

### USB 3.2 Type-C to SMA Breakout Board

#### FEATURES

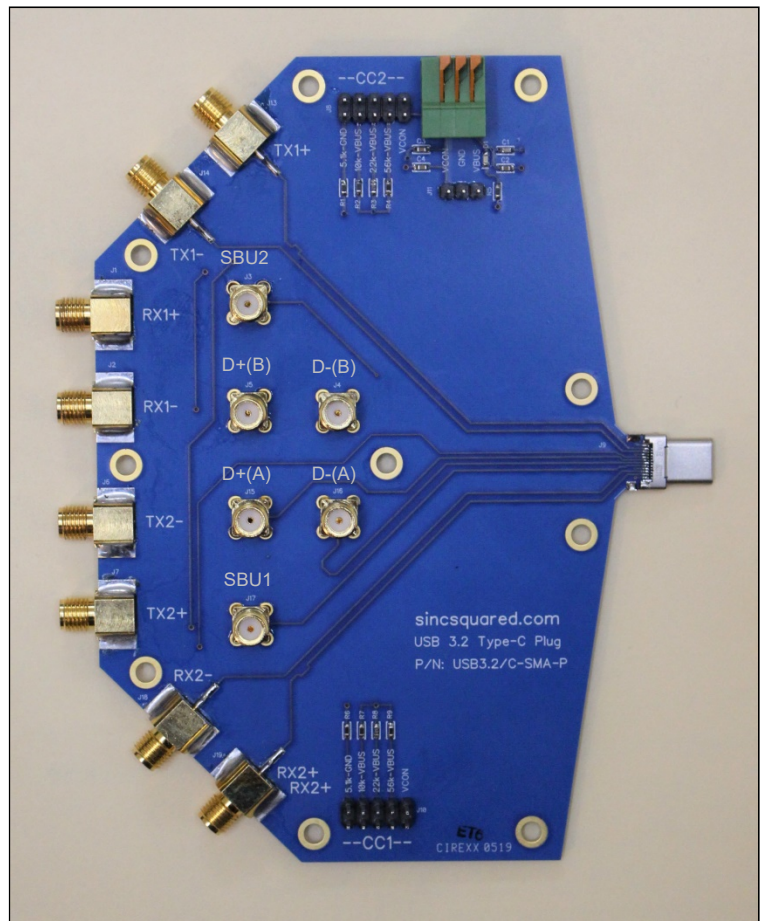
- Full-Featured USB-3.2 Enhanced Superspeed Gen 2x2 test board
- USB Type-C plug or receptacle connectors
- 20 GHz SMA connectors on TX/RX lanes
- Rogers 4350 low-loss dielectric rated at less than 1dB insertion loss up to 30 GHz
- Single-Ended (non-coupled) 50  $\Omega$  microstrip transmission lines
- High-speed D+/- and SBU1/SBU2 connections
- VBUS, VCONN, and CC1/CC2 connections with on-board Rp/Rd termination options

#### APPLICATIONS

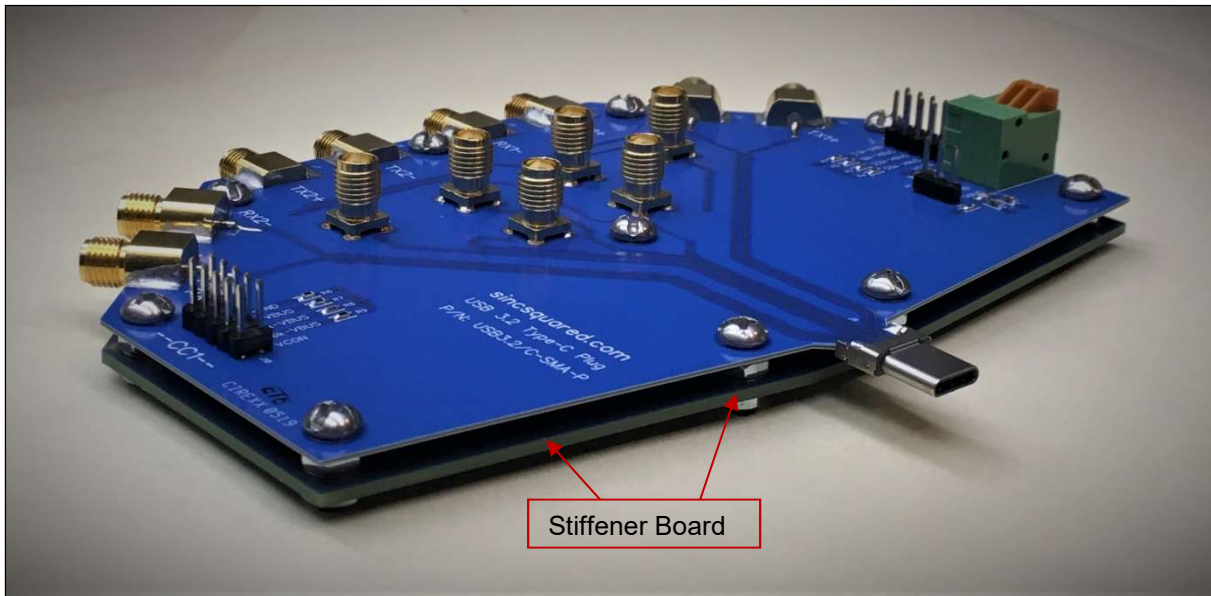
- Test/Verification of USB 3.2 host or device
- Testing of all USB Type-C cable types
- Monitor/Debug all aspects of USB 3.2 link during operation
- Test/Debug USB Type-C alternate modes, such as DisplayPort, Digital Audio, Audio Adapter, and Debug Accessory Mode

