Error ratio for PMD and AUI component receiver tests
Comment #62

Matt Brown (Alphawave Semi)
Adee Ran (Cisco)
Guangcan Mi (Huawei)

Comment #62

Cl **180** *SC* **180.9.13** *P* **467** *L* **27** # 62

Brown, Matt Alphawave Semi

Comment Type **T** *Comment Status* **D** *Receiver sensitivity (CO)*

Rather than referring broadly to a subset of requirements in 180.2 and methods in 174A.8 it would be helpful to the reader to provide the details locally including the target numbers, test parameter values, as well as target value or mask. This concern is similarly relevant to receiver specifications in clauses 178 through 183, 185, 187, 176C, and 176D.

SuggestedRemedy

Provide details as suggested in the comment. A contribution will be provided with more detail.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
The comment raised an important point. Annex 174A provides information about the block error method system. It is, however, very much broad in scope and content. While PMD clauses such as 180 only uses part of the method and under specific conditions.
It would be much helpful to the readers to have the definition and equations locally in the PMD clauses and tailored to the use case.

Pending review of the contribution and CRG discussion.
<URL>/brown_3dj_04_2509.pdf

Error ratio specifications in Clause 180

180.2 Error ratio allocation

A complete PHY is expected to meet the frame loss ratio specifications in 174A.5.

With a compliant input signal, a PMD receiver is expected to meet the block error ratio of 1.45×10^{-11} (see 174A.5), measured at the PMA adjacent to the PMD using the method described in 174A.8, with BER_{added} equal to 6.4×10^{-5}.

With a compliant input signal, a PHY receiver is expected to meet the block error ratio of 1.45×10^{-11} (see 174A.5), measured at the PCS using the method described in 174A.10, with BER_{added} equal to 3.2×10^{-5}.

180.9.13 Receiver sensitivity

The receiver sensitivity (OMA_{outer}) of each lane shall be within the limits given in Table 180–8 if measured using a test pattern for receiver sensitivity in Table 180–14. The conformance test signal at TP3 meets the requirements for a transmitter followed by an attenuator.

The TECQ of the conformance test signal is measured according to 180.9.5, except that the test fiber is not used. The measured value of TECQ is then used to calculate the limit for receiver sensitivity (OMA_{outer}) as specified in Table 180–8.

The measured receiver sensitivity is the lowest value of OMA_{outer} where the receiver meets the requirements in 180.2 using the test method in either 174A.8.5 or 174A.8.7.

180.9.14 Stressed receiver sensitivity

Stressed receiver sensitivity of each lane shall be within the limit given in Table 180–8 if measured using the method defined in 121.8.10 with the following exceptions:

— The SECQ of the stressed receiver conformance test signal is measured according to 180.9.5, except that the test fiber is not used. The transition time of the stressed receiver conformance test signal is no greater than the value specified in Table 180–7.

— With the Gaussian noise generator on and the sinusoidal jitter and sinusoidal interferer turned off, the $RIN_{xx}OMA$ of the SRS test source should be no greater than the value specified in Table 180–7.

— The signaling rate of the test pattern generator and the extinction ratio of the E/O converter are as given in Table 180–7 using test patterns specified in Table 180–14.

— The required values of the "Stressed receiver sensitivity (OMA_{outer}), each lane (max)", "Stressed eye closure for PAM4 (SECQ), lane under test" and "OMA_{outer} of each aggressor lane" are as given in Table 180–8.

The measured stressed receiver sensitivity is the lowest value of OMA_{outer} where the receiver meets the requirements in 180.2 using the test method in either 174A.8.5 or 174A.8.7.

Block error ratio requirements and related parameters are provided here.

The requirements in this subclause (and similar subclauses elsewhere) have evolved organically from draft to draft.

The definition of the receiver sensitivity (RS) and stressed receiver sensitivity (SRS) tests points to the requirements in 180.2 and the test method in 174A.8.5 and 174A.8.7.

