

【電源量測技術論壇】 提升Power不斷電!





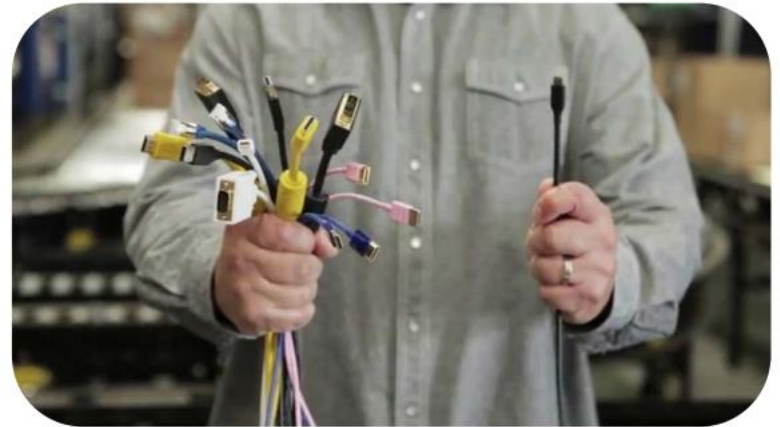
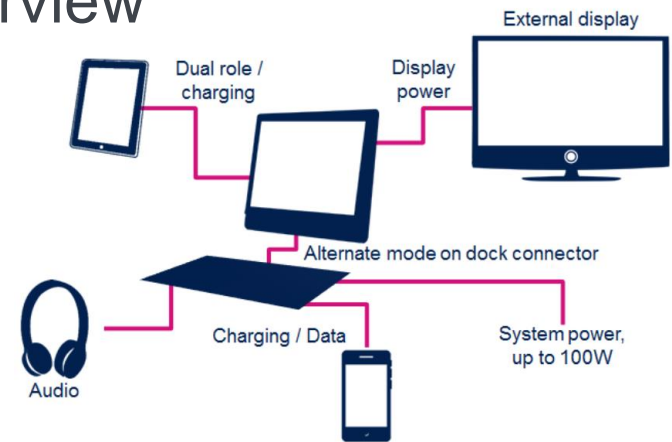
USB Power Delivery2.0

Miles Chang
Account Manager

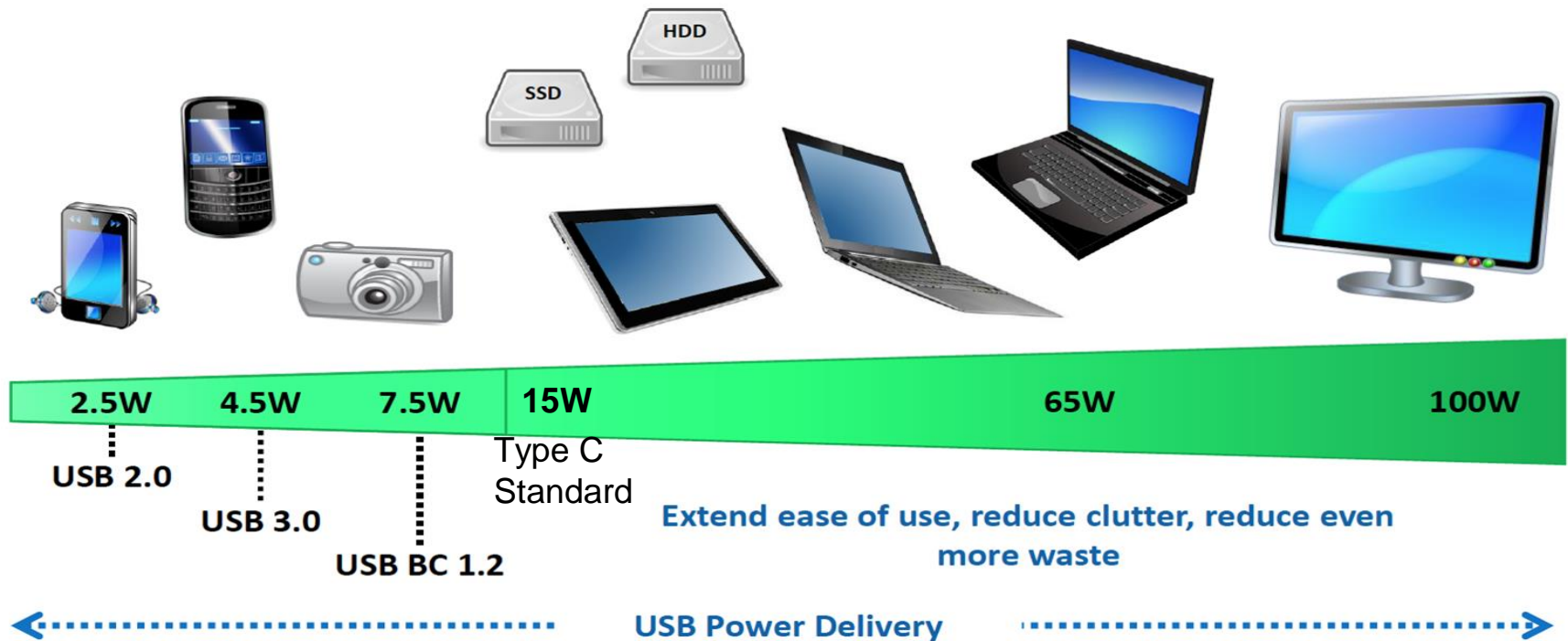
2 DECEMBER 2016

Agenda

- Introduction and Architectural Overview
- Specifications relevant to Type-C
- Power Delivery 2.0
 - PD Test Solution
 - Alternate Mode Test Solution
- Summary



