ERL with Host Backplane Channels

Howard Heck, Intel

2018/02/21

Summary

- Results for host backplane channels support ERL as a more useful metric than RL.

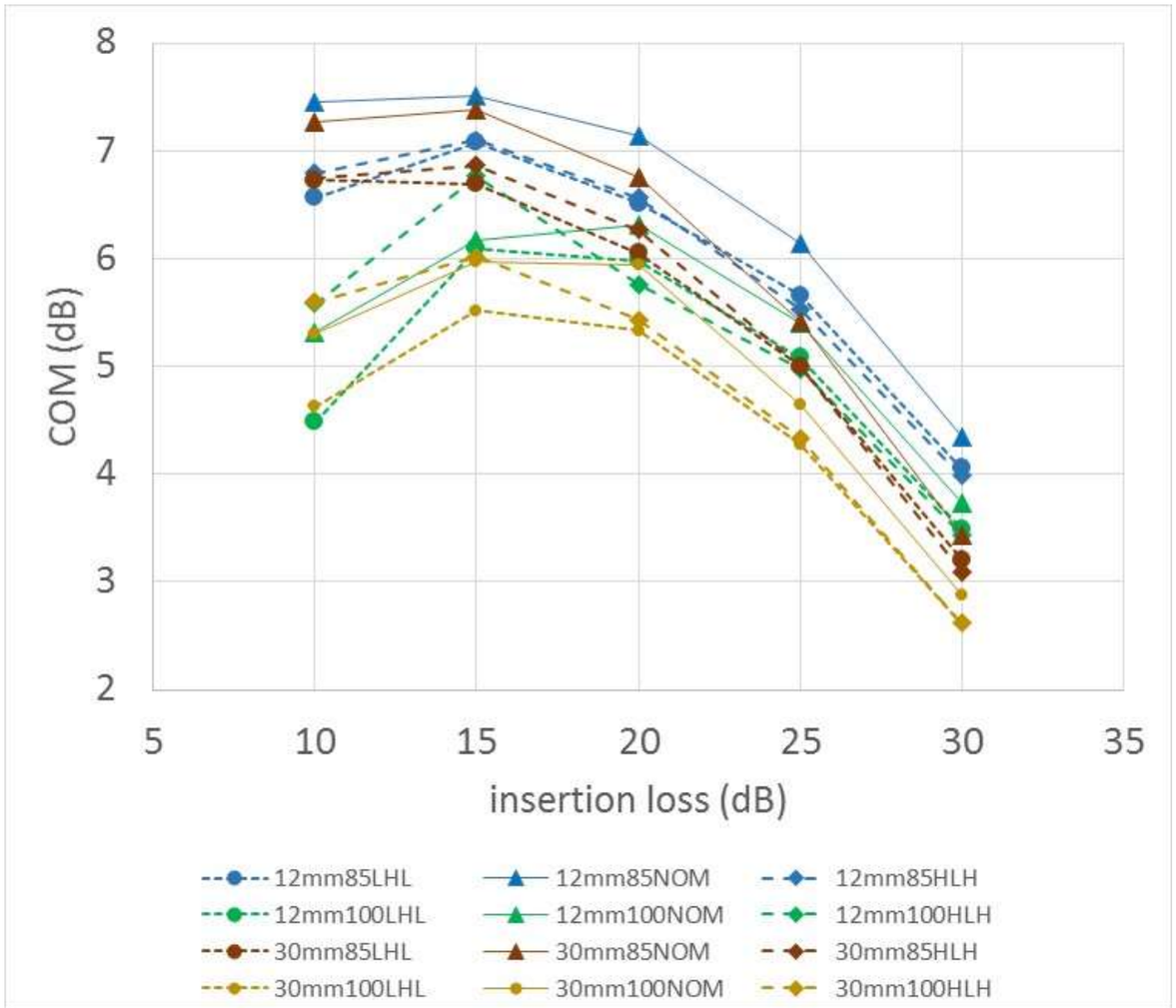
Metric	Result
COM	PASS - all except 30dB, 100ohm, 30mmpkg
ERL	PASS - all
RL	FAIL - all

- Results for the channels studied here support the proposed values for rho_x, beta_x, and ERL limit.
  - Probably some leeway here. Recommend studying more channels.

Channels

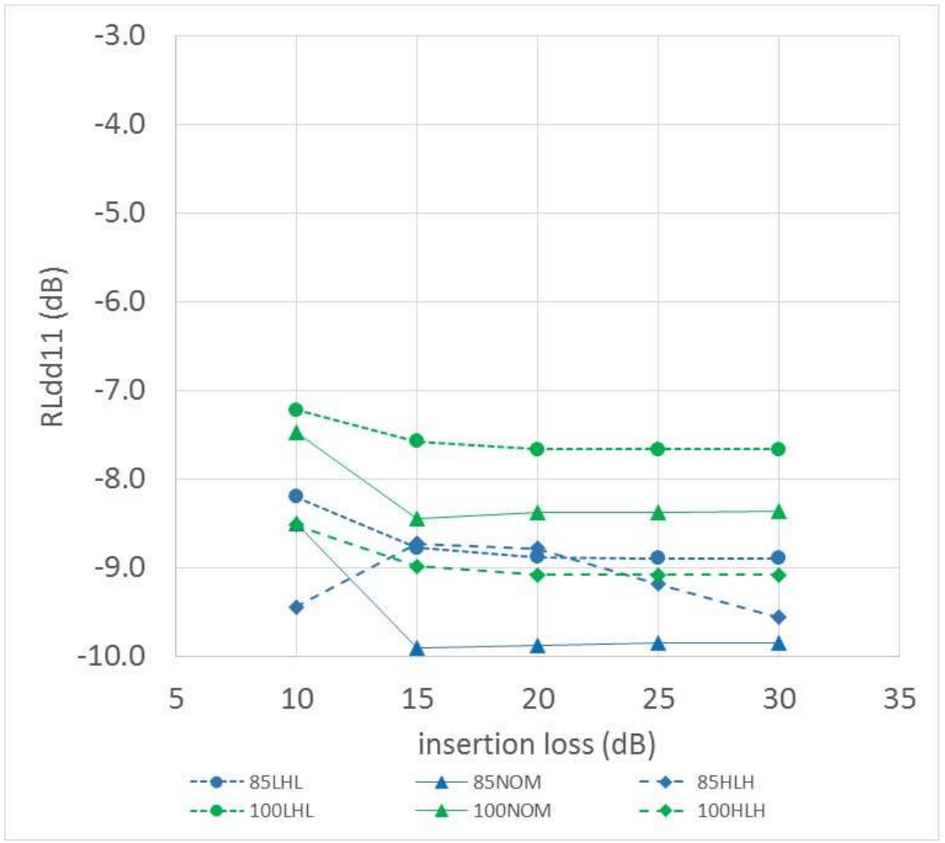
- Files – previously contributed
  Mellitz_01_021716_10dB_6_channels.zip
  Mellitz_01_021716_15dB_6_channels.zip
  Mellitz_01_021716_20dB_6_channels.zip
  Mellitz_01_021716_25dB_6_channels.zip
  Mellitz_01_021716_30dB_6_channels.zip
- 6 channel models for each loss point:
  - Impedance: 85ohm, 100ohm
  - Impedance variation: nominal, low/high/low, high/low/high (compute card/backplane/line card)
- 30 channels total