Test methods in 174A

The test method in 174A.5 measures a histogram of probability of *k* test symbol errors within a test block.

The test block takes into consideration the interleaving of codewords in the PCS and distribution of those codewords across the *p* lanes of a PMD. See 174A.8.2. The value *p* can be inferred from the number of lanes for the PMD.

BER_total and BER_added are defined in 174A.8.

The value for BER_added is provided in 180.2 (see previous slide).

The value for BER_total is provided in 174A.5 (below).

With all the correct information we can calculate an upper limit, H_max for the measured histogram.

Finding that information is a bit of a scavenger hunt.

174A.8.5 Error mask test method using PMA measurements

This test method permits measurement of the performance of each physical lane in a PMD or xAUI-n independently of the others using error checkers and counters in the PMA. Compliance is determined by measuring an error histogram on each lane and comparing the measured histogram to a calculated limit mask. If this test passes for each lane, then the PHY or xMII Extender will meet the expected codeword error ratio. If this test fails, then the performance may be further verified using the method in 174A.8.6.

For each lane *i*, measure the error histogram $H_m^{(i)}(k)$ (see 174A.8.3).

The upper limit for $H_m^{(i)}(k)$ is defined by the histogram $H_{max}(k)$. Compute the histogram $H_{max}(k)$ using Equation (174A–5), where $n = 544 / p$ and $BER = BER_{total} - BER_{added}$.

$$H_{max}(k) = \frac{n!}{k!(n-k)!} RSSER^k (1 - RSSER)^{n-k} \qquad (174A–5)$$

$$RSSER = 1 - (1 - 2BER)^5 \qquad (174A–6)$$

The expected block error ratio is met if, for each lane *i*, $H_m^{(i)}(k)$ is less than $H_{max}(k)$ for all $k > 0$.

174A.8 Error ratio tests for 200 Gb/s per lane ISLs using PMA measurements

This subclause defines test methods for an ISL (see 178B.3) with 200 Gb/s per lane signaling between a pair of PMAs including:

- a PMD at each end and a medium between
- an Inner FEC and PMD at each end and a medium between
- an xAUI-n between

These test methods may be used to verify that the error ratio over the ISL is within the error ratio allocation for the ISL. They utilize two parameters: BER_{total} and BER_{added}.

BER_{total} represents the total BER allocation for the PHY-to-PHY path or XS-to-XS path. It is derived from the codeword error ratio allocated to the PHY-to-PHY path (see 174A.5) or xMII Extender (see 174A.4) assuming random errors.

BER_{added} represents the BER allocated to account for all other ISLs within the same PHY-to-PHY path or XS-to-XS path assuming random errors. The value assigned to BER_{added} is defined by the Physical Layer specification that invokes the method.

174A.5 Error ratio allocation for a PCS-to-PCS path

Error ratio allocation of a PCS-to-PCS path (see Figure 174A–6, Table 174A–1, and Table 174A–2) is defined in terms of the frame loss ratio between the service interfaces of the transmitting PCS and the receiving PCS.

The frame loss ratio for 64-octet MAC frames with minimum interpacket gap is expected to be less than 6×10^{-11}.

For 200GBASE-R, 400GBASE-R, 800GBASE-R, or 1.6TBASE-R PHYs that do not include an FEC-to-FEC path, (see 174A.6), the expected frame loss ratio is equivalent to an FEC codeword error ratio (see 174A.11.1), as measured at the PCS, of less than 1.45×10^{-11}. If the errors at the input of the RS-FEC are uncorrelated, this is equivalent to a pre-correction BER (BER_{total}) of 2.92×10^{-4}.

For an 800GBASE-ER1 or 800GBASE-ER1-20 PHY, the codeword error ratio expectations are defined in 174A.6 and 174A.7.

NOTE—The frame loss ratio is affected by multiple components within the PHYs and by the medium, and is not a normative requirement of a specific component.

Proposal part 1, Clause 180 to 183

In 180.9.13 “Receiver Sensitivity”...

