



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

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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
- ❑ Nathan Tracy, 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	$\rho_x$ D3.2	$\beta_x$ D3.2	N D3.2	ERL Min (dB) D3.2 comment	When COM (dB) is <	$\rho_x$ D3.2 comment	$\beta_x$ 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	<b>Propose 12 other options possible</b>	<b>NA</b>	<b>.3</b>	<b>1.7</b>	<b>300</b>
136 Rx Host	14.5	0.44	10.7	300	<b>12</b>	<b>NA</b>	<b>.3</b>	<b>1.7</b>	<b>300</b>
136 Cable Assembly	11	0.44	10.7	1000	<b>10.5</b>	<b>4</b>	<b>.25</b>	<b>1.7</b>	<b>1000</b>
137 Tx Device	16.1	0.44	10.7	100	<b>15</b>	<b>NA</b>	<b>.32</b>	<b>1.7</b>	<b>100</b>
137 Rx Device	16.1	0.44	10.7	100	<b>15</b>	<b>NA</b>	<b>0.32</b>	<b>1.7</b>	<b>100</b>
137 Channel	10	0.44	10.7	300	<b>10</b>	<b>4</b>	<b>0.18</b>	<b>1.7</b>	<b>1000</b>

# 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

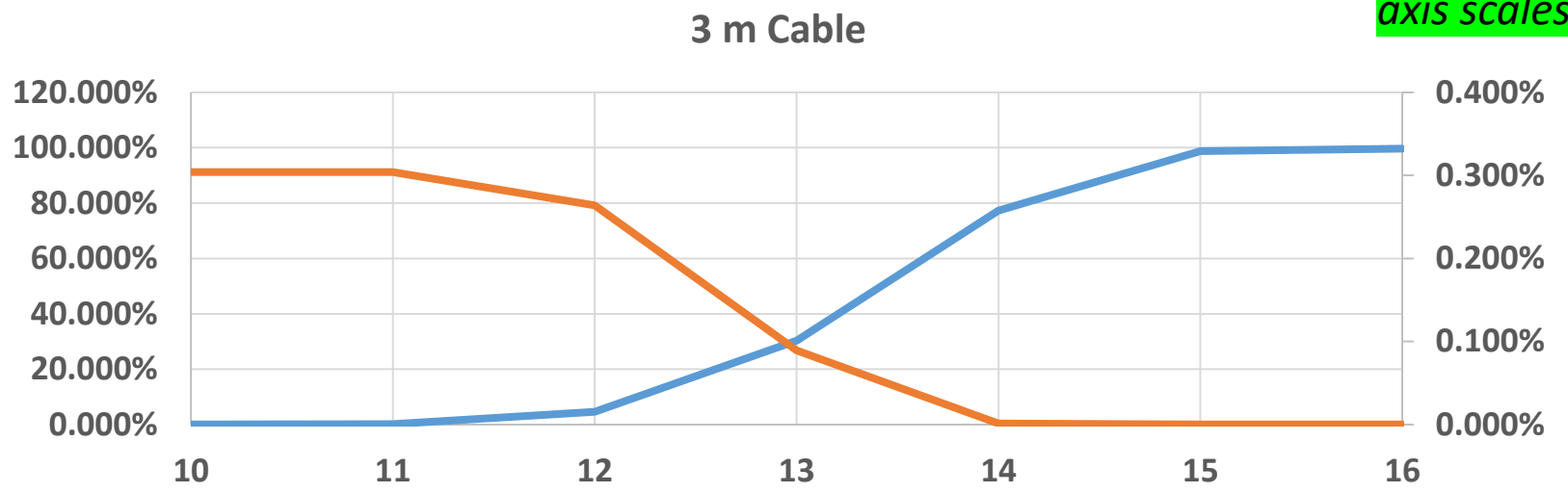
# Evaluation of the Population of Host Designs for Tx ERL

- ❑ Given: A host must pass all the requirements such as
  - SNDR
  - $V_{\text{peak}}/V_f$  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  $V_{\text{peak}}/V_f$  limit considered
- ❑  $V_{\text{peak}}/V_f$  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%

