



GRL Platform Solutions

User Guide

WPC Qi Wireless Magnetic Power Profile (MPP) Charging Power Receiver [PRx] Tester (GRL-C3-TPT) Compliance Testing with Positioning Tool

This material is provided as a reference to perform compliance testing for the PRx DUT using the GRL Platform Solutions WPC Qi Wireless Charging Power Receiver [PRx] Tester (GRL-C3-TPT) and the GRL Platform Solutions Positioning Tool.

For software support, contact support@grlps.com.

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1 Scope of this User Guide

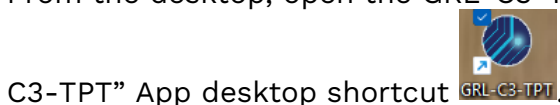
This User Guide describes how to perform compliance testing using the GRL-C3-TPT and GRL Platform Solutions Positioning Tool. The subsequent sections provide the procedures to set up the GRL-C3-TPT automation test application and positioning tool and run compliance tests for the wireless power receiver DUT.

Note: For details on how to get started with the GRL-C3-TPT App and tester hardware, refer to the GRL-C3-TPT user documentation in <http://grlps.com/download-center/>.

2 Compliance Testing with GRL-C3-TPT

Note: The user is required to follow the steps below for compliance testing.

1. From the desktop, open the GRL-C3-TPT App by double-clicking on the “GRL-



2. Ensure that the power profile is set to **MPP** as indicated in Figure 2.1 below.

Note: Ensure that the tester hardware contains MPP firmware files.

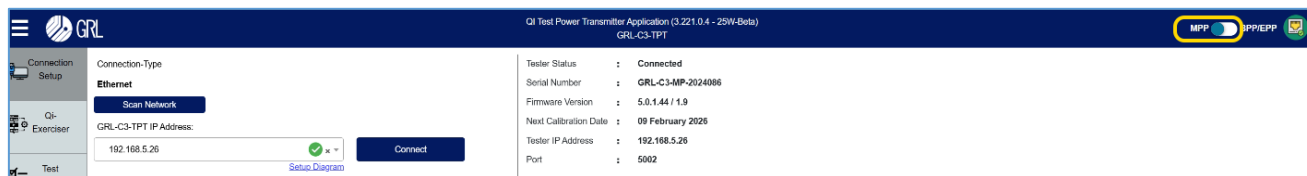


FIGURE 2.1: SET TO MPP POWER PROFILE

3. Click on the **Test Configuration** tab on the left-side bar of the application as shown in Figure 2.2 below.

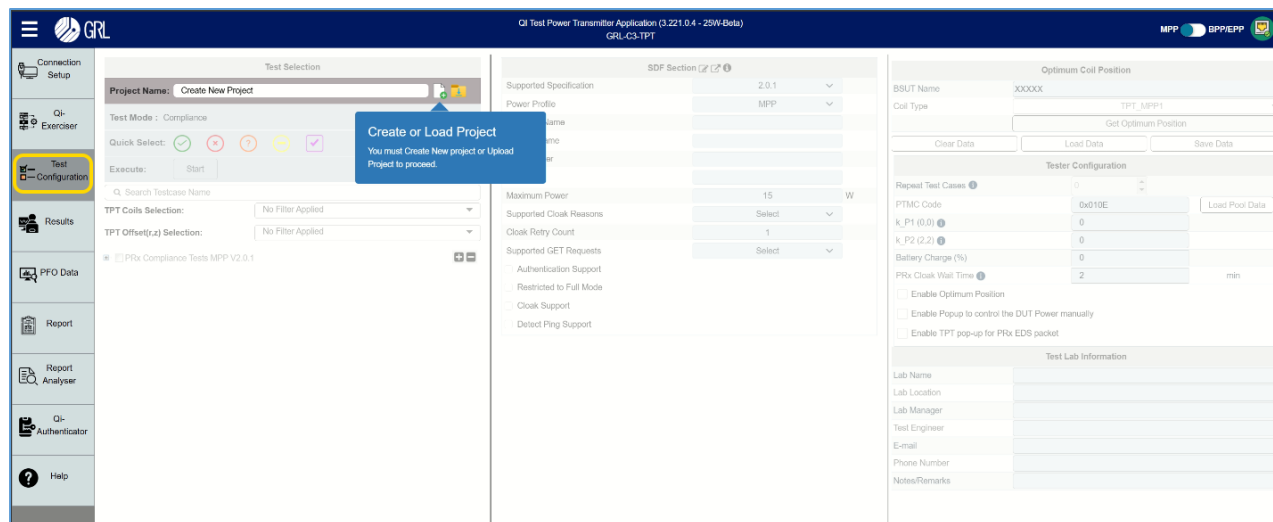


FIGURE 2.2: TEST CONFIGURATION SCREEN

4. Create a new Project by clicking on the Project Name entry field or Create New Project icon as shown in Figure 2.3 below.

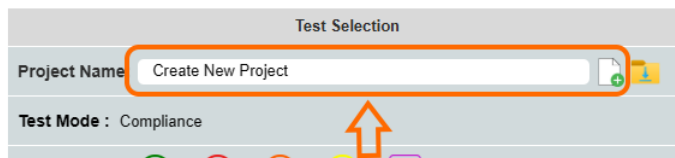


FIGURE 2.3: CREATE NEW PROJECT

5. Enter the **Project Name** (allowed up to 15 letters and special characters) and select the **Test Mode** as “Compliance”.

Note: Select the “Compliance” test mode if the eSDF (Electronic Self Declaration Form) file of the DUT is available. If the eSDF is not available, select the “Pre-Compliance” test mode.

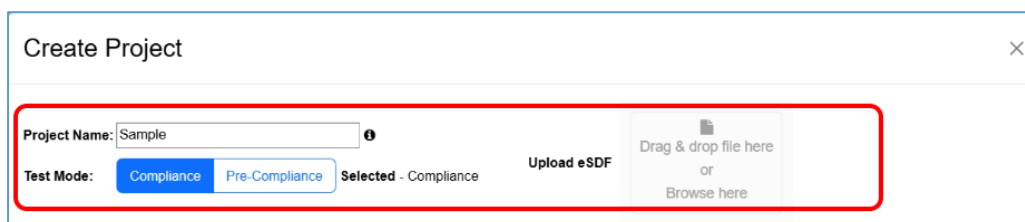


FIGURE 2.4: CREATE NEW PROJECT— #1

6. **Upload** the **eSDF** file of the DUT by dragging and dropping the file into the panel on the right or clicking on the panel to select the file from the system. Then click on the **Create Project** button at the bottom.

