Lower Power 100G PAM4 Receiver Alternative Based on Balanced Equalization Approach

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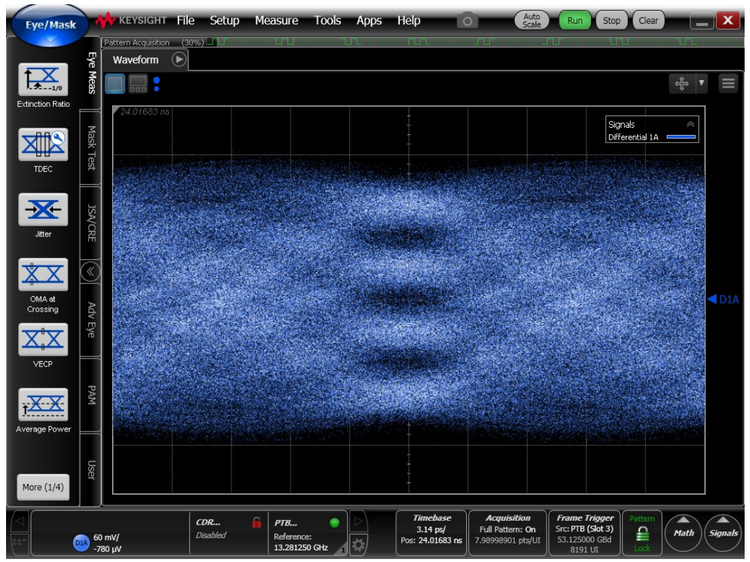
Introduction

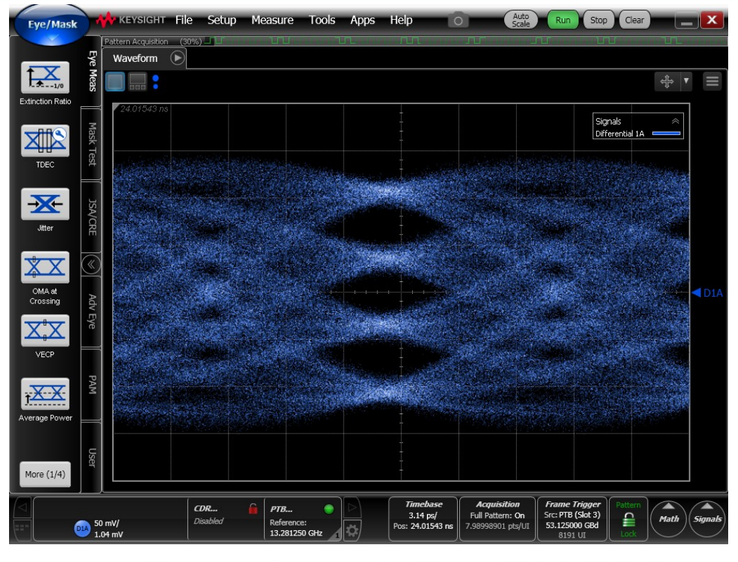
- 100G single lane SERDES complexity and power has been a concern based on channel simulation results and FEC choices.
- sun_100GEL_01b_0118 proposed “Balanced Architecture” for SERDES to reduce power by about 30%.
- sun_3ck_01_0518 showed open Tx eye after 14dB channel
- This contribution is to report more preliminary test results, help understand TX Equalization, and provide reference data for SERDES architecture considerations.

