CONSORTIUM FOR ON-BOARD OPTICS

COBO 8-Lane & 16-Lane Host Compliance Board and Module Compliance Board (HCB/MCB) Specification

Release 1.0

Release 1.0

17 September 2019

This specification defines the characteristics of 8 and 16 lane On- Board Optics (OBO) Compliance boards which are used to test a COBO Host or Module.

Revision History

TABLE 0-1 - REVISION HISTORY

Version	Date	Description
-	January 30, 2018	Baseline Draft
0.01	November 28, 2018	Editorial changes including Table of Contents, Figures, and Tables
0.02	December 13, 2018	Initial Draft (Consented by DCN Working Group December 13, 2018)
0.03	February 12, 2019	Implemented comments in “COBO-DCN - Comments Against MCB-HCB Draft 0.02 - All Comments to Date v1.24.” Added Section 3.1.2. Added Section 3.1.3.
0.04	March 8, 2019	Added new equations from OIF/IEEE Standards to Section 4. Revised Section numbering. Color-coded equations to match Figures.
0.04	March 20, 2019	Editorial changes requested from Juniper.
0.04	March 25, 2019	Added CCB definition and revised graphs.
0.04	April 2, 2019	Added additional equations from OIF specification.
0.05	July 25, 2019	Editorial changes requested from TE and Samtec. Approval Draft.
1.0	September 17, 2019	Approved HCB-MCB Specification (Release 1.0)

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Terms and Definitions

1. **Bank** – For the 16-lane OBO, a collection of 8 electrical lanes and its corresponding optical lanes
2. **C2M** – Chip to Module
3. **CCB** – COBO Compliance Boards
4. **CDR** – Clock and Data Recovery
5. **CMIS** – Common Management Interface Specification
6. **CML** – Current Mode Logic
7. **COBO** – Consortium for On-Board Optics
8. **Connectorized Module** – a PMD with a separable fiber optic connection on the module itself (see also Receptacled module)
9. **Data Center Cabling** – the IEEE defined copper or fiber optic infrastructure between the two MDI points
10. **Dual LC** – Dual Lucent Connector
11. **FFU** – For Future Use
12. **GPIO** – General Purpose Input Output
13. **HS** – High Speed
14. **IEEE** – Institute of Electrical and Electronics Engineers – The IEEE802.3 organization develops standards for Ethernet including the electrical and optical interfaces
15. **LS** – Low Speed
16. **LVCMOS** – Low Voltage CMOS complementary metal oxide semiconductor
17. **LVTTL** – Low voltage TTL transistor logic
18. **MDI** – Medium Dependent Interface – the IEEE defined link location at which the copper or fiber optic connector mates to the PMD
19. **MPO** – Multi-fiber Push-On - Physical contact connector with multiple fibers arranged in a linear array of up two rows. Available in up to twelve fibers per row.
20. **MPO-16** – Multi-fiber Push-On - Available in up to sixteen fibers per row and up to two rows. Keyed differently to prevent mating with MPO.
21. **MPO-12** – MPO connector with 12 fibers
22. **MR** – Medium Reach – An electrical interface capable of supporting ~20dB loss at a frequency of baud rate/2
23. **OBO** – On-Board Optics – an optical transmitter, receiver, or transceiver which is mounted to the interior of the PCBA
24. **OIF** – Optical Internetworking Forum – Develops electrical and optical interoperability agreements
25. **PMD** – Physical Medium Dependent – the IEEE defined transceiver module minus any copper or fiber optic cabling necessary to take the signal to the card edge
26. **Pigtailed Module** – a PMD with an inseparable length of fiber, typically terminated with a fiber optic connector, exiting the module and routing to the card edge
27. **Pluggable Optical Module** – an optical transmitter, receiver, or transceiver which gets mounted to the edge of the PCBA
28. **PCBA** – Printed Circuit Board Assembly – the printed circuit board along with all the typical components (resistors, capacitors, etc.) soldered in place
29. **Receptacled Module** – a PMD with a separable fiber optic connection on the module itself (see also Connectorized module)
30. **RU** – Rack Unit – A unit of measure describes the height of electronic equipment designed to mount in a 19-inch rack or a 23-inch rack and is 1.75 inches (44.45mm) high

