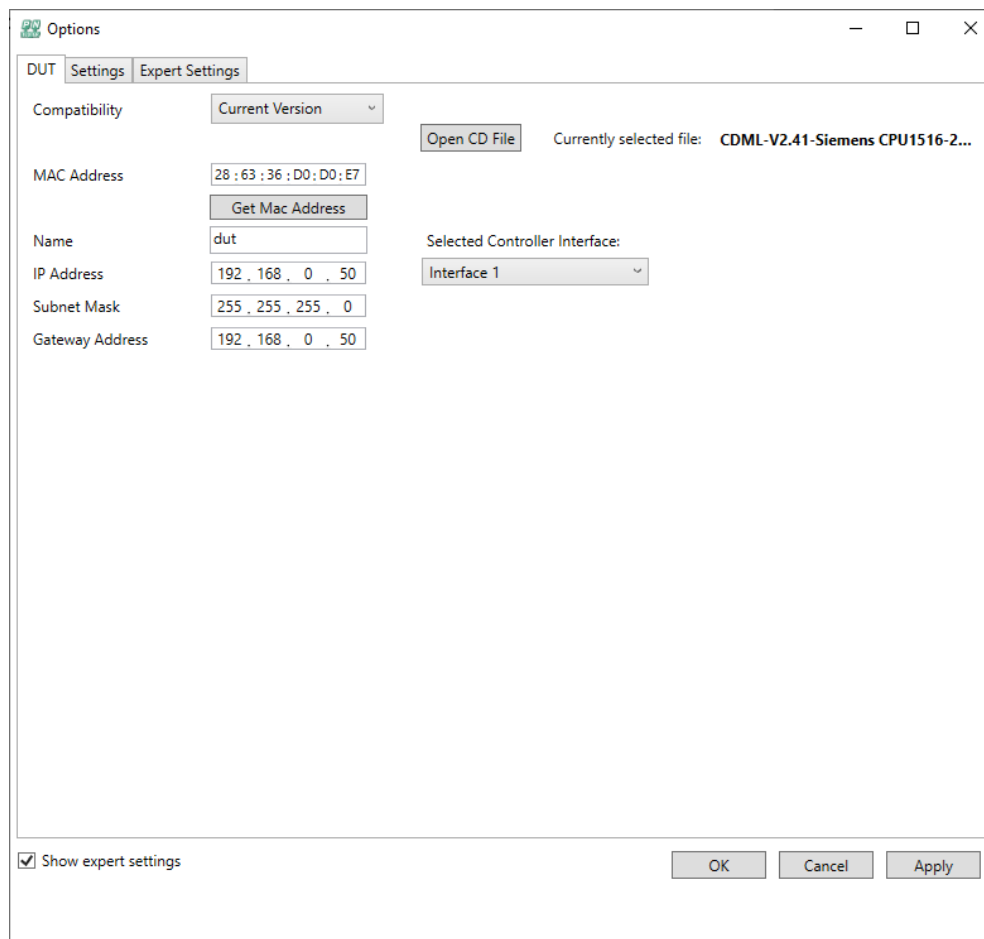

Figure 37 - Options window – DUT settings (Controller Test)

Furthermore, there is the possibility to load a different CD file and the preferred version of ART can be selected under compatibility section.
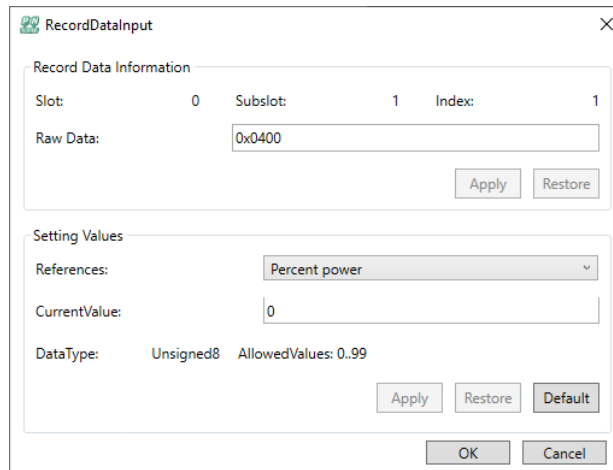
In the *Settings* tab changes to the Host and the PowerSupply-Unit can be made. By clicking the *Refresh Devices* button, the Automated RT Tester detects the available devices automatically. IP – Addresses can be changed as shown in the Figure below.
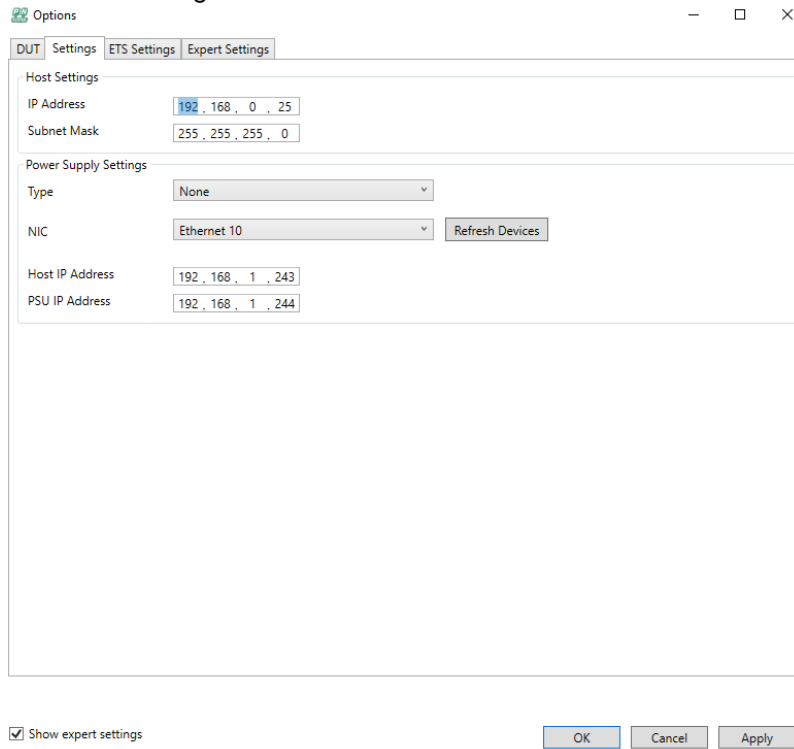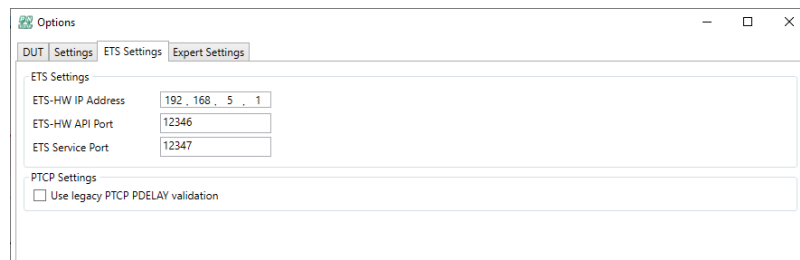