CredŐ

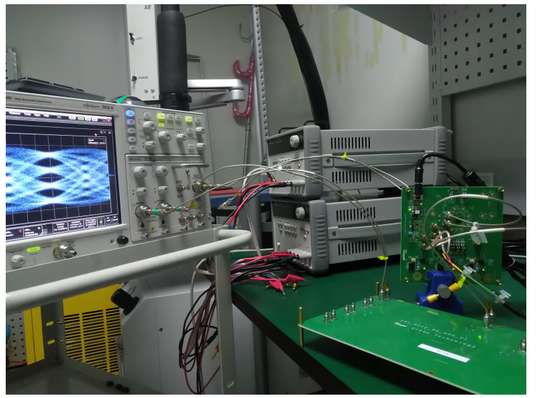
Test Results from sun_3ck_01_0518



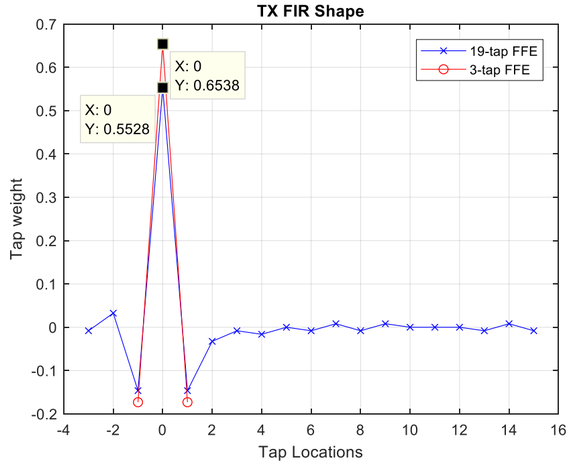
Eye after 3 Tap TX FFE



Eye after 19 Tap TX FFE



Total channel loss is more than 14dB

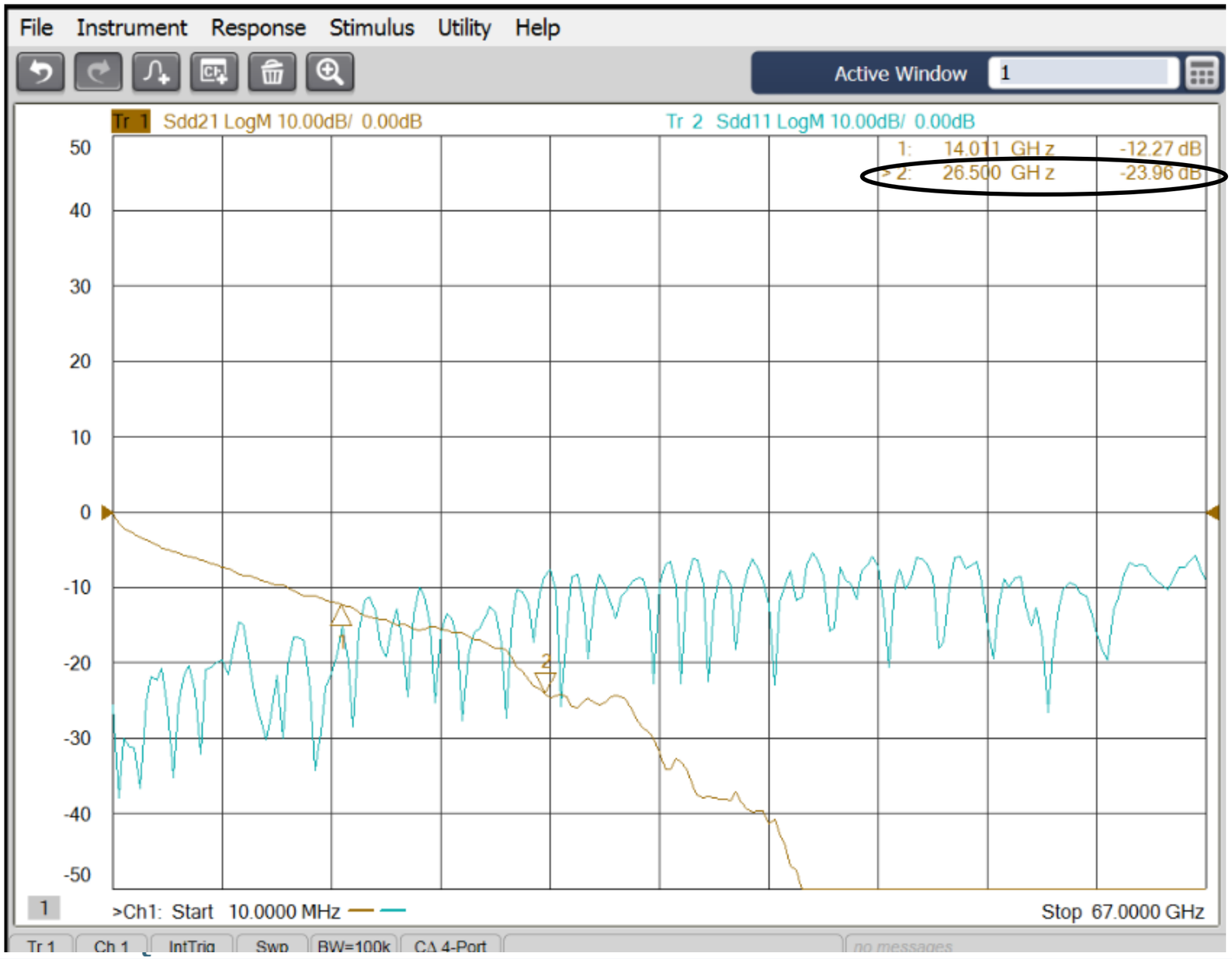


TX FIR Shape

- Taps [-1 0 1 2] has 88% weight of TX FFE.

30dB Ball to Ball Channel Summary

106.26G Tx -> QSFP-DD compliance board -> 2M QSFP cable -> QSFP compliance board -> 106.26G Rx



<u>Total Channel Loss = 30dB</u>

- Compliance channel loss
  - 23.96 @ 26.5GHz
- Eval board loss
  - 6dB @ 26.5GHz

30dB Ball to Ball Channel Performance Summary

RX Monitor

	AR0[86/87]	AR1[8A/8B]
LinkStatus	ON	OFF
PRBS Counter	6047426	N/A
PRBS Counter Reset	Reset	Reset
Timer Counter	20	111080
Eye Margin(mV)	93.750	0.000
EM0/Tap F1(mV)	93.750	0.000
EM1/Tap F2(mV)	101.562	0.000
EM2/Tap F3(mV)	93.750	0.000
PRBS Mode	QPRBS-31	Disabled
BER	2.93e-06	N/A
State Reset	State Reset	State Reset

	Address	Data (Hex)	Read	Write	D
0	8620	0380	Read	Write	0000 0
1	86f6	75b3	Read	Write	0111 0
