10 Gigabit Ethernet Consortium
10GBASE-CX4 PMD Test Suite v1.0

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28-Dec-2004

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Mr. Vendor:

Enclosed are the results from the 10GBASE-CX4 Physical Layer testing performed on the CompanyCom Fantabulax 4000 CX4 Transceiver. The testing was performed according to Version 1.0 of the 10GBASE-CX4 PMD Test Suite, which may be viewed online at:

http://www.iol.unh.edu/testsuites/10gec/index.html

Note that the tests are based on Clause 54 of IEEE Std 802.3ak-2003. Table 2 is included to summarize the requirements of this standard and reflect the coverage of the test suite. Results are included in Table 3. Figures 1 through 13 are graphical supplements to the tabulated results.

Also note that while Clause 54 does not include a transmitter eye mask specification, the eye diagrams shown in Figure 2 are plotted against the Clause 47 XAUI near-end mask, for reference purposes only. This mask is intended purely as a visual aid, to facilitate in the comparison of the various lane-to-lane eye features. It is not used for determining conformance results of any kind.

Also note that while Clause 54 only specifies conformance limits for TX and RX differential return loss, the Agilent N1951A Physical Layer Test System used by the IOL for performing these tests normally measures the entire mixed-mode s-parameter matrix by default. As a result, measurement results for TX/RX common-mode return loss are included in this report for any informative value they may contain. Also, for each of the return loss results, an additional plot is included showing the return loss data plotted as impedance, again for informative purposes only.

Also note that prior to running the formal tests, preliminary testing was performed in order to determine the optimal emphasis and/or amplitude settings for the formal test run. The settings used for the formal test, shown in Table 1, were deemed optimal based on the results of these preliminary tests.

Please feel free to contact me at schaller@iol.unh.edu if you have any questions regarding the contents of this report.

Sincerely,

Rob Schaller

Table 1: Setup and Configuration Information

Product	
Manufacturer	CompanyCom
Model	Fantabulax 4000 CX4 Transceiver
Hardware Version	0.01
Firmware Version	Rev 0
Software Version	Version 0.1
DUT Configuration	
Amplitude Setting	0x0F
Emphasis Setting	0x03
Test System Hardware	
Real-time DSO	LeCroy SDA6000, S/N SDA00538, Firmware v3.3.0
Vector Network Analyzer	Agilent N1951A 20GHz Physical Layer Test System, S/N US0020201
MDI-to-SMA Adapter	W.L. Gore & Associates, Inc. Part Number IBNTSTCX4

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Reviewed 28-Dec-2004

Bob Noseworthy
(Reviewer)

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Table 2: Summary of 10GBASE-CX4 electrical requirements

Test	Parameter	Min	Max	Units
54.1.1	**Signaling Speed**			
	Average TX bit rate, difference from 3.125 GBd	-312.5	312.5	kBd
54.1.2	**Common Mode Output Voltage**			
	DC voltage at TP2, measured with respect to signal shield	-400	1900	mV
54.1.3	**Differential Output Amplitude**			
	Maximum differential peak-to-peak output voltage measured at TP2 while sourcing the LF test pattern	800	1200	mV
	Maximum lane-to-lane amplitude difference	-	150	mV
54.1.4	**Differential Output Template**			
	Template fit of TX signaling observed at TP2 while the DUT is sourcing the LF test pattern	-	-	
54.1.5	**Transition Time**			
	20%-80% rising edge transition time	60	130	ps
	80%-20% falling edge transition time	60	130	ps
54.1.6	**Transmit Jitter**			
	Peak-to-peak deterministic jitter (DJ)	-	0.170	UI
	Peak-to-peak random jitter (RJ, 14σ)	-	0.270	UI
	Peak-to-peak total jitter (TJ)	-	0.350	UI
54.2.1	**Output Return Loss**			
	The transmitter output impedance shall result in a differential return loss greater than 10 dB from 100 MHz to 625 MHz and greater than $10-10\log_{10}(f/625\ MHz)$ dB from 625 MHz to 2.0 GHz, based on a 100-ohm source impedance. The minimum difference between the limit line and the SDD22 curve will be indicated as the Return Loss Margin.	0	Unlimited	dB
54.2.2	**Input Return Loss**			
	The receiver input impedance shall result in a differential return loss greater than 10 dB from 100 MHz to 625 MHz and greater than $10-10\log_{10}(f/625\ MHz)$ dB from 625 MHz to 2.0 GHz, based on a 100-ohm source impedance. The minimum difference between the limit line and the SDD11 curve will be indicated as the Return Loss Margin.	0	Unlimited	dB

Table 3: Summary of results for the DUT

Test	Parameter	Lane 0	Lane 1	Lane 2	Lane 3	Units
54.1.1	**Signaling Speed**					
	Difference from 3.125 GBd	8.59	8.56	8.70	8.59	kBd
54.1.2	**Common Mode Output Voltage**					
	DC bias voltage measured at TP2	0	0	0	0	mV
54.1.3	**Differential Output Amplitude**					
	Differential pk-pk output voltage	1113	1100	1119	1158	mV
	Maximum lane-lane difference	44	57	39	57	mV
54.1.4	**Differential Output Template**					
	Template fit of averaged waveform	PASS	PASS	PASS	PASS	
54.1.5	**Transition Time**					
	20%-80% rise time	91.1	88.0	101.0	96.9	ps
	80%-20% fall time	92.0	86.8	101.6	99.5	ps
54.1.6	**Transmit Jitter**					
	Peak-peak deterministic jitter (DJ)	0.164	0.168	0.136	(0.180)	UI
	Peak-peak random jitter (RJ, 14σ)	0.190	0.204	0.189	0.205	UI
	Peak-peak total jitter (TJ)	(0.354)	(0.372)	0.324	(0.385)	UI
54.2.1	**Output Return Loss**					
	TX differential return loss margin	3.4	3.2	2.7	3.3	dB
54.2.2	**Input Return Loss**					
	RX differential return loss margin	4.6	4.5	3.3	5.3	dB