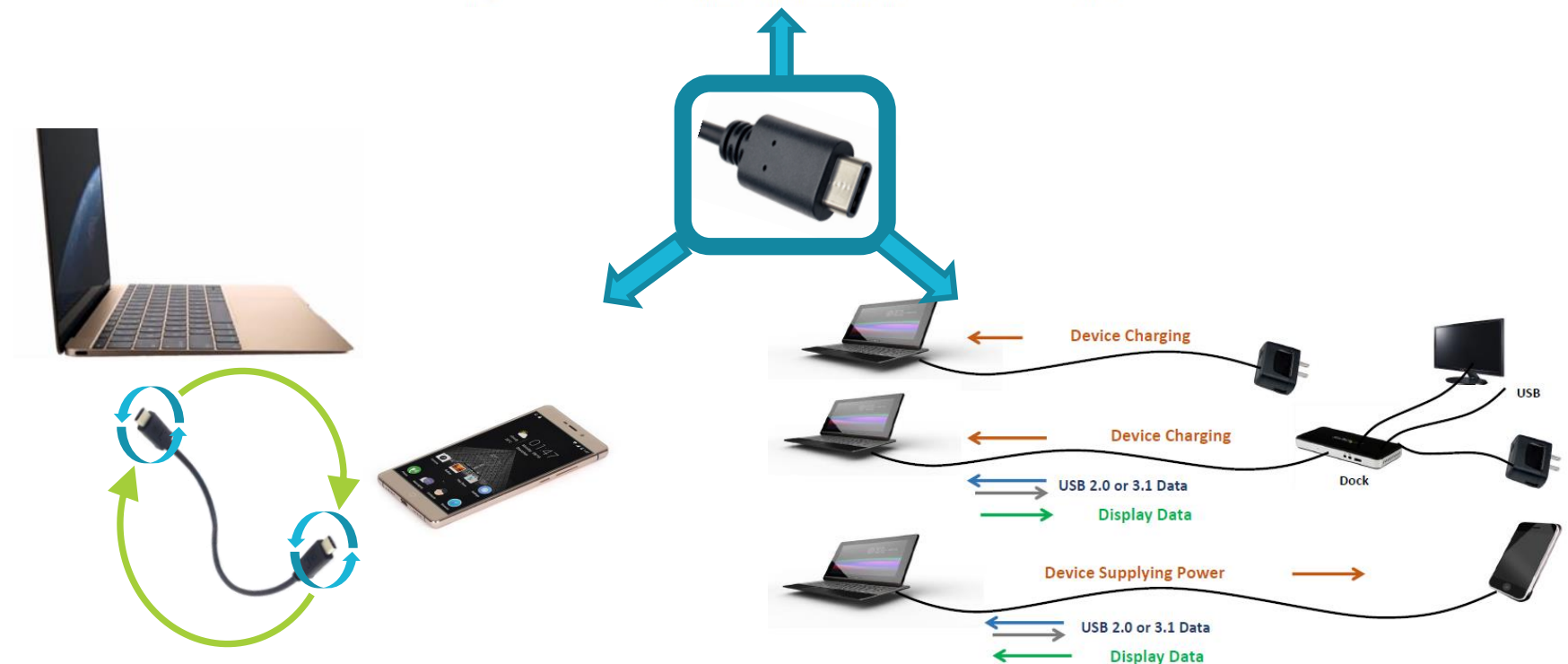
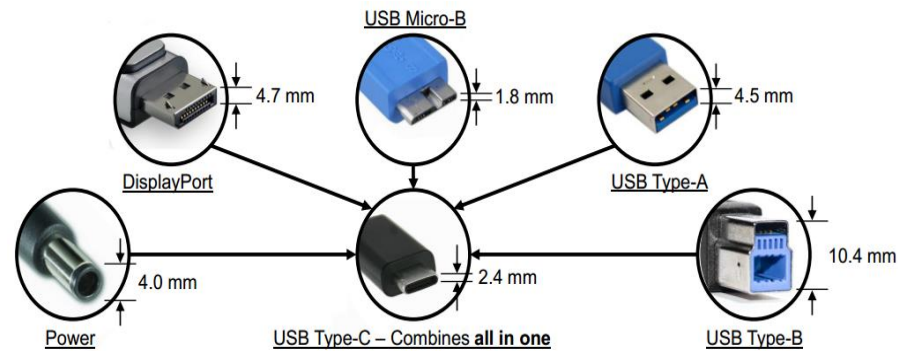
Why we need the Power Delivery?



Power increased to ~ 100W

Concept of universal charging being extended by IEC6302

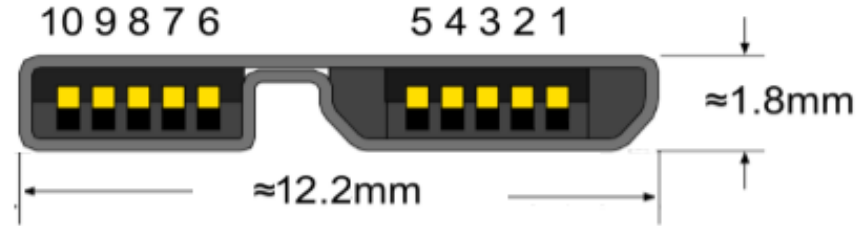
What is Type-C, why is it important?



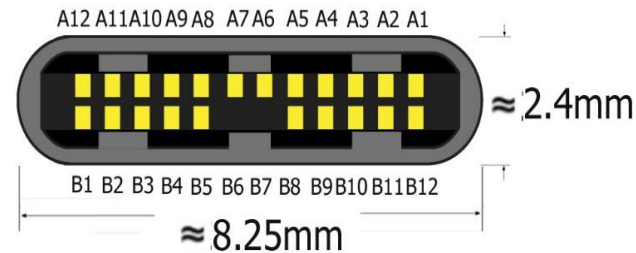
Type-C Comparison (*USB-C*)

- Rounded, reversible, flipable
- ~25% less width vs. μB
- Signaling

Micro B Plug



Type-C Plug

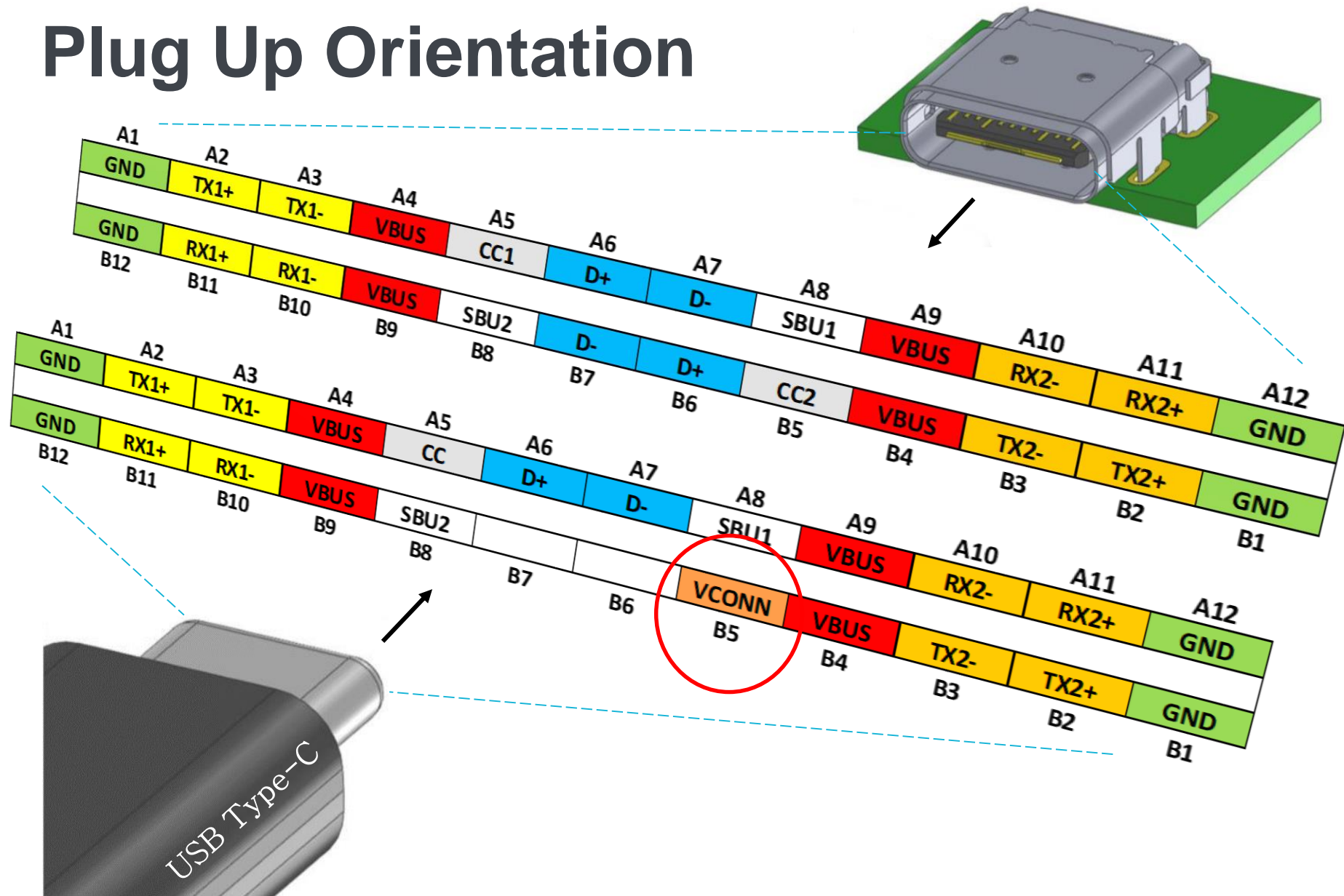


- Two SS differential pairs
- Vbus power
- Configuration Channel (CC)
- USB 2.0 differential pair