2	86ed	0852	Read	Write	0000 1

TX FFE
- (-3, 13, -38, 69, -2, 0, 0, 0, -1, 0, 0, 0, 0, 0, 0, -1)

RX (CTLE, 3-Tap FFE, DFE)
- 106.26G
- QPRBS31
- BER = 2.93E-6

18dB Ball to Ball Channel Performance Summary

RX Monitor		
	AR0[86/87]	
LinkStatus	ON	
PRBS Counter	269	
PRBS Counter Reset	Reset	
Timer Counter	95	
Eye Margin(mV)	132.812	
EM0/Tap F1(mV)	132.812	
EM1/Tap F2(mV)	140.625	
EM2/Tap F3(mV)	132.812	
PRBS Mode	QPRBS-31	
BER	2.75e-11	
State Reset	State Reset	

TX FFE
- (-4, 12, -32, 70, 0, -1, 2, -2, -1, -1, 0, -1, 0, 0, 0, -1)

RX (CTLE, DFE), No FFE
- 106.26G
- QPRBS31
- BER = 2.75E-11

Summary & Actions

- Balanced EQ with more TX taps allows for relaxed RX implementation(s)
  - LR Channel demonstrated with CTLE, 3-Tap FFE, and DFE
  - MR Channel demonstrated be CTLE and DFE
  - VSR Channels should be CTLE only (plan to test channels & report)

- Work with partners to test more channels and include power measurements

- A more Balanced SERDES Architecture is a realistic option to keep SERDES power under envelope, for both long and short reach