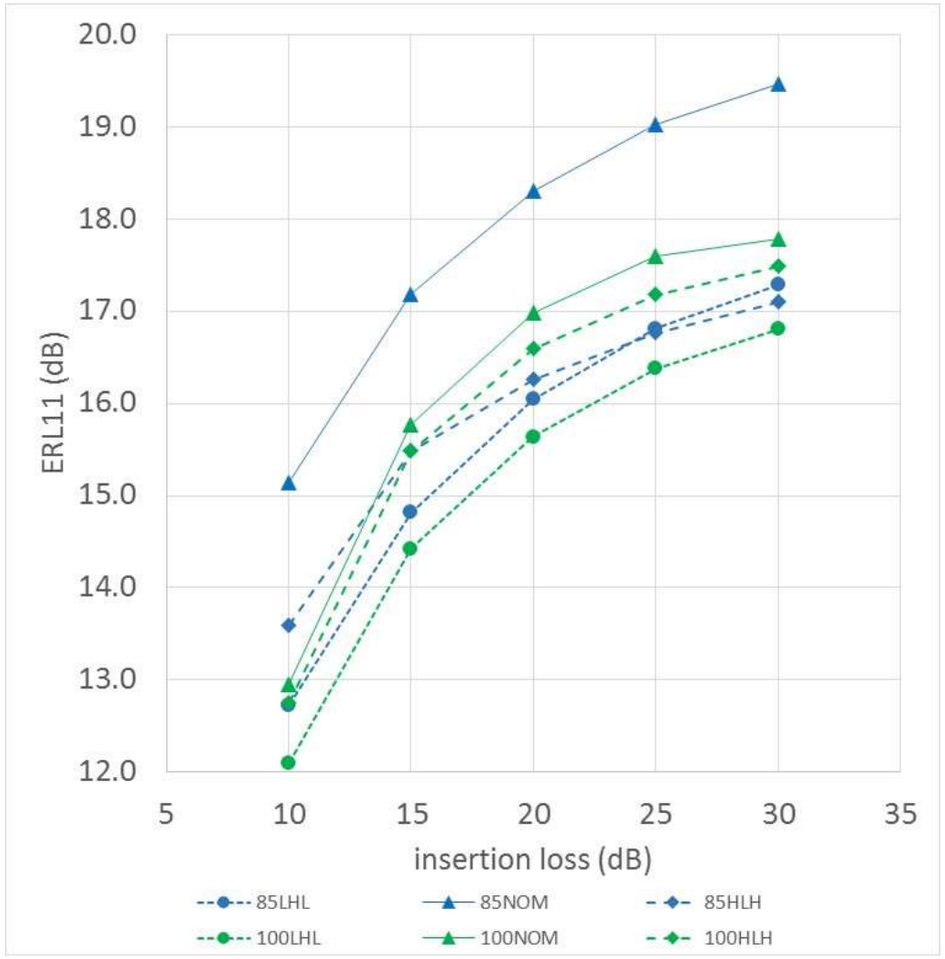
COM vs IL


8
7
6
5
4
3
2
COM (dB)
5
10
15
20
25
30
35
insertion loss (dB)
12mm85LHL
12mm85NOM
12mm85HLH
12mm100LHL
12mm100NOM
12mm100HLH
30mm85LHL
30mm85NOM
30mm85HLH
30mm100LHL
30mm100NOM
30mm100HLH