31. **TP2** – Test Point 2 – the IEEE defined location at which optical power is measured from the source PMD
32. **TP3** – Test Point 3 – the IEEE defined location at which optical receive signal is measured going to the destination PMD
33. **TWI** – Two wire interface used for management interface
34. **VSR** – Very Short Reach – An electrical interface capable of supporting a ~10dB loss at a frequency of baud rate/2

References

1. [1] COBO 8-Lane & 16-Lane On-Board Optics Specification – latest release (1.1)
2. TIA-604-5, FOCIS 5 - Fiber Optic Connector Intermateability Standard - Type MPO
3. ANSI-TIA-604-18, FOCIS 18- Fiber Optic Connector Intermateability Standard - Type MPO- 16
4. IEC 61754-7-1, Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces - Part 7-1: Type MPO connector family - One fibre row (similar to FOCIS 5)
5. IEC 61754-7-2, Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces - Part 7-2: Type MPO connector family - Two fibre rows (similar to FOCIS 5)
6. TIA-604-10, FOCIS 10B - Fiber Optic Connector Intermateability Standard- Type LC
7. IEC 61754-20, Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces - Part 20: Type LC connector family (similar to FOCIS 5)
8. IEEE Std. 802.3-2015 (IEEE 802.3bm, 100G/40G Ethernet for optical fiber)
9. IEEE 802.3bs, 400 Gb/s Ethernet over optical fiber using multiple 25G/50G lane
10. SFF-8636, Management Interface for Cabled Environments (Rev 2.7) (Link)
11. SFF-8665, QSFP+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28) (Rev 1.9) (Link)
12. SFF-8679, QSFP+ 4X Base Electrical Specification (Rev 1.7) (Link)
13. QSFP-DD Hardware Specification, Rev 3.0
14. CDFPrev3-0-Mar20-2015-released.pdf, CDFP MSA (Rev 3.0) (Link)
15. OIF2014.230.06, CEI-56G-VSR-PAM4 Very Short Reach Interface (Sep 8, 2015)
16. OIF2014.245.06, CEI-56G-MR-PAM4 Medium Reach Interface (Sep 10, 2015)
17. OIF2014.380.02, CEI-56G-LR-PAM4 Long Reach Interface (Apr 23, 2015)
18. SFF-8431, SFP+ 10Gb/s and Low Speed Electrical Interface
19. SFF-8472, Diagnostic Monitoring Interface for Optical Transceivers
20. Common Electrical I/O (CEI) - Electrical and Jitter Interoperability agreements for 6G+ bps, 11G+ bps and 25G+ bps I/O IA latest version
21. GR-253-CORE, Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria
22. GR-63-CORE, NEBS Requirements
23. JESD8c.01, Interface Standard for Nominal 3 V/3.3 V Supply Digital Integrated Circuits
24. IEEE 802.3bm, 100G/40G Ethernet for optical fiber
25. CEI-56G-VSR-PAM4 Very Short Reach Interface, Latest Version
26. OIF-Thermal-01.0 – Implementation Agreement for Thermal Interface Specification for Pluggable Optics Modules (May 2015) (Link)
27. [x] Y. Shlepnev, "Quality Metrics for S-parameter Models," presentation at DesignCon 2010 IBIS 23 Summit, Santa Clara, February 4, 2010.
28. [y] P. Triverio S. Grivet-Talocia, M. S. Nakhla, F. G. Canavero, R. Achar, "Stability, Causality, and Passivity in Electrical Interconnect Models," IEEE Trans. on Advanced Packaging, vol. 30. 2007, N4, p. 795-808.