Figure 38 - Options window – General settings (Controller Test)

Additionally, when the checkbox *Show expert settings* is checked, various parameters which are used in the testcases can be changed.

Once *Show expert settings* is unchecked all parameters are automatically set to their default values.
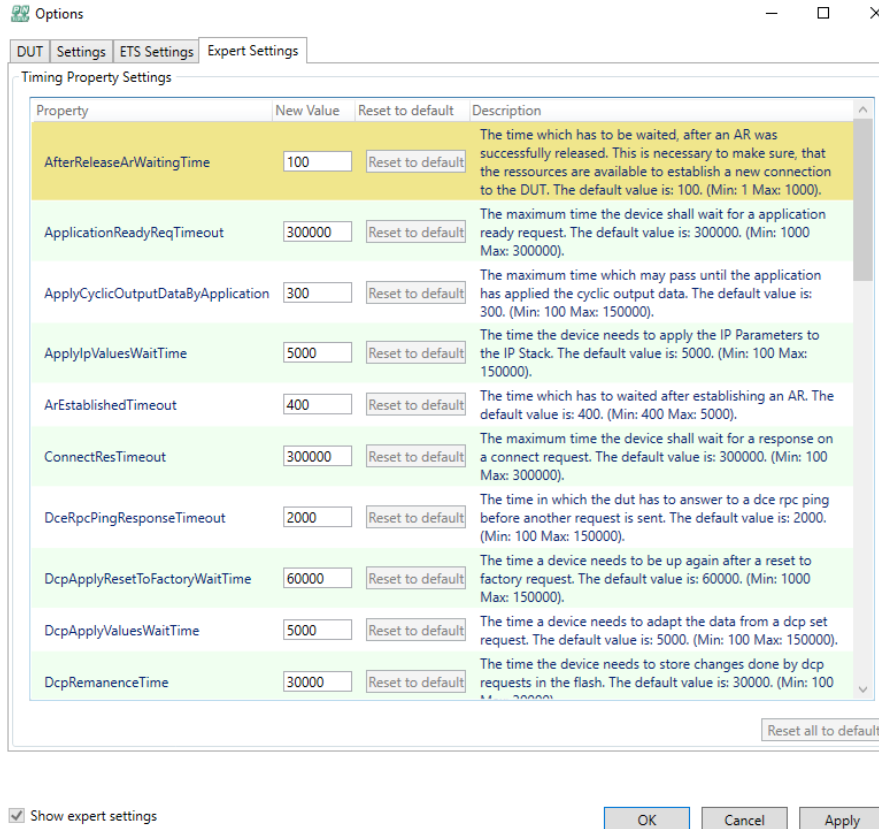
Figure 39 - Options window – Expert settings (Controller Test)

7.6   Report

The report for a test case is shown on the right side of the main window, when the test case is selected in the list on the left side. If no report is available, a message is shown in the report window, which states why no report is available.