RL11, ERL11 vs IL

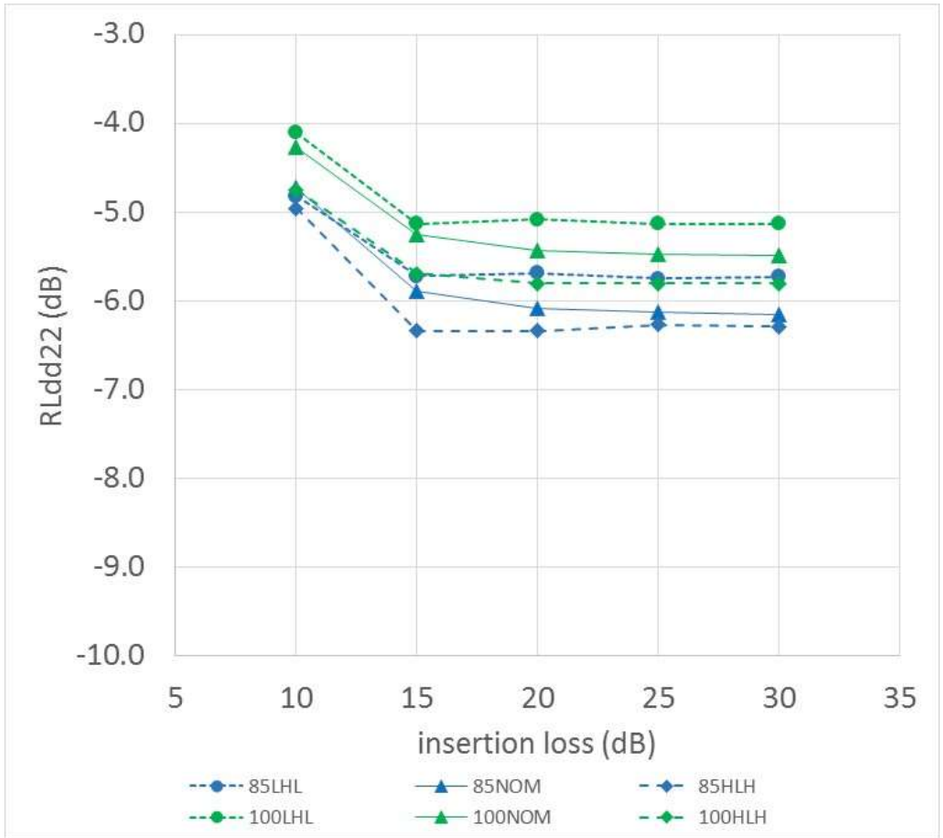
RL is peak value

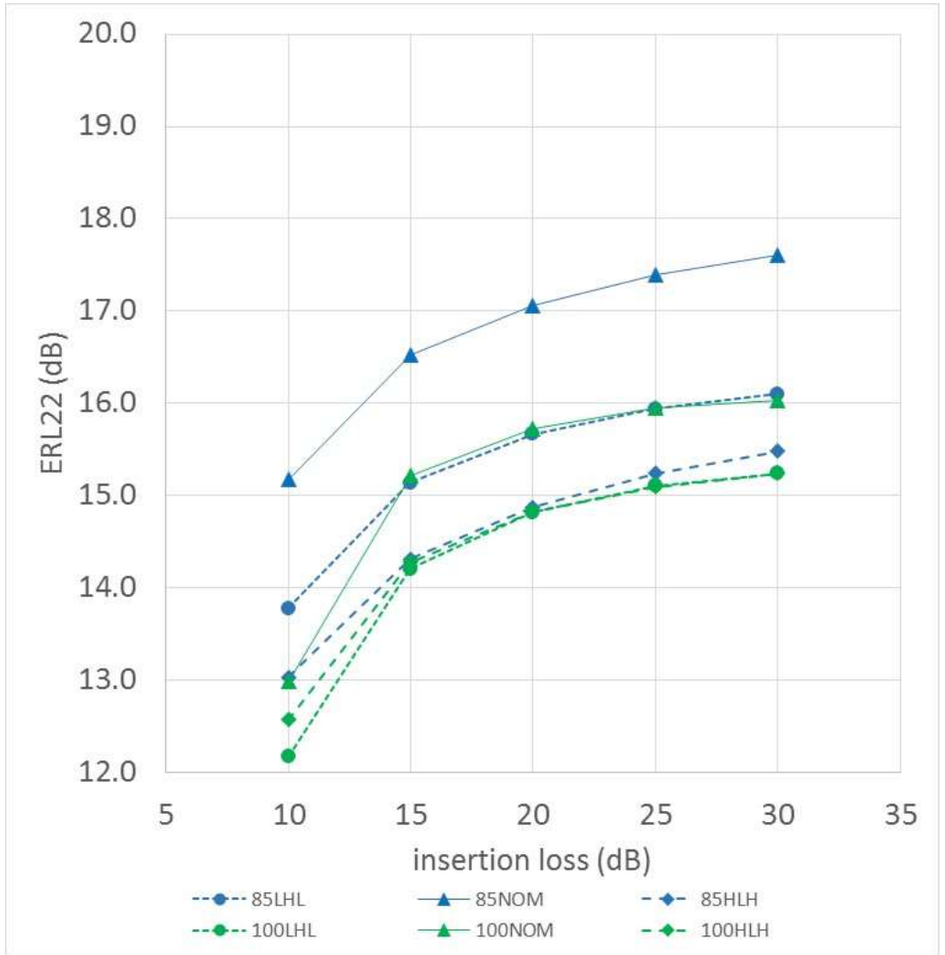




RL22, ERL22 vs IL

RL is peak value





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  - Probably some leeway here. Recommend studying more channels.

Additional info

Simulation Setup

Table 93A-1 parameters			
Parameter	Setting	Units	Information
f_b	26.5625	GBd	
f_min	0.05	GHz	
Delta_f	0.01	GHz	
C_d	[1.8e-4 1.8e-4]	nF	[TX RX]
z_p select	[1 2]		[test cases to run]
z_p (TX)	[12 30]	mm	[test cases]
z_p (NEXT)	[12 12]	mm	[test cases]
z_p (FEXT)	[12 30]	mm	[test cases]
z_p (RX)	[12 30]	mm	[test cases]
C_p	[1.1e-4 1.1e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[50 50]	Ohm	[TX RX] or selected
f_r	0.75	*fb	
c(0)	0.6		min
c(-1)	[-0.25:0.05:0]		[min:step:max]
c(-2)	[0:0.025:0.1]		[min:step:max]
c(1)	[-0.25:0.05:0]		[min:step:max]
g_DC	[-20:1:0]	dB	[min:step:max]
f_z	10.625	GHz	
f_p1	10.625	GHz	
f_p2	53.125	GHz	
A_v	0.415	V	tdr selected
A_fe	0.415	V	tdr selected
A_ne	0.604	V	tdr selected
L	4		
M	32		
N_b	12	UI	
b_max(1)	0.7		
b_max(2..N_b)	0.2		
sigma_RJ	0.01	UI	
A_DD	0.02	UI	
eta_0	1.64E-08	V^2/GHz	
SNR_TX	32.5	dB	tdr selected
R_LM	0.95		
DER_0	1.00E-04		
Operational control			
COM Pass threshold	3	dB	
Include PCB	0	Value	0, 1, 2
g_DC_HP	[-6:1:0]		[min:step:max]
f_HP_PZ	0.6640625	GHz	

