




# PSF Source Lite Demo Read Me

 <b>MICROCHIP</b> Microchip Technology, Inc.			Microchip Technology, Incorporated 2355 W. Chandler Boulevard Chandler, Arizona 85224 480/792-7200
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	
1.05	24-Jul-20	Updated document version to align with v1.05 release	

## Table of Contents

1	Software License Agreement .....	4
2	Terms and Abbreviations .....	4
3	Introduction .....	4
4	Prerequisites .....	5
5	Setting up the PSF-EVB board for “PSF_EVB_Source_Lite” .....	7
6	Running the demo .....	10
7	Expected Results .....	11

## 1 Software License Agreement

Copyright ©[2019-2020] Microchip Technology Inc. and its subsidiaries.

Subject to your compliance with these terms, you may use Microchip software and any derivatives exclusively with Microchip products. It is your responsibility to comply with third party license terms applicable to your use of third party software (including open source software) that may accompany Microchip software.

THIS SOFTWARE IS SUPPLIED BY MICROCHIP "AS IS". NO WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, APPLY TO THIS SOFTWARE, INCLUDING ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE SOFTWARE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THIS SOFTWARE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THIS SOFTWARE.

## 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)

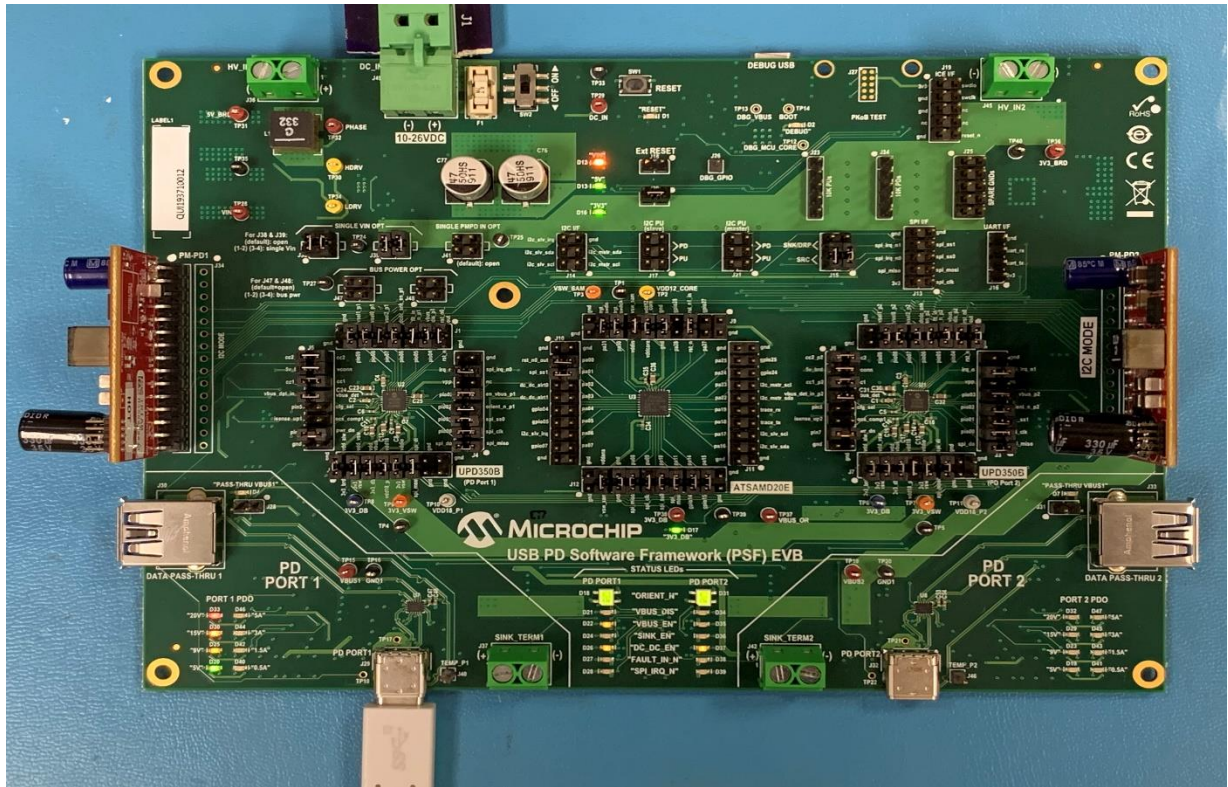


Figure 4.1 Microchip PSF Evaluation Board

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

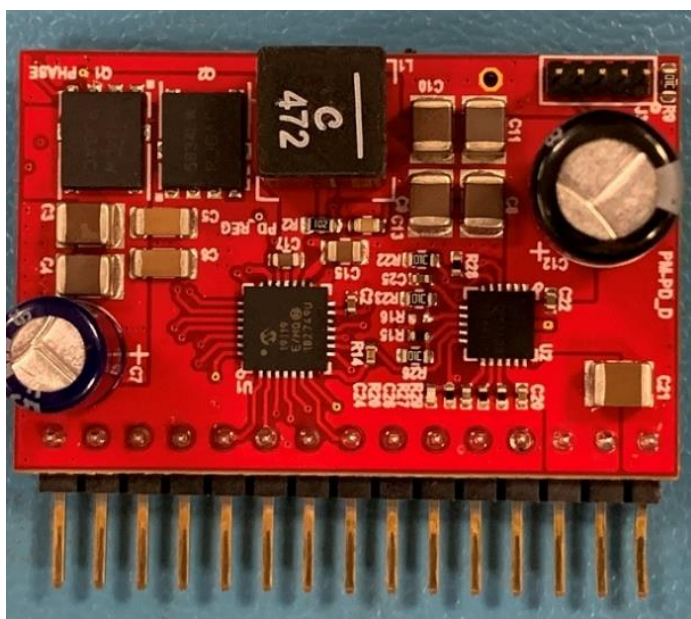


Figure 4.2 Microchip UNG 8122 Rev D PM-PD Card

## 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

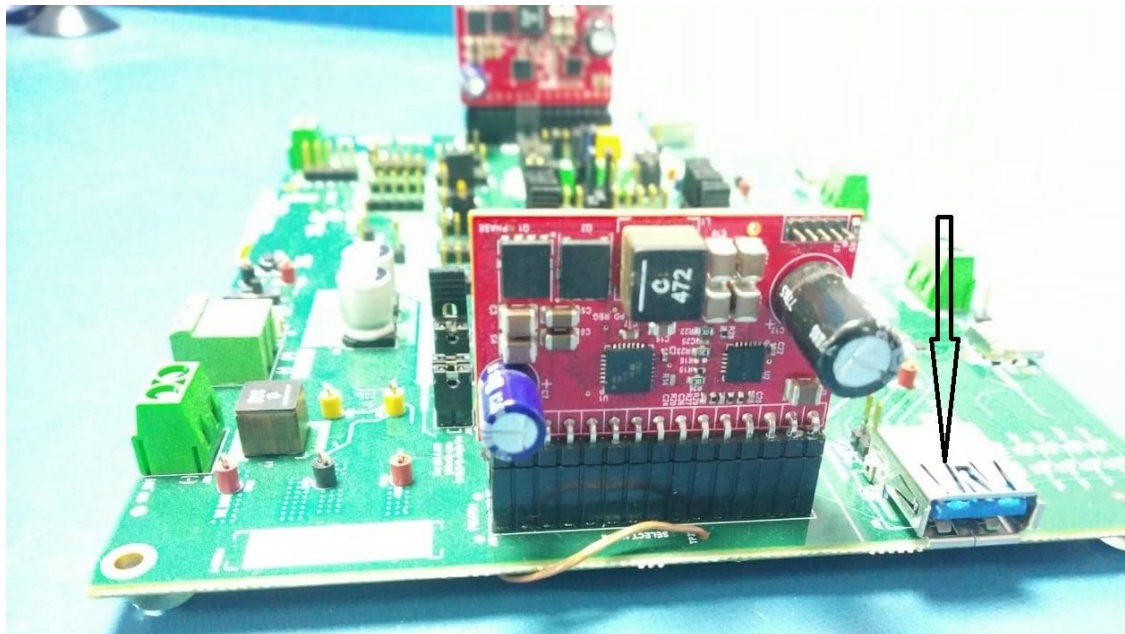


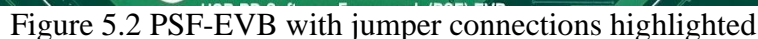
Figure 5.1 PM-PD Orientation

