Application Report
SLVA892A–May 2017–Revised September 2019

USB Power Delivery - Compliance Tests

ABSTRACT

The *USB Power-Delivery Certification* process requires all USB Power Delivery (PD) end-products using TI's TPS659xx PD Controllers to comply with the deterministic and communication-engine MOI of the USB-IF, in addition to various other load and signaling tests. This application report explains the setup of four extensively used USB-PD testers, and configuration of the PD *Vendor Information File (VIF)* as per the PD features or capabilities of the product.

Contents

List of Figures

List of Tables

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1 Introduction

The TPS65988 device is a standalone, USB Type-C™, power-delivery controller that provides cable-plug and orientation detection at the USB Type-C connector. Upon cable detection, the TPS65988 device communicates on the CC wire using the USB-PD protocol. After successfully completing USB-PD negotiation, the TPS65988 enables the appropriate power paths, and configures alternate mode settings for internal and external (optional) multiplexers.

The device must comply with the PD specifications and test plans of the USB-IF and the various USB-PD testers or examiners that test the compliance of the device. This document describes the setup of four extensively used USB-PD testers and the execution of their various compliance test suites with the TPS65988EVM.

2 Compliance Test Program Overview

The USB-IF Compliance Program uses multiple test specifications to qualify each product. This application note covers three test specifications, due to their wide applicability to products based on the TPS65988. These are: the USB Type-C Functional Test Specification, the USB PD 3.0 Compliance Plan, and the USB PD 2.0 Compliance Plan. Each document contains a series of test plans designed to verify a portion of the corresponding standard specification. These specifications can be obtained from the Document Library at www.usb.org.

Note that in each USB PD Compliance Test Specification there are a series of tests designed to verify consistency between the VIF and product-reported results. Mismatches between VIF and the product are a common source of Compliance failures. These failures do not indicate an issue with device behavior. Rather, they require a reexamination of VIF settings against the Application Configuration Tool project settings to ensure the desired configuration is set and reflected in the VIF. In the following example, there are two mismatches between the VIF and UUT.

TD.PD.VNDI.E5 Source Capabilities - Testing Downstream Port

PASSED	Checking Rp	Source must advertise Rp for 3A @ 5V (actual CC voltage is 1.69 V)
FAILED	Checking Source PDOs	Number of Source PDOs declared as 1, actual is 4
PASSED	Checking Source PDO 1	Supply Type declared as Fixed
PASSED	Checking Source PDO 1	Data Role Swap bit must be 1
FAILED	Checking Source PDO 1	USB Communication Capable declared as No, actual is Yes
PASSED	Checking Source PDO 1	Unconstrained Power declared as Yes
PASSED	Checking Source PDO 1	Dual Power Role bit must be 1
PASSED	Checking Source PDO 1	Voltage declared as 5 V
PASSED	Checking Source PDO 1	Peak Current declared as 100% IOC
PASSED	Checking Source PDO 1	Max Current declared as 3 A
PASSED	Sending DR_Swap	PUT must respond with Accept or Wait
PASSED	Sending PR_Swap	PUT must respond with Accept or Wait

Figure 1. Ellisys Consistency Check Failure Example

2.1 Vendor Information File Generation

The*Vendor Information File* (VIF) defines the capabilities of the UUT, and is a medium for the all test solutions to detect the UUT and the associated properties. The testers use this information to assign certain tests and interpret the results. For example, if the UUT is configured to *not* accept any *DR Swap to DFP* requests, the tester fails the corresponding test cases if the UUT accepts such a request. Also, the tester selectively includes or excludes the tests depending on the capabilities of the UUT.

There are two methods to generating the VIF: Automatic and User Defined VIF Generation

2.2 Automatic VIF Generation

Certain versions of the TPS6598x Configuration Tool support Automatic VIF Generation. This feature enables the tool to create a VIF based on current project settings. During Automatic VIF Generation, project settings are extracted and converted into corresponding lines in the VIF. The result is a complete VIF ready for use in a compliance test. Access Automatic VIF Generation from the Application Configuration Tool menu Binary and select menu item Save Binary. If the current tool supports Automatic VIF Generation, then there is an option to Save a VIF of the Current Project.

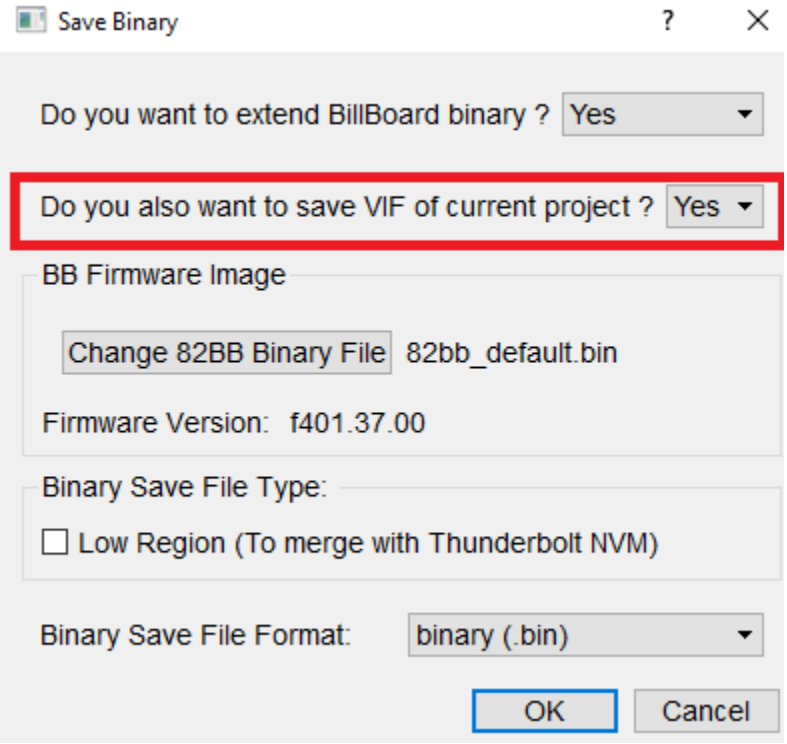

Figure 2. VIF Generation Dialog

2.3 User Defined VIF Generation

User Defined VIF Generation is the process of creating a VIF based on settings selected in the TPS6598x Configuration Tool. The USB-IF supports this process with the USB VIF Generator tool.

To start this process, launch the *USB VIF Generator* tool to create a VIF for the tests. The format of the VIF and information about the various fields are detailed in the VIF user guide (VIF-UG), which is part of the installer. The following sections briefly explains these fields, and relates them to configurations and features of the TPS65988. Transfer the TPS65988 application configuration project settings to the VIF as described.

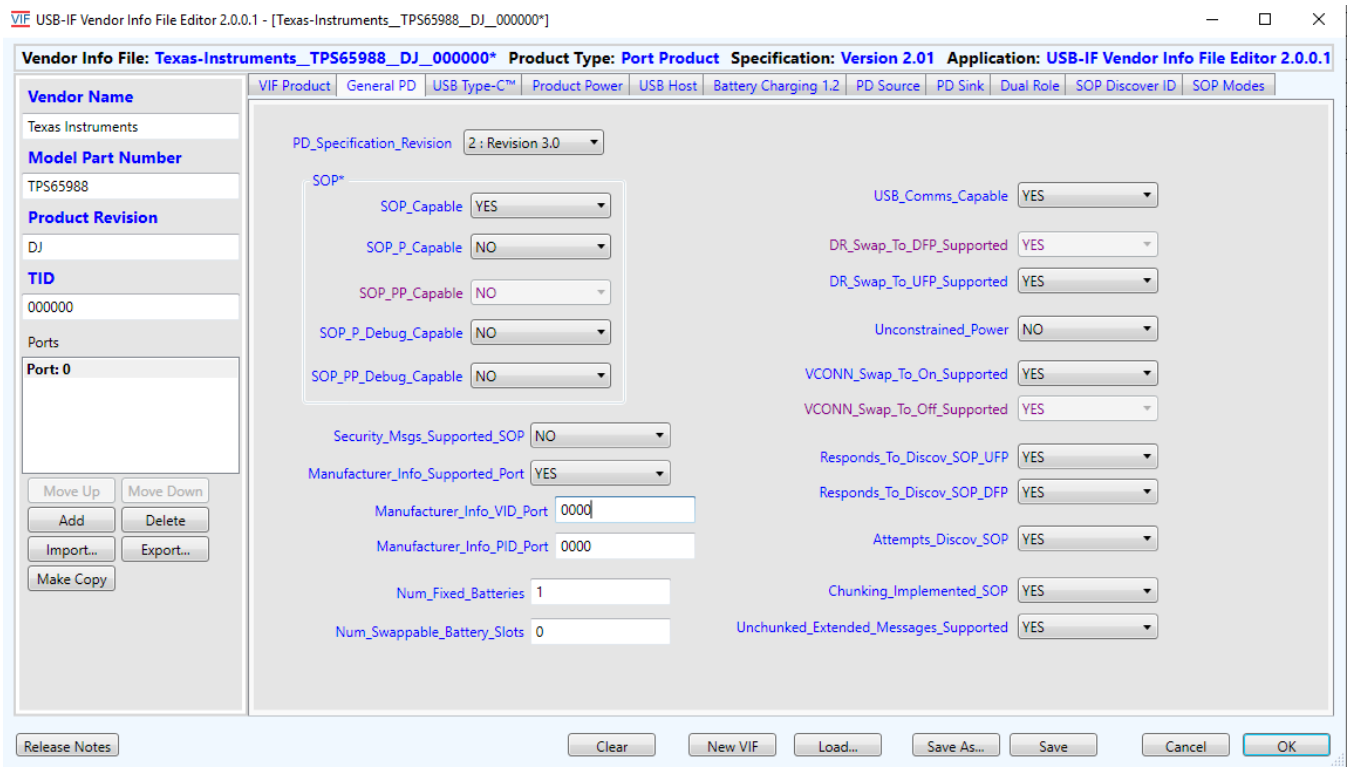

Figure 3. USB VIF Generator

3 Getting Started - Ellisys®

This section lists the instructions for setting up the Ellisys Explorer 350® tester, the *unit under test* (UUT), and the host and control system for executing the compliance tests using the Ellisys compliance test solution. Instructions to configure the UUT using the TPS598x Configuration Tool and USB VIF Tool are common for all compliance test solutions.

3.1 Prerequisites

- Ellisys USB Explorer 350 protocol test and analysis system
- USB VIF Generator
- TPS65988 EVM
- Aardvark I2C/SPI™ adapter, or Micro USB Cable
- PC running Microsoft Windows® 7 or greater

3.2 Installation

Download and install the following drivers and tools (if not yet installed on the Windows PC):

- Ellisys USB Explorer 350 Examiner
- Ellisys USB Explorer 350 Analyzer
  - The Analyzer software is optional, and only required for the collection of PD logs.
- TPS6598x Configuration Tool

NOTE: This guide assumes that all TI tools are installed at location *C:\Program Files\Texas Instruments*.

3.3 Test Setup

3.3.1 Preparing the UUT for the Tests

If the customized application binaries are already programmed on the TPS6598x EVM or customer platform, proceed to Section 3.3.2.

Launch the latest version of the *TPS6598x Configuration* tool and generate a test binary to be programmed on the UUT. See *TPS6598x Application-Customization Tool User Guide* for detailed instructions on generating the binaries and programming the same on the UUT.

3.3.2 VIF Item Entry

Intro Fields

- *UUT_Device_Type*: This field defines the type of UUT, and a suitable (or valid) option must be set for the same depending on the configuration of the device. For example, if the *Port Configuration* field of the *Port Configuration* register is set as Figure 4, the field in VIF must be set to *4 : DRP*.

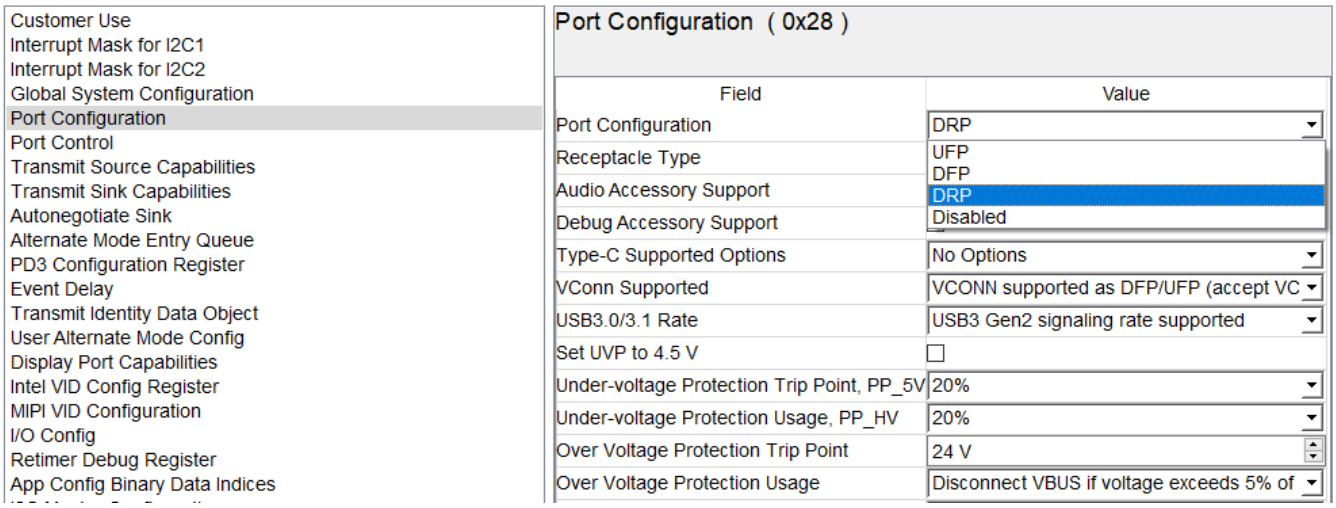

Figure 4. Port Configuration - Port Configuration (0x28) Register

- Other fields in this tab define the vendor and product name or ID of the UUT. Refer to the VIF-UG for details, and fill these fields appropriately.

General PD Fields

- *PD_Specification_Revision*: This field defines the version of the PD specification supported by the UUT. For example, TPS65988 is PDd-compliant, so this field must be set to *2 Revision 3.0*.
- USB_Comms_Capable: This field is used by the tester to determine if the UUT is capable of USB communication. The field must be set to either *YES* or *NO* depending on the setting of *USB Communication Capable* bit of *Autonegotiate Sink* register.
  If this field is configured as *YES*, then one of the companion fields, *Type_C_Can_Act_As_Device* or *Type_C_Can_Act_As_Host*, in the *USB Type-C* tab of the *VIF Generator* tool is set to *YES*.

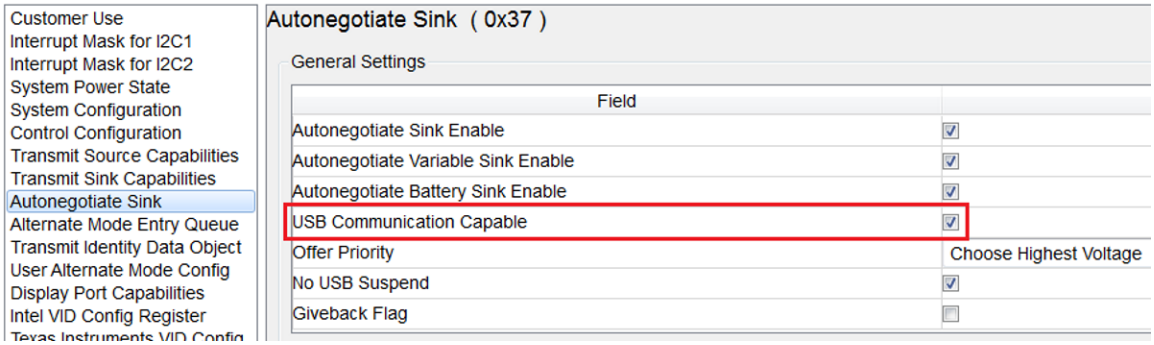

Figure 5. USB Communication Capability - Autonegotiate Sink (0x37) Register

- *DR_Swap_To_DFP_Supported* and *DR_Swap_To_UFP_Supported*: These fields define the data-role swap capability of the UUT, and must be set in accordance with the properties of the device defined in the *Port Control Configuration* register in Figure 6.