1.0 Introduction

1.1 Scope

This specification defines the characteristics of COBO Compliance Boards (CCB), which are used for electrical and optical testing of COBO networking equipment. The CCB includes a host compliance board (HCB) and a module compliance board (MCB) which support 400GAUI-8 C2M interfaces. This is illustrated in Figure 1-1. The requirements of COBO 8-Lane On-Board Optics Specification latest release form the baseline for the requirements herein.

The software management interface (memory map) is not in scope.

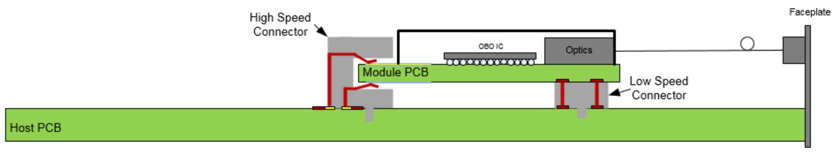

FIGURE 1-1 – ELECTRICAL INTERFACE WITH CONNECTORS – SIDE VIEW

1.2 High Speed Electrical Configurations

The single OBO, eight-lane, supports eight high-speed data lanes (8 × 25GBd PAM4) and the dual OBO, sixteen-lane, supports two independent eight high-speed data lanes (2 x 8 x 25GBd PAM4). The high-speed data interface for the OBO is based on 400GAUI-8 C2M. This document does not preclude usage of other baud rates up to the prescribed 25GBd.

1.3 Management Interface

The management interface uses the QSFP-DD Common MIS [Editor's note: Proper reference to be provided when published] and communicates over a two-wire interface. The memory map supports up to 16 optical lanes in two banks.

The dual OBO configurations appear to the host as two separate single 400G optics for both the independent and integrated versions.

2.0 Electrical Specifications

2.1 Purpose and Applications

The CCB shall be designed to interface with COBO modules and hosts as defined in the COBO 8-Lane & 16 Lane On-Board Optics Specification. Section 2 of this document provides the high speed and low speed pin mappings, mating sequence, application schematics, control timing, return path isolation and management interface requirements. These sections of the reference specification will not be repeated herein but provide useful background in understanding the CCB design objectives.

2.2 Power Supply

Typical usage of an MCB involves insertion of a module which is tested for compliance. As such, the MCB shall provide filtered DC power in accordance with Table 2-8 [1]. Figure 2-10 [1] of the COBO 8-Lane & 16-Lane On-Board Optics Specification [1] provides a reference DC power filter which serves as a starting point for the MCB filter design.

2.2.1 OBO Hot Pluggability

The OBO does not support hot pluggability.

2.2.2 OBO Power Supply Noise Output

The OBO shall generate less than the value specified in Table 2-1 when tested by the methods of SFF-8431, section D.17.2. Note: The series resistor specified in D.17 Figure 56 may need to be reduced for high power OBOs.

2.2.3 OBO Power Supply Noise Tolerance

The OBO shall meet all requirements and remain fully operational in the presence of a sinusoidal tolerance signal of amplitude given by Table 2-1, swept from 10Hz to 10 MHz according to the methods of SFF-8431, section D.17.3. This emulates the worst-case noise output of the host.

2.2.4 Return path Isolation

For the 16-lane application, the host return path does not require isolation between the two 8 lane connectors. It is up to the host PCB to keep the noise contributions within the limit of the OBO requirements.

2.2.5 OBO Power Sequencing

No power sequencing is required for the OBO.

2.2.6 OBO Power Supplies Requirements

The host board power supply is responsible for supplying up to the maximum current limits during startup.

Table 2-1 – Power Supply Requirements

Parameters	Symbol	Min	Nom	Max	Unit	Notes
Host power supply voltages including ripple, droop and noise	VCC	3.14	3.30	3.47	V	<100kHz
Power Consumption, operating 8Lane 16Lane	POP			 20.8 41.6	 W W	See Note 1 & 2
Power Consumption, Low power mode 8 Lane 16 Lane	PLP			 1.5 3	 W W	
Low-Speed connector current per pin (2)				1.5	A	Including deratings
High-Speed connector current per pin				0.9	A	Including deratings
Host RMS noise output				25	mV	10Hz -10MHz, See SFF-8419. A.1.1
OBO RMS Noise output				15	mV	10Hz -10MHz, See SFF-8419. A.1.2.
OBO Power Supply Tolerance				66	mV (p-p)	10Hz -10MHz See SFF-8419. A.1.3.

