Getting started with STM32CubeWiSE – 802.15.4 Explorer

Introduction

This document describes the STM32CubeWiSE – 802.15.4 Explorer (STM32CubeWiSE8e) which consists of following components:

- STM32CubeWiSE – 802.15.4 Explorer PC GUI application

The STM32CubeWiSE - 802.15.4 Explorer PC GUI application is a graphical user interface which allows to perform the 802.15.4 radio frequency tests on the selected device. This PC tool allows to send and receive test packets to check the efficiency of radio frequency boards and compute the packet error rate (PER) on STM32 devices supporting IEEE 802.15.4 technology.

1 General information

This document describes software that works with the STM32WBA Arm® Cortex®-M33 based microcontroller.

For information on the Arm® Cortex®-M33, refer to the technical reference manuals, available from the www.arm.com website.

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1.1 Ordering information

The STM32CubeWiSE8e is available for free download on ST website.

2 Getting started

This section describes all system requirements to run the STM32CubeWiSE – 802.15.4 Explorer PC GUI application, as well as the relative SW package installation procedure.

2.1 System requirements

The STM32CubeWiSE - 802.15.4 Explorer PC GUI application has the following minimum requirements:

- PC with Intel® processor running one of the following Microsoft® operating systems: Windows 11
- At least 2 GB of RAM
- USB ports

2.2 STM32CubeWiSE - 802.15.4 Explorer SW package setup

1. Extract the content of the stm32wise-8ewin-vx-y-z.zip file into a temporary directory.
2. Extract and launch the STM32CubeWiSE-802.15.4 Explorer _Vx.y.x.exe file and follow the on-screen instructions.

2.3 STM32CubeWiSE – 802.15.4 Explorer SW package folders

The STM32CubeWiSE - 802.15.4 Explorer SW package files are organized into the following folders:

- App: contains STM32CubeWiSE-802154-Explorer.exe
- Firmware: contains the 802.15.4 Phy_Cli binary images for the supported STM32 802.15.4 microcontrollers to be loaded as prerequisite for running the PC GUI application. User is requested to open the STM32CubeProgrammer tool and follow these steps:

1. Plug the selected STM32WBA NUCLEO kit on PC USB port;
2. On STM32CubeProgrammer tool, select and connect to the plugged NUCLEO kit;
3. Select the STM32WBA, Phy_Clin.bin binary image related to the specific device variant available on firmware folder;
4. Download the selected binary image;
5. Disconnect the NUCLEO kit from STM32CubeProgrammer and unplug and plug again the NUCLEO kit to PC USB port.

Release notes and license files are located in the root folder.

Note: For STM32WBA devices, the 802.15.4 Phy_Cli application project is available in the STM32CubeWBA firmware package (refer to \Projects\NUCLEO-WBAx\Applications\Phy_802_15_4\Phy_Cli folder).

3 STM32CubeWiSE - 802.15.4 Explorer PC GUI application description

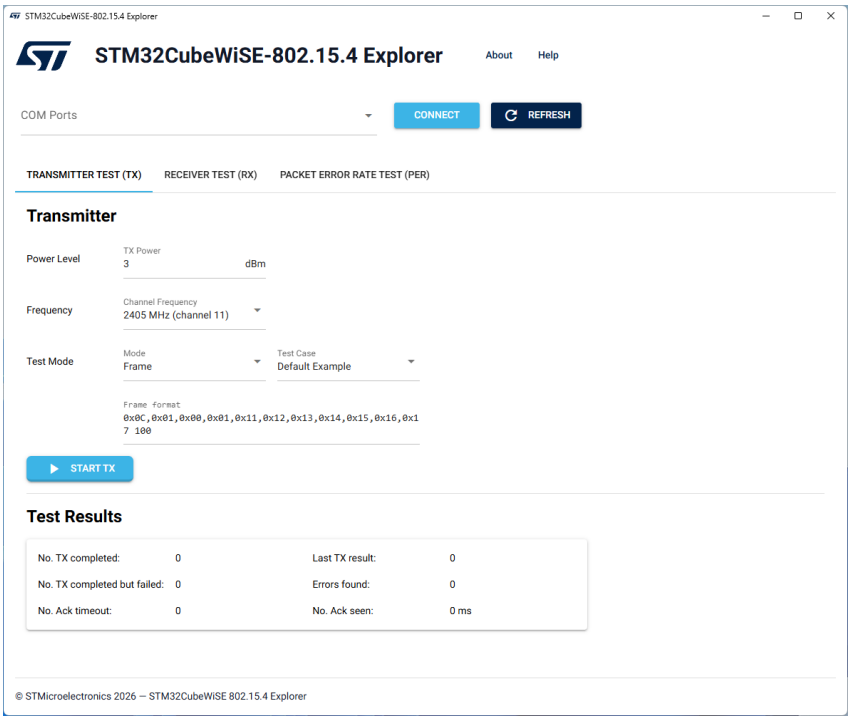
This section describes the main functions of the PC GUI application. You can run this utility by clicking on the STM32CubeWiSE-802.15.4 Explorer icon.

