PSF Source Lite Demo Read Me

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REV	DATE	DESCRIPTION OF CHANGE
0.92	02-Dec-19	Initial version
0.95	07-Jan-20	Renamed the title of document Changed the order of sections - Software License, Terms and Abbreviations and Introduction Added section 4 Prerequisites Added jumpers list and modified the images in section 5 Modified the image in section 6 Added images in section 7 Removed Appendix section – Harmony Framework usage
1.00	26-Feb-20	Updated document version to align with v1.00 release
1.01	16-Mar-20	Updated document version and title to align with v1.01 release. Updated sections 3, 5 and 6 specific to Source Lite
1.04	26-May-20	Updated document version to align with v1.04 release

Table of Contents

1 Software License Agreement

2 Terms and Abbreviations

Term	Definition
PSF	Universal Serial Bus Power Delivery Software Framework
EVB	Evaluation Board
PD	Power Delivery
IDE	Integrated Development Environment
PDO	Power Data Object
PM-PD	Power Module-USB Power Delivery
LED	Light Emitting Diode
GPIO	General Purpose Input Output

3 Introduction

Microchip's USB Power Delivery Software Framework (PSF) is a configurable USB PD solution that is compliant to USB-PD 3.0 specification.

PSF Source Lite application includes PD Source functionality with the support for Boot time configuration parameters and GPIO based DC-DC controller for port power control. This document is intended to guide a user on setting up the PSF-EVB to work properly with Source Lite version of PSF along with a demonstration of a PD device attached to the PSF-EVB.

4 Prerequisites

Hardware:

1) Microchip PSF Evaluation Board (PSF-EVB)