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



Table 5.1 PSF-EVB Jumper Connections

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,



5. The whole connection looks like,

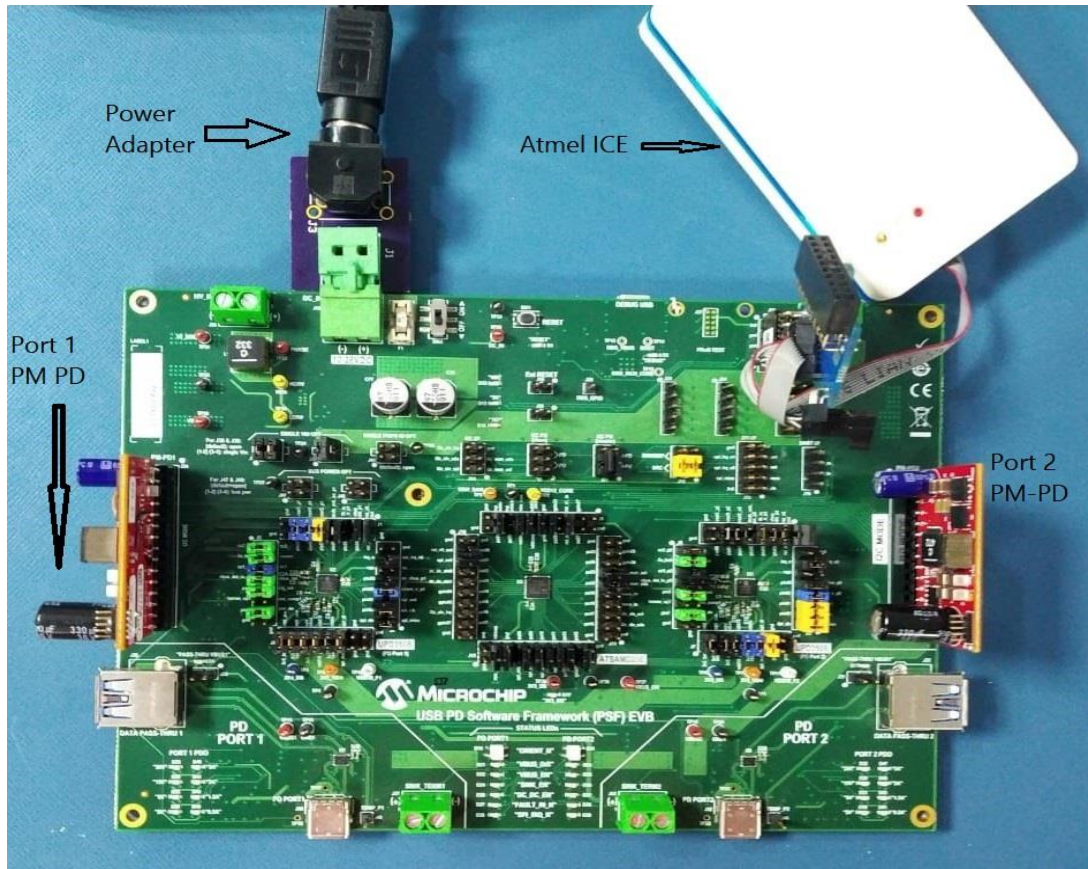


Figure 5.4 PSF-EVB Full Setup

## 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



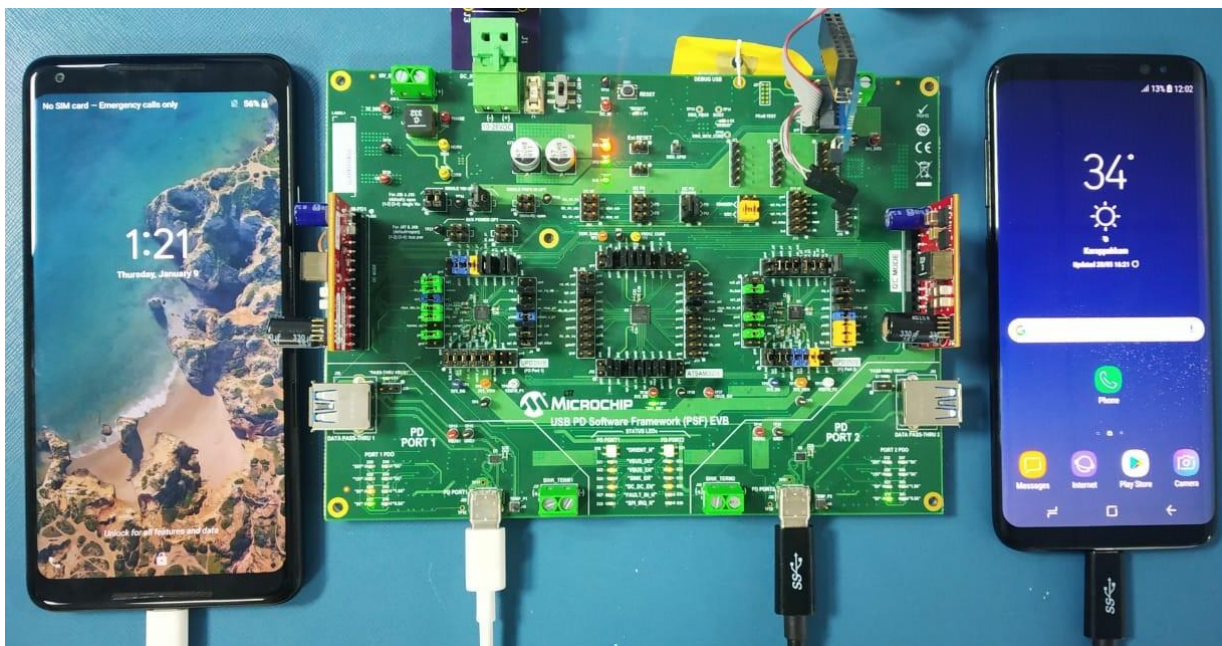


Figure 6.1 Two PD Devices connected to each PD port