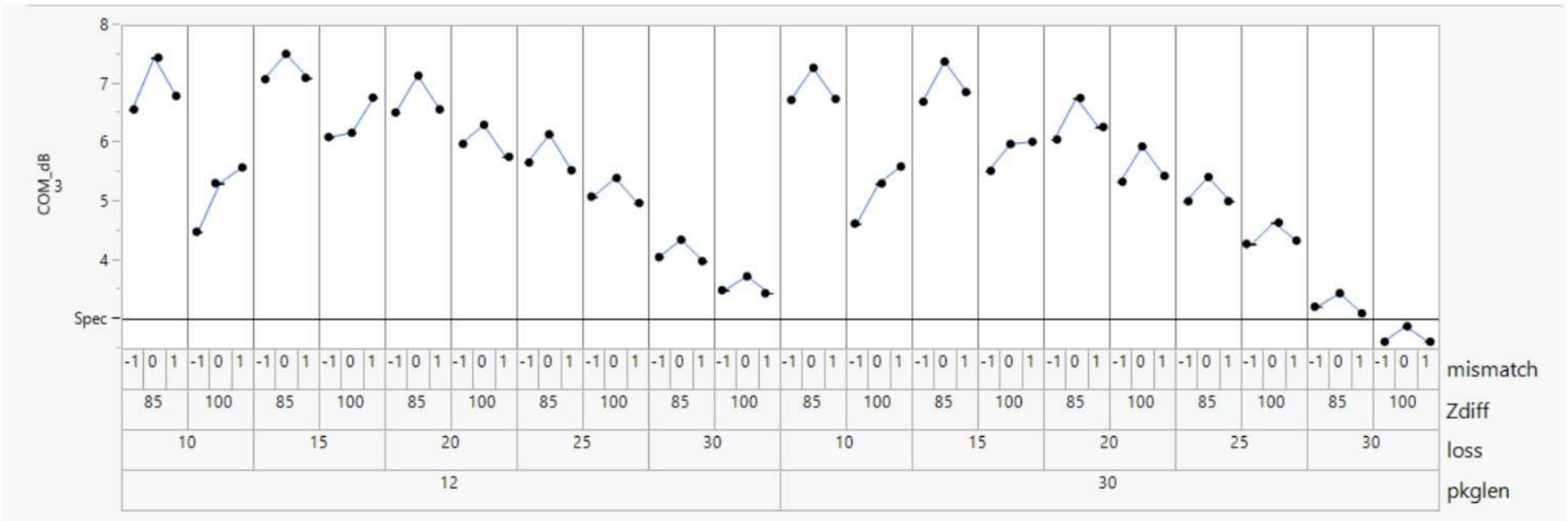
I/O control		
DIAGNOSTICS	1	logical
DISPLAY_WINDOW	0	logical
Display frequency domain	1	logical
CSV_REPORT	1	logical
RESULT_DIR	.\results\Com2p1\	
SAVE_FIGURES	0	logical
Port Order	[1 3 2 4]	
RUNTAG	COM2p1_KR50G	
Receiver testing		
RX_CALIBRATION	0	logical
Sigma BBN step	5.00E-03	V
IDEAL_TX_TERM	0	logical
T_r	0.012	ns
FORCE_TR	1	logical

Non standard control options		
COM_CONTRIBUTION	0	logical
TDR	1	logical
ERL	1	logical
Z_t	50	ohms
ERL_ONLY	0	logical
TR_TDR	0.0189	ns
TDR_duration	10	
TDR_f_BT_3db	19.921875	GHz
TDR_Butterworth	1	logical
beta_x	10700000000	
rho_x	0.44	
fixture delay time	0.00E+00	set to zero for no fixture for KR channel
Grr_limit	0	
ERL_FOM	0	

Table 93A–3 parameters		
Parameter	Setting	Units
package_tl_gamma0_a1_a2	[0 1.734e-3 1.455e-4]	
package_tl_tau	6.141E-03	ns/mm
package_Z_c	95	Ohm (tdr sel)

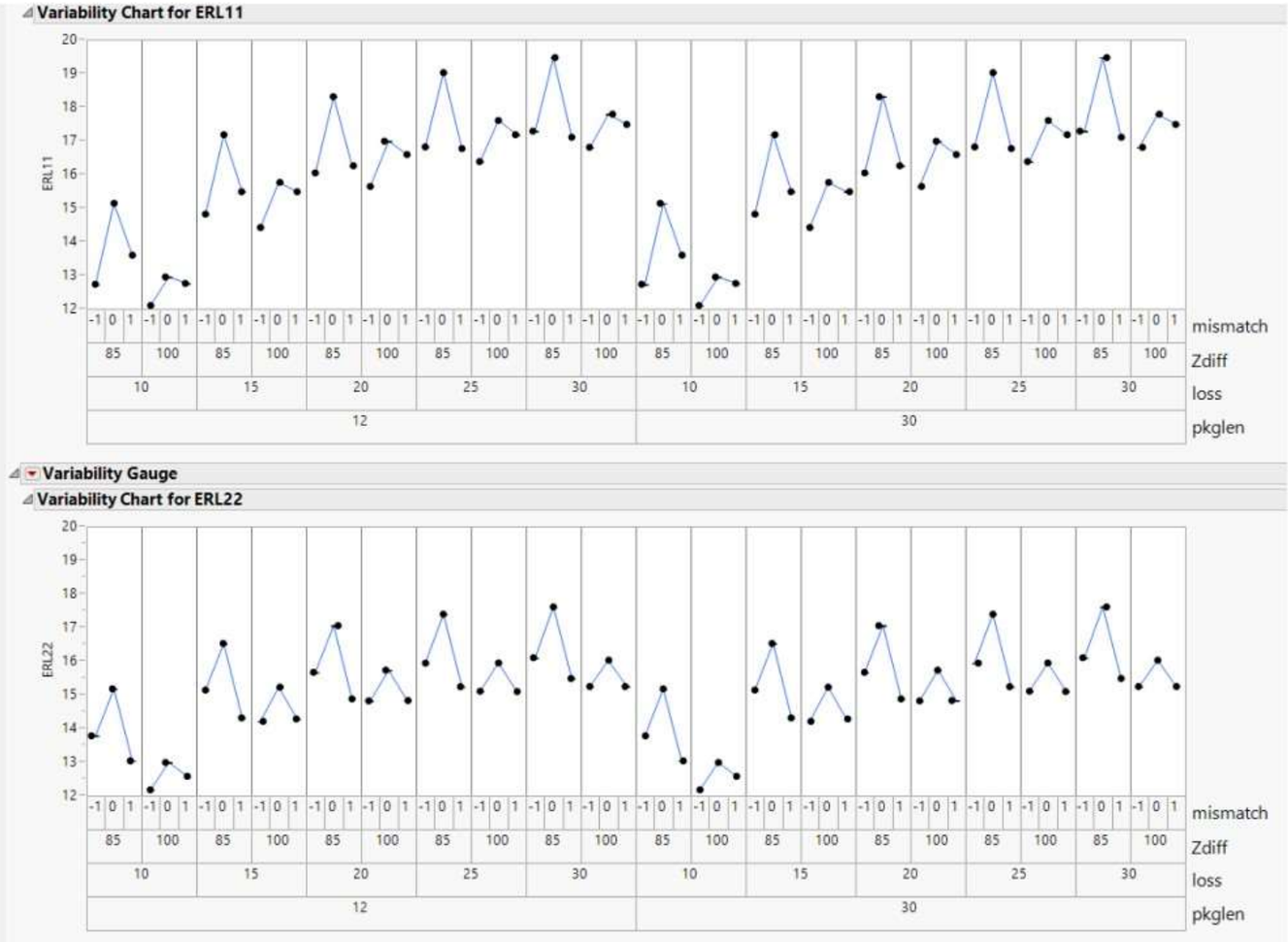
Table 92–12 parameters		
Parameter	Setting	
board_tl_gamma0_a1_a2	[0 4.114e-4 2.547e-4]	
board_tl_tau	6.191E-03	ns/mm
board_Z_c	110	Ohm
z_bp (TX)	151	mm
z_bp (NEXT)	72	mm
z_bp (FEXT)	72	mm
z_bp (RX)	151	mm

