IEEE P802.3by 25 Gb/s Ethernet Task Force Ad Hoc

3 meter 26AWG 4xSFP to QSFP without FEC at 0°C, 25°C, and 55°C

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Supporters

Purpose

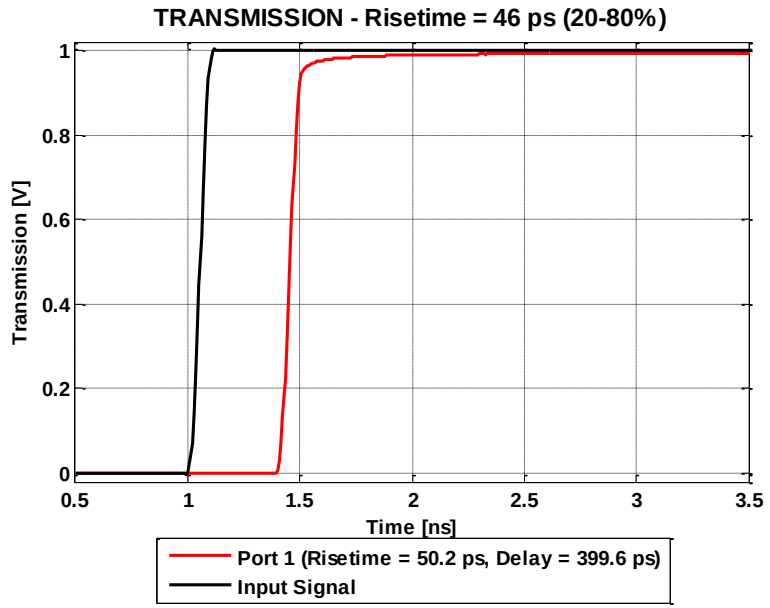
- To compare a 3m, 26 AWG, 4xSFP to QSFP cable assembly measured at 0°C, 25°C, and 55°C to COM and the specifications set forth in Clause 92.10.2 – 92.10.6 to support the effort for consensus regarding 3m cable assemblies operation without FEC.

Test Board Description

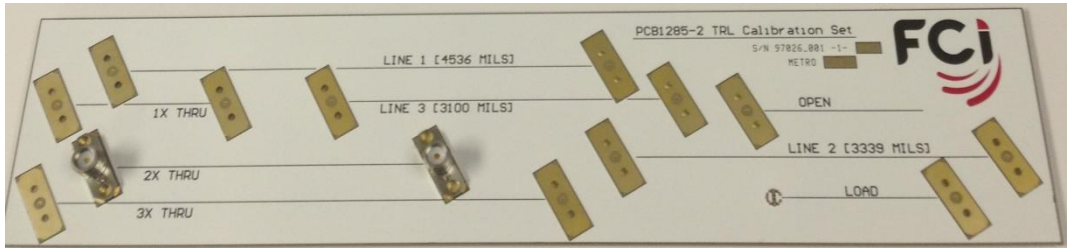
- Five test boards were used for testing.
  - PCB1310 Rev A – Side A (SFP, four total boards)
    - Approximate thickness: 1.57mm
    - Trace Length from SMA to VIA: 37.25 mm and 2X calibration trace is 74.50mm.
  - PCB1285 Rev B – Side B (QSFP, one board)
    - Approximate thickness: 1.57mm
    - Trace Length from SMA to VIA: 39.82mm and 2X calibration trace is 79.64mm.

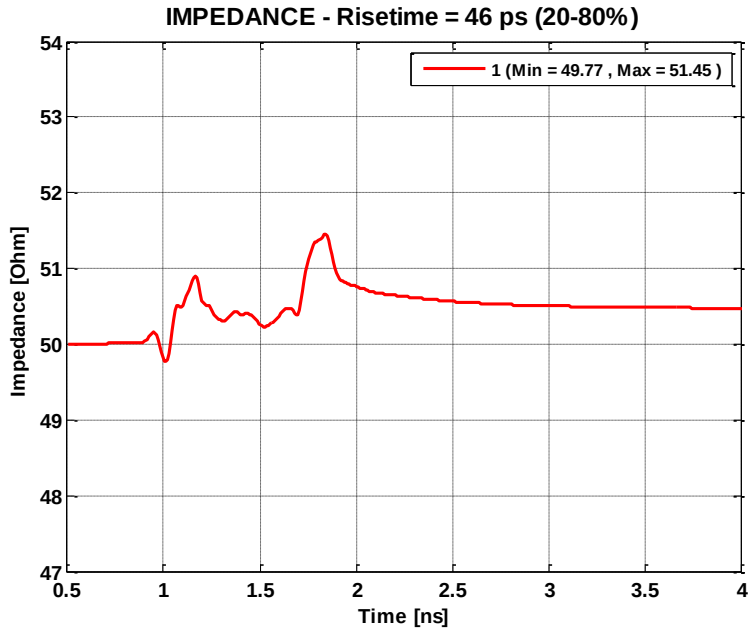
Test Board Information (SFP – Side A)

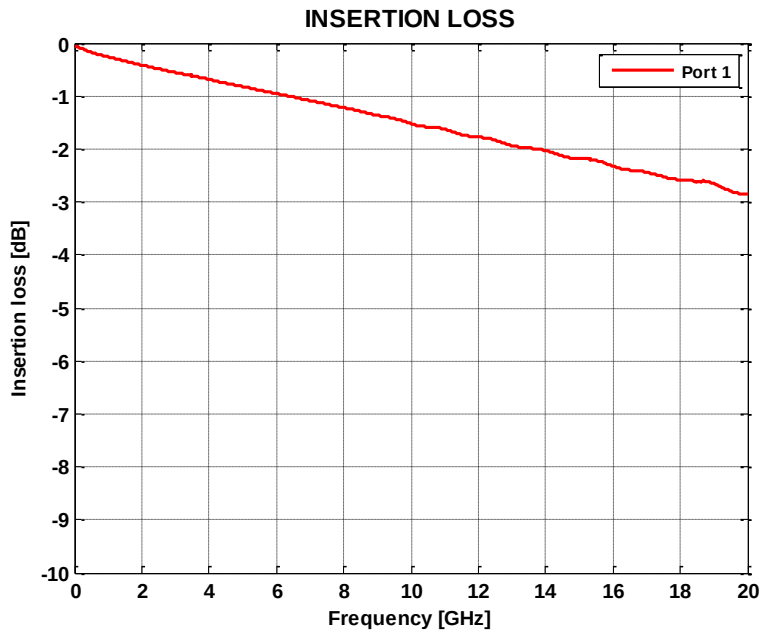
- An input risetime of 46ps (20-80%) was used to achieve a 50ps (20-80%) effective risetime



Transmission 2X trace length

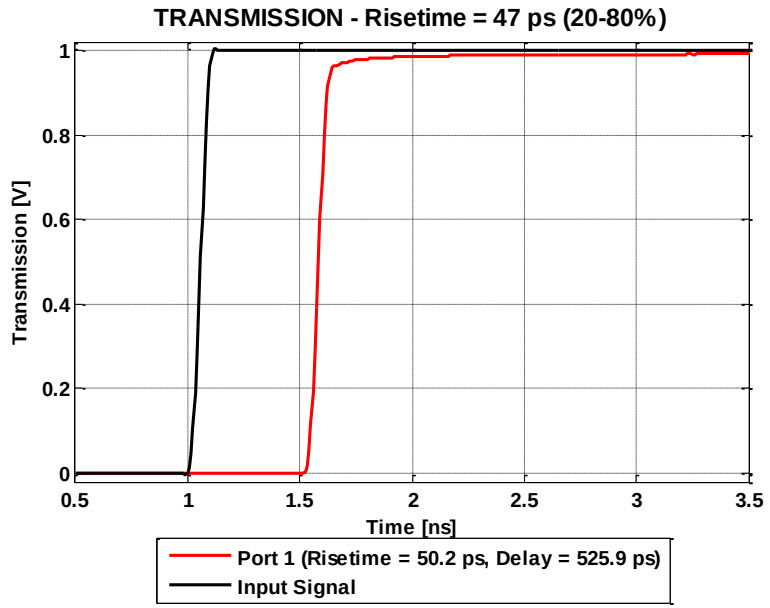




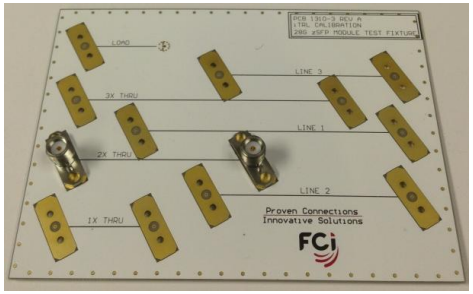


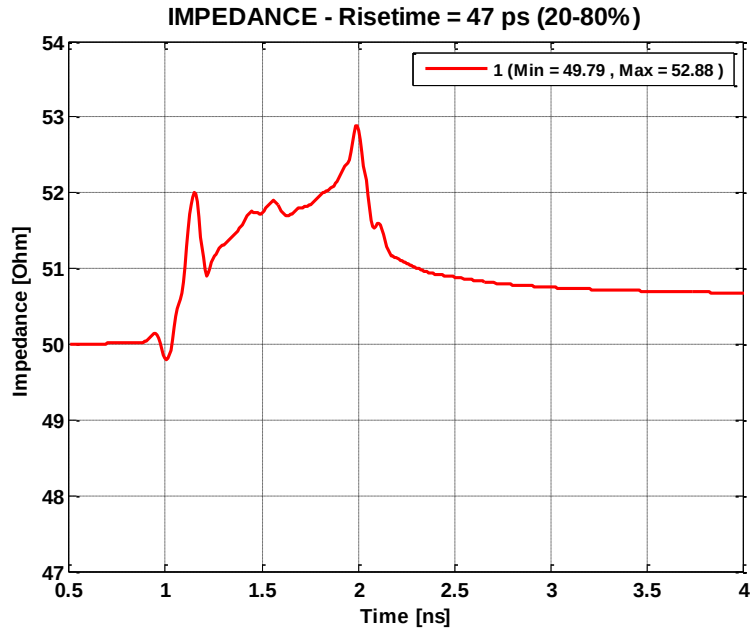
Test Board Information (QSFP – Side B)

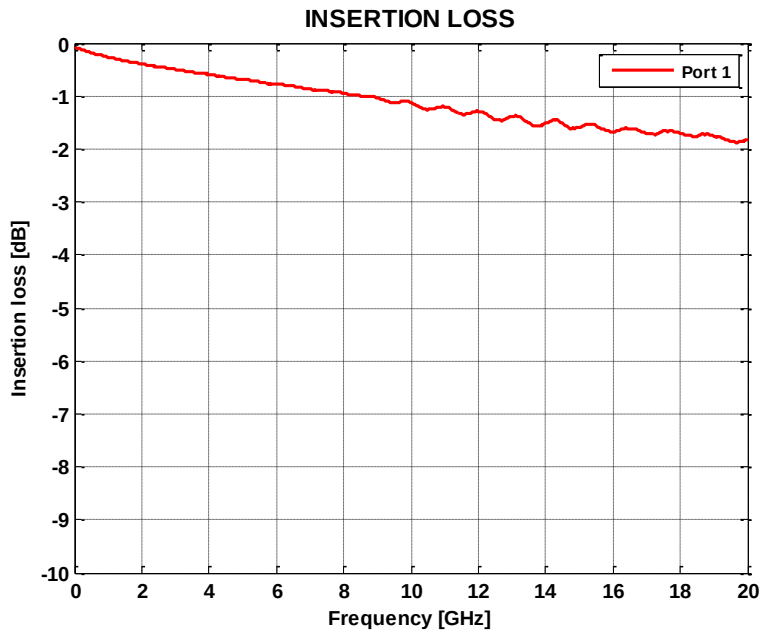
- An input risetime of 47ps (20-80%) was used to achieve a 50ps (20-80%) effective risetime



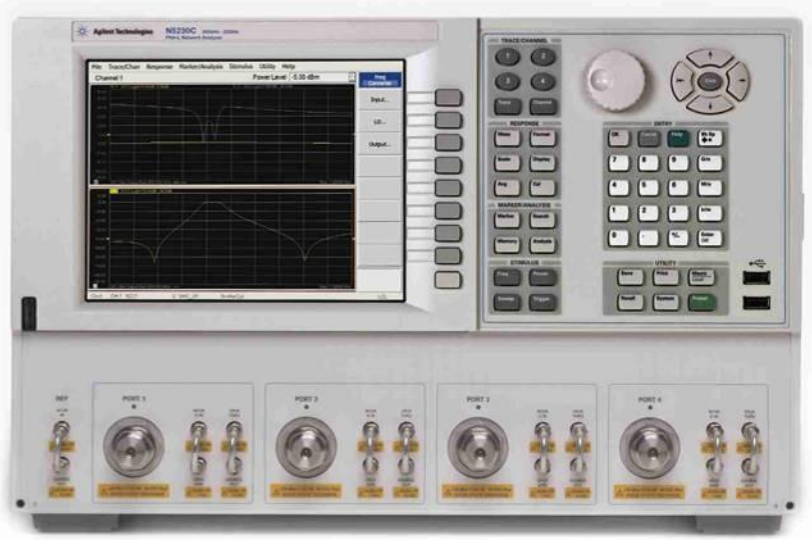
Transmission 2X trace length







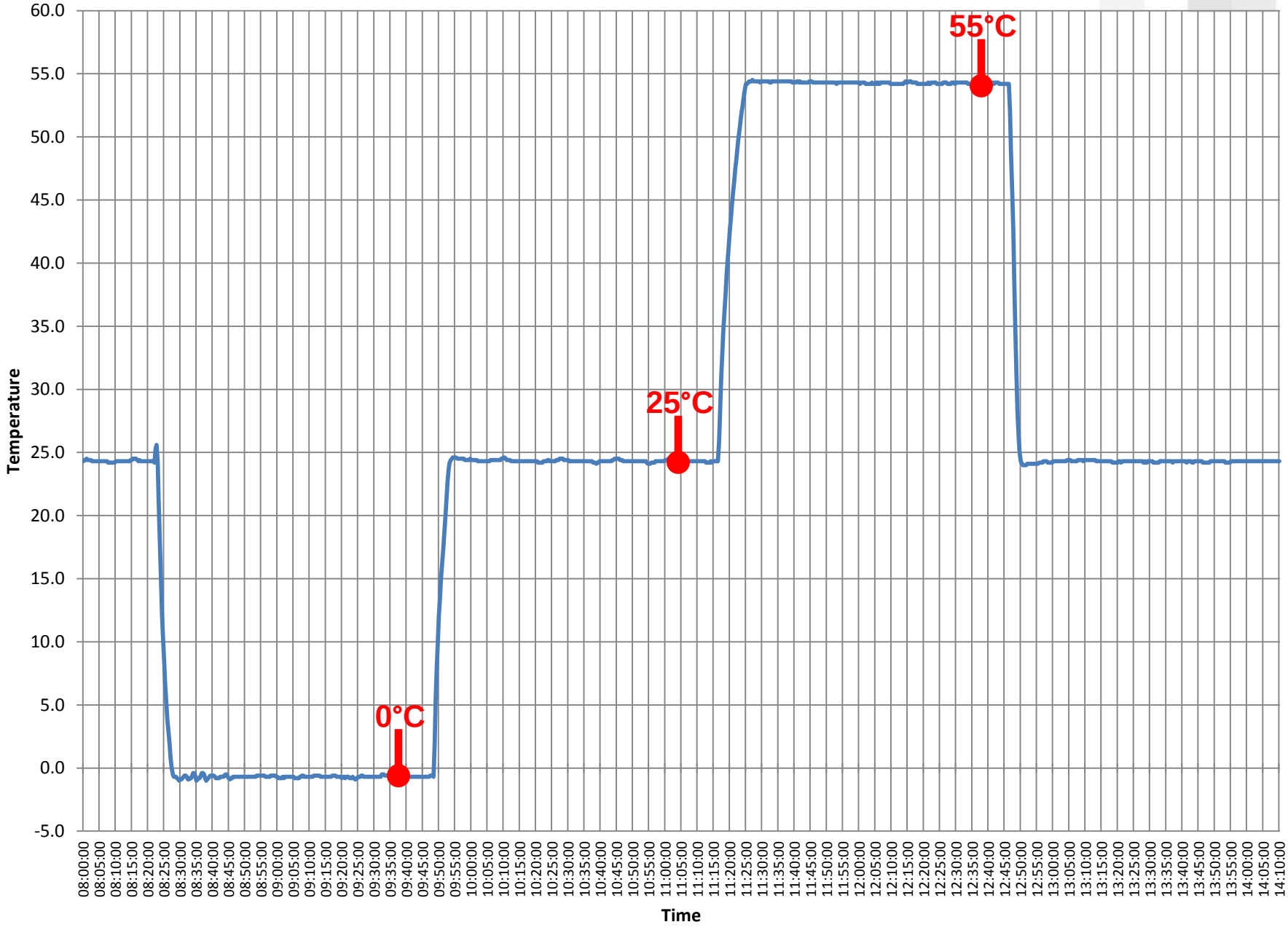
Equipment Used



Stock Photo taken from www.keysight.com

- Keysight Technologies N5222A PNA-L Network Analyzer
  - Frequency Range:
    300 KHz – 26.5 GHz
- Sentry test software – v2.5.3
- Calibration Used:
  - SOLT calibration from
    10 MHz to 26 GHz with 2600 data points and having an IF Bandwidth of 1 KHz