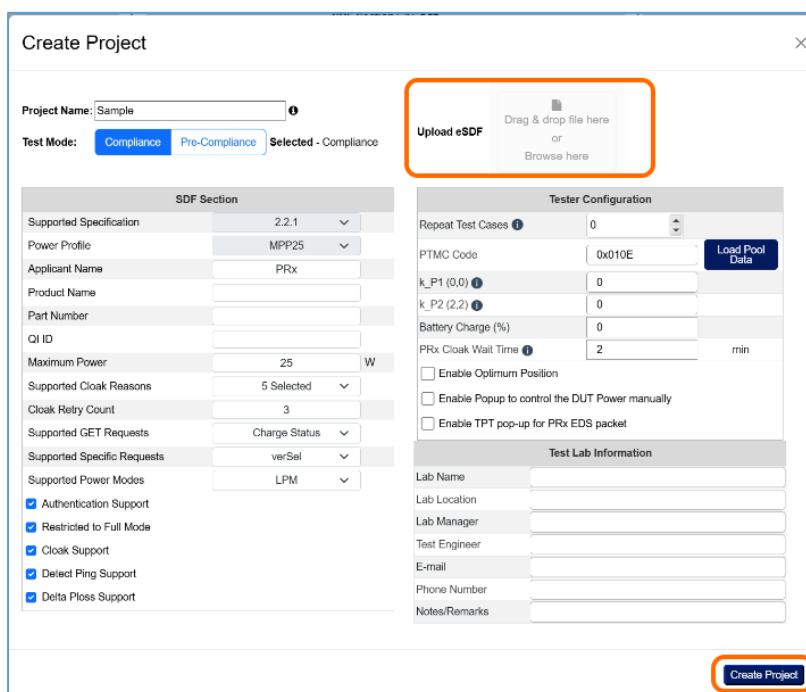


FIGURE 2.5: CREATE NEW PROJECT— #2

7. Use the procedures in the subsequent sections to perform the optimum coil positioning test.

Note: These procedures are required to be followed in order to execute the compliance tests.

2.1 Overview of the GRL Platform Solutions Positioning Tool

Figure 2.6 below illustrates the positioning tool and its various components.

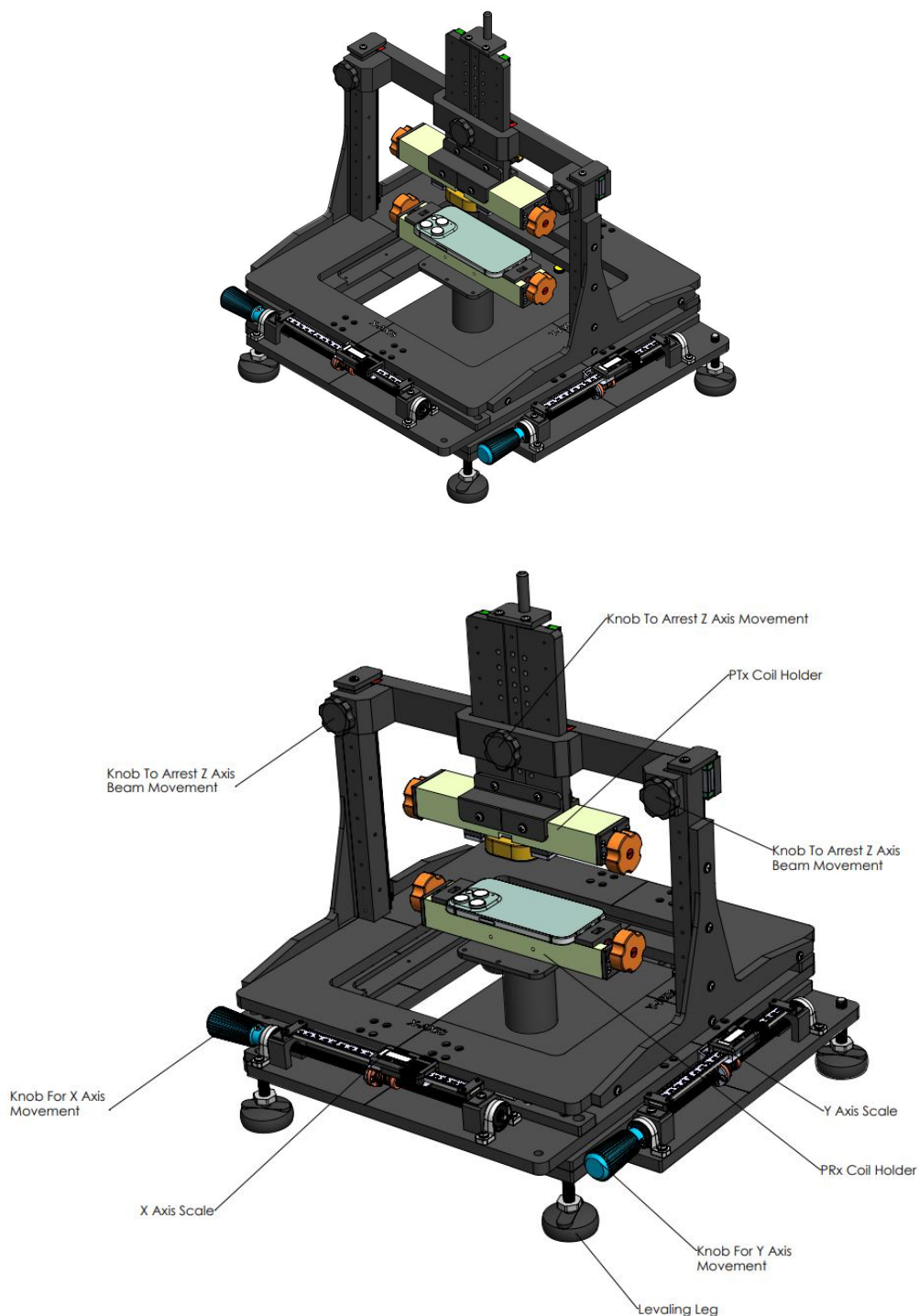


FIGURE 2.6: POSITIONING TOOL OVERVIEW

2.1.1 Positioning Tool Mechanical Dimensions

Figure 2.7 below shows the mechanical dimensions of the positioning tool.