NOTE: Failures are indicated in red text, enclosed by parentheses

Figure 1: Differential Output Templates

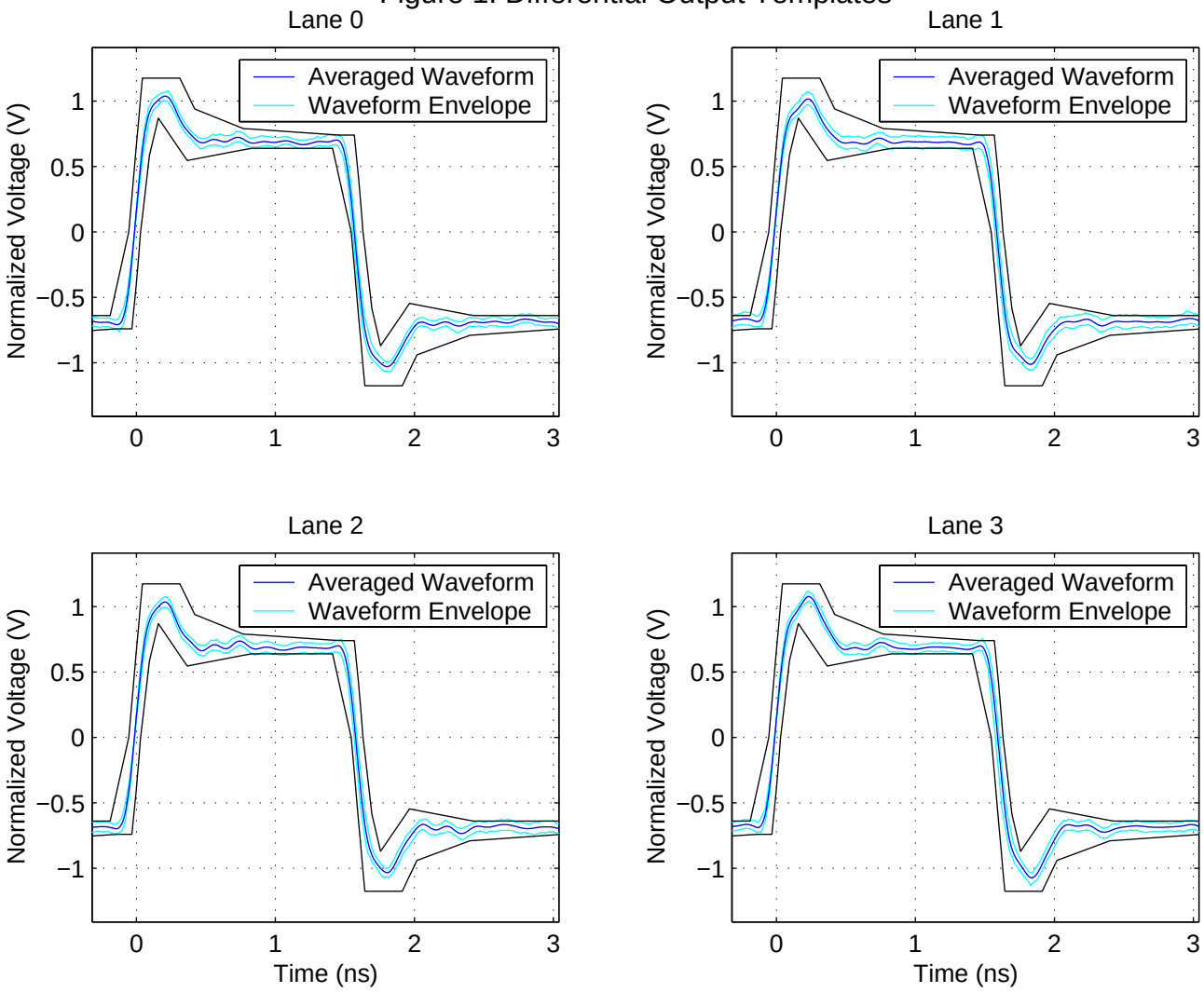

Figure 2: Eye Diagrams (Informative)

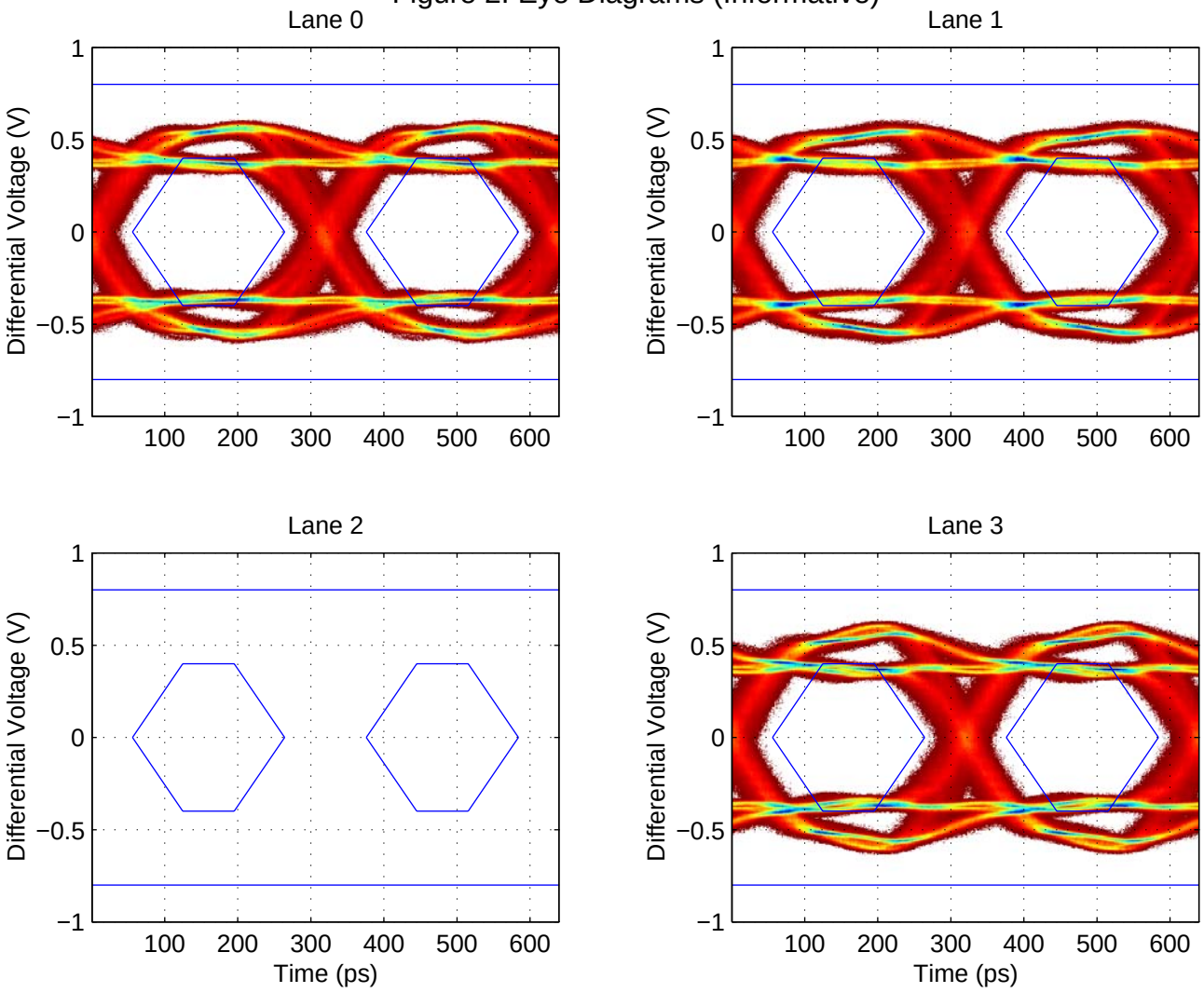

Figure 3: Jitter Histograms (Informative)