#### DESCRIPTION

The SS-USB3.2C-SMA breakout board is designed to test everything USB, from USB-2.0 up through dual-lane USB-3.2. It incorporates a standards compliant USB Type-C connector (plug or receptacle boards are available) on one end of the printed circuit board and 20 GHz SMA connectors on the other end of the board. High-speed transmit and receive signals are routed to the SMA connectors via 50-ohm microstrip transmission lines over Rogers RO4350 low-loss dielectric for excellent signal integrity at frequencies up to 30 GHz. All USB Type-C connector pins (both A and B sides) are routed to individual connectors, including USB-2.0 D+/-, Sideband Use (SBU1/SBU2), and Configuration Channel (CC1/CC2). On-board CC1 and CC2 jumper connections are provided for all valid Rp and Rd terminations as well as VCONN. A spring-loaded terminal block is provided for easy connection to external VBUS, Ground, and VCONN. Conveniently placed mounting holes provide mechanical strength when attached to the separate base-board stiffener.



**SS-USB3.2/C-SMA-P:** USB-3.2 Type-C to SMA Breakout Board



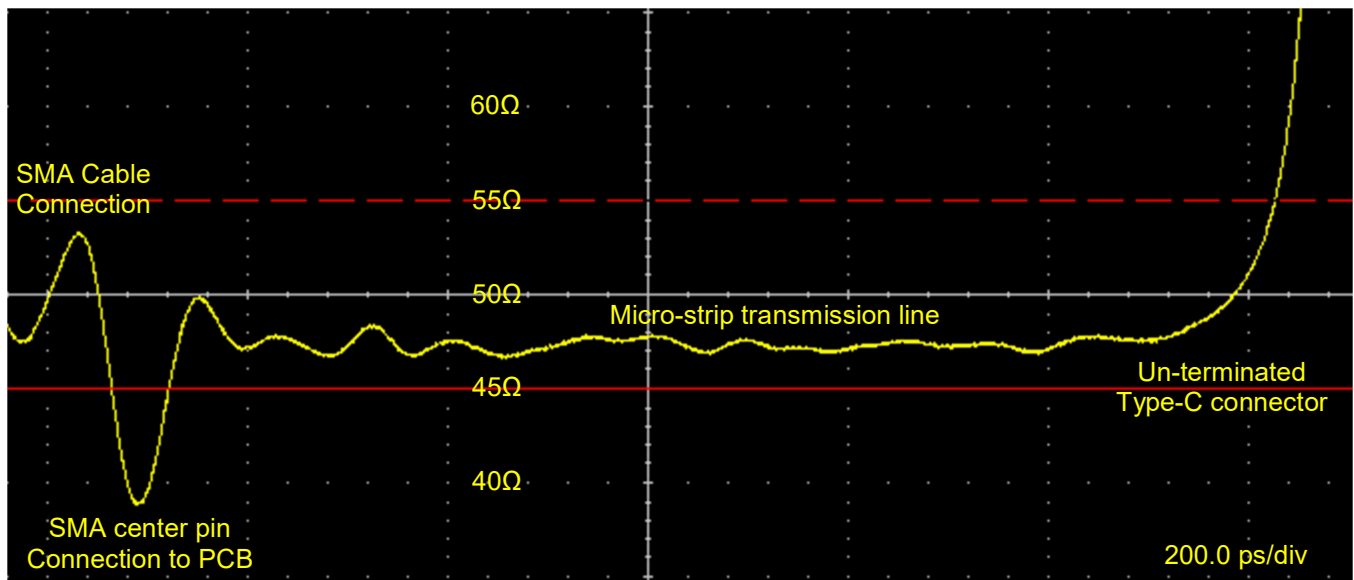
**SS-USB3.2/C-SMA-P:** USB-3.2 Type-C to SMA Breakout Board mounted to Stiffener

