

**SFF-8431/8436 – SFP+
QSFP+ Compliance and
Debug Solution — SFP+
QSFP+ TX**

**SFF-8431 – SFP+ QSFP+ Measurements & Setup
Library Methods Of Implementation (MOI) for
Verification, Debug, Characterization, Conformance
Test.**



Compatibility

Following Tektronix oscilloscopes are supported for SFP+ QSFP+ TX:

- DPO/DSA/MSO71604C and DPO/DSA/MSO72004C Series Digital Oscilloscopes
- DPO/DSA72504D and DPO/DSA73304D Series Digital Oscilloscopes

Minimum system requirements

The following is the minimum system requirements to run SFP+ QSFP+ TX option:

- Tektronix Oscilloscopes (models compatible with SFP+ QSFP+ TX)
- DPOJET, Jitter and Eye Diagram Analysis Tool (version 6.0.1 or later)
- TWDPc is available only on Oscilloscopes having a bandwidth ≥ 16 GHz on C or D models (DPO/DSA/MSO 71604C/72004C/72504D/73304D) only (Having Sample Rate of 100GS/s).

Licensing

Activate the license using the option installation wizard on the oscilloscope. Follow these steps to activate the TekExpress SFP QSFP+ TX license:

- From the oscilloscope menu bar, click Utilities→Option Installation. The TekScope Option Installation wizard opens. (refer [Figure 1a](#))
- Instructions for using the Options Installation window to activate licenses for installed applications are provided in the oscilloscope online help. Press the F1 key on the oscilloscope keyboard to open the Option Installation help topic. Follow the directions in the topic to activate the license.