* New signals ◦ Sideband Use (SBU)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND	TX1+	TX1-	VBUS	CC	D+	D-	SBU1	VBUS	RX2-	RX2+	GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
GND	RX1+	RX1-	VBUS	SBU2			VCONN	VBUS	TX2-	TX2+	GND

Plug Up Orientation



USB Power Delivery offers the following features:

- **Increased power levels from existing USB standards** up to 100W.
- **Power direction is no longer fixed.** This enables the product with the power (Host or Peripheral) to provide the power.
- **Optimize power management across multiple peripherals** by allowing each device to take only the power it requires, and to get more power when required for a given application.
- **Intelligent and flexible system level management of power** via optional hub communication with the PC.
- **Allows low power cases** such as headsets to negotiate for only the power they require.

Architectural overview

The background of the slide is a solid dark blue. Overlaid on this are several abstract geometric shapes in various shades of blue and teal. These shapes include long, thin parallelograms and larger, more complex polygons. One prominent shape in the lower-left quadrant is filled with a fine, light-blue halftone dot pattern. The overall composition is modern and technical, with a strong sense of direction and structure.

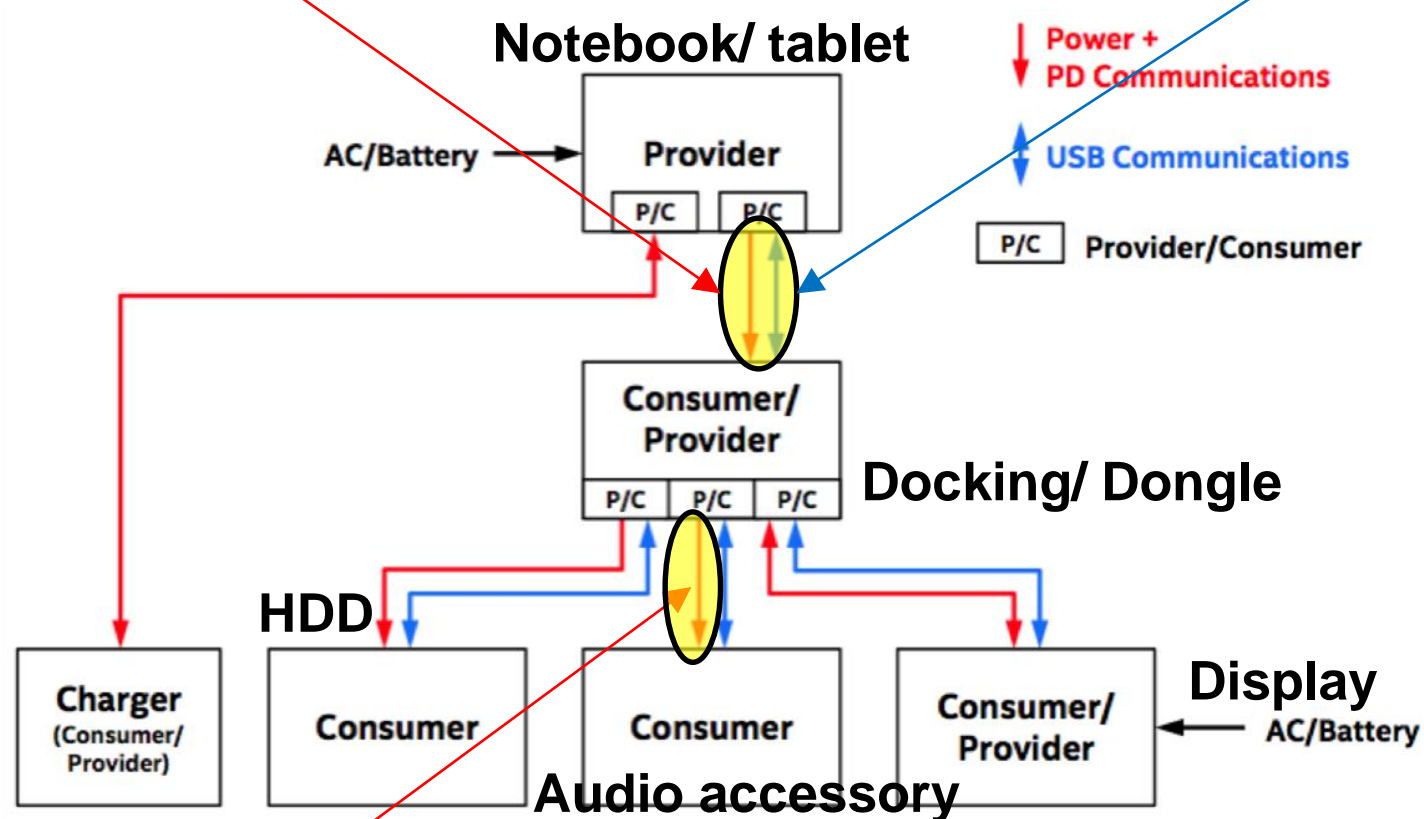
Terminology

- ***DFP (Downstream Facing Port) /UFP(Upstream Facing Port)***
 - Defines the Port's position in the USB topology
 - DFP is equivalent to Host, UFP is equivalent to Device
 - Does not require USB Communication Capability
- ***Source/ Sink***
 - Defines the power role the port is currently operating in
- ***Dual-Role Power Port***
 - Port can operate as either a Source or Sink
- ***Dual-Role Data Port***
 - Port can operate as either a DFP or a UFP