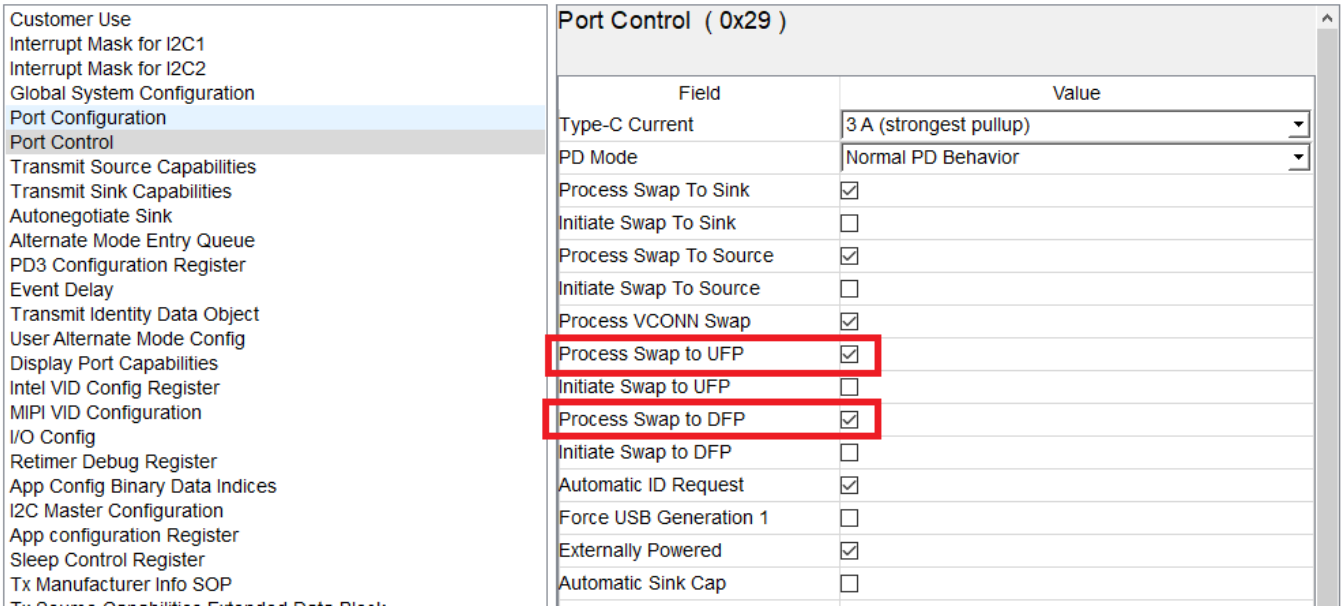

Figure 6. Data Role Swap Capability - Port Control (0x29) Register

- *Unconstrained_Power*: This field indicates to the tester that the UUT is powered by a source other than the VBus. It must be set to either YES or NO depending on the properties of the device. As shown in Figure 7, this is defined in the *Port Control* register, where it is called Externally Powered.

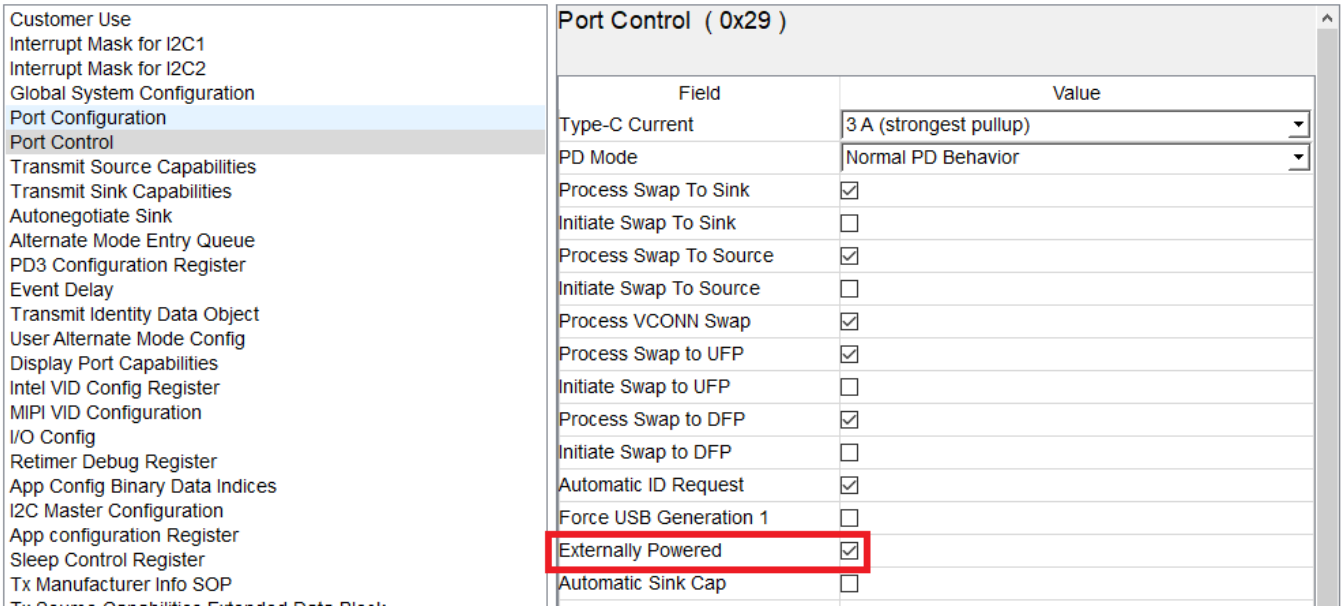

Figure 7. Externally Powered - Port Control (0x29) Register

- *VCONN_Swap_To_On_Supported* and *VCONN_Swap_To_Off_Supported*: These fields define the VCONN swap capability of the device. Both must be set to either *YES*' or *NO* depending on the setting of the device, as defined in the *Port Control* register in Figure 8.

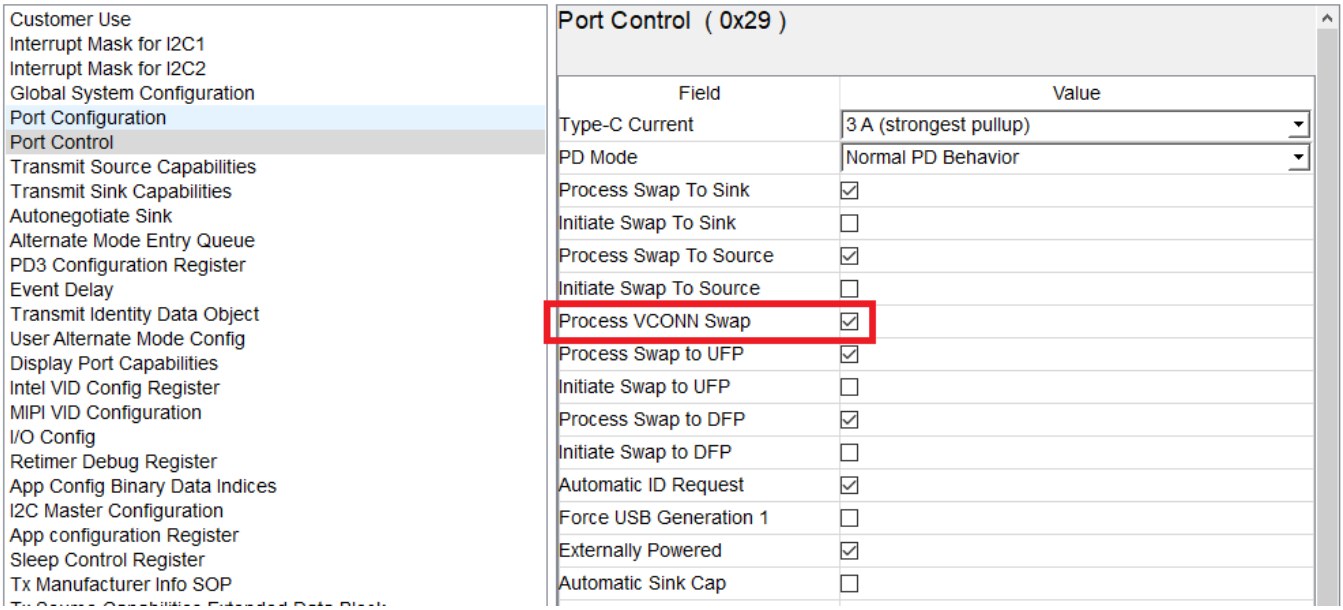

Figure 8. VCONN Swap Capability - Port Control (0x29) Register

- *Responds_To_Discov_SOP* and *Attempts_Discov_SOP*: These fields define the ability of the device to respond or initiate a *Discover Identity* message respectively. As shown in Figure 9, *Responds_To_Discov_SOP* must be set to *YES* if the *Transmit Identity Object* register is set to a non-zero value. *Attempts_Discov_SOP* must be set to *YES* if the device supports any *Alternate Modes*, or *NO* otherwise.

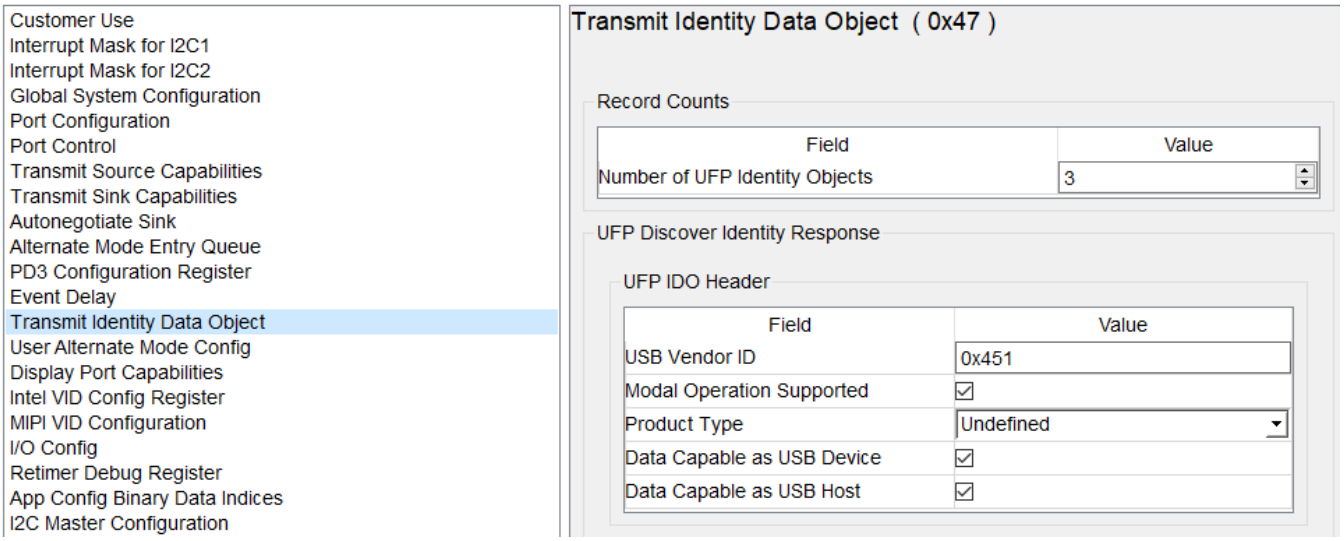

Figure 9. Transmit Identity Data Object (0x47) Register

- *SOP**: This section defines the capabilities of the device to handle the SOP* protocol, and must be set in accordance to the properties of the device. For the TPS6598x, *SOP_Capable* must be set to *YES*.

Source Fields

- *PD_Power_as_Source*: This field defines the maximum PDP level in mW supported by the source-capable device, and must be set per the settings in the *Transmit Source Capabilities* register. For example, as shown in Figure 10 this field is set to (3 A × 12 V) = 36000 mW if the device has two source PDOs.

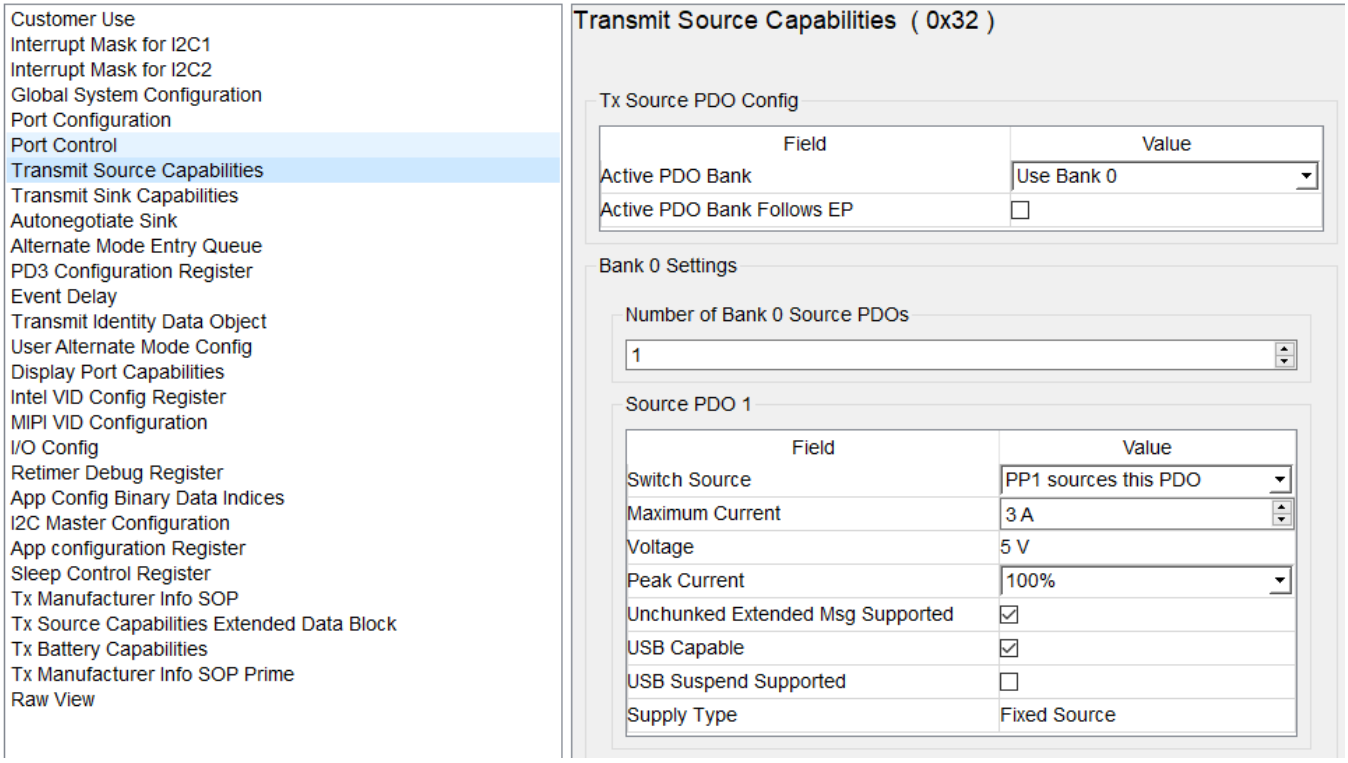

Figure 10. PD Power - Transmit Source Capabilities (0x32) Register

- *USB_Suspend_May_Be_Cleared*: This field indicates to the connected sink whether it must obey *USB Suspend*. It must be set depending on the settings in Figure 11 in the *Transmit Source Capabilities* register. If the UUT (as a source) has *USB Suspend Supported* set to 0, then the VIF must set this field to *YES*, or *NO* otherwise.

