

Differential to common mode conversion for 40GBASE-R and 100GBASE-R

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Overview |

- Proposed modification of Clauses 85 and 86 for high speed serial operation with 40GBASE-R and 100GBASE-R PHYs
- This presentation specially addresses the differential to common mode conversion at transmitter and receiver

Background

- n As the effects on high speed channel performance, differential to common mode conversion need to be taken into account
- n Computation and limit of reflected differential to common mode conversion, SCD11, for 40GBASE-R and 100GBASE-R can be found in 802.3ba D1.2
- n Computation of differential to common mode through response, SCD12(or SCD21), is given in Section 86.7.1.1

The recommended limit on the differential to common-mode through response of the mated HCB and MCB is given in Equation 86-11 and shown in Figure 86-8.

$$\begin{aligned} 20 \times \log_{10}(|SCD_{ij}|) &\leq -30 + 2.91 \times f & 0.01 \leq f \leq 5.5 \\ &\leq -14 & 5.5 \leq f \leq 15 \end{aligned} \quad (86-11)$$

where SCD_{ij} is SCD21 or SCD12 looking into the HCB or looking into the MCB, and *f* is the frequency in gigahertz.

Background Cont.

- Computation of differential NEXT and FEXT response is also illuminated in Equations (86-12) and (86-13)
- In 802.3ba D1.2, Figure 86-8 shows the limits of SCD12, SCD21 and NEXT

The recommended limit on the differential NEXT (reflected crosstalk) response of the mated HCB and MCB is given in Equation 86-12 and shown in Figure 86-8.

$$\begin{aligned}
 20 \times \log_{10}(|\text{NEXT}|) &\leq -50 & 0.01 \leq f \leq 4 \\
 &\leq -70 + 5 \times f & 4 \leq f \leq 8 \\
 &\leq -30 & 8 \leq f \leq 15
 \end{aligned}
 \tag{86-12}$$

where NEXT is the differential response from any transmit lane to any receive lane or vice versa, looking into the HCB or looking into the MCB, and f is the frequency in gigahertz.

The recommended limit on the differential FEXT (co-propagating crosstalk) response of the mated HCB and MCB is given in Equation 86-13.

$$\begin{aligned}
 20 \times \log_{10}(|\text{FEXT}|) &\leq -50 & 0.01 \leq f \leq 4 \\
 &\leq -70 + 5 \times f & 4 \leq f \leq 8 \\
 &\leq -30 & 8 \leq f \leq 15
 \end{aligned}
 \tag{86-13}$$

where FEXT is the differential through response between one transmit lane and another, or between one receive lane and another, looking into the HCB or looking into the MCB, and f is the frequency in gigahertz.

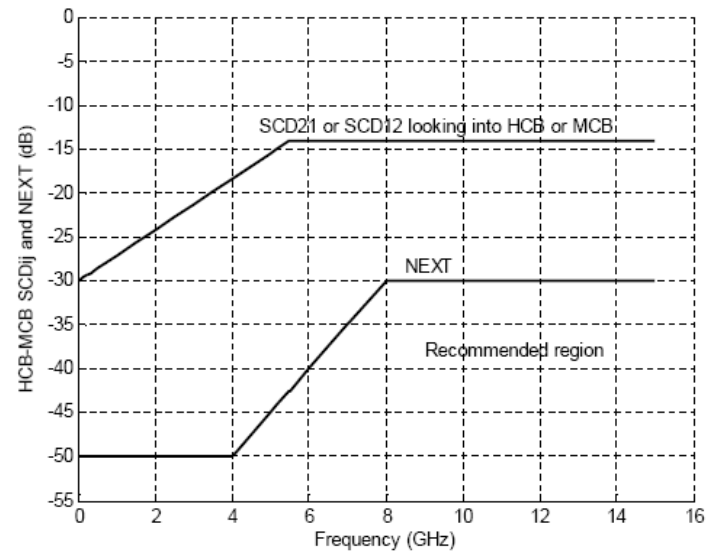


Figure 86-8—Mode conversion of mated HCB-MCB

Proposed modification

- n modifications needed for the following section
 - ∅ 85.8.4 receiver characteristics Table 85-6
 - ∅ 86.6.1.1 transmitter electrical specifications Table 86-7
 - ∅ 86.6.5 receiver electrical specifications Table 86-11
 - ∅ 83A.3.4 receiver characteristics Table 83A-2

85.8.4 Receiver characteristics, Table 85-6

- n Replace Table 85-6 as shown:
 - o Add row to Table 85-6 for SCD12 or SCD21

Table 85-6—Receiver characteristics' summary

Parameter	Subclause reference	Value	Units
Bit error ratio	85.8.4.1	10^{-12}	
Signaling speed, per lane	85.8.4.2	10.3125 ± 100 ppm	GBd
Unit interval (UI) nominal	85.8.4.2	96.969697	ps
Receiver coupling	85.8.4.3	AC	
Differential input peak-to-peak amplitude (maximum)	72.7.2.4	1200 ^a	mV
Differential input return loss (minimum) ^b	72.7.2.5	[See Equation (72-4) and Equation (72-5)]	dB
Differential to common mode conversion SCD11	85.8.4	-10 max from 0.01 to 11.1 GHz	dB
Differential to common mode conversion SCD21 or SCD12	86.7.1.1	See Equation (86-11)	dB

^aThe receiver shall tolerate amplitudes up to 1600 mV without permanent damage

^bRelative to 100 Ω differential.

