Comment Agenda
162 cable assembly
162A-D Annexes

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Comment Agenda

Topic – 162 CA	Comments
CA IL	181
CA ERL and Tr	[68], 44, champion_3ck_01_0720.pdf
CA DC RL	71*, 181, 148, 74, haser_3ck_adhoc_02_061720.pdf
CA CD IL	148*, 181
CA CC RL	73*,181,76, haser_3ck_adhoc_02_061720.pdf
CA COM Tr	149
CA COM SNRTX	37*, 70, 77, 152, 11162

Topic-162A	Comments
ILMaxHost(f) TBD, ILCamin(f) TBD	182

Topic -162C	Comments
MDI Connector contact map	#1, lusted_3ck_01_0720.pdf

Comment Agenda

Topic -162B	Comments
RL	180*,86,87
CMIL	180*,88,89

Topic -162B	Comments
Frequency Range	91*,79,80,81,84,85,87,89,90
FOM_{ILD}	83 value, 84 frequency range, 180
ICN	92,93,94,95,96

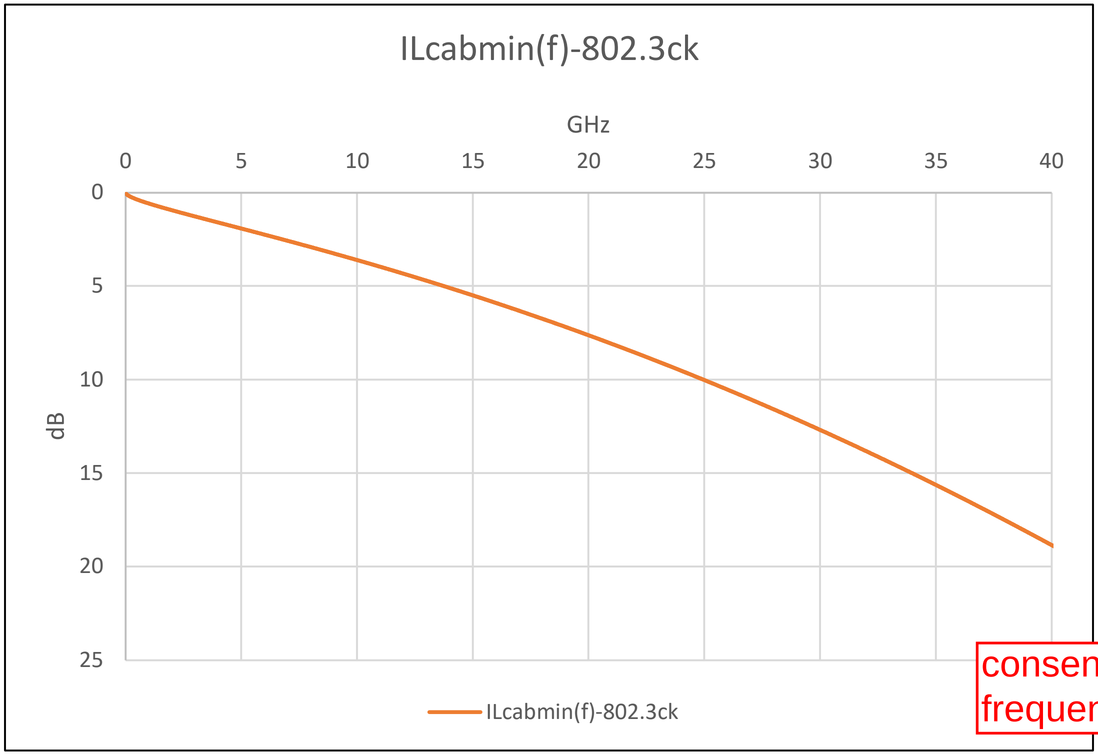
Topic – MDI	Comments
MDI connectors require normative references	232*,233,234,251,252, 253,254

CA IL minimum - #181

162.11.2 Cable assembly insertion loss

The measured insertion loss of a cable assembly shall be greater than or equal to the minimum cable assembly insertion loss given in TBD and illustrated in TBD.

The measured insertion loss at 26.56 GHz of a cable assembly shall be less than or equal to 19.75 dB.



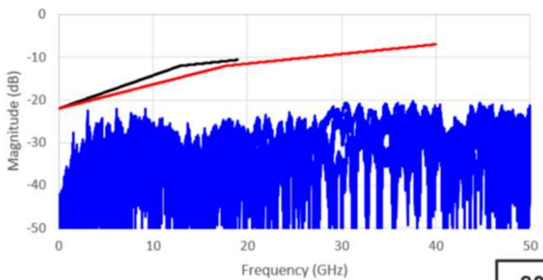
consensus around equation and frequency limits

ILcabmin(f)=0.418*SQRT(f)+0.177*f+0.0059*f^2 f from TBD GHz to 40 GHz

ILcabmin(f)=11 dB=0.418*SQRT(26.56)+0.177*(26.56)+0.0059*26.56^2

CA DC RL – 71*, 181, 147, 74,

Differential to Common-Mode Return Loss:



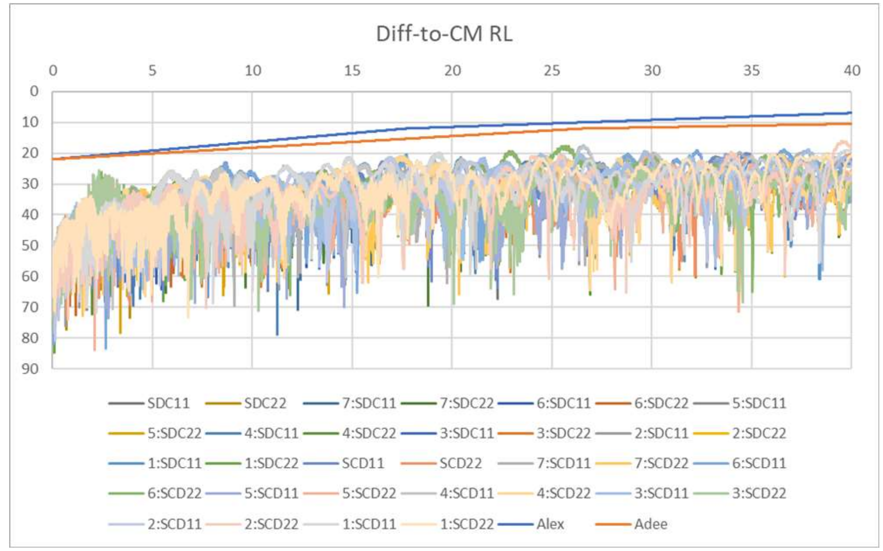
Key:
BLUE = POC Data
BLACK = 802.3cd
RED = 802.3ck proposal

#71 haser_3ck_adhoc_02_061720.pdf

4

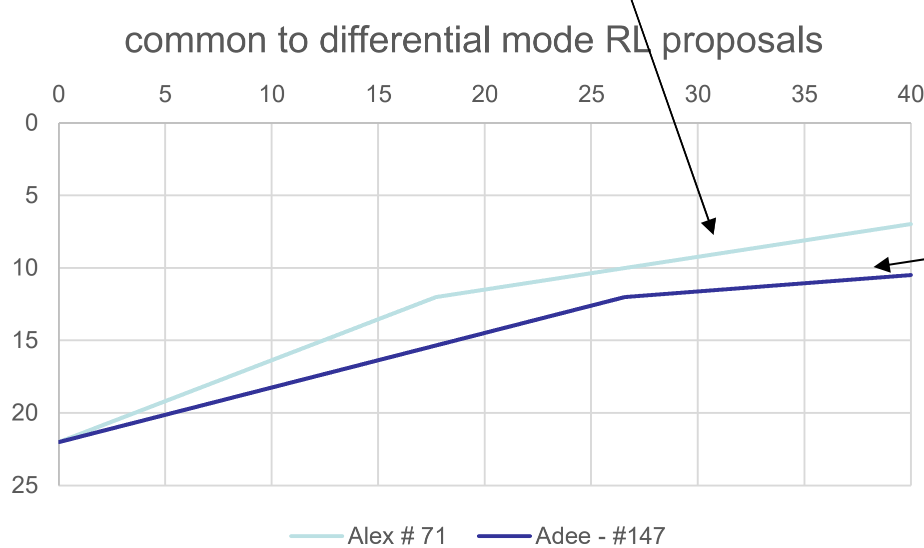
802.3ck proposal:

$\left(22 - \frac{15}{26.56} f\right) dB$	$0.05\ GHz \le f < 17.7\ GHz$
$\left(16 - \frac{6}{26.56} f\right) dB$	$17.7\ GHz \le f \le 40\ GHz$



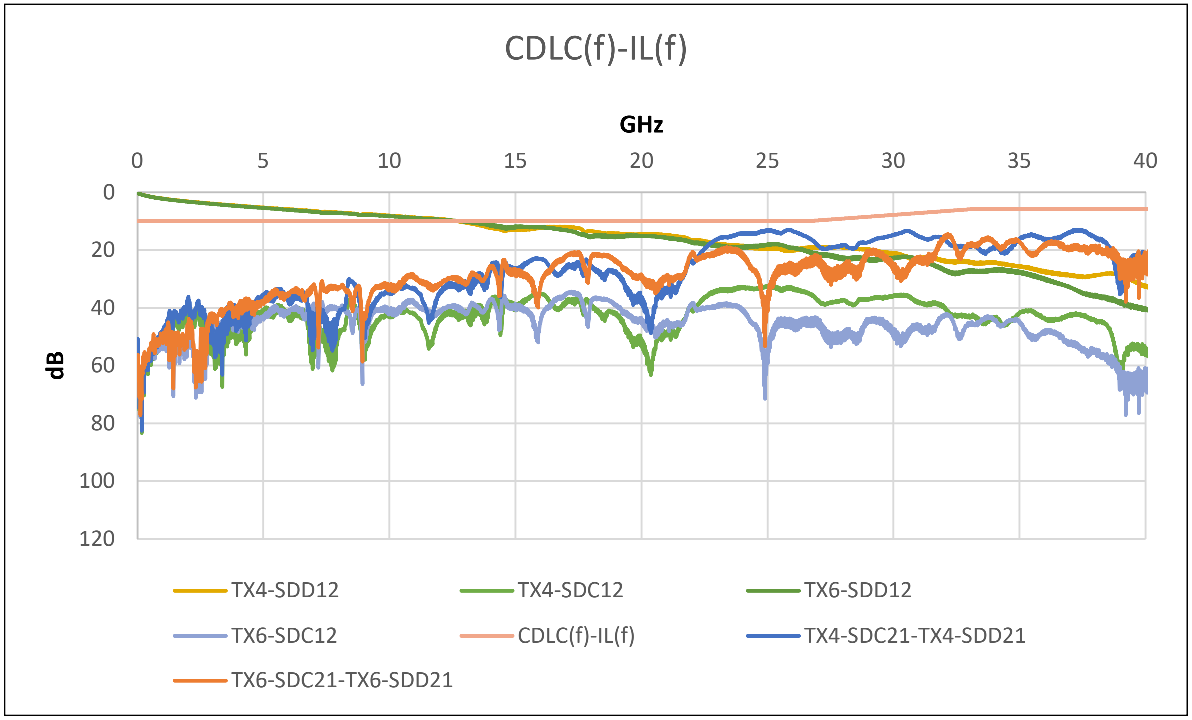
tracy_3ck_01a_0719.pdf

100 Gbps Copper Cable Measurement
and S-Parameter File
8 Channel Cable Measurement



#147 ---CDRL(f) ≥
22-10*f/f_N, 0.01 ≤ f ≤ f_N
15-3*f/f_N, f_N< f < 40
Where
f_N=26.5625 is the Nyquist frequency in GHz
f is the frequency in GHz

CA CDCL – 148*, 74



tracy_3ck_01a_0719.pdf

100 Gbps Copper Cable Measurement and S-Parameter File 8 channel cable measurement

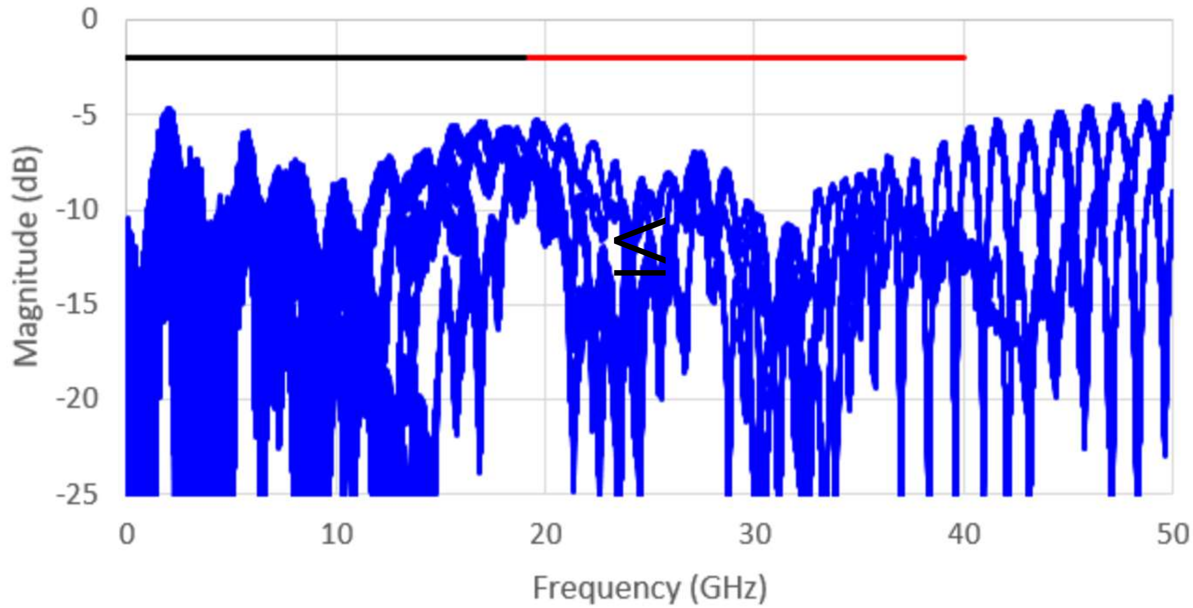
162.11.5 Cable assembly differential to common-mode conversion loss Conversion between differential and common-mode signals can result in degradation of the signal at the receiver, and in introduction of differential noise into the receiver. To limit these effects, the differential to common-mode mode conversion loss, relative to the insertion loss, has to be limited. f

The difference between the cable assembly differential to common-mode conversion loss
and the cable
assembly insertion loss shall meet Equation (162-new).
CDCL(f) - IL(f) ≥
10, 0.01 ≤ f ≤ f_N
27-17*f/f_N, f_N < f ≤ 1.25*f_N
5.75, 1.25*f_N < f < 40
Where
f_N=26.5625 is the Nyquist frequency in GHz
f is the frequency in GHz
CDCL(f) is the common-mode to differential inversion loss in dB at frequency

CA CC RL – 73*,181,76

Common-Mode to Common-Mode Return Loss:

Key:
BLUE = POC Data
BLACK* = 802.3cd
RED = 802.3ck proposal



802.3ck proposal: 2 dB $0.05\ GHz \leq f < 40\ GHz$

≤

molex

haser_3ck_adhoc_02_061720.pdf

CA COM: SNRTx - #37

Cl **162** *SC* **162.11.7** *P* **160** *L* **42** # 77

Haser, Alex — Molex

Comment Type **TR** *Comment Status* **D** *CA COM*

Fill in TBD for SNR_Tx

SuggestedRemedy

Set SNR_Tx to 32.52 dB. All lanes of cables must pass COM; need a higher SNR_Tx value to do so given shared data (see champion_3ck_adhoc_01_031120)

Proposed Response *Response Status* **W**

PROPOSED ACCEPT

The referenced presentation is here:
http://www.ieee802.org/3/ck/public/adhoc/mar11_20/champion_3ck_adhoc_01_031120.pdf

Resolve using response to comment #37.