Provide a table with all of the necessary parameter values, Table 180-a to the right

Provide a second table with the calculated H_max values, Table 180-b to the right

In 180.9.13 and 180.9.14 reword the definition of [stressed] receiver sensitivity to point to these tables as follows:

“The measured receiver sensitivity is the lowest value of OMAouter where the PMD receiver meets the block error ratio requirements in 180.2, measured at the PMA using the test method in either 174A.8.5 or 174A.8.7 with parameters provided in Table 180-a. The error mask $H_{max}(k)$ to be used in the method of 174A.8.5 is provided in Table 180-b.

NOTE—When measuring receiver sensitivity of a complete PHY at the PCS using the method of 174A.10 (see 180.2), a different value of BER_{added} and a different error mask are required.”

Update Clause 181, 182, and 183, similarly, referring back to Table 180-a and Table 180-b.

Table 180-a error ratio parameters

Parameter name	Value
p 200GBASE-DR1 400GBASE-DR2 800GBASE-DR4 1.6TBASE-DR8	 1 2 4 8
Block error ratio limit	1.45×10^{-11}
*BER*_total	2.92×10^{-4}
*BER*_added	6.4×10^{-5}
BER	2.28×10^{-4}

Table 180-b Receiver error mask

Test symbol errors per test block, k (see 174A.8.5)	$H_{max}(k)$			
	p=1	p=2	p=4	p=8
1	3.6E-01	3.3E-01	2.3E-01	1.3E-01
2	2.2E-01	1.0E-01	3.5E-02	1.0E-02
3	9.2E-02	2.1E-02	3.6E-03	5.1E-04
4	2.8E-02	3.3E-03	2.7E-04	1.9E-05
5	7.0E-03	4.0E-04	1.6E-05	5.5E-07
6	1.4E-03	4.1E-05	8.2E-07	1.3E-08
7	2.5E-04	3.5E-06	3.5E-08	2.7E-10
8	3.9E-05	2.7E-07	1.3E-09	4.7E-12
9	5.2E-06	1.8E-08	4.1E-11	7.1E-14
10	6.4E-07	1.1E-09	1.2E-12	9.6E-16
11	7.1E-08	5.8E-11	3.1E-14	1.2E-17
12	7.2E-09	2.9E-12	7.5E-16	1.3E-19
13	6.7E-10	1.3E-13	1.6E-17	1.2E-21
14	5.8E-11	5.6E-15	3.3E-19	1.1E-23
15	4.7E-12	2.2E-16	6.1E-21	9.1E-26
16	3.8E-13	8.3E-18	1.1E-22	6.9E-28

Proposal part 2, Clause 185

In 185.8.15 “Average receive power tolerance”...

Add tables 185-a and 185-b as shown on the right.

Reword the definition of average receive power tolerance as follows:

“The average receive power tolerance defines the range of average receiver input power at TP3 over which the block error ratio requirement in 185.2 is met is met using the test method in either 174A.9.4 or 174A.9.5 with parameters provided in Table 185-a. The error mask $H_{max}(k)$ to be used in the method of 174A.9.4 is provided in Table 185-b.

In 185.8.16, reword the definition of receiver sensitivity as follows:

“Receiver sensitivity is an optional parameter defined as the lowest average receiver input power at TP3 at which the block error ratio requirement in 185.2 is met using the test method in either 174A.9.4 or 174A.9.5 with parameters provided in Table 185-a. The error mask $H_{max}(k)$ to be used in the method of 174A.9.4 is provided in Table 185-b.”