86.6.1.1 transmitter electrical specifications, Table 86-7

- n Replace Table 86-7 as shown:
 - o Add row to Table 86-7 for SCD12 or SCD21

Table 86–7—PPI electrical transmit signal input specifications at TP1 and TP1a

Parameter description	Test point	Min	Max	Units	Conditions
Single ended input voltage tolerance ^a	TP1a	-0.3	4.0	V	Referred to TP1 signal common
AC common mode input voltage tolerance	TP1a	15	-	mV	RMS
Differential input reflection coefficient, SDD11	TP1	-	See 86.6.1.1	dB	10 MHz to 11.1 GHz
Reflected differential to common mode conversion, SCD11	TP1	-	-10	dB	10 MHz to 11.1 GHz
Differential to common mode conversion SCD21 or SCD12	TP4	See (86-11)	Equation	dB	See 86.7.1.1
J2 Jitter tolerance	TP1a	0.18	-	UI	
J9 Jitter tolerance	TP1a	0.26	-	UI	
Data Dependent Pulse Width Shrinkage (DDPWS)	TP1a	0.07	-	UI	
		Specification values			
Eye mask coordinates: X1, X2 Y1, Y2	TP1a	0.1, 0.31 95, 350		UI mV	Hit ratio = 5×10^{-5}

^a The single ended input voltage tolerance is the allowable range of the instantaneous input signals

86.6.5 receiver electrical specifications, Table 86-11

n Replace Table 86-11 as shown:

o Add row to Table 86-11 for SCD12, SCD21, NEXT and FEXT

Table 86–11—PPI receiver electrical output specifications at TP4

Parameter description	Min	Max	Units	Conditions
Single ended output voltage	-0.3	4.0	V	Referred to signal common
AC common mode output voltage (RMS)	-	7.5	mV	
Termination mismatch at 1 MHz	-	5	%	
Differential output reflection coefficient, SDD22	-	See 86.6.5.1	dB	10 MHz to 11.1 GHz
Common mode output reflection coefficient, SCC22	-	See 86.6.1.2	dB	10 MHz to 11.1 GHz
Differential to common mode conversion SCD21 or SCD12	See Equation (86-11)		dB	See 86.7.1.1
Differential NEXT response	See Equation (86-12)		dB	86.7.1.1
Differential FEXT response	See Equation (86-13)		dB	86.7.1.1
Output transition time, 20% to 80%	28	-	ps	
J2 Jitter output	-	0.46	UI	
J9 Jitter output	-	0.63	UI	
Specification values				
Eye mask coordinates: X1, X2 Y1, Y2	0.29, 0.5 150, 425		UI mV	Hit ratio = 5×10^{-5} See 86.7.4.5

83A.3.4 receiver characteristics, Table 83A-2

- n Replace Table 83A-2 as shown:
 - o Add row to Table 83A-2 for SCD12, SCD21
 - o Change the superscript 'd' for receiver eye mask definition to 'c'

Table 83A-2—Receiver characteristics

Parameter	Subclause reference	Value	Units
Signaling speed per lane (range)	83A.3.3	10.3125 ± 100 ppm	GBd
Maximum Input AC Common Mode Voltage, RMS	86.7.4.1	20	mV
Minimum Input Rise and Fall Time (20% to 80%) ^a	83A.3.3.2	24	ps
Differential Input S-parameters	83A.3.4.3	see 83A.3.4.3	dB
Differential Common Mode Input Conversion S-parameters	83A.3.4.4	see 83A.3.4.4	dB
differential to common mode output conversion S-parameters	86.7.1.1	See Equation (86-11)	dB
Maximum Total Jitter ^b	83A.3.4.2	0.62	UI
Maximum Deterministic Jitter	83A.3.4.2	0.42	UI
Receiver eye mask definition X1 ^c	83A.3.4.2	0.31	UI
Receiver eye mask definition X2 ^c	83A.3.4.2	0.5	UI
Receiver eye mask definition Y1 ^c	83A.3.4.2	42.5	mV
Receiver eye mask definition Y2 ^c	83A.3.4.2	425	mV

^aRise and Fall times are defined in 83A.3.3.2

^bTotal Jitter Measurement Methodology defined in 83A.5

^cReceiver Eye Mask illustrated in Figure 83A-7

Thanks