The shown report can be exported to 'pdf' by selecting the *Print to PDF* button in the toolbar of the report window.
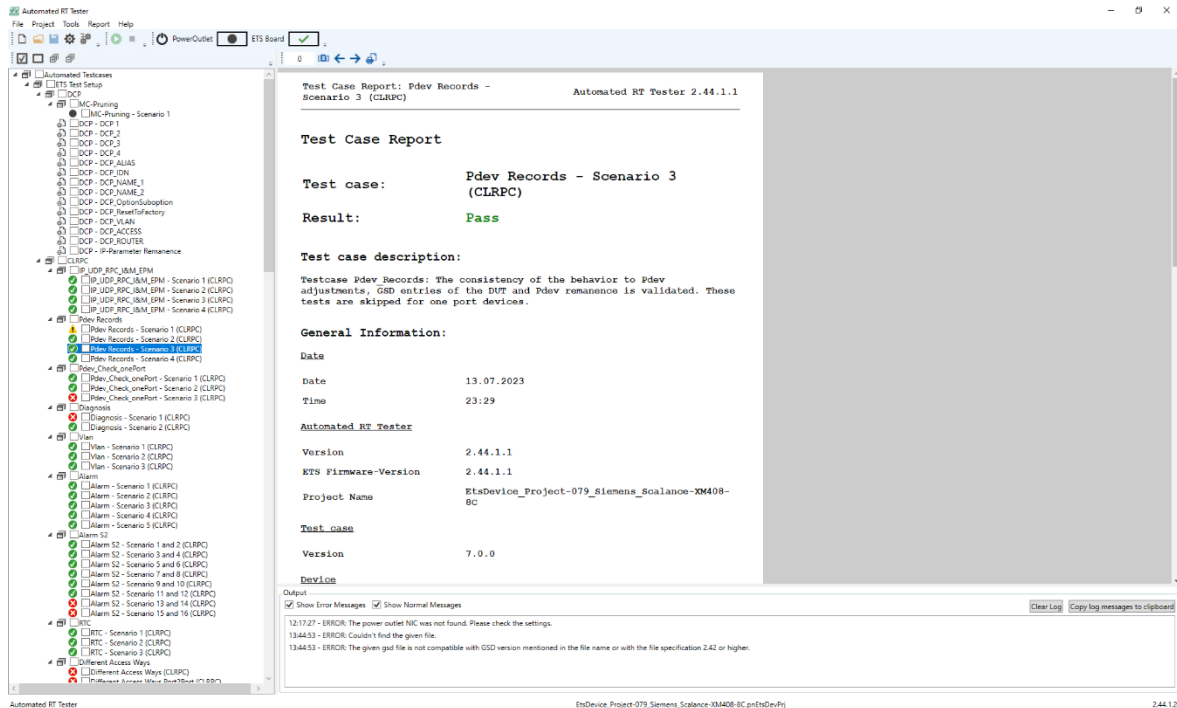
Figure 40 - Main window report

7.7   Certification Report

A certification report which contains the result of all available test cases can be created by selecting *REPORT->CERTIFICATION REPORT*. This report provides a minor detailed overview of the results of all available test cases.

7.8   Adding test cases

It is possible to add user defined test cases to the 'Automated RT Tester' with any version starting from 2.33.1 RC. Just like standard test cases, these can be selected from the tree view on the left side of the screen. For further information on how to create and add user defined test cases please refer to the "UserManualTestCase.pdf", which can be found in the documentation folder under "UserTestCase".

7.8.1   Adding Temporary test cases

In this case *'temporary'* means that after the current instance of the 'Automated RT Tester' is closed, the test case is no longer available and must be added manually in the next session. To add a temporary test case a project must be loaded. To add a test case temporary first a project must be opened. Then press *PROJECT->ADD TESTCASE* or use the Shortcut *'ALT+A'.* Now the dll which contains the test case must be selected.
If an error occurs, e. g. a library is selected which doesn't contain a test case, an error message is shown in the popup and a more detailed message is shown in the log window.
If the adding of the test case was successful, it now can be found in the test case tree view (marked with the red rectangle) next to the standard test cases which are stored in the categories 'Automated Testcases' and 'Manual Testcases'.
The test cases are shown under their category.
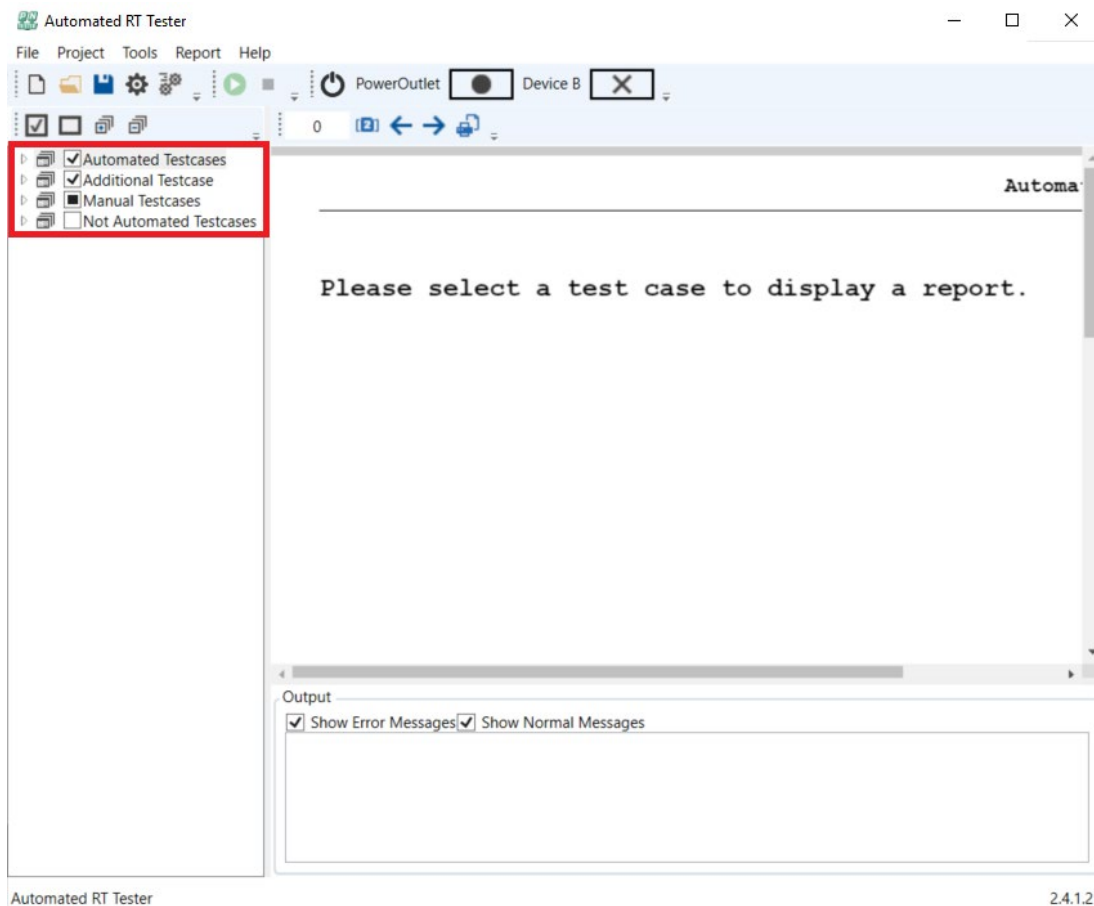
Figure 41 - Main view with added test case