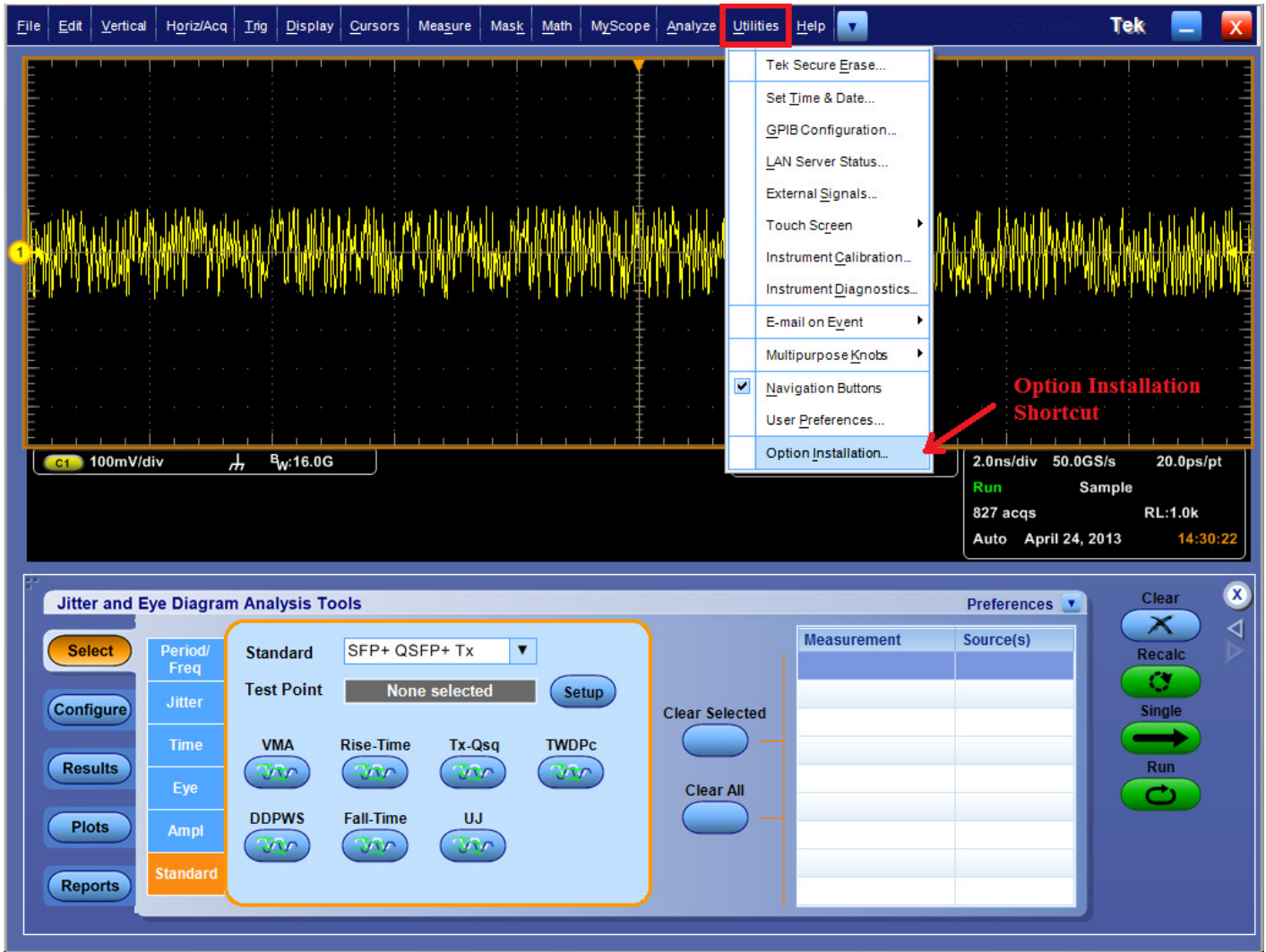


Figure 1a. Option Installation Procedure

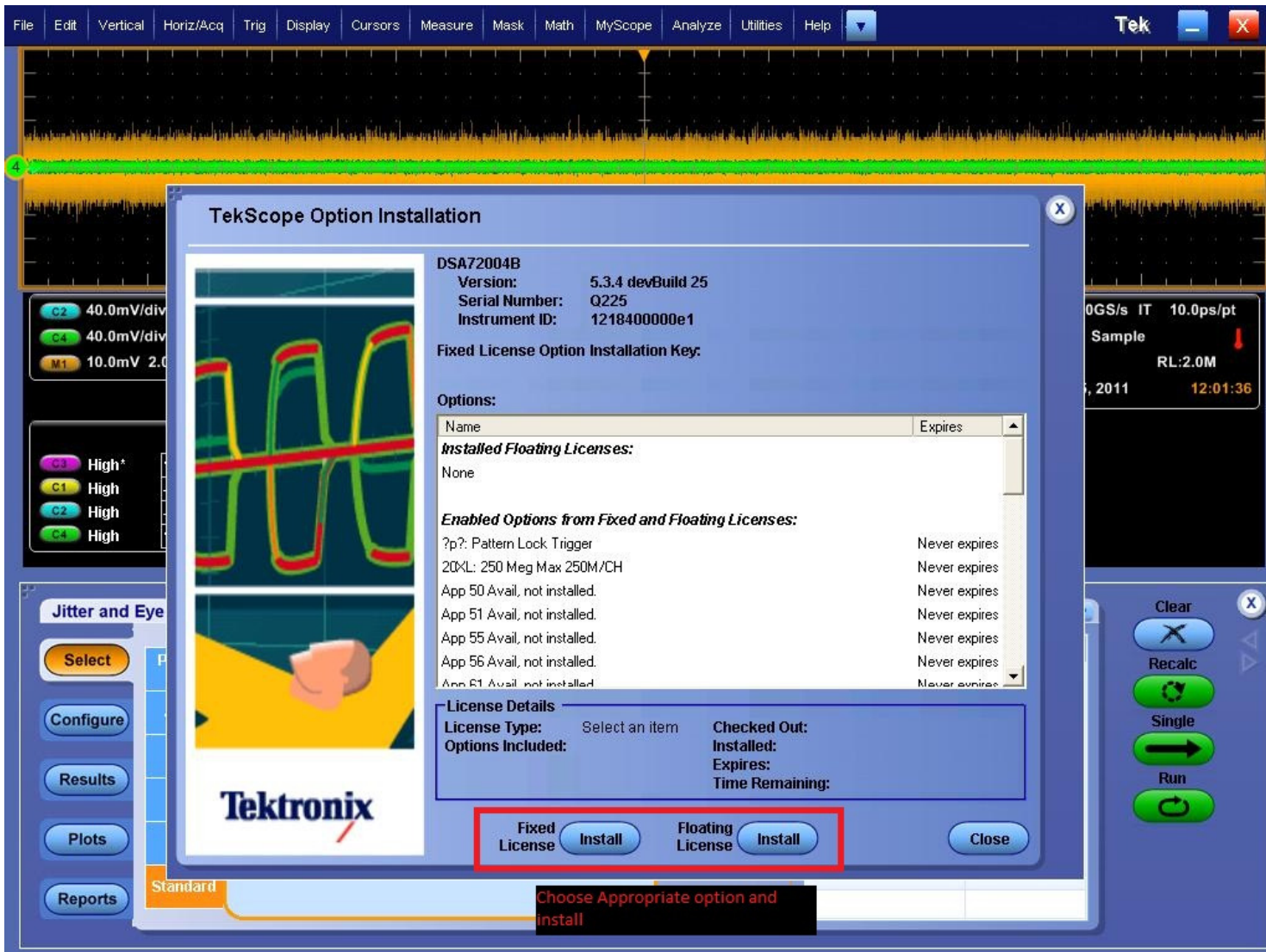


Figure 1b. Option Installation Procedure

List of Setup Files available

The following is the list of setup files available:

- SFP+ QSFP+ Tx_8180.set – This setup file loads all the measurements which can be run using 8180 (squarewave) signal supported for SFP+ QSFP+ TX standard(both Host and Module). (refer [Table 1](#) and [Table 2](#) for the list of measurements and their recommended signal types).
- SFP+ QSFP+ Tx_PRBS9.set – This setup file loads all the measurements which can be run using PRBS9 signal supported for SFP+ QSFP+ TX standard(both Host and Module). (refer [Table 1](#) and [Table 2](#) for the list of measurements and their recommended signal types).

- SFP+ QSFP+ Tx_PRBS31.set – This setup file loads all the measurements which can be run using PRBS31 signal supported for SFP+ QSFP+ TX standard(both Host and Module). (refer [Table 1](#) and [Table 2](#) for the list of measurements and their recommended signal types).
- SFP+ QSFP+ Tx_TWDPc.set – This setup file loads SFP+ QSFP+ TX Host TWDPc (Transmitter Distortion Penalty for Copper) measurement with the required settings. It is required that a PRBS9 signal be transmitter for this measurement. **Note:** TWDPc requires an additional option purchase and installation (SFP+ QSFP+ WDP).

List of Measurements covered in SFP- TX Solution