Table 185-a error ratio parameters

Parameter name	Value
p	1
Block error ratio limit	1.45×10^{-11}
*BER*_total	2.92×10^{-4}
*BER*_added	6.4×10^{-5}
BER	2.28×10^{-4}

Table 185-b Receiver error mask

Test symbol errors per test block, k (see 174A.8.5)	$H_{max}(k)$
	p=1
1	3.6E-01
2	2.2E-01
3	9.2E-02
4	2.8E-02
5	7.0E-03
6	1.4E-03
7	2.5E-04
8	3.9E-05
9	5.2E-06
10	6.4E-07
11	7.1E-08
12	7.2E-09
13	6.7E-10
14	5.8E-11
15	4.7E-12
16	3.8E-13

Proposal part 3, Clause 178 and 179

In 178.9.3.4 “Receiver interference tolerance”

Provide a table with all of the necessary parameter values, Table 178-a to the right. In Table 178-10, change the value in “Block error ratio” row to a cross-reference to Table 178-a.

Provide a second table with the calculated H_max values, Table 178-b to the right

Reword the definition of receiver interference tolerance to point to these tables as follows:

“Receiver interference tolerance is defined by the specifications in 178.9.3.4.1 through 178.9.3.4.3. The receiver on each lane shall meet the expected block error ratio specified in 178.2, using the test method in either 174A.8.5 or 174A.8.7 with parameters provided in Table 178-a, under both Test 1 and Test 2 conditions in Table 178-10 . The error mask $H_{max}(k)$ to be used in the method of 174A.8.5 is provided in Table 178-b.”

In 178.9.3.3 reword the definition of amplitude tolerance as follows:

“<...> the PMD receiver operation shall enable a block error ratio as specified in 178.2 using the test method in either 174A.8.5 or 174A.8.7 with parameters provided in Table 178-a. The error mask $H_{max}(k)$ to be used in the method of 174A.8.5 is provided in Table 178-b.”

In 178.9.3.5

“The receiver under test shall meet the block error ratio in Table 178–a for each case in Table 179–13. Block error ratio is measured using the test method in either 174A.9.4 or 174A.9.5 with parameters provided in Table 178-a. The error mask $H_{max}(k)$ to be used in the method of 174A.8.5 is provided in Table 178-b.”

Implement with editorial license.

Update Clause 179, similarly.

Table 178-a error ratio parameters

Parameter name	Value
p	
200GBASE-KR1	1
400GBASE-KR2	2
800GBASE-KR4	4
1.6TBASE-KR8	8
Block error ratio limit	1.45×10^{-11}
*BER*_total	2.92×10^{-4}
*BER*_added	1.6×10^{-5}
BER	2.76×10^{-4}

Table 178-b Receiver error mask

Test symbol errors per test block, k (see 174A.8.5)	$H_{max}(k)$			
	p=1	p=2	p=4	p=8
1	3.3E-01	3.5E-01	2.6E-01	1.6E-01
2	2.5E-01	1.3E-01	4.8E-02	1.4E-02
3	1.3E-01	3.3E-02	6.0E-03	8.8E-04
4	4.7E-02	6.1E-03	5.5E-04	3.9E-05
5	1.4E-02	9.1E-04	4.0E-05	1.4E-06
6	3.5E-03	1.1E-04	2.4E-06	4.1E-08
7	7.4E-04	1.2E-05	1.2E-07	9.9E-10
8	1.4E-04	1.1E-06	5.5E-09	2.1E-11
9	2.3E-05	8.7E-08	2.2E-10	3.9E-13
10	3.3E-06	6.4E-09	7.6E-12	6.3E-15
11	4.5E-07	4.2E-10	2.4E-13	9.2E-17
12	5.5E-08	2.5E-11	6.9E-15	1.2E-18
13	6.2E-09	1.4E-12	1.8E-16	1.4E-20
14	6.5E-10	7.1E-14	4.4E-18	1.6E-22
15	6.4E-11	3.4E-15	1.0E-19	1.5E-24
16	6.4E-12	1.6E-16	2.1E-21	1.4E-26

Proposal part 4, Annex 176C

In 176C.4.5 “Receiver interference tolerance”...

Provide a table with all of the necessary parameter values, Table 176C-a to the right

Provide a second table with the calculated H_max values, Table 176C-b to the right

Reword the definition of receiver interference tolerance as proposed for 178.9.3.4 on the previous slide except point to tables 178C-a and 178C-b.