Cl **162** *SC* **162.11.7** *P* **160** *L* **43** # 152

Ran, Adee — Intel

Comment Type **T** *Comment Status* **D** *CA COM*

SNR_TX of the CR PHY needs to be somewhat lower than the corresponding CK PHY COM value (33 dB), to account for crosstalk that is introduced by practical host board routing. The mathematical host board model that is used in COM does not introduce any crosstalk.

Proposed value is 32.5 dB.

SuggestedRemedy

Change TBD to 32.5 dB.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Resolve using response to comment #37.

Cl **162** *SC* **162.11.7** *P* **160** *L* **43** # 37

Ben Artsi, Liav — Marvell Technology

Comment Type **T** *Comment Status* **D** *CA COM*

Transmitter signal-to-noise ratio is TBD

SuggestedRemedy

In benartsi_3ck_01a_0919 it was shown that an optimized break-out section cross-talk degrades SNR by at least 0.5dB.
This degradation is not represented in the "include PCB" section and should be accounted for in setting a proper value of SNR_Tx in section 162. In Table 163–10 SNR_Tx is specified to be 33dB and very likely same devices will be used for both sections. For comparison, in section 163 the break-out area crosstalk is included in the interconnect supplied to COM.
According to all of the above, set 162 section's SNR_Tx COM value to be 32.5dB (to account for host board break-out section crosstalk which is not included in the "include PCB" specification). This value correlates to 163 section's SNR_Tx of 33dB and allows traces and conector crosstalk degradation of an additional 1dB up to TP2 resulting in the 31.5dB already specified in table 162–9 (SNDR = 31.5dB)

Proposed Response *Response Status* **W**

PROPOSED ACCEPT

The referenced presentation is here:
http://www.ieee802.org/3/ck/public/19_09/benartsi_3ck_01a_0919.pdf

Comments #37, #70, #77, #152 all propose the same remedy.

Cl **162** *SC* **162.11.7** *P* **160** *L* **42** # 70

Champion, Bruce — TE Connectivity

Comment Type **T** *Comment Status* **D** *CA COM*

SNR_Tx listed at TBD

SuggestedRemedy

Change TBD to 32.5 as described in champion_3ck_adhoc_01_031120.pdf. See presentation

Proposed Response *Response Status* **W**

PROPOSED ACCEPT

The referenced ad hoc presentation is here:
http://www.ieee802.org/3/ck/public/adhoc/mar11_20/champion_3ck_adhoc_01_031120.pdf

Pending review of the following new presentation:
http://www.ieee802.org/3/ck/public/20_07/champion_3ck_02_0720.pdf

Resolve using response to comment #37.

Cl **162** *SC* **162.11.7** *P* **160** *L* **42** # 11162

Palkert, Tom — Molex

Comment Type **T** *Comment Status* **D** *CA COM*

[Comment resubmitted from Draft 1.1. 162.11.7, P160, L6]

Need value for SNRtx

SuggestedRemedy

Make SNRtx = 33dB (See supporting presentation)

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE

Resolve using the response to comment #37.

C#	Proposal	Proposed Response
37	32.5 dB	Accept
70		
77		Accept. Resolve using response to comment #37.
152		
11162	33 dB	AIP. Resolve using response to comment #37.

CA COM Tr - #149

Cl **162** *SC* **162.11.7** *P* **159** *L* **20** # 149

Ran, Adee Intel

Comment Type **T** *Comment Status* **D** *ERL*

(cross-clause)
Addressing the value of T_r used in COM, which is currently TBD.

Tr is not mesurable, but it implicitly affects the transmitter specification peak/Vf which is measurable, and is also TBD in 162, 163 and 120F.

The proposed value for Tr (as used in COM, prior to the device package model) is 7.5 ps. This values matches results of feasible transmitter devices and will enable reasonble values of peak/Vf.

Note that the value 6.16 ps has been used in prior analysis, but has never been adopted. This latter value is overly aggressive and does not enable feasible design of transmitters. The proposed value has only a mild effect on COM results in comparison.

A presentation supporting this value and possible values for peak/Vf at Tp0 or TP0a (possibly informative) will be provided.

SuggestedRemedy

Change TBD to 7.5 ps in 162.11.7, in 163.10, and in 120F.4.1.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

A related presentation was not submitted.
Resolve using the response to comment 45.

Comment Agenda - #182

Topic-162A	Comments
ILMaxHost(ƒ) TBD, ILCamin(ƒ) TBD	182

162A.4 Transmitter and receiver differential printed circuit board trace loss

The recommended maximum and minimum printed circuit board trace insertion losses are specified in TBD and TBD, respectively.

Note that the recommended maximum insertion loss allocation for the transmitter or receiver differential controlled impedance printed circuit boards with allowances for ball grid array (BGA) footprint and host connector footprints is 6.875 dB at 26.56 GHz and the recommended minimum insertion loss allocation for the transmitter or receiver differential controlled impedance printed circuit boards is 2.3 dB at 26.56 GHz. The recommended maximum insertion loss allocation for the transmitter or receiver differential controlled impedance printed circuit boards is consistent with the insertion loss from TP0 to TP2 or TP3 to TP5 given in TBD and an assumed mated connector loss of 1.6 dB.

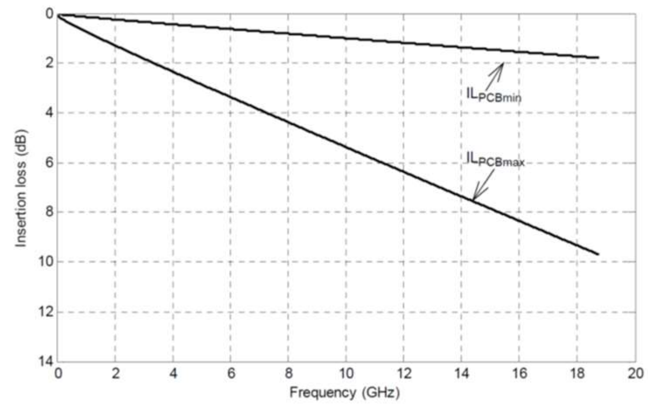
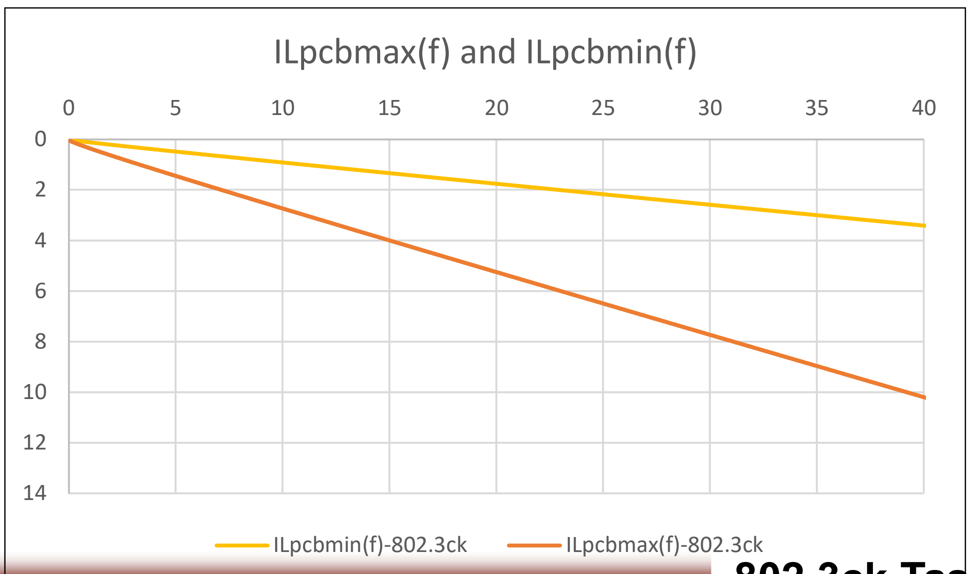


