COM parameter for 2.5G and 5G Ethernet KR: Starting Points

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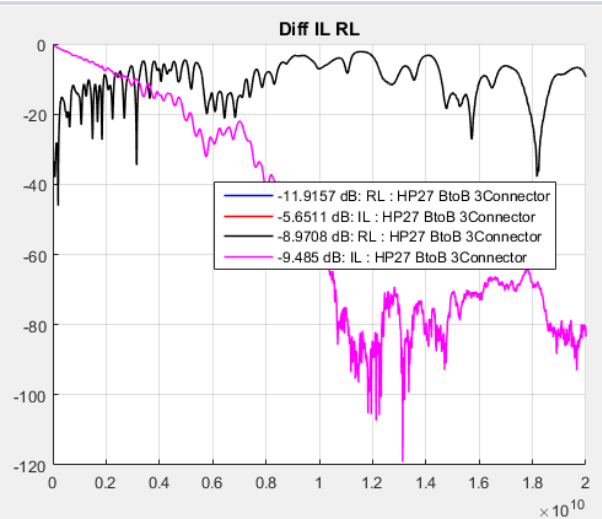
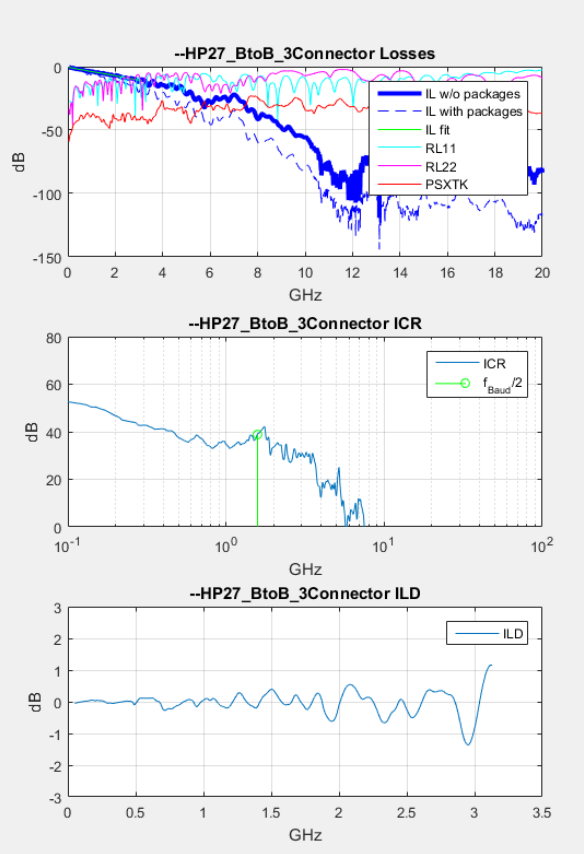
COM parameter decisions and specs

- The COM parameters formulate the specifications on silicon performance.
  - Provide clear focus for consensus discussions
- These COM parameter are used to determine channel performance.
- It is relatively easy to get relative impact of any parameters changes
- The following is a discussion of these parameters with the intent of forming consensus.