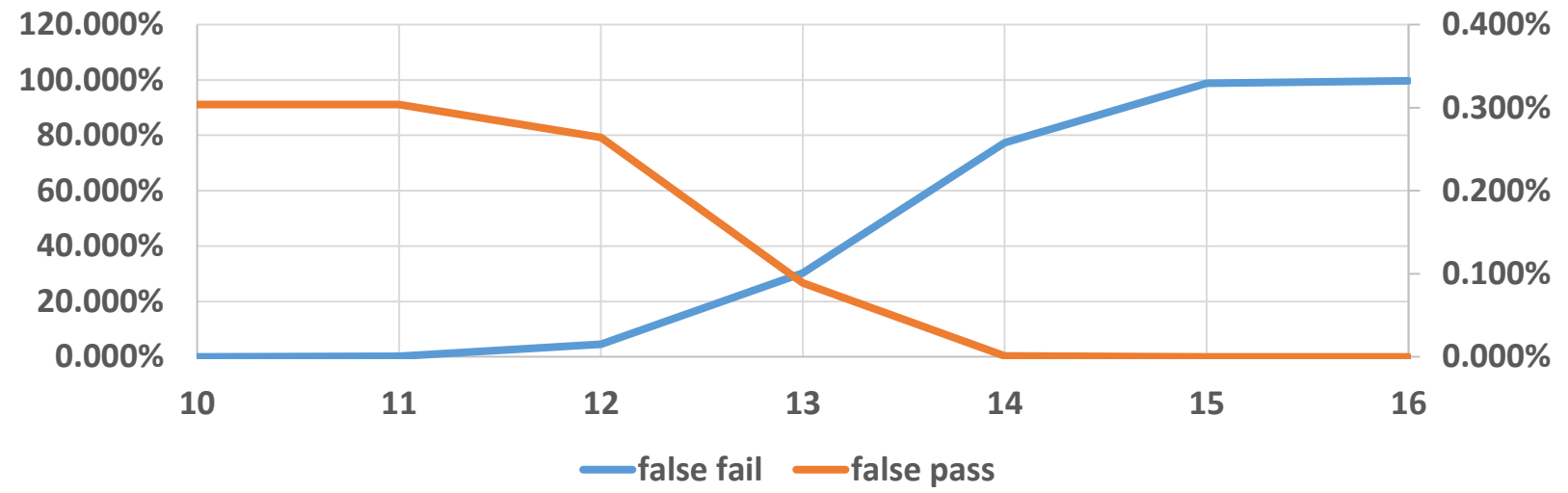


## False Fail

— false fail — false pass

## False Pass

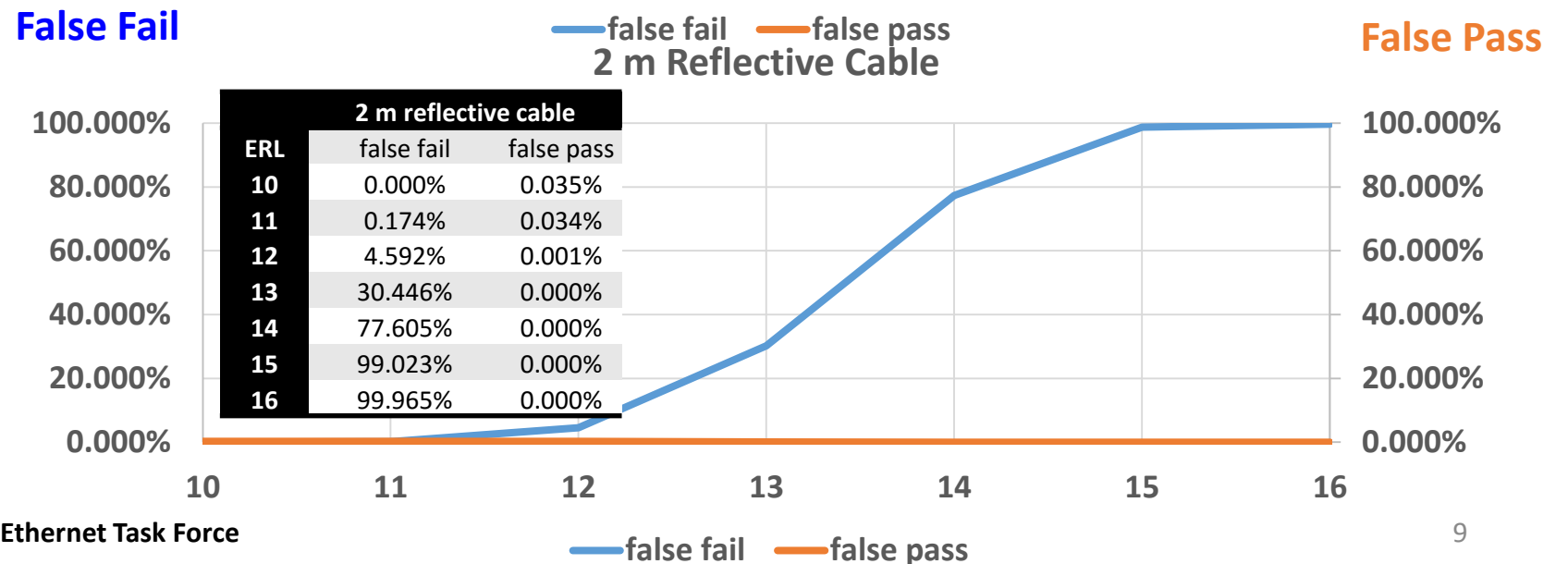
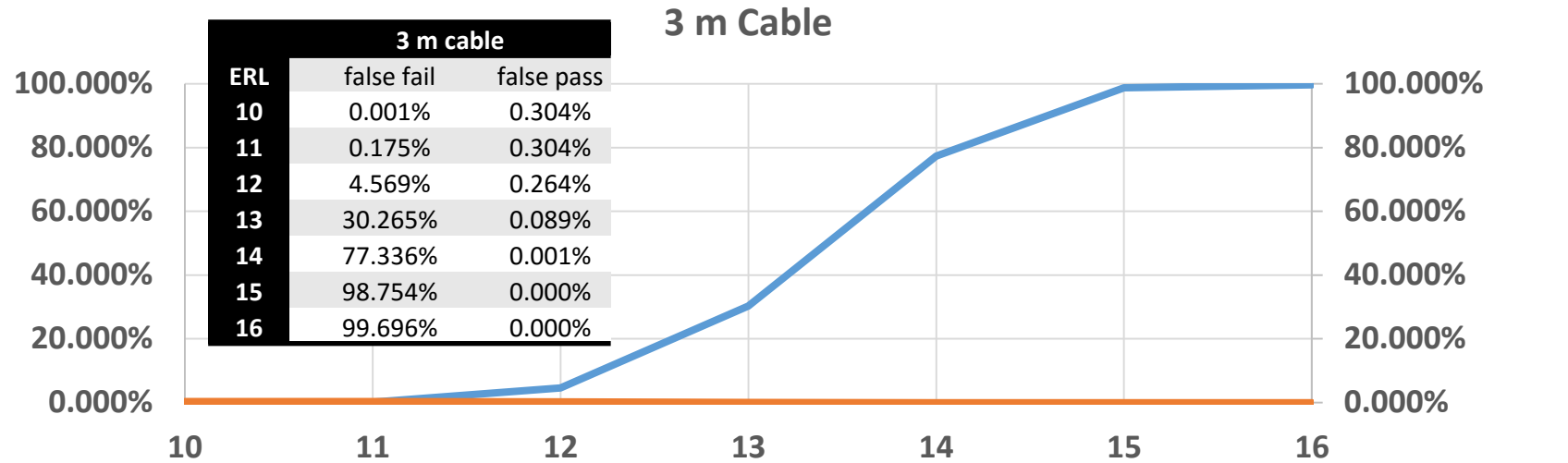
2 m reflective cable		
ERL	false fail	false pass
10	0.000%	0.035%
11	0.174%	0.034%
12	4.592%	0.001%
13	30.446%	0.000%
14	77.605%	0.000%
15	99.023%	0.000%
16	99.965%	0.000%





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



# 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 <	$\rho_x$ D3.2 comment	$\beta_x$ D3.2 comment	N D3.2 comment
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136 Cable Assembly	10.5	4	.25	1.7	1000
137 Tx Device	15	NA	.32	1.7	100
137 Rx Device	15	NA	0.32	1.7	100
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

A stylized, grey-toned illustration of a tiger's head, shown in profile facing left. The tiger has a white muzzle and chest, with dark stripes on its face and body. The illustration is positioned on the left side of the slide.

Thank You!

A series of colorful, parallel lines radiating from the bottom right towards the center. The lines are in various colors including yellow, red, blue, green, and purple, and are set against a background of a fine grid of dots.