Figure 92A–1—Insertion Loss Tx or Rx PCB max and min



ILpcbmax(fghz)=0.0176+0.1082*SQRT(fghz)+0.2372*fghz
ILpcbmax(26.56)=6.875=0.0176+0.1082*SQRT(26.56)+0.2372*26.56

ILpcbmin(f)=0.0059+0.0361*SQRT(fghz)+0.0794*fghz
Ilpcbmin(26.56)=2.30=0.0059+0.0361*SQRT(26.56)+0.0794*26.56

Editorial license update Annex reference to 162.11.2 ILCamin

Comment Agenda - #1

Topic -162C	Comments
MDI Connector contact map	#1, lusted_3ck_01_0720.pdf

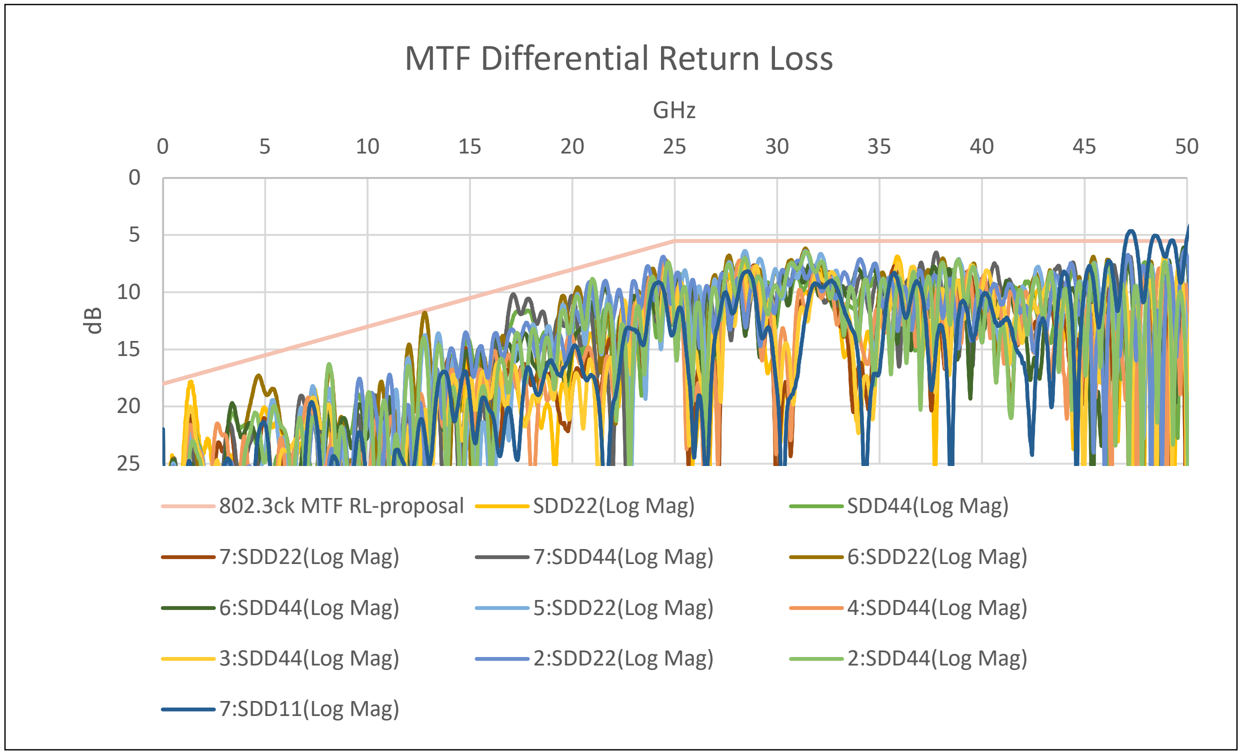
Pin#	Symbol	Description
1	GND	Ground
2	SL1p	Transmitter Data Non-Inverted
3	SL1n	Transmitter Data Inverted
4	GND	Ground
5	SL3p	Transmitter Data Non-Inverted
6	SL3n	Transmitter Data Inverted
7	GND	Ground
8	SL5p	Transmitter Data Non-Inverted
9	SL5n	Transmitter Data Inverted
10	GND	Ground
11	SL7p	Transmitter Data Non-Inverted
12	SL7n	Transmitter Data Inverted
13	GND	Ground
18	GND	Ground
19	DL6n	Receiver Data Inverted
20	DL6p	Receiver Data Non-Inverted
21	GND	Ground
22	DL4n	Receiver Data Inverted
23	DL4p	Receiver Data Non-Inverted
24	GND	Ground
25	DL2n	Receiver Data Inverted
26	DL2p	Receiver Data Non-Inverted
27	GND	Ground
28	DL0n	Receiver Data Inverted
29	DL0p	Receiver Data Non-Inverted
30	GND	Ground
31	GND	Ground
32	DL1p	Receiver Data Non-Inverted
33	DL1n	Receiver Data Inverted
34	GND	Ground
35	DL3p	Receiver Data Non-Inverted
36	DL3n	Receiver Data Inverted
37	GND	Ground
38	DL5p	Receiver Data Non-Inverted
39	DL5n	Receiver Data Inverted
40	GND	Ground
41	DL7p	Receiver Data Non-Inverted
42	DL7n	Receiver Data Inverted
43	GND	Ground
48	GND	Ground
49	SL6n	Transmitter Data Inverted
50	SL6p	Transmitter Data Non-Inverted
51	GND	Ground
52	SL4n	Transmitter Data Inverted
53	SL4p	Transmitter Data Non-Inverted
54	GND	Ground
55	SL2n	Transmitter Data Inverted
56	SL2p	Transmitter Data Non-Inverted
57	GND	Ground
58	SL0n	Transmitter Data Inverted
59	SL0p	Transmitter Data Non-Inverted
60	GND	Ground

Comment Agenda

Topic -162B	Comments
RL	[180],86,87
CMIL	[180],88,89

#180 - MTF Differential Return Loss

#86,#87 - 162B.1.3.2 Mated test fixtures - RL (TBD) - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.