### Ordering Information

Part Number	Description	USB-3.2 Connector	Thickness
SS-USB3.2/C-SMA-P	USB-3.2 Type-C to SMA Breakout Board	Type-C Plug	0.8mm (main board) + 1.6mm external stiffener*
SS-USB3.2/C-SMA-R	USB-3.2 Type-C to SMA Breakout Board	Type-C Receptacle	1.6mm

\* Main board thickness is constrained to 0.8 mm in order to accommodate Type-C plug connector. For added mechanical strength, a 1.6mm FR-4 “stiffener” board with identical mounting hole pattern (included) can be attached with 6-32 screws and short stand-offs.

### Transmission Line TDR Measurements



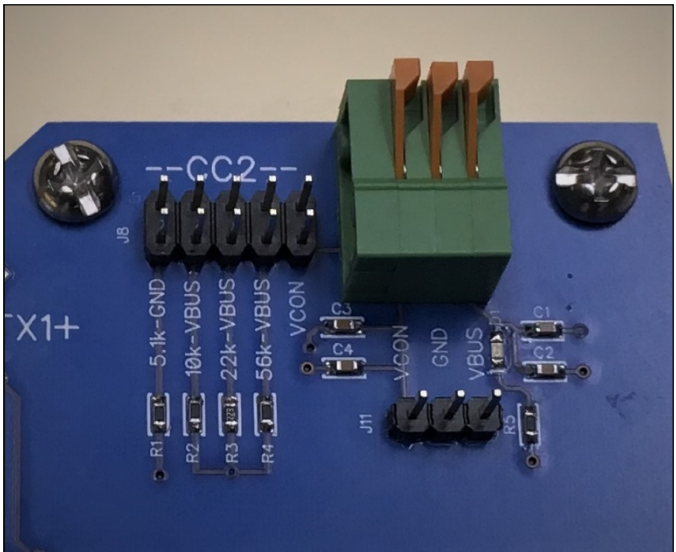
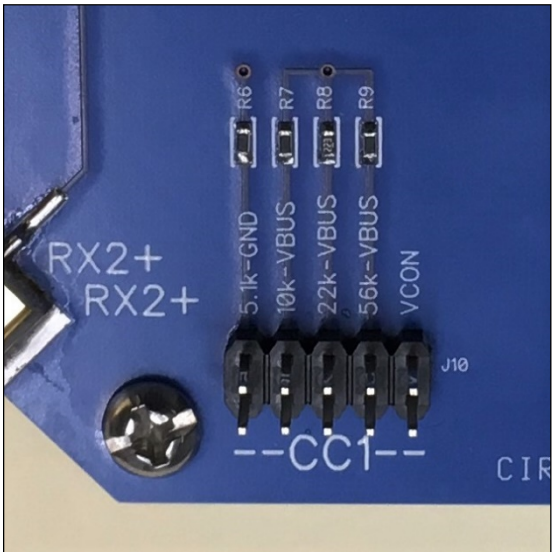
**TDR - Edge-mount SMA to Type-C plug**

TECHNICAL INFORMATION

**Length Matching** – All microstrip transmission line pairs are length matched to within +/- 0.001 inch (0.025 mm).

**Single-Ended (Non-Coupled)** – All microstrip transmission lines are routed as single-ended 50-ohm lines that are spaced far enough apart to minimize differential coupling between pairs. This enables device/cable testing that is single-ended (one line at a time) or differential.

**Configuration Channel (CC1, CC2) Connections** – The two configuration channels (CC1 and CC2) are routed to on-board 0.1 inch headers, enabling jumpers to be placed for various different terminations.