PD Topology

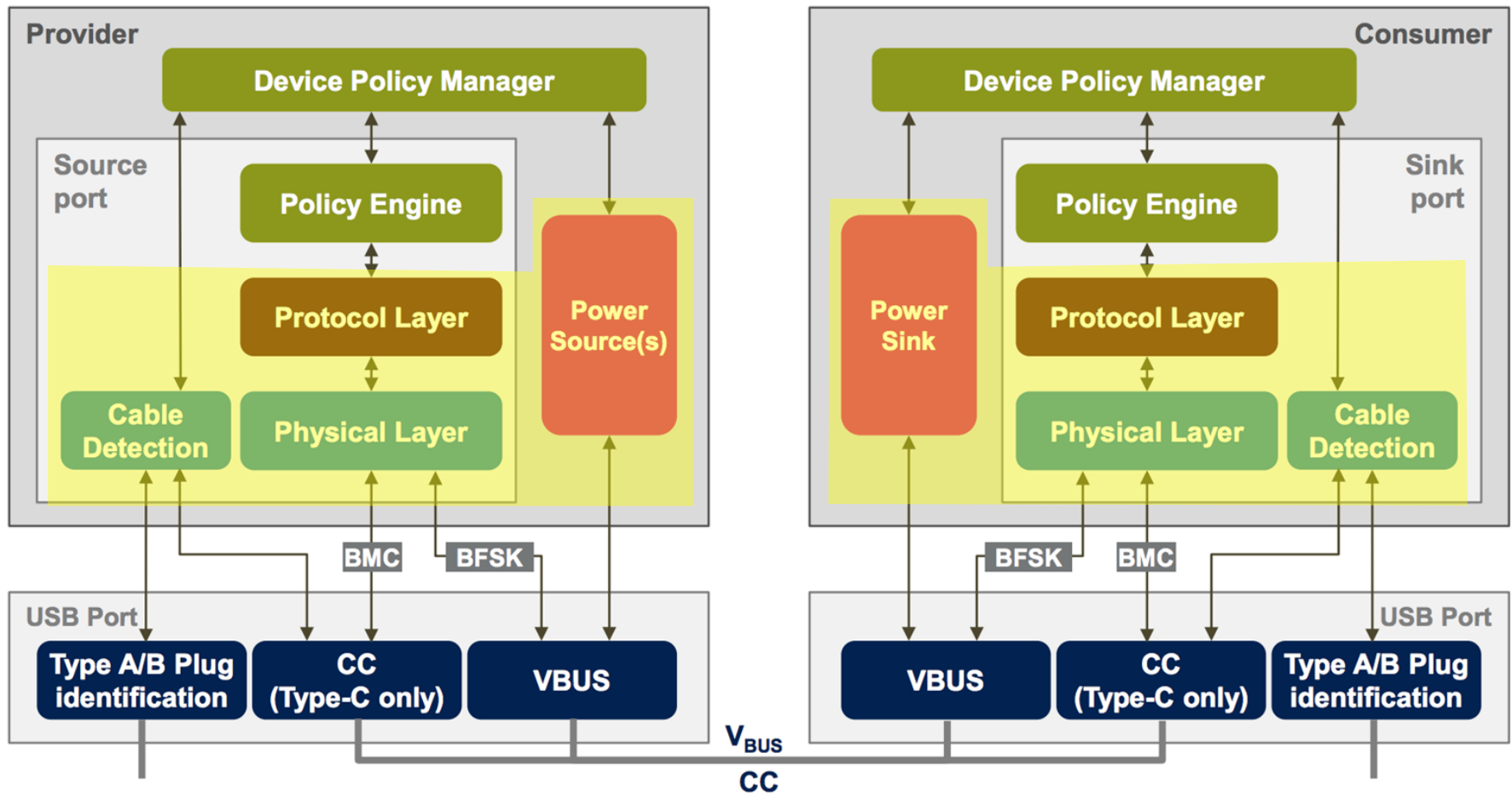
Power transmitted upstream or downstream as needed

System Level control via USB



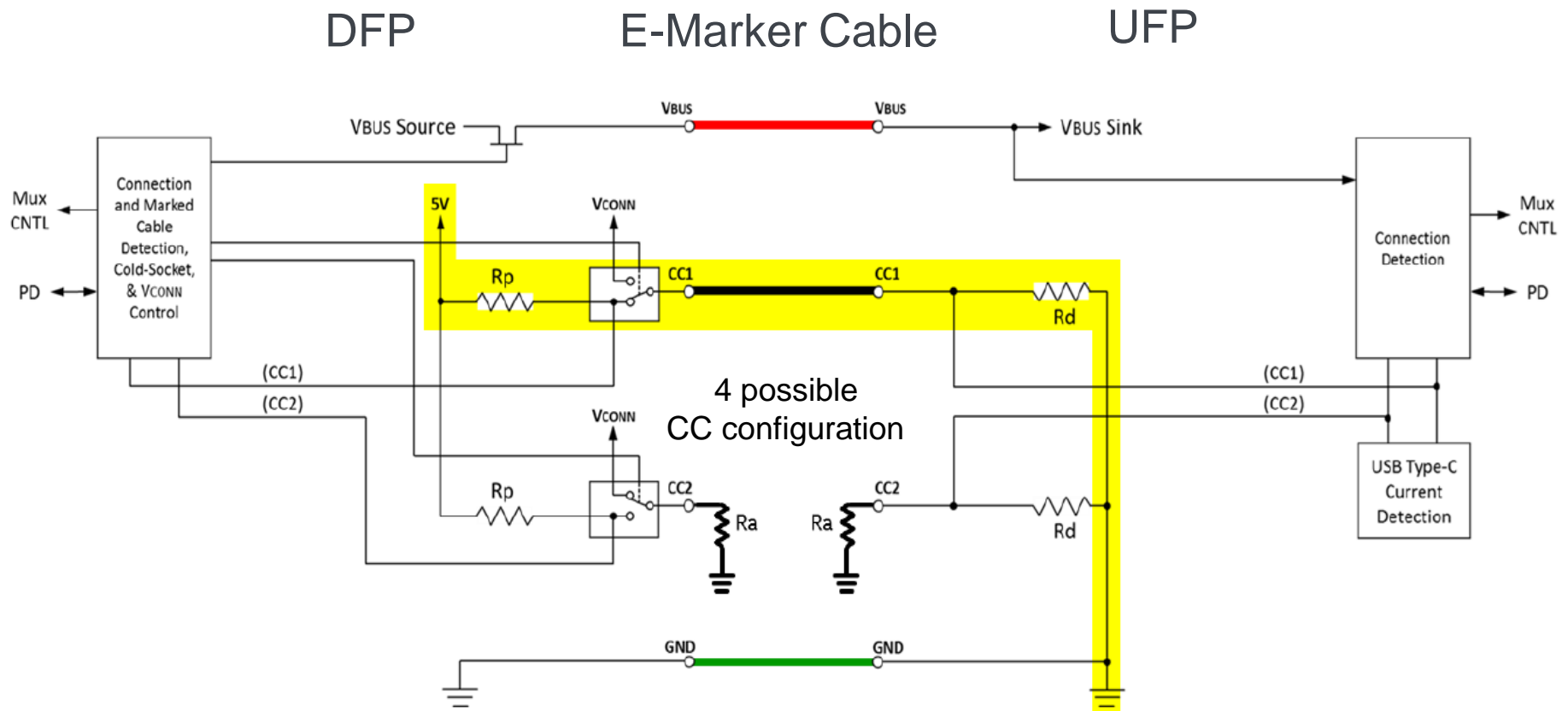
Port to port communication and negotiated power contract using PD communication

Overview



Communication across the channel uses Biphase Mark Coding (BMC) over CC in Type C connector

Pull-up/Pull down CC model



Host detects connect status

CC1	CC2	State	Position
Open	Open	Nothing connected	N/A
Rd	Open	UFP connected	①
Open	Rd	UFP connected	②
Open	Ra	Powered Cable/No UFP connected	①
Ra	Open	Powered Cable/No UFP connected	②
Rd	Ra	Powered Cable/UFP connected	①
Ra	Rd	Powered Cable/UFP connected	②
Rd	Rd	Debug Accessory Mode connected (Appendix B)	N/A
Ra	Ra	Audio Adapter Accessory Mode connected (Appendix A)	N/A

Power Rules

Table 10-2 Normative Voltages and Currents

PDP (W)	Current at 5V (A)	Current at 9V (A)	Current at 15V (A)	Current at 20V (A)
$0.5 \leq x \leq 15$	$x \div 5$			
$15 < x \leq 27$	3	$x \div 9$		
$27 < x \leq 45$	3	3	$x \div 15$	
$45 < x \leq 60$	3	3	3	$x \div 20$
$60 < x \leq 100$	3	3	3	$x \div 20^1$

¹ Requires a 5A cable.