PROPOSAL: Differential Return Loss =

18-0.5*f_{GHz} 0.05 GHz ≤ f_{GHz} < 25 GHz

5.5 25 GHz ≤ f_{GHz} ≤ 40 GHz

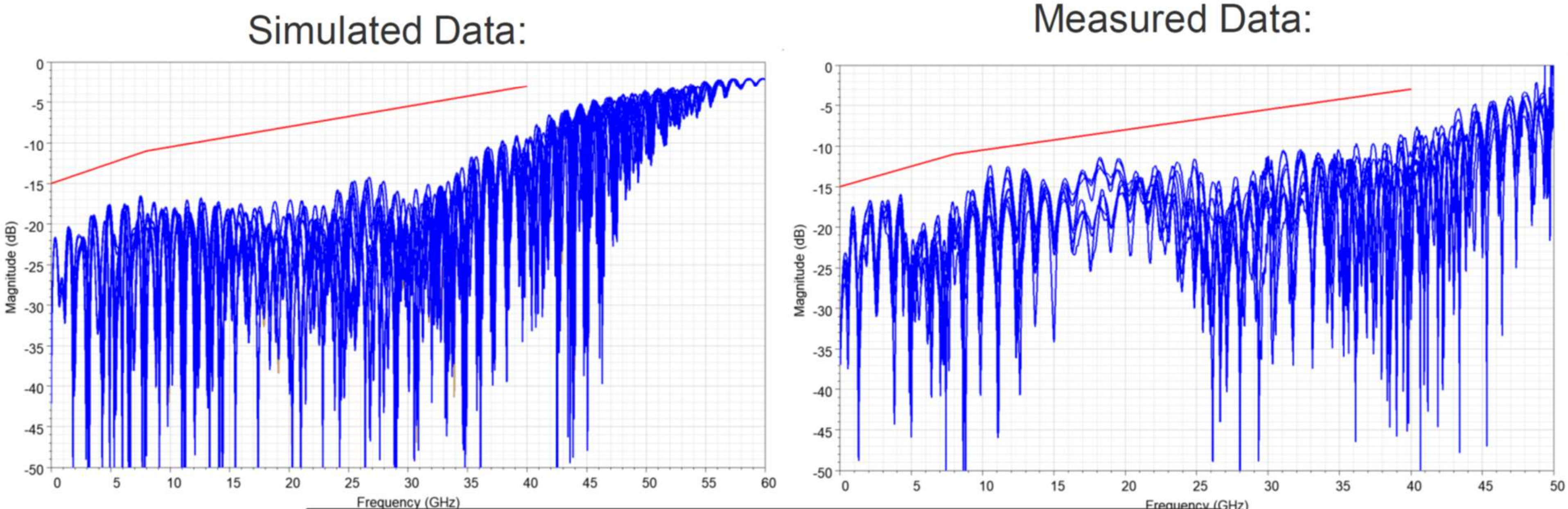
#86,87 - MTF Differential Return Loss

#86,#87 - 162B.1.3.2 Mated test fixtures - RL (TBD) - Change from 0.01 GHz $\leq f_{GHz} \leq$50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

SDD11:

NOTE: 802.3ck D1.2 does not include a limit line for this parameter

Key:
BLACK = 802.3ck D1.2
RED = Proposal



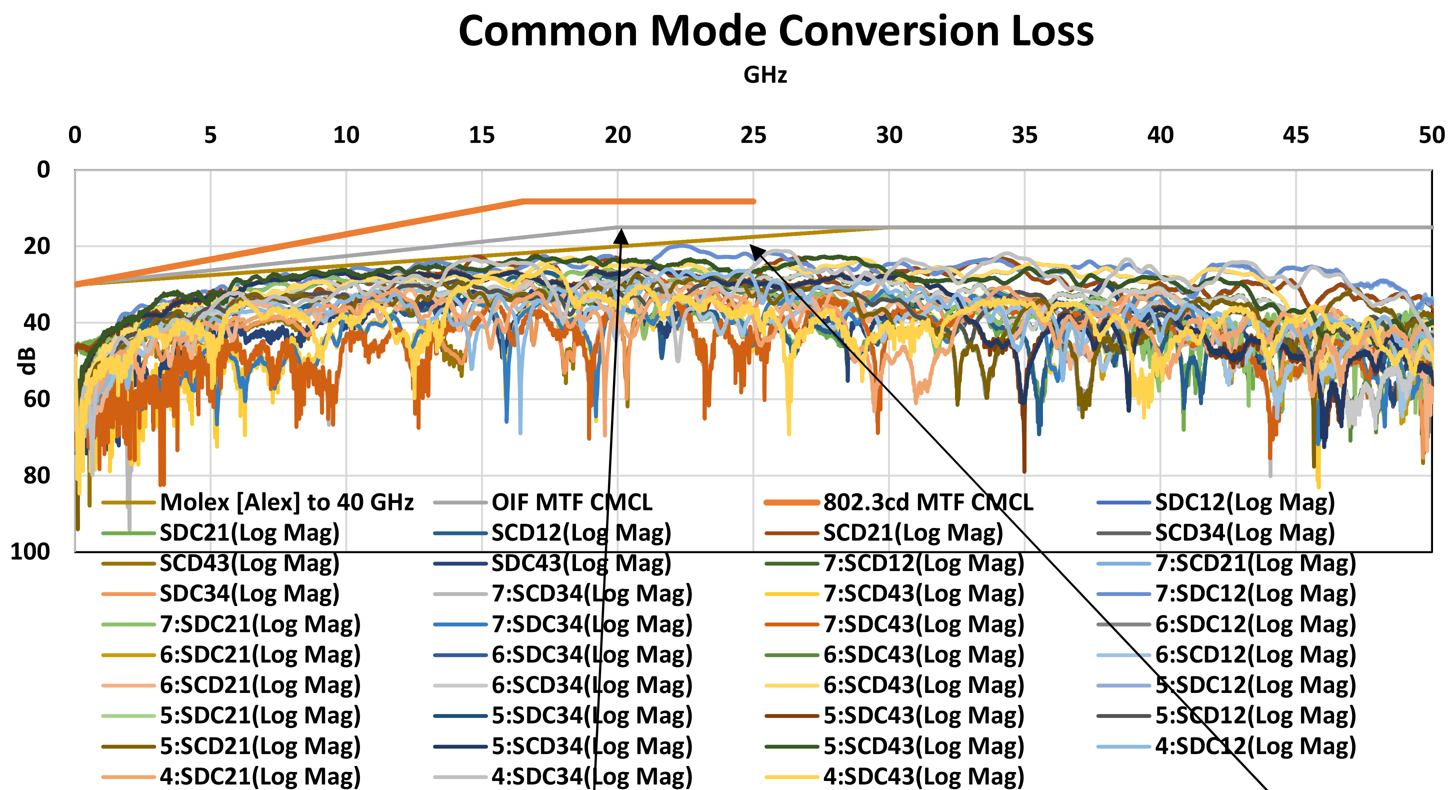
Proposal: $15 - 0.5f$ $f < 8\ GHz$
$13 - 0.25f$ $8\ GHz \leq f \leq 40\ GHz$

molex

10
http://www.ieee802.org/3/ck/public/adhoc/jun24_20/haser_3ck_adhoc_01c_062420.pdf

#180- MTF Common Mode Conversion Loss

#88,#89 - 162B.1.3.4 Mated test fixtures - CMCIL (TBD) - Change from 0.01 GHz $\leq f_{GHz} \leq 50$ GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.



