ERL Comment Proposal Overview (r02-19 - r02-26)

Richard Mellitz, Samtec

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IEEE 802.3 50 Gb/s, 100 Gb/s, and 200 Gb/s Ethernet Task Force

Supporters

- Derek Cassidy. ICRG / IET
- Howard Heck, Intel
- Yasuo Hidaka, Independent
- Ryan Lott, Spectra7
- Erdem Matoglu, Amphenol
- Rick Rabinovich, Keysight Technologies
- Arturo Pachon, TE
- Alexander Rysin, Mellanox
- Toshiaki Sakai, Socionext
- Tracy, Nathan L, TE
- Andy Zambell, Amphenol

Toc

- ❑ ERL and parameter value proposal in comments
- ❑ Supporting data recap
- ❑ Tx host false pass/fail review
- ❑ Tx/Rx Host measurement data
- ❑ Summary and meeting actions

Overview of minimum ERL proposal in r02-19 to r02-26

Recommend changes in the last term of Grr (93A-61) plus:

Clause	ERL Min (dB) D3.2	ρ_x D3.2	β_x D3.2	N D3.2	ERL Min (dB) D3.2 comment	When COM (dB) is <	ρ_x D3.2 comment	β_x D3.2 comment	N D3.2 comment
136 Tx Host	$8 - 40\log_{10}\left(\frac{P_{max}}{V_f}\right)$	0.44	10.7	300	**Propose 12 other options possible**	**NA**	**.3**	**1.7**	**300**
136 Rx Host	14.5	0.44	10.7	300	**12**	**NA**	**.3**	**1.7**	**300**
136 Cable Assembly	11	0.44	10.7	1000	**10.5**	**4**	**.25**	**1.7**	**1000**
137 Tx Device	16.1	0.44	10.7	100	**15**	**NA**	**.32**	**1.7**	**100**
137 Rx Device	16.1	0.44	10.7	100	**15**	**NA**	**0.32**	**1.7**	**100**
137 Channel	10	0.44	10.7	300	**10**	**4**	**0.18**	**1.7**	**1000**

Quick Recap of Latest Minimum ERL Reports

- Toshiaki Sakai - Socionext: " '15dB' number is good enough with reasonable margin for clause 137 Tx/Rx."
- Howard Heck - Intel: "good with 10dB for clause 137 channels" and "idea of ERL only being applicable for COM <4"
- Richard Mellitz - Samtec: prior work suggests that ERL min should be 10.5 dB for cable assemblies and only applicable when COM is between 3 dB and 4 dB
  - Notwithstanding results from DAC cable folks and other data presented/discussed at this interim
- CL137 Tx/Rx host false pass/false results suggests 12 dB for CL 136 Hosts.
  - Notwithstanding results from Mike Dudek and other options presented/discussed at this interim
  - New data on false pass/fail in following slides

Tx ERL limit of 12 dB is suggested by experiment

- ❑ Representing a wide range of design and manufacturing permutations
- ❑ Wide range of packages
  - 12 mm to 120 mm
  - Die pad capacitance up to 300 fF
  - Package differential impedance between 85 and 120 ohms
- ❑ Wide range of board and intra-cable configurations
  - Up to 70 mm of host trace with up to 500 mm of cable
  - Board impedance between 80 and 100 ohms
- ❑ QSFP connectors and mounting
- ❑ 2 DAC cables
  - 3 meter cable which just barely passes COM
  - 2 meter cable fabricated with reflections and barely passes COM
    - 270 fF added to QSFP assembly