Thermal Profile



Original COM Parameters

4SFP to QSFP 0C Config. 1		
	Case 1	Case 2
RX4A	2.85	1.99
RX2A	2.82	1.90
RX3A	3.21	2.28
RX1A	2.84	1.96
RX4B	3.59	2.61
RX2B	3.59	2.63
RX3B	3.12	2.38
RX1B	3.54	2.62

4SFP to QSFP 25C Config. 1		
	Case 1	Case 2
RX4A	2.65	1.70
RX2A	2.60	1.70
RX3A	2.90	1.97
RX1A	2.61	1.57
RX4B	3.30	2.38
RX2B	3.30	2.38
RX3B	2.86	2.06
RX1B	3.28	2.31

4SFP to QSFP 55C Config. 1		
	Case 1	Case 2
RX4A	2.30	1.29
RX2A	2.20	1.27
RX3A	2.57	1.57
RX1A	2.27	1.24
RX4B	2.89	1.93
RX2B	2.95	1.94
RX3B	2.66	1.80
RX1B	2.91	1.91

COM Parameter	COM Parameter Value
Z_p	30mm
A_v	0.4V
A_{fe}	0.4V
A_{ne}	0.6V
C_d	250ff
C_p	180ff
CTLE	12dB
Z_c	78.2Ω
SNR_{TX}	27dB
Board Z_c	109.8Ω

First set of changes

4SFP to QSFP 0C Config. 1		
	Case 1	Case 2
RX4A	3.60	2.68
RX2A	3.59	2.72
RX3A	4.03	3.14
RX1A	3.53	2.71
RX4B	4.50	3.67
RX2B	4.47	3.68
RX3B	3.86	3.15
RX1B	4.35	3.62

4SFP to QSFP 25C Config. 1		
	Case 1	Case 2
RX4A	3.30	2.43
RX2A	3.31	2.42
RX3A	3.65	2.82
RX1A	3.36	2.41
RX4B	4.21	3.33
RX2B	4.22	3.41
RX3B	3.76	3.00
RX1B	4.10	3.35

4SFP to QSFP 55C Config. 1		
	Case 1	Case 2
RX4A	2.89	2.01
RX2A	2.92	2.02
RX3A	3.36	2.36
RX1A	2.95	2.01
RX4B	3.84	2.95
RX2B	3.80	3.01
RX3B	3.39	2.62
RX1B	3.67	2.91

COM Parameter	COM Parameter Value
Z_p	30mm
A_v	0.43V
A_{fe}	0.43V
A_{ne}	0.645V
C_d	200ff
C_p	130ff
CTLE	12dB
Z_c	85Ω
SNR_{TX}	28.4dB
Board Z_c	109.8Ω

Second set of changes

4SFP to QSFP 0C Config. 1		
	Case 1	Case 2
RX4A	4.20	3.56
RX2A	4.10	3.52
RX3A	4.56	3.83
RX1A	4.12	3.50
RX4B	5.01	4.35
RX2B	4.93	4.26
RX3B	4.52	3.92
RX1B	4.89	4.23

4SFP to QSFP 25C Config. 1		
	Case 1	Case 2
RX4A	4.01	3.32
RX2A	3.87	3.20
RX3A	4.24	3.48
RX1A	3.94	3.21
RX4B	4.74	4.03
RX2B	4.66	3.91
RX3B	4.32	3.73
RX1B	4.66	3.96

4SFP to QSFP 55C Config. 1		
	Case 1	Case 2
RX4A	3.69	2.90
RX2A	3.52	2.88
RX3A	3.93	3.14
RX1A	3.61	2.81
RX4B	4.36	3.62
RX2B	4.29	3.59
RX3B	4.11	3.36
RX1B	4.31	3.55

COM Parameter	COM Parameter Value
Z_p	30mm
A_v	0.43V
A_{fe}	0.43V
A_{ne}	0.645V
C_d	200ff
C_p	130ff
CTLE	16dB
Z_c	85Ω
SNR_{TX}	28.4dB
Board Z_c	109.8Ω

Third set of changes

4SFP to QSFP 0C Config. 1		
	Case 1	Case 2
RX4A	3.87	3.16
RX2A	3.74	3.10
RX3A	4.10	3.34
RX1A	3.69	3.01
RX4B	4.48	3.75
RX2B	4.38	3.68
RX3B	3.96	3.39
RX1B	4.31	3.65

4SFP to QSFP 25C Config. 1		
	Case 1	Case 2
RX4A	3.63	2.91
RX2A	3.51	2.71
RX3A	3.81	3.01
RX1A	3.44	2.74
RX4B	4.20	3.45
RX2B	4.14	3.42
RX3B	3.85	3.20
RX1B	4.04	3.36

4SFP to QSFP 55C Config. 1		
	Case 1	Case 2
RX4A	3.31	2.49
RX2A	3.15	2.36
RX3A	3.45	2.63
RX1A	3.18	2.28
RX4B	3.80	3.04
RX2B	3.81	2.95
RX3B	3.55	2.82
RX1B	3.75	2.95

COM Parameter	COM Parameter Value
Z_p	30mm
A_v	0.43V
A_{fe}	0.43V
A_{ne}	0.645V
C_d	250ff
C_p	180ff
CTLE	16dB
Z_c	78.2Ω
SNR_{TX}	28.4dB
Board Z_c	109.8Ω

Recommended per goergen_3by_0715.pdf

Fourth set of changes

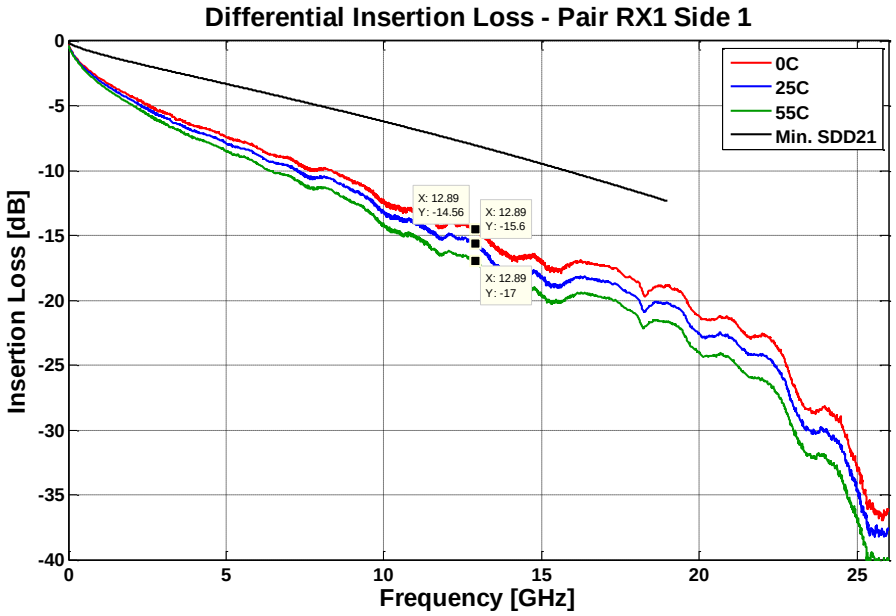
4SFP to QSFP 0C Config. 1		
	Case 1	Case 2
RX4A	4.07	3.37
RX2A	3.98	3.32
RX3A	4.33	3.56
RX1A	3.99	3.28
RX4B	4.68	3.98
RX2B	4.61	3.93
RX3B	4.24	3.63
RX1B	4.57	3.91

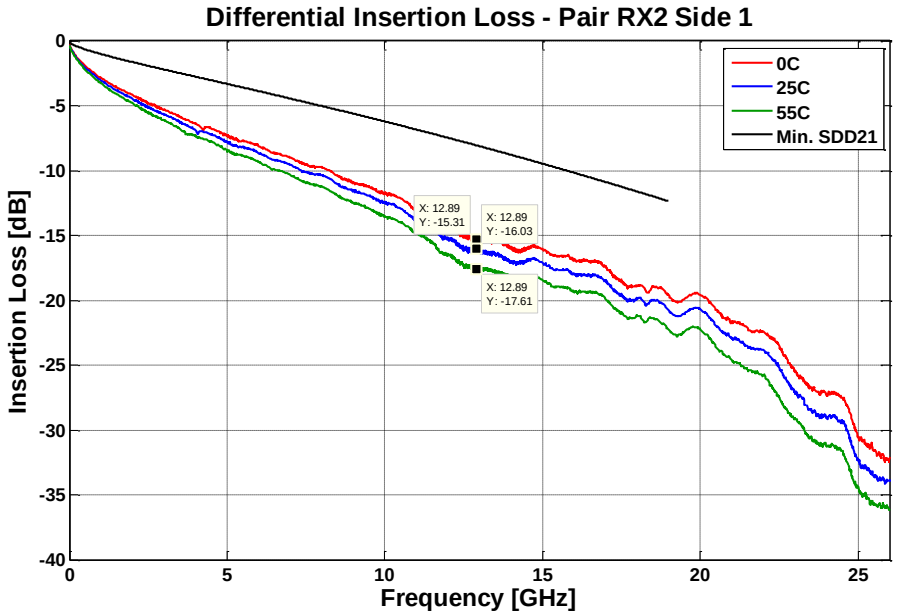
4SFP to QSFP 25C Config. 1		
	Case 1	Case 2
RX4A	3.87	3.14
RX2A	3.75	3.05
RX3A	4.06	3.27
RX1A	3.75	2.97
RX4B	4.39	3.63
RX2B	4.34	3.63
RX3B	4.03	3.44
RX1B	4.27	3.63

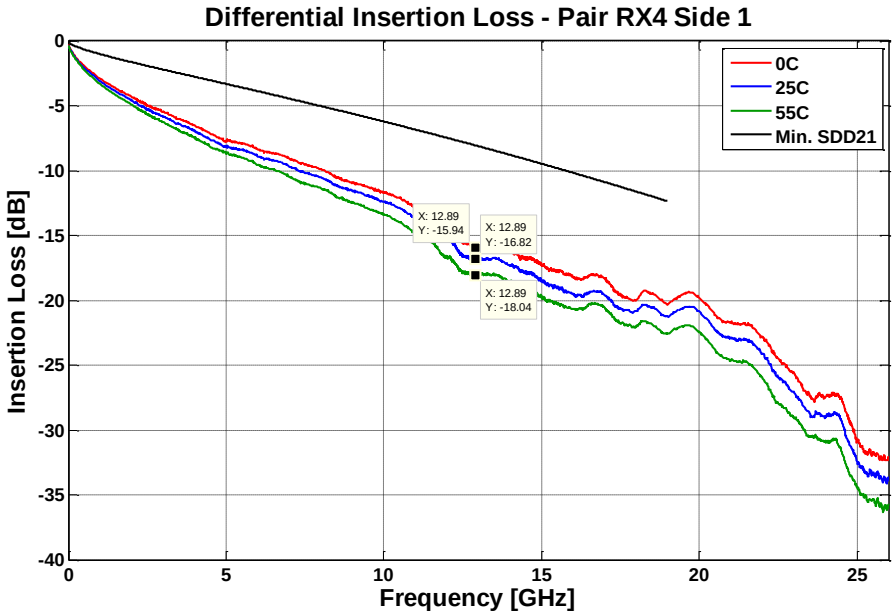
4SFP to QSFP 55C Config. 1		
	Case 1	Case 2
RX4A	3.51	2.75
RX2A	3.36	2.61
RX3A	3.74	2.86
RX1A	3.43	2.58
RX4B	4.08	3.26
RX2B	3.97	3.20
RX3B	3.73	3.08
RX1B	4.00	3.23

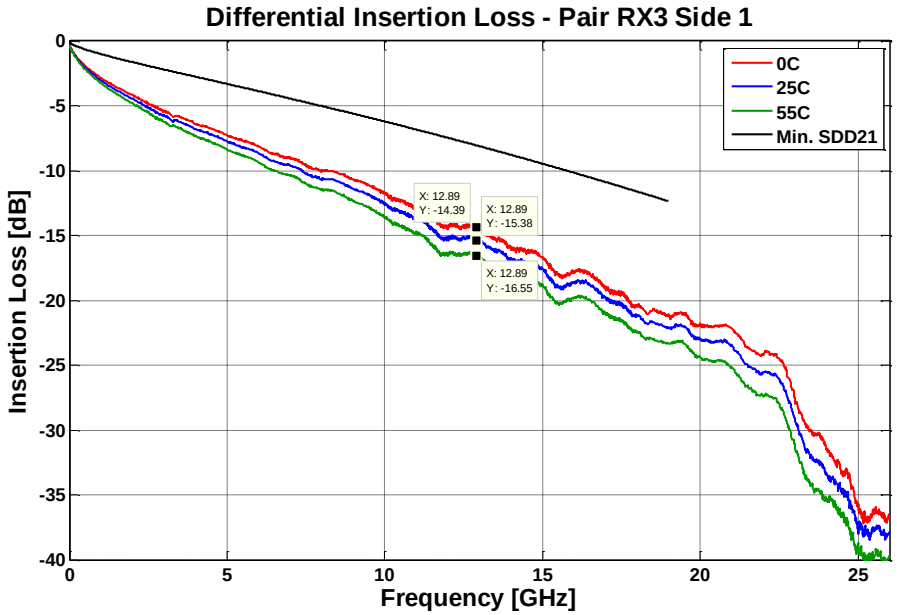
COM Parameter	COM Parameter Value
Z_p	30mm
A_v	0.43V
A_{fe}	0.43V
A_{ne}	0.645V
C_d	250ff
C_p	180ff
CTLE	16dB
Z_c	85Ω
SNR_{TX}	28.4dB
Board Z_c	109.8Ω