CC1 and CC2 Termination Jumpers

Configuration Channel Jumper Settings

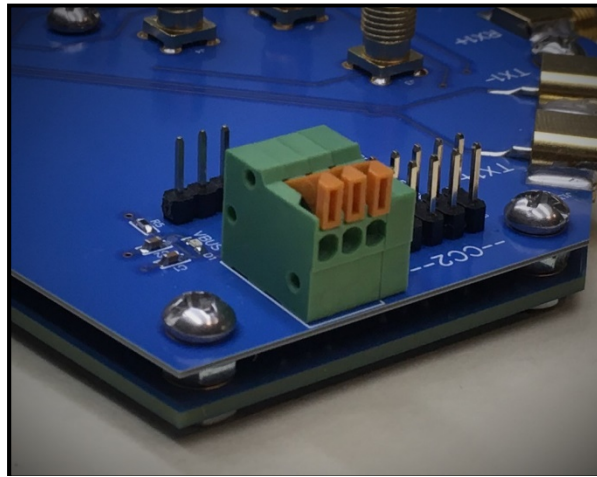
Acting as Device or Host?	CC1 Jumper Position	CC2 Jumper Position	USB 3.2 Type-C Functionality
Host	10k ohms to VBUS	VCONN	TX1 & RX1 active, 3.0 Amps @ 5V available
Host	22k ohms to VBUS	VCONN	TX1 & RX1 active, 1.5 Amps @ 5V available
Host	56k ohms to VBUS	VCONN	TX1 & RX1 active, Default USB Power
Host	VCONN	10k ohms to VBUS	TX2 & RX2 active, 3.0 Amps @ 5V available
Host	VCONN	22k ohms to VBUS	TX2 & RX2 active, 1.5 Amps @ 5V available
Host	VCONN	56k ohms to VBUS	TX2 & RX2 active, Default USB Power
Device	5.1k ohms to ground	Open (connected by host to VCONN)	TX1 & RX1 active
Device	Open (connected by host to VCONN)	5.1k ohms to ground	TX2 & RX2 active

USB Type-C Connector Pin-Out – Front view.

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	Top Side
GND	TX1+	TX1-	VBUS	CC1	D+	D-	SBU1	VBUS	RX2-	RX2+	GND	
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	Bottom Side
GND	RX1+	RX1-	VBUS	SBU2	D-	D+	CC2	VBUS	TX2-	TX2+	GND	



**External VBUS and VCONN Connections** – A spring loaded terminal block enables simple connections to external VBUS, VCONN, and Ground wires. Lift the brown lever up to disengage the spring tension for inserting or removing the wire. Release the lever to clamp the wire in place.



**Terminal block for external VBUS, VCONN, and Ground Connections**

**Stiffener Board** – The USB-C **plug** connector straddles the board edge with connections on the top and bottom sides of the printed circuit board. Commercially available connectors are not available for board thickness greater than 0.8mm (31 mil). SMA cable connections along with the inherent weight of the printed circuit board and its components can cause excessive flex of the 0.8mm thick board. For this reason, a standard 1.6mm (62 mil) FR-4 “stiffener” board is provided (see photo on page 2). The stiffener board can be optionally attached/detached with standard 6-32 screws and nuts. **Caution:** There remains a point of potential weakness at the narrow “neck” of the board near the USB-C connector. Care must be taken to ensure sufficient support in order to prevent damaging strain at this point.