The following radios/protocols are supported:

- 802.15.4 radios.

3.1 Main window

Figure 1. Main Window of STM32CubeWiSE - 802.15.4 Explorer PC GUI



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STM32CubeWiSE - 802.15.4 Explorer PC GUI application allows to send and receive test packets to check the efficiency of radio frequency boards and compute the packet error rate (PER) on STM32 device supporting IEEE 802.15.4 technology.

Three tests tabs are available:

1. Transmitter test (TX): to set the device in transmitter mode.
2. Receiver test (RX): to set the device in reception mode.
3. Packet error rate test (PER): to set the device in reception while one additional device is used as a packet generator.

The STM32CubeWiSE - 802.15.4 Explorer PC GUI application's main window has different areas that allow you to:

1. Configure and run the transmitter test
2. Configure and run the packet error test
3. Configure and run the receiver test

3.2 Transmitter test (TX)

This test configures the 802.15.4 device in transmission.

In order to perform a TX test, the following steps must be followed:

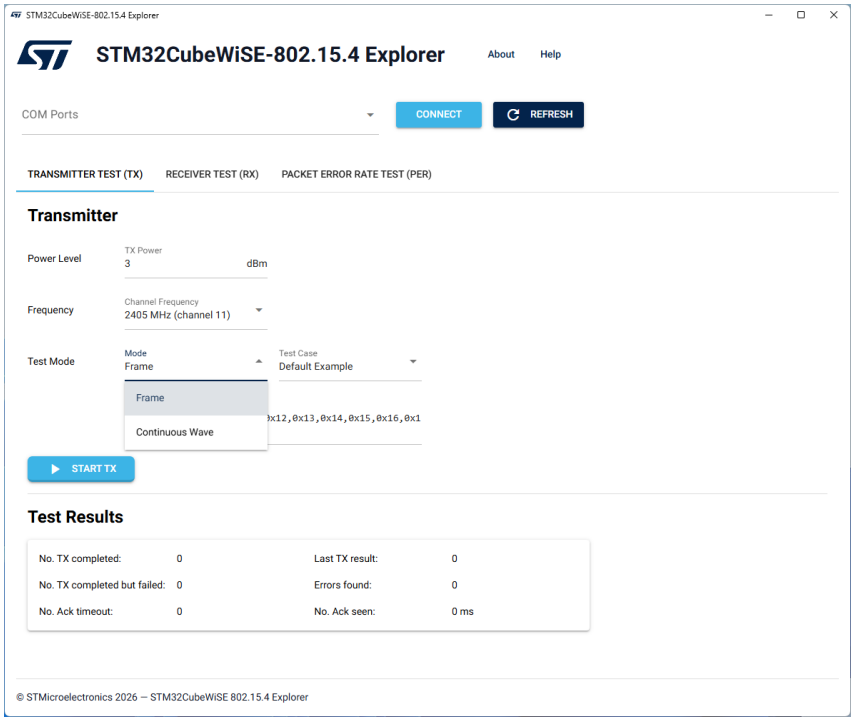
- Select the power level
- Select the TX frequency (channel 11 - 2405 MHz to channel 26 - 2480 MHz).
- Select the TX mode:
  - Frame
  - Continuous wave
- Select one of the supported Test case which determines the specific prebuilt frame format used for the test
  - Default example
  - TX to RX turnaround time
  - Ack required
  - Data frame type and ack required
  - MAC command frame type and ack required
  - Used for validation
  - Big frame size
  - Biggest frame size

3.2.1 TX mode

Two TX modes are available:

- Frame
- Continuous modulated modes

Figure 2. TX mode



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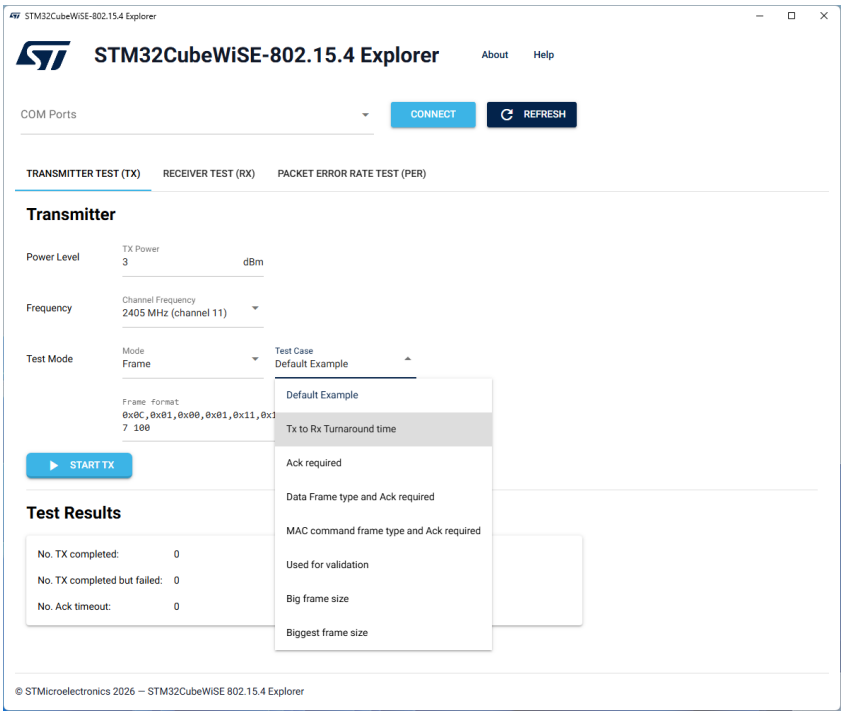
The frame mode allows the user to send a MAC frame. Either the user selects one frame available in the picklist through the test case field or it fills the frame format field.