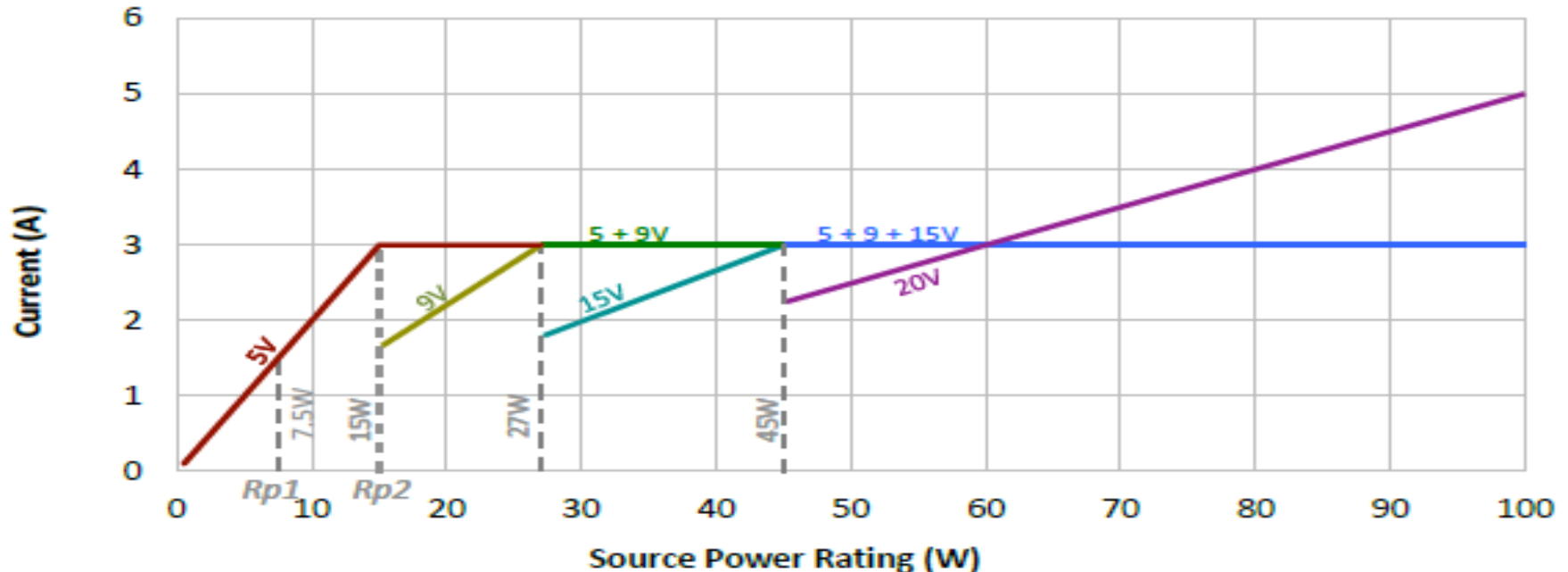


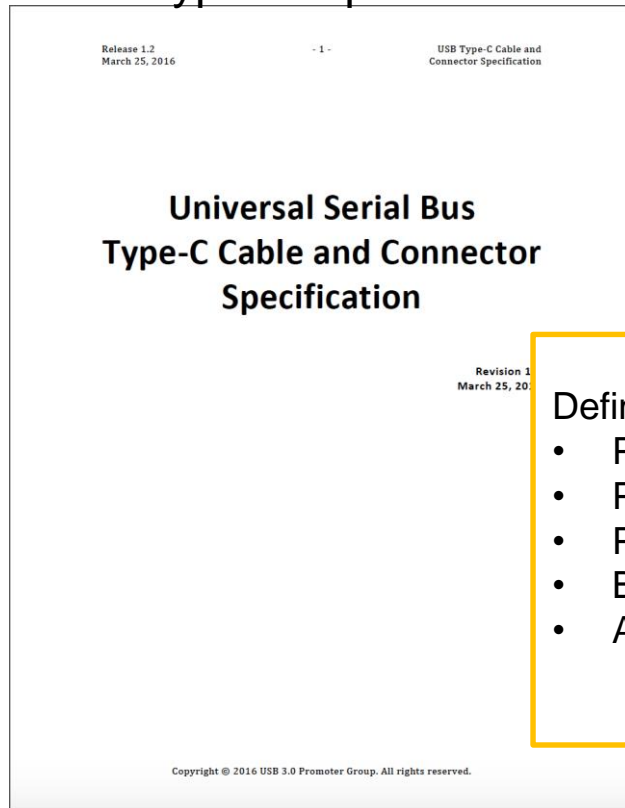
Figure 10-2 shows an example of an adapter with a rating at 50W. The adapter is required to support 20V at 2.5A, 15V at 3A, 9V at 3A and 5V at 3A.

Specifications relevant to Type-C

The background of the slide is a solid dark blue. Overlaid on this are several diagonal stripes in a lighter blue and teal color, running from the bottom left towards the top right. One of these stripes, located in the lower-left quadrant, features a fine halftone dot pattern. The overall aesthetic is modern and technical.

USB specifications

USB Type-C Spec



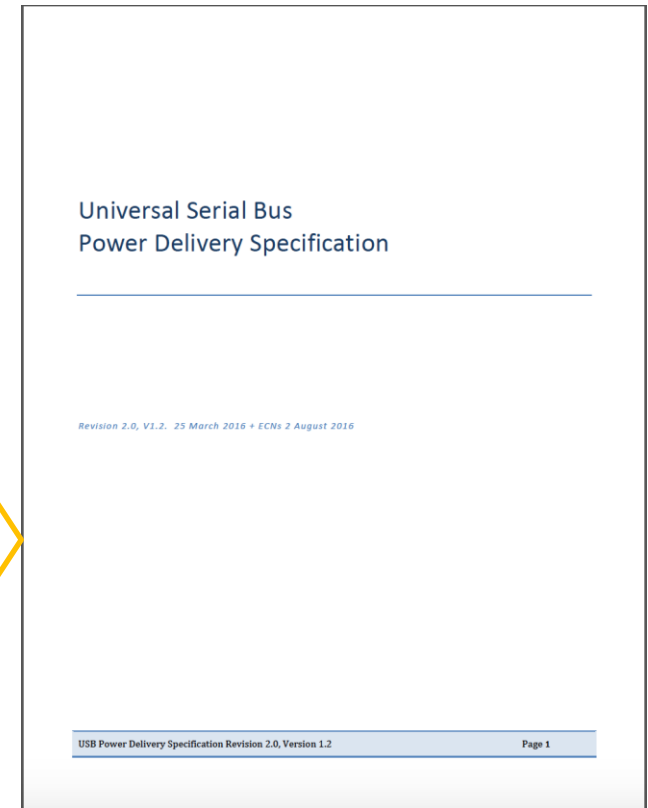
Defines:

- Mechanical
- Electrical
- Active Cable
- Alternate mode

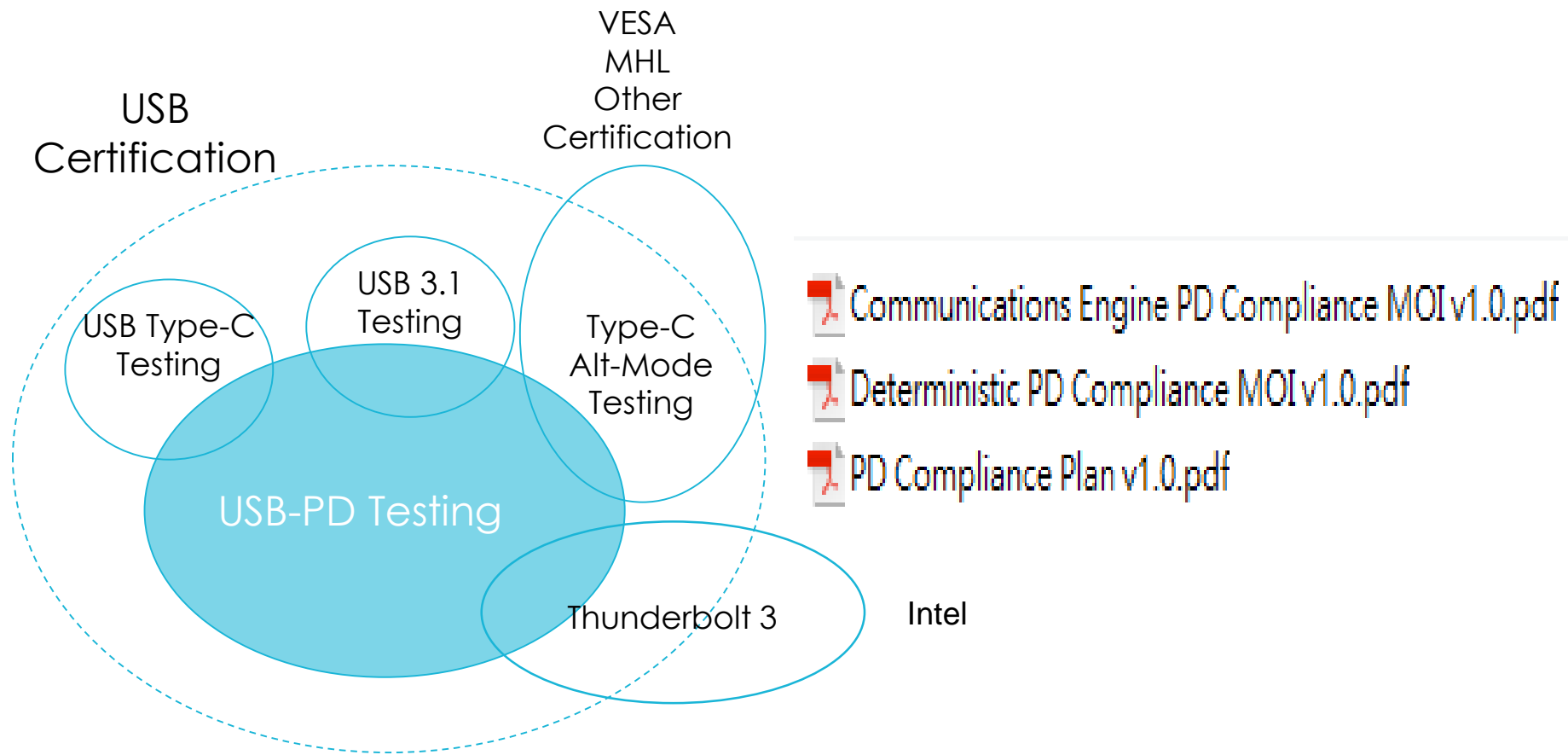
Defines:

- PD Discovery
- PD Negotiation
- PD Power Role Swap
- BMC Signaling
- Alternate mode

Power Delivery 2.0 Spec

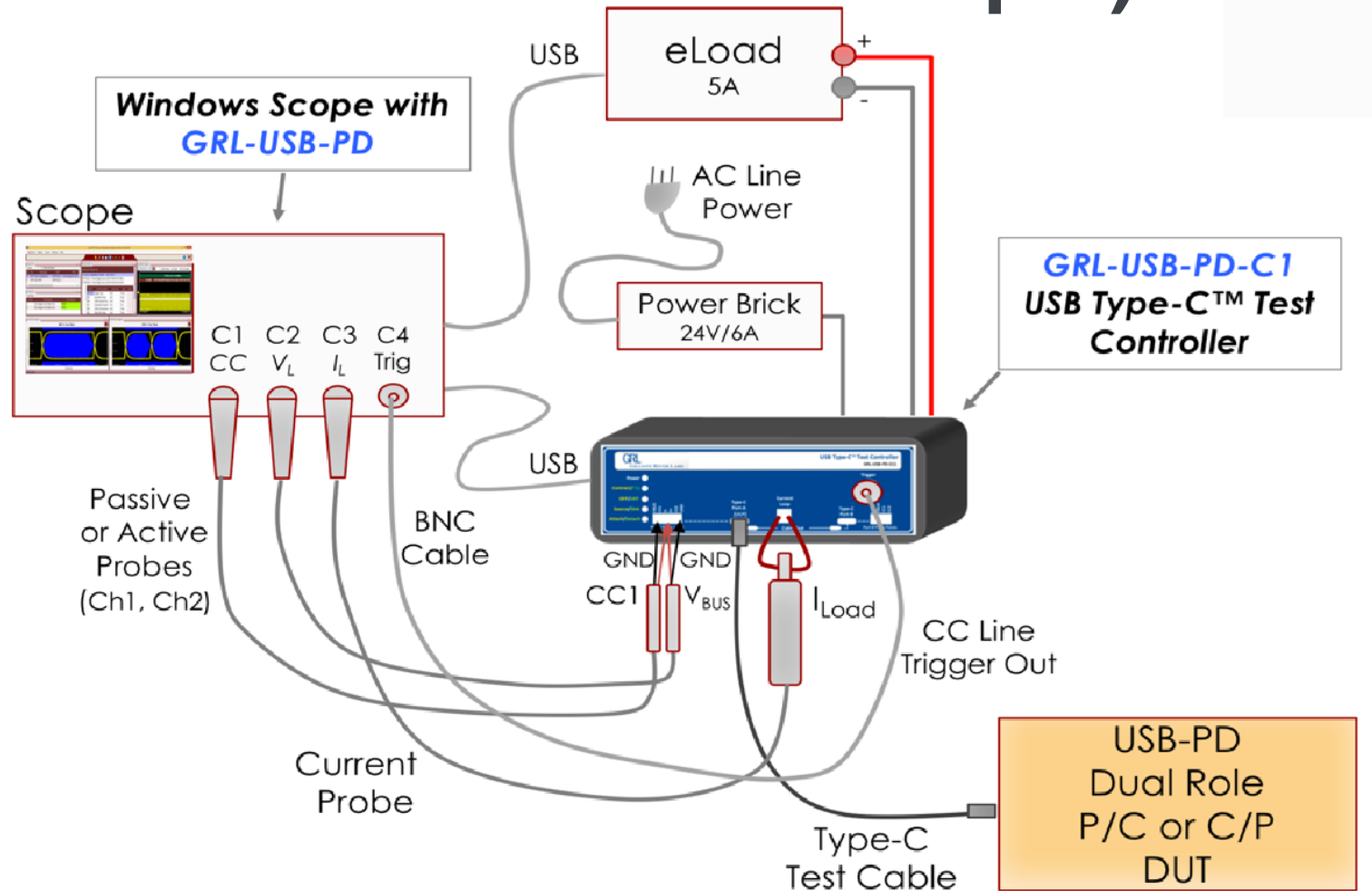


USB-PD & DisplayPort Specification & CTS Overlap



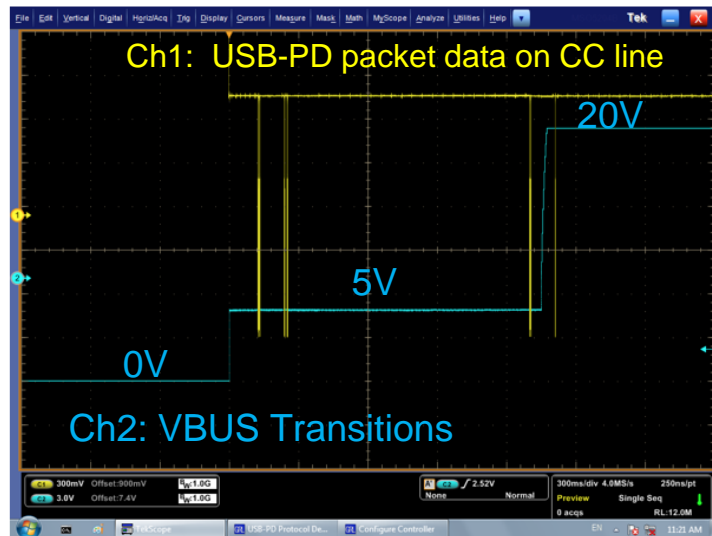
Power Delivery 2.0 Test Solution

Confirm Test Setup (Provider/Consumer Example)