PROPOSAL: **Common Mode Conversion Loss =**

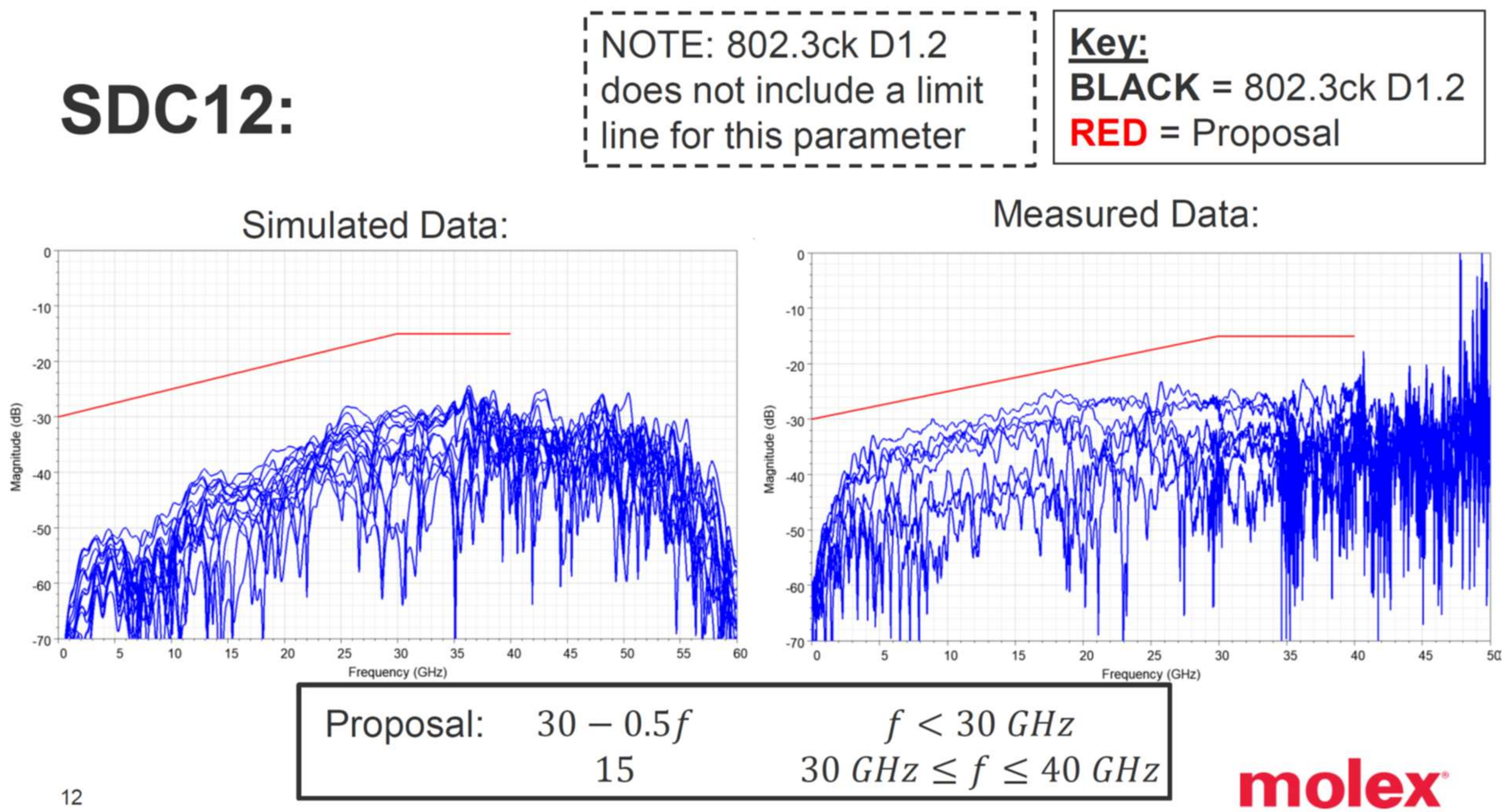
30-(21/28)*f_{GHz} **0.05 TBD GHz $\leq f_{GHz} <$ 20 GHz**

15 **20 GHz $\leq f_{GHz} \leq$ 40 GHz**

$$\begin{cases} 30 - 0.5f & f < 30\ GHz \\ 15 & 30\ GHz \leq f \leq 40\ GHz \end{cases}$$

#88,#89 -162B.1.3.4 Mated test fixtures - CMCIL

#88,#89 - 162B.1.3.4 Mated test fixtures - CMCIL (TBD) - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.



http://www.ieee802.org/3/ck/public/adhoc/jun24_20/haser_3ck_adhoc_01c_062420.pdf

Comment Agenda

Topic -162B	**Comments**
Frequency Range	91*,79,80,81,84,85,87,89,90
FOM_{ILD}	83* value, 84 frequency range, 180
ICN	92,93,94,95,96

Mated Test Fixtures – Frequency Range

- Proposal -
  - Comments 79,80,81,84,85,87,89,90,91
    - + Specify frequency range 0.05 GHz - 40 GHz to align with available in-house VNA ranges.
    - + For stop frequency; consider VNA ranges, MTF max IL, ICN sensitivity, and receiver BW (0.75* fb = ~ 40 GHz); comment#91
    - + For start frequency; consider VNA ranges and FOMILD sensitivity.

Frequency range – 79,80,81,84,85,87,89,90,91

#79- 162B.1.1.1 Reference IL - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

#80- 162B.1.2.1 Cable assembly test fixture reference IL - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

#81,#82- 162B.1.3.1 Mated test fixtures max and min IL - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

#83,#84 - 162B.1.3.1 FOM_{ILD} Tt= TBD=6.16 ps; change f_min to 0.05 GHz.

#85 - 162B.1.3.1 Mated test fixtures reference IL - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

#85 - 162B.1.3.1 Mated test fixtures reference IL - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

#86,#87 - 162B.1.3.2 Mated test fixtures - RL (TBD) - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

#88,#89 - 162B.1.3.4 Mated test fixtures - CMCIL (TBD) - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

#90, - 162B.1.3.5 Mated test fixtures CMDRL - Change from 0.01 GHz ≤f_{GHz}≤50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

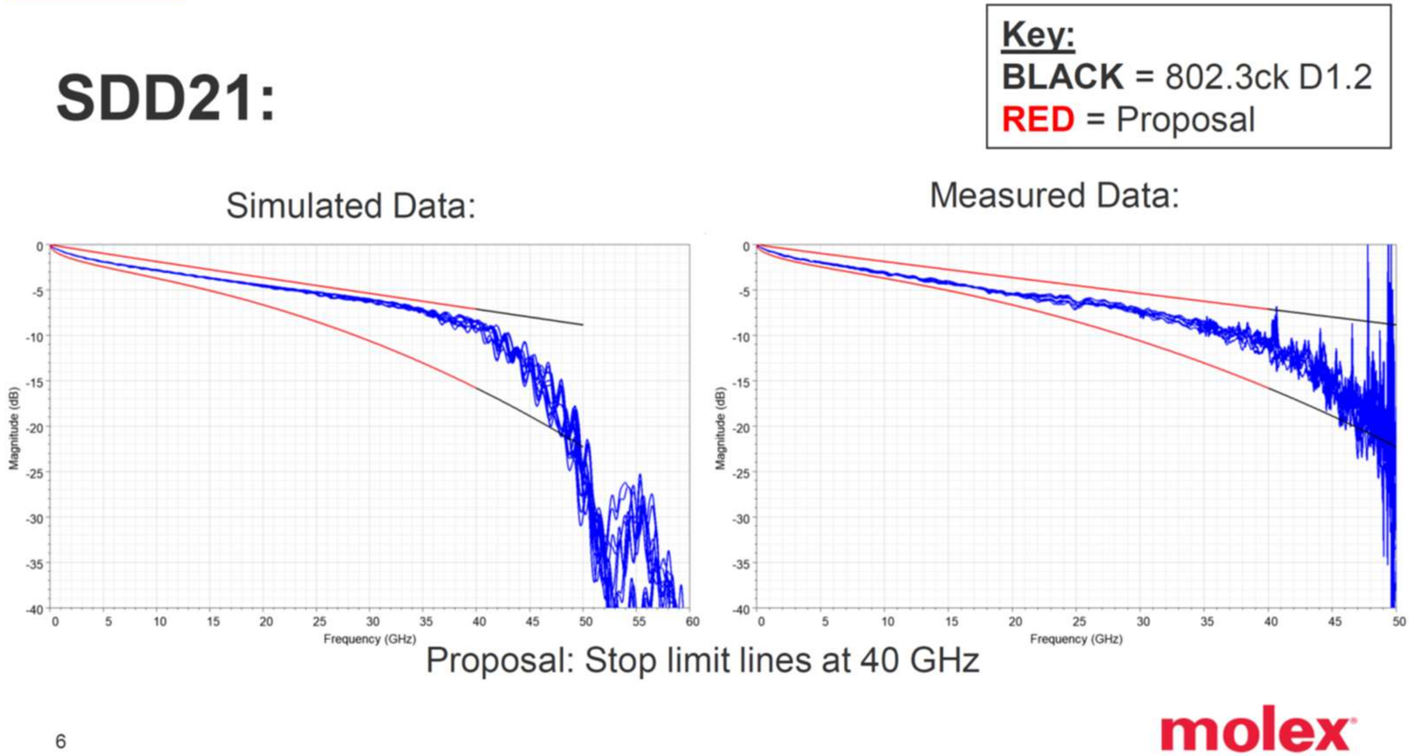
#91, - 162B.1.3.6 Mated test fixtures integrated crosstalk noise – Add "Integrated crosstalk RMS noise voltages are measured over N uniformly-spaced frequencies f_n spanning the frequency range 50 MHz to 40 GHz with a minimum spacing of 10 MHz." to the end of this section.