Figure 3. TX frame mode



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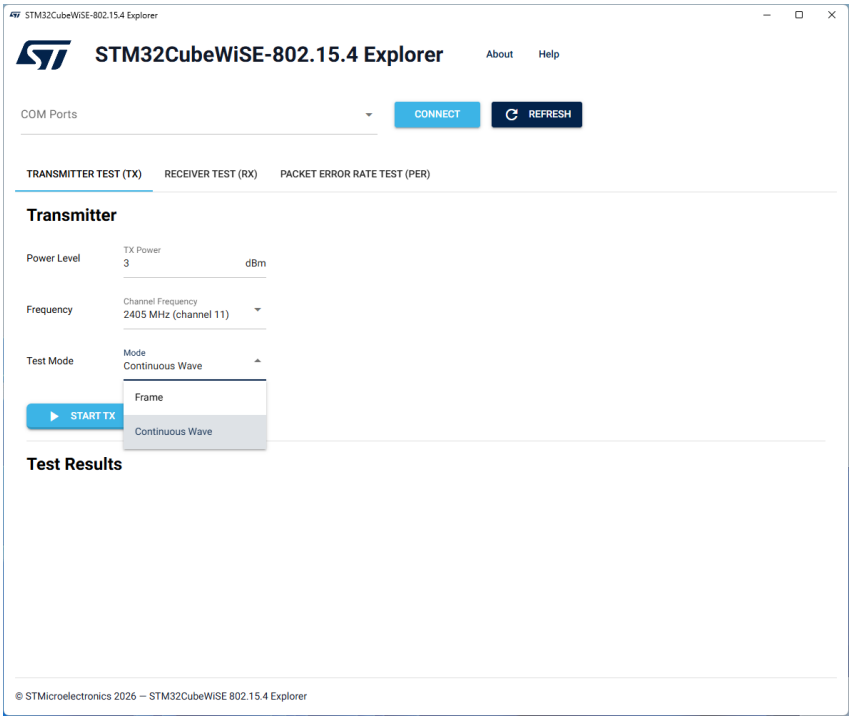
Note: In the picklist, there is the frame required for the certification test of TX to RX turnaround time.

The START TX button is enabled when the frame in the field is valid. Press the start button to launch the transmission, the button is disabled until the frame is transmitted.

The continuous wave mode transmits a continuous signal with no modulation.

Press the START TX button to launch the transmission. The label of the button is switched to STOP TX and allows the user to stop the transmission.

Figure 4. TX continuous wave mode



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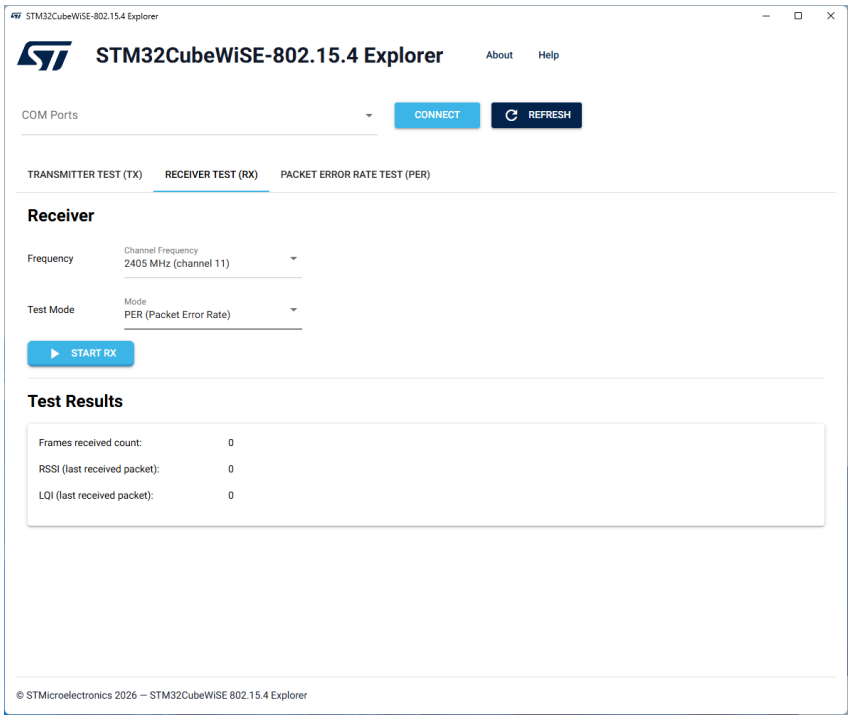
3.3 Receiver test (RX)

This test mode configures the device in reception and requires an external generator.