Table 1. – List of Host Measurements (along with Recommended signal type and Limits) that are covered in SFP+ QSFP+ TX Solution.

SL No.	Measurements	Signal Type Recommended	Alternate Signal Type	Limit			
				Min	Target	Max	Units
Host Transmitter output electrical Specifications:							
1	Single Ended Output Voltage Range	PRBS31	PRBS9	-0.3		4	V
2	Output AC Common Mode voltage (RMS)	PRBS31	PRBS9			15	mV(RMS)
Host Transmitter Jitter and Eye Mask specifications							
3	Crosstalk source rise/fall time (20%-80%) (Tr, Tf)	8180	-		34		ps
4	Crosstalk source amplitude (p-p differential)	8180	-		1000		mV
5	Signal rise/fall time (20%-80%) (Tr, Tf)	8180	-	34			ps
6	Total Jitter (p-p) (Tj)	PRBS31	PRBS9			0.28	UI(p-p)
7	Data Dependent Jitter (p-p) (DDJ)	PRBS9	PRBS31			0.1	UI(p-p)
8	Data Dependent Pulse Width Shrinkage (p-p) (DDPWS)	PRBS9	-			0.055	UI(p-p)
9	Uncorrelated Jitter (RMS) (UJ)	PRBS9	PRBS31			0.023	UI(p-p)
10	Transmitter Qsq	8180	-	50			
11	Eye mask hit ratio(Mask hit ratio of 5×10-5)	PRBS31	PRBS9	X1=0.12UI, X2=0.33UI, Y1=95mV, Y2=350mV			
Host Transmitter output specifications for Cu (SFP+ host supporting direct attach cables)							
12	Voltage Modulation Amplitude (p-p)	8180	-	300			mV
13	Transmitter Qsq Output AC Common Mode voltage	8180	-	63.1			
14	Output AC Common Mode Voltage	PRBS31	PRBS9			12	mV(RMS)
15	Host Output TWDPc*	PRBS9	-			10.7	dBe

* Requires an additional option purchase and installation (SFP+ QSFP+ WDP). Also available only on Oscilloscopes having a bandwidth >= 16 GHz on C or D models only (Having Sample Rate of 100GS/s).