7.8.2   Adding Permanent test cases

If a test case should always be automatically loaded at the startup of the program, the corresponding dll has to be copied to the directory: "%HOMEDRIVE%\%HOMEPATH%\Documents\Automated RT Tester\Testcases". If a 'dll' is not a valid test case this will be reported to the log window. The automatically loaded test cases are also shown in the test case tree view.

8 Command Line Interface (CLI)

As a precondition for the usage of the command line interface a power outlet must be present and configured in the project.

The CLI can be found on the installation path of the 'Automated RT Tester' (the default path of the installer is "C:\Program Files(x86)\Automated RT Tester\"). The executable is called AutomatedRTTesterCli.exe.
The project to be executed must be provided as the first parameter of the AutomatedRTTesterCli.exe. As an optional parameter the reference to which the result should be compared can be handed over as well.

The usage is as follows:

```
AutomatedRTTesterCli.exe \path\to\project [-c compare-path]

    -c, --compare-path  The path, where the compare result files are stored.
    -r, --restart-dut   Contains if the DUT should powered off and on again before each test case.
    -e, --expert-mode   Gives access to more advanced parameter. (see chapter "CLI expert mode")
    -h, --help          Shows this help menu.
```

Examples:

```
AutomatedRTTesterCli.exe "%HOMEDRIVE%%HOMEPATH%\Documents\Automated RT Tester\ExampleProject\
ExampleProject.pnprj"
```

The example above just runs all the selected test cases in the ExampleProject.

```
AutomatedRTTesterCli.exe "%HOMEDRIVE%%HOMEPATH%\Documents\Automated RT Tester\ExampleProject\
ExampleProject.pnprj" –c "%HOMEDRIVE%%HOMEPATH%\Documents\Automated RT Tester\ReferenceProject\Report"
```

The example above runs all the selected test cases in the ExampleProject and compares the result with the results of the reference project.

8.1   CLI expert mode

With the expert mode of the CLI, it is possible to access some parameter beyond the expert settings of the project file.
Implemented Parameter are:

```
DcpHelloDevRel
    The max. allowed relative deviation in the time span between two DCP-Hello requests. [%]
    min: 0
    max: 100
    default: 10

DcpHelloDevAbs
    The max. allowed absolute deviation in the time span between two DCP-Hello requests. [ms]
    min: 0
    max: int32.MaxValue
    default: 10

SkipMrpStartupTime
    Skips the waiting time at start of MRP test cases.
    min: 0
    max: 1
    default: 0

ScrambleTestcaseList
    Scrambles the testcase list before execution.
    min: 0
    max: 1
    default: 0

RandomGeneratorSeed
    Provides the seed for all random generators in the tester.
    Set to 0 if current time shall be used as seed.
    min: int.MinValue
    max: int.MaxValue
    default: 0
```

Example:

```
AutomatedRTTesterCli.exe "path/to/project.pnprj" -e DcpHelloDevRel 50 ScrambleTestcaseList 1
```

The example above runs a project with an allowed deviation in the time span between two DCP-Hello requests of 50 % and executes the selected testcases in a random order.