Three test mode are available:

- PER (packet error rate) which requires an external frame generator.
- ED (energy detection) which requires an external continuous wave generator.
- CCA (channel clear assessment) which requires an external frame generator.

Figure 5. Receiver test



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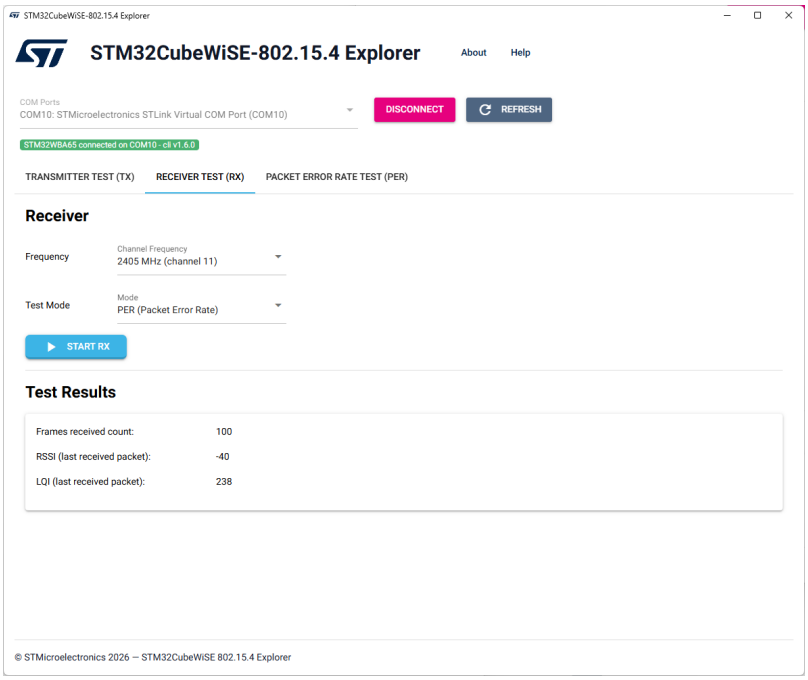
3.3.1 Packet error rate (PER) test

This test requests to use an external frame generator. To start the test, follow the procedure described below:

- Select the RX frequency (channel) to be tested.
- Press the START RX button: the device enters receiver mode and the button switches to STOP RX. With one external generator, send the frames to test in the frequency selected above.
- Once the frames are completely sent, press the STOP RX button. The three fields frames received counts, RSSI, and LQI are filed. The button switches to START RX.

Figure 6. PER frame reception completed



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- Depending on the number of frames sent, the PER can be calculated using the value in the frames received counts field.

3.3.2 Energy detection (ED) test

This test requests to use an external frame generator and follow the procedure below:

- Select the RX frequency (channel) to be tested.
- Either the measurement is done in continuous (default mode) or step-by-step checking the single measurement item.
- With one external generator, send the RF CW signal in the frequency selected above.
- Press the START RX button to launch the ED measurement.

The instantaneous measurement appears on the right side and is also reported in the chart.

Figure 7. ED measurement

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3.3.3 Channel clear assessment (CCA) test

This test requests to use an external frame generator and follow the procedure below:

- Select the RX frequency (channel) to be tested.
- Either the measurement is done continuously (default mode) or step by step when checking the single measurement item.
- With one external generator, send the RF signal to test in the frequency selected above.
- Press the START RX button to launch the CCA measurement.

The instantaneous measurement appears on the right side and is also reported in the chart.