Note 1. The OBOs power classes described in the CMIS, “Module Card Power Class” register (200h), are not used and instead, the host relies on the value populated in the “Max Power” register (201h).

Note 2. Two additional pins are available on the low-speed connector and are targeted “For Future Use” (FFU). In the event these pins are assigned as power supply pins, the current carrying capacity of the power pins is reduced to 1.4A per pin. If these pins are assigned to a 3.3V supply, the max operating power consumption of the OBO increases to 29.1W.

2.2.7 Host Board Power Supply Noise Output

The host shall generate an effective weighted integrated spectrum RMS noise less than the value in Table 2-1 when tested by the methods of SFF-8431, section D.17.1.

3.0 Mechanical

The CCB shall be designed to accept a range of COBO 8-Lane & 16-Lane On-Board Optics Specification [1] modules. Section 4 of the COBO spec provides the host and module board connector footprints which shall be used as the basis for the design of the CCB. Section 4 also includes drawings of the 3 classes of OBO modules which will mate with the CCB. A brief description is provided below to convey the concept of OBO class.

For each of the ×8 and ×16 channel version of connectors, there are three OBO form factors, Class A, Class B and Class C. These three form factors allow COBO to address various optical technologies, optical reaches and power-dissipation classes. The following illustration identifies the use cases; which OBOs can be used on which host implementations. The image shows the ×8 OBO/host examples and the same methodology and use cases apply to the ×16 OBO/host.