Example Channel Responses

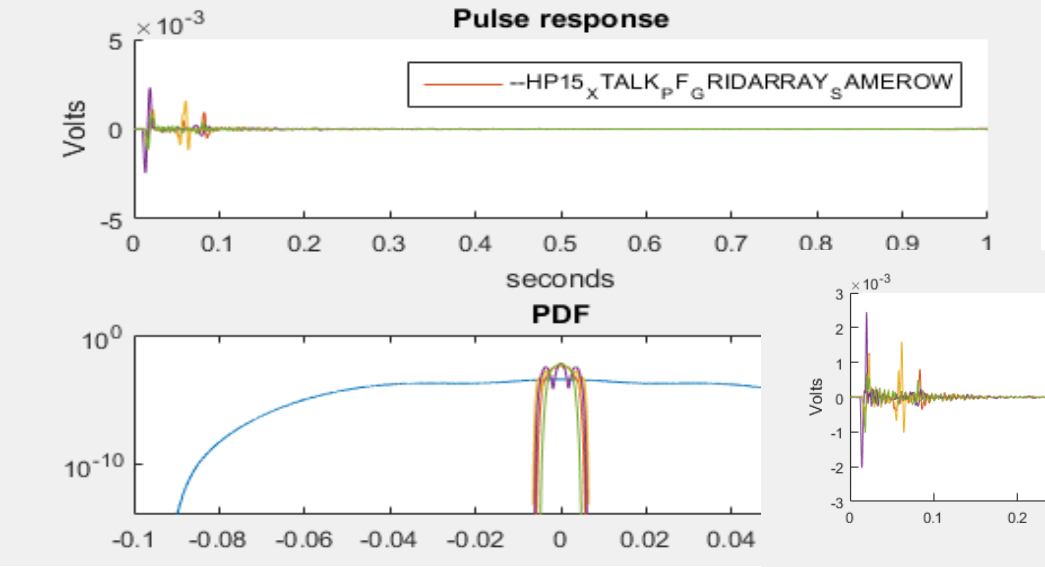


5.6 dB IL [oss@1.56Ghz]
9.5 dB IL loss@2.578GHz

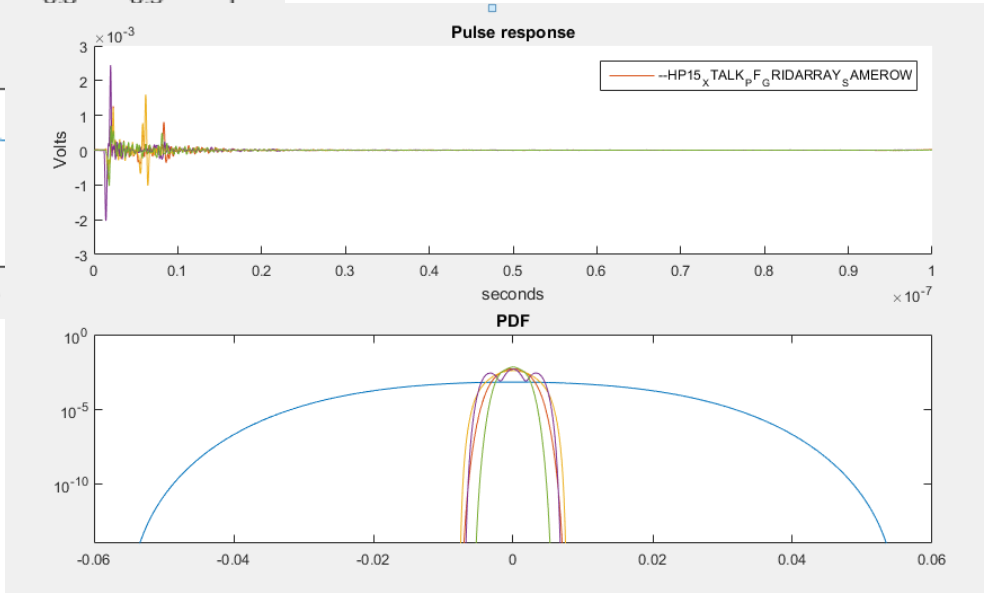


Noise response and PDF

2.5GBASE KR



5GBASE KR



Package and Load

5GBASE KR

C_d	[1e-3 1e-3]	nF	[TX RX]
z_p select	[1 2]		[test cases to run]
z_p (TX)	[12 50]	mm	[test cases]
z_p (NEXT)	[12 12]	mm	[test cases]
z_p (FEXT)	[12 50]	mm	[test cases]
z_p (RX)	[12 50]	mm	[test cases]
C_p	[3e-4 3e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[55 55]	Ohm	[TX RX]

2.5GBASE KR

C_d	[1e-3 1e-3]	nF	[TX RX]
z_p select	[1 2]		[test cases to run]
z_p (TX)	[12 50]	mm	[test cases]
z_p (NEXT)	[12 12]	mm	[test cases]
z_p (FEXT)	[12 50]	mm	[test cases]
z_p (RX)	[12 50]	mm	[test cases]
C_p	[3e-4 3e-4]	nF	[TX RX]
R_0	50	Ohm	
R_d	[55 55]	Ohm	[TX RX]

- Cpad
  - 5G – 1pF
  - 2.5G 1pf (could go higher)
- 500 ff BGA to package load (another trade off parameter)
- Hi Termination resistance 55 ohms
- Package length
  - Short
    - 12mm
  - Long
    - 50mm 5G & 3G
    - Could consider asymetric budget
- Drives return loss specs
- May impact transition time specs and questions

Linear Equalization

5GBASE KR

f_r	0.75	*fb	
c(0)	0.62		min
c(-1)	[-.1:0.05:0]		[min:step:max]
c(1)	[-0.25:0.125:0]		[min:step:max]
g_DC	[-12:1:0]	dB	[min:step:max]
f_z	1.2890625	GHz	
f_p1	1.2890625	GHz	
f_p2	5.15625	GHz	

2.5GBASE KR

f_r	0.75	*fb	
c(0)	0.62		min
c(-1)	[0]		[min:step:max]
c(1)	[0]		[min:step:max]
g_DC	[-10:1:0]	dB	[min:step:max]
f_z	0.78125	GHz	
f_p1	0.78125	GHz	
f_p2	3.125	GHz	

- CTLE
  - 2 poles, 1 zero
  - AC-DC gain
    - 5G: 0 to 12 dB, 1dB step
    - 2.5G: 0 to 10 dB, 1dB step
- Tx FFE (normalized)
  - 5G:
    - pre: -0.1,0.05,0
    - Post: -0.25,-0.125,0
  - 2.5G: none
- Butterworth Receiver filter
  - 0.75 f_b

DFE and clocking

5GBASE KR

N_b	6
b_max(1)	0.35
b_max(2..N_b)	0.35

- 5G DFE6
  - Coefficients (normalized) and limited to 0.35
  - Approximate: Mueller-Muller
  - DFE may be eliminated by trading off other parameters and channels
- 2.5G none
  - Approximate Bang-Bang

Jitter, noise, and DER (FEC)

5GBASE KR

sigma_RJ	0.010	UI	1.9	ps
A_DD	0.06	UI	23.3	ps
eta_0	5.20E-08	V^2/GHz		
SNR_TX	30	dB	8.0	mV RMS

2.5GBASE KR

sigma_RJ	0.010	UI	3.1	ps
A_DD	0.085	UI	54.4	ps
eta_0	5.20E-08	V^2/GHz		
SNR_TX	30	dB	17.9	mV RMS

- Jitter
  - Rj
    - 5G: 1.9 ps RMS
    - 2.5G: 3.1 ps RMS
  - Dj
    - 5G: 23.3 ps
    - 2.5G: 54.4 ps
- EOJ – not in COM computation
  - Part of COM Rx budget
  - Implementation dependent
- Eta_0 taken from 155dBm/Hz + 1 mV alien system noise at RX pin
- SNR_Tx can tolerate
  - 12.5mV RMS
  - Trade off parameter

COM passing threshold i.e. receiver budget

- 3 dB