In 176C.6.4.2, reword the definition of amplitude tolerance as proposed for 178.9.3.3 on the previous slide except point to tables 178C-a and 178C-b.

In 176C.6.4.6, reword as proposed for 178.9.3.5 on the previous slide except point to tables 178C-a and 178C-b.

Note that with the BER_added specified in 176C.2, the calculated BER value does not match the number in Table 174A-1 and Table 174A-2 and results in much tighter error mask. The value of BER_added was calculated based on a BER_total of 2.921E-4 rather than the rounded-down value of 2.92E-4 (see backup slides). Thus the former is listed in Table 176-c.

Table 176C-a error ratio parameters

Parameter name	Value
p	
200GAUI-1	1
400GAUI-2	2
800GAUI-3	4
1.6TAUI-8	8
Block error ratio limit	1.45×10^{-11}
*BER*_total	2.921×10^{-4}
*BER*_added	2.841×10^{-4}
BER	8×10^{-6}

Table 176C-b Receiver error mask

Test symbol errors per test block, k (see 174A.8.5)	$H_{max}(k)$			
	p=1	p=2	p=4	p=8
1	4.3E-03	2.2E-03	1.1E-03	5.4E-04
2	9.4E-06	2.4E-06	5.9E-07	1.5E-07
3	1.4E-08	1.7E-09	2.1E-10	2.6E-11
4	1.5E-11	9.1E-13	5.6E-14	3.3E-15
5	1.3E-14	3.9E-16	1.2E-17	3.4E-19
6	9.1E-18	1.4E-19	2.1E-21	2.9E-23
7	5.6E-21	4.2E-23	3.1E-25	2.0E-27
8	3.0E-24	1.1E-26	3.9E-29	1.2E-31
9	1.4E-27	2.6E-30	4.5E-33	6.6E-36
10	6.2E-31	5.5E-34	4.6E-37	3.1E-40
11	2.4E-34	1.1E-37	4.2E-41	1.3E-44
12	8.5E-38	1.8E-41	3.5E-45	5.0E-49
13	2.8E-41	2.9E-45	2.7E-49	1.7E-53
14	8.4E-45	4.3E-49	1.9E-53	5.4E-58
15	2.4E-48	6.0E-53	1.2E-57	1.6E-62
16	6.3E-52	7.7E-57	7.4E-62	4.1E-67

Proposal part 5, Annex 176D

In 176D.8.12 “Interference tolerance”...

Provide a table with all of the necessary parameter values, Table 176D-a to the right

Provide a second table with the calculated H_max values, Table 176D-b to the right

Add an exception that tables 178D-a and 178D-b are used in place Table 178-a and Table 178-b.

In 176D.8.11, reword the definition of amplitude tolerance as proposed for 178.9.3.3 on the two slides back except point to tables 178D-a and 178D-b.

In 176D.8.13.1 and 176D.8.13.2, add an exception that tables 178D-a and 178D-b are used in place Table 178-a and Table 178-b.

Note that with the BER_added specified in 176D.2, the calculated BER value does not match the number in Table 174A-1 and results in slightly tighter error mask. The value of BER_added was calculated based on a BER_total of 2.921E-4 rather than the rounded-down value of 2.92E-4 (see backup slides). Thus the former is listed in Table 176-c.

Table 176D-a error ratio parameters

Parameter name	Value
p 200GAUI-1 400GAUI-2 800GAUI-3 1.6TAUI-8	 1 2 4 8
Block error ratio limit	1.45×10^{-11}
*BER*_total	2.921×10^{-4}
*BER*_added	2.681×10^{-4}
BER	2.4×10^{-5}