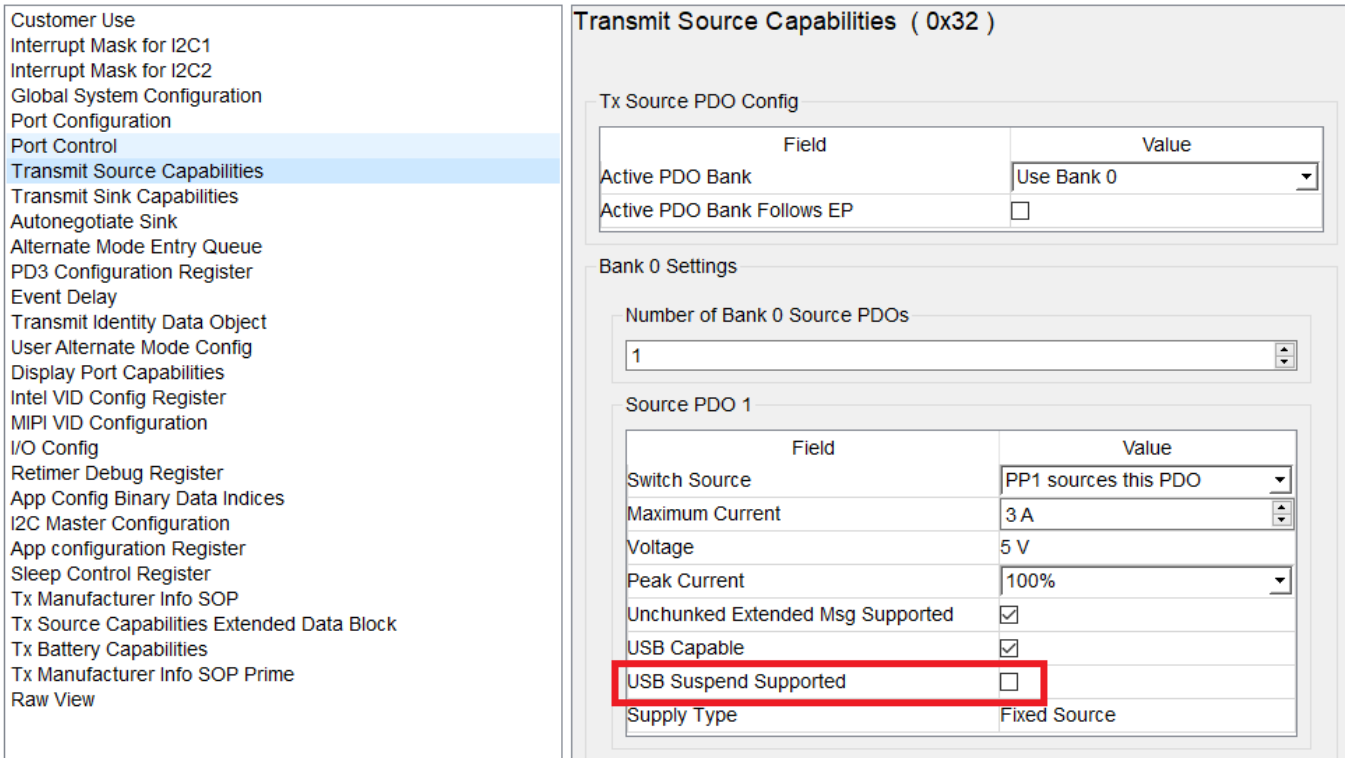

Figure 11. USB Suspend Support - Transmit Source Capabilities (0x32) Register

- *Num_Src_PDOs*: This field defines the number of source PDOs supported by the UUT. It must be set in accordance to the device properties defined in the *Transmit Source Capabilities* register in Figure 12.

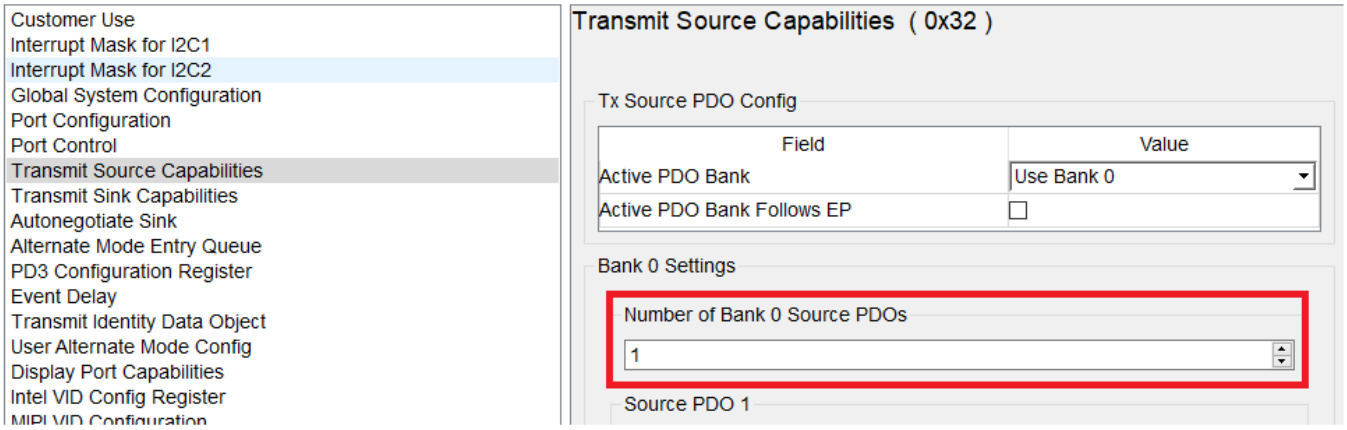

Figure 12. Total Source PDOs - Transmit Source Capabilities (0x32) Register

- Source PDOs: The following fields represent the parameters for a single Source PDO where <X> is an integer between 1 and 7:
  - *Src_PDO_Supply_Type <X>*: This field defines the type of the source PDO, and, depending on the settings in Figure 13 in the *Transmit Source Capabilities* register, must be set to either *1 : Fixed*, *2 : Battery*, or *3 : Variable*.

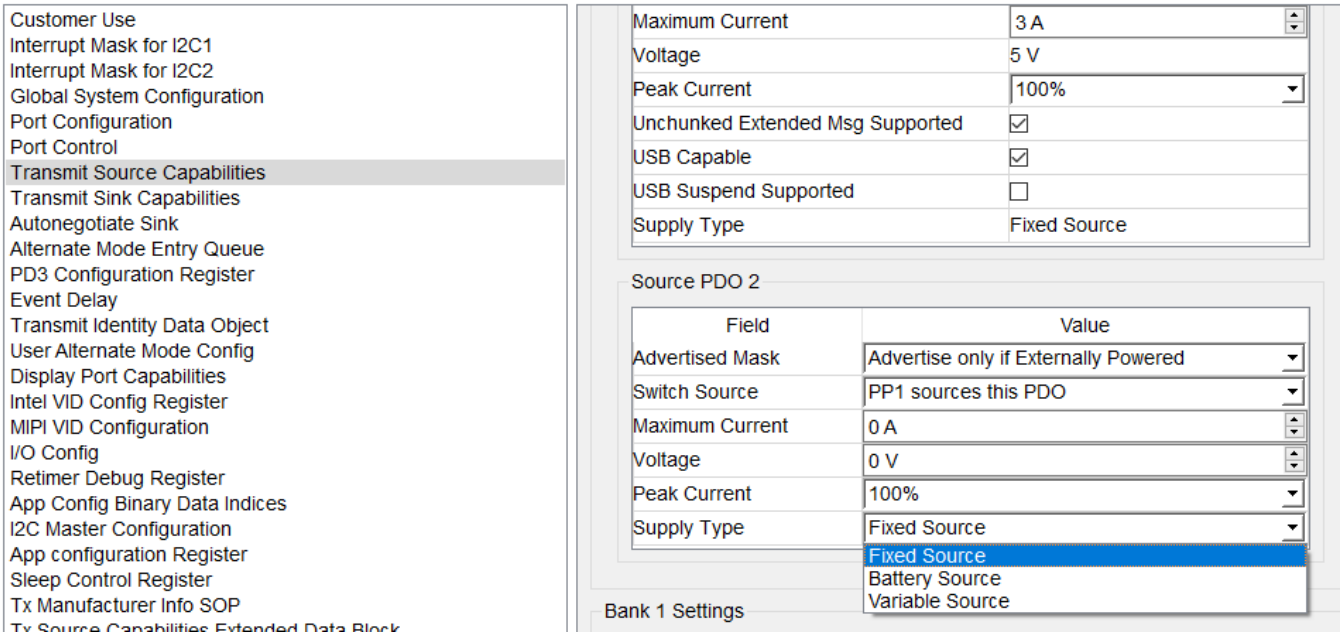

Figure 13. Supply Type - Transmit Source Capabilities (0x32) Register

– *Src_PDO_Peak_Current <X>*: This field defines the peak currents supported by the UUT for short periods, and is indicated as a percent of the operating current. Depending on the settings in Figure 14 in the *Transmit Source Capabilities* register, it must be set to one of the available options

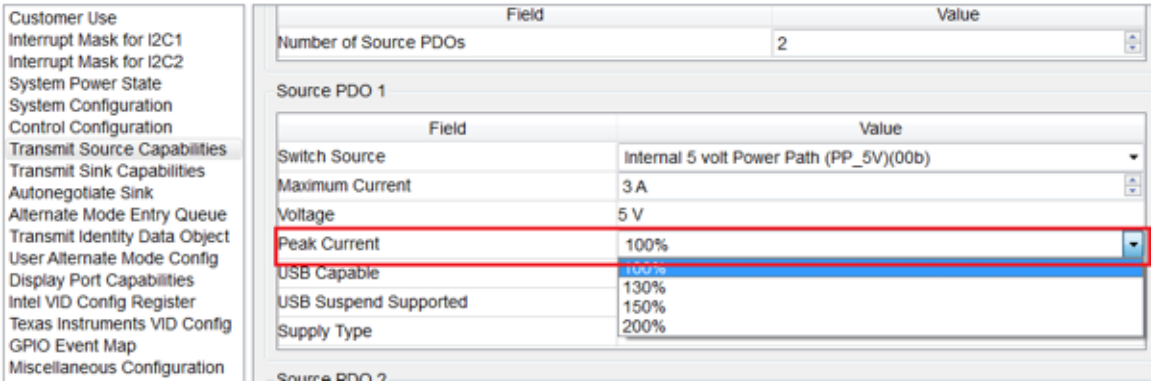

Figure 14. Peak Current - Transmit Source Capabilities (0x32) Register

– *Src_PDO_Voltage <X>*: This field defines the output voltage of a source PDO in the units of 50 mV, and must be set per the Figure 15 configuration in the *Transmit Source Capabilities* register. For example, for the Figure 15 settings of PDO-1, this field must be set to 5000 mV / 50 mV = 100. The *VIF Generator* tool takes care of this conversion when generating the vendor information file.

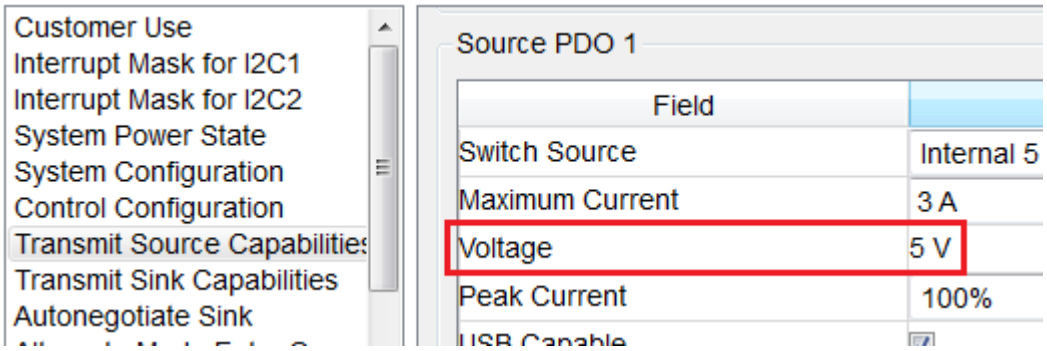

Figure 15. PDO Voltage - Transmit Source Capabilities (0x32) Register

– *Src_PDO_Max_Current*: This field defines the maximum operating current of a source PDO in units of 10 mA, and must be set per the Figure 16 configuration in the *Transmit Source Capabilities* register. For example, for the Figure 16 settings of PDO-1, this field must be set to 3000 mA / 10 mA = 300. The *VIF Generator* tool takes care of this conversion when generating the vendor information file.

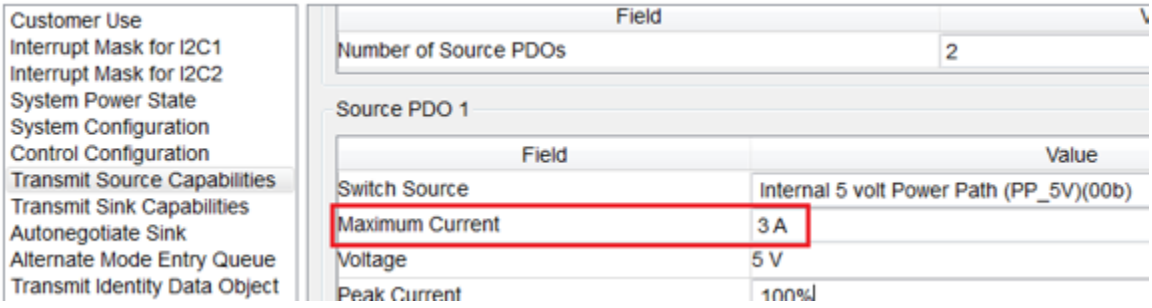

Figure 16. Maximum PDO Current - Transmit Source Capabilities (0x32) Register

– *Src_PDO_Min_Voltage <X>* and *Src_PDO_Max_Voltage <X>*: These fields define the minimum and maximum output voltage of a source PDO in units of 50 mV, and must be set per the Figure 17 configuration in the *Transmit Source Capabilities* register. For example, for the 5V and 12V settings of PDO-2, these fields must be set to (5000 mV / 50 mV) = 100 and (12000 mV / 50 mV) = 240, respectively. The *VIF Generator* tool takes care of this conversion when generating the vendor information file.