IL Frequency range Max – 79, 80, 81,82

#79- 162B.1.1.1 Reference IL - Change from 0.01 GHz $\le f_{GHz} \le$50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

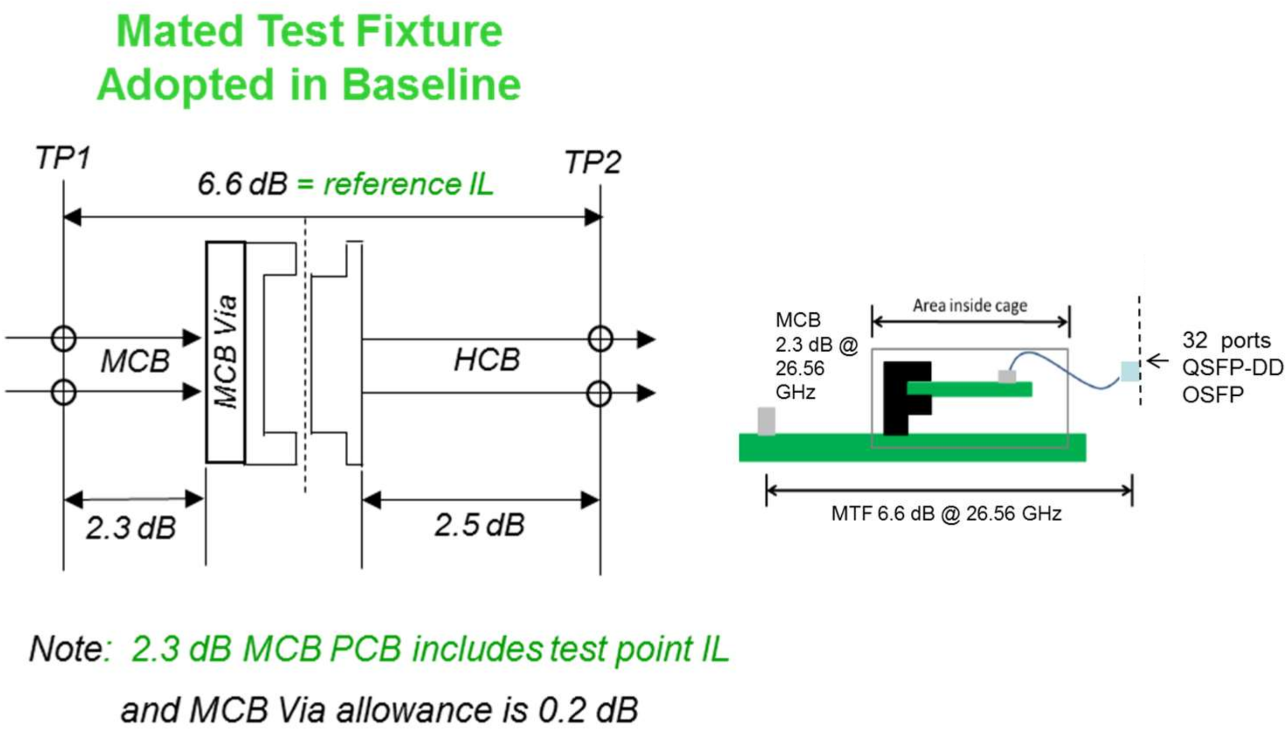
#80- 162B.1.2.1 Cable assembly test fixture reference IL - Change from 0.01 GHz $\le f_{GHz} \le$50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.

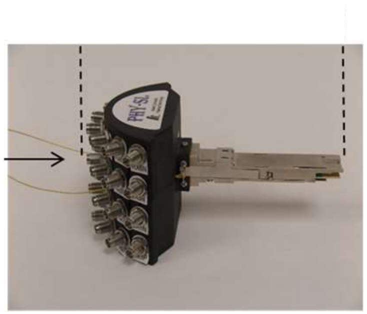
#81,#82- 162B.1.3.1 Mated test fixtures max and min IL - Change from 0.01 GHz $\le f_{GHz} \le$50 GHz to 0.05 GHz ≤fGHz≤40 GHz and update figure.



#180 - Mated Test Fixture Specifications

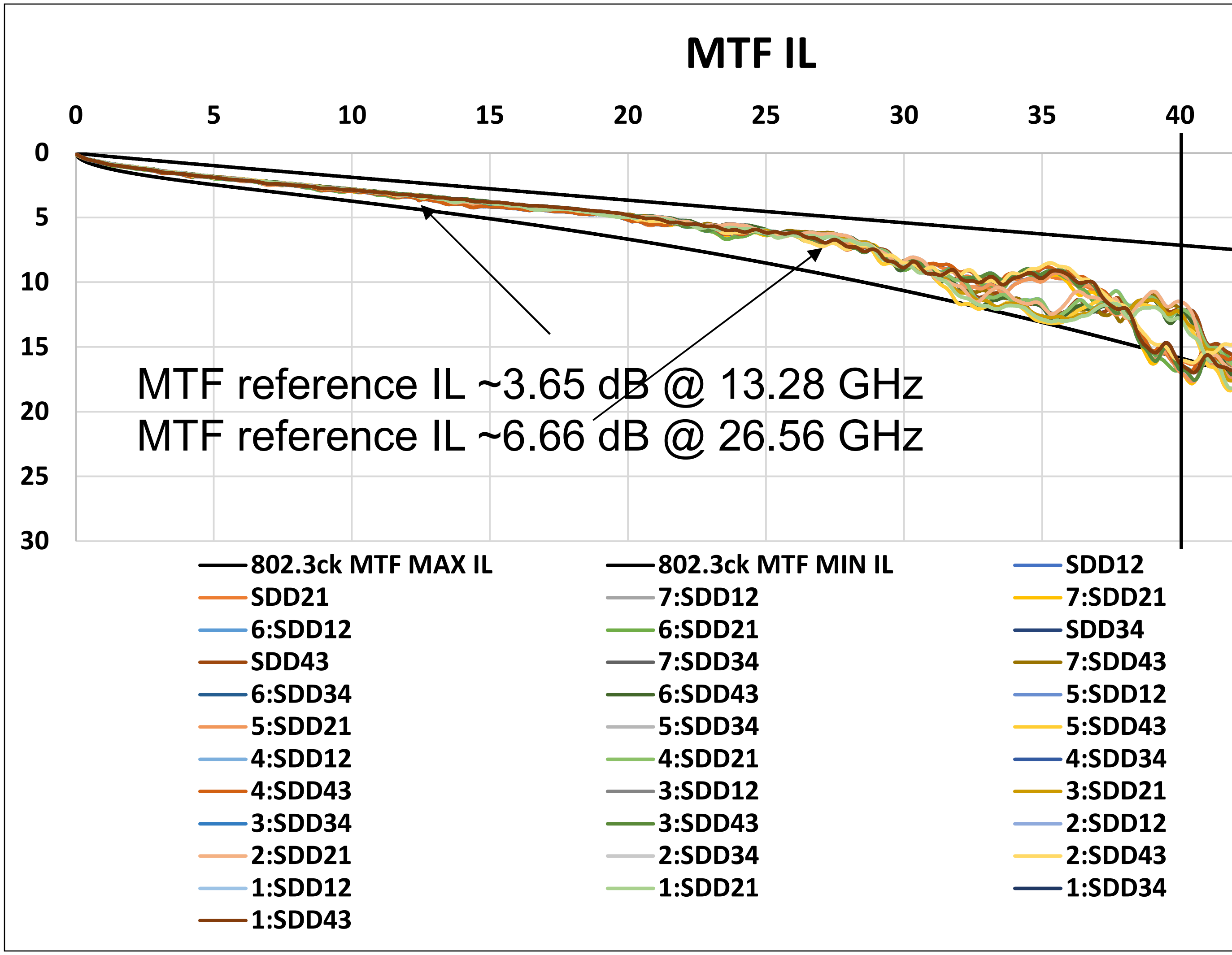
- **Measurements with compliant PCB IL - HCB and MCB**