## 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.

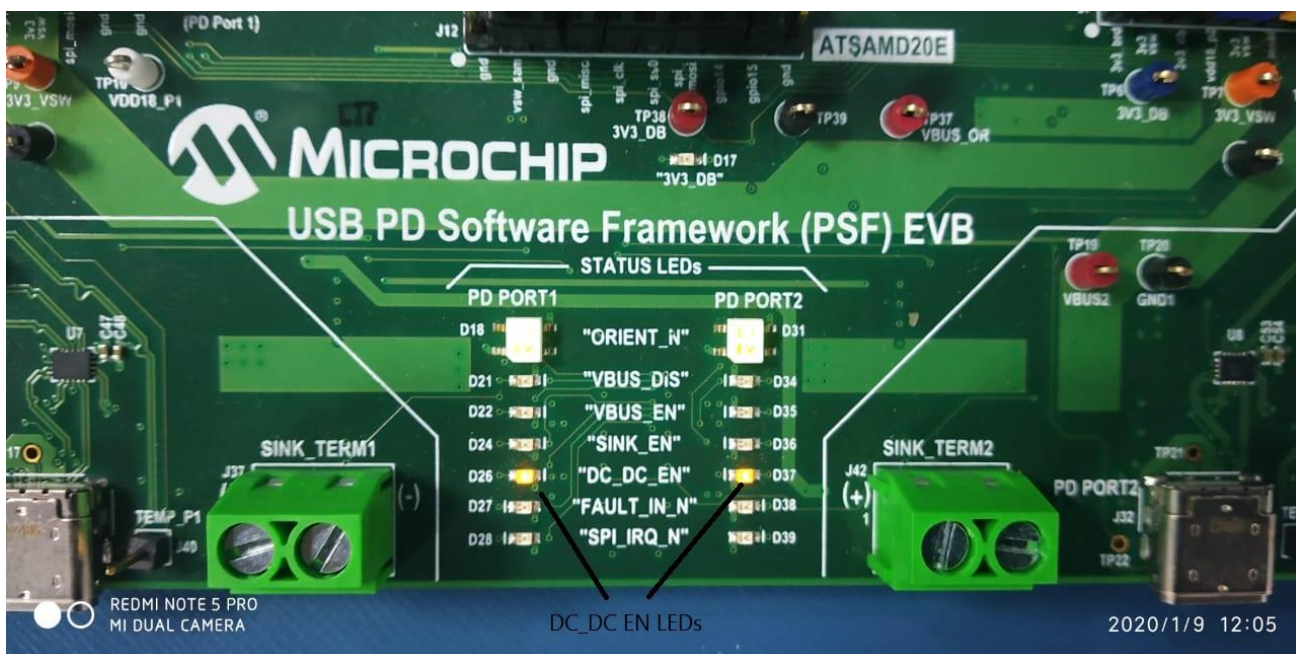


Figure 7.1 Status of DC\_DC\_EN LEDs after power on

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

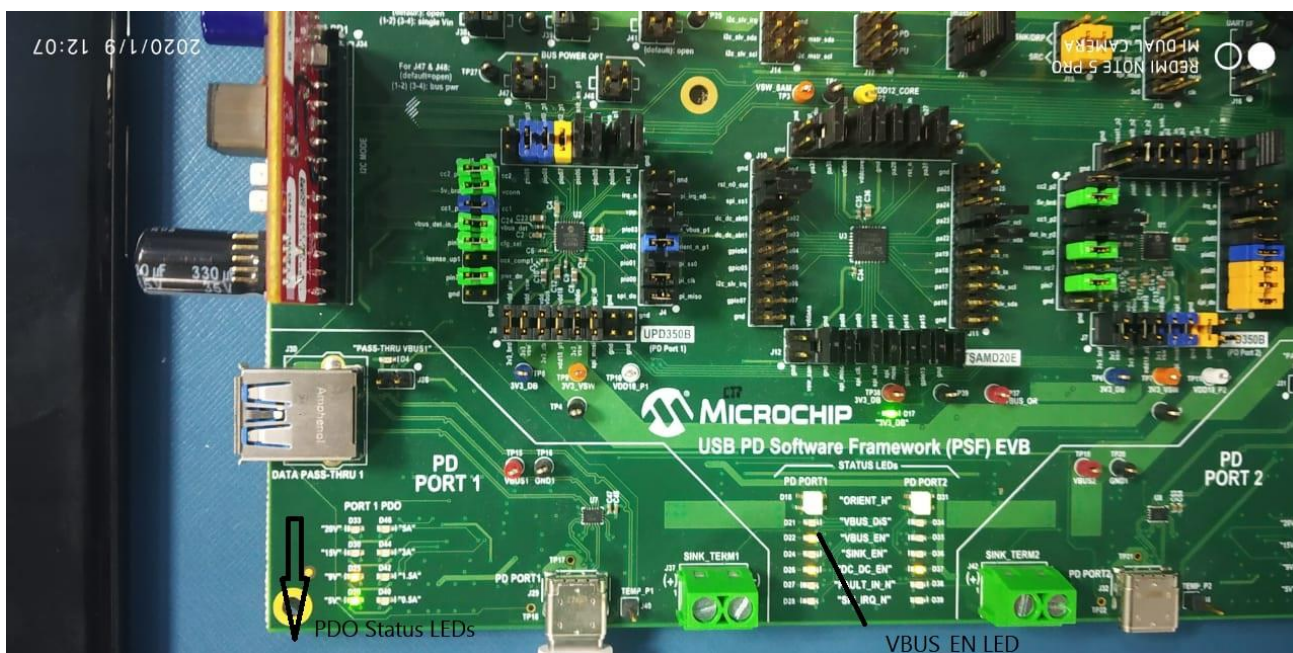


Figure 7.2 VBUS\_EN and PDO Status LEDs after device attach

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.



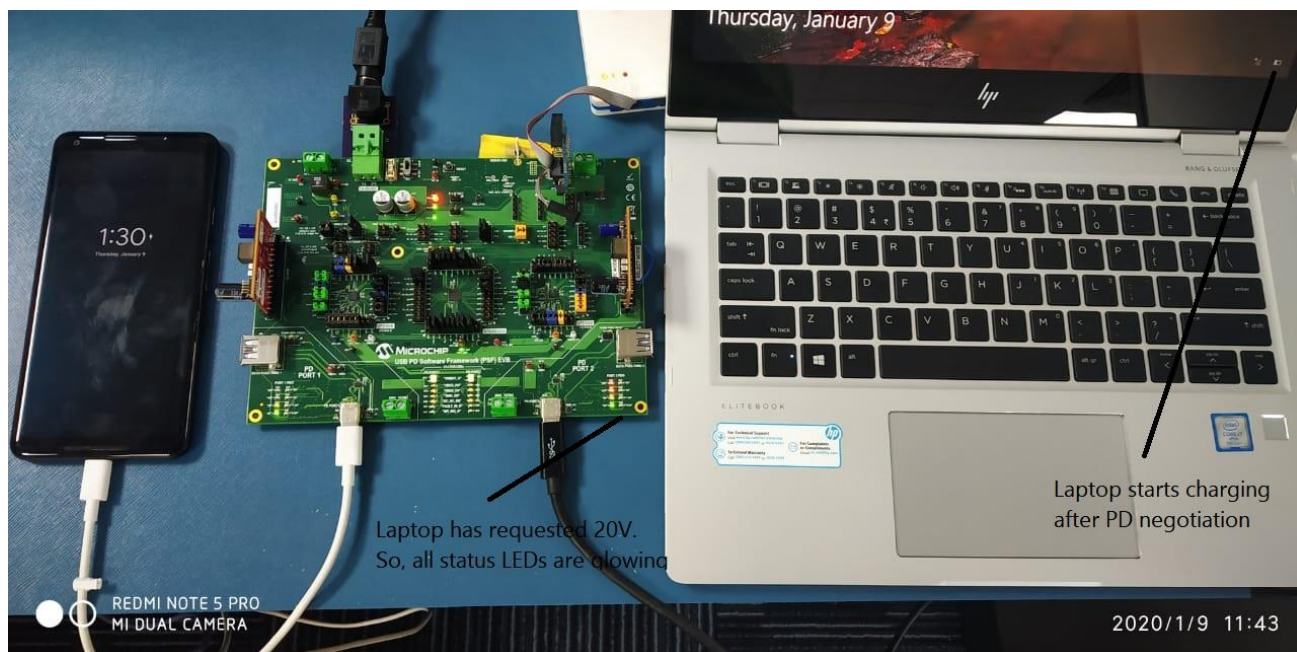


Figure 7.3 20V negotiation with HP Elite book connected to PD Port 2