9   Reports and Wireshark dump files

An xml report and a Wireshark dump file are automatically saved to the project location in the folders 'Reports' and 'EthernetDump'.
Additionally, for ETS device tests, Wireshark captures of the GRPC communication between Automated RT Tester and ETS-HW are automatically saved to the project location in the folder 'EthernetDump/GrpcLog'.

10 Logger

The logging feature simplifies tracing bugs based on the data in its output log files.

Usage:
To activate the logger, a folder named "Trace" should be created in the standard project directory. ("C:\Users\...\Documents\Automated RT Tester\")
Create an xml file called "trace.config" according to the following pattern and place it inside the newly created folder.

Sample trace.config file:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LogConfig>

    <!-- Mandatory start -->
    <TraceLevel>DebugLevel1</TraceLevel>
        <DeepDebugMode>true</DeepDebugMode>
    <LogTypes>
        <LogType>File</LogType>
        <LogType>Debug</LogType>
    </LogTypes>
    <!-- Mandatory end -->


    </LogConfig>
```

Once this is done, the Automated RT-Tester can be used as usual. After all selected testcases are finished, the Logger will create a new directory "Logging" and place a log file inside.
Attention: Make sure to remove the config file after using the logger. Running the Automated RT-Tester with an active logger might impact performance and results.
To create multiple log files in a row, the Automated RT-Tester must be restarted after every test run.

11 ETS Hardware description

The goal of the ETS-HW is to support Embedded test system to provide a test environment to validate the functionality of PROFINET Devices and Controllers

The ETS-HW allows the Embedded test system to communicate with the DUT and provides a real-time environment for tests. Figure 1 shows how the test environment is built.

11.1   Components necessary for running the Embedded Test System

Components necessary for running the Embedded Test System:
- TI TMDX654IDKEVM industrial development kit revision 2.0
- Power supply 24V for IDK board. Please refer the Quick Start Guide (included in IDK) for detailed specification.
- SD card - at least 8GB (included in IDK)
- Ethernet cable to connect PC's network interface (IF1) to the control interface of the IDK board
- 10m Ethernet cables to connect DUT to the interfaces 1, 2 and 3 of the IDK board
- PC with Win10 to run ART and communicate via ethernet interface to ETS - HW
- Device under test (DUT)
- SD card slot/reader
- System image provided in the PN test bundle

Note: The Embedded test system will not work with cable between ETS HW and DUT shorter than 2 meters.

11.2 ETS overview
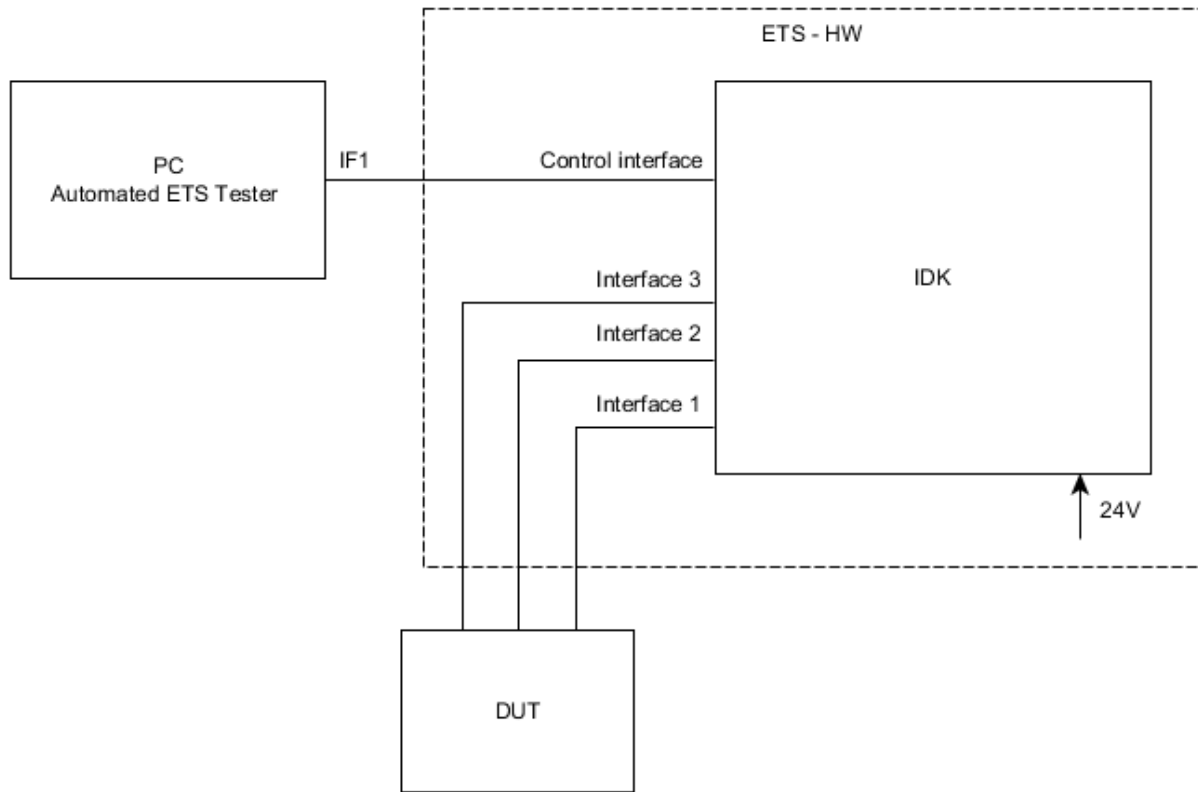
Figure 42 - ETS - HW setup overview
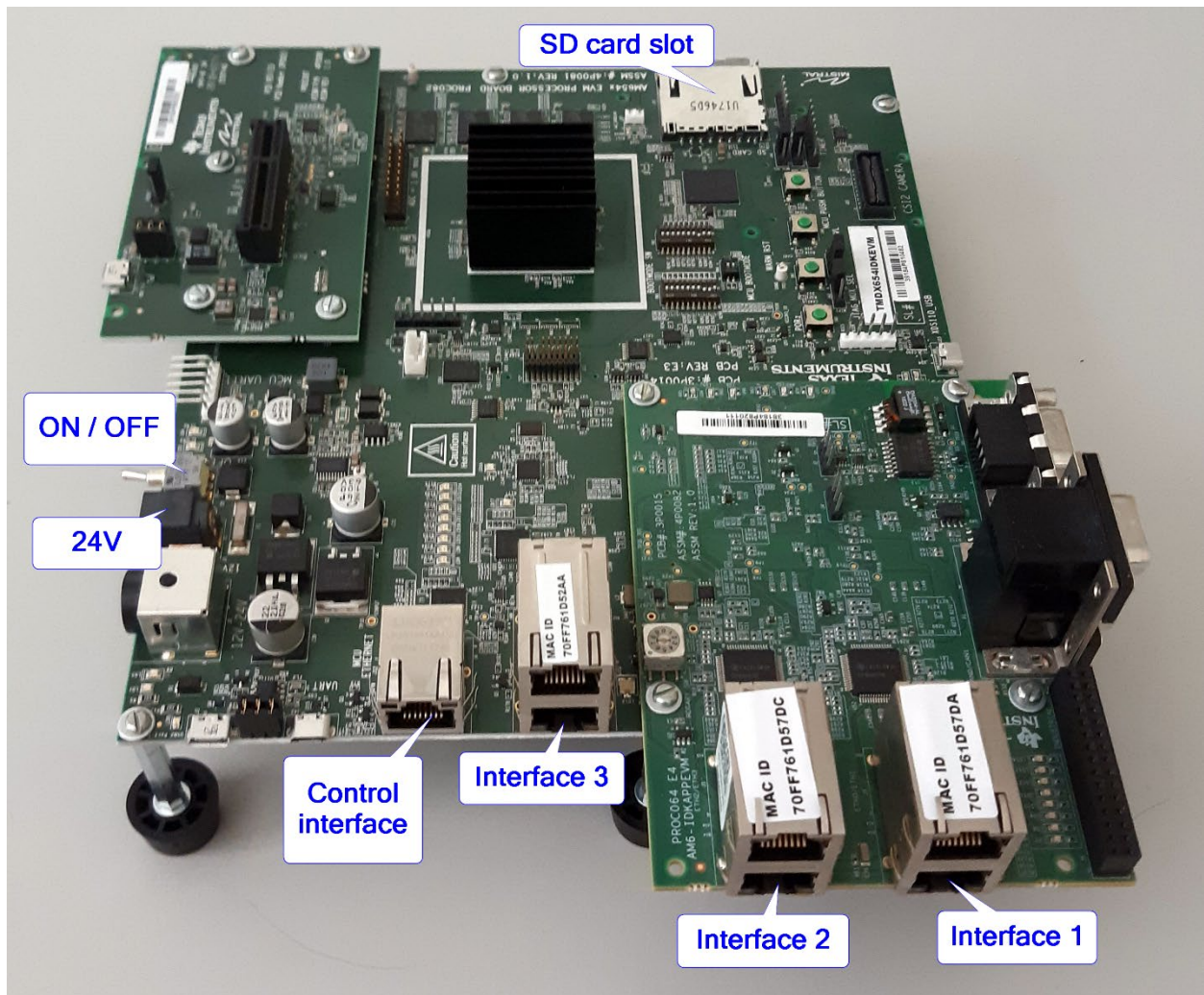
Figure 43 - IDK