http://www.ieee802.org/3/ck/public/20_07/diminico_3ck_01_0720.pdf

In support of IL Frequency range Max – 79, 80, 81,82



Tr (ps)	FOMild	BW (GHz)
6.6	0.2722	40
6.6	0.2554	50
7.5	0.2358	40
9.27	0.1902	40
9.4	0.1872	40
9.6	0.1872	40

- **Measurements with compliant PCB IL - HCB and MCB**

IL frequency range min- FOM_{ILD} 83, 84

FOM_{ILD}:

Parameter	Value
f_b	53.125 GHz
T_r	**6.16 ps** TBD
f_r	0.75 x fb
f_{start}	**0.05 GHz***
f_{stop}	40 GHz
FOM_{ILD} Limit	**0.18 dBrms**

* The current D1.2 specification identifies f_{start} = 0.01 GHz (see next slide for more information)

Pair	Simulated	Measured
1 (Tx1)	0.040	
2 (Tx3)	0.042	
3 (Tx5)	0.046	
4 (Tx7)	0.053	
5 (Tx6)	0.040	0.132
6 (Tx8)	0.045	0.121
7 (Tx2)	0.072	0.099
8 (Tx4)	0.064	0.093
9 (Rx4)	0.043	
10 (Rx2)	0.040	
11 (Rx8)	0.051	
12 (Rx6)	0.047	
13 (Rx7)	0.047	0.110
14 (Rx5)	0.042	0.133
15 (Rx3)	0.062	0.118
16 (Rx1)	0.069	0.114
MAX	**0.072**	**0.133**

Key:
Legacy Pair
DD Pair
Proposed Value

molex

7

#83 -Tt= TBD=6.16 (TBD) ps;

#84 - change f_min to 0.05 GHz

http://www.ieee802.org/3/ck/public/adhoc/jun24_20/haser_3ck_adhoc_01c_062420.pdf

ICN Frequency Range - 91

#91, - 162B.1.3.6 Mated test fixtures integrated crosstalk noise –
Add "Integrated crosstalk RMS noise voltages are measured over N uniformly-spaced frequencies f_n spanning the frequency range 50 MHz to 40 GHz with a minimum spacing of 10 MHz." to the end of this section..

Editors proposal; change first paragraph 162B.1.3.6 Mated test fixtures integrated crosstalk noise to read;

The SFP112 mated test fixture integrated near-end crosstalk noise voltage for the disturber near-end crosstalk loss is determined according to the method in 110B.1.3.7, given the disturber near-end crosstalk loss NEXTloss(f) is measured over N uniformly spaced frequencies fn spanning the frequency range 50 MHz to 40 000 MHz with maximum frequency spacing of 10 MHz, and the parameters shown in Table 162B–1. The mated test fixture integrated near-end crosstalk noise voltage shall meet the specification in Table 162B–2.

Editors proposal; change 2nd paragraph 162B.1.3.6 Mated test fixtures integrated crosstalk noise to read;

The multi-lane mated test fixtures integrated crosstalk noise voltages is determined using Equation (92–44) through Equation (92–48), given the multiple disturber near-end crosstalk loss MNEXT_loss(f) and multiple disturber far-end crosstalk loss MDFEXT_loss(f) are measured over N uniformly-spaced frequencies fn spanning the frequency range 50 MHz to 40 000 MHz with a maximum frequency spacing of 10 MHz, and the parameters shown in Table 162B–3 . The Multi-lane mated test fixture integrated crosstalk noise shall meet the specifications in Table 162B–4.

ICN -92,93,94,95,96

-#92- T_{nt}=6.16 (TBD) ps, #93- T_{ft}=6.16 (TBD)ps, #94 - ICN_{FEXT}=4.2mV, #95 - ICN_{NEXT} =1.5 mV, #96 - ICN_{Total} =4.4 mV

Max Values	Simulated			Measured		
Victim	ICN_{NEXT}	ICN_{FEXT}	ICN_{Total}	ICN_{NEXT}	ICN_{FEXT}	ICN_{Total}
f_{stop} = 40 GHz	1.031	3.072	3.188	0.973	3.840	3.961
f_{stop} = 50 GHz	1.108	3.138	3.293	1.019	3.857	3.989

Parameter	Value
f_b	53.125 GHz
f_r	0.75 x fb
f_{min}	**0.05 GHz**
f_{max}	**40 GHz**
A_{nt}, A_{ft}	600 mV
T_{nt}, T_{ft}	**6.16 ps** TBD
ICN_{NEXT} Limit	**1.5 mV***
ICN_{FEXT} Limit	**4.2 mV***
ICN_{Total} Limit	**4.4 mV***

- The ICN values calculated with a 40 GHz stop frequency are roughly the same as those calculated with a 50 GHz stop frequency
- This is due to the decay of the weighting function over this frequency band
- Calculating ICN all the way to 50 GHz has a minimal impact on the results
- Recommendation: For ICN, f_{stop} = 40 GHz
- NOTE: 0.75 x f_b = 39.84 GHz

* No change from 802.3cd spec

21

molex

http://www.ieee802.org/3/ck/public/adhoc/jun24_20/haser_3ck_adhoc_01c_062420.pdf

MDI - 232,233,234,251,252, 253,254

Topic – MDI	Comments
MDI connectors require normative references	232,233,234,251,252, 253,254

- **MDI connectors require normative references. We need these references to close on MDI connector naming.**

1.3 Normative references

Insert the following new references in alphanumeric order:

DSFP MSA Dual small form factor pluggable module, Rev. 1.0.[1]

OSFP MSA Specification for OSFP octal small form factor pluggable module, Rev 3.0.[2]

QSFP112 TBD

QSFP-DD MSA QSFP-DD Hardware Specification for QSFP double density 8x pluggable transceiver, Rev 5.0.[3]

QSFP-DD800 MSA QSFP-DD Specification for 800G operation, Rev 1.0.[4]

SFP112 TBD

SFP-DD MSA SFP-DD Hardware Specification for SFP double density 2X pluggable transceiver, Rev 3.0.[5]

Editor's note: Some references above are placeholders for required references to be provided at a later date.