Differential Insertion Loss

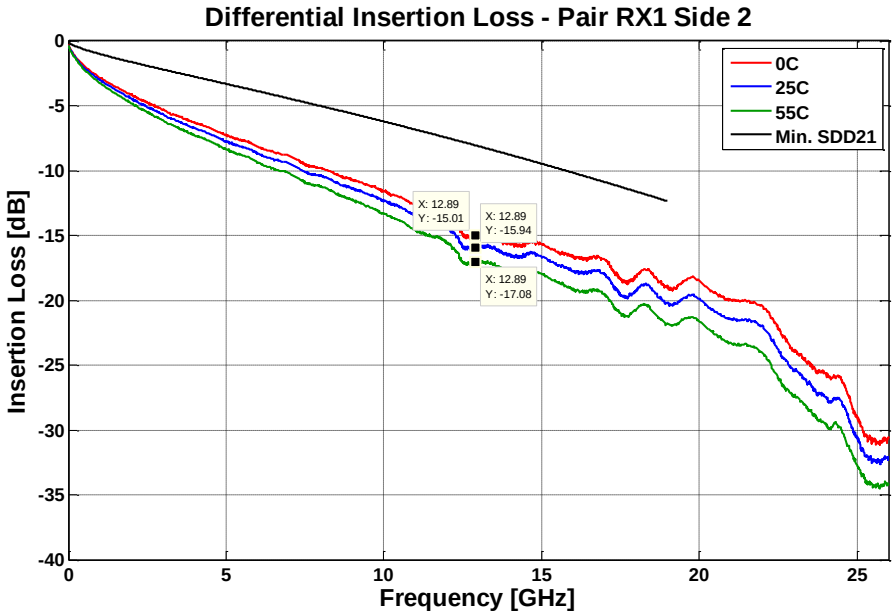


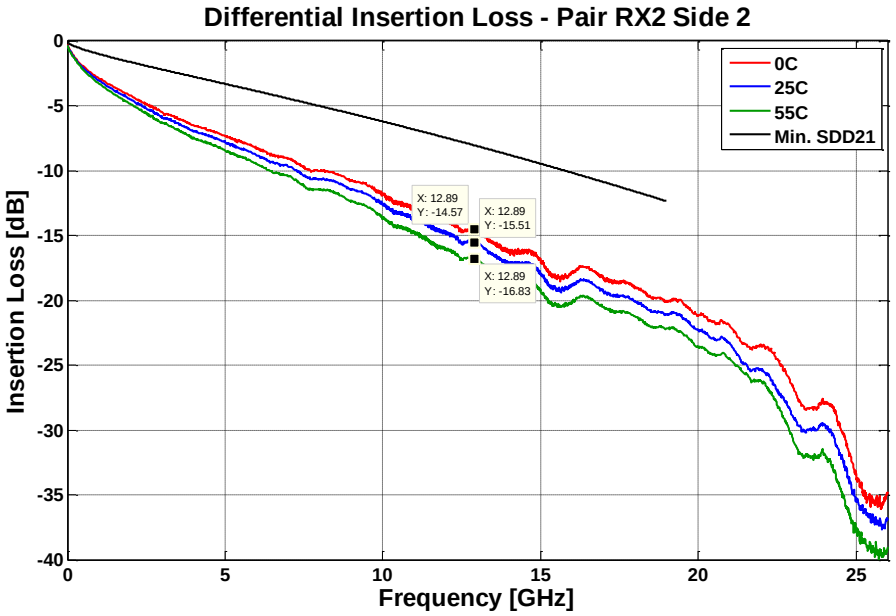


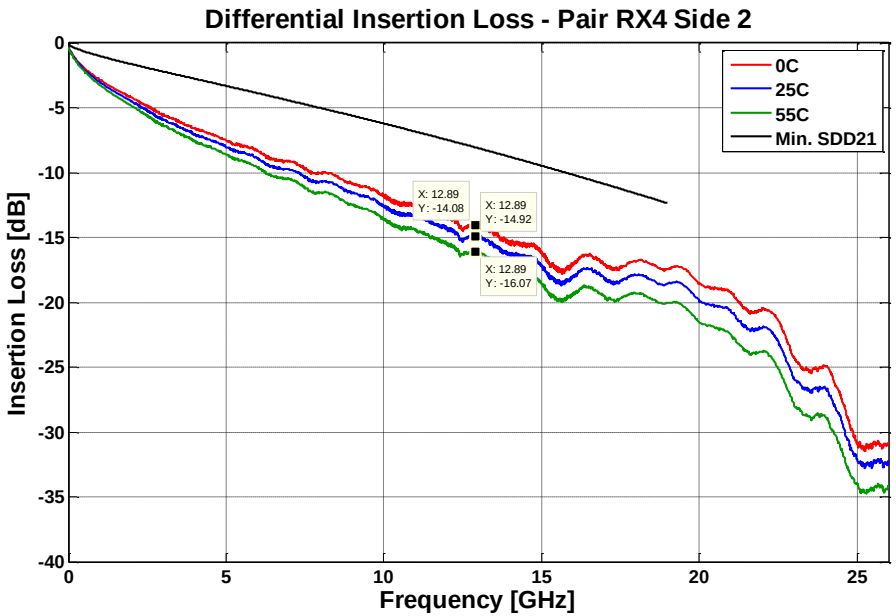


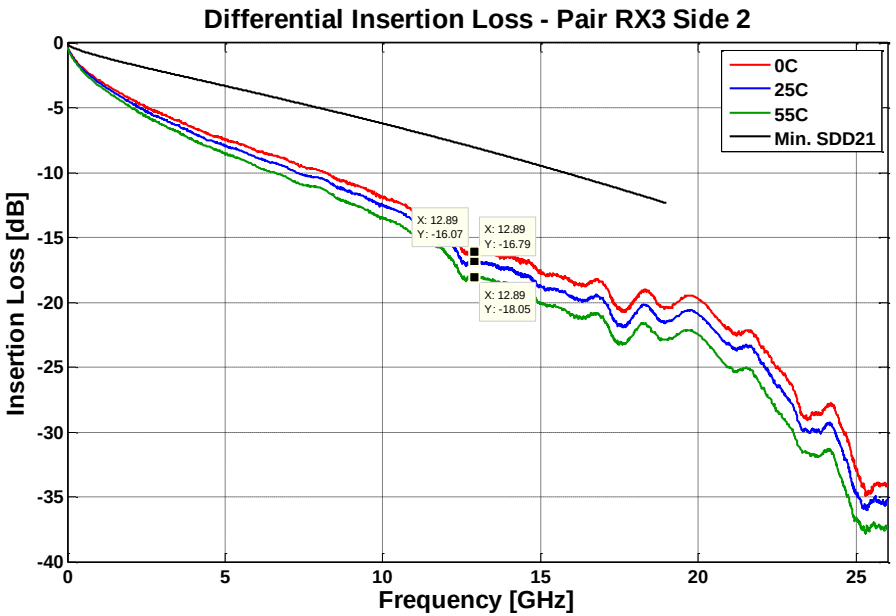


Differential Insertion Loss

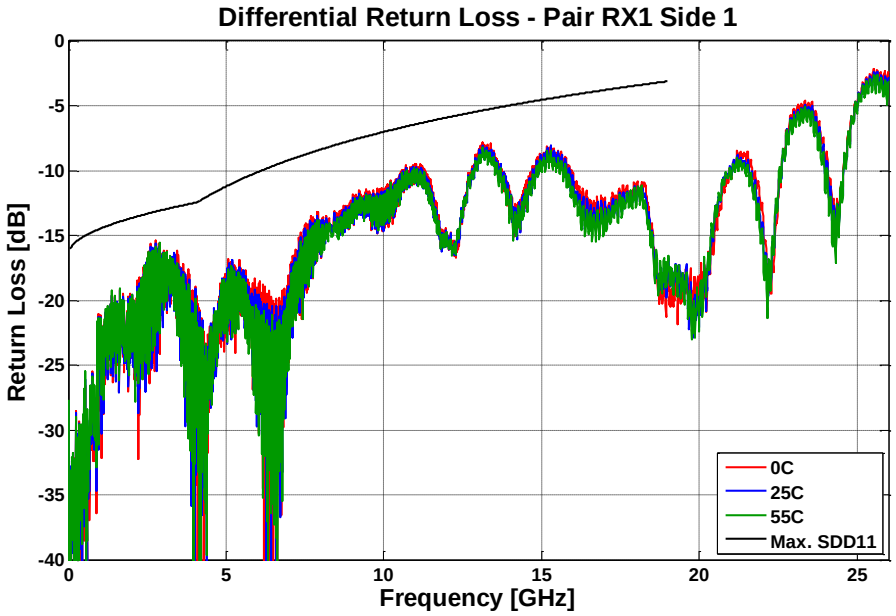


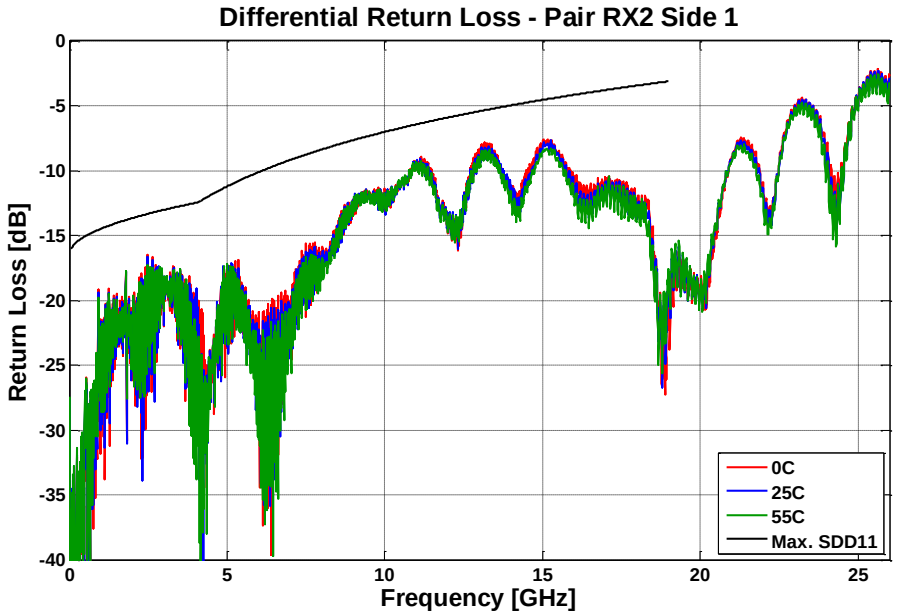


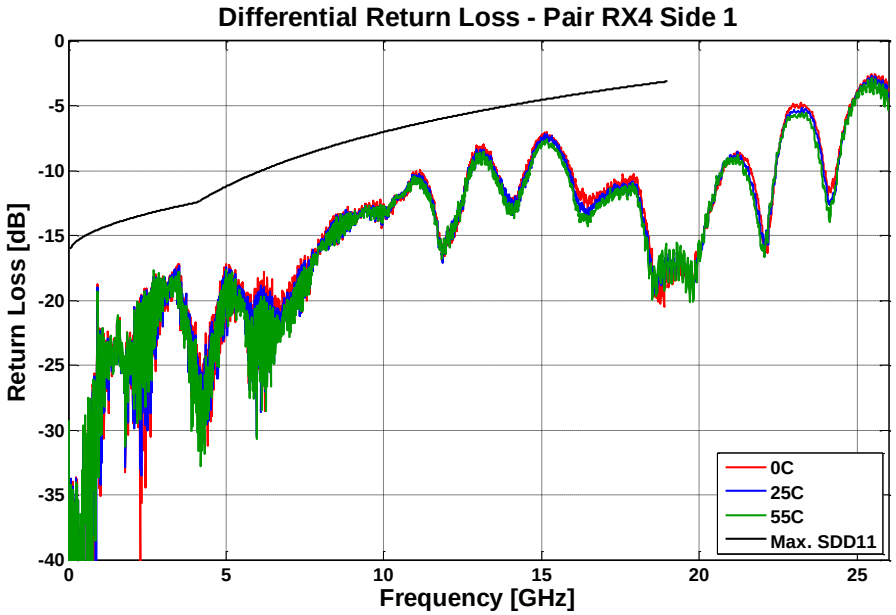


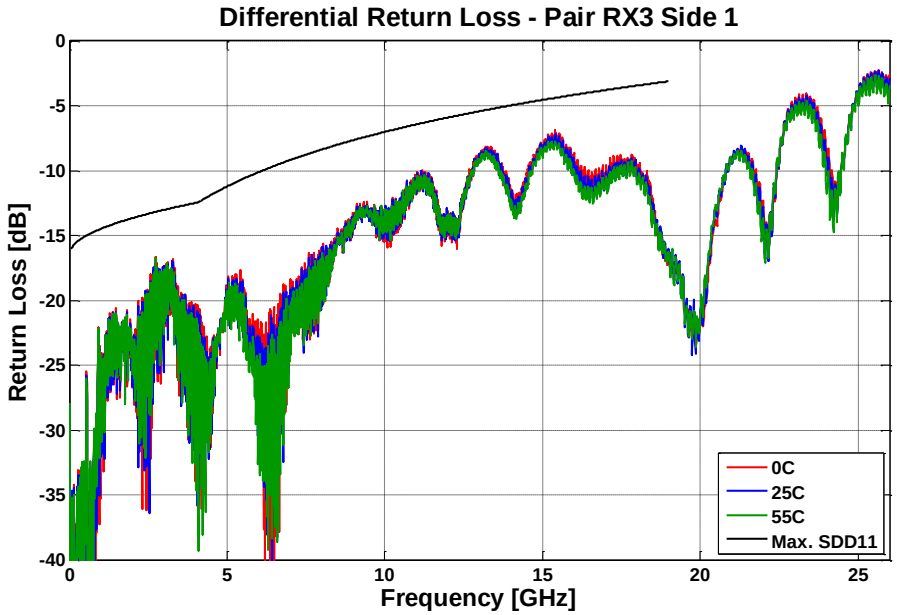


Differential Return Loss

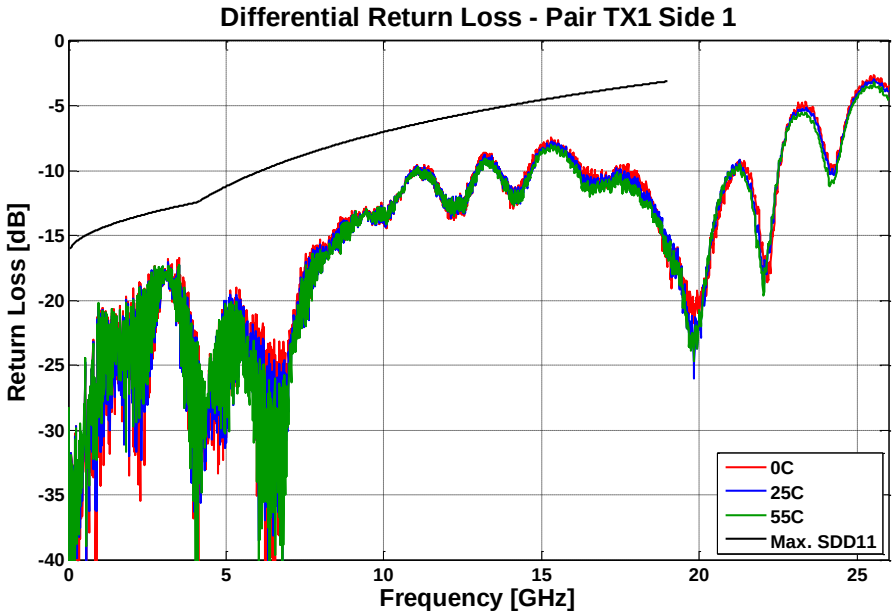


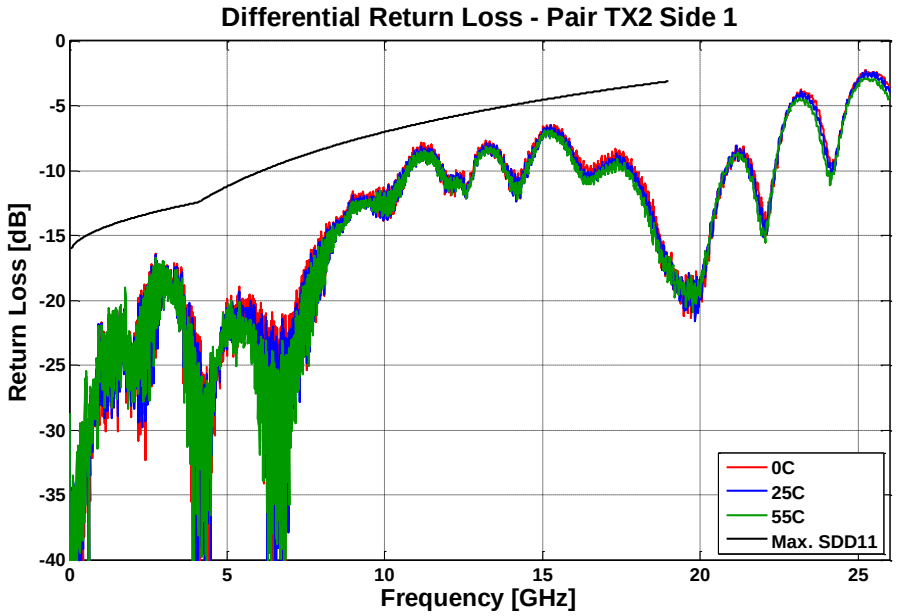