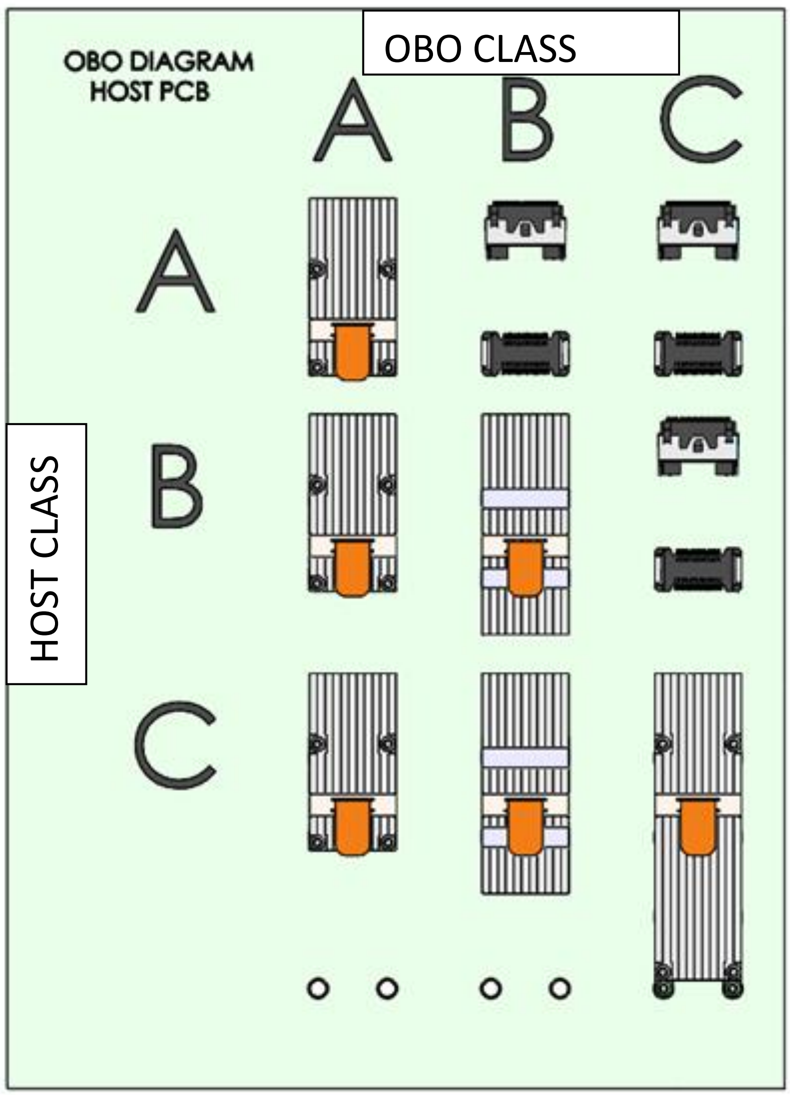

FIGURE 3-1 – HOST-OBO CLASS COMPATIBILITY CHART

3.1 CCB Form Factor

Traditional compliance boards typically have SI optimized connector footprint and carefully controlled PCB characteristics to meet the SI requirements. With the density that COBO introduces, cable based CCB HCB are attractive as the cable used is typically less lossy than high performance PCB laminates. For x16 CCBs, it is permissible to have multiple CCBs, each of which allow test point access to a portion of the high speed signals.

The COBO HCB should fulfill the criteria of a size A OBO.

The CCB vendor has complete flexibility with regards to implementation, it is not defined herein.

The cable based CCB concept is shown in Figure 3-2.

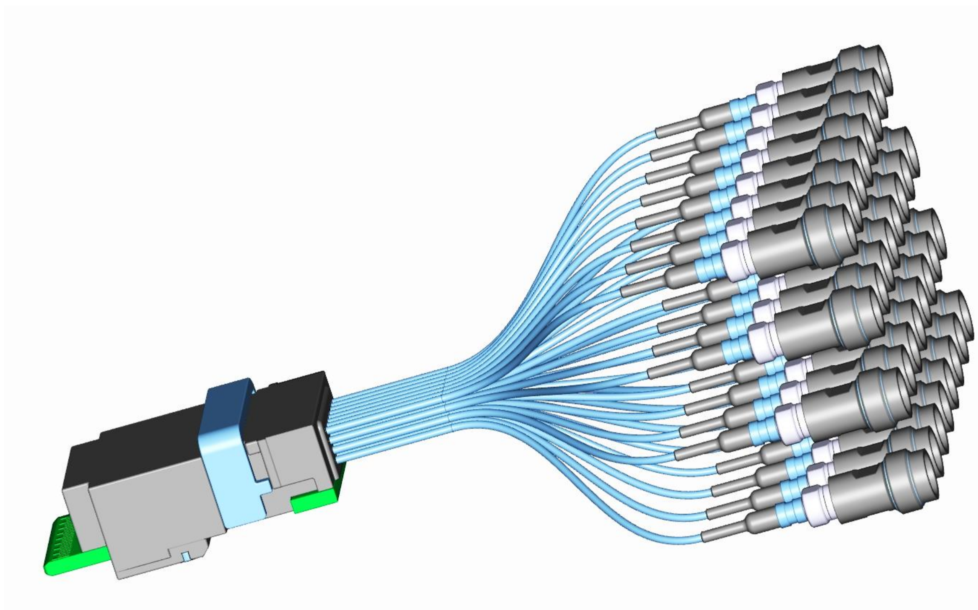

FIGURE 3-2 – CABLE BASED CCB HCB FORM FACTOR

3.2 HCB Dimensions

A host compliance board should fit to all specified positions. The outer dimensions therefore should be referred to as a class A module.

In Figure 3-3 the recommended PCB geometry is depicted for a x8 CCB. For a x16 CCB the approach is adopted accordingly. The outline of the CCB PCB is derived from the geometries of class A OBO module PCB given in Ref. 1 and modified such that coaxial PCB connectors on top and bottom are added. The cables from the bottom of the compliance board must be routed to the top in order to avoid collision with the low speed connector. To achieve good signal integrity performance the cable should run through a keep-out area of the CCB-PCB as well as proper phase matching of all cables should be considered.