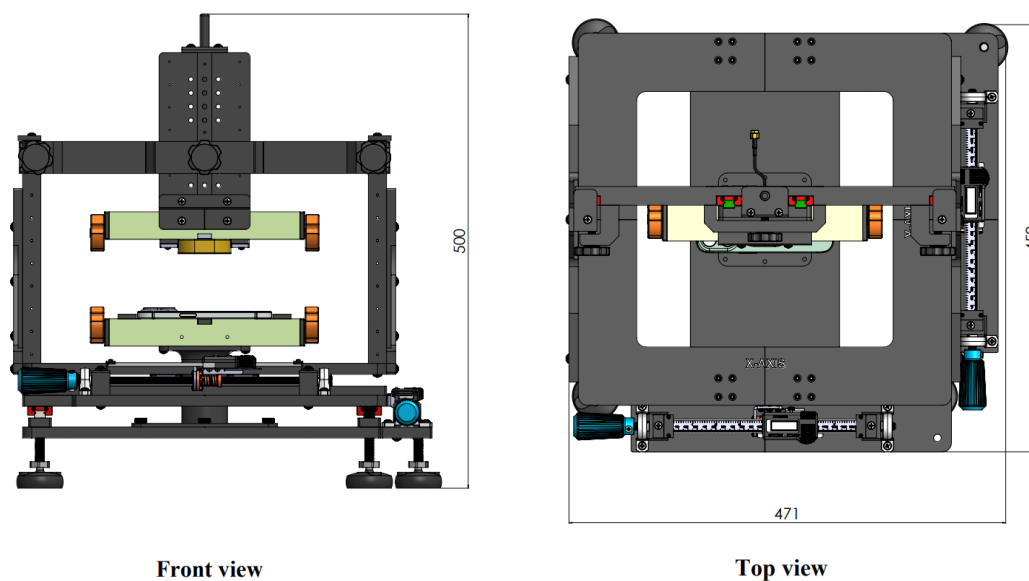


FIGURE 2.7: POSITIONING TOOL MECHANICAL DIMENSIONS

2.2 Positioning Tool Usage

2.2.1 DUT Fixing

Place the DUT in the bottom-side Rx holder by opening the coil holding jaws. Adjust the coil holding jaws using the rotating thumb wheels, as shown in Figure 2.8 below.

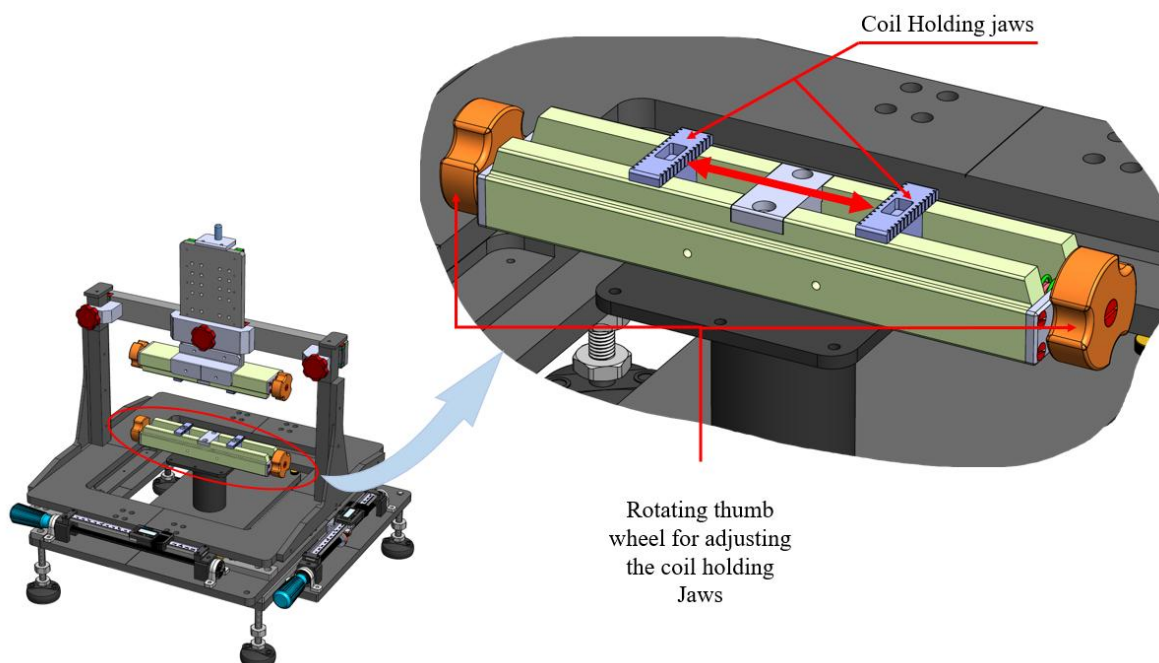


FIGURE 2.8: POSITIONING TOOL DUT FIXING

2.2.2 Procedure to Find Optimum Coil Position

1. Adjust the PRx DUT in the GRL Platform Solutions PTx Coil to align with the magnetic position on the positioning tool as shown in Figure 2.9 below.

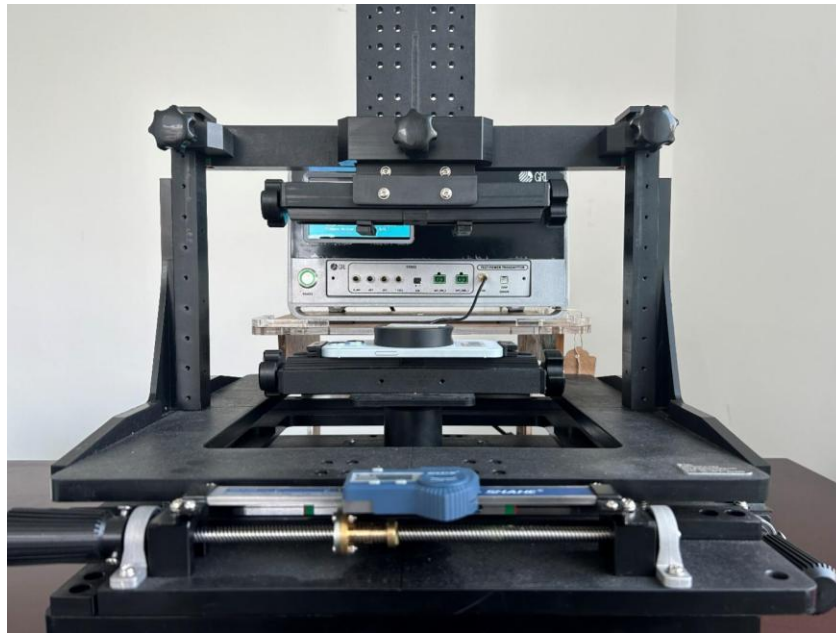


FIGURE 2.9: FIND OPTIMUM COIL POSITION - #1

2. Arrest the PRx DUT by rotating the rotating thumb wheels and adjust the positioning tool to make sure the GRL Platform Solutions PTx coil is placed at the center as shown in Figure 2.10 below.