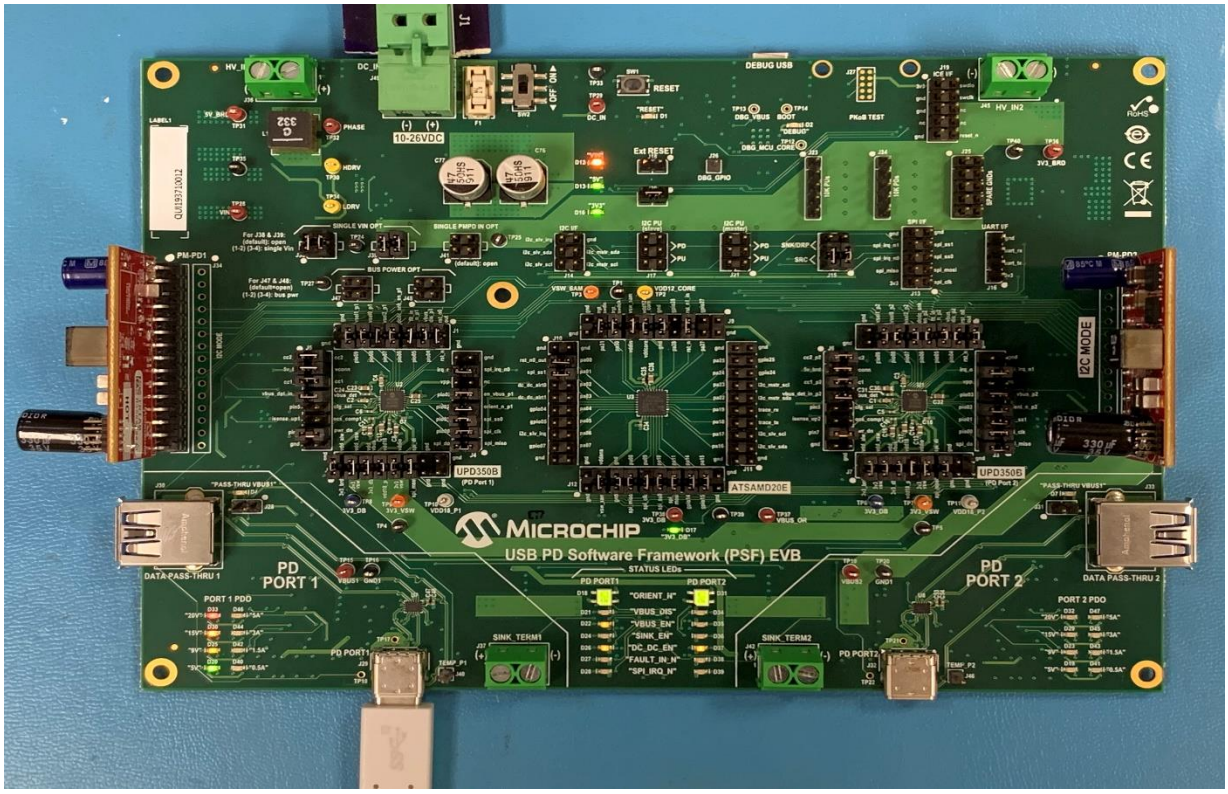

Figure 4.1 Microchip PSF Evaluation Board

2) 2 Microchip UNG 8122 Rev D PM-PD Cards – 1 per port

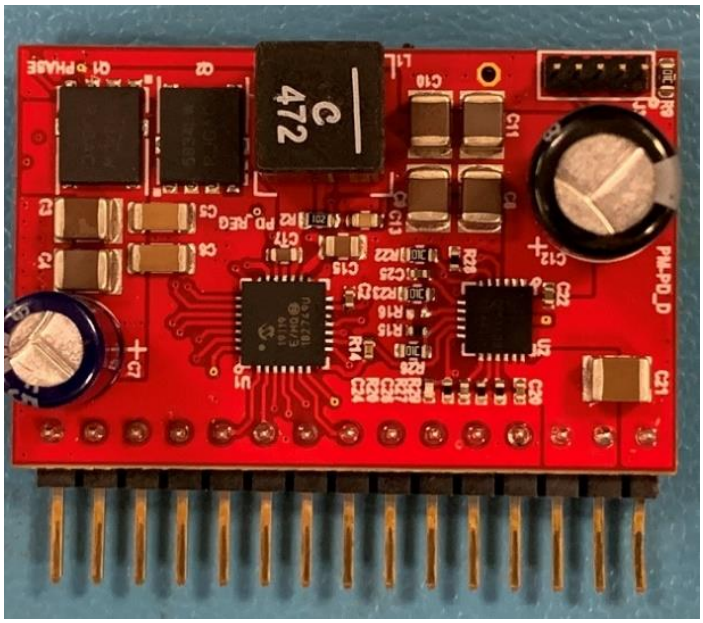

Figure 4.2 Microchip UNG 8122 Rev D PM-PD Card

3) 150W Power Adapter with 24V, 6.25A output

Figure 4.3 Power Adapter with 24V, 6.25A output capacity

4) USB-C to USB-C cable

5) Atmel ICE Debugger kit

Figure 4.4 Atmel-ICE Debugger Kit

6) USB Power Delivery capable Phones or Laptops

5 Setting up the PSF-EVB board for “PSF_EVB_Source_Lite”

1. Connect PM-PD cards to J35 and J44 of the PSF-EVB in correct orientation as shown in Figure 5.1