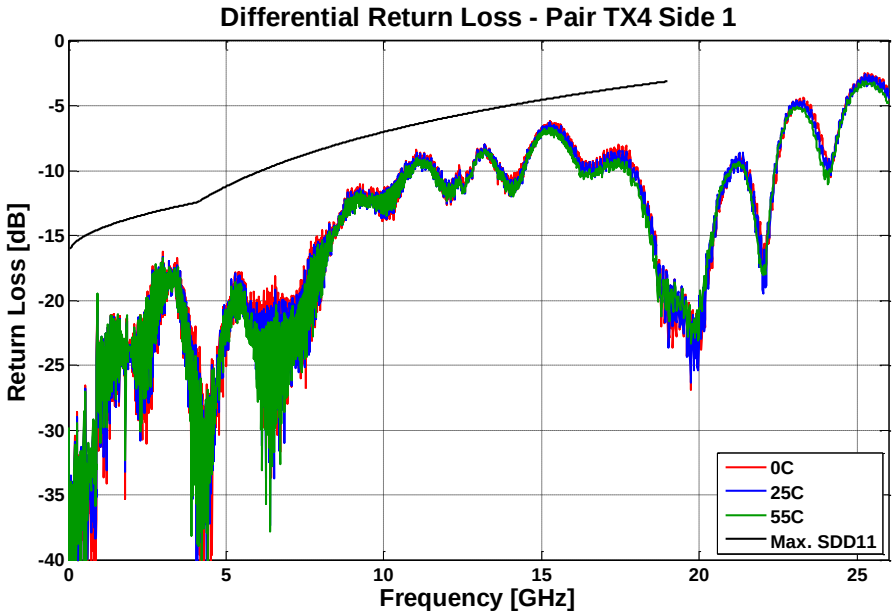


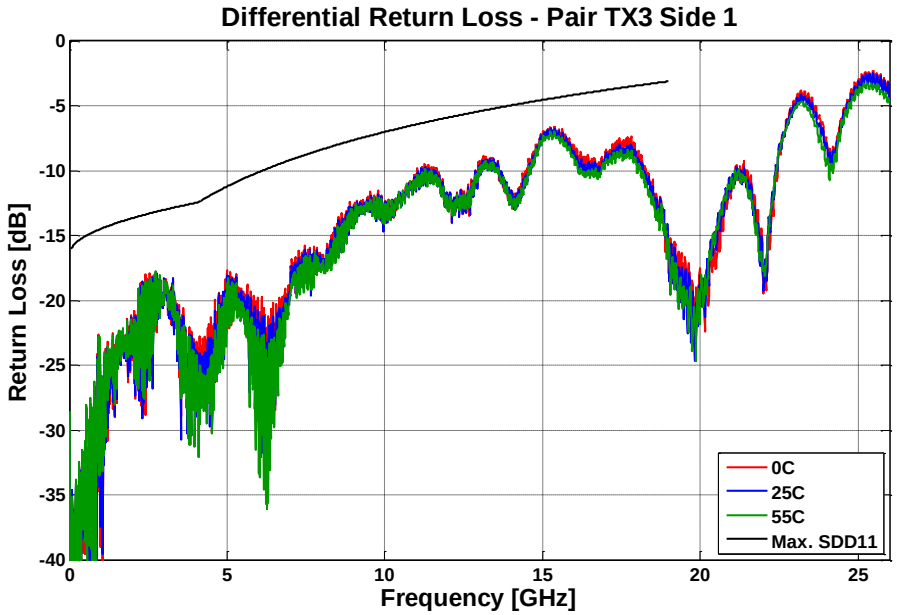


Differential Return Loss

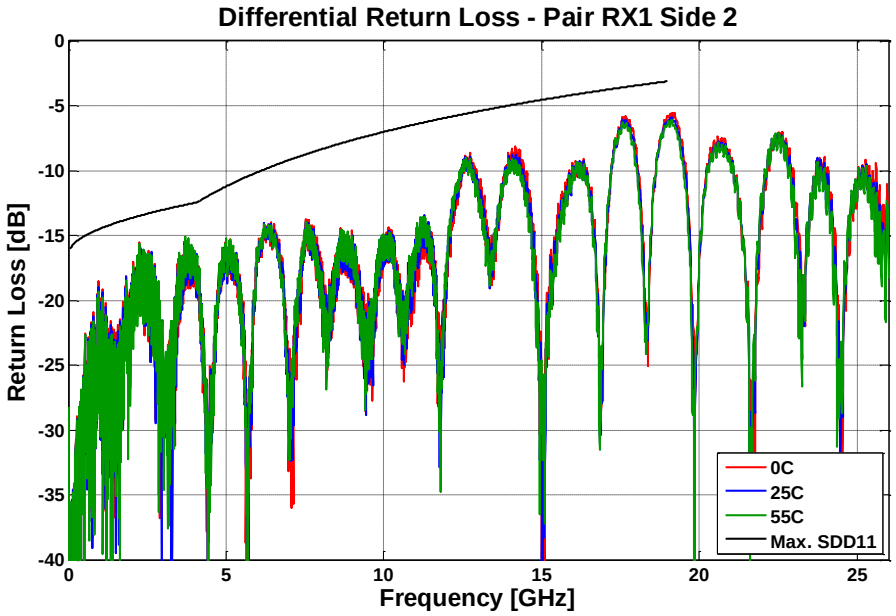


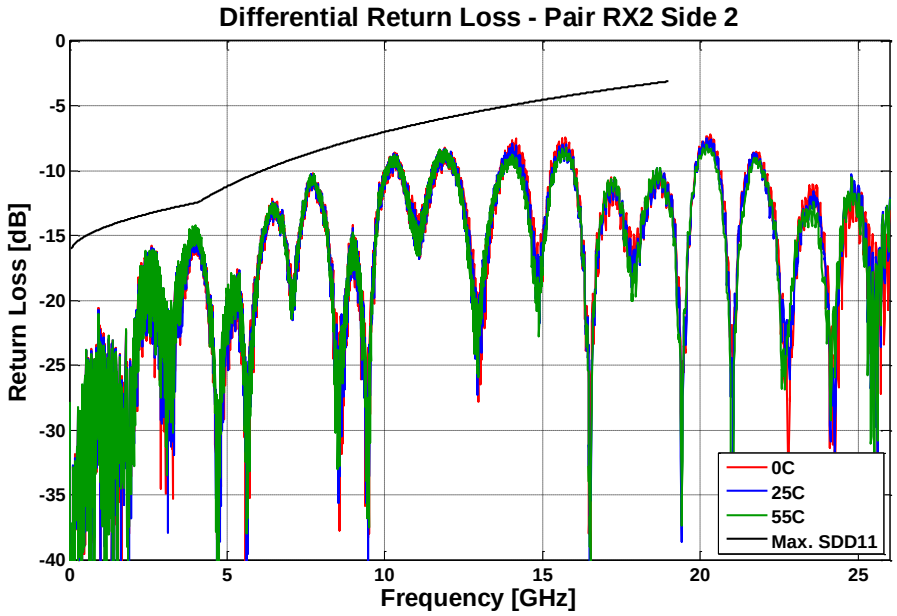


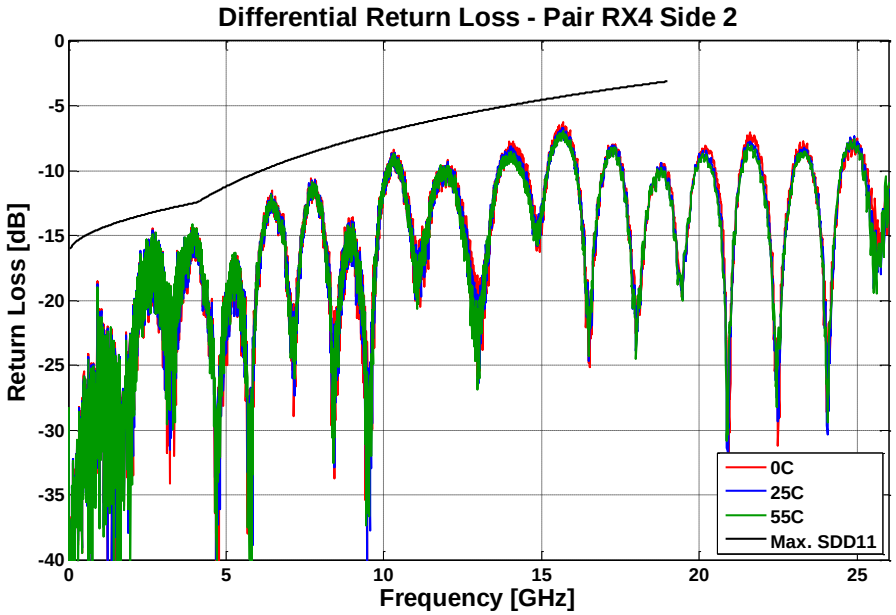


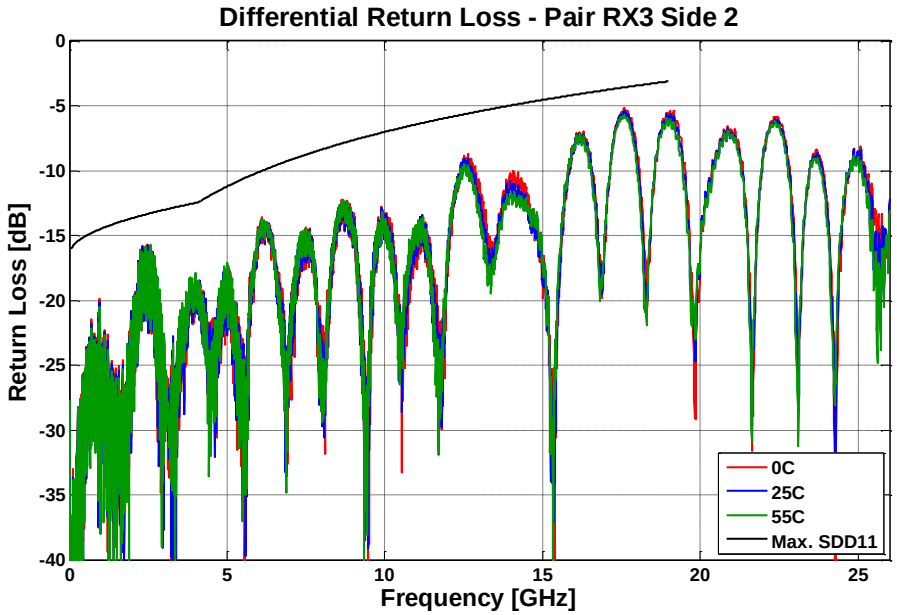


Differential Return Loss

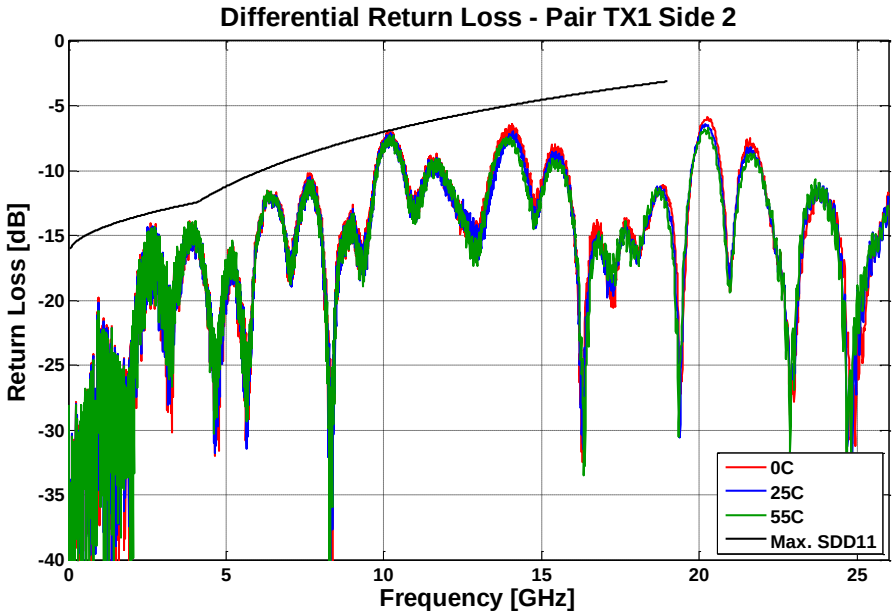


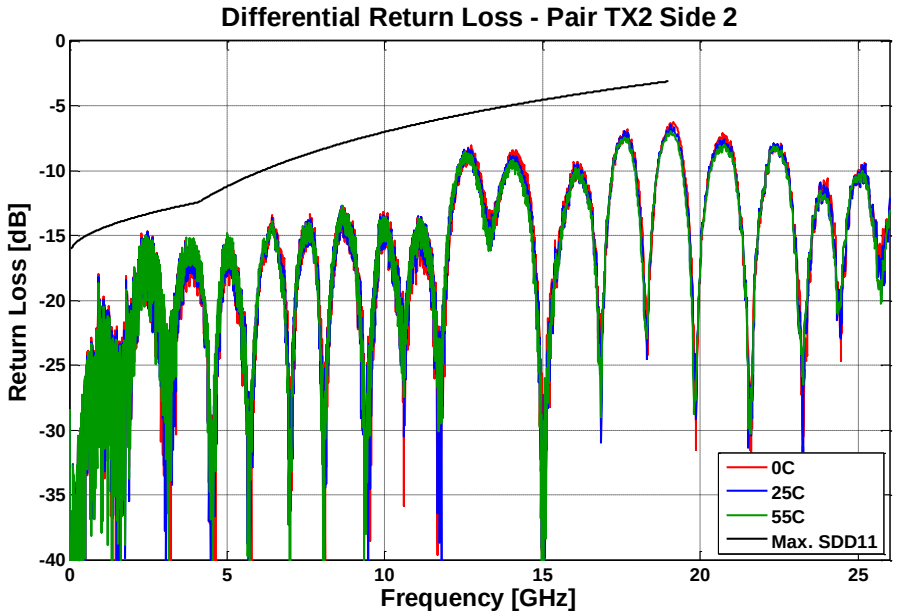


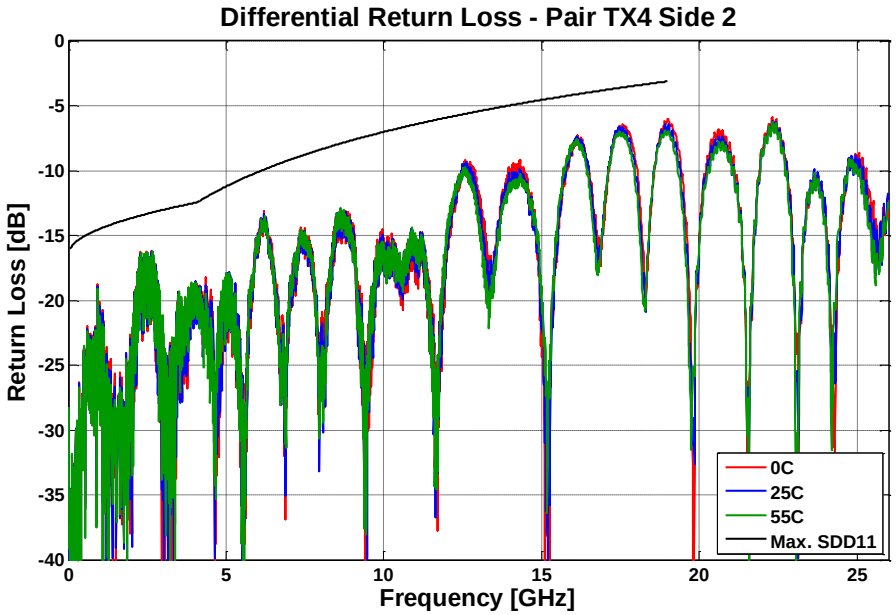


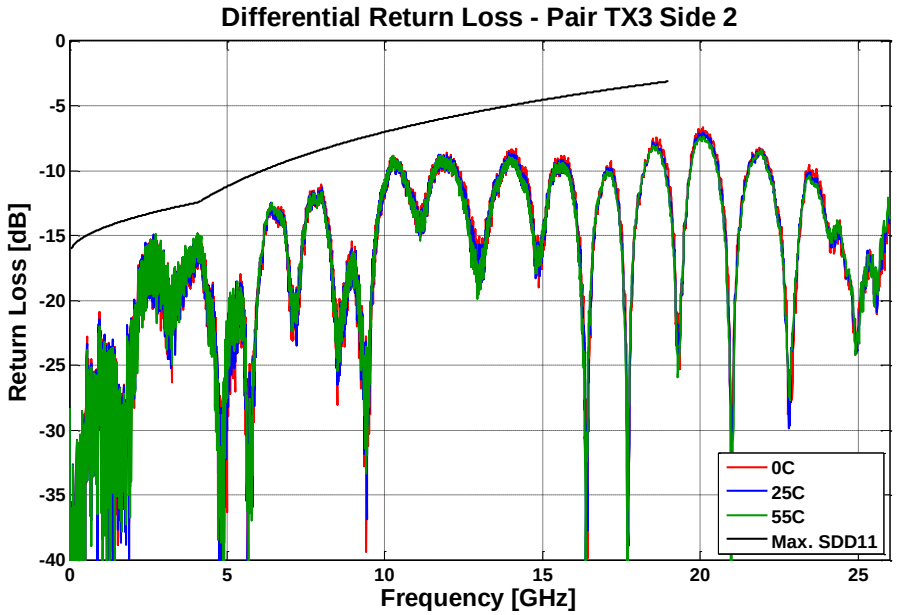


Differential Return Loss

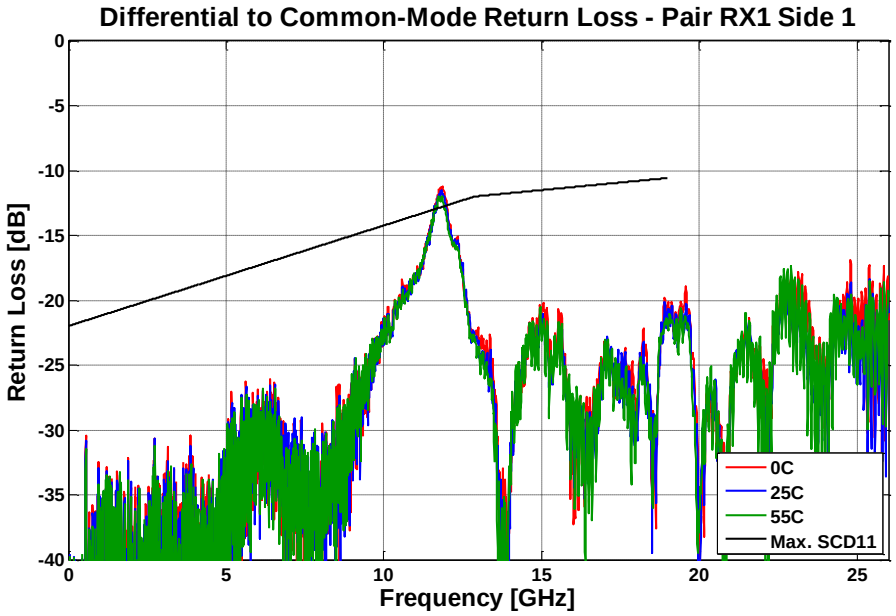