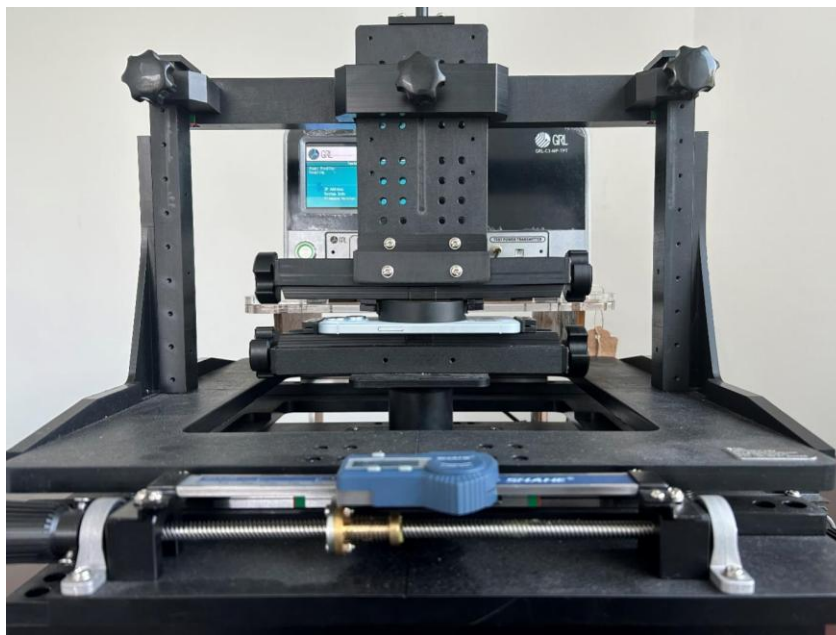


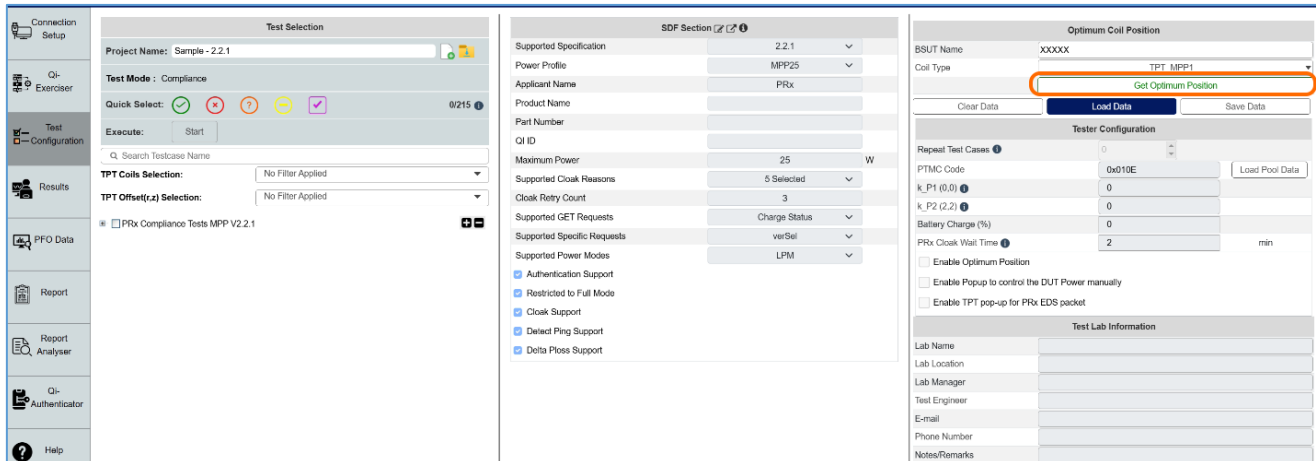
FIGURE 2.10: FIND OPTIMUM COIL POSITION - #2

3. Press the reset button (labeled as ZERO) to set the X axis and Y axis as (0,0) before starting the test as shown in Figure 2.11 below.



FIGURE 2.11: FIND OPTIMUM COIL POSITION - #3

4. On the Test Configuration screen, click on the **Get Optimum Position** button under the “Optimum Coil Position” section as indicated in Figure 2.12 below.



The screenshot shows the 'Test Configuration' screen with several sections:

- Test Selection:** Project Name: Sample - 2.2.1, Test Mode: Compliance, Quick Select: Start, Execute: Start.
- SDF Section:** Supported Specification: 2.2.1, Power Profile: MPP25, Applicant Name: PRx, Product Name, Part Number, QI ID, Maximum Power: 25 W, Supported Cloak Reasons: 5 Selected, Cloak Retry Count: 3, Supported GET Requests: Charge Status, Supported Specific Requests: verSel, Supported Power Modes: LPM.
- Optimum Coil Position:** BSUT Name: XXXXX, Coil Type: TPT MPP1, **Get Optimum Position** button (highlighted with a red box), Clear Data, Load Data, Save Data.
- Tester Configuration:** Repeat Test Cases: 1, PTMC Code: 0x010E, k_P1 (0.0): 0, k_P2 (2.2): 0, Battery Charge (%): 0, PRx Cloak Wait Time: 2 min, Enable Optimum Position, Enable Popup to control the DUT Power manually, Enable TPT pop-up for PRx EDS packet.
- Test Lab Information:** Lab Name, Lab Location, Lab Manager, Test Engineer, E-mail, Phone Number, Notes/Remarks.

FIGURE 2.12: FIND OPTIMUM COIL POSITION - #4

5. A pop-up message will appear (as shown in Figure 2.13 below) to prompt the user to select the method for optimum coil positioning (using default SS values or Vrect). Click **Yes** to continue with the next step by using the default SS values.

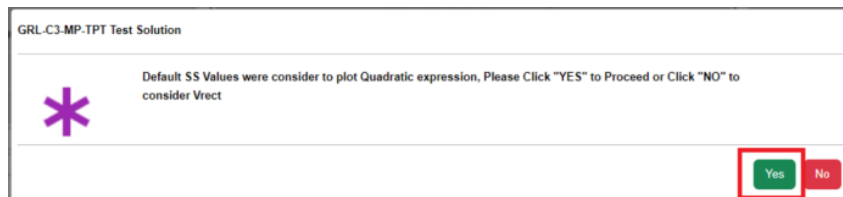


FIGURE 2.13: FIND OPTIMUM COIL POSITION - #5

6. Follow the instructions (as seen in Figure 2.14 below) to align the X-axis and Y-axis values accordingly using the respective knobs. Then click **Ok** to proceed with the next step.

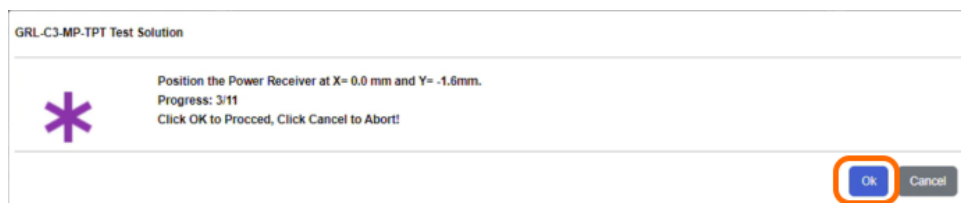


FIGURE 2.14: FIND OPTIMUM COIL POSITION - #6

7. After aligning the respective X-axis & Y-axis values from the final pop-up message (as seen in Figure 2.15 below), the signal strength value will be updated in the Optimum Coil Position table (as seen in Figure 2.16 below). Make sure to take a note of the signal strength value.