COM Results



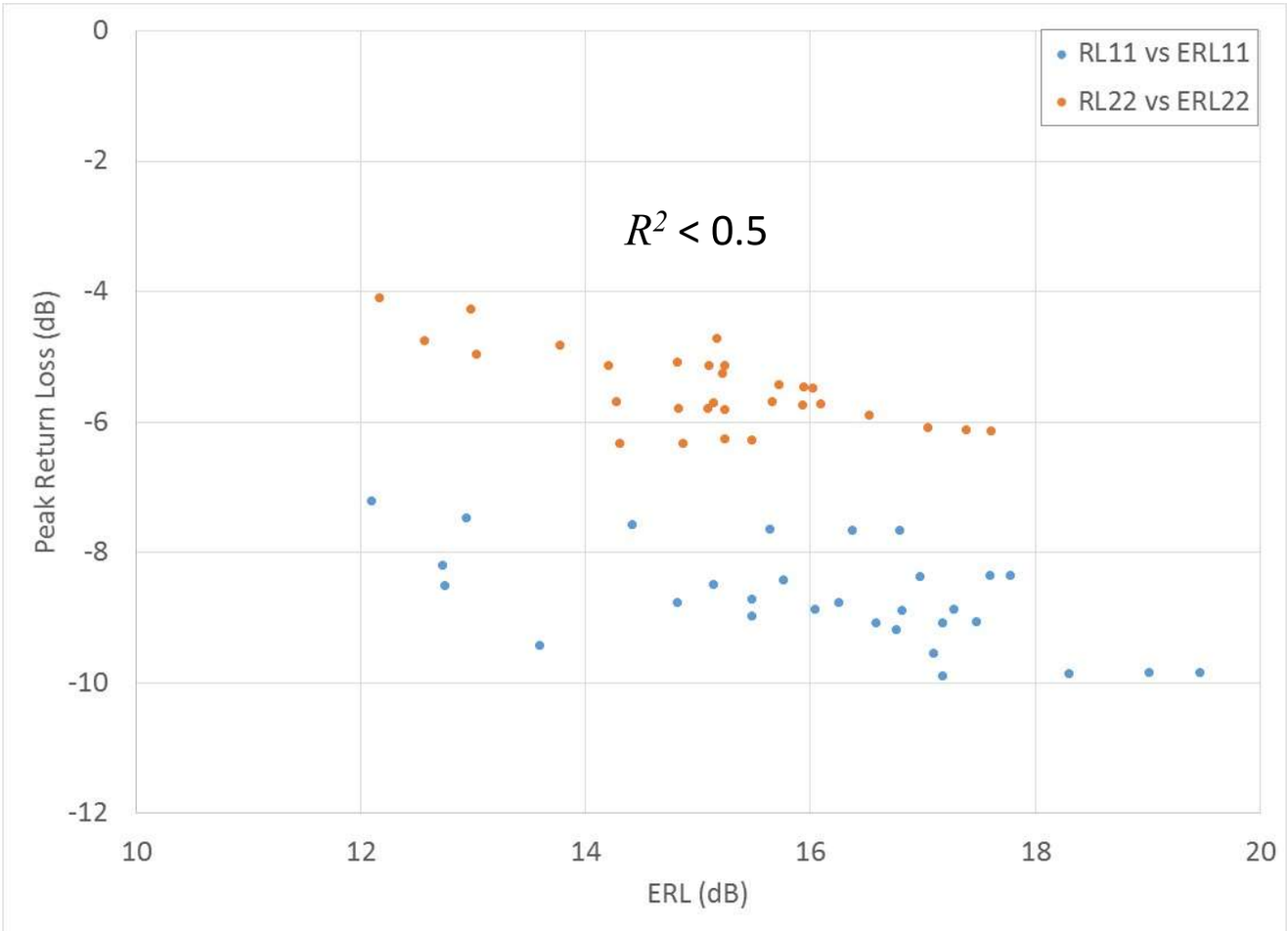
- All channels pass COM except for 30db, 100ohm, 30mm package.
- All channels fail return loss spec.