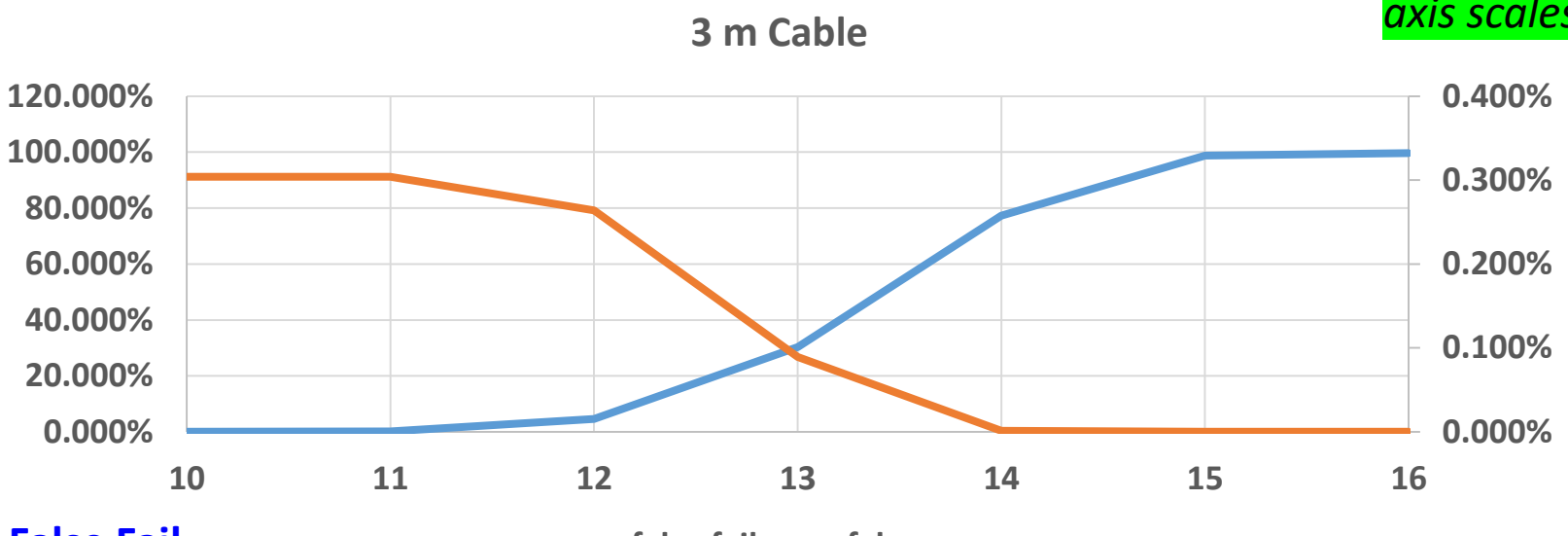
Evaluation of the Population of Host Designs for Tx ERL

- Given: A host must pass all the requirements such as
  - SNDR
  - V_{peak}/V_f limitations
  - ERL
- A Tx host attached to cable should pass COM if the Cable Assembly alone passes COM.
  - Assuming the receiver host is the reference host used in COM
- Only Tx hosts which pass the V_{peak}/V_f limit considered
- V_{peak}/V_f in most cases appears to be a good performance discriminator
- ERL will catch the remainder
- The goal is to determine a limit for ERL
  - Which balances false ERL false fails vs. false ERL false passes

Suggest Tx host ERL minimum 12 dB

Note: different axis scales!

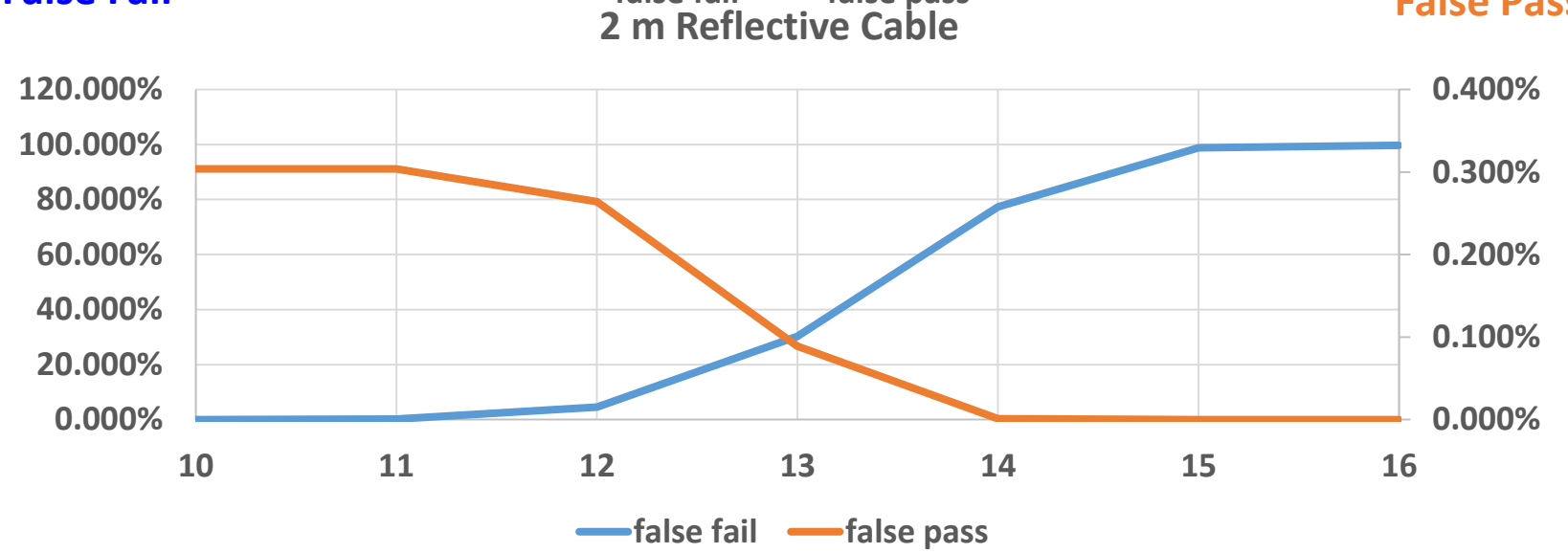
	3 m cable	
ERL	false fail	false pass
10	0.001%	0.304%
11	0.175%	0.304%
12	4.569%	0.264%
13	30.265%	0.089%
14	77.336%	0.001%
15	98.754%	0.000%
16	99.696%	0.000%