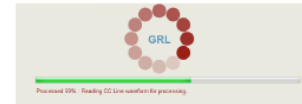
Run Test

Scope Acquisition

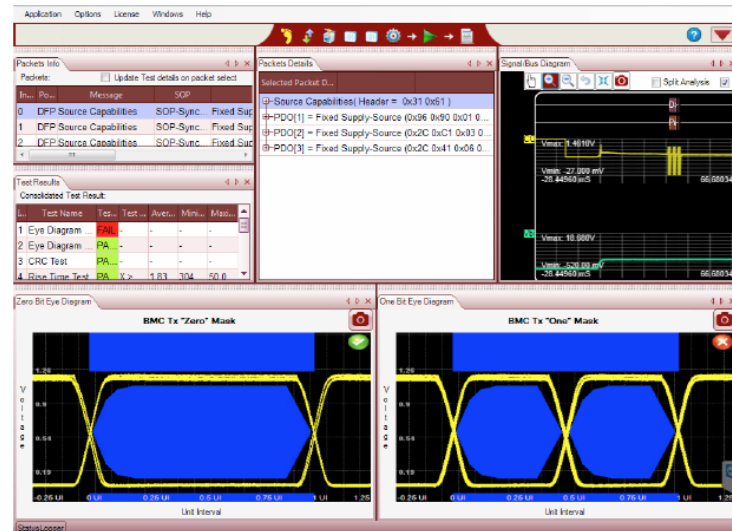


- Tests can be run on live or saved waveforms
- Waveforms from all tests are saved for future analysis

Press
Run

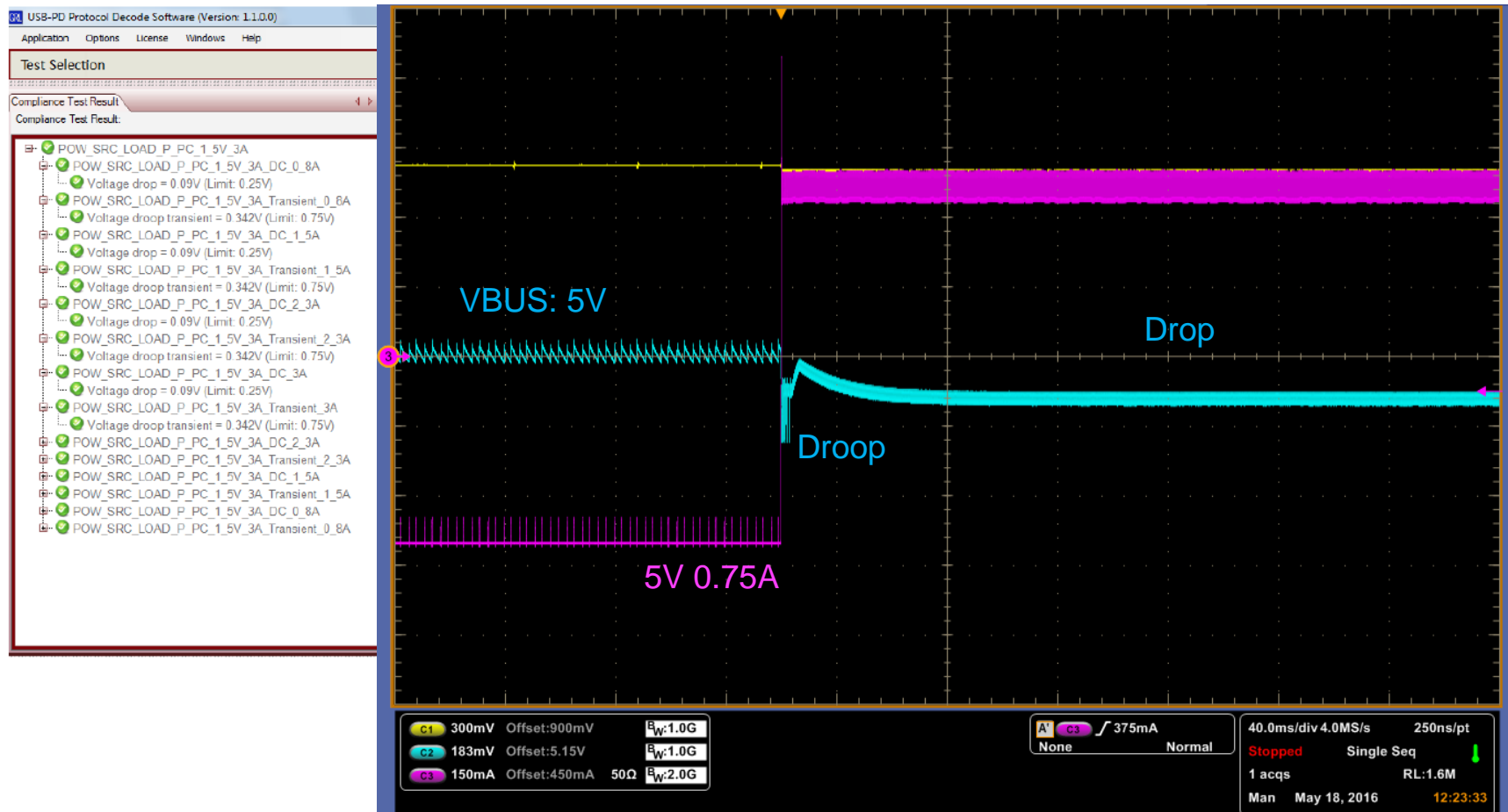


Results 'Dashboard'