ERL Results

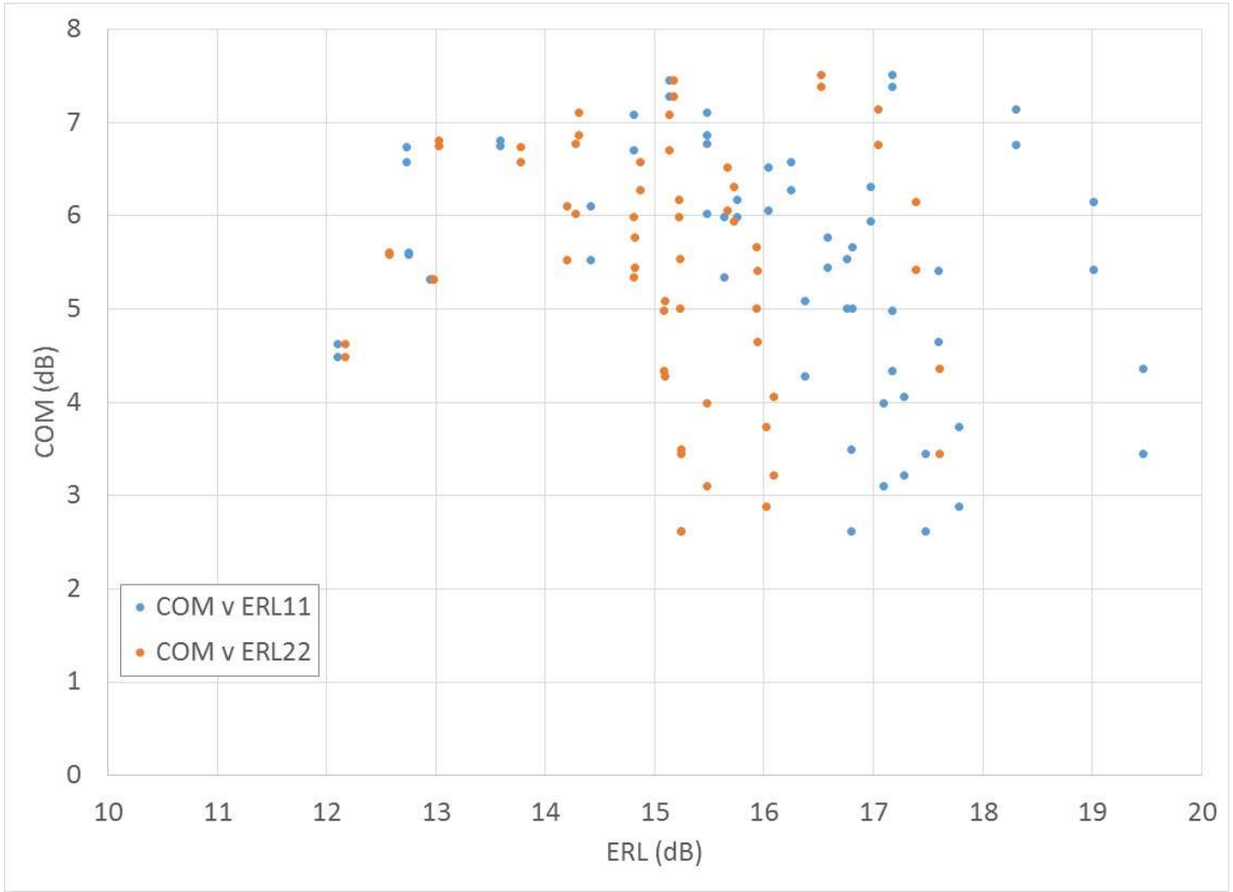


- All channels meet the propose ERL spec.
- ERL increases with loss, as expected.