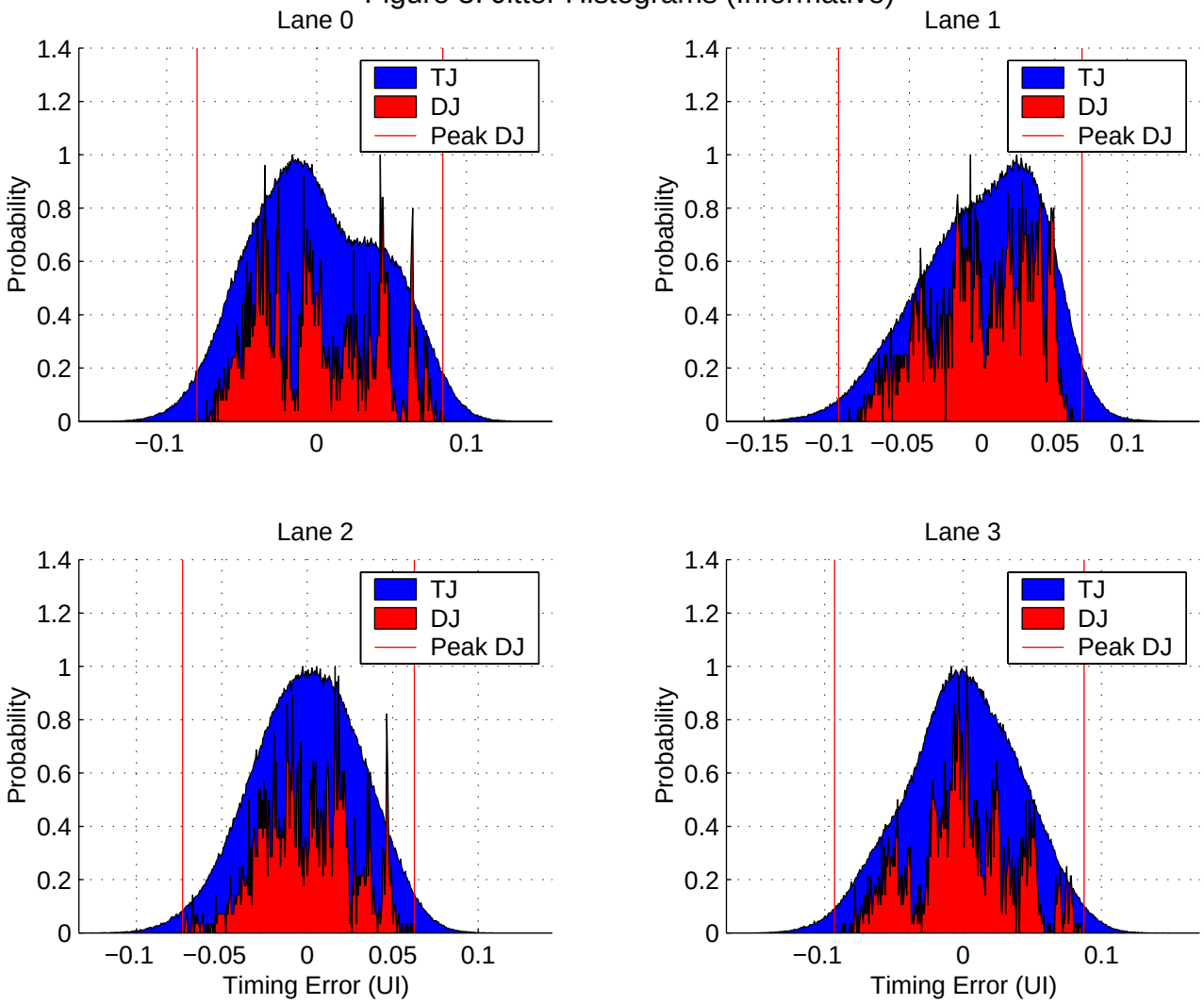

Figure 4: Jitter PSDs (Informative)