Table 2. – List of Module Measurements (along with Recommended signal type and Limits) that are covered in SFP+ QSFP+ TX Solution.

SL No.	Measurements	Signal Type Recommended	Alternate Signal Type	Limit			
				Min	Target	Max	Units
Module Transmitter Input electrical Specifications:							
1	Single Ended Input Voltage Tolerance	PRBS31	PRBS9	-0.3		4	V
2	AC common mode voltage tolerance	PRBS31	PRBS9	15			mV(RMS)
Module Transmitter Input Tolerance Signal Calibration							
3	Crosstalk source rise/fall time (20%-80%) (Tr, Tf)	8180	-		34		ps
4	Crosstalk source amplitude (p-p differential)	8180	-		1000		mV
5	AC Common Mode Voltage	PRBS31	PRBS9			15	mV(RMS)
6	Total Jitter (Tj)	PRBS31	PRBS9			0.28	UI(p-p)
7	Data Dependent Jitter (DDJ)	PRBS9	PRBS31		0.1		UI(p-p)
8	Pulse Width Shrinkage Jitter (DDPWS)	PRBS9	-		0.055		UI(p-p)
9	Uncorrelated Jitter (RMS) (UJ)	PRBS9	PRBS31		0.023		UI(p-p)
10	Eye mask hit ratio(Mask hit ratio of 5×10^{-5})	PRBS31	PRBS9	X1=0.12UI, X2=0.33UI, Y1=95mV, Y2=350mV			

De-skewing procedure

Use the following procedure to compensate for timing differences between voltage probes:

1. Set up the instrument to display all of the channels that you want to deskew.
2. Push the instrument Autoselect button.
3. Adjust the vertical Scale and Position controls for each channel so that the signals overlap and are centered on the display.
4. Adjust the horizontal Position so that a rising edge is triggered at the center of the display.
5. Adjust the horizontal Scale so that the differences in the channel delays are clearly visible.
6. Adjust the horizontal Position again so that the first rising edge is exactly at the center of the display. The fastest probe is connected to this channel (the fastest probe is usually the one with the shortest cable or with the highest bandwidth).
7. Select Deskew from the Vertical menu to open the Deskew control window.
8. Select one of the slower channels.
9. Adjust the deskew time for the slower channel so that its signal aligns with that of the fastest channel. The deskew adjustment range is ± 75 ns.
10. Repeat steps 8 and 9 for each additional channel you want to deskew.
11. Remove the connections from the probe compensation terminals.

Note: You can also refer to the TekScope Help for the Deskew procedure.

How to recall a setup file and run measurements

1. Transmit the signal positive in Ch1 and Signal negative in Ch3.
2. Launch TekScope.exe
3. On TekScope go to “Analyze” menu and click on SFP+ QSFP+ Tx. This will take you to SFP+ QSFP+ standard DPOJET option. (Alternately you can launch DPOJET. Select the “Standards” Tab and select “SFP+ QSFP+ Tx” standard).
4. Now click on the “Setup” button and select the appropriate setup file. (one of SFP+ QSFP+ Tx_8180.set ,SFP+ QSFP+ Tx_PRBS9.set, SFP+ QSFP+ Tx_PRBS31.set or SFP+ QSFP+ Tx_TWDPc.set based on which measurement(s) are required to be run)
5. This will load all the measurements onto DPOJET and set the appropriate Trigger and Scope settings. It is recommended that you clear the measurements that are not supported for the particular signal type (please refer [Table 1](#) and [Table 2](#) for the list of measurements and their recommended signal types).
6. Click on” Run” (or single) on DPOJET to run the measurement. (Refer to [Figure 2](#))
7. The results are tabulated in the results panel.

Note: The results are valid for compliance when they are run using the recommended signal. The measurements whose results do not conform to compliance for that particular signal can be removed.