Table 176D-b Receiver error mask

Test symbol errors per test block, k (see 174A.8.5)	$H_{max}(k)$			
	p=1	p=2	p=4	p=8
1	1.1E-01	6.1E-02	3.2E-02	1.6E-02
2	7.5E-03	2.0E-03	5.1E-04	1.3E-04
3	3.2E-04	4.3E-05	5.5E-06	6.8E-07
4	1.1E-05	6.9E-07	4.4E-08	2.7E-09
5	2.7E-07	8.9E-09	2.8E-10	8.2E-12
6	5.9E-09	9.5E-11	1.5E-12	2.1E-14
7	1.1E-10	8.7E-13	6.5E-15	4.4E-17
8	1.7E-12	6.9E-15	2.5E-17	8.0E-20
9	2.5E-14	4.9E-17	8.6E-20	1.3E-22
10	3.2E-16	3.1E-19	2.6E-22	1.8E-25
11	3.7E-18	1.8E-21	7.2E-25	2.3E-28
12	4.0E-20	9.2E-24	1.8E-27	2.6E-31
13	3.9E-22	4.4E-26	4.1E-30	2.7E-34
14	3.6E-24	2.0E-28	8.7E-33	2.6E-37
15	3.0E-26	8.1E-31	1.7E-35	2.2E-40
16	2.4E-28	3.1E-33	3.1E-38	1.8E-43

Proposal part 6, Annex 187

No changes are proposed for Clause 187 since for the PMD link the FEC is fully terminated by the 800GBASE-ER1 FEC sublayer.

Final thoughts

- For multiple-lane PMDs and AUI components, do we need to measure with p = {2, 4, 8} or is it sufficient to measure only with p = 1?
- Should we update BER_total to be 2.921E-1, rather than 2.92E-1, everywhere and adjust BER_added as necessary?
- We suggest that we deal with these in the next ballot with a comment and full proposal.

Backup slides

Draft 1.1 comment #137

Cl **176D** *SC* **176D.2.1** *P* **676** *L* **35** # 137

Dudek, Mike Marvell

Comment Type **TR** *Comment Status* **A** *error ratio*

The value of BERadded is incorrect. It should be the KP4 random error correction capability minus the allowed BER for the AUI. Assuming the adopted DER of 0.67e-5, and an assumed worst case error extension for FEC symbol errors of 0.6 (see Dudek_3dj_01_2309) the random BER allowance is only 0.8e-5. Anslow_3ck_adhoc_01_072518 slide 7 is showing the KP4 random error correction capability as 3.2e-4. however I am not sure this number is correct and the number needs to be confirmed.

SuggestedRemedy

Change 2.7e-4 to 3.12e-4. Add an editor's note that the value is to be confirmed.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

The CRG reviewed slides 7 to 9 in the following presentation:
https://www.ieee802.org/3/dj/public/24_09/brown_3dj_04_2409.pdf

Change BERadded to 2.841e-4.

Implement with editorial license.

Cl **176E** *SC* **176E.2** *P* **695** *L* **3** # 143

Dudek, Mike Marvell

Comment Type **TR** *Comment Status* **A** *error ratio*

The value of BERadded is incorrect. It should be the KP4 random error correction capability minus the allowed BER for the AUI. Assuming the adopted DER of 2e-5, and an assumed worst case error extension for FEC symbol errors of 0.6 (see Dudek_3dj_01_2309) the random BER allowance is 2.4e-5. Anslow_3ck_adhoc_01_072518 slide 7 is showing the KP4 random error correction capability as 3.2e-4. however I am not sure this number is correct and the number needs to be confirmed.

SuggestedRemedy

Change 2.7e-4 to 2.96e-4. Add an editor's note that the value is to be confirmed.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

The CRG reviewed slides 7 to 9 in the following presentation:
https://www.ieee802.org/3/dj/public/24_09/brown_3dj_04_2409.pdf

Change BERadded to 2.681E-4.

Implement with editorial license.