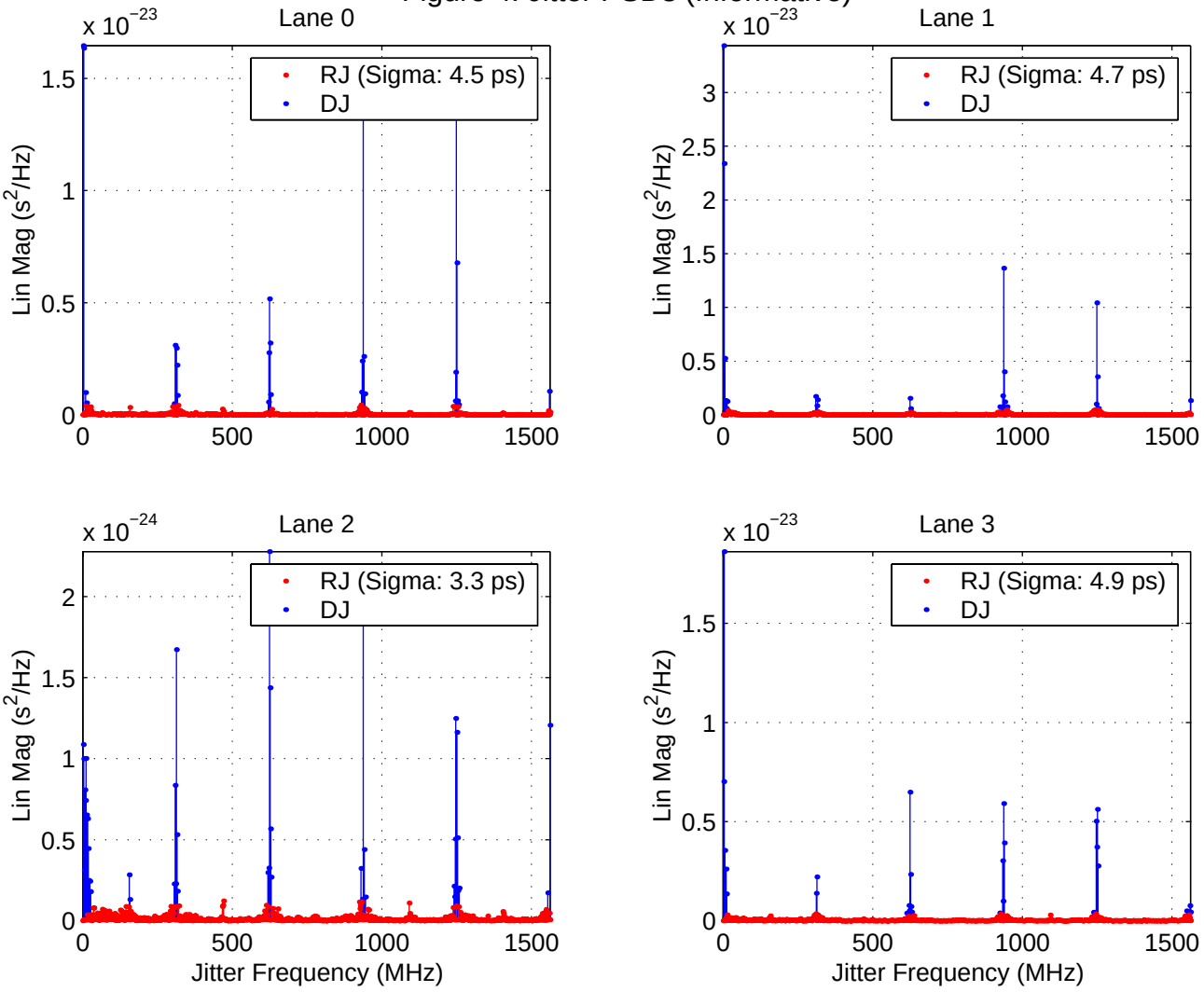

Figure 5: Rise/Fall Times

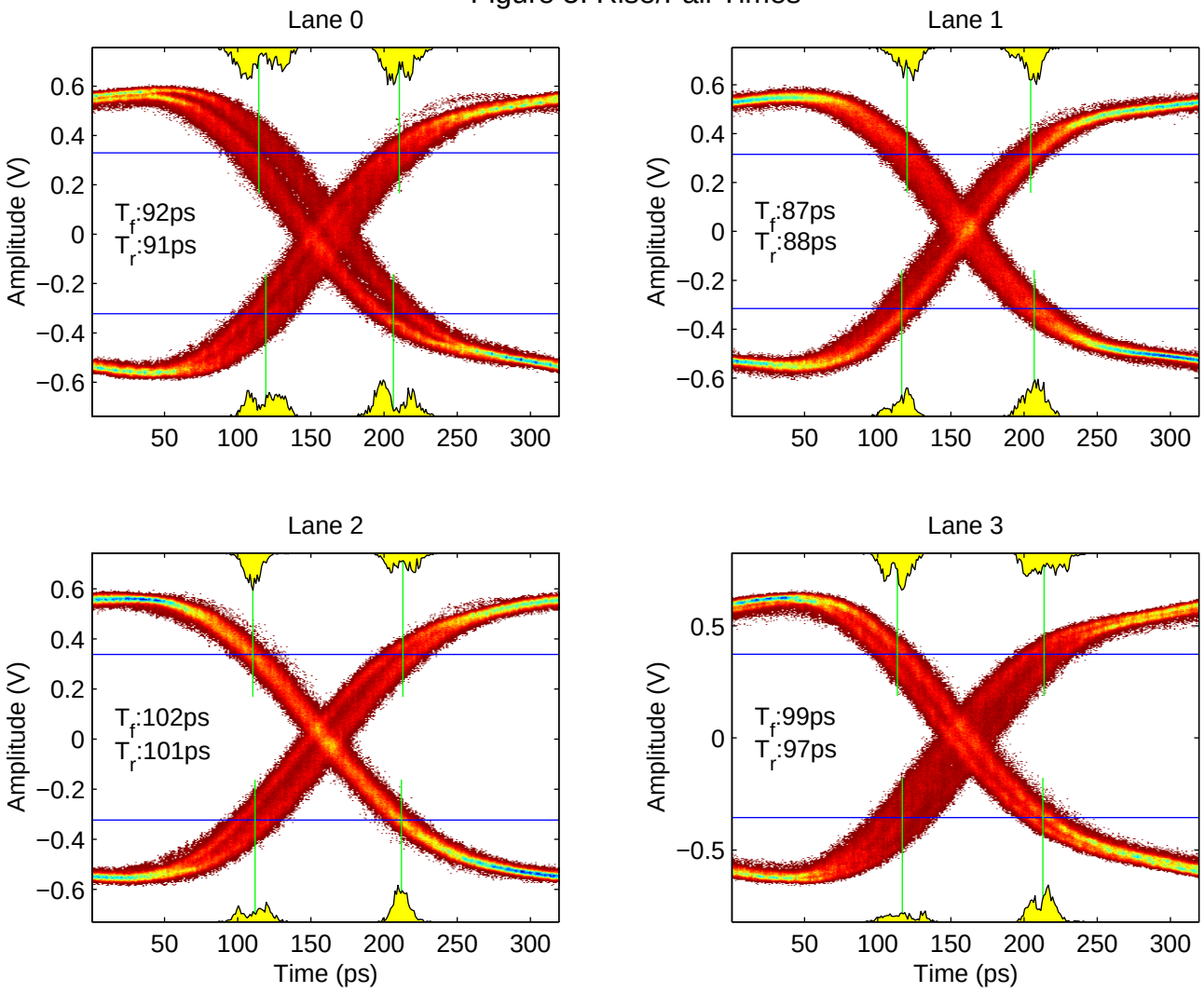

Figure 6: SDD11 (RX Differential Return Loss) vs. Frequency

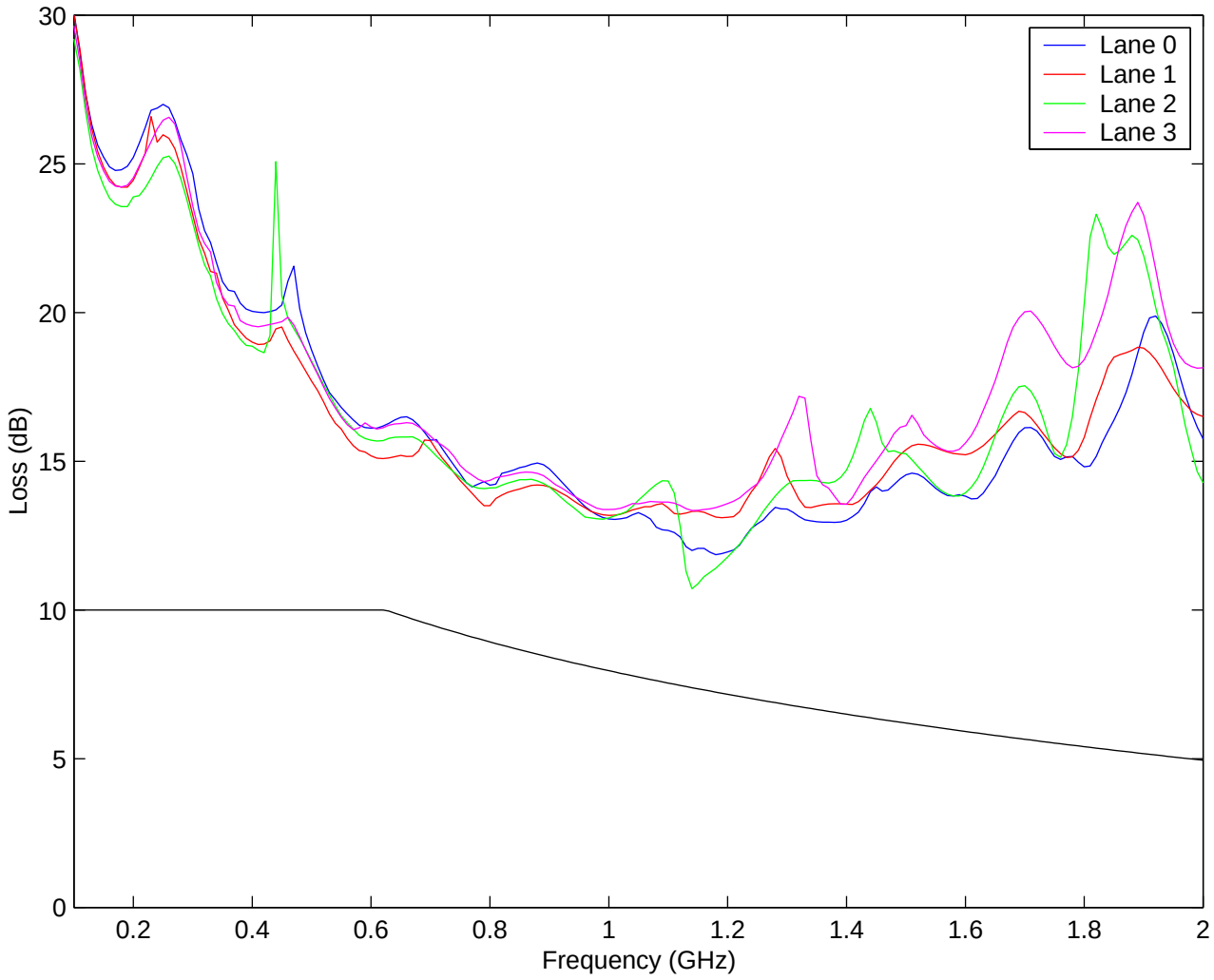