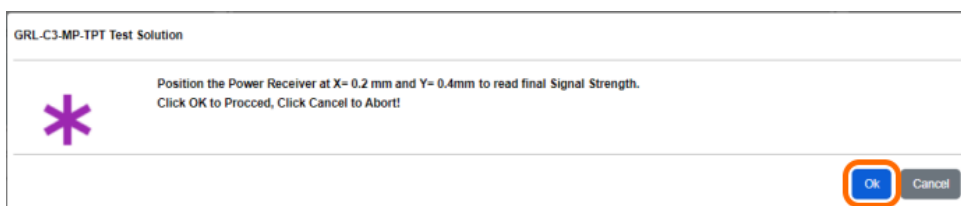
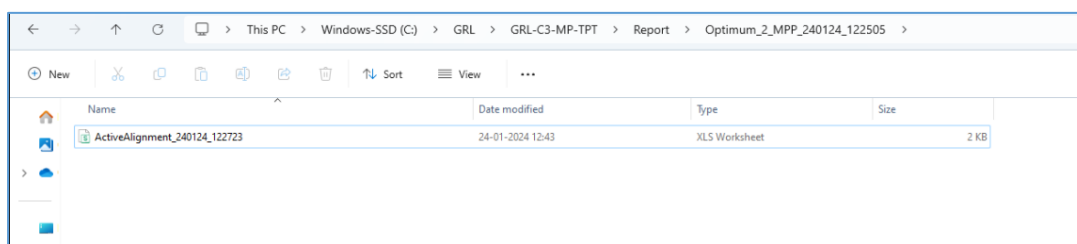


FIGURE 2.15: FIND OPTIMUM COIL POSITION - #7

Optimum Coil Position	
BSUT Name	XXXXX
Coil Type	TPT_MPP4
Get Optimum Position	
Coil	Value
TPT_MPP1	161
TPT_MPP4	161
Clear Data Load Data Save Data	

FIGURE 2.16: FIND OPTIMUM COIL POSITION - #8

Note: The obtained optimum coil position signal strength values for all the X- & Y-axis will be updated in an Excel file “ActiveAlignment” in the following location “C:\GRL\GRL-C3-TPT\Report\User created project folder”.



Step 3. Filled in the coefficients from the fit equations from the plot in step (2)				
$y=ax^2+bx+c$				
	a	b	c	AxisCenter
X-Axis	-0.8723	0.3676	159.2447	0.2
Y-Axis	-0.6231	0.9437	158.6424	0.8
Step 4. Swept signal strength across positions again with updated center from step (3)				
X	Y	Signal Strength		
-2.3	0.8	155	0	
-2.05	0.8	155	0	
-1.8	0.8	155	0	
-1.4	0.8	157	0	
-1	0.8	158	0	
0.2	0.8	159	0	
1.4	0.8	158	0	
1.8	0.8	157	0	
2.2	0.8	156	0	
2.45	0.8	154	0	
2.7	0.8	153	0	
0.2	-1.7	156	0	
0.2	-1.45	156	0	
0.2	-1.2	157	0	
0.2	-0.8	158	0	
0.2	-0.4	158	0	
0.2	0.8	159	0	
0.2	2	158	0	
0.2	2.4	157	0	
0.2	2.8	155	0	
0.2	3.05	154	0	
0.2	3.3	153	0	
Step 5. Identify final centre from plots of step 4				
$y=ax^2+bx+c$				
	a	b	c	AxisCenter
X-Axis	-0.856	0.2065	159.0897	0.1
Y-Axis	-0.7671	0.7716	159.0216	0.5
Step 5. Find SS value at final AxisCenter (X and Y) Positions				
Signal Strength Value: 159				

FIGURE 2.17: OPTIMUM COIL POSITION ACQUIRED SIGNAL STRENGTH VALUES

- After obtaining the final optimum coil position of the X-axis and Y-axis, reset both the X- and Y-axis to zero as the optimum position in the positioning tool as shown in Figure 2.18 below.

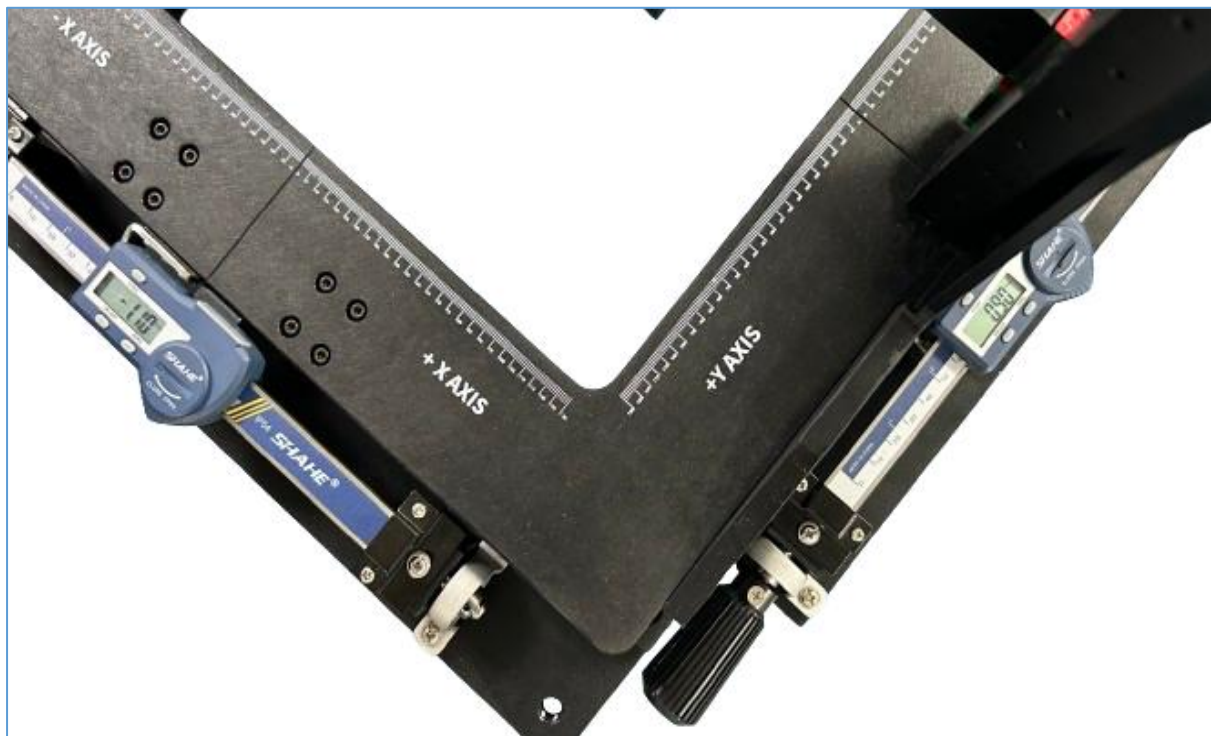


FIGURE 2.18: RESET X- AND Y-AXIS TO ZERO IN POSITIONING TOOL

9. Execute the (0,0) position test cases and compare the 128kHz signal strength value with the above noted signal strength value.