Control interface – The interface which is used by the PC running the ART - Software to control the provided functionality of the ETS-HW. This IDK interface has a preconfigured IP address 192.168.5.1/24. Corresponding interface 1 of the PC has to be set to 192.168.5.2.

Interface 1, Interface 2, Interface 3 – The interfaces of the ETS-HW, which are connected to the ports of the DUT according to the Test Specification. Use lower ports for connection (see Figure 3).

24V – Power supply of board.

SD card slot – Slot for SD card with system image.

ON/OFF – Switch for powering on/off the IDK.

11.3   Setup and starting the Embedded Test System

To setup ETS follow these steps:

1. Setup ART application on PC with Win10 (Use the AutomatedRtTester_vx.xx.x.x_Setup.exe inside the AutomatedRtTester_vx.xx.x.x.zip). This installer includes all the needed features, also for ETS.).
2. Set the PC's network interface IF1 (see **Figure 1**) used to control ETS – HW to IP address 192.168.5.2 and netmask 255.255.255.0. It is necessary to use the lower interface ports (see **Figure 3**).
3. Prepare SD card according to the **Chapter 10.4**

4. Insert the SD card to the IDK board.
5. Plug in the 24V power supply for the IDK board.
6. Connect the Ethernet cable from the PC's IF1 to the control interface of the IDK board.
7. Connect the Ethernet cables between the DUT and the ETS-HW according to the Test Specification (see **Figure 3**).
8. Power on the IDK board.
9. Before starting a test case in the ART application wait at least 65 seconds for the IDK board to boot.

Figure 44 - IDK side view

11.4 Flashing system image to SD card

To flash the system image to the SD card use the program Etcher. Etcher is available for download at https://www.balena.io/etcher/. Following description is based on Etcher v1.5.120. Please use product documentation in the case of differences in your version.
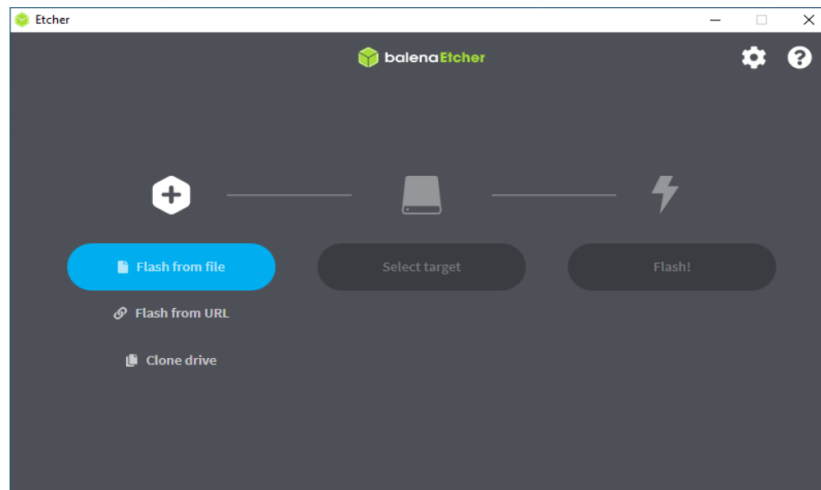
Figure 45 – Etcher

Insert the SD card to the slot or reader at the PC which contains a copy of the system image from the bundle (located by default at c:\Program Files (x86)\Automated RT-Tester\EtsFirmware\).

- There are two hardware versions of IDK. Only SR2 version is supported. Difference can be distinguished by label. Please use the correct hardware version (SR2) otherwise ETS may not work properly.
- IDK SR2: AM654x EVM PROCESSOR BOARD PROC062A – use SD card image ets.VERSION.sr2.img.xz

PROC062A SR2	PROC062B SR2	SR1

SR1 not supported
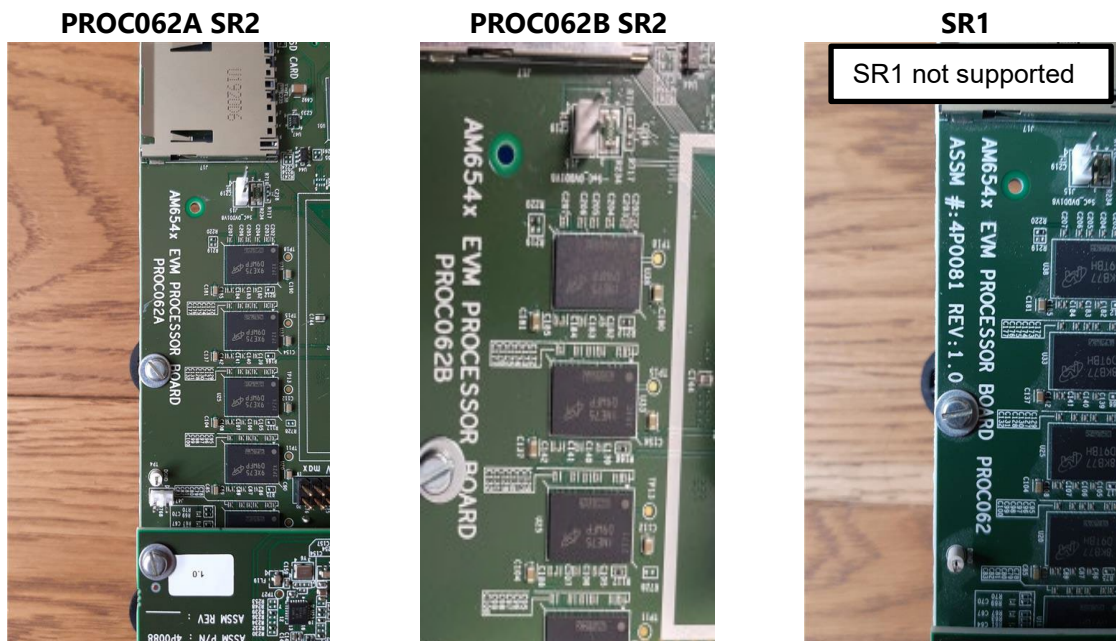
1. Click on "Flash from file" and in the dialog select the system image for the ETS-HW. The matching image to the installed Automated RT Tester version can be found in its installation path in the **EtsFirmware** subdirectory e.g. C:\Program Files (x86)\Automated ETS Tester\EtsFirmware.
2. Click on "Select target" and choose the SD card which will be used in ETS HW. If you already used Etcher for flashing, SD Card can be preselected you can change it with "Change" button.