Figure 7: SDD11 (Impedance) vs. Frequency (Informative)

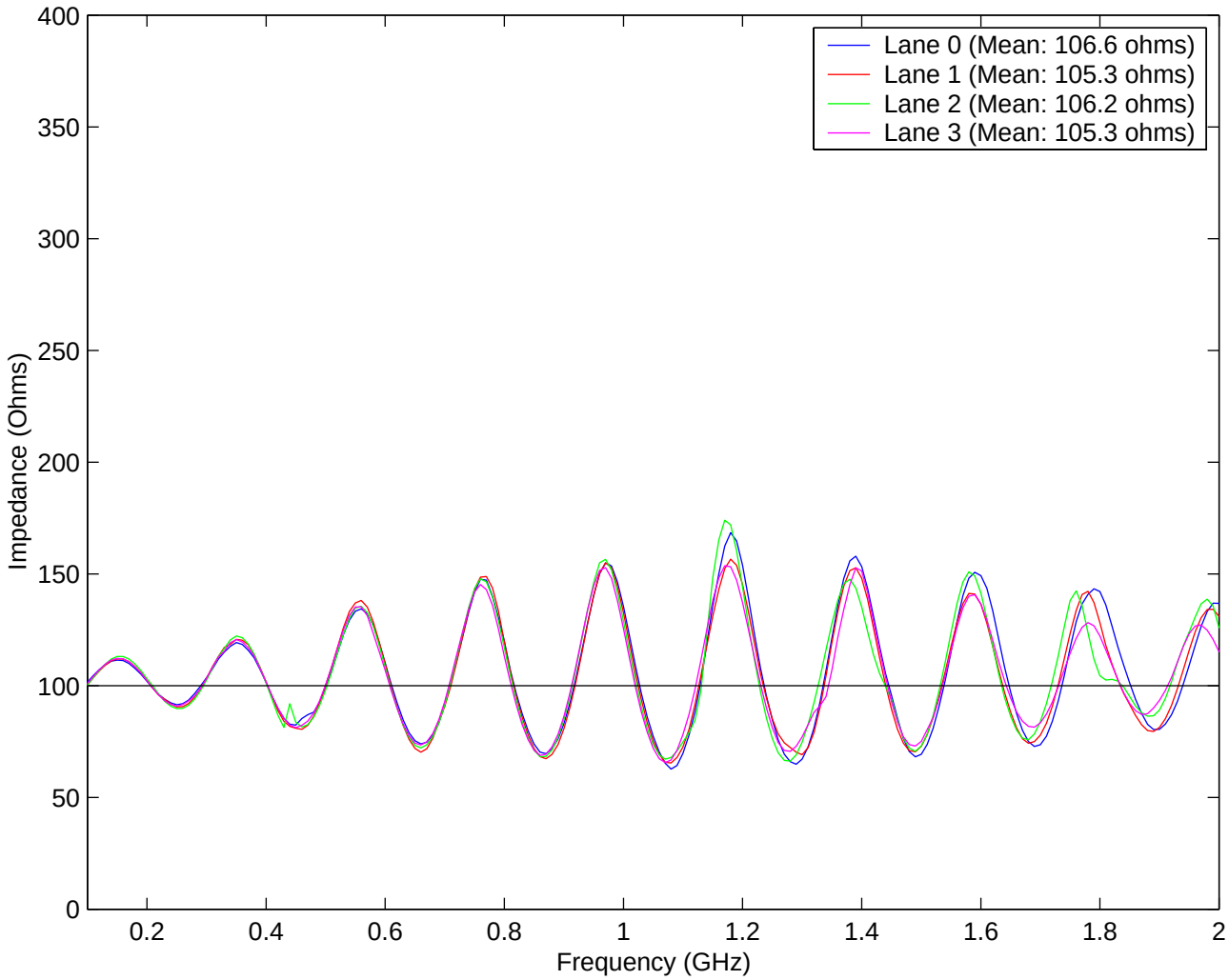

Figure 8: SCC11 (RX Common Mode Return Loss) vs. Frequency (Informative)