False Fail

False Pass

	2 m reflective cable	
ERL	false fail	false pass
10	0.000%	0.035%
11	0.174%	0.034%
12	4.592%	0.001%
13	30.446%	0.000%
14	77.605%	0.000%
15	99.023%	0.000%
16	99.965%	0.000%



Plotting on same scale could suggest Tx Host ERL min could be more like 10 dB or 11 dB

False fails seems like a much bigger problem

3 m cable		
ERL	false fail	false pass
10	0.001%	0.304%
11	0.175%	0.304%
12	4.569%	0.264%
13	30.265%	0.089%
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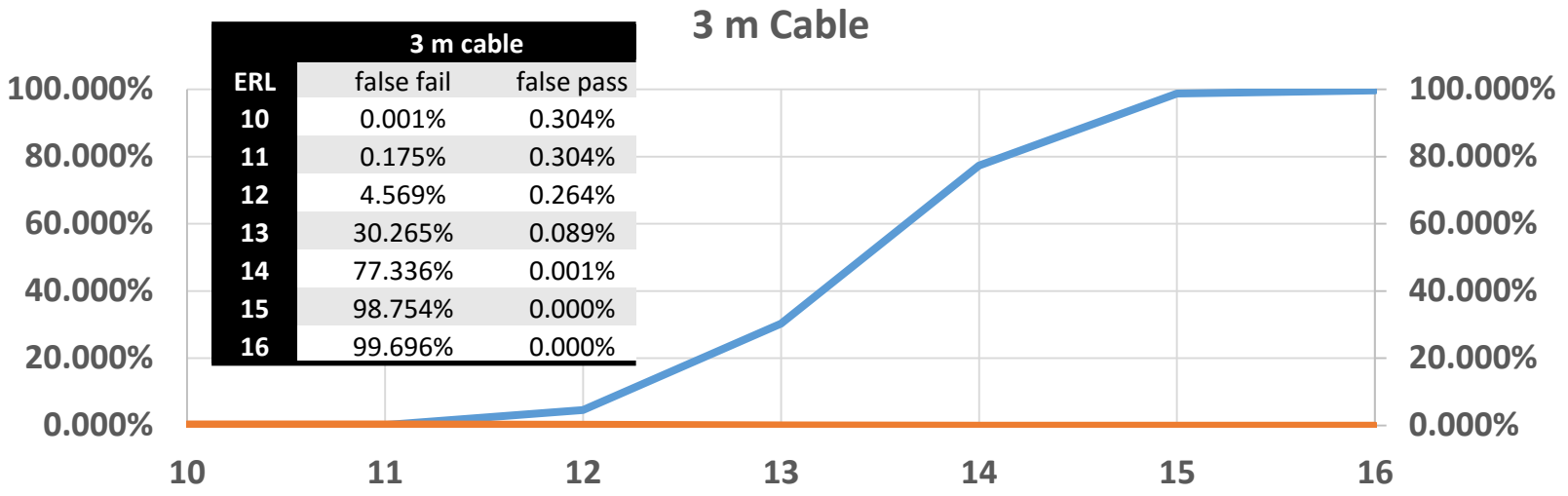