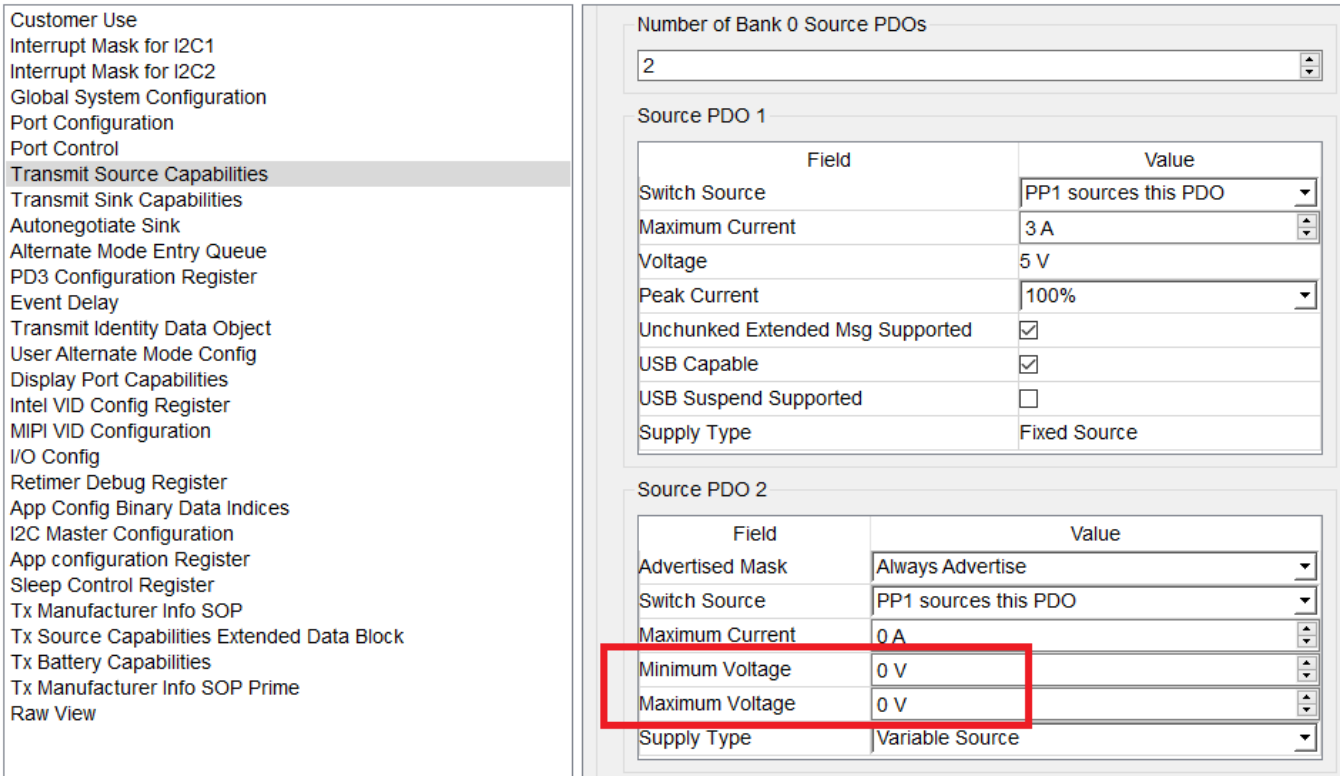

Figure 17. Minimum and Maximum Voltage - Transmit Source Capabilities (0x32) Register

– *Src_PDO_Max_Power <X>*: This field defines the maximum operating power of a source PDO in units of 250 mW. It must be set based on the Figure 18 configuration in the *Transmit Source Capabilities* register. For example, for 15V and 5A settings of PDO-2, this field must be set to 75000 mW / 250 mW = 300. The *VIF Generator* tool takes care of this conversion when generating the vendor information file.

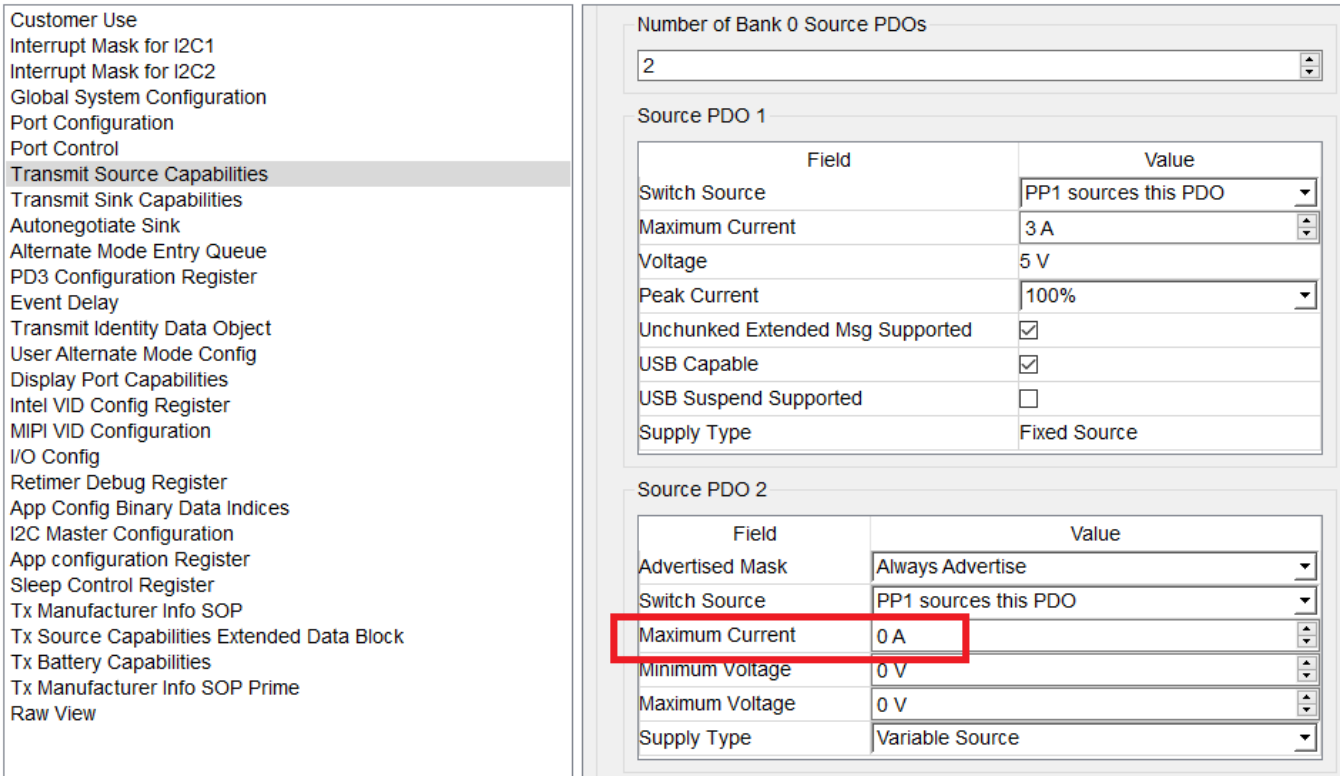

Figure 18. Maximum PDO Current - Transmit Source Capabilities (0x32) Register

Sink Fields

- *PD_Power_as_Sink*: This field defines the maximum PDP level in mW supported by the sink-capable device. It must be set per the Figure 19 settings in the *Transmit Sink Capabilities* register. For example, if the device has two sink PDOs, as shown in Figure 19, this field must be set to (3 A × 5 V) = 15000 mW.

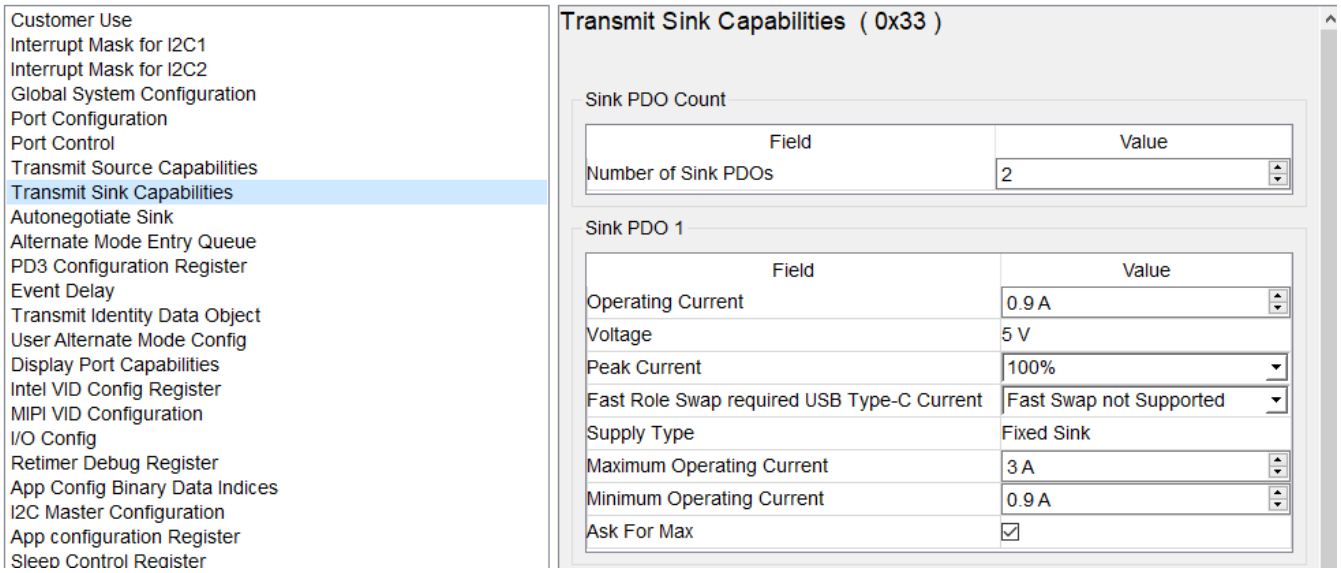

Figure 19. PD Power - Transmit Sink Capabilities (0x33) Register

- *No_USB_Suspend_May_Be_Set*: This field indicates the intent of the sink device to not obey *USB Suspend*. It must be set depending on the Figure 20 settings in the *Autonegotiate Sink* register. If the UUT (as a sink) has *No USB Suspend* set to 1, then the VIF must set this field to *YES*, or *NO* otherwise.

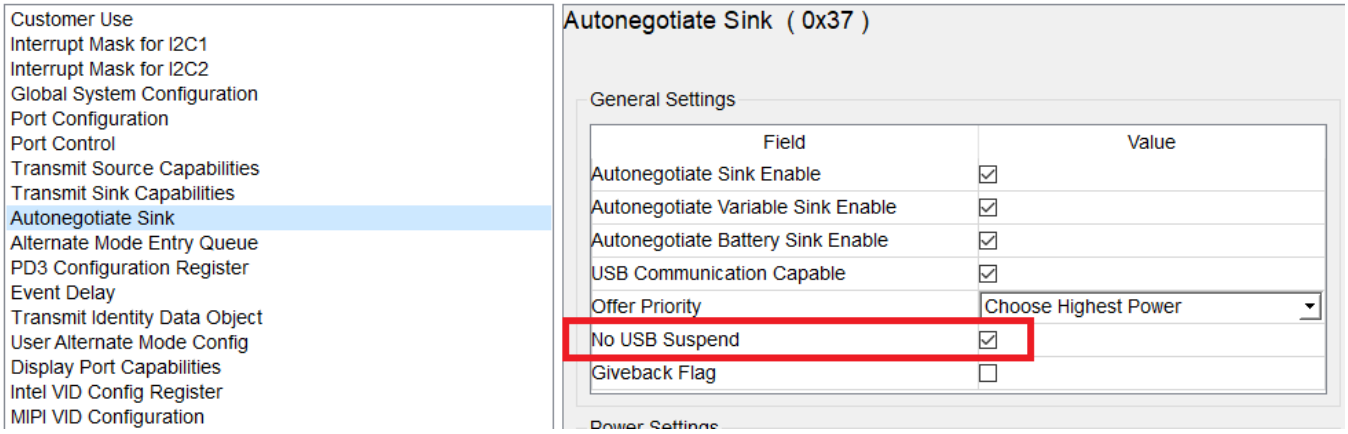

Figure 20. No USB Suspend - Autonegotiate Sink (0x37) Register

- *GiveBack_May_Be_Set*: This field indicates if a sink is prepared to lower the operating current to the minimum-supported operating current, on demand. It must be set depending on the Figure 21 settings in the *Autonegotiate Sink* register. If the UUT (as a sink) has *Giveback Flag* set to 1, then the VIF must set this field to *YES*, or *NO* otherwise.

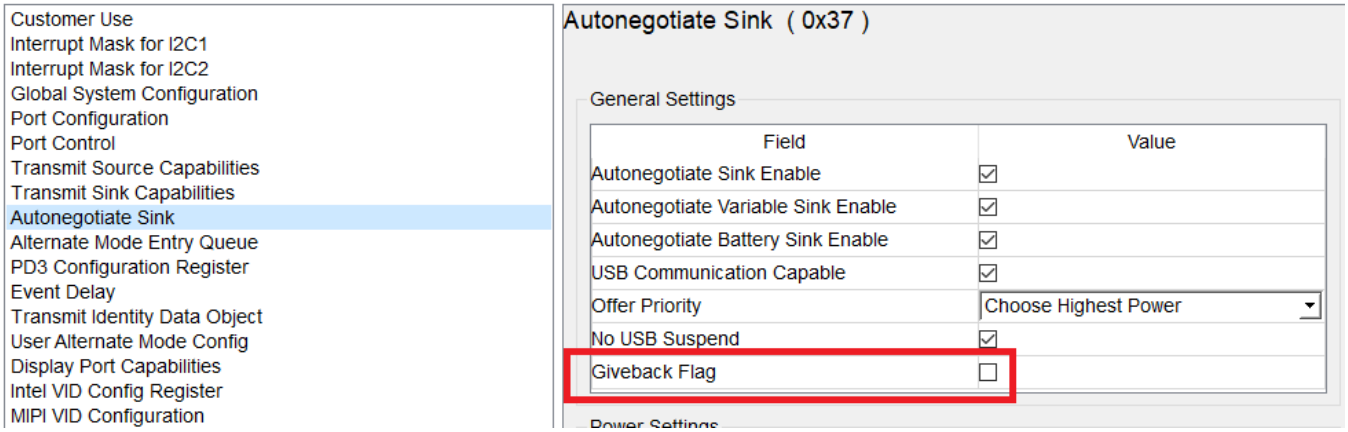

Figure 21. Giveback Flag - Autonegotiate Sink (0x37) Register

- *Higher_Capability_Set*: This field indicates that the sink requires more than vSafe5V to provide full functionality, and must be set to *YES* if the UUT has more than one sink PDO.

- *Num_Snk_PDOs*: This field defines the number of sink PDOs supported by the UUT. It must be set in accordance to the device properties defined in the *Transmit Sink Capabilities* register in Figure 22.

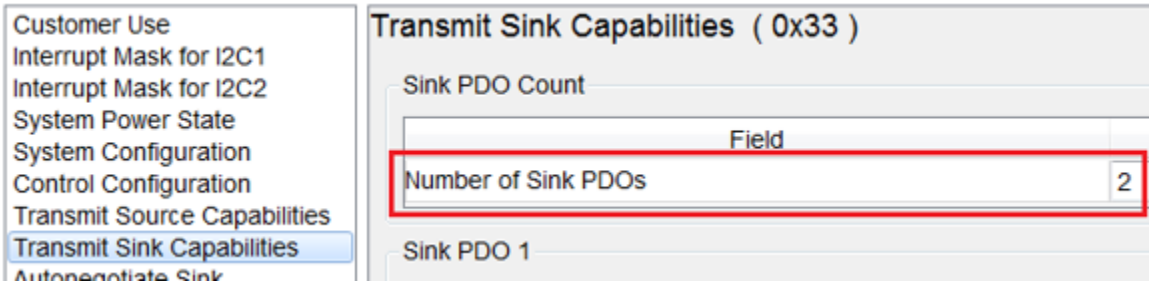

Figure 22. Total Sink PDOs - Transmit Sink Capabilities (0x33) Register

- Sink PDO: The below fields represent the parameters for a single-sink PDO where <X> is an integer between 1 and 7:
  - *Snk_PDO_Supply_Type <X>*: The field defines the sink-PDO type, and must be set to either *1 : Fixed*, *2 : Battery*, or *3 : Variable*. This depends on the Figure 23 settings in *Transmit Sink Capabilities* register.