Figure 8. CCA measurement

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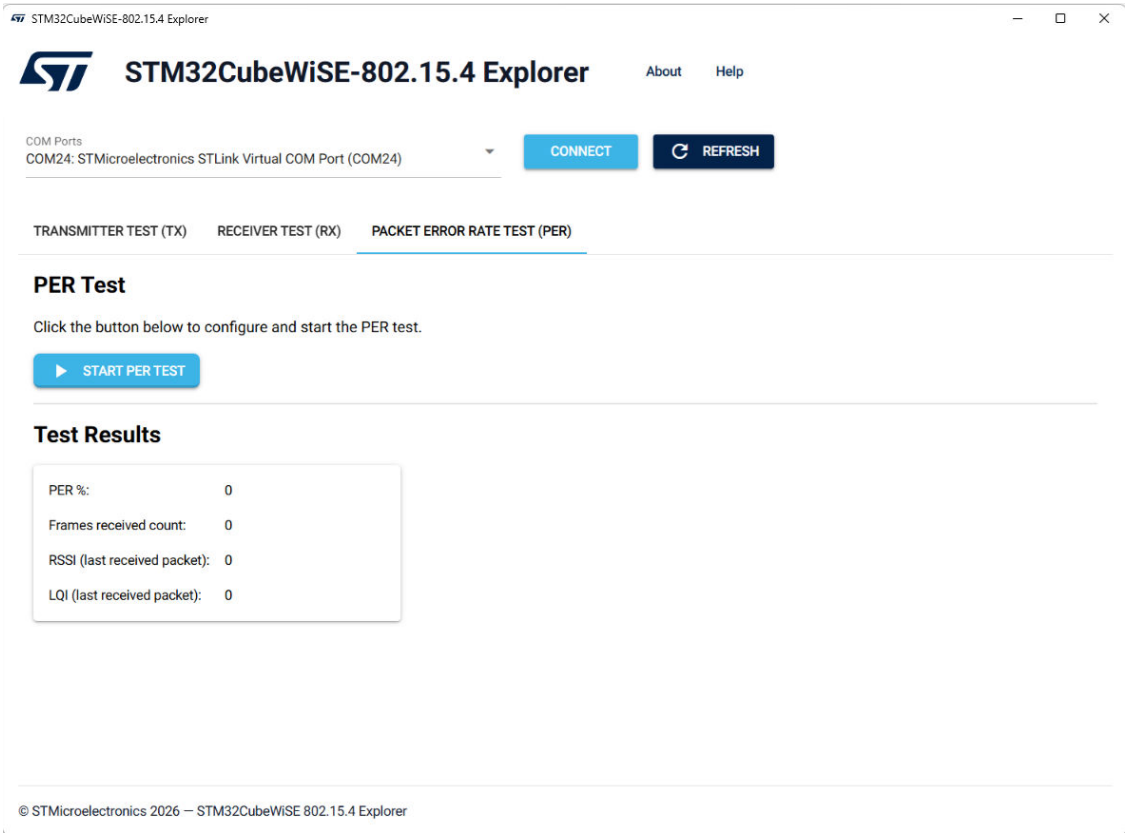
3.4 Packet error rate test (PER)

This test configures the device in reception and one other device to play the role of the generator.

Figure 9. PER test



The tool makes four measurements:

- PER: packet error rate - computed with the number of frames received and the number of frames sent 100 x (Number of frames sent - number of frames received) / number of frames sent
- Frame received count
- RSSI: received signal strength indication
- LQI: link quality indicator

Four steps are necessary:

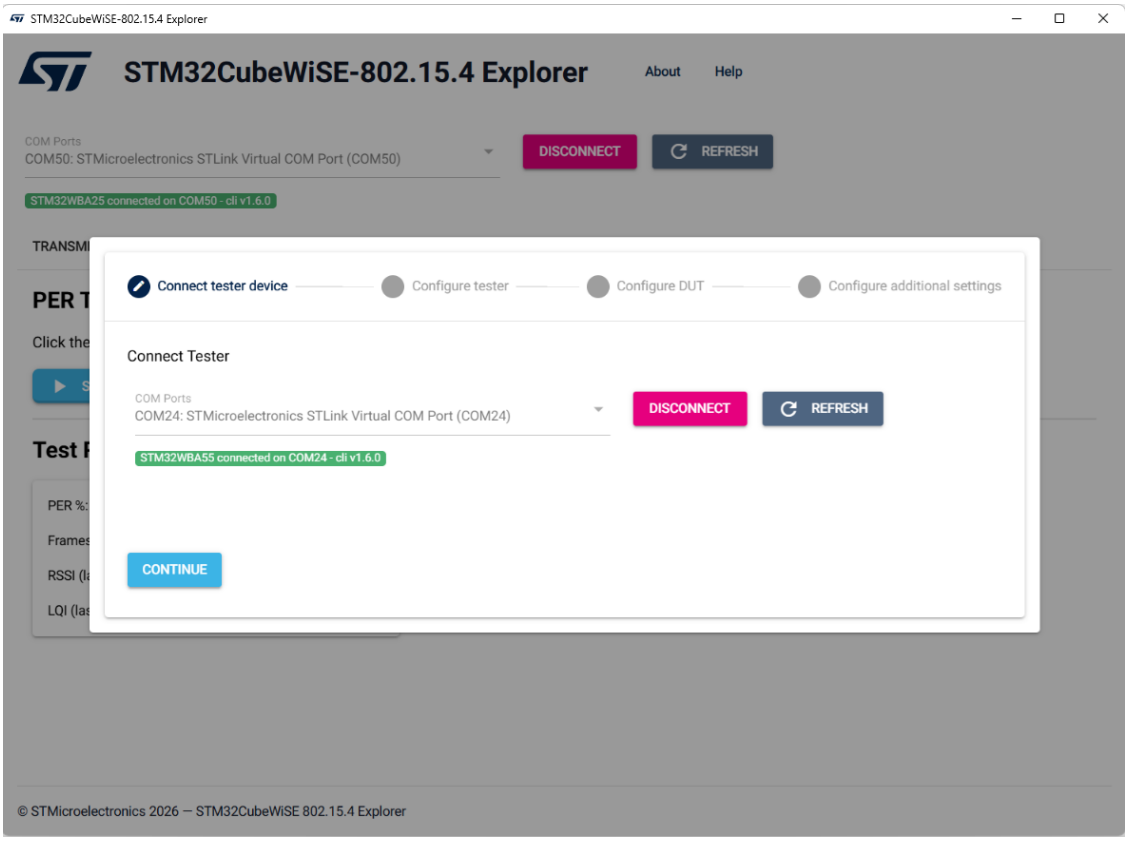
- Connect the additional device to play the role of a packet generator (tester).
- Configure the parameters of the tester:
  - Power level (high power on/off)
  - TX power
  - TX frequency
- Configure the parameters of the device under test (DUT):
  - RX frequency
- Configure the measurement:
  - Continuous measurement or specific number of frames to send
  - Test multiple channels
  - Save results to file