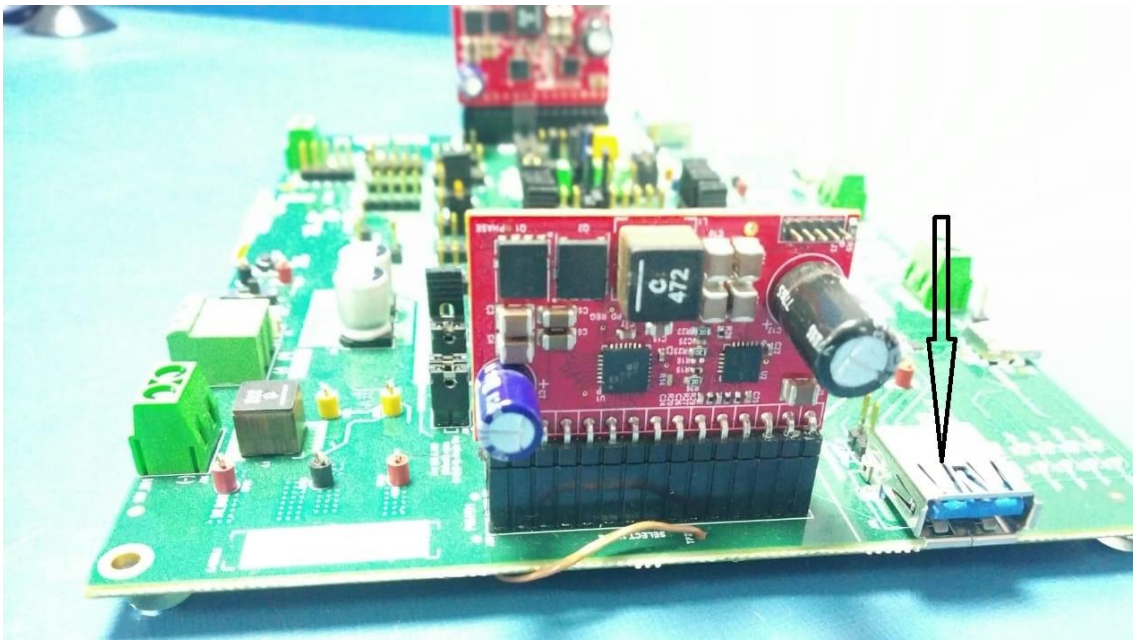

Figure 5.1 PM-PD Orientation

2. Ensure the following jumpers are connected in PSF-EVB before proceeding to next step. An image of PSF-EVB with all the required jumper connections highlighted is shown in Figure 5.2

Jumper	**Pins**
J38	1-2, 3-4
J39	1-2, 3-4
J21	1-3, 2-4
J15	1-3, 2-4
J1	1-2 3-4 5-6 7-8 9-10 11-12 13-14
J4	1-2 3-4 5-6 7-8 9-10 13-14
J5	1-2 3-4

	5-6 7-8 9-10 13-14
J8	1-2 3-4 5-6 7-8 9-10 11-12
J9	5-6 9-10 11-12 13-14 15-16 17-18
J10	3-4 5-6
J11	11-12 13-14
J12	3-4 5-6 7-8 9-10 11-12 13-14 15-16 17-18