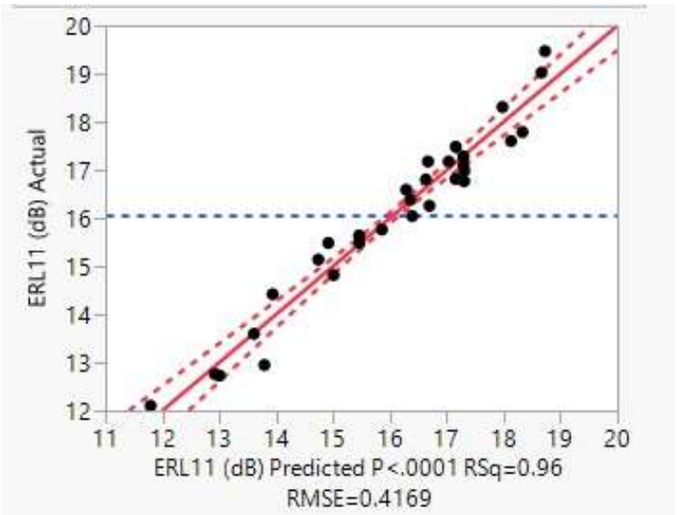
Return Loss vs. ERL

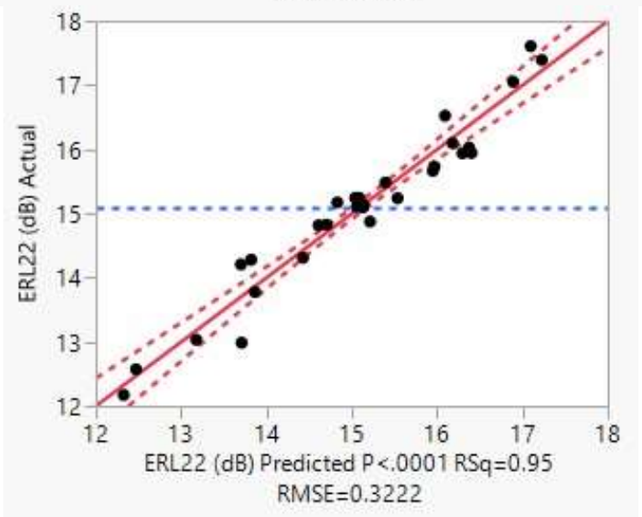


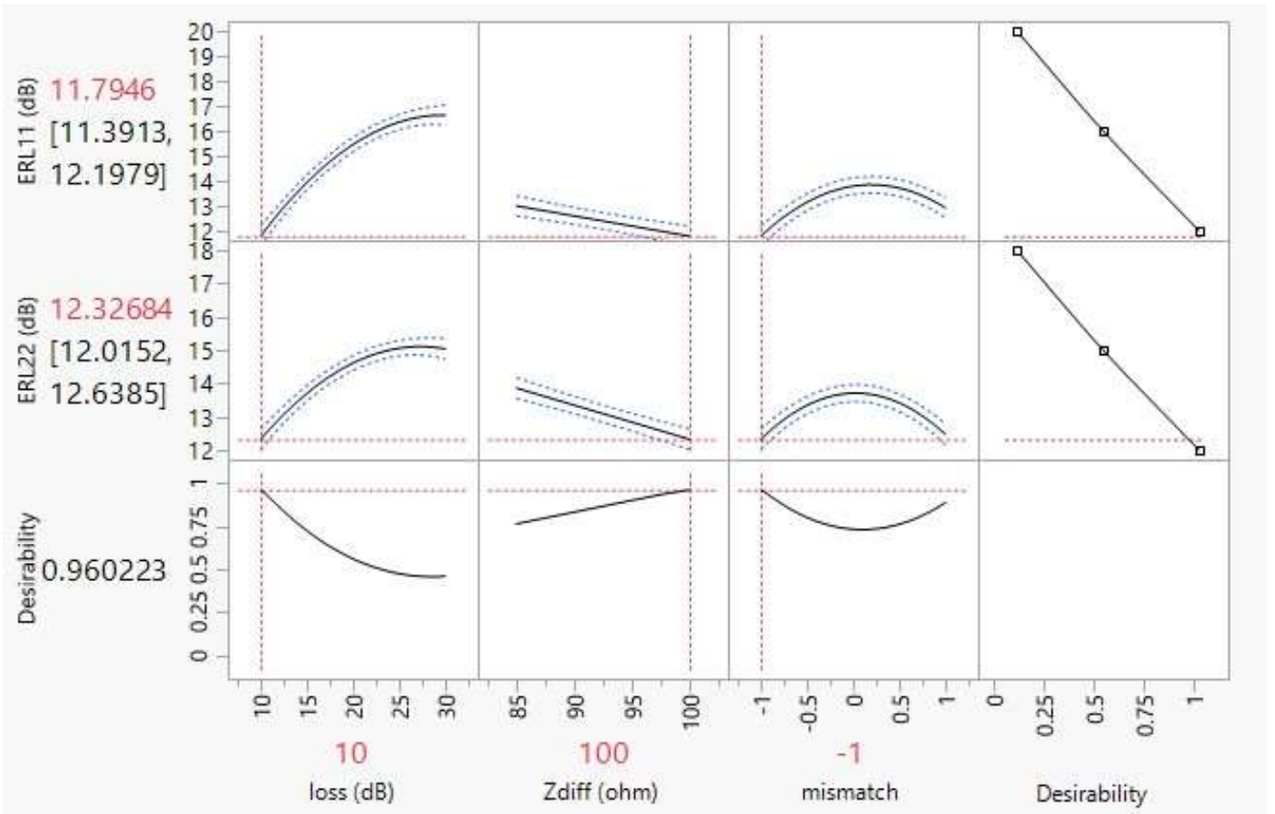
COM vs ERL


8
7
6
5
4
3
2
1
0
COM (dB)
10
11
12
13
14
15
16
17
18
19
20
ERL (dB)
COM v ERL11
COM v ERL22

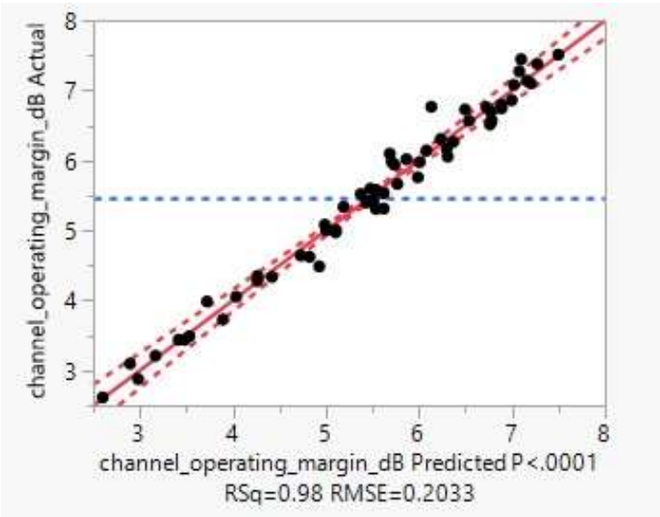
ERL RSM Model

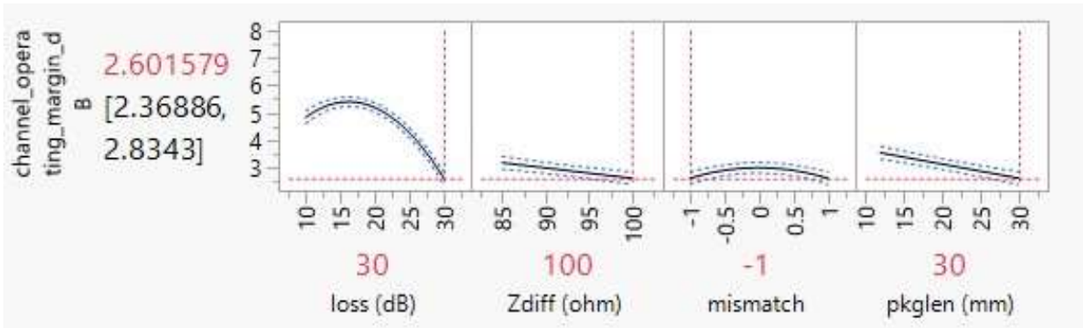


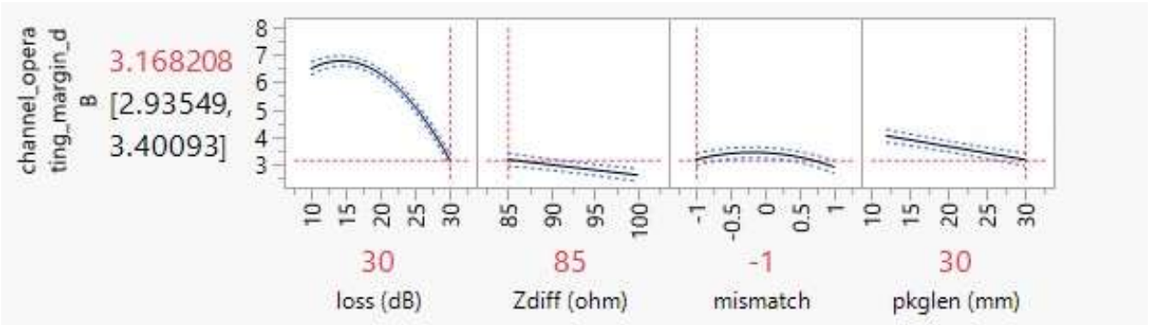




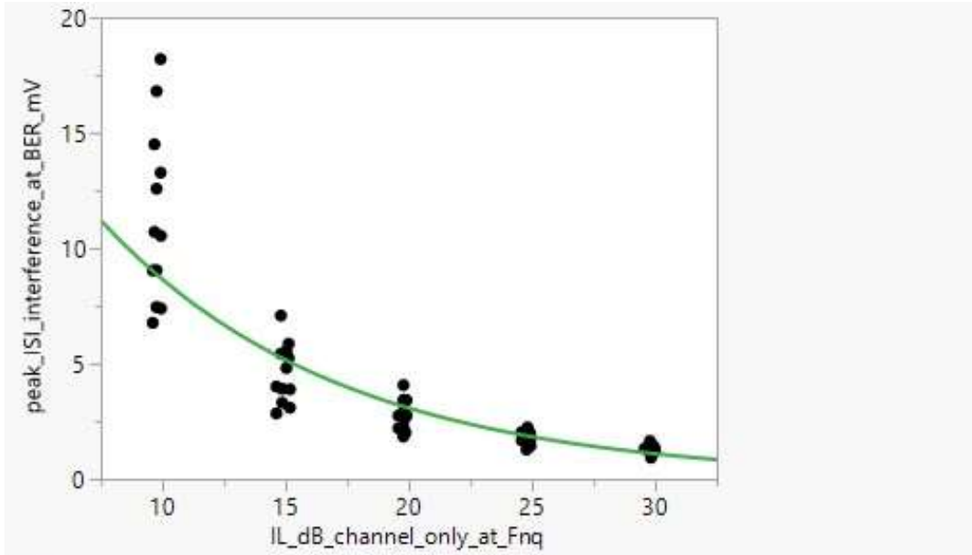
COM RSM Model







Peak ISI vs Channel IL



Transformed Fit Log

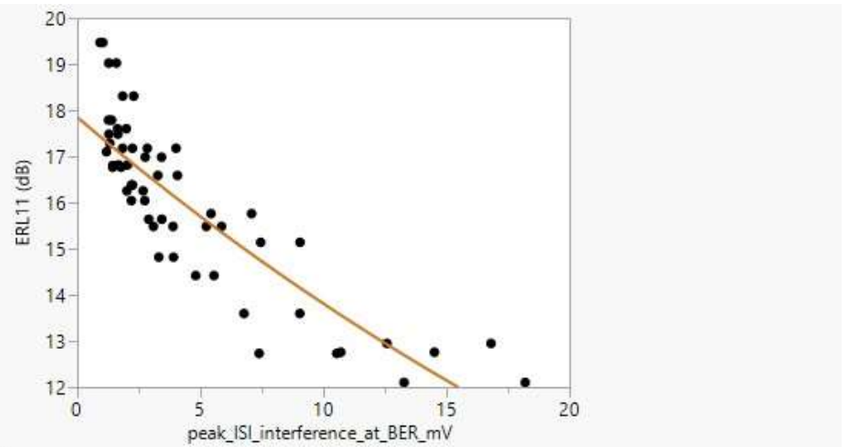
Transformed Fit Log

Log(peak_ISI_interference_at_BER_mV) =
3.1925285 - 0.1034934*IL_dB_channel_only_at_Fnq

Summary of Fit