3.4.1 Connect the tester device

The connect tester device area allows you to select the COM port of the tester device

- Plug one additional device into the computer (the same requirements as the first device, refer to Section 2.2: STM32CubeWiSE - 802.15.4 Explorer SW package setup).
- Select the serial port to use in the picklist.
- Click on the CONNECT key, the device information must appear on the right side of the connect key.

Figure 10. Packet tester connection



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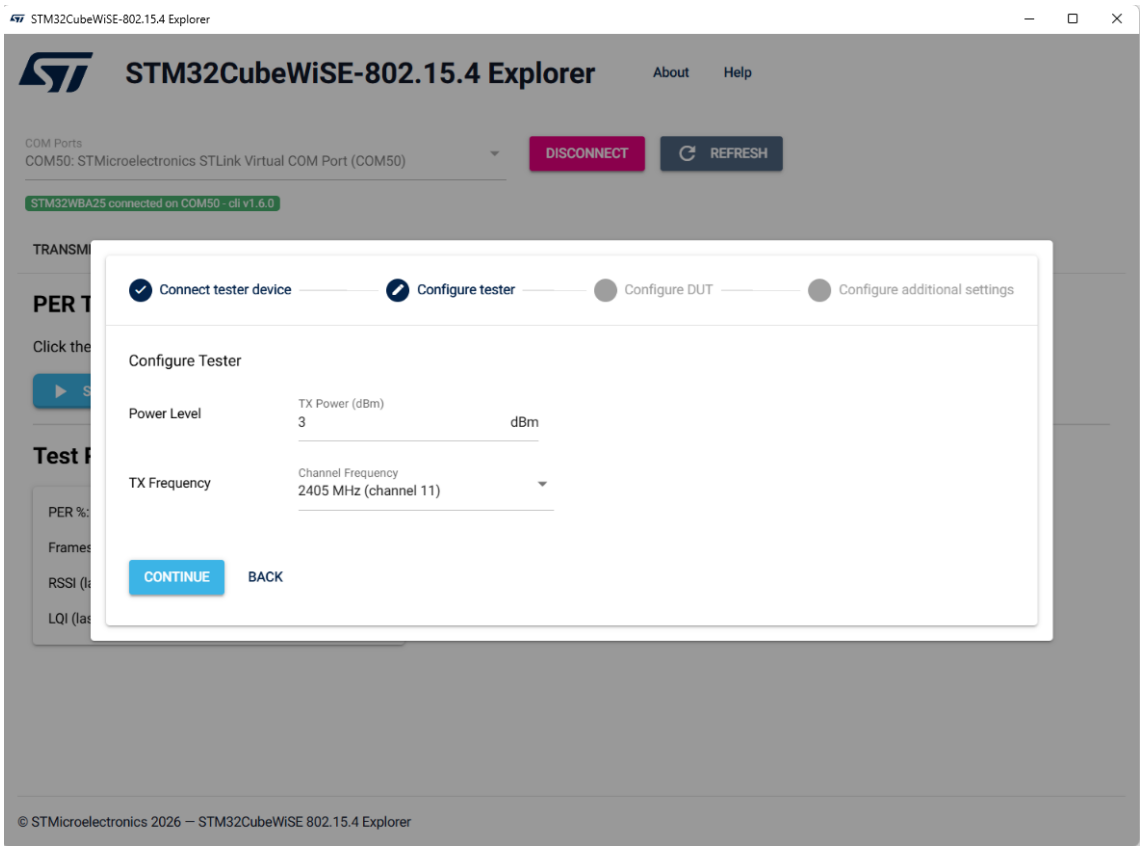
When the second device is connected, it is not possible to change the mode. First, the user needs to disconnect the device and then press the back button.