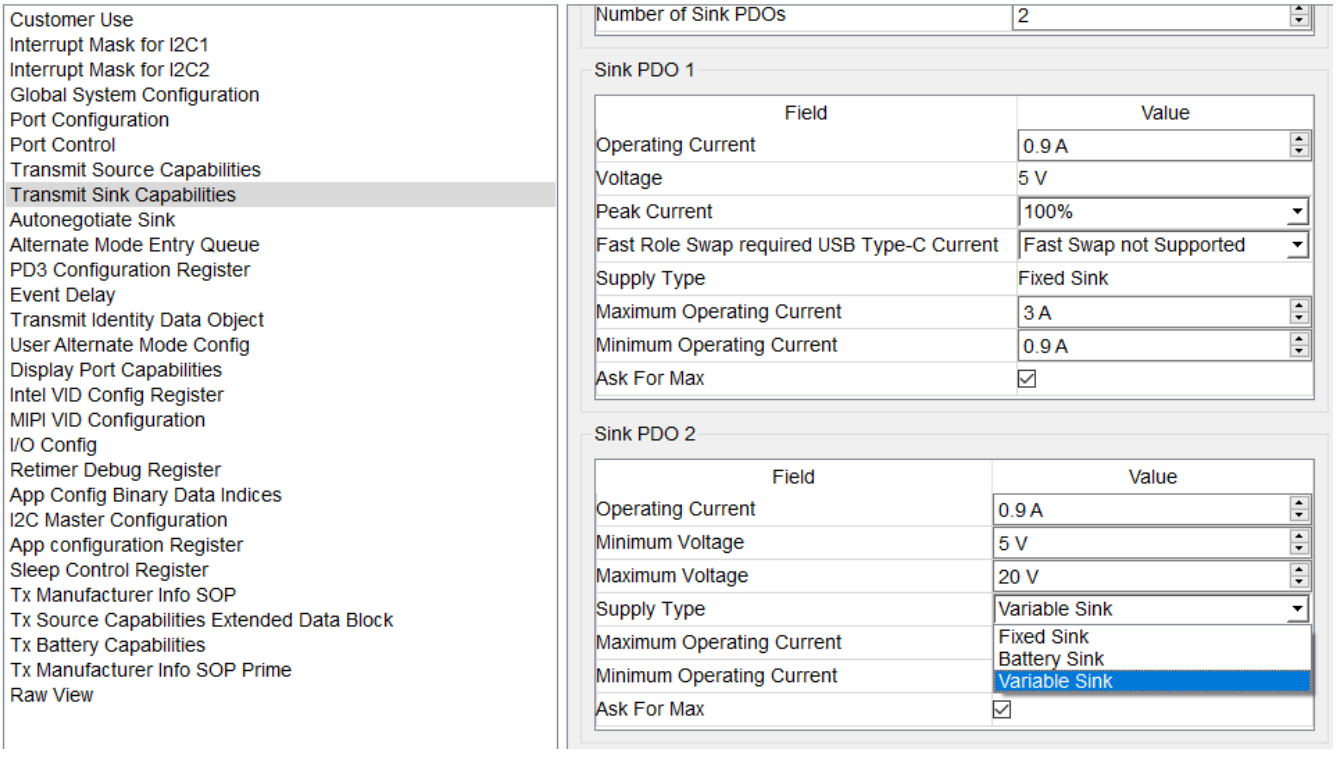

Figure 23. Supply Type - Transmit Sink Capabilities (0x33) Register

– *Snk_PDO_Voltage* <*X*>: This field defines the output voltage of a sink PDO in the units of 50 mV, and must be set per the Figure 24 configuration in the *Transmit Sink Capabilities* register. For example, for theFigure 24 settings of PDO-1, this field must be set to 5000 mV / 50 mV = 100. The *VIF Generator* tool takes care of this conversion when generating the vendor information file.
– *Snk_PDO_Op_Current* <*X*>: This field defines the operating current of a sink PDO in units of 10 mA, and must be set per the Figure 24 configuration in *Transmit Sink Capabilities* register. For example, for the Figure 24 settings of PDO-1, this field must be set to 900 mA / 10 mA = 90. The *VIF Generator* tool takes care of this conversion when generating the vendor information file.

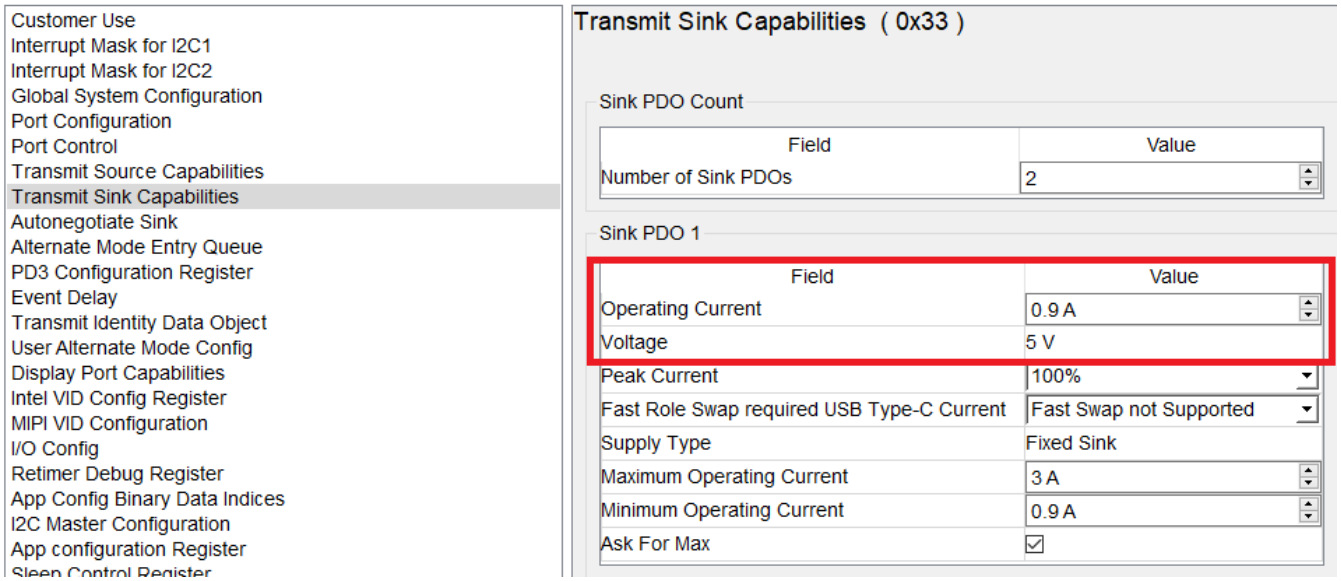

Figure 24. Operating Current and Voltage - Transmit Sink Capabilities (0x33) Register

– *Snk_PDO_Min_Voltage* <*X*> and *Snk_PDO_Max_Voltage* <*X*>: These fields define the minimum and maximum voltage of a sink PDO in units of 50 mV. They must be set per the Figure 25 configuration in the *Transmit Sink Capabilities* register. For example, for the Figure 25 settings of PDO-2, these fields must be set to (12000 mV / 50 mV) = 240 and (20000 mV / 50 mV) = 400, respectively. The *VIF Generator* tool takes care of this conversion when generating the vendor information file.

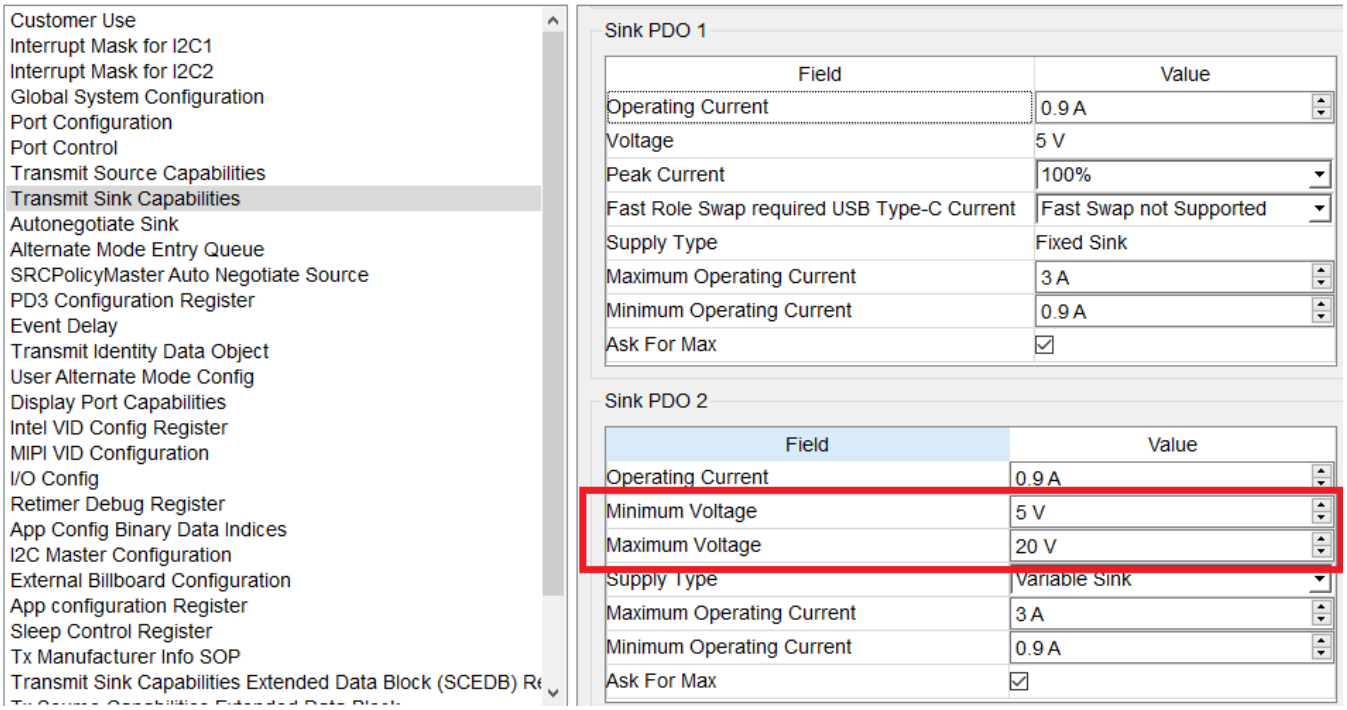

Figure 25. Minimum and Maximum Voltage - Transmit Sink Capabilities (0x33) Register

Dual Role Fields

- *Accepts_PR_Swap_As_Src* and *Accepts_PR_Swap_As_Snk*: These fields define the power-role swap capability of the device, and must be set in accordance to the device properties defined in the *Port Control* register in Figure 26.

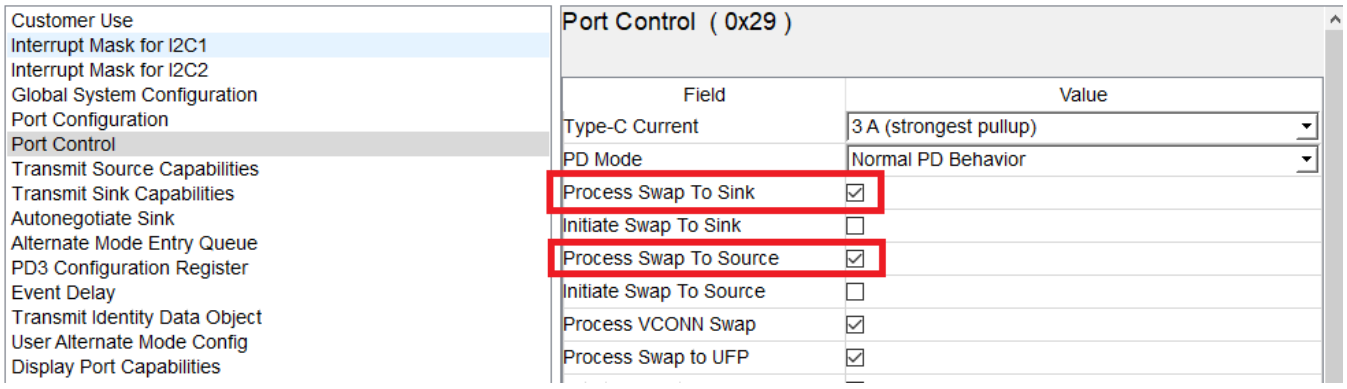

Figure 26. Power Swap Capabilities - Port Control (0x29) Register

- *Requests_PR_Swap_As_Src* and *Requests_PR_Swap_As_Snk*: These fields define the ability of the device to request for power-role swaps. They must be set in accordance to the device properties as defined in the *Control Configuration* register in Figure 27.

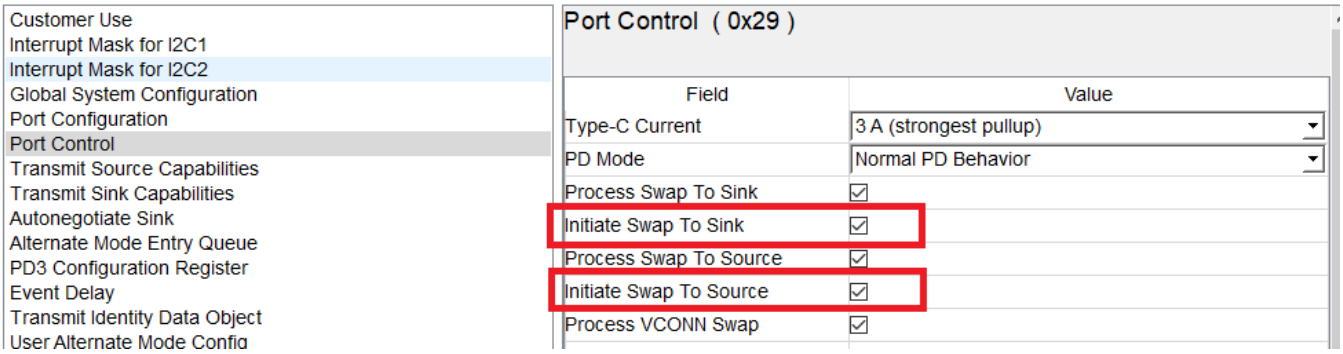

Figure 27. Power Swap Capabilities - Control Configuration (0x29) Register

SOP Discovery Fields

- The fields in the *Part One* tab define the identity of the UUT, and must be set in accordance with the Figure 28 configuration defined in the *Transmit Identity Data Object* register.
  Data_Capable_as_USB_Host_SOP and *Data_Capable_as_USB_Device_SOP*: These fields are automatically set by the tool, and depend on the corresponding settings in *USB Type-C* fields.