Note: If a new project is created, this Optimum coil position signal strength value will not be available. The user either needs to get the optimum coil position again using the above procedure or previous data can be loaded if available.

Further Information:

The optimum coil position signal strength value can be saved and used later if the same setup (PTx/PRx/Optimum coil position tool) exists.

In the Optimum Coil Position section, the user can click on the following buttons to:

- **Save Data** - Save the obtained Optimum Coil Position signal strength value to a file in the desired location.
- **Load Data** - Load the previously saved data from the respective location.

Refer to Figure 2.19 below.

Optimum Coil Position	
BSUT Name	XXXXX
Coil Type	TPT_MPP1
Get Optimum Position	
Clear Data	Load Data
Save Data	

FIGURE 2.19: SAVE OR LOAD OPTIMUM COIL POSITION SIGNAL STRENGTH VALUE

2.2.3 Procedure to Execute the (0,0) Position Test Cases

After acquiring the optimum coil position and the final signal strength value, ensure the eSDF fields are provided with the expected values to execute the respective test cases.

1. In the SDF Section, click on  to edit the eSDF data and the following pop-up window will allow the user to make the required edits.

SDF Section 	
Supported Specification	2.2.1 
Power Profile	MPP25 
Applicant Name	PRx

2. Select the **Enable Optimum Position** checkbox as shown in Figure 2.20 below.
 - This is required when the optimum coil position value is loaded or obtained using the positioning tool.

Project Configuration 

SDF Section	
Supported Specification	2.2.1 
Power Profile	MPP25 
Applicant Name	PRx
Product Name	
Part Number	
QI ID	
Maximum Power	25 W
Supported Cloak Reasons	5 Selected 
Cloak Retry Count	3
Supported GET Requests	Charge Status 

Tester Configuration	
Repeat Test Cases 	0 
PTMC Code	0x010E 
k_P1 (0,0) 	0
k_P2 (2,2) 	0
Battery Charge (%)	0
PRx Cloak Wait Time 	2 min
☒ Enable Optimum Position	
☐ Enable Popup to control the DUT Power manually	
☐ Enable TPT pop-up for PRx EDS packet	

FIGURE 2.20: EXECUTE (0,0) POSITION TEST CASES - #1

3. Load the PTMC pool data (as indicated in Figure 2.21 below) — if supported by the PRx DUT (the PRx DUT should be able to initiate the “General Request(ID) packet”).

Also load the latest PTMC pool data available in the WPC website.

Project Configuration

SDF Section		Tester Configuration	
Supported Specification	2.2.1	Repeat Test Cases	0
Power Profile	MPP25	PTMC Code	0x010E Load Pool Data
Applicant Name	PRx	k_P1 (0,0)	0
Product Name		k_P2 (2,2)	0
Part Number		Battery Charge (%)	0
QI ID		PRx Cloak Wait Time	2 min
Maximum Power	25 W	☒ Enable Optimum Position	
Supported Cloak Reasons	5 Selected	☐ Enable Popup to control the DUT Power manually	
Cloak Retry Count	3	☐ Enable TPT pop-up for PRx EDS packet	
Supported GET Requests	Charge Status		

FIGURE 2.21: EXECUTE (0,0) POSITION TEST CASES - #2

- Under the “Tester Configuration” section, set the “k_P1 (0,0)” field to **0.87** (this value is considered as per the PRx test tool book). See Figure 2.22 below.

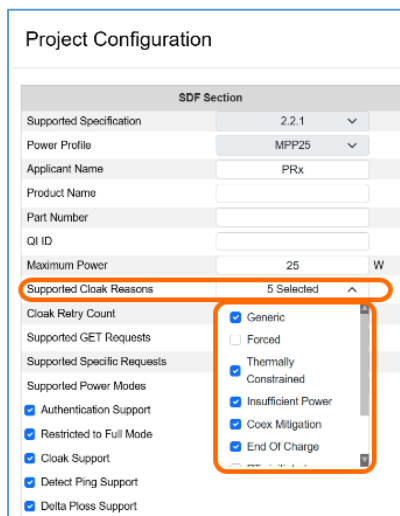
***This field is required to execute the 8.1-MPP.PRX.POW.K-EST test.**

Project Configuration

SDF Section		Tester Configuration	
Supported Specification	2.2.1	Repeat Test Cases	0
Power Profile	MPP25	PTMC Code	0x010E Load Pool Data
Applicant Name	PRx	k_P1 (0,0)	0.87
Product Name		k_P2 (2,2)	0
Part Number		Battery Charge (%)	0
QI ID		PRx Cloak Wait Time	2 min
Maximum Power	25 W		

FIGURE 2.22: EXECUTE (0,0) POSITION TEST CASES - #3

- Under the “SDF Section” section, if the PRx DUT supports cloak and response with specific reason:
 - Select the respective parameter checkboxes in the **Supported Cloak Reasons** field — select the specific reason(s) supported by the PRx DUT as shown in Figure 2.23 below.



Project Configuration

SDF Section

Supported Specification: 2.2.1

Power Profile: MPP25

Applicant Name: PRx

Product Name:

Part Number:

Qi ID:

Maximum Power: 25 W

Supported Cloak Reasons: 5 Selected

- ☒ Generic
- ☐ Forced
- ☒ Thermally Constrained
- ☒ Insufficient Power
- ☒ Coex Mitigation
- ☒ End Of Charge

Cloak Retry Count:

Supported GET Requests:

Supported Specific Requests:

Supported Power Modes:

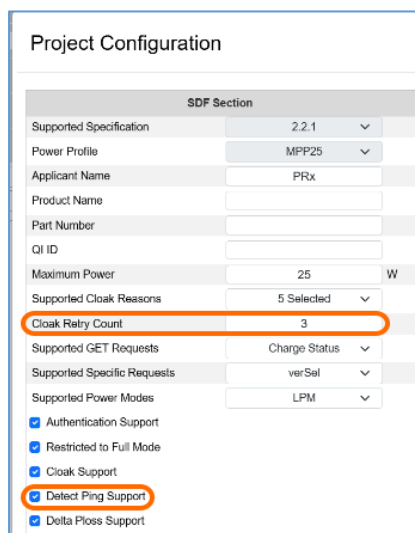
- ☒ Authentication Support
- ☒ Restricted to Full Mode
- ☒ Cloak Support
- ☒ Detect Ping Support
- ☒ Delta Ploss Support

FIGURE 2.23: EXECUTE (0,0) POSITION TEST CASES - #4

***The selection of these fields are mandatory to execute the cloak phase test case (11.4.1_TC1 to TC5 / 11.4.2 / 11.4.3).**

As shown in Figure 2.24 below:

- Select the **Detect Ping Support** checkbox to declare that the PRx DUT will detect the “cloak detect ping” initiated by the PTx.
- In the **Cloak Retry Count** field, declare the number of retry the PRx DUT will initiate if the PTx cloak ping is not observed.