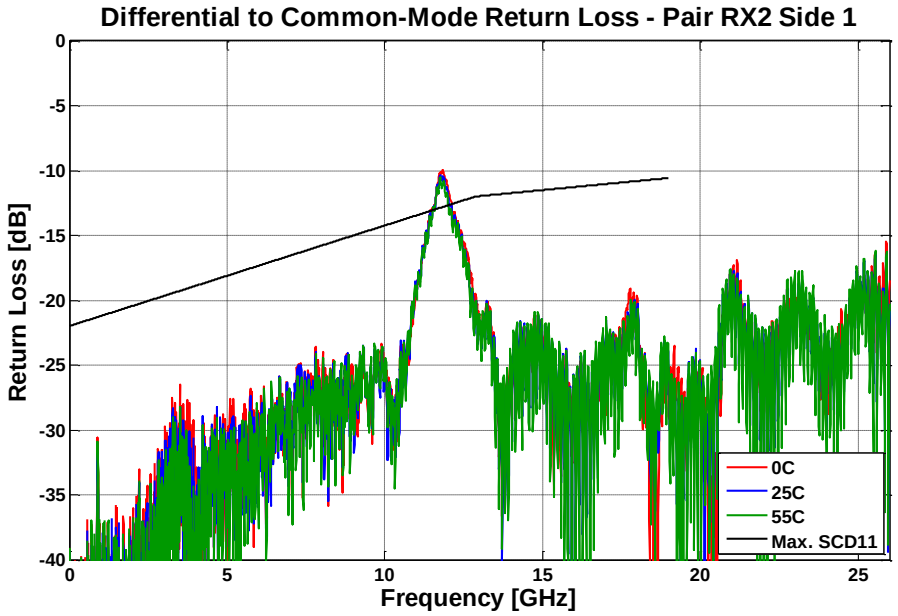


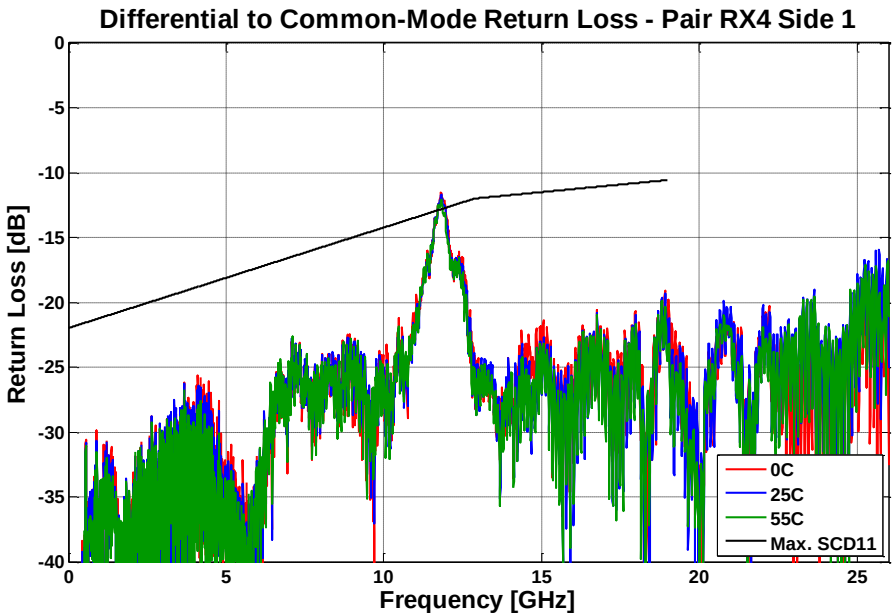


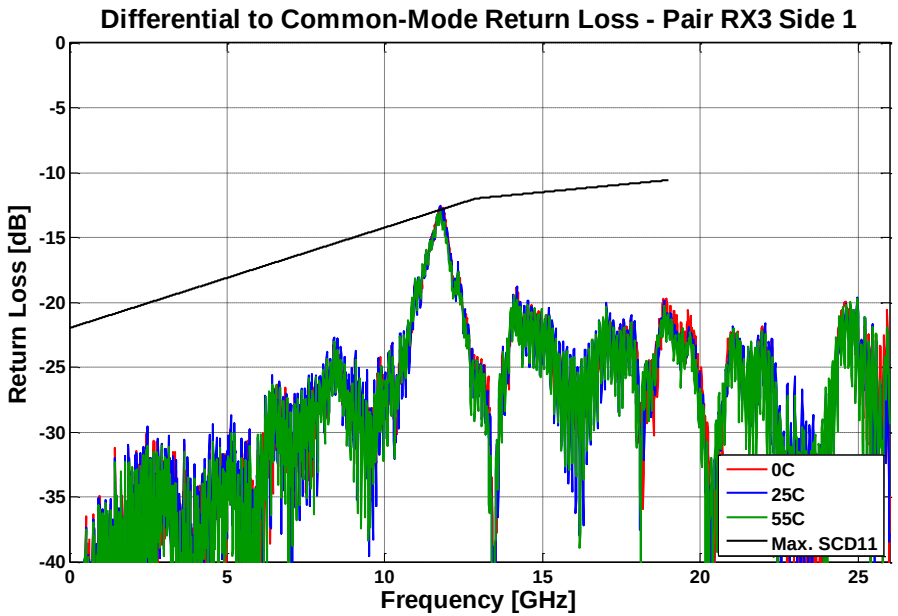


Differential to Common-Mode Return Loss

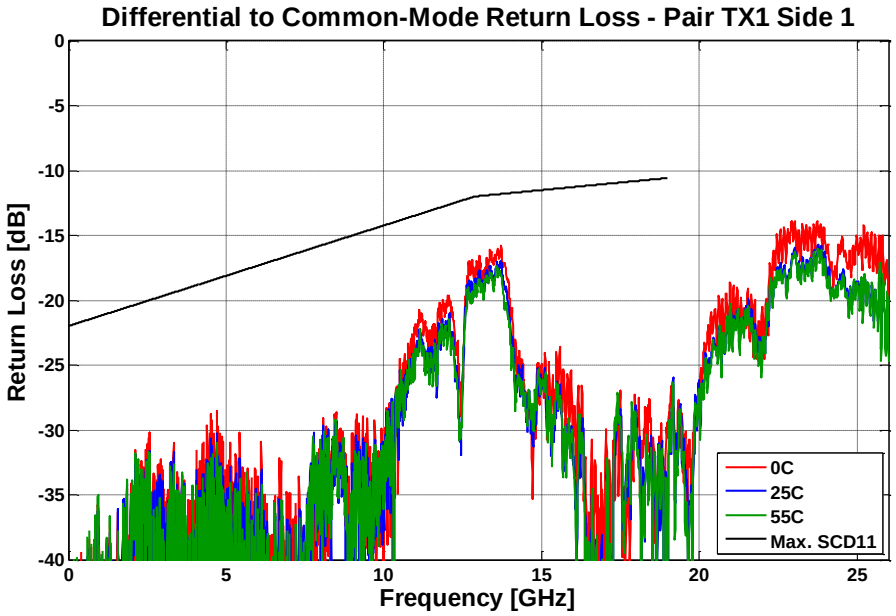


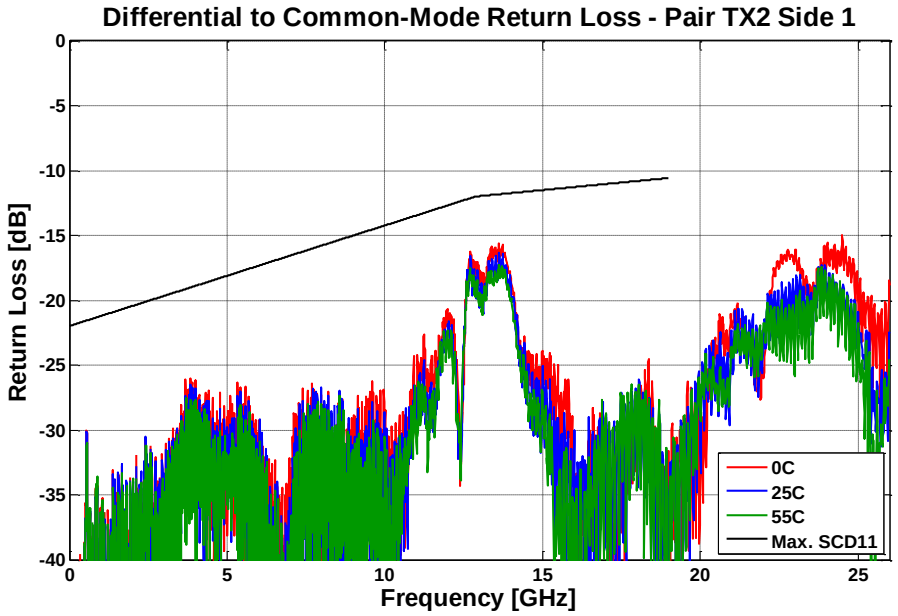


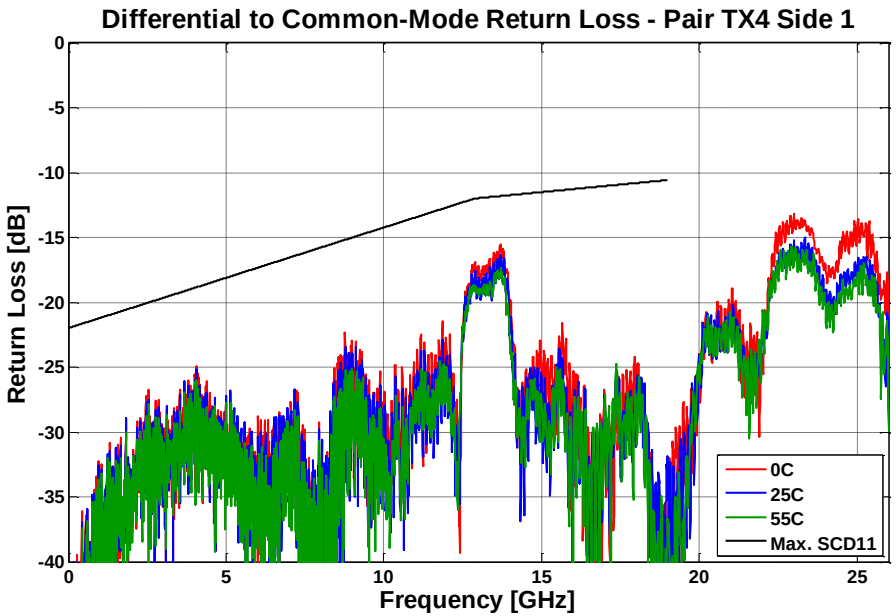


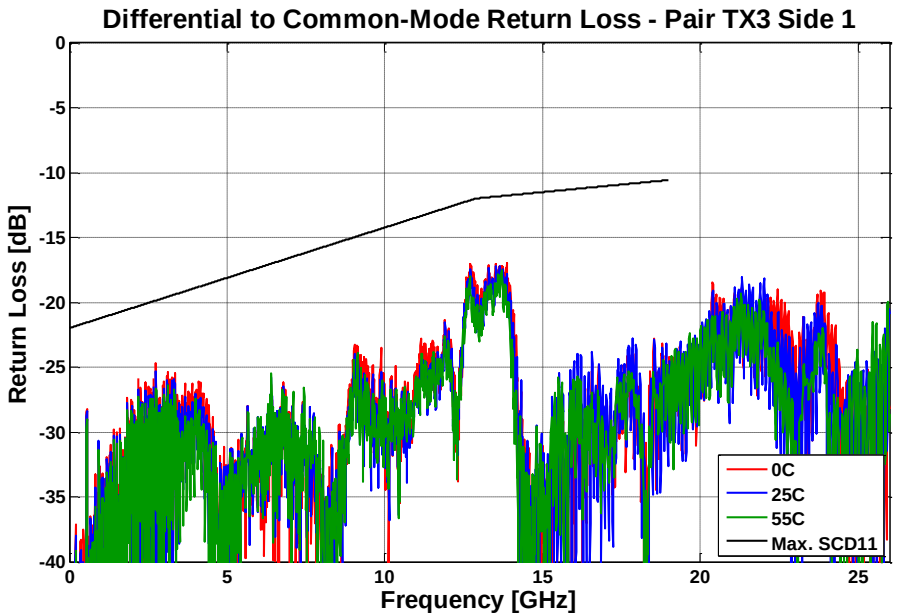


Differential to Common-Mode Return Loss

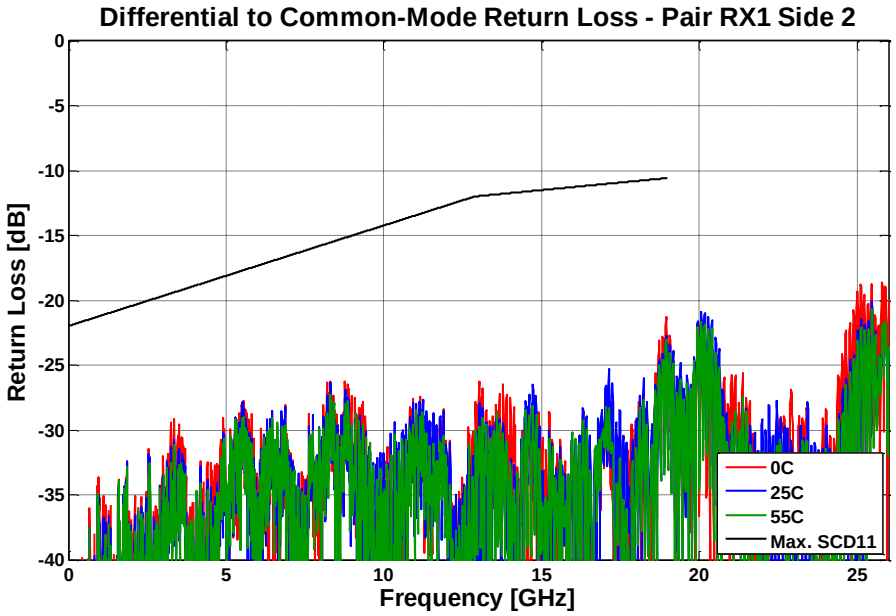


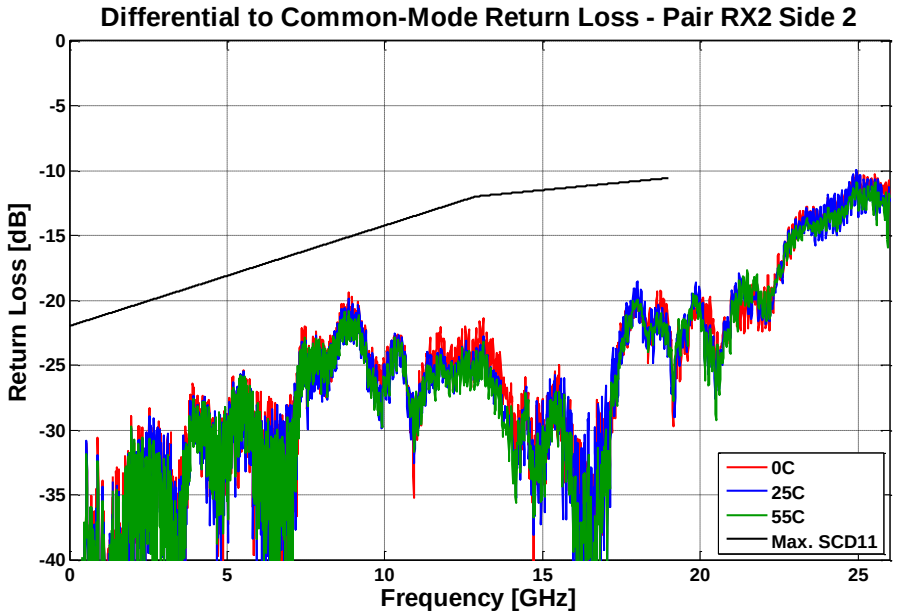


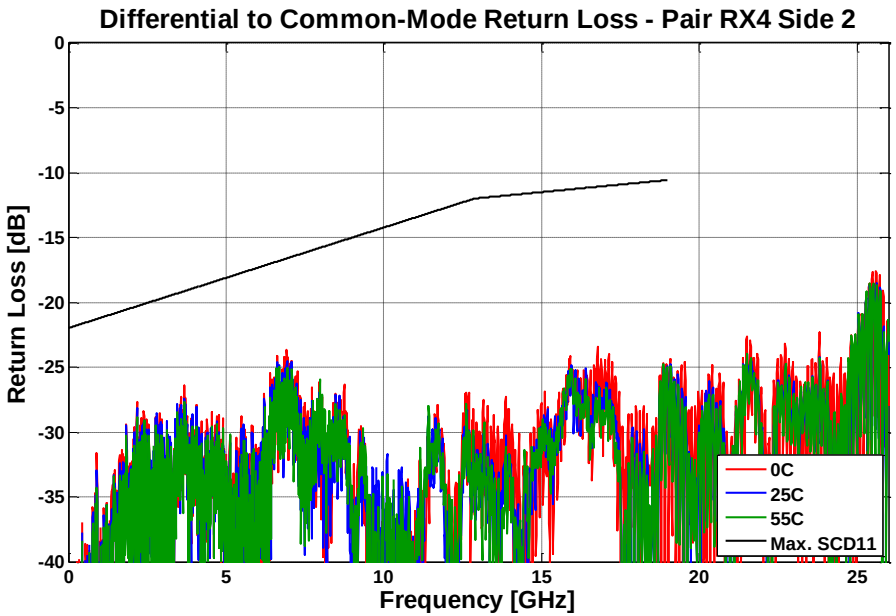