From brown_3dj_04_2409 slide 7…

BER_{added} for AUIs Comments 137, 143

Cl **176D** *SC* **176D.2.1** *P* **676** *L* **35** # 137

Dudek, Mike Marvell

Comment Type **TR** *Comment Status* **D** *error ratio*

The value of BERadded is incorrect. It should be the KP4 random error correction capability minus the allowed BER for the AUI. Assuming the adopted DER of 0.67e-5, and an assumed worst case error extension for FEC symbol errors of 0.6 (see Dudek_3dj_01_2309) the random BER allowance is only 0.8e-5. Anslow_3ck_adhoc_01_072518 slide 7 is showing the KP4 random error correction capability as 3.2e-4. however I am not sure this number is correct and the number needs to be confirmed.

SuggestedRemedy

Change 2.7e-4 to 3.12e-4. Add an editor's note that the value is to be confirmed.

Cl **176E** *SC* **176E.2** *P* **695** *L* **3** # 143

Dudek, Mike Marvell

Comment Type **TR** *Comment Status* **D** *error ratio*

The value of BERadded is incorrect. It should be the KP4 random error correction capability minus the allowed BER for the AUI. Assuming the adopted DER of 2e-5, and an assumed worst case error extension for FEC symbol errors of 0.6 (see Dudek_3dj_01_2309) the random BER allowance is 2.4e-5. Anslow_3ck_adhoc_01_072518 slide 7 is showing the KP4 random error correction capability as 3.2e-4. however I am not sure this number is correct and the number needs to be confirmed.

SuggestedRemedy

Change 2.7e-4 to 2.96e-4. Add an editor's note that the value is to be confirmed.

BERadded for an AUI should be **the KP4 random BER correction capability** (RBCC) for the whole path minus **the random BER allowance** for the AUI.
In 174A.5, the PHY-to-PHY path is allocated FLR=6e-11 (2e-12 is allocated to the extenders).

For an FLR of 6e-11 (with 64-octet frames and minimum IPG), with 4-way interleaving, the CER is 6e-11/4.125=1.45e-11 (see opsasnick_3df_logic_220630a slide 4). This yields RBCC=**2.921e-4**.

- Calculation can be done in Excel using =1-BINOM.DIST(15, 544, 1-(1-RBCC)^10, TRUE)
- Alternatively in Wolfram Alpha using SER=1-(1-RBCC)^10=2.917e-3

3.2e-4 (which appears on slide 5 of anslow_3ck_adhoc_01_072518) is the RBCC for the KP FEC without interleaving for FLR=6.2e-11 (CER=6.2e-11/1.125=5.5e-11).

The random BER allowance for the AUI-C2M is based on the adopted DER_0=2e-5 which corresponds to a random **initial error** probability of 1.5e-5 (=3/4*DER_0).

It is arguable whether the allowance should account for DFE error propagation, or should assume that it is compensated for by margin (like other implementation effects). Considering both options:

A. If DFE error propagation in AUI-C2M is assumed to be compensated for by margin, then the AUI-C2M random BER allowance should be taken as **1.5e-5**.
B. If DFE error propagation is to be accounted for, the referenced presentation dudek_3dj_01_2309 calculates the probability of a random initial error to impact two FEC symbols that are from different codewords, with maximum error propagation, as 0.6 (assuming precoding is used). Results without precoding were shown to be similar (although calculation is less straightforward). This corresponds to an increase of 60% in the initial BER, so the AUI-C2M random BER allowance should be taken as 1.5e-5*1.6=**2.4e-5**.

For AUI-C2C (comment #137), the corresponding values are **5e-6** for option A and **8e-6** for option B.

This yields the BERadded values in the table below.

	BER_{added}, AUI-C2M	BER_{added}, AUI-C2C
Option A (allocation does not include DFE EP)	2.921e-4 - 1.5e-5 = 2.771e-4	2.921e-4 - 5e-6 = 2.871e-4
Option B (allocation includes DFE EP)	2.921e-4 - 2.4e-5 = 2.681e-4	2.921e-4 - 8e-6 = 2.841e-4

Editors' recommendation: Use BERadded values based on "Option B" above, with 2 significant digits, rounded upwards:
- **2.9e-4** for C2C (comment #137)
- **2.7e-4** for C2M (comment #143)

September 2024 IEEE P802.3dj Task Force 7