Project Configuration

SDF Section

Supported Specification: 2.2.1

Power Profile: MPP25

Applicant Name: PRx

Product Name:

Part Number:

Qi ID:

Maximum Power: 25 W

Supported Cloak Reasons: 5 Selected

Cloak Retry Count: 3

Supported GET Requests: Charge Status

Supported Specific Requests: verSel

Supported Power Modes: LPM

- ☒ Authentication Support
- ☒ Restricted to Full Mode
- ☒ Cloak Support
- ☒ Detect Ping Support
- ☒ Delta Ploss Support

FIGURE 2.24: EXECUTE (0,0) POSITION TEST CASES - #5

***The selection of the above fields are mandatory to execute the following cloak test cases which involves cloak ping cycles: (11.4.4 / 11.4.5 / 11.4.6 / 11.4.7_TC1 / 11.4.7_TC2 / 11.4.8)**

6. Select the respective parameter checkboxes in the **Supported GET Requests** field based on the PRx DUT capabilities as shown in Figure 2.25 below.

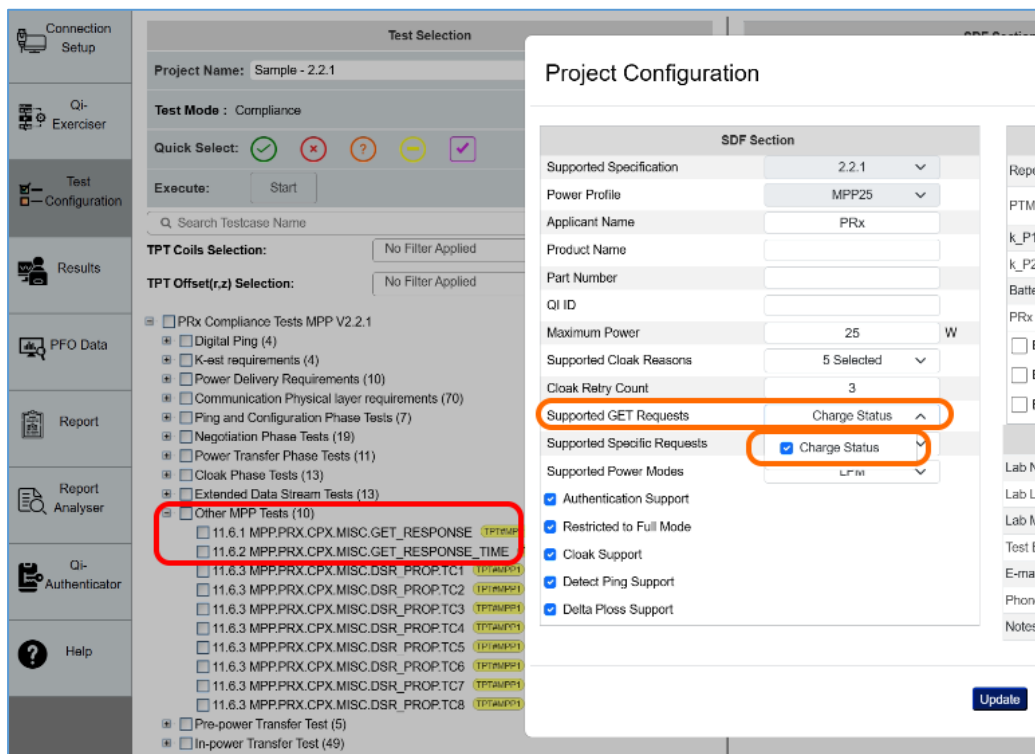


FIGURE 2.25: EXECUTE (0,0) POSITION TEST CASES - #6

These checkboxes are required to be selected in order to execute the following test cases if the PRx DUT supports any of the parameters: (11.6.1 & 11.6.2)

7. Select the **Enable Popup to control the DUT Power manually** checkbox if the PRx DUT load needs to be controlled manually. See Figure 2.26 below.

Tester Configuration		
Repeat Test Cases	0	
PTMC Code	0x010E	Load Pool Data
k_P1 (0,0)	0.87	
k_P2 (2,2)	0.7	
Battery Charge (%)	0	
PRx Cloak Wait Time	2	min
☐ Enable Optimum Position		
☒ Enable Popup to control the DUT Power manually		
☐ Enable TPT pop-up for PRx EDS packet		

FIGURE 2.26: EXECUTE (0,0) POSITION TEST CASES - #7

8. Select the **Authentication Support** checkbox if the PRx DUT supports authentication sequence to execute the EDS (Extended Data Stream) test cases. See Figure 2.27 below.

Project Configuration

SDF Section	
Supported Specification	2.2.1
Power Profile	MPP25
Applicant Name	PRx
Product Name	
Part Number	
QI ID	
Maximum Power	25 W
Supported Cloak Reasons	5 Selected
Cloak Retry Count	3
Supported GET Requests	Charge Status
Supported Specific Requests	verSel
Supported Power Modes	LPM
☒ Authentication Support	
☒ Restricted to Full Mode	

FIGURE 2.27: EXECUTE (0,0) POSITION TEST CASES - #8

9. Select the **TPT Coils** and **TPT Offset(r,z)** - (0,0) position to select and execute the tests by clicking on the **Start** button as indicated in Figure 2.28 below.

Test Selection

Project Name: Sample - 2.2.1

Test Mode: Compliance

Quick Select: ✔ ✖ ? ⚠ ✔ 0/141

Execute: Start

Search Testcase Name

TPT Coils Selection: TPT_MPP1

TPT Offset(r,z) Selection: ☒ TPT_MPP1
☐ TPT_MPP4

☐ PRx Compliance Tests MPP V2.2.1

- ☐ Digital Ping (4)
- ☐ K-est requirements (2)
- ☐ Power Delivery Requirements (10)
- ☐ Communication Physical layer requirements (38)
- ☐ Ping and Configuration Phase Tests (7)
- ☐ Negotiation Phase Tests (9)
- ☐ Power Transfer Phase Tests (9)
- ☐ Cloak Phase Tests (13)
- ☐ Extended Data Stream Tests (13)
- ☐ Other MPP Tests (10)
- ☐ Pre-power Transfer Test (5)
- ☐ In-power Transfer Test (21)

Test Selection

Project Name: Sample - 2.2.1

Test Mode: Compliance

Quick Select: ✔ ✖ ? ⚠ ✔ 0/90

Execute: Start

Search Testcase Name

TPT Coils Selection: TPT_MPP1

TPT Offset(r,z) Selection: ☒ (0,0)
☐ (0,2)
☐ (0,3)
☐ (0,3.5)
☐ (2,0)
☐ (2,2)
☐ (2,3.5)
☐ (3,3)
☐ (4,0)

☐ PRx Compliance Tests MPP V2.2.1

- ☐ Digital Ping (1)
- ☐ K-est requirements (1)
- ☐ Power Delivery Requirements (5)
- ☐ Communication Physical layer requirements (2)
- ☐ Ping and Configuration Phase Tests (2)
- ☐ Negotiation Phase Tests (9)
- ☐ Power Transfer Phase Tests (9)
- ☐ Cloak Phase Tests (13)
- ☐ Extended Data Stream Tests (13)
- ☐ Other MPP Tests (10)
- ☐ Pre-power Transfer Test (1)
- ☐ In-power Transfer Test (8)

FIGURE 2.28: EXECUTE (0,0) POSITION TEST CASES - #9

10. Once the test execution is started then the progress can be viewed in the “Results” tab as shown in Figure 2.29 below.