As a coaxial test point interface, a 2.4mm (f) interface could be considered.

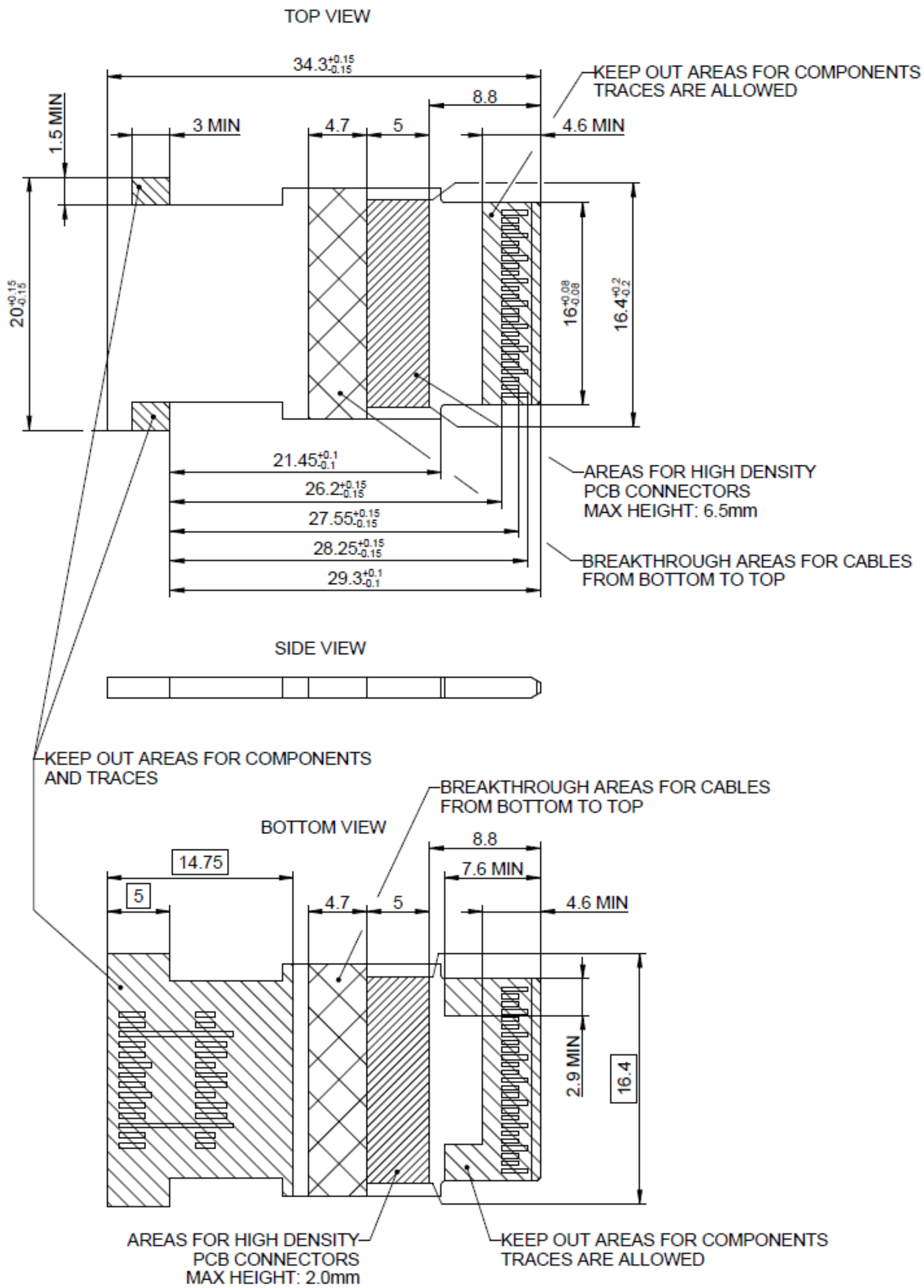

FIGURE 3-3 – CLASS A, X8 CHANNEL HCB DIMENSIONS

3.3 MCB Recommendations

The following are design recommendations for the MCB.