Click on CONTINUE to set the tester parameters.

3.4.2 Configure the parameters of the tester

Figure 11. PER tester configuration



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The user must:

- For the STM32WBA devices, check or uncheck the high power box according to high-power support.
- Select the power level in the TX power picklist.
- Select the frequency in the TX frequency picklist. This parameter is used only for the single measurement mode. It is not used for continuous or multiple-channel modes. It is applied to the tester device.

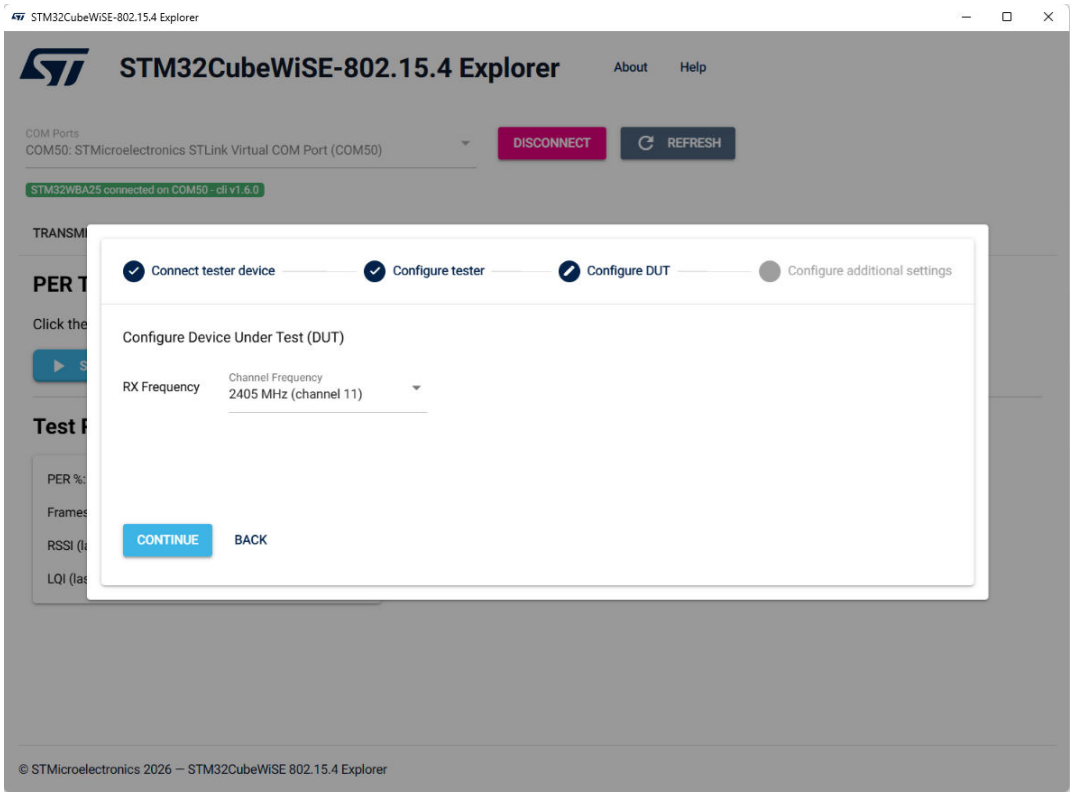
Click on CONTINUE to configure the device under test (DUT).

3.4.3 Configure the parameters of the device under test (DUT)

The user must:

- Select the frequency in the RX frequency picklist. It is the frequency of the DUT.