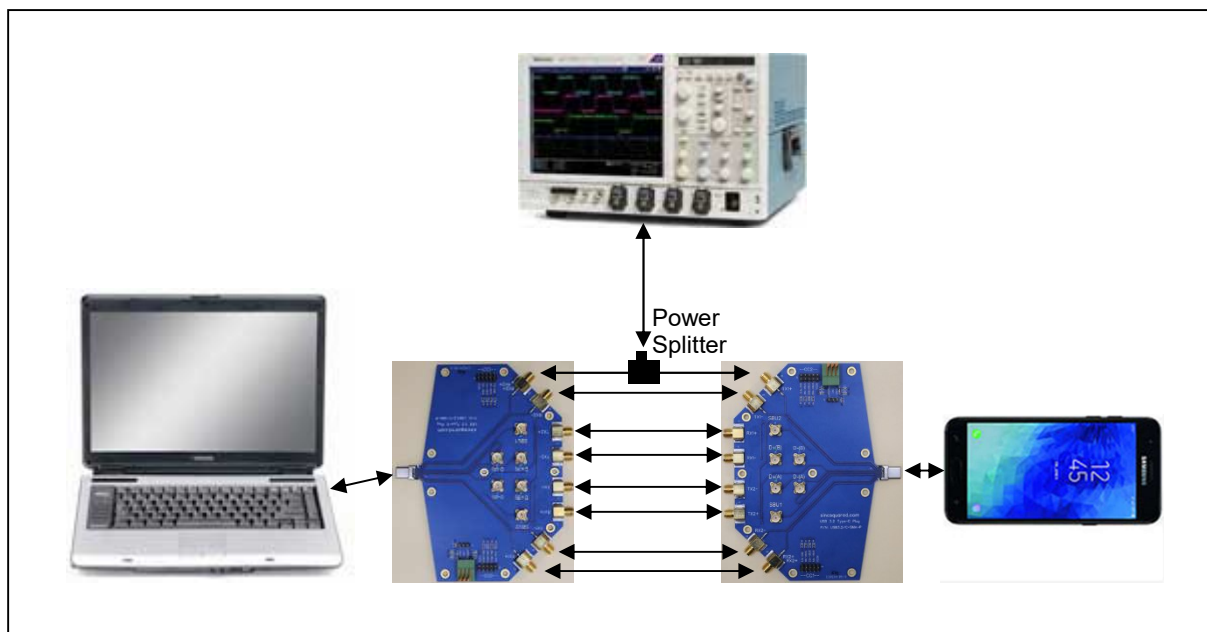
Note that the USB-C **receptacle** connector attaches only to the top side of the board and therefore does not constrain the board thickness. For this reason, the receptacle version of the board is 1.8mm (62 mil) thick and is not supplied with the “stiffener” board.

**USB-2.0 D+/D- Connections** – Separate USB-2.0 D+ and D- connections are provided to both the top (A-side) and bottom (B-side) of the USB Type-C connector. In normal operation, only one of the USB-2.0 D+/D- pairs will be used at a time. Connections are made via high-speed 50-ohm length-matched microstrip lines to vertical mount SMA connectors.

## APPLICATION INFORMATION

**Host or Device?** – Both the plug and receptacle versions of the board can act as host or device. This role is primarily determined by proper setting of the configuration channel (CC1 and CC2) terminations. See table above for guidance on settings.

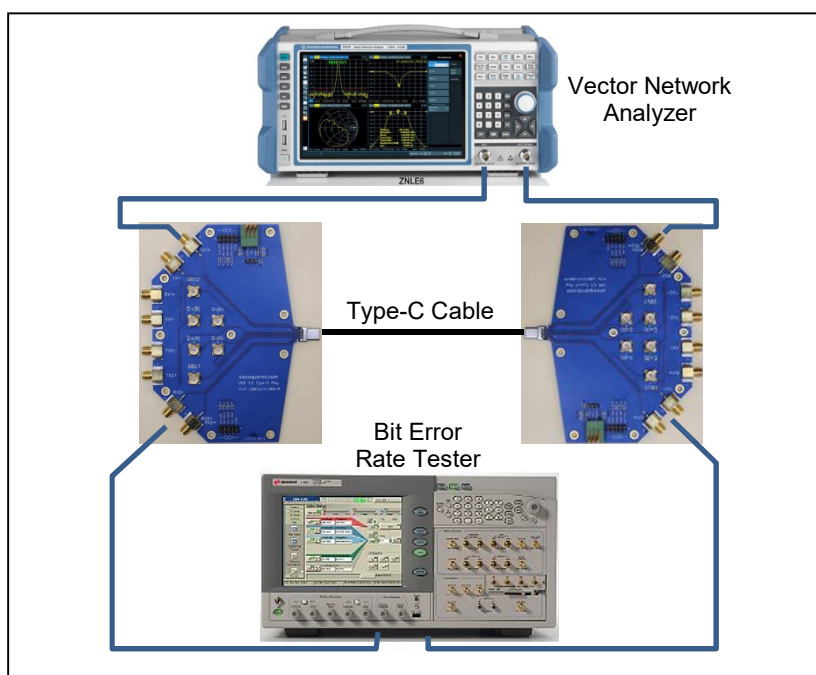
**Live USB 3.2 Link Monitoring** – Two of the USB 3.2 breakout boards can be connected back to back using SMA cables for all of the high-speed links and jumper wires for the control channels (CC1/CC2). In this manner a live link can be established between a host and device where all of the signals are passing through individual cables. The activity on any of the lines can be “snooped” (displayed) on an oscilloscope to observe the signaling while the link is live.