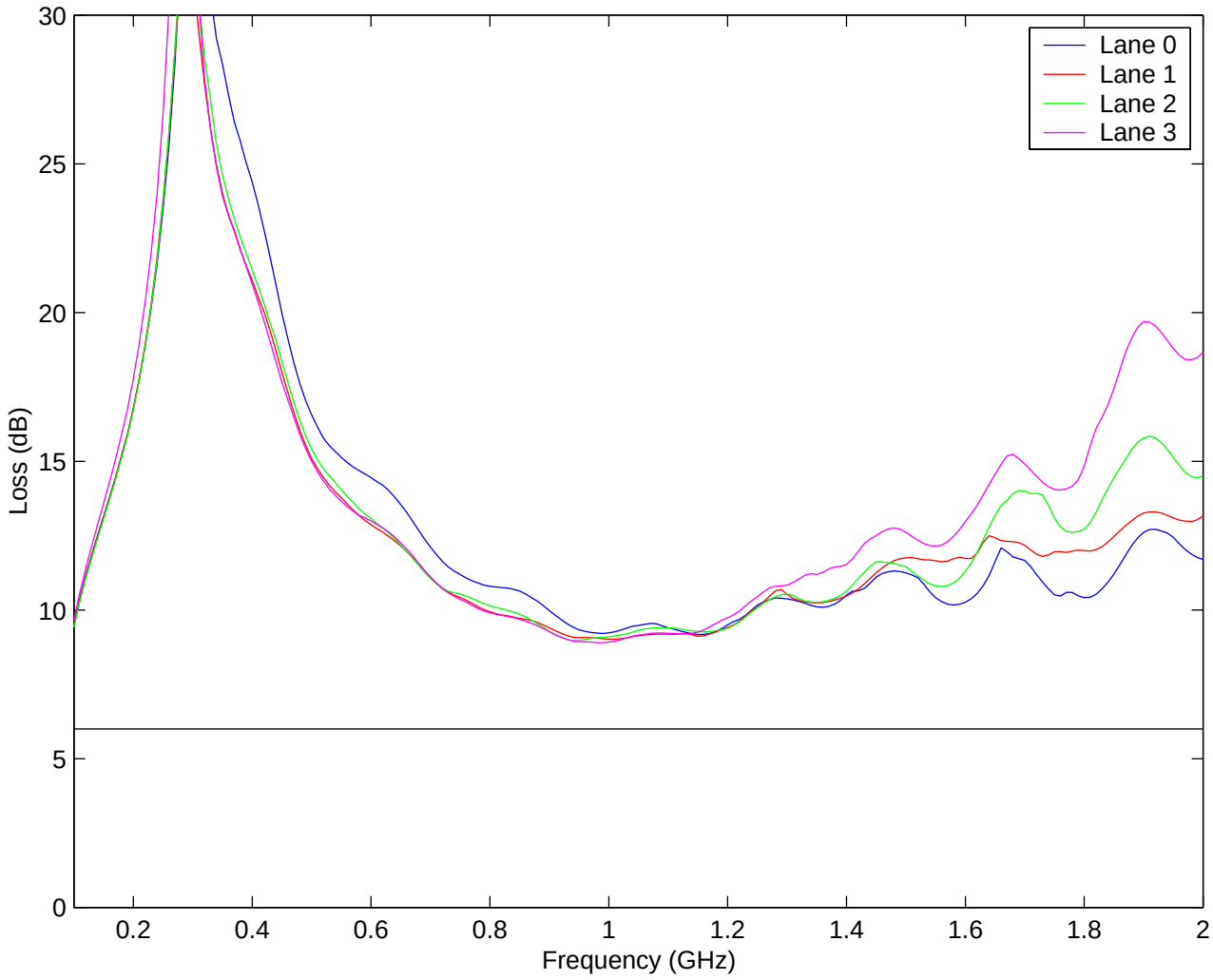

Figure 9: SCC11 (Impedance) vs. Frequency (Informative)