Figure 12. DUT configuration



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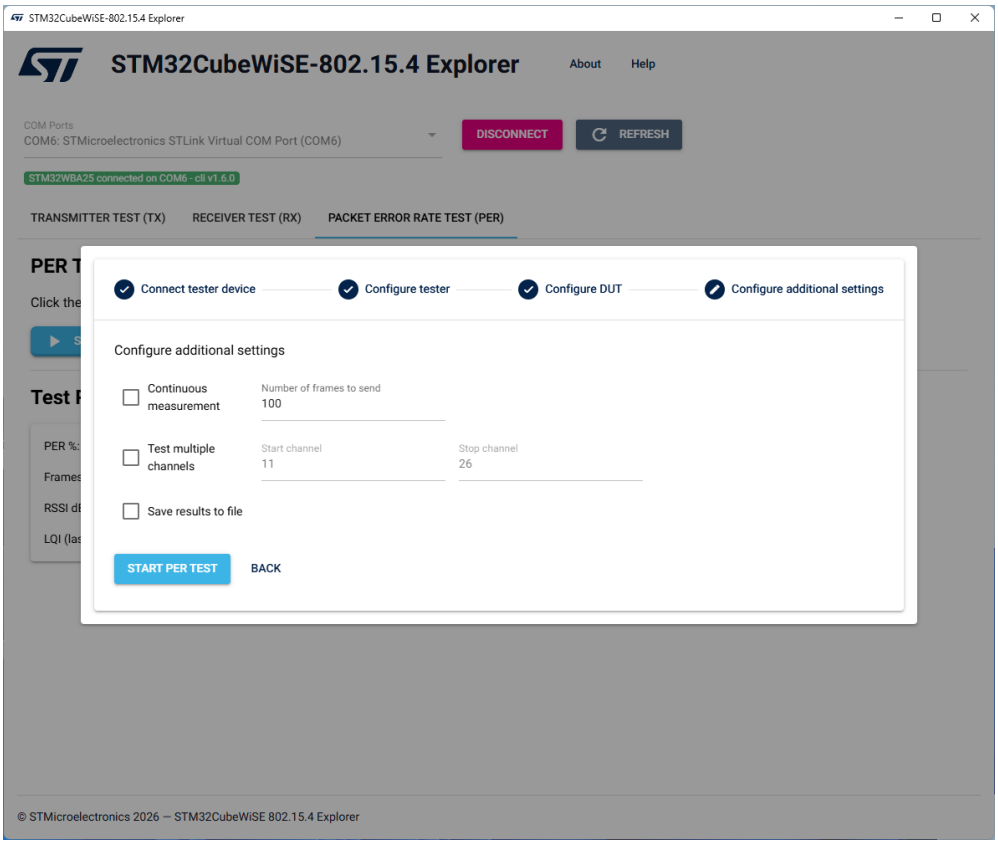
Click on CONTINUE to configure additional settings.

3.4.4 Configure the additional settings

Figure 13. **PER test parameters**



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Three measurement modes are available:

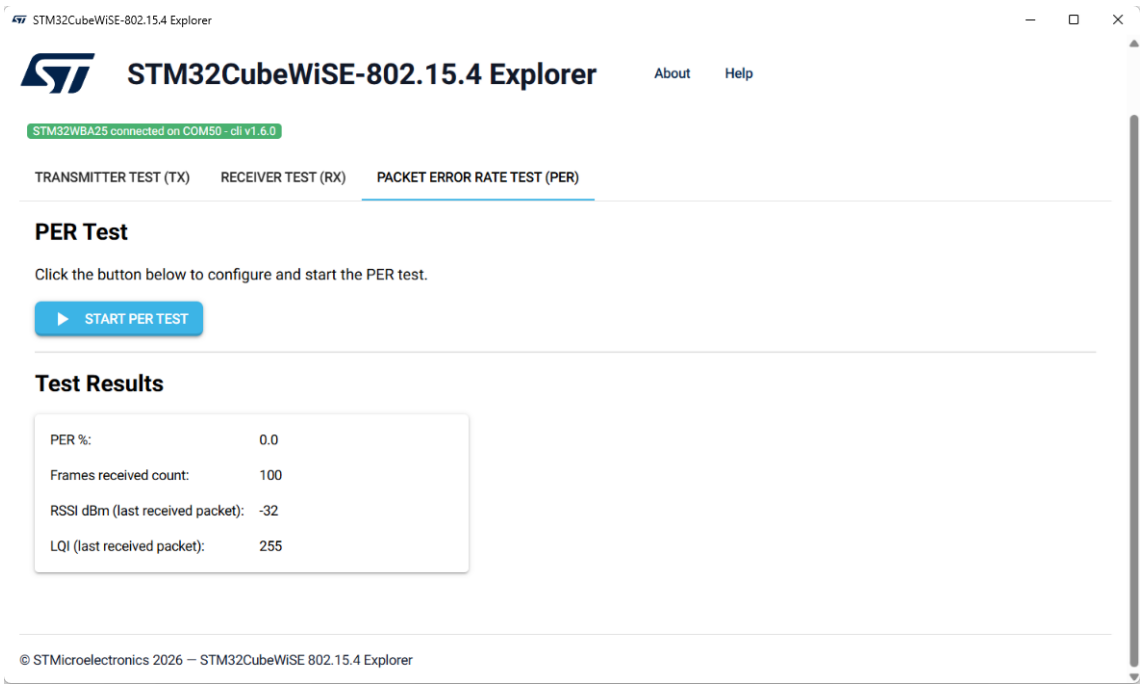
- Continuous measurement repeats the measurement on frame number until the user presses the STOP PER TEST key. The DUT and tester frequencies are identical. They are defined once in the DUT configuration panel
- Multiple channels measure the frequency defined in the selected channels interval. The default values are 11-26, which means that all channels are in the range of 11 to 26. The user can interrupt the test with the stop test key.

The results of continuous and multiple-channel measurements can be saved in a csv file. The user must check the save results to file checkbox.

The PER tests results are displayed with the following information:

- PER %
- Frame received count
- RSSI
- LQI

Figure 14. **PER tests results**



Revision history

Table 1. **Document revision history**

Date	Revision	Changes
11-Mar-2026	1	Initial release.

Contents

List of tables

List of figures

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