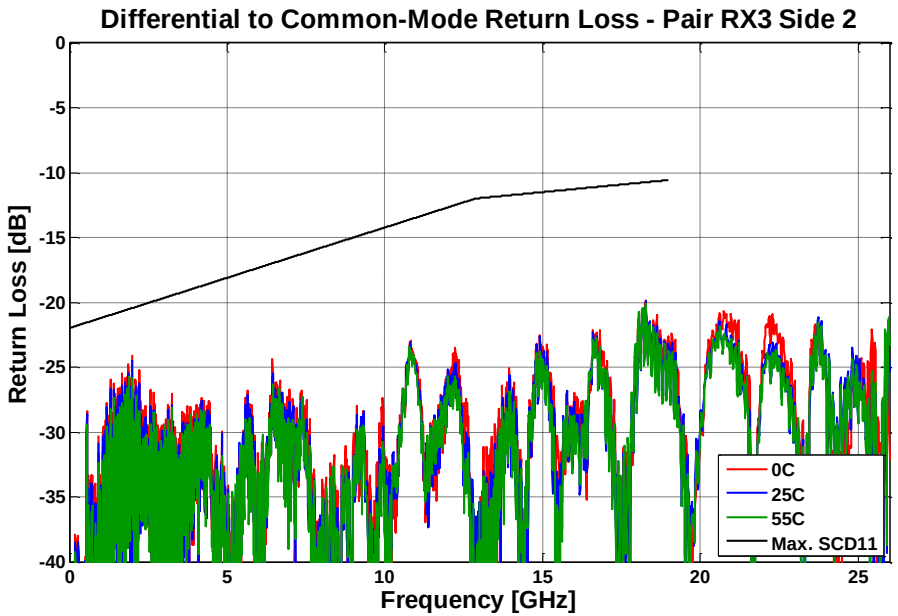


Differential to Common-Mode Return Loss

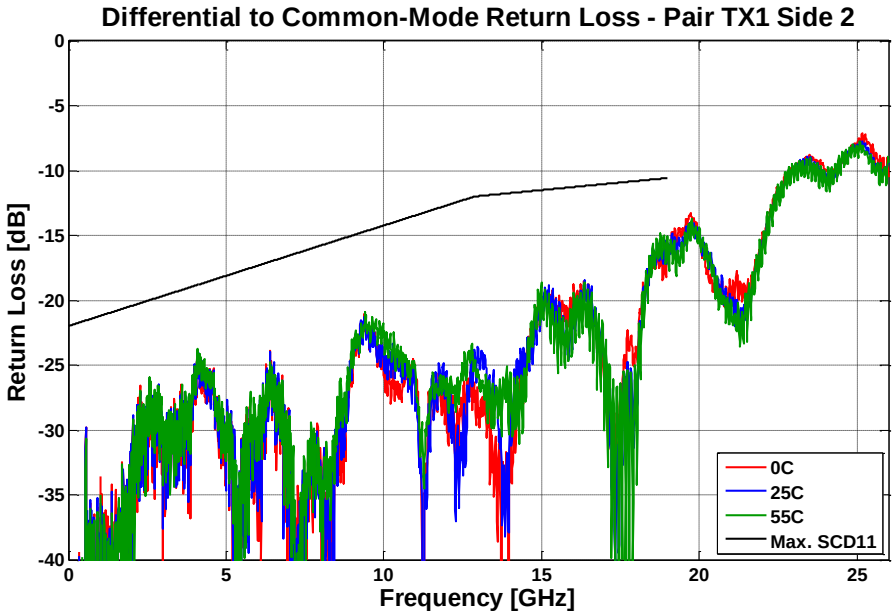


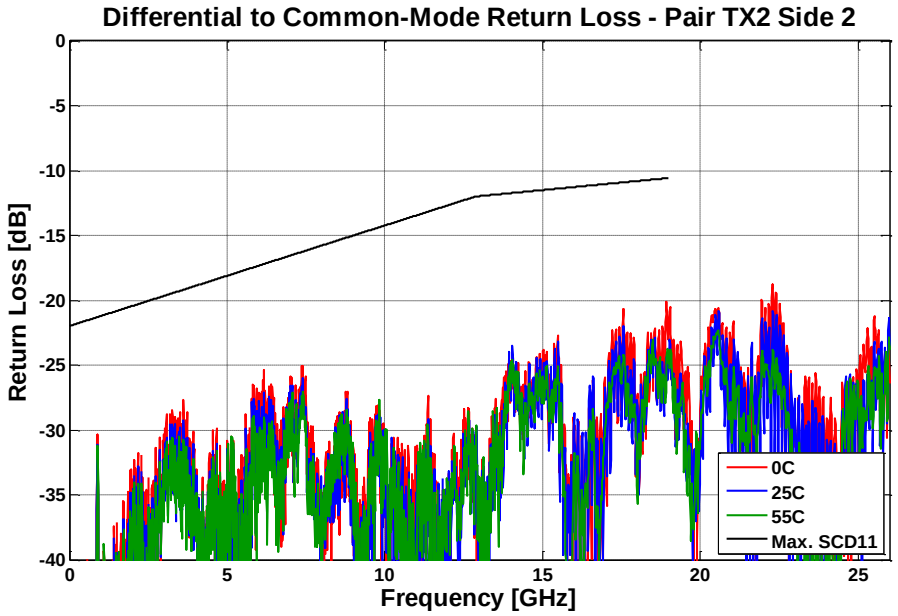


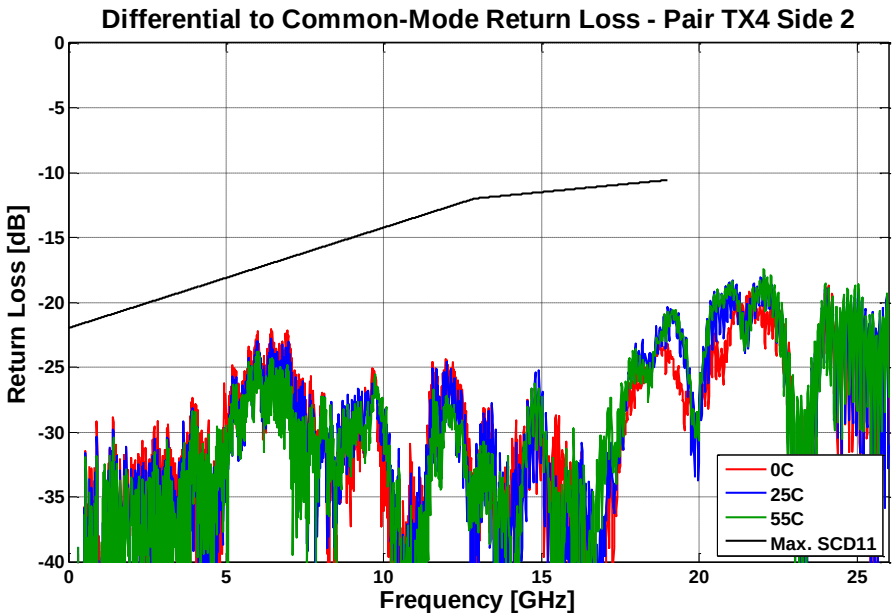


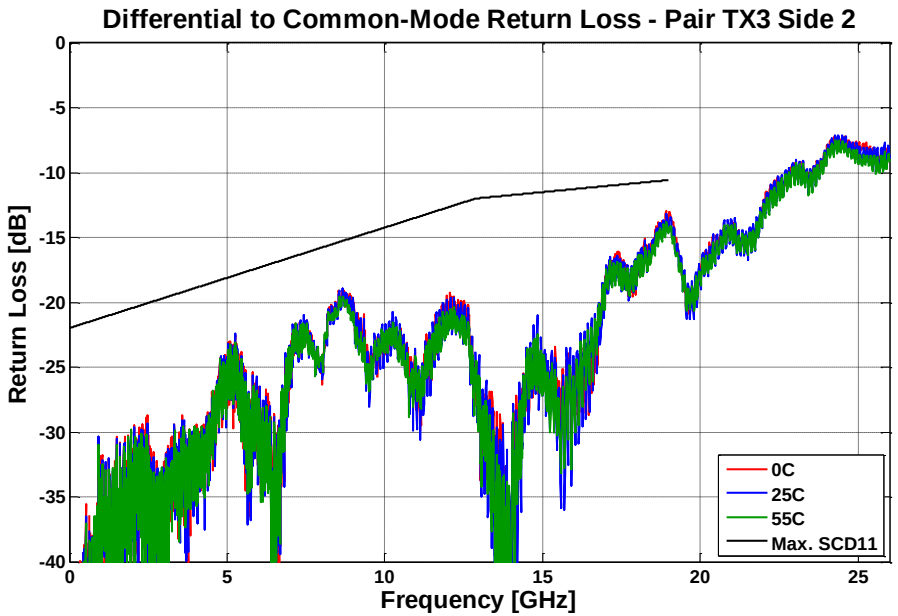


Differential to Common-Mode Return Loss

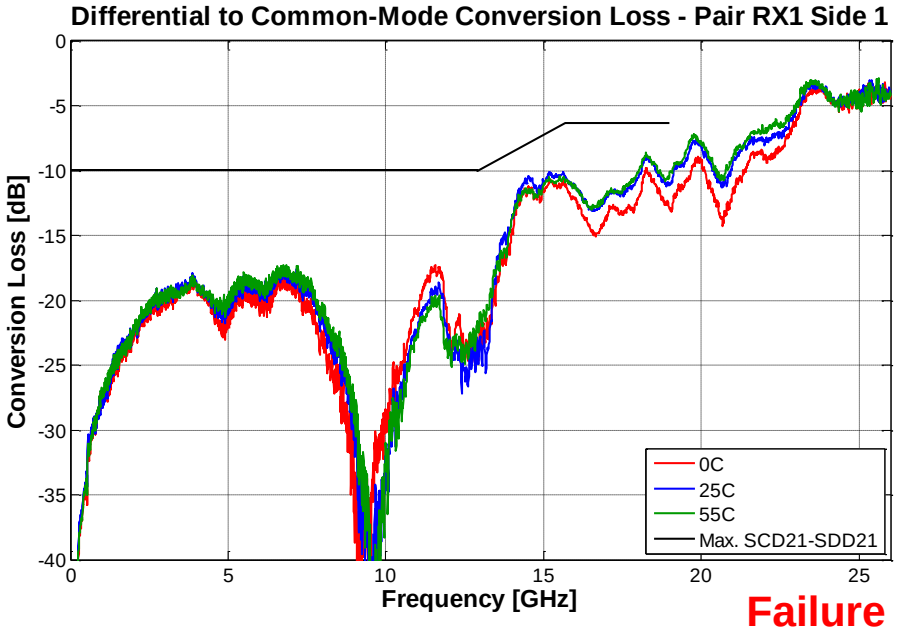


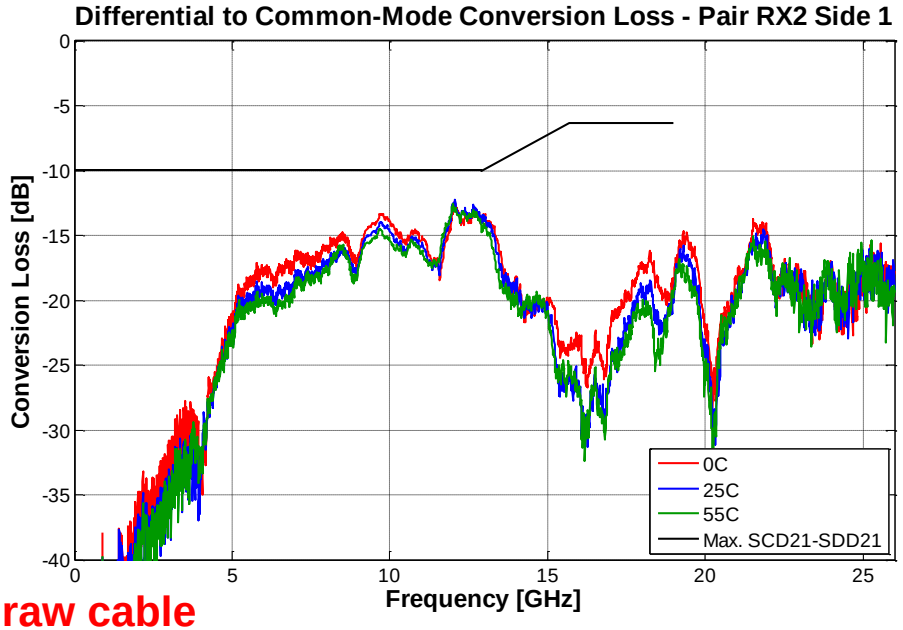




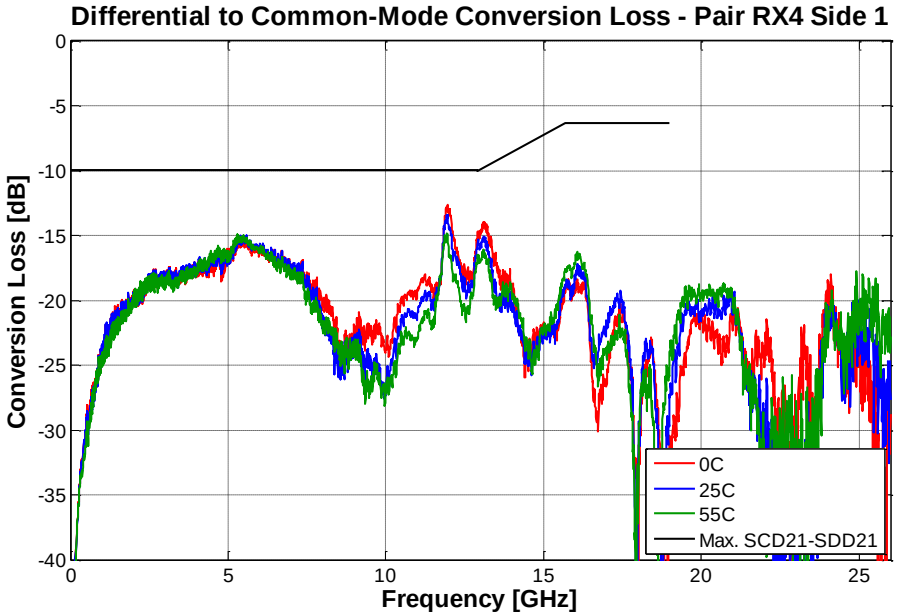


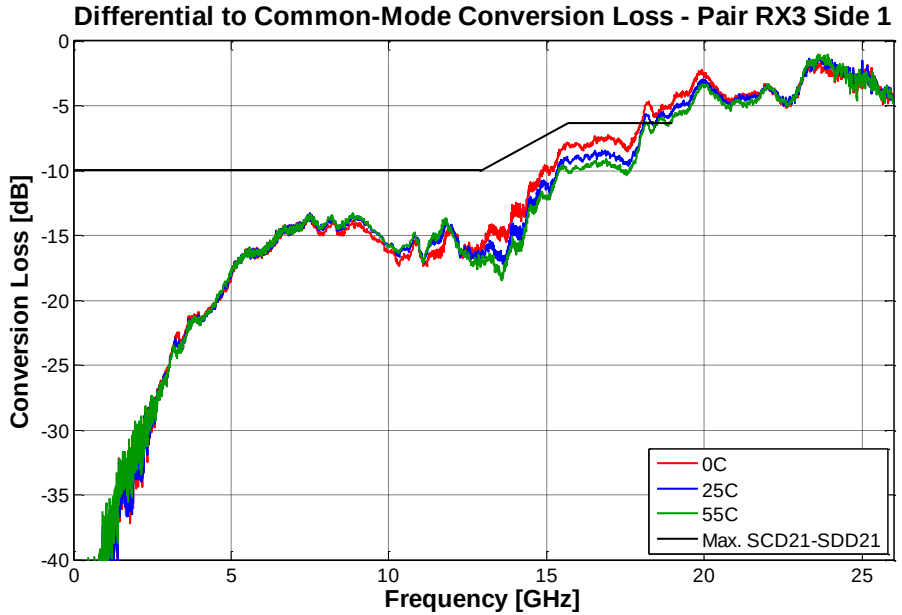
Differential to Common-Mode Conversion Loss