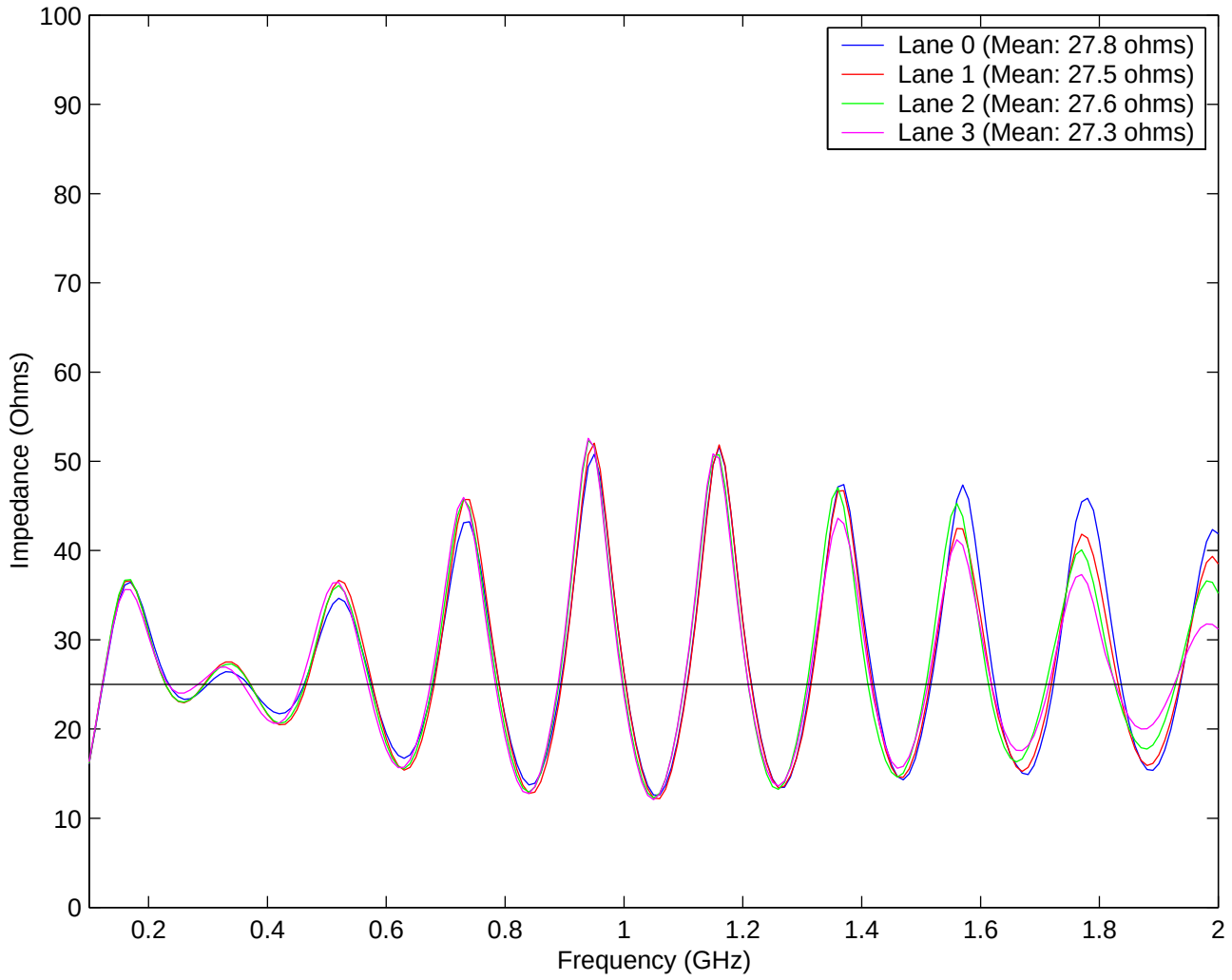

Figure 10: SDD22 (TX Differential Return Loss) vs. Frequency

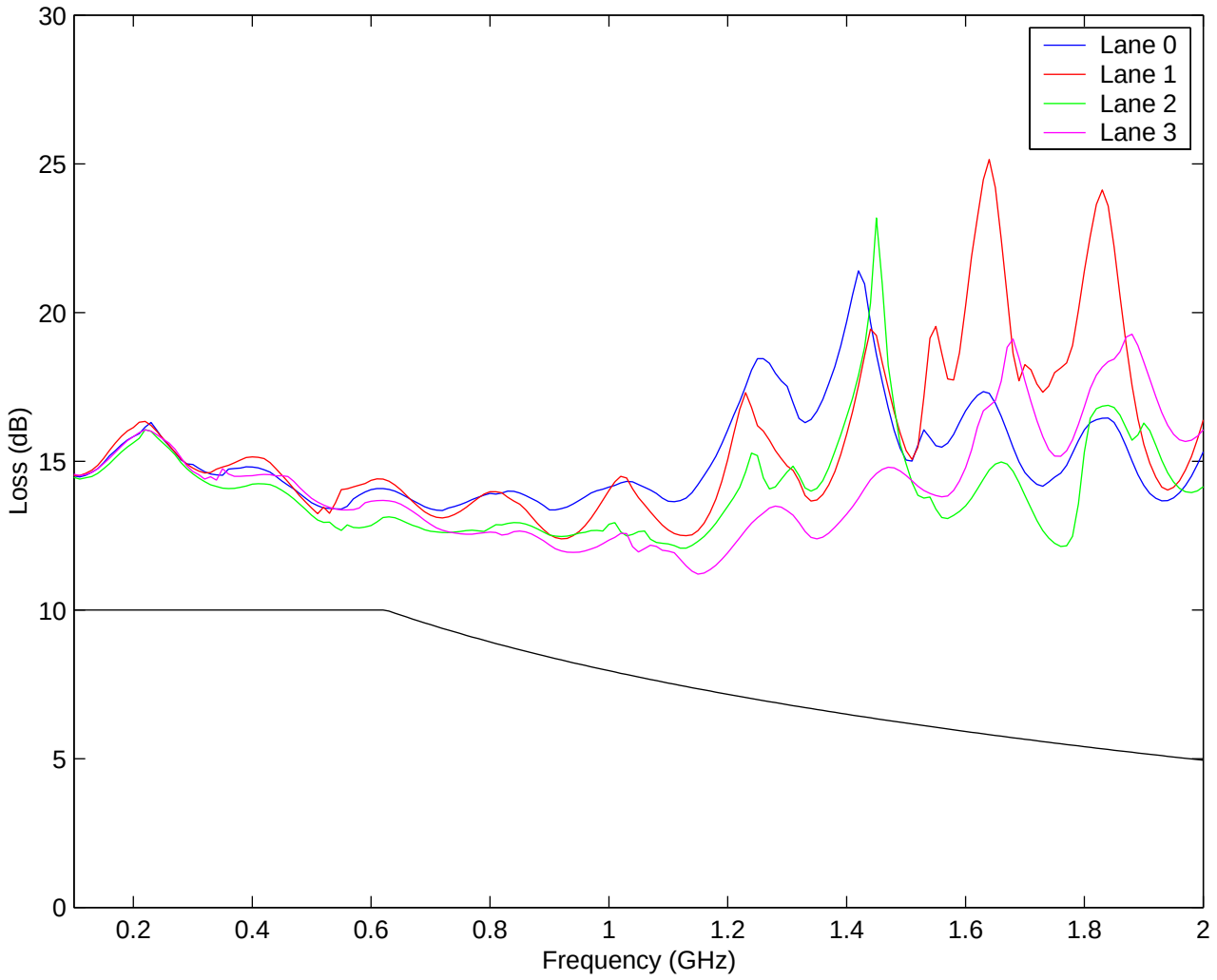

Figure 11: SDD22 (Impedance) vs. Frequency (Informative)