J2	1-2 3-4 5-6 7-8 9-10 11-12 13-14
J3	1-2 3-4 5-6 7-8 9-10 13-14
J6	1-2 3-4 5-6 7-8 9-10 13-14
J7	1-2 3-4

	5-6 7-8 9-10 11-12

Table 5.1 PSF-EVB Jumper Connections

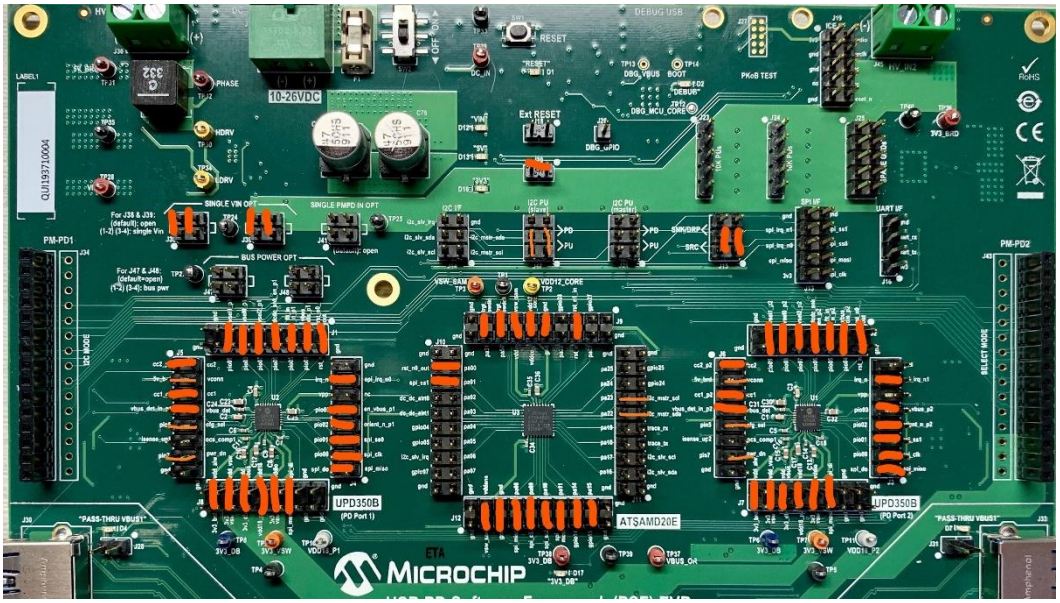

Figure 5.2 PSF-EVB with jumper connections highlighted

3. Connect 150W power adapter to J49 of the PSF-EVB

4. Connect one end of Atmel ICE to PC using USB Micro-B cable and the other end to J19 of PSF-EVB. A dot(encircled in image) will be present in Atmel ICE Adapter board which gives an indication that this pin should be connected to 3v3 of J19. The right way to connect is,