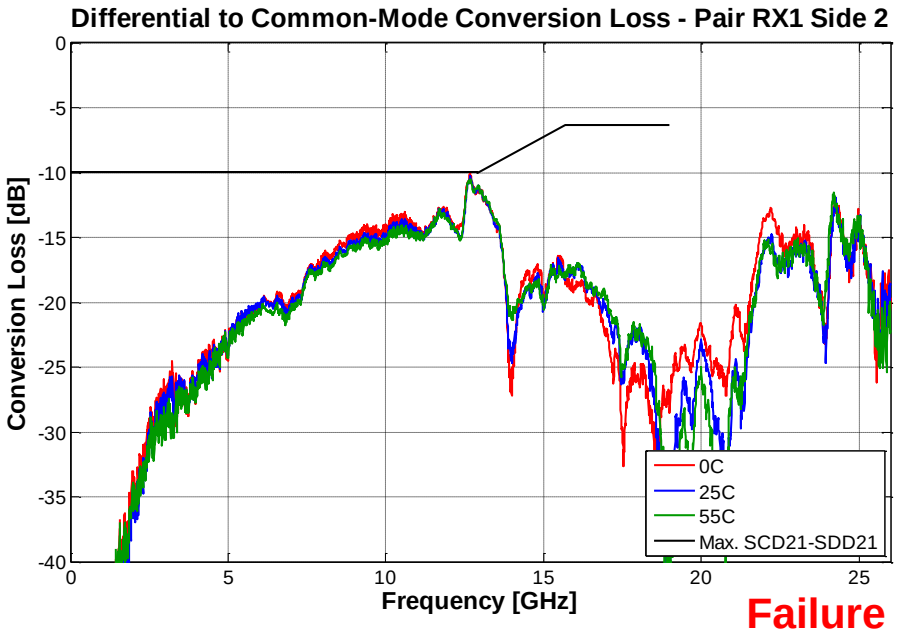


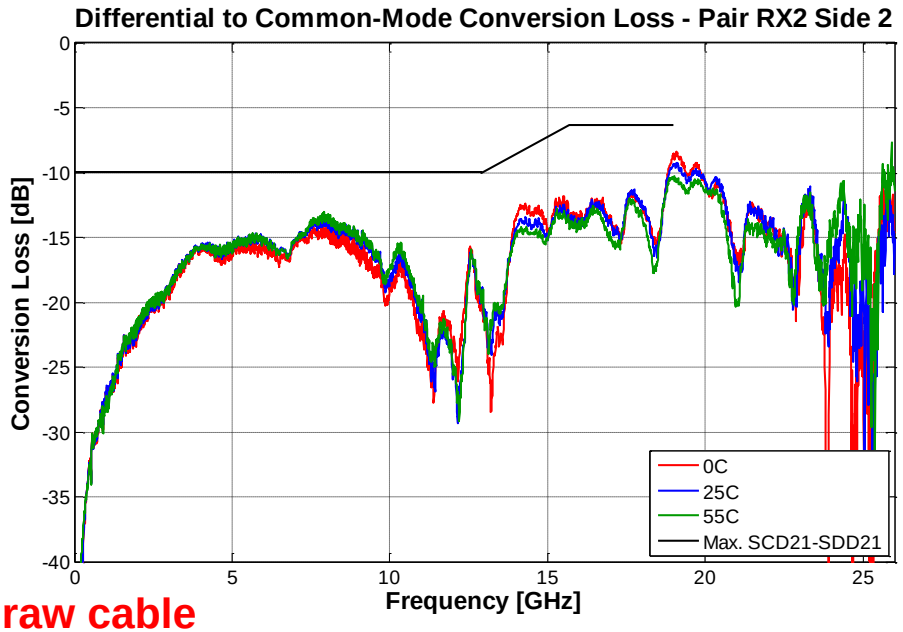
Failure due to raw cable



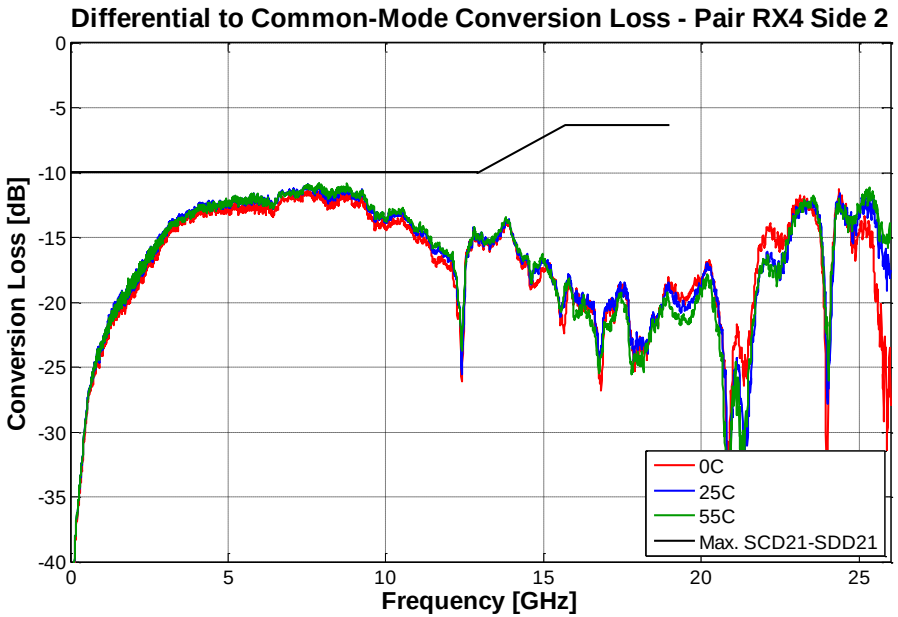


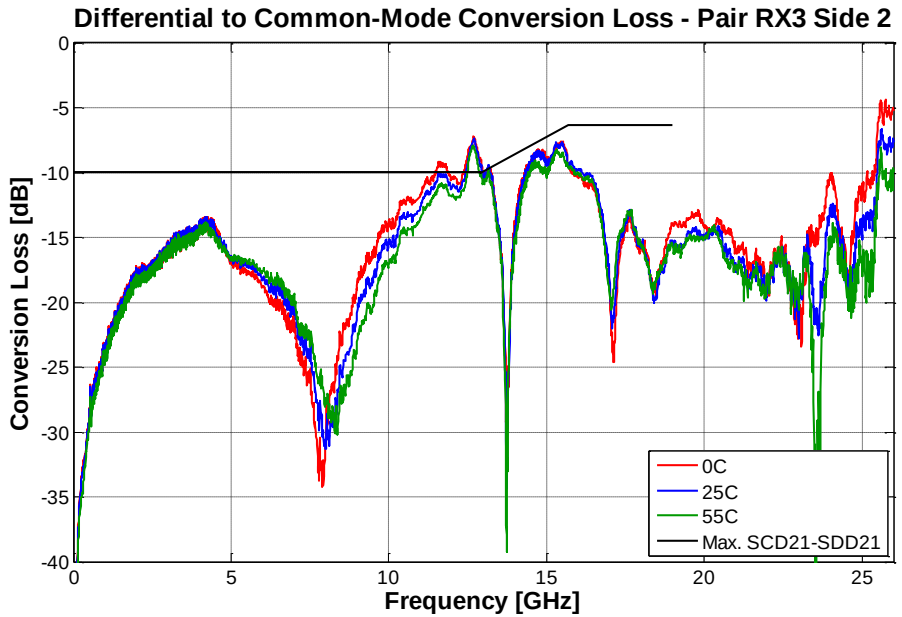
Differential to Common-Mode Conversion Loss