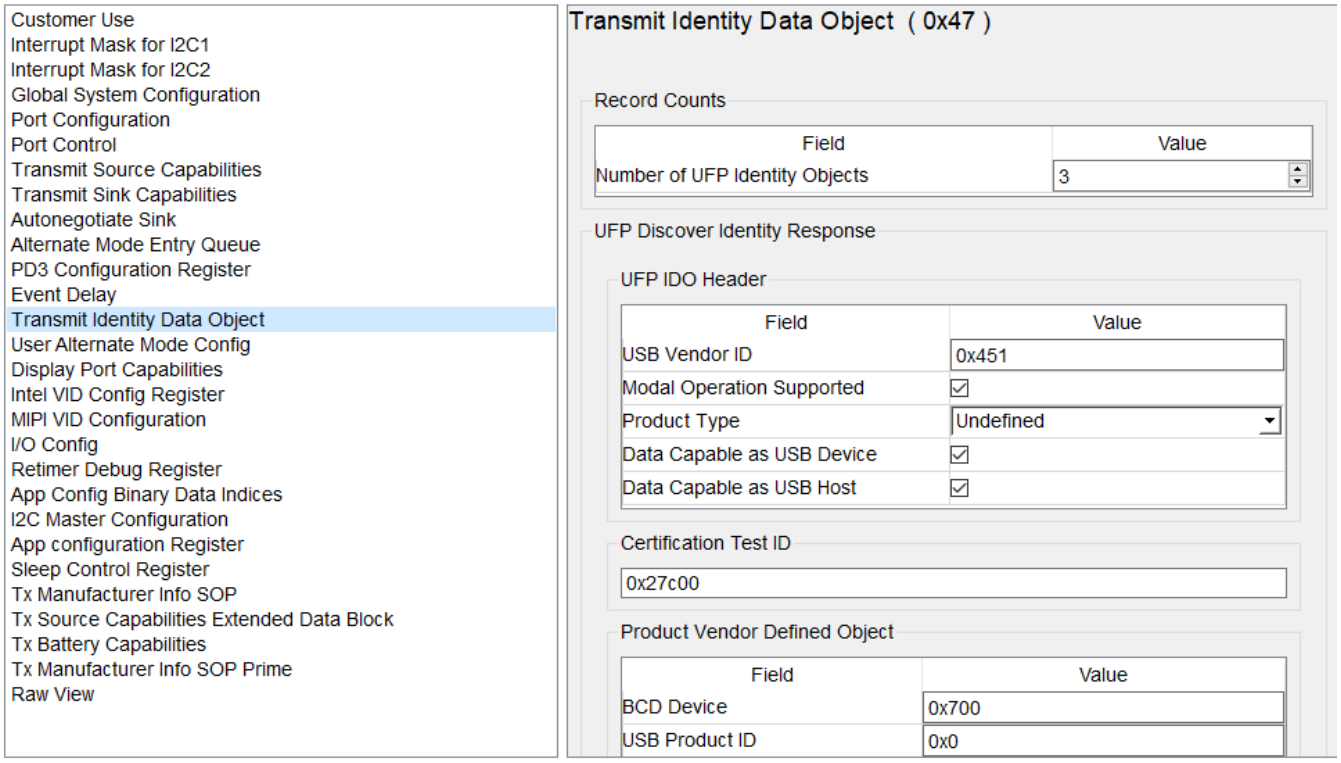

Figure 28. Transmit Identity Data Object (0x47) Register

USB Type-C Fields

- *Type_C_State_Machine*: This field indicates the type of Type-C state machine implemented on the UUT. For some of the configurations of UUT_Device_Type, this field is set automatically by the tool.
- *Rp_Value*: This field defines the Rp value that the UUT (as a source) presents upon a connection. It must be set depending on the Figure 29 configuration in the *System Configuration* register.

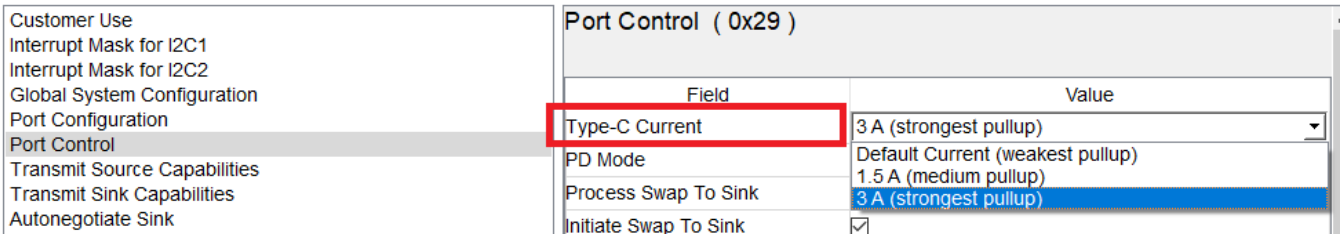

Figure 29. Type-C Current - System Configuration (0x28) Register

- *Type_C_Implements_Try_SRC* and *Type_C_Implements_Try_SNK*: These fields define the ability of the UUT to support *Try.SRC* and *Try.SNK* states when transitioning out of *AttachWait.SNK* and *AttacheWait.SRC* respectively. These fields must be set in accordance with the Figure 30 configuration in the *Port Configuration* register.

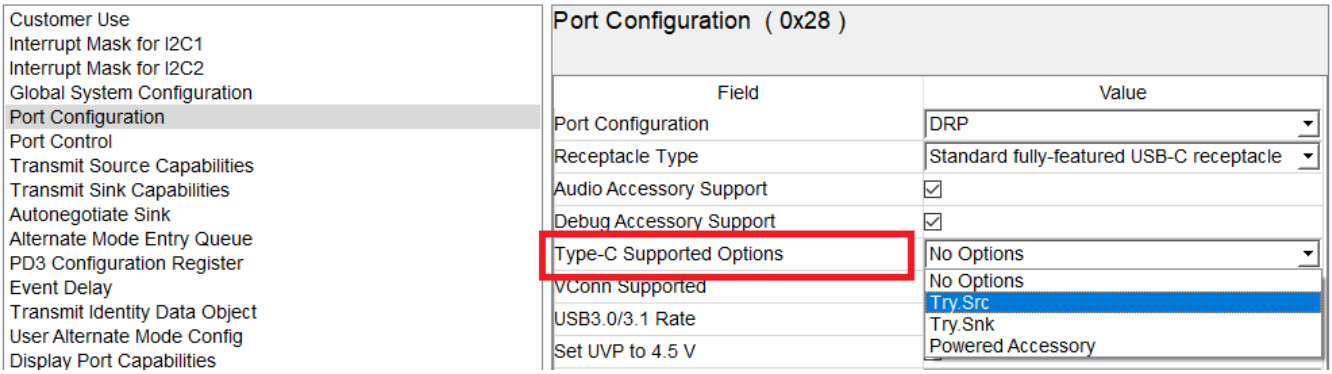

Figure 30. Type-C Supported Options - System Configuration (0x28) Register

- *Type_C_Is_Debug_Target_SRC*, *Type_C_Is_Debug_Target_SNK*, and *Type_C_Supports_Audio_Accessory*: These fields define the ability of the device to support *Debug Accessory Mode* and *Audio Accessory Mode* respectively, and must be set per the Figure 31 configuration in the *Port Configuration* register.

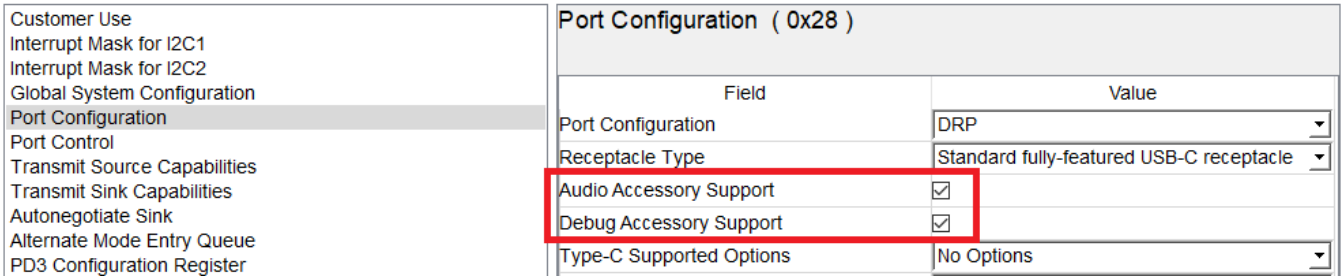

Figure 31. Accessory Support - Port Configuration (0x28) Register

NOTE: Some device variants do not have support for the accessory modes. Contact your TI representative for more details.

- *Type_C_Sources_VCONN* and *Type_C_Supports_VCONN_Powered_Accessory*: These fields indicate whether the UUT source VCONN supports communication with a VCONN-powered accessory. They

must be set per the configuration in the *Port Configuration* register. These fields are automatically set by the tool if *VCONN_Swap_To_XXX* is set as *YES* in the *General PD Settings* tab.

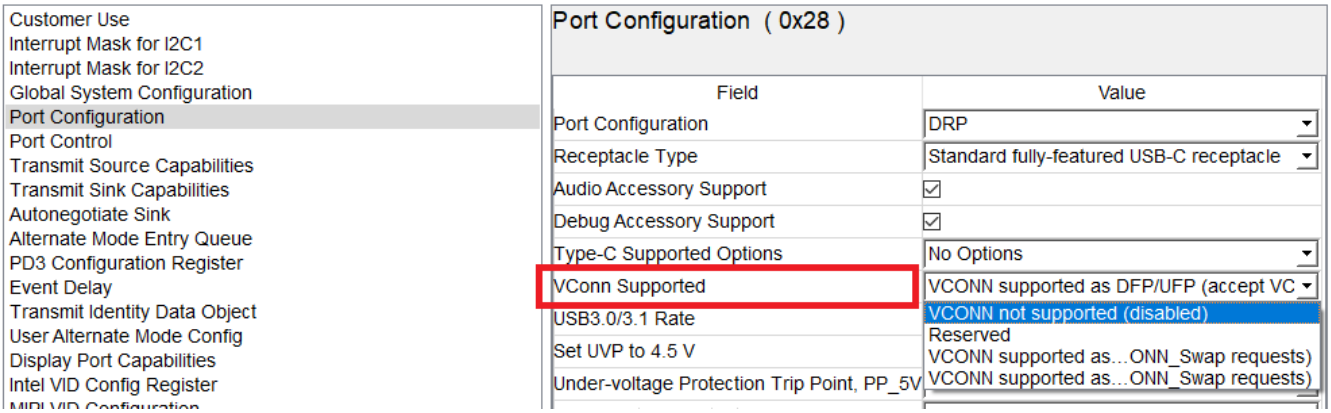

Figure 32. VCONN Support - Port Configuration (0x28) Register

- *Type_C_BC_1_2_Support*: This field indicates whether the UUT supports *USB Battery Charging v1.2* and must be set per the Figure 33 configuration in the *Port Control* register.

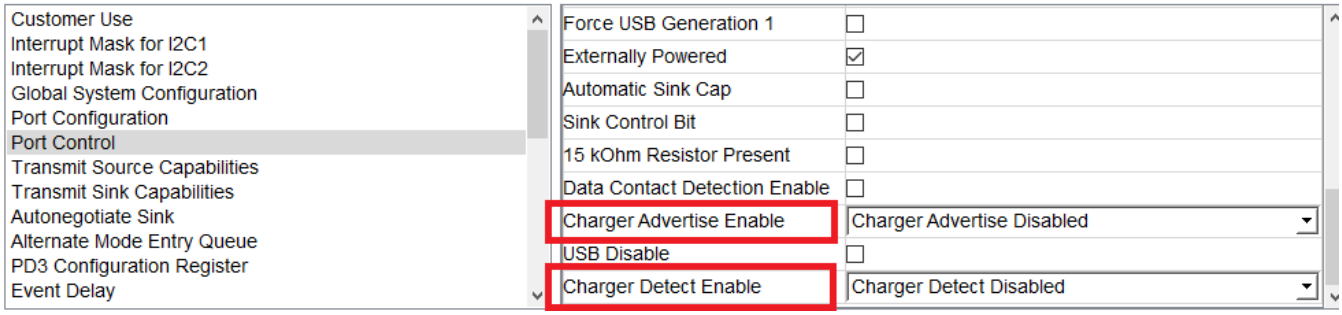

Figure 33. BC1.2 Support - Port Control (0x29) Register

- *Type_C_Can_Act_As_Host* and *Type_C_Can_Act_As_Device*: These fields indicate whether the UUT can communicate with USB 2.0 or USB 3.1 (as a host or device) respectively. They must be set per the Figure 34 configuration in the *Transmit Identity Data Object* register.

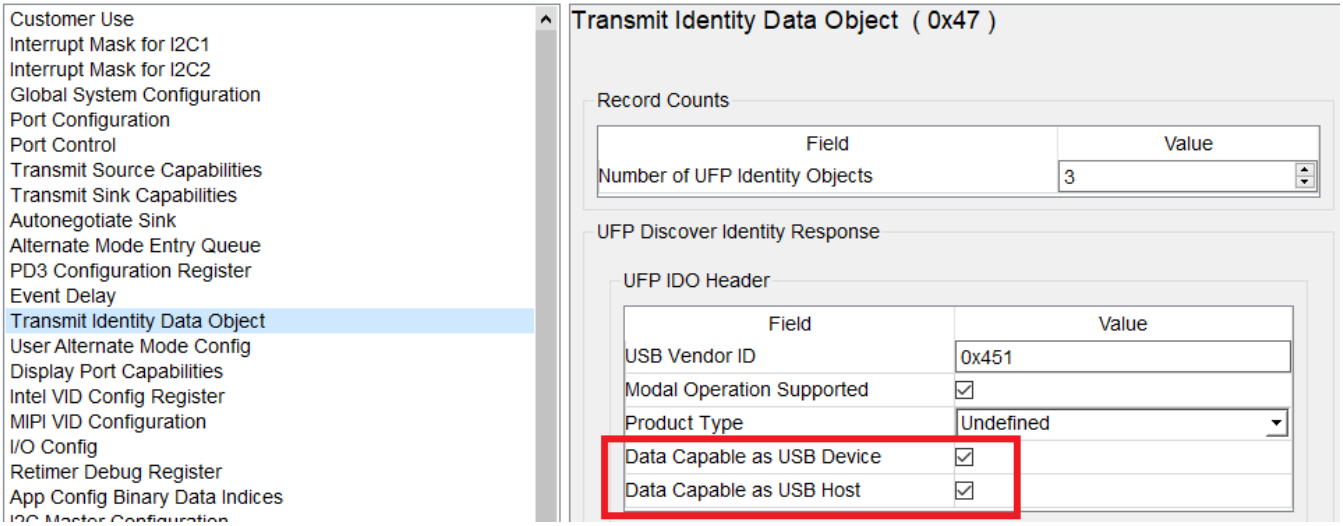

Figure 34. Transmit Identity Data Object

- *Type_C_Host_Speed* and *Type_C_Device_Speed*: These fields indicate which USB speed is supported when communicating as a host or a device respectively.

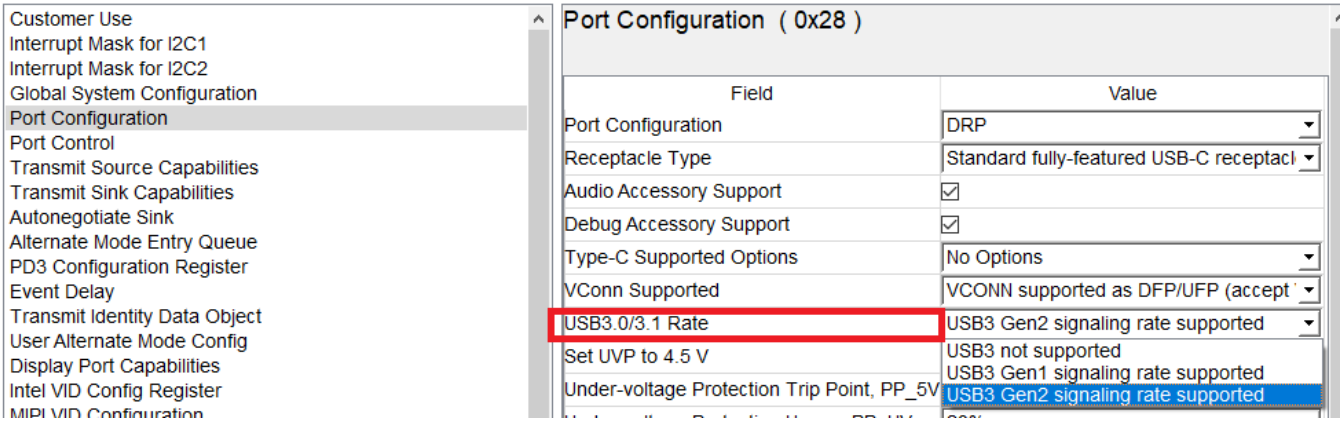

Figure 35. Data Capability as USB Device and Host - Port Configuration (0x28) Register

- *Type_C_Is_Alt_Mode_Controller* and *Type_C_Is_Alt_Mode_Device*: These fields indicate whether the UUT is capable of acting as an *Alternate Mode Controller* or *Alternate Mode Device* respectively. They must be set to *YES* if the device supports alternate modes.

3.3.3 Connection and Test Execution

Connect the test-equipment and UUT to the PC as shown in Figure 36.