Note: If for the loaded Vertical Settings (from the Setup files provided) clips part of the waveform. Adjust Vertical settings appropriately such that the waveform fits 6-8 divisions of the Vertical Scale

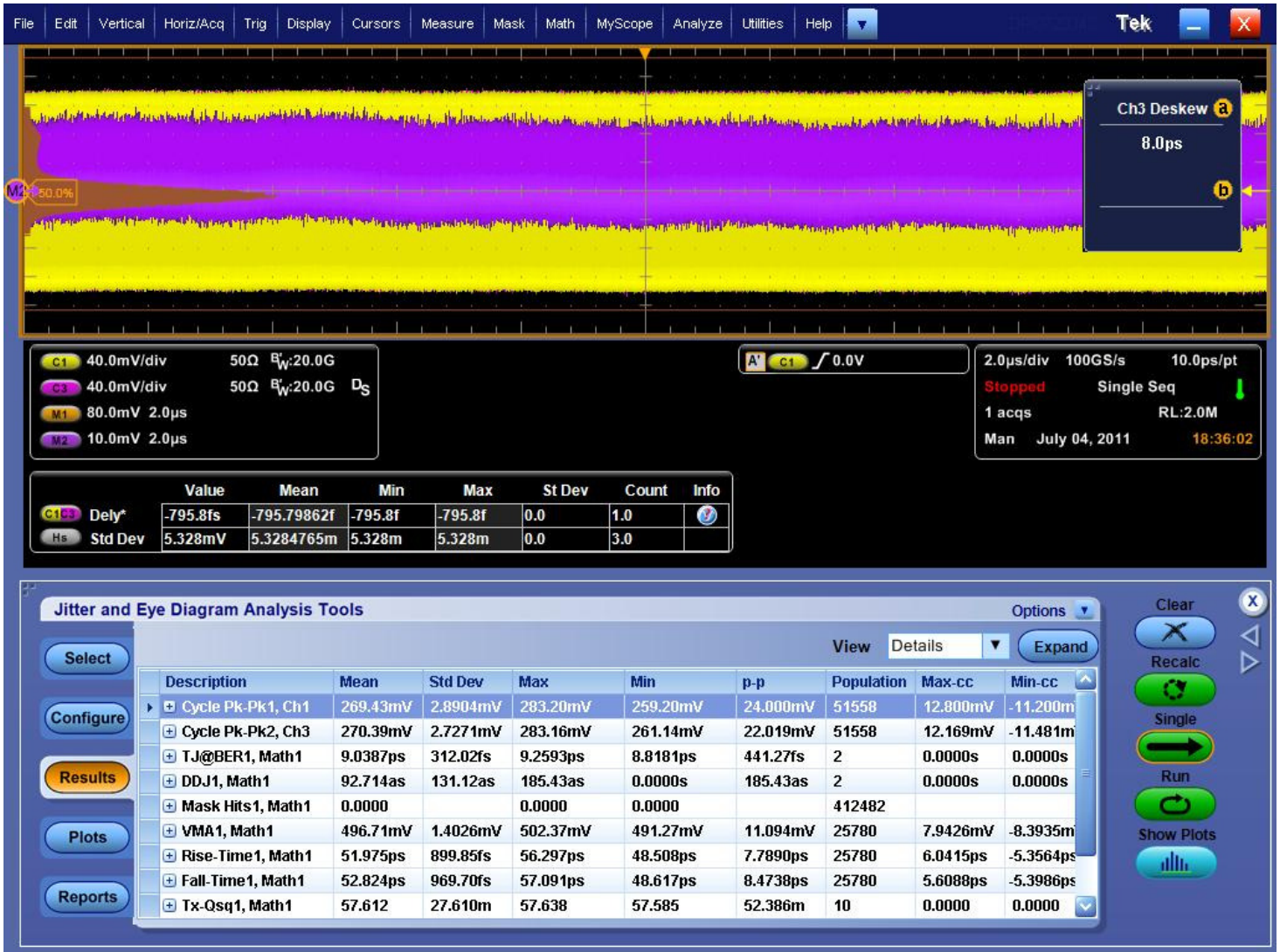


Figure 2. List of all measurements and results that are run with SFP+ QSFP+ Tx_PRBS9.set as example