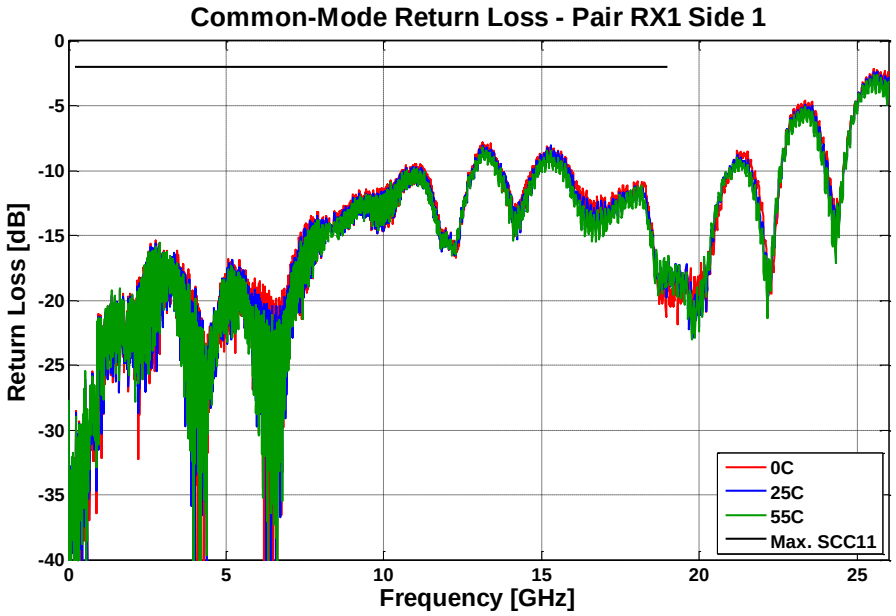


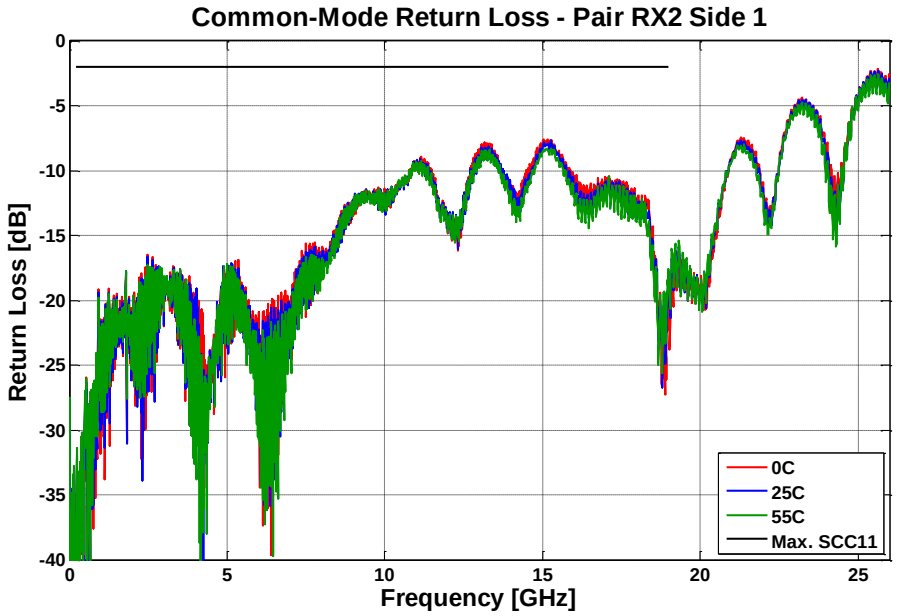
Failure due to raw cable

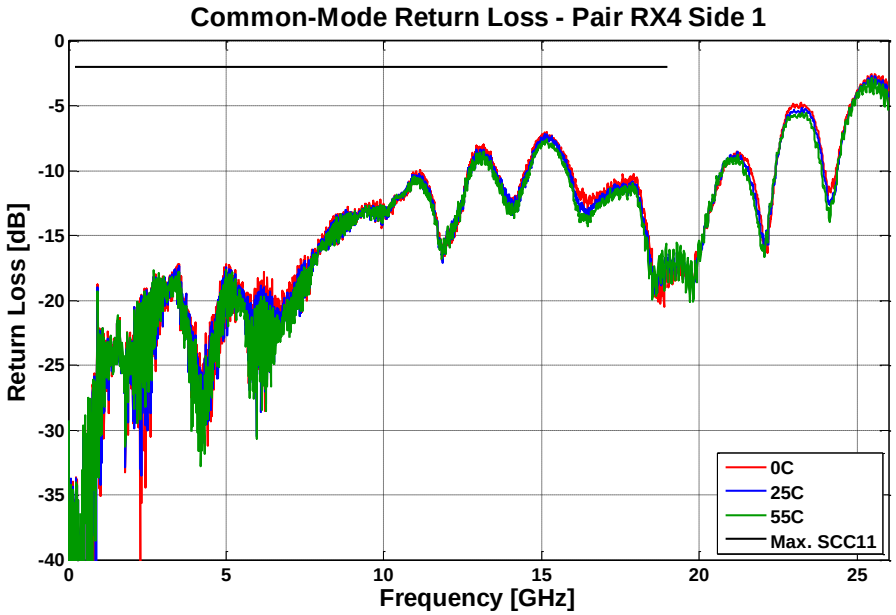


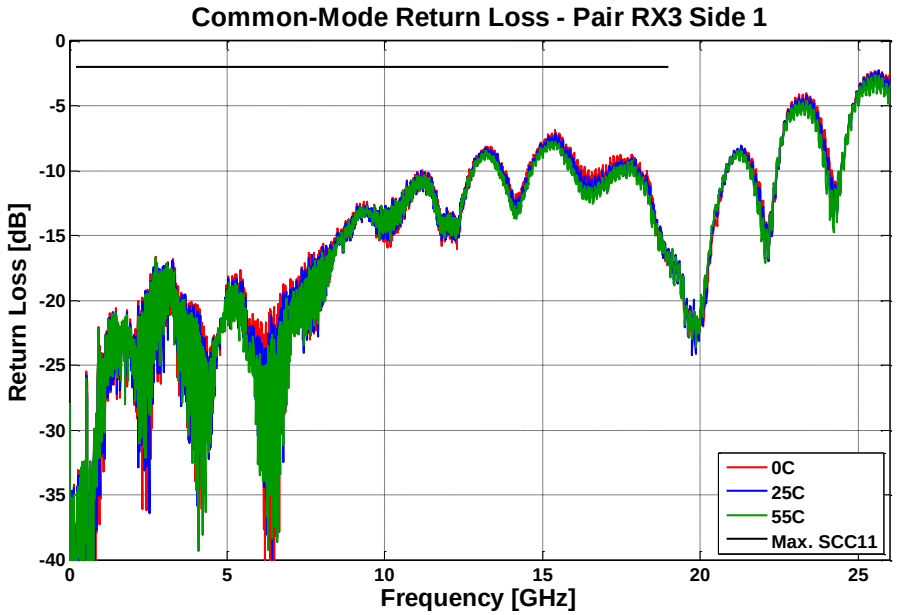


Common-Mode Return Loss

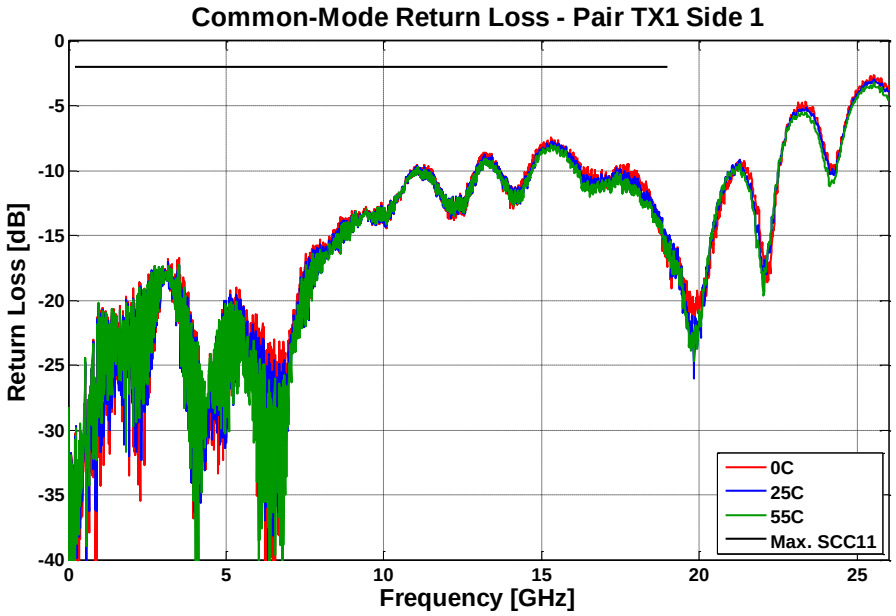


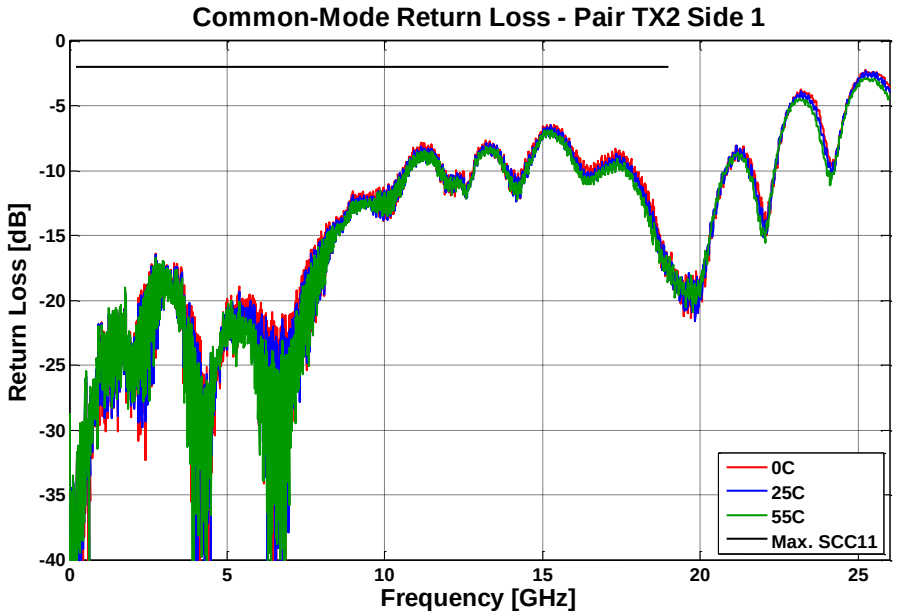


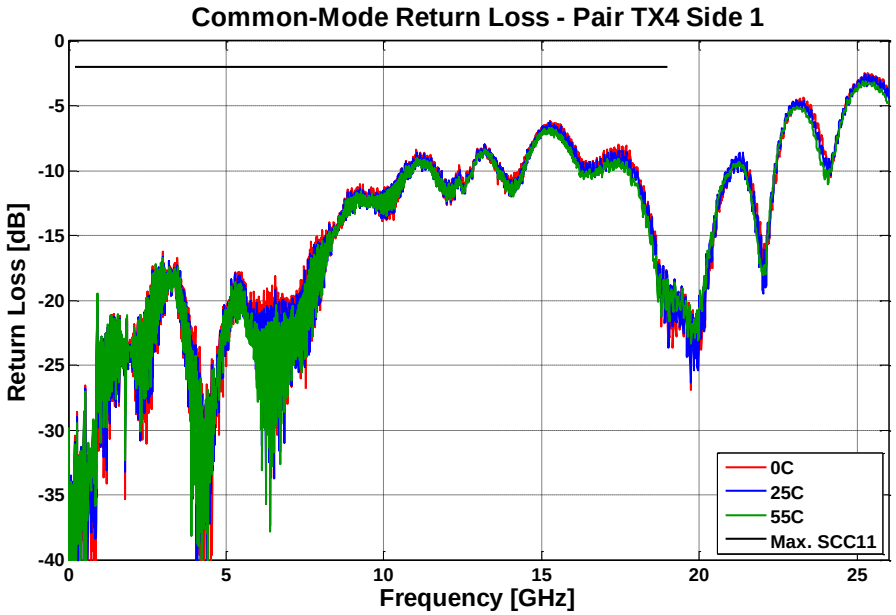


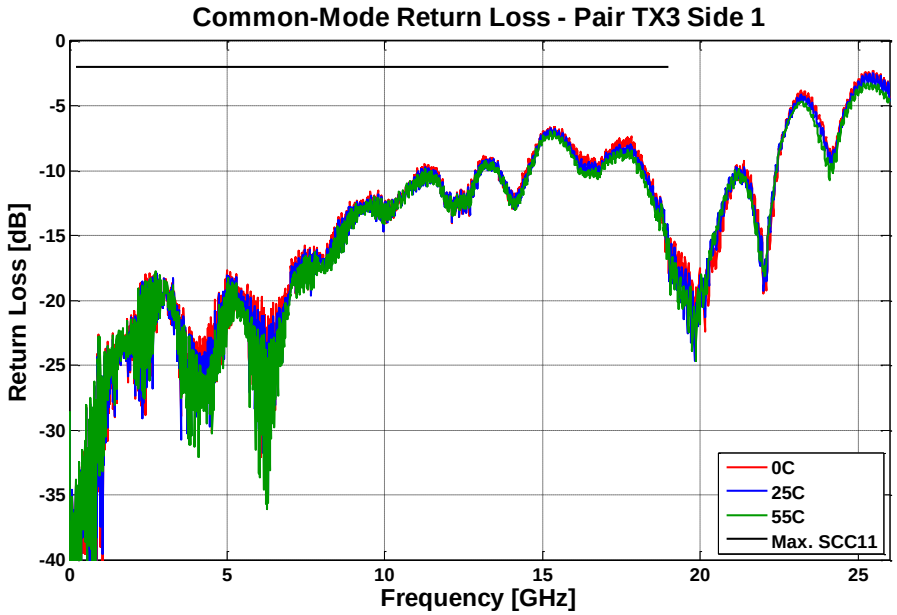


Common-Mode Return Loss

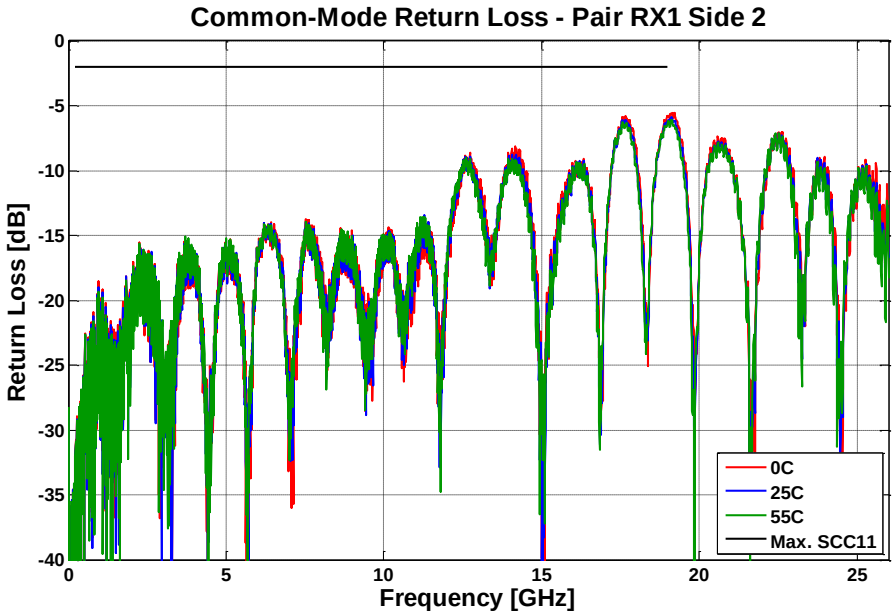


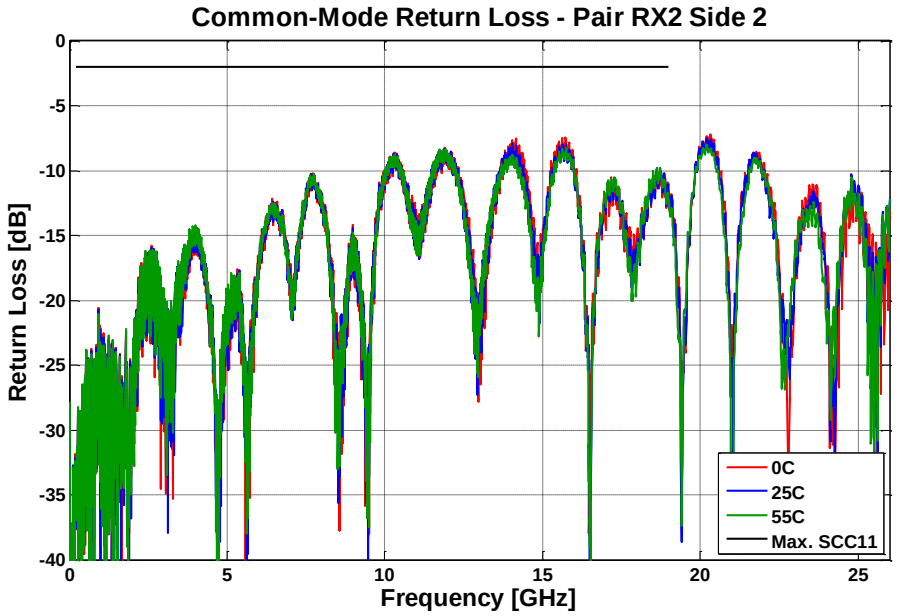


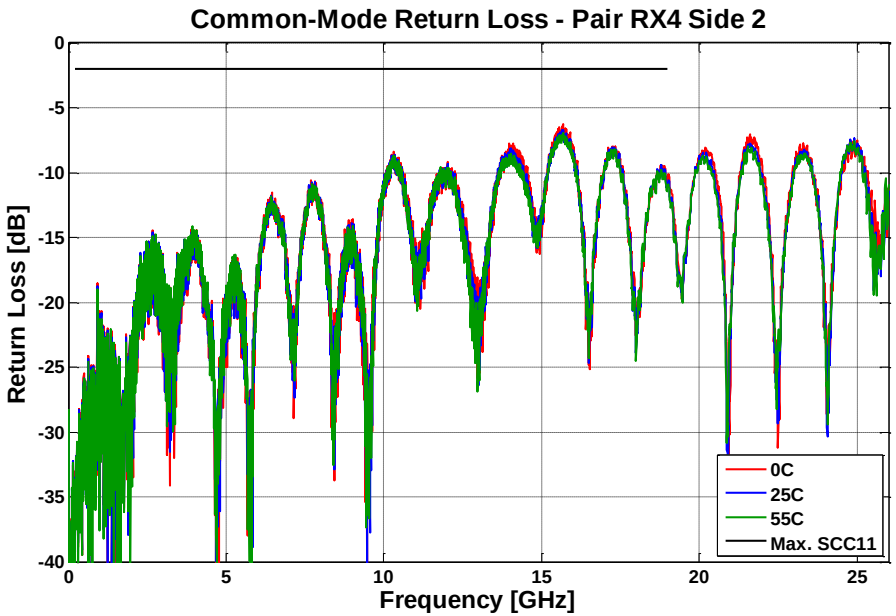


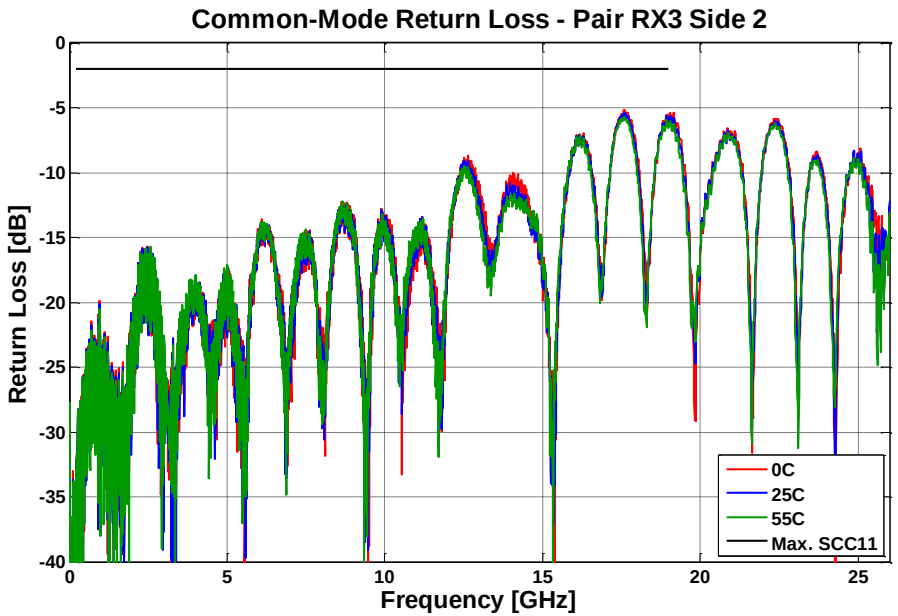


Common-Mode Return Loss

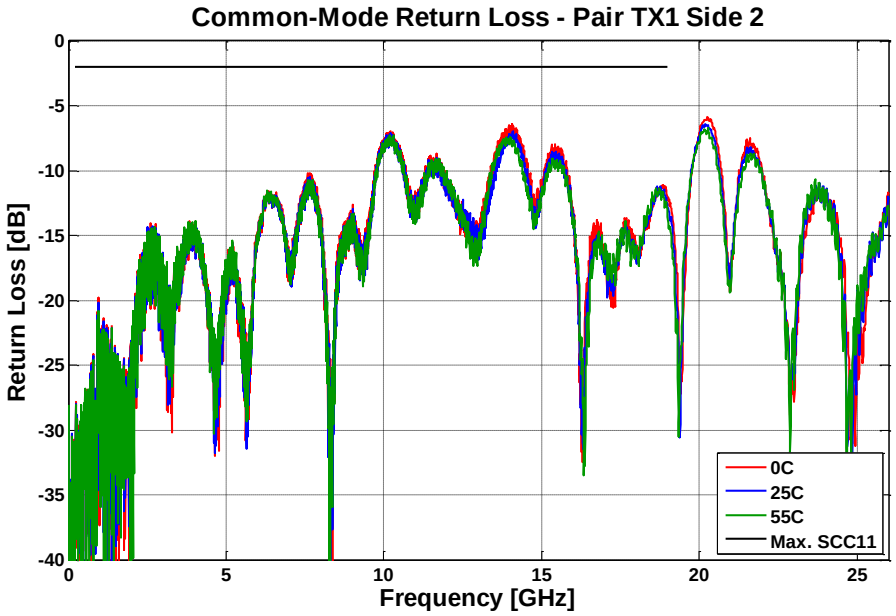


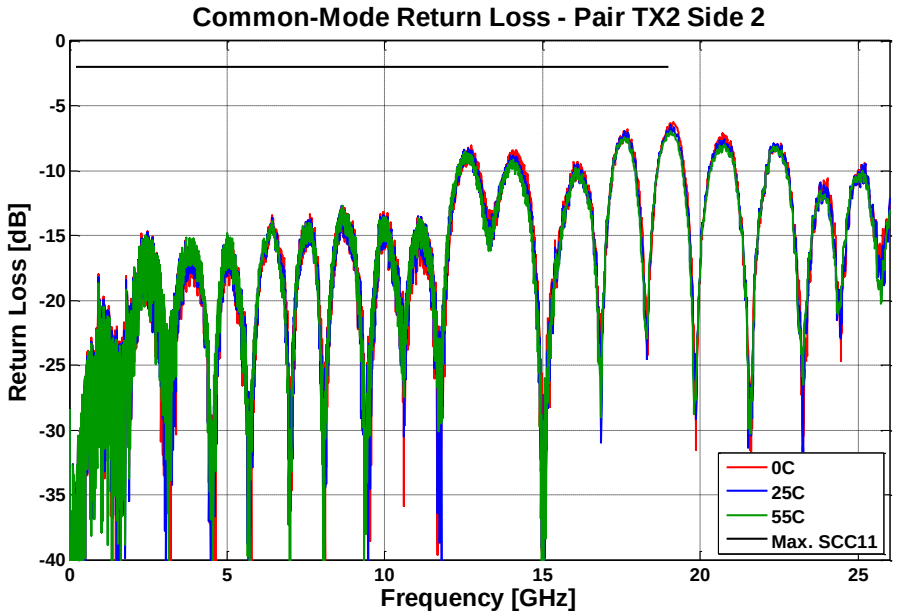


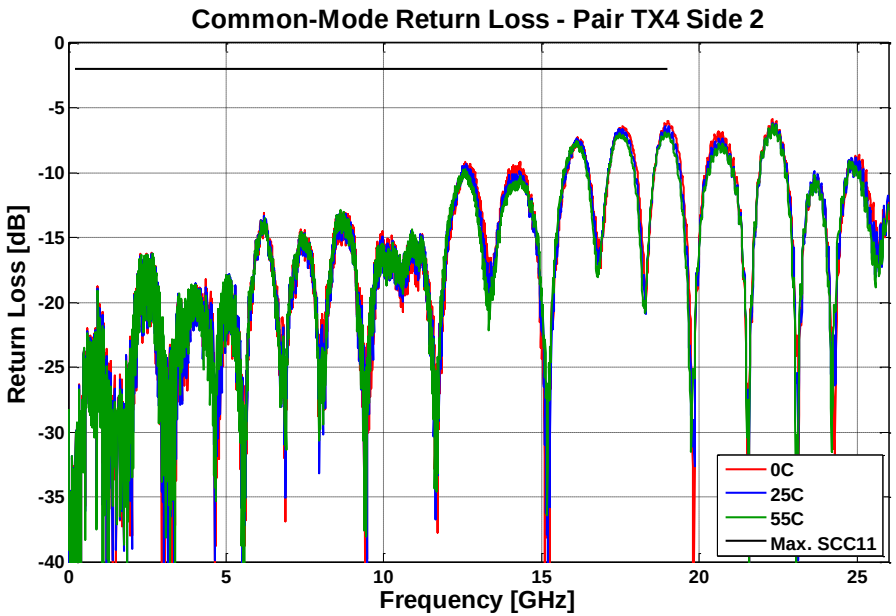


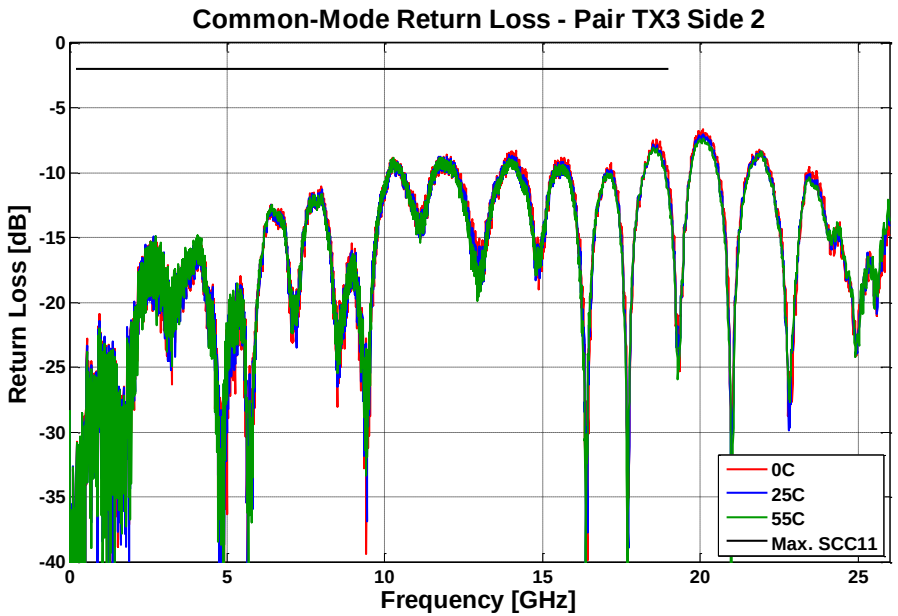


Common-Mode Return Loss









Conclusions

- Would prefer the second (slide 11) or fourth (slide 13) set of changes made to the COM parameters but would support the third set of changes (slide 12) assuming the spec is written for channels at room temperature.

- Victims RX2A and RX2B and their aggressors Touchstone files provided.