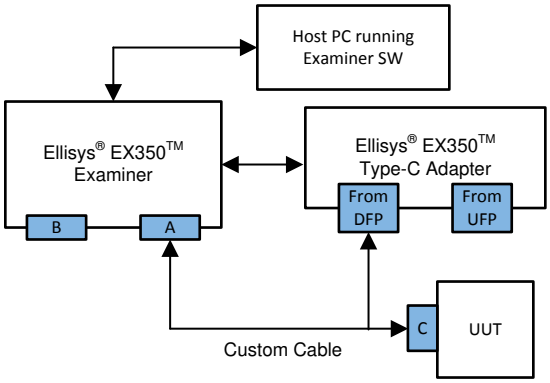

Figure 36. Ellisys® Examiner and UUT - Connection Diagram

1. Connect the test equipment to the Windows PC.
2. Launch the tester GUI, and select the tests to execute.

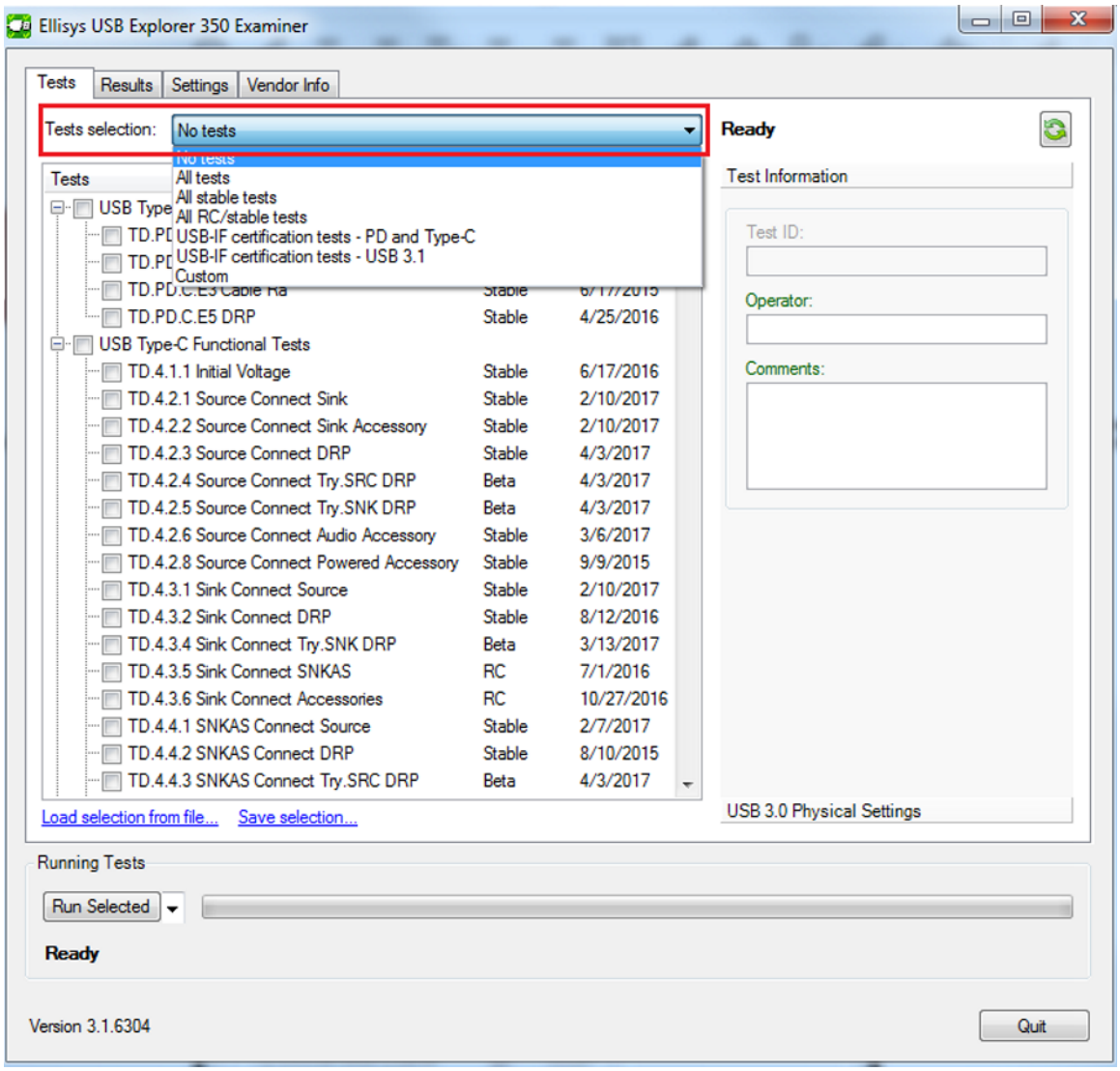

Figure 37. Test Selection - Ellisys® Examiner

3. Upload the VIF that was created previously, and run the selected tests.

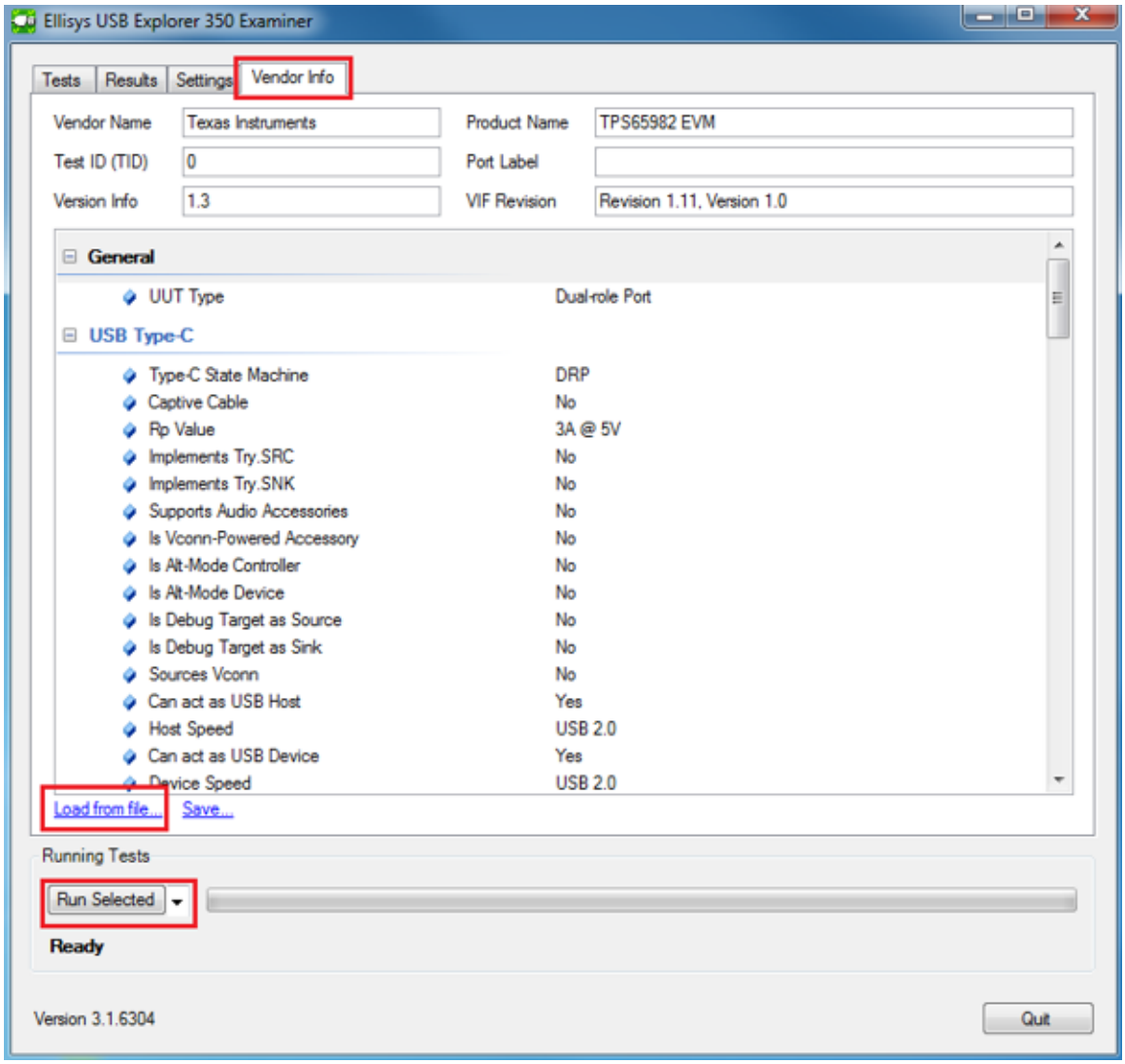

Figure 38. Vendor Information File - Ellisys® Examiner

4. After the tests are completed, the results can be found under the *Results* tab.

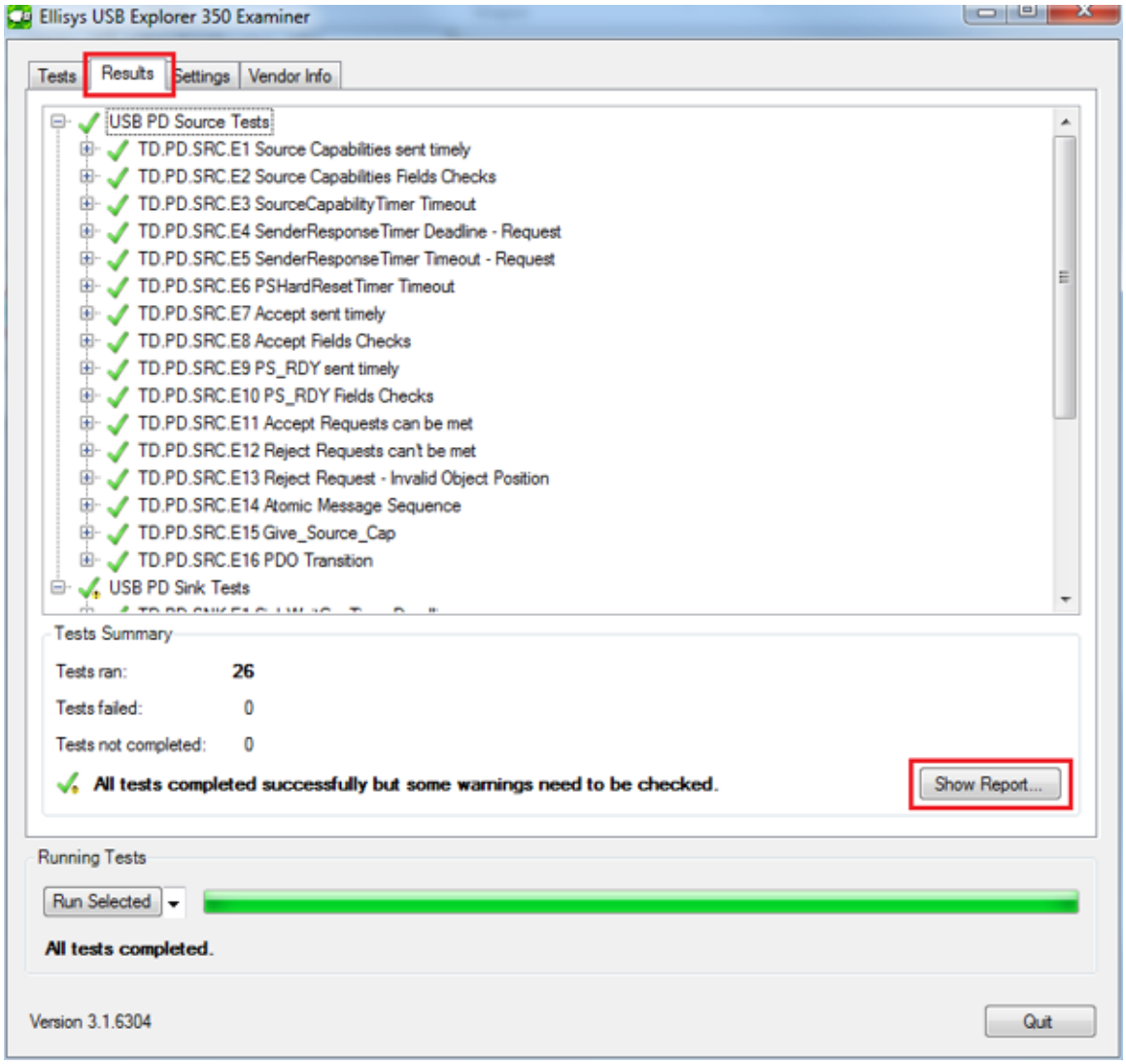

Figure 39. Test Results - Ellisys® Examiner

4 Getting Started – Granite River Labs GRL-USB-PD-C2

4.1 Installation

Download and install the following tool on the Windows PC from Granite River Labs

- GRL USB PD/Type-C Compliance Test Software/Firmware for USB Power Delivery and Type-C™ Tester and Analyzer (GRL-USB-PD-C2)

4.2 Setup and Test Execution

1. Connect the test equipment to the Windows PC. The C2 device connects using Ethernet.
2. Launch "GRL-USB-PD-C2" Software
3. Select Connection Setup. Click on Connect/Refresh and verify the Tester Status turns green.

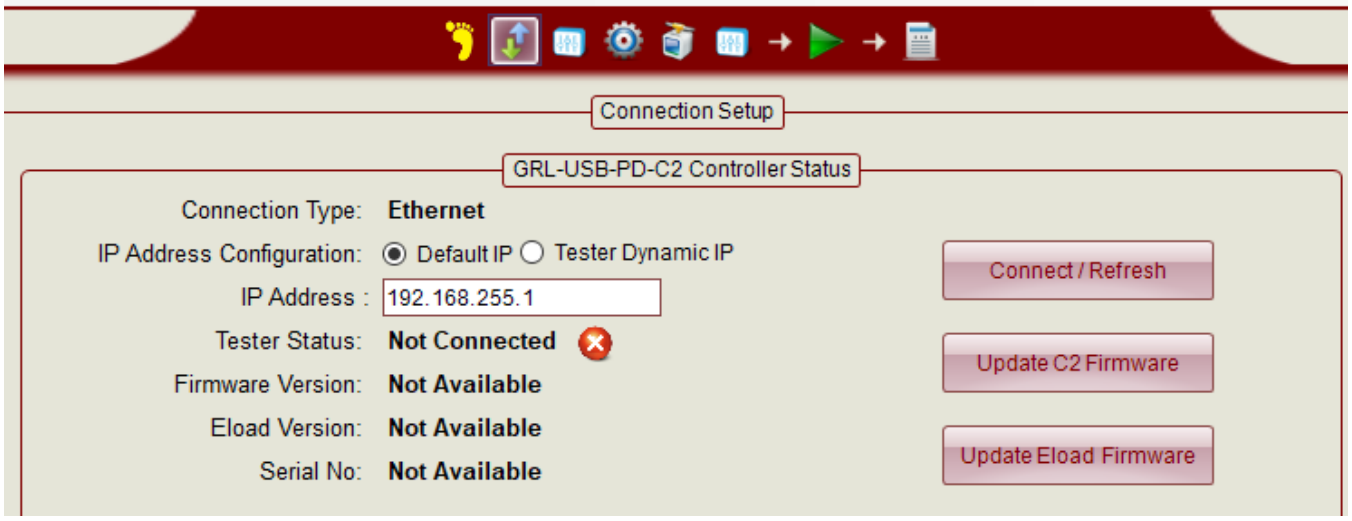

Figure 40. GRL Connection Setup

4. Select Product Capability. Click on VIF1, locate the VIF created and click Open.

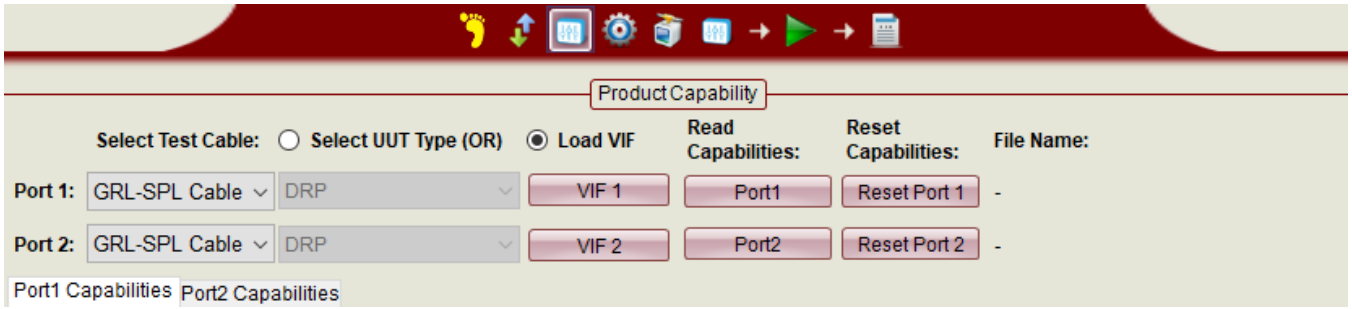

Figure 41. GRL VIF Entry

5. Select Test Configuration. Review settings and change if needed.
6. Review Test Setup Connection and connect UUT to the GRL C2 as shown.
7. Select Test Selection. Click to select the desired compliance tests.
8. Select Run/Start to execute selected tests. The GRL Advanced Plot window opens to show current operations.
9. Select Report Generation. Leave default options checked and select Generate Report.