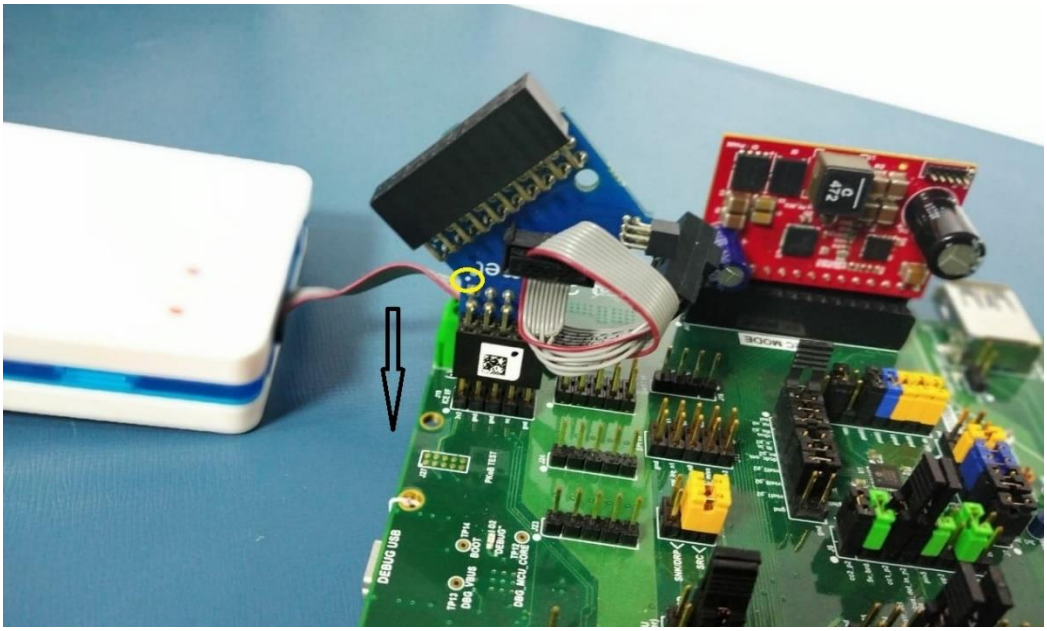

Figure 5.3 Connecting Atmel-ICE Debugger to J19

5. The whole connection looks like,

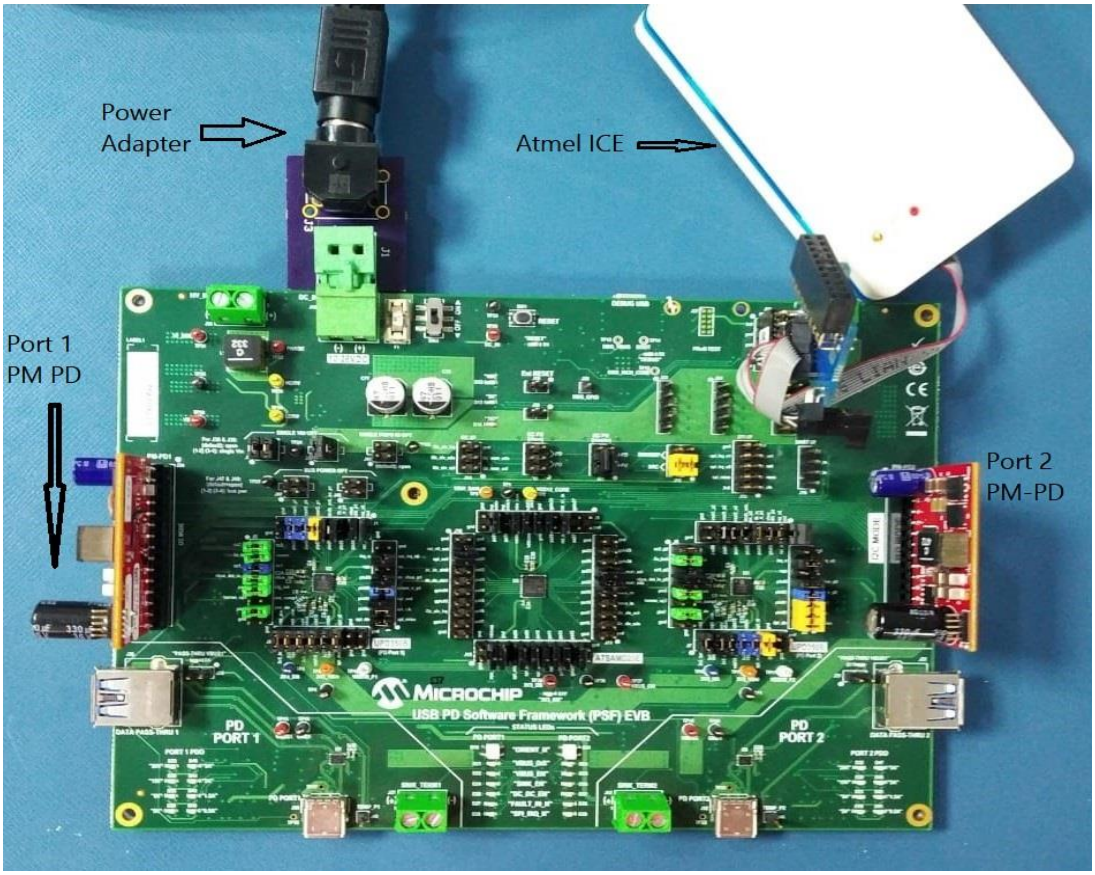

Figure 5.4 PSF-EVB Full Setup

6 Running the demo

Refer Getting Started with PSF document for the detailed steps on setting up the build environment, building the Source Lite PSF project and programming the hex file in the PSF-EVB.

Refer Appendix 8.2 of Getting Started with PSF to change any SAMD20 Harmony configuration. Refer 10.2.9 Boot time Configuration of PSF User Guide to change any configuration parameters.

1. Ensure all the jumpers are in place and Power on the PSF-EVB.

2. Program the hex file by following the steps mentioned in section 8 of Getting Started with PSF

3. Connect a PD device to Port 1 of PSF-EVB using a USB-C to USB-C cable.

4. Connect another PD device to Port 2 of PSF-EVB using a USB-C to USB-C cable.

5. The image demonstrates a scenario where a Google Pixel 2 phone has been connected to Port 1 and Samsung Galaxy S8 phone has been connected to Port 2