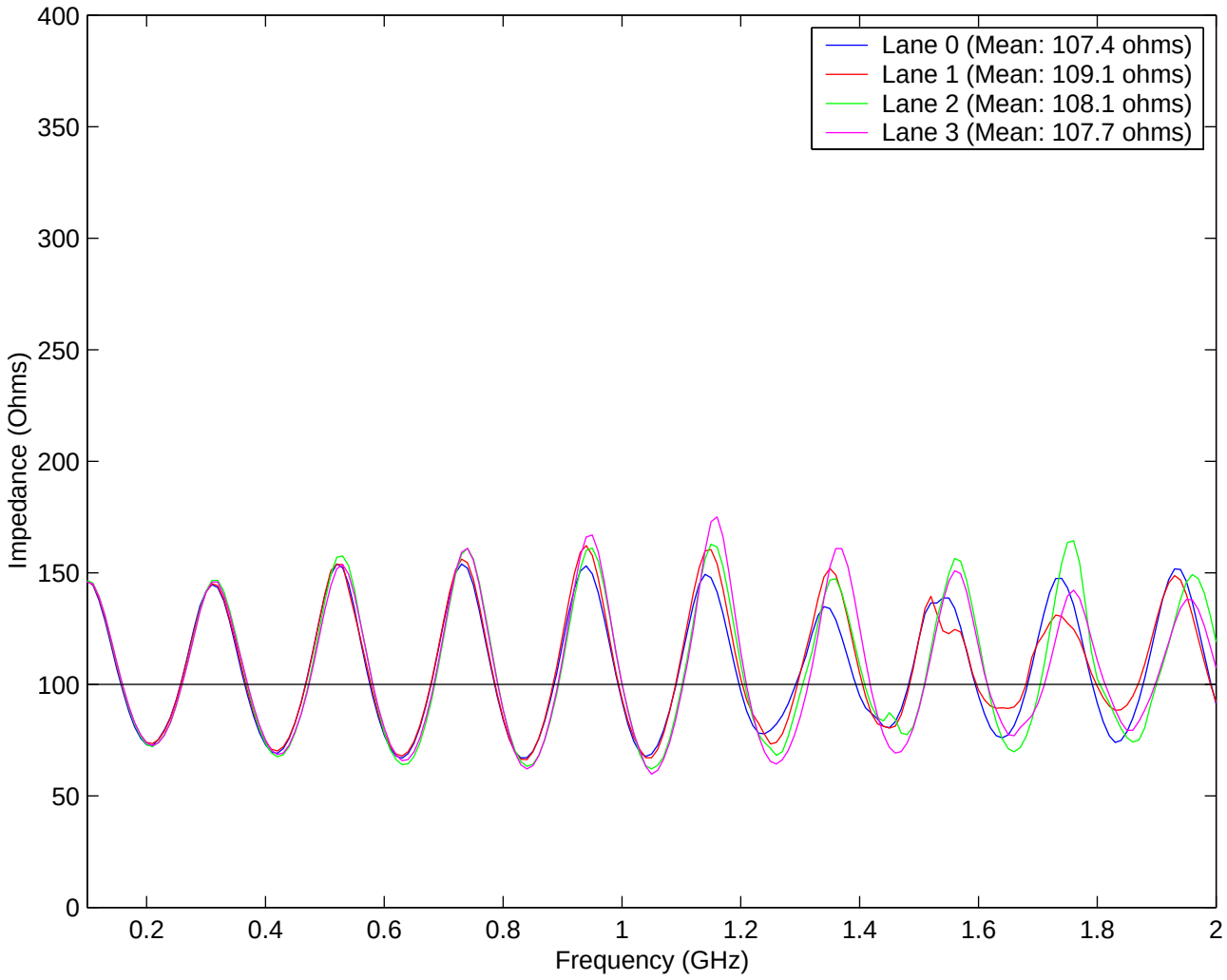

Figure 12: SCC22 (TX Common Mode Return Loss) vs. Frequency (Informative)

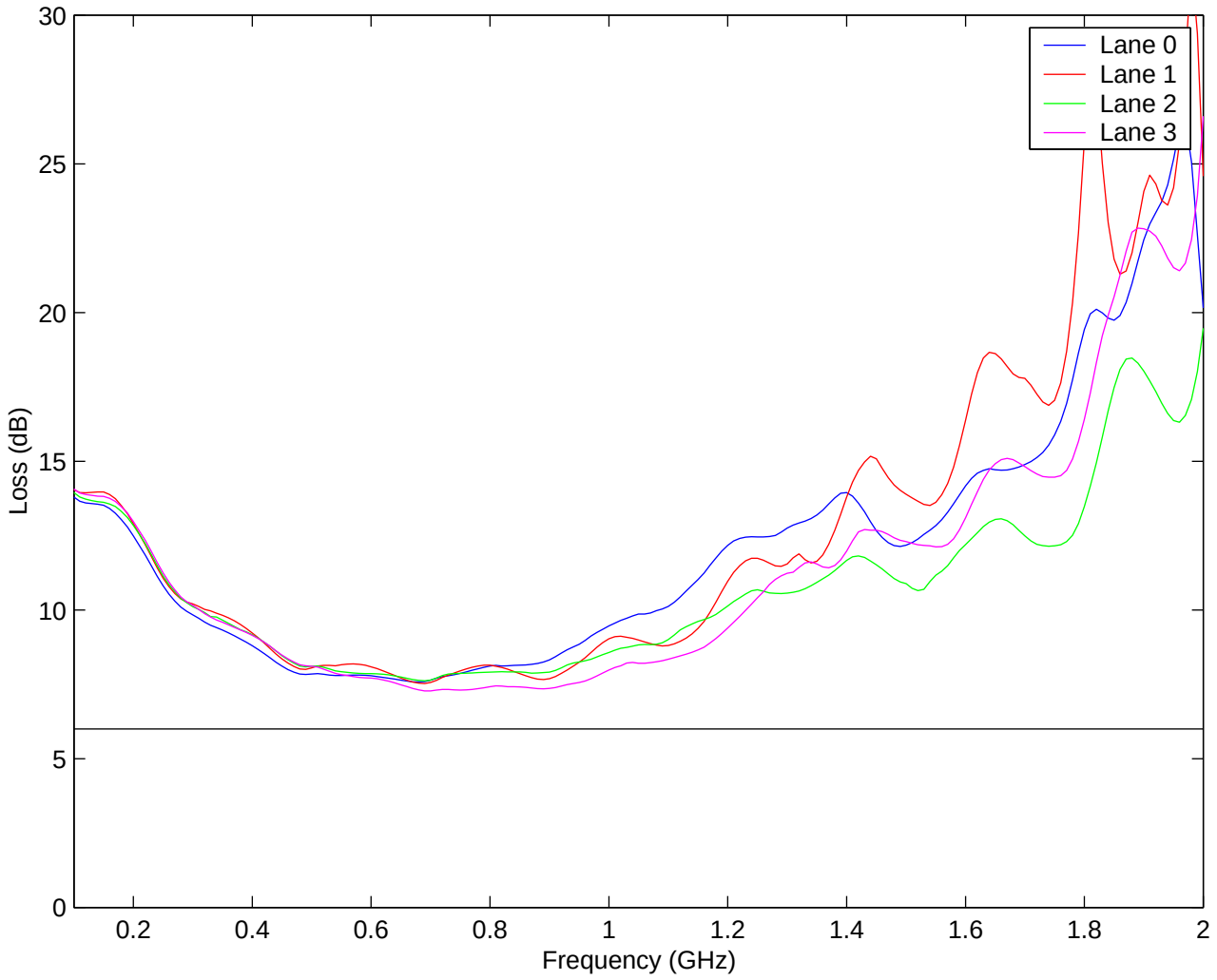

Figure 13: SCC22 (Impedance) vs. Frequency (Informative)