Launch "GRL-USB-PD-C2 Software"

5 Getting Started – MQP Packet-Master

5.1 Installation

Download and install the following tool onto the Windows PC from MQP Electronics

- GraphicUSB Software

5.2 Setup and Test Execution

1. Connect the test equipment to the Windows PC. The MQP Packet-Master device connects using USB.
2. Launch the "Graphics USB" software.
3. Select menu items Operations, PD, and PD Compliance
4. Under the Gen tab, select Load an Existing Vendor Info File

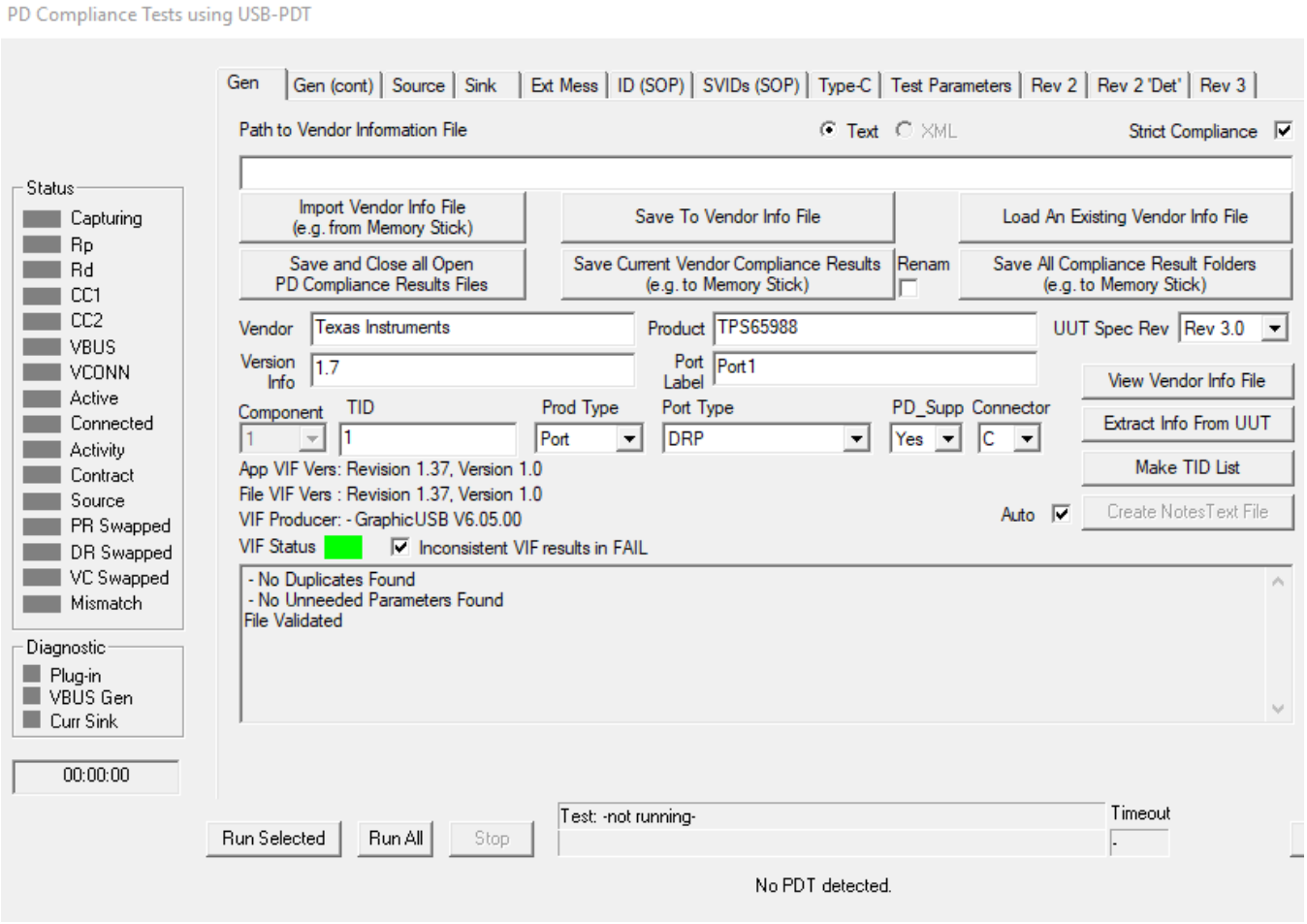

Figure 42. MQP VIF Entry

5. Select one of the tabs Rev 2, Rev 2 Det, or Rev 3 to select the desired Compliance Tests

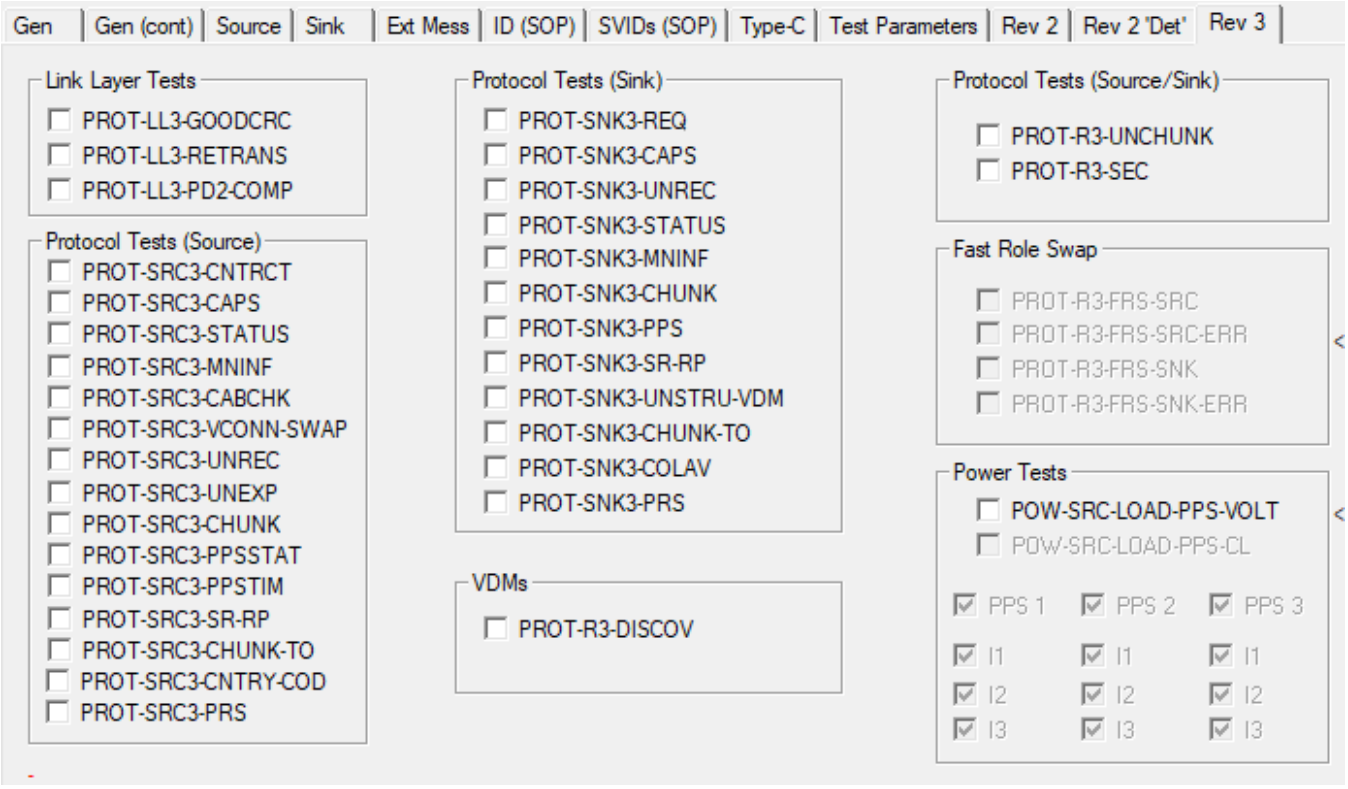

Figure 43. MQP Test Selection

6. Select Run Selected or Run All to execute desired tests

6 Getting Started – LeCroy M310P

6.1 Installation

Download and install the following tool on the Windows PC from Teledyne LeCroy Protocol Analyzers

- USB Analysis Software: USB Compliance Suite
- USB Analysis Software: USB Protocol Suite
  - Note: This item is optional and only required for collecting PD logs

6.2 Setup and Test Execution

1. Connect the test equipment to the Windows PC. The LeCroy M310P device connects using USB.
2. Launch USB Compliance Suite.
3. Use the left Workspace area to select desired compliance tests.

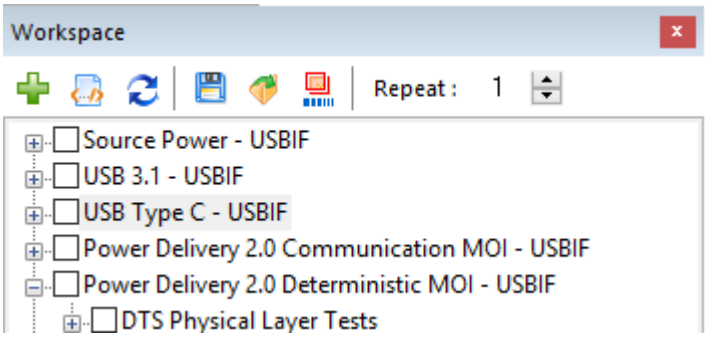

Figure 44. LeCroy Test Selection

4. Select the green plus sign to add selected tests to the test queue
5. Select the VIF icon. Select the Load File icon and enter the previously created VIF file

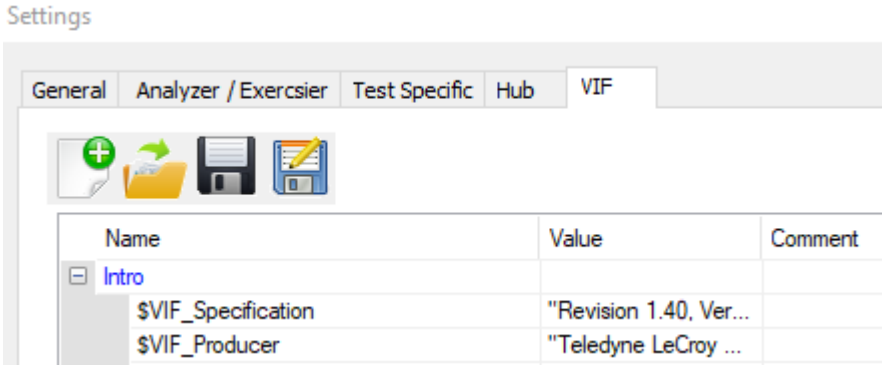

Figure 45. LeCroy VIF Entry

6. Select the blue forward arrow icon (or enter shortcut F5) to execute selected tests

7 Compliance Test Notes

- Some tests like TD.PD.VNDI.E4 SOP* might fail if SOP_P_Capable is set to YES in VIF because the tester wrongly marks the test case as failed if the tester does not detect a Good-CRC from the UUT. Instead, the tester must check if the device sent any VDM response against the set configuration for this particular test-case. Though the TPS65988 supports SOP' and SOP'' handling, the device monitors SOP* messages from the plug only when expecting a response.
- Certain tests under the PD2 and Type-C Functional Test Specification (Ex: TD.4.10.2, TD.PD.VNDI.E10, etc.) might fail with 'Init Swap to DFP/UFP' set in the configuration of the UUT. The tester will incorrectly responds to the role swap requests of the UUT, which results in a test failure.
- Some Type-C Functional Tests are sensitive to the UUT Under Voltage Protection (UVP) threshold when set to 20% or less of the negotiated contract. The testers expect the UUT to maintain a stable contract when VBUS is reduced to 3.7 V for a 5-V contract, and the UUT may trigger a disconnect if the UVP threshold is not set low enough.

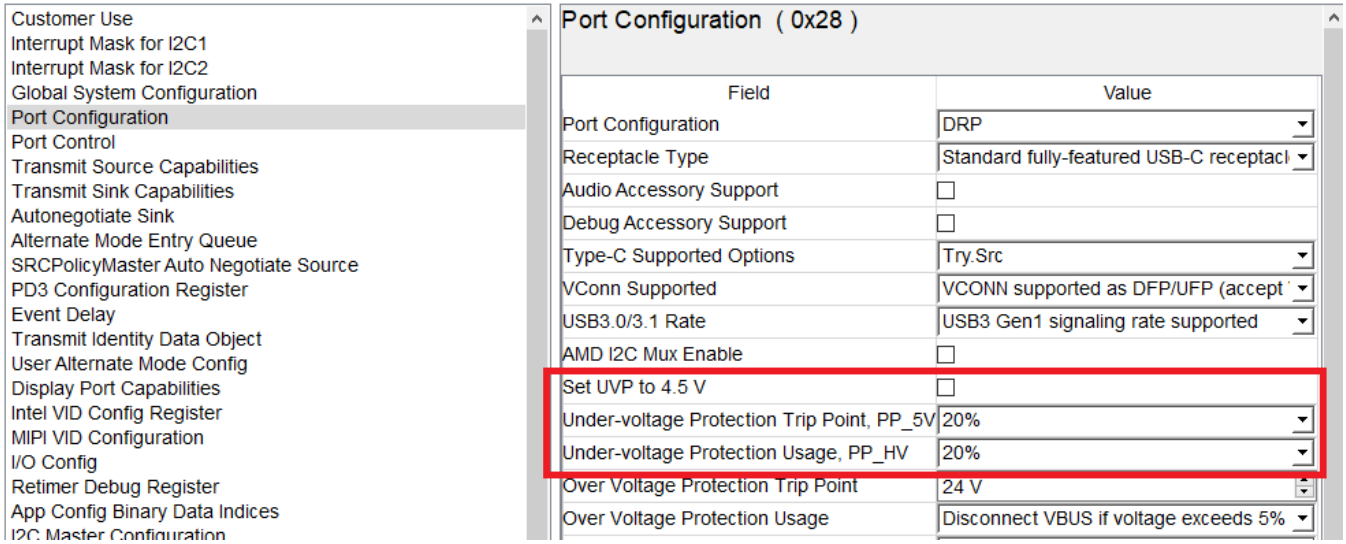

Figure 46. Undervoltage Protection Options

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (May 2017) to A Revision	Page
• Updated app report for increased clarity	1
• Added Compliance Test Program Overview section	2
• Added Compliance Test Notes section	32

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