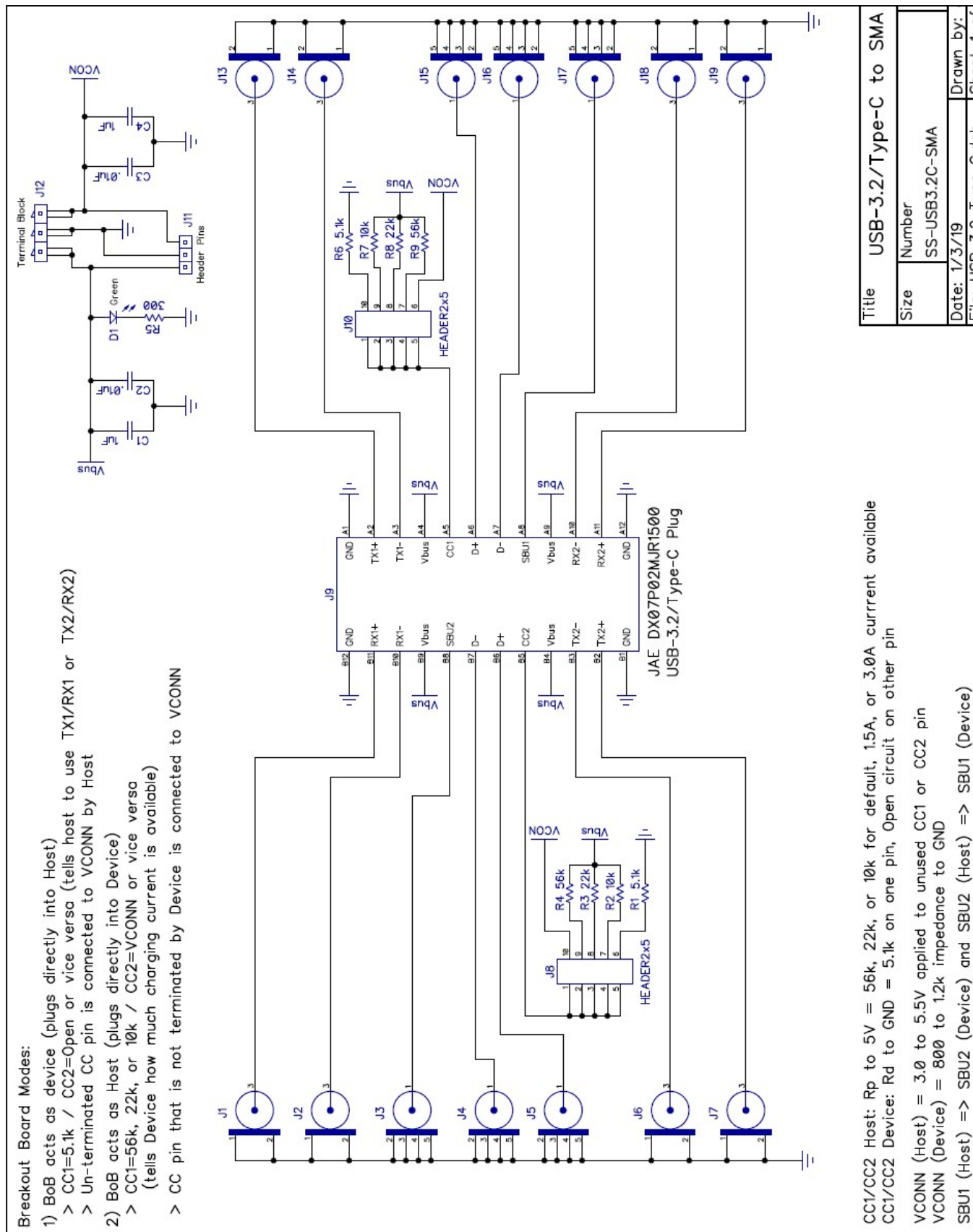
Setup for monitoring a live link between a host and device

**Re-Driver/Equalizer Testing** – Similar to the figure above a device such as an active cable equalizer or re-driver can be placed between the two USB-3.2 breakout boards and connected with SMA cables. This can be very useful for testing/debugging.