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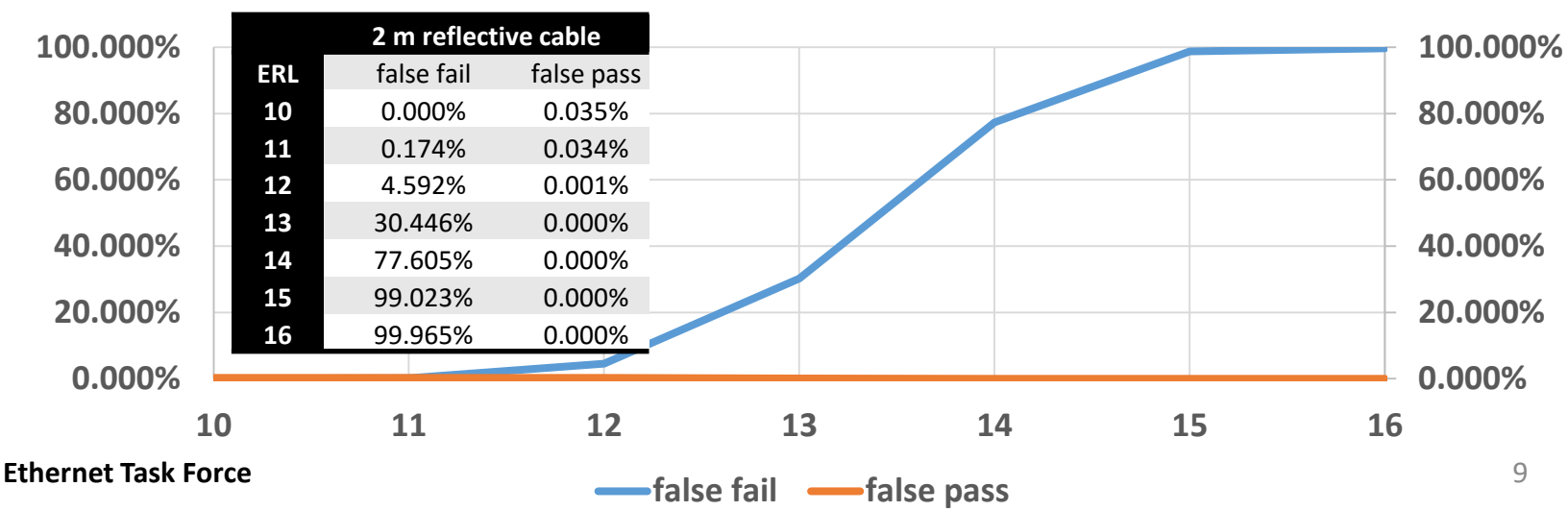

Measured CL 136 Host provided by **Upen Reddy, Wei Yao, and Karan Sharma at Cisco**

Host	tfx	ERL After tfx
CL_136_HOST_ Rx_host_6in	9.39E-10	**17.7**
CL_136_HOST_ Tx_host_6in	9.39E-10	**15.3**
CL_136_HOST_ Rx_host_2p6in	9.39E-10	**13.1**
CL_136_HOST_ Tx_host_2p6in	9.39E-10	**13.5**
CL_136_HOST_ Rx_host_8in	9.39E-10	**16.9**
CL_136_HOST_ Tx_host_8in	9.39E-10	**15.7**
CL_136_HOST_ Tx_host_8in	9.33E-10	**15.5**
CL_136_HOST_ Rx_host_8in	9.58E-10	**17.0**
CL_136_HOST_ Tx_host_8in	9.61E-10	**16.6**
CL_136_HOST_ --rx	2.70E-09	**11.6**
CL_136_HOST_ --tx	2.70E-09	**11.3**
CL_136_HOST_ --rx	2.70E-09	**11.6**
CL_136_HOST_ --tx	2.70E-09	**11.1**
CL_136_HOST_ --rx	2.70E-09	**11.9**
CL_136_HOST_ --tx	2.70E-09	**9.9**
CL_136_HOST_ --rx	2.70E-09	**11.0**
CL_136_HOST_ --tx	2.70E-09	**10.3**

This suggests that Tx and Rx Host ERL min is closer to 10 dB for real products

ERL minimum proposal reducing false fails

Recommend changes in the last term of Grr (93A-61) plus:

Clause	ERL Min (dB) D3.2 comment	When COM (dB) is <	ρ_x D3.2 comment	β_x D3.2 comment	N D3.2 comment
136 Tx Host	**10**	**NA**	**.3**	**1.7**	**300**
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136 Cable Assembly	**10.5**	**4**	**.25**	**1.7**	**1000**
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137 Channel	**10**	**4**	**0.18**	**1.7**	**1000**

Summary

- Recommend minimum ERL values with associated parameters in slide 10
- Utilize the straw ballot process
  - To resolve ERL minimum values which generate a lot of discussion

Thank You!