RSquare	0.87331
RSquare Adj	0.871125
Root Mean Square Error	0.283392
Mean of Response	1.1406
Observations (or Sum Wgts)	60

ERL vs Peak ISI

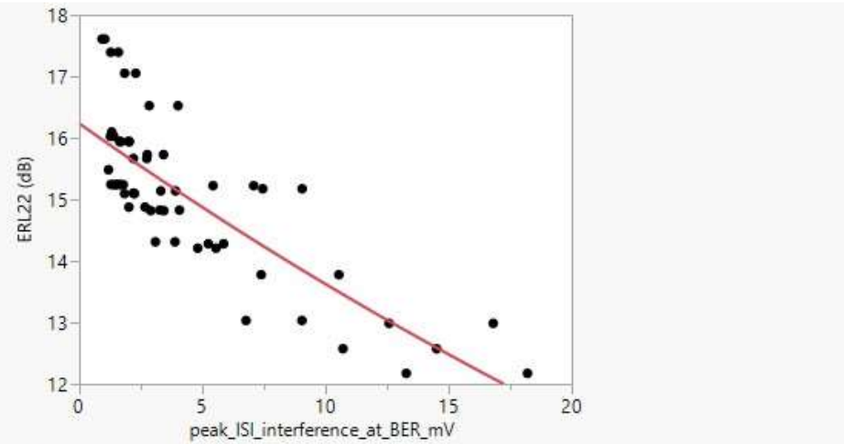


Transformed Fit Log

Log(ERL11 (dB)) = 2.8819692 -
0.0256568*peak_ISI_interference_at_BER_mV

Summary of Fit

RSquare	0.768592
RSquare Adj	0.764602
Root Mean Square Error	0.058104
Mean of Response	2.769774
Observations (or Sum Wgts)	60



Transformed Fit Log

Log(ERL22 (dB)) = 2.7871913 -
0.0175301*peak_ISI_interference_at_BER_mV

Summary of Fit

RSquare	0.669293
RSquare Adj	0.663591
Root Mean Square Error	0.050858
Mean of Response	2.710534
Observations (or Sum Wgts)	60