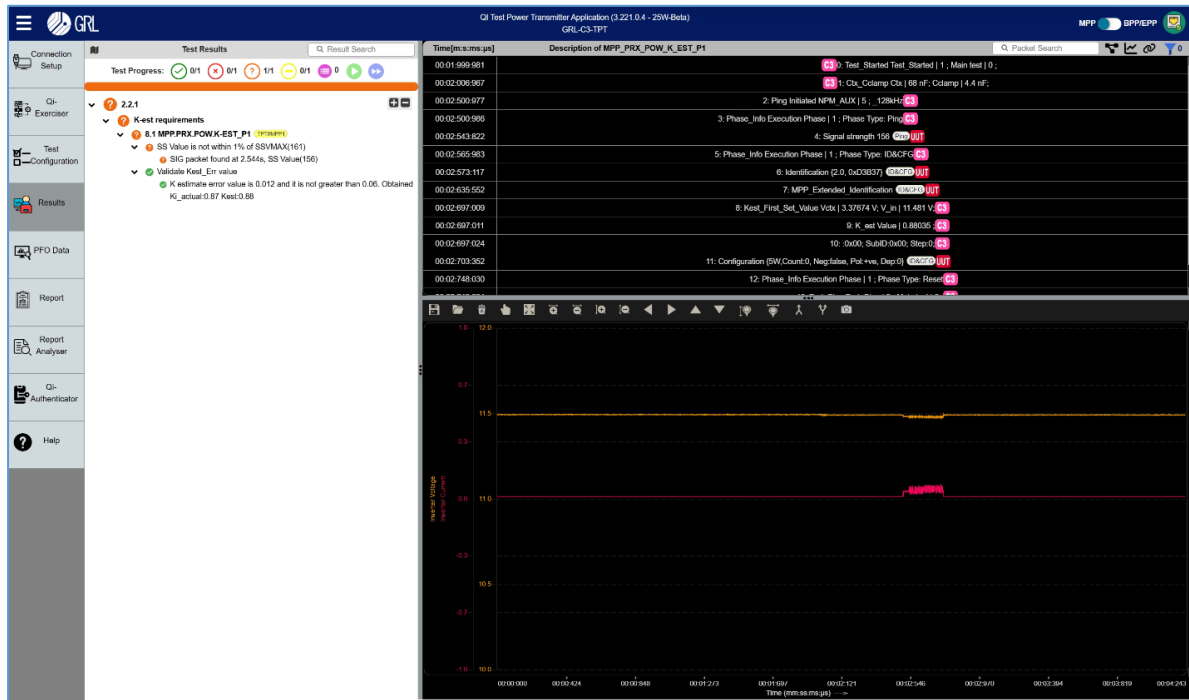


FIGURE 2.29: EXECUTE (0,0) POSITION TEST CASES - #10

11. The test reports will be updated in the “Report” tab (as shown in Figure 2.30 below) and can be downloaded offline.

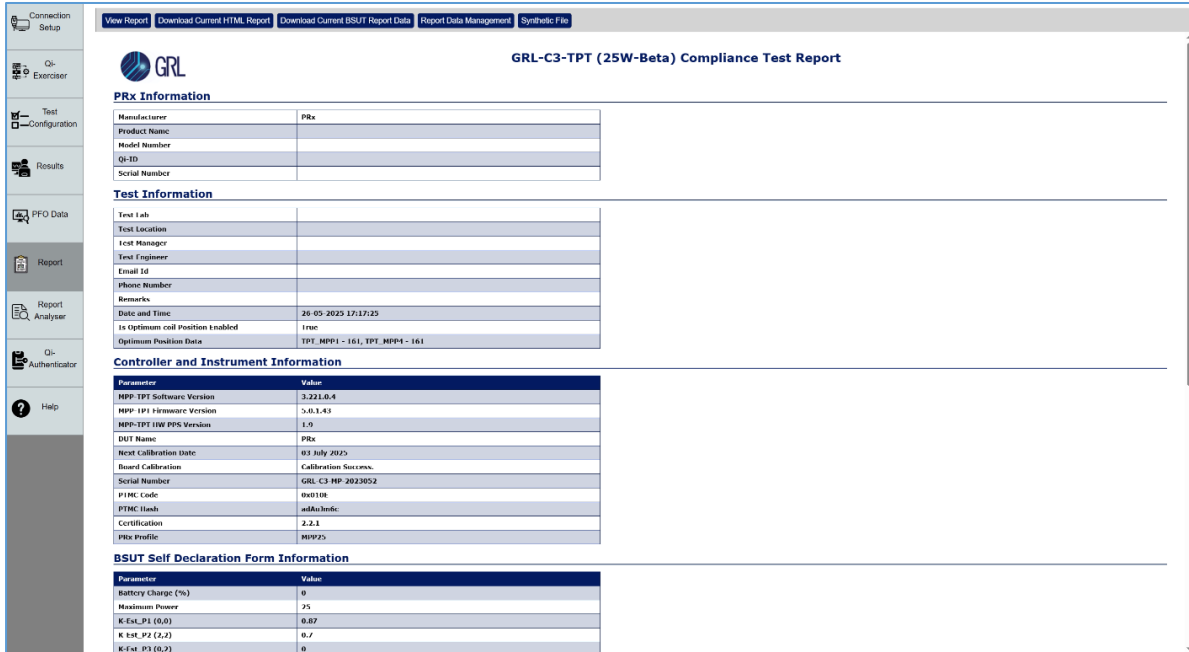


FIGURE 2.30: TEST REPORT FOR (0,0) POSITION TEST CASES

The test reports will be automatically saved in the following location — “C:\GRL\GRL-C3-TPT\Report” as HTML & JSON files.

2.2.4 Procedure to Execute Other Position Compliance Tests

1. Align the X-axis or Y-axis values from zero to the respective offset value using the respective knobs. For example, for the (4,3) position, move the X-axis or Y-axis from 0 to 4 mm.
2. Follow the same procedure from Section 2.2.3 to execute the tests based on the PRx DUT capabilities.

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