GRL-USB-PD Software

Run Tests – Power Load Tests



View Power Provider Test Results

'Dashboard' View

Compliance Results

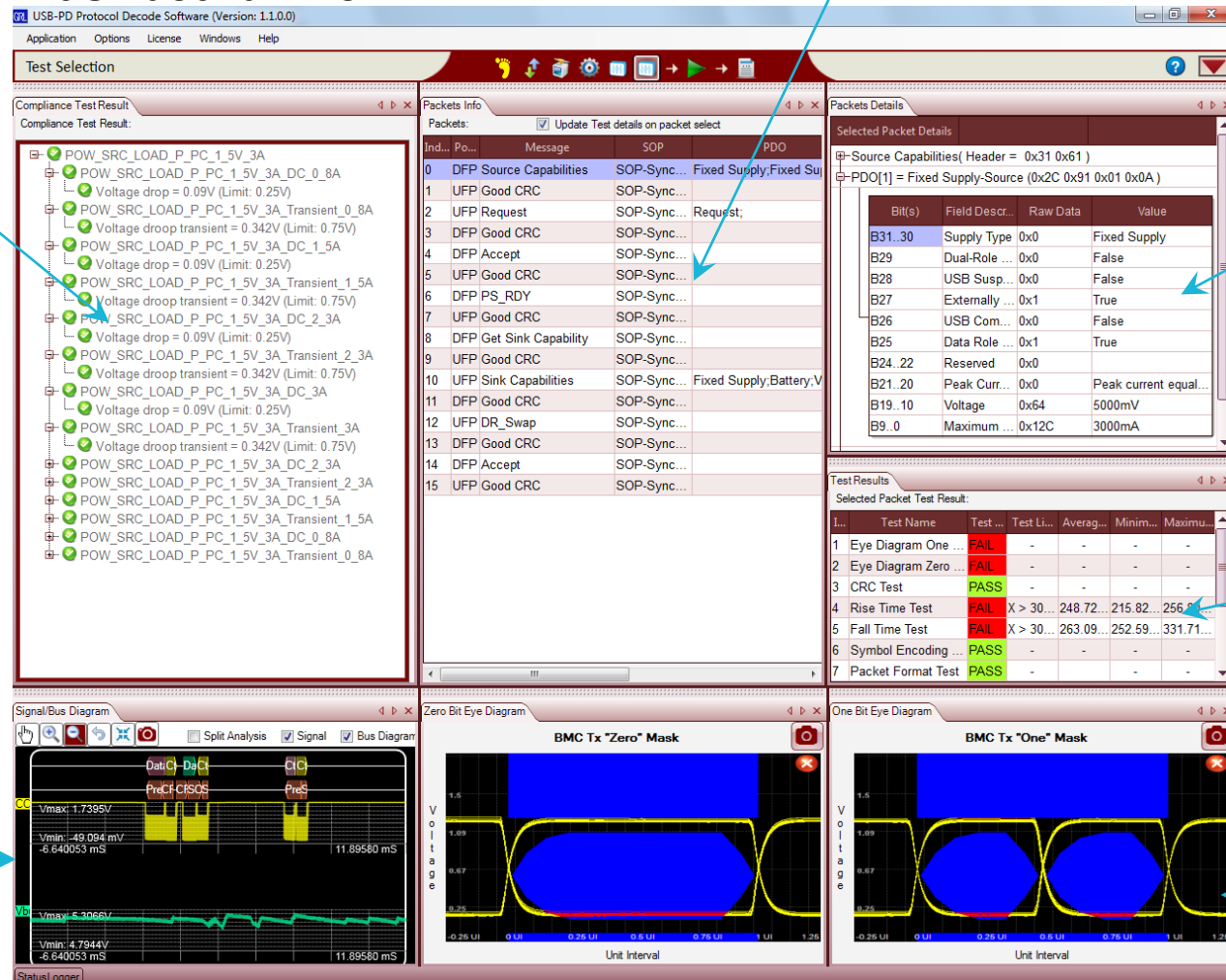
Packet Info

Packet Details

BMC Electrical Meas

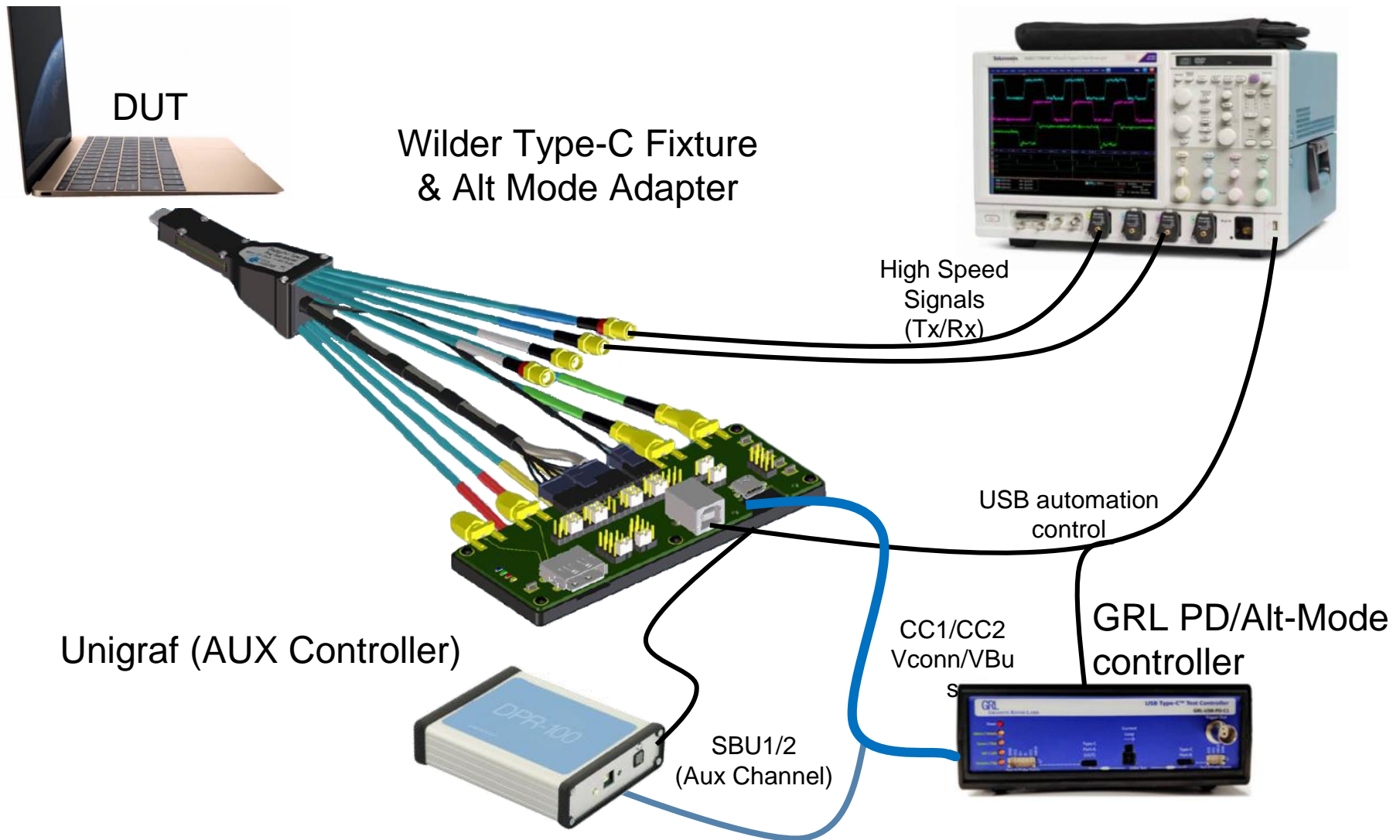
BMC Eye

SignalBus Timing



Alternate Mode Test solution

DP over Type-C test solution



Summary

Complete USB-PD Compliance Solution

- **Required Equipment List**

- DPO5000 Series Scopes and above
- 2ea. Passive Probes for CC and VBUS
- 1ea. TCP-2020A Current Probe for Load Current
- Keithley eLoad & Power Supplies:
 - 1 ea – Keithley 2380 DC E-Load
 - 1 ea – Keithley 2280S-32-6 (32V/6A) <option>
- GRL-USB-PD Power Delivery SW & controller
- Download Data Sheet and Demo SW, MOI
 - www.graniteriverlabs.com/usb-pd/

TekScope DPO5000 Series



Keithley 2380



GRL-USB-PD-C1



TCP-2020A