3. When selecting "Flash!" the write process is started. This might take some time.

Etcher flashes the system image to the selected SD card and verifies afterwards that the image was successfully transferred. After the write is successfully finished, the message "Flash Complete!" appears. The system SD card is now prepared for usage.

11.5   Update ETS - HW

In this development step the update can only be executed as an update of the complete SD card image. For updating, please refer to the chapter "Flashing system image to SD card".

11.6   Known bugs

Reliability of communication

ETS - HW can lose packets in communication with DUT. Consequence of lost packets is some communication on the line is not done. This bug will appear as a discontinuous sequence id, delay between packets is not in required range, etc.

Timestamp inaccuracy after link up

In certain cases, after link up, the frames might have incorrect timestamps (up to 5 seconds after link up). These frames are marked by syslog message in the pcap.

Used cable length

System shall be used with at least 10 m cable length – connection ETS – DUT

Long term Clock instability

After 4 hours of operation the interface clock can jump. It is strongly recommended to restart system before each use.

12 Troubleshooting

Troubleshooting steps are provided for the known error messages.

12.1   EtsConnectionState is Undefined. Check configuration/connection

The Automated RT Tester reports this error message, due to the faulty connection between the PC and ETS board (or) ETS settings in the projects settings set wrongly (or) the IP address of the PC interface was not set correctly. Please make sure the following are correct.

- Check the connection of the ETS board with the PC.
- Check the ETS settings as specified in Figure 16 (ETS settings.)
- Check the IP address of PC interface to be 192.168.5.2, as specified in chapter **Error! Reference source not found.** (General Test Setup).

12.2   TSN is not supported by the given device, so this test is skipped

The Automated RT Tester reports this error message, when the used GSDML file does not contained the following information.
For this error message make sure the used GSDML file have the respective supported information as mentioned below.

- Check the GSDML for **ConformanceClassExt**, it must be "**D**"
- Check the GSDML for **SupportedFeatures**, it must be "**TSN**"
- Check the GSDML for **MAUTypeItem Value**, it must be "**16**" (Full Duplex 100Mbit Copper)
- Check the GSDML for **MAUTypeItem Value**, it must be "**30**" (Full Duplex 1000Mbit Copper)

12.3   Etcher reports an error when flashing system image to the SD card

It may happen that Etcher reports an error while flashing or verifying the SD card. Please, repeat the operation once again according to the chapter "Flashing system image to SD card".