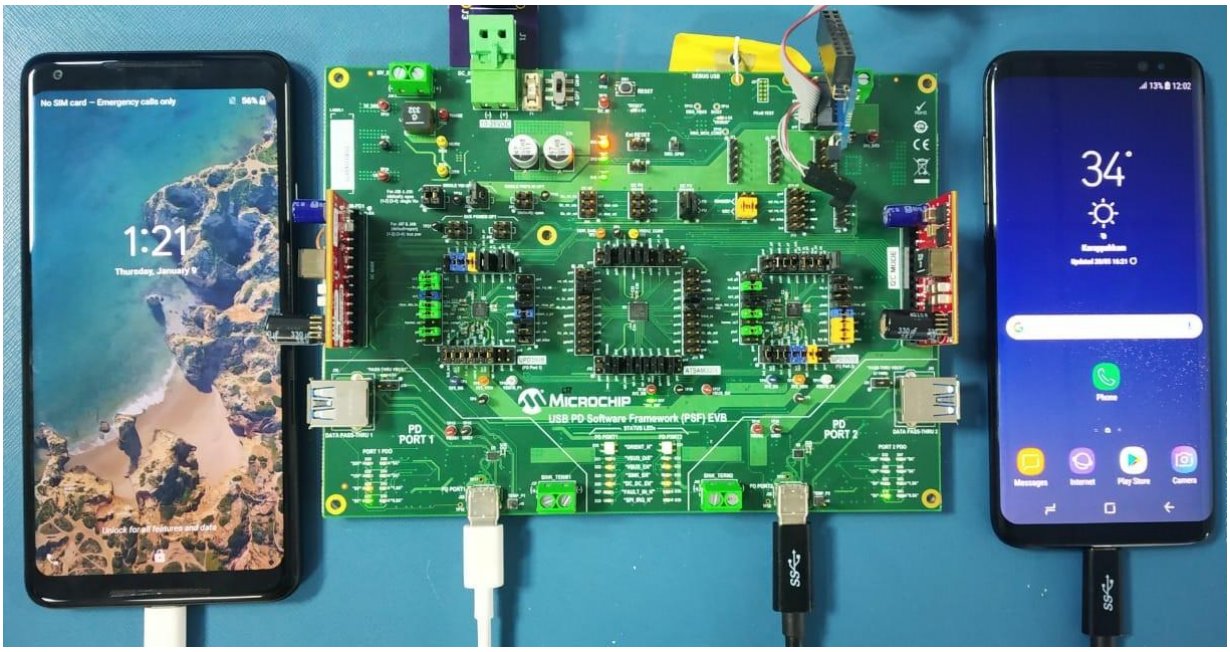

Figure 6.1 Two PD Devices connected to each PD port

7 Expected Results

1. Once the hex file is programmed, the SPI_IRQ_N LEDs in both the ports flash and then turn off. DC_DC_EN LEDs will also turn on.

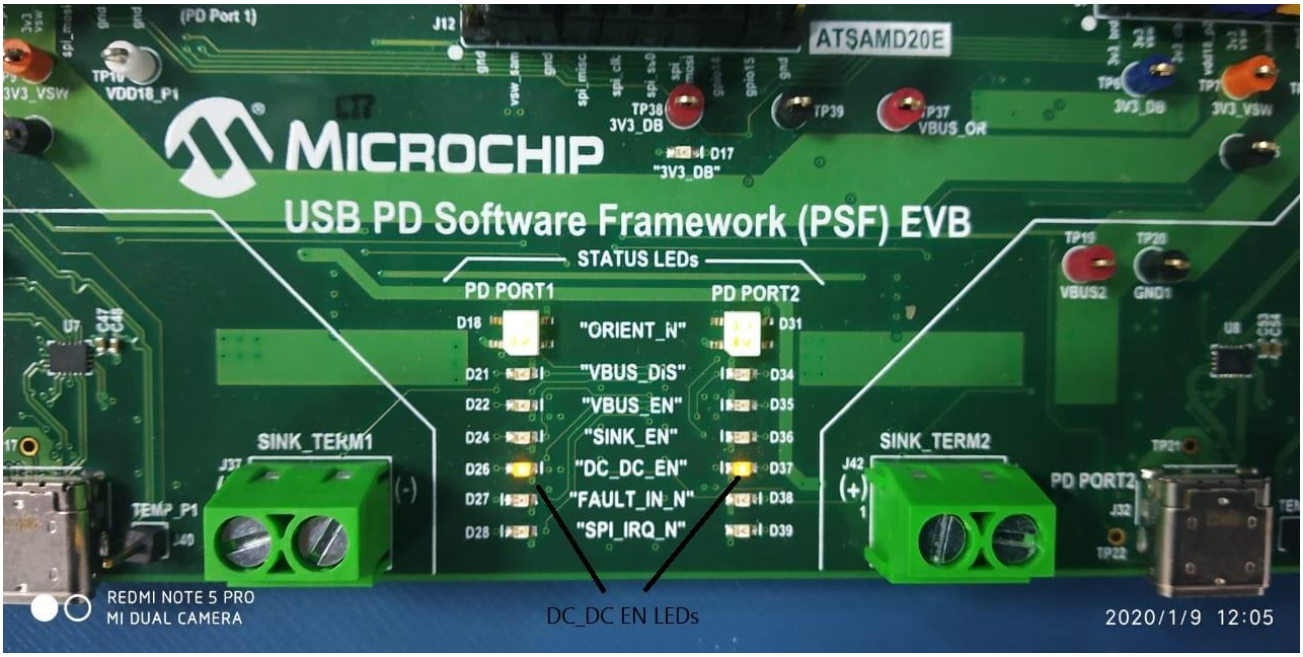

Figure 7.1 Status of DC_DC_EN LEDs after power on

2. Once a PD Device is attached to a PD port, Source capabilities will be advertised by the PSF, followed by a PDO request from the device.