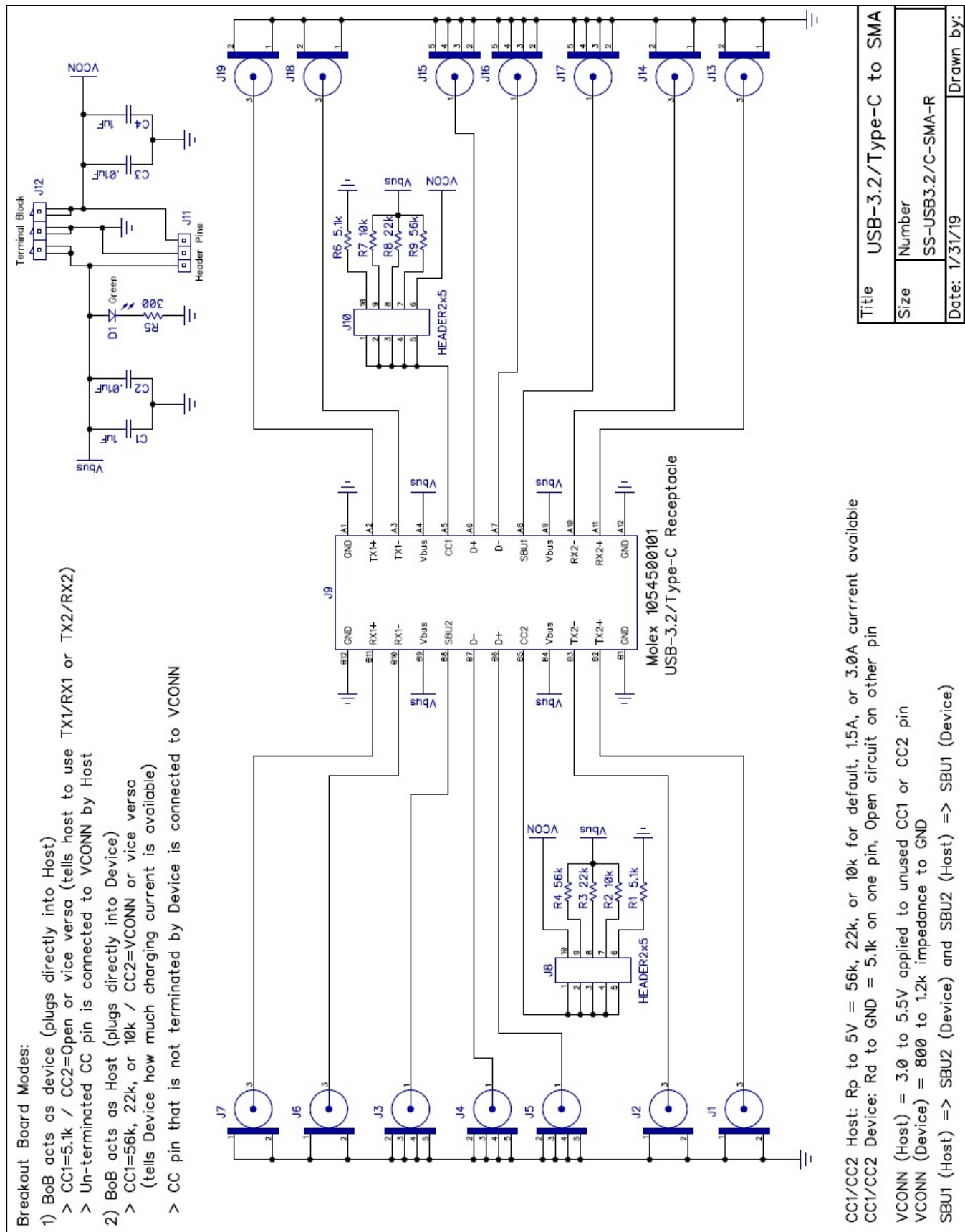
**Type-C Cable Testing** – The USB 3.2 breakout boards can be used for a variety of Type-C cable tests, including S-parameters with a Vector Network Analyzer (VNA), Bit Error Ration Testing (BERT), Time Domain Reflectometry (TDR), etc.



Type-C cable testing examples



Schematic Diagram: SS-USB3.2/C-SMA-P (USB 3.2 Type-C Plug Connector)



Schematic Diagram: SS-USB3.2/C-SMA-R (USB 3.2 Type-C Receptacle Connector)