12.4   IDK does not start

It may happen that Automated RT Tester reports an error that IDK does not start. This error may be caused by a corrupted SD card image. Please, restore system image on SD card according to the chapter "Flashing system image to SD card".

13 Power Outlet

The Power Outlet must be connected directly to the selected NIC of the host PC.
The proper connection to the Power Outlet is tested before the test execution is started. If it is not connected and/or configured properly, the test case execution will not be started.

ATTENTION
The username and the password of the 'NET-PwrCtrl PRO' Power Outlet from the company Anel may not be changed from default values, otherwise no connection between the 'Automated RT Tester' and the Power Outlet can be established.

It is also possible to add custom power outlets.
For further information on how to create and add custom power outlets to the Automated RT Tester please refer to "UserManualPowerOutlet.pdf", which can be found in the documentation folder under "PowerOutlet".

13.1   Turning 'On/Off' the Power Outlet

The Power Outlet can be turned on and off via Button in the Automated RT Tester. If no Power Outlet is connected, this button is disabled and cannot be used.

When a Power Outlet is connected, the button is enabled. When switching OFF the power outlet, a black colored cross marked icon is shown.

Figure 46 - Power Outlet state 1

When a Power Outlet is connected, the button is enabled. When switching ON the power outlet, a green tick marked icon is shown.

Figure 47 - Power Outlet state 2

When a Power Outlet is not connected, the button is disabled and the power outlet cannot be switched on or off, a grey colored Hyphen marked icon shown.

Figure 48 - Power Outlet state 3

13.2   Workaround "Lost communication"

In some cases, the communication with the power outlet is lost. In this case, the following workaround could help.

Before setting up the project and starting the test case, please assign a fix IP address to the network card to which the power outlet is connected. By default, and according to the Profinet Test Setup the IP Address is set to '192.168.1.243'. This can be done as described by the following steps:

1. Open the start menu and click "Control Panel".
2. In the control panel click "View network status and task" in menu item "Network and Internet"
3. In the following dialog click "Change adapter settings" on the left side on the screen
4. Right click on the network adapter and select properties.
5. Now click "Internet Protocol Version 4 (TCP/IP)" and then the properties button
6. In the now opening dialog select "Use the following IP Address" – now the desired IP address can be set.
7. After setting the IP address click "OK".

When these settings have been selected, the Automated RT-Tester can be started and the settings can be set as usual, but with the newly setup IP address.