3. PSF checks if the PDO requested by the device is within the range of its capabilities. If so, it accepts the request and starts driving the requested voltage in the VBUS.

4. Once an explicit power contract negotiation is in place, the device starts charging. VBUS_EN LED will turn on along with the PDO status LEDs indicating the negotiated voltage as shown in Figure 7.2

PDO	Status LED
5V	Port 1 – D20, Port 2 – D19
9V	Port 1 – D25, Port 2 – D23
15V	Port 1 – D30, Port 2 – D29
20V	Port 1 – D33, Port 2 – D32

Table 8.1 PDO Status LEDs

Example with Port 1: If 5V is negotiated by the device, LED in the D20 of Port 1 PDO will glow. If 9V is negotiated, then LEDs in D20 and D25 will glow. In case of 15V, LEDs in D20, D25 and D30 will glow. If 20V is negotiated, all the LEDs will glow.

5. In our case, Google Pixel connected in Port 1 has requested 9V and Samsung Galaxy in Port 2 has requested 5V. The status of VBUS_EN and PDO status LEDs is shown in Figure 7.2

Figure 7.2 VBUS_EN and PDO Status LEDs after device attach

6. One more scenario is shown where a HP Elite book laptop is connected to PD port 2. It has requested for 20V. After PD negotiation, the laptop starts charging. All the PDO status LEDs glow which indicates that 20V is negotiated.

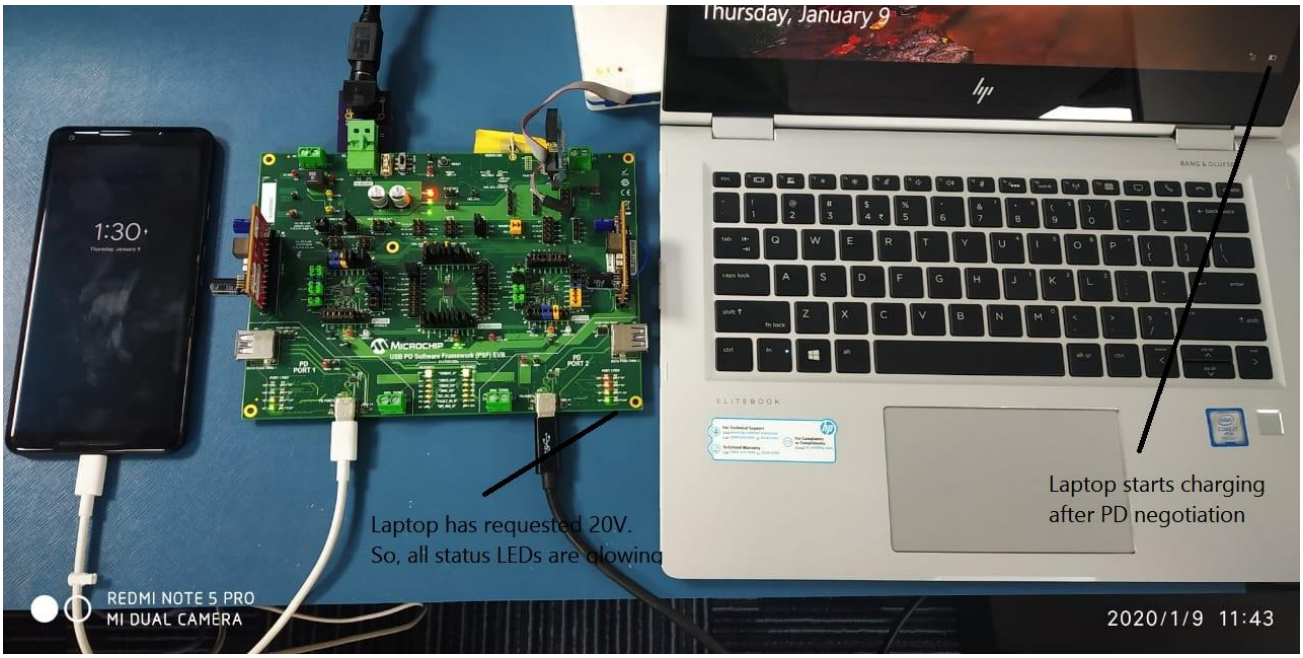

Figure 7.3 20V negotiation with HP Elite book connected to PD Port 2