The high-speed lanes from the COBO high-speed connector are routed to the high-density PCB connector, where the signal then transitions to the coaxial cables. In order to achieve a good port density, it is recommended to route half of the top-layer signals and half of the bottom layer signals into one high-density PCB connector and the others to the other high-density PCB connector. Proper phase matching of all cables should be considered.

As a coaxial test point interface, a 2.4mm (f) interface could be considered.

The distance between the high-density PCB connector and the high-speed COBO connector on the PCB strongly depends on the PCB material used for the MCB due to the loss budget provided in IEEE and OIF specs, see section 4.0 of this document. In order to improve signal integrity, the distance between the high-speed COBO connector and high-density PCB connector would be kept as short as possible, however routing might become difficult.

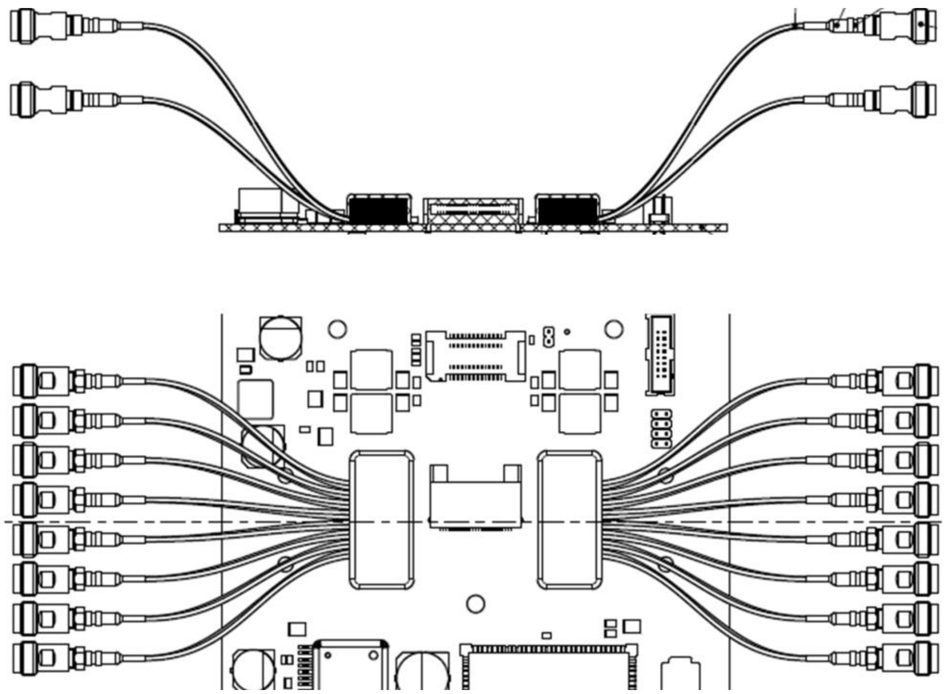

FIGURE 3-4 – COBO MEZZANINE COMPLIANCE BOARD

4.0 Signal Integrity Requirements

4.1 400GAUI-8 C2M and OIF CEI VSR Interfaces

Tracking the SI requirements from a brief description like 400GAUI-8 C2M can be confusing to engineers who have not worked extensively with Ethernet and OIF specifications. The following is meant to clarify the SI specifications and requirements.

400GAUI-8 C2M is sometimes referred to as a "10 dB channel" which means the insertion loss from a host to a module is roughly 10 dB over a short length, roughly 12".

400GAUI-8 C2M interfaces are defined in IEEE 802.3bs. Annex 120E describes this interface including insertion loss budgets, BER, reference equalization and eye height/width requirements. It also references to IEEE802.3bj for the compliance board SI requirements but adjusts the upper frequency from 25 GHz to 26.5625 GHz. 802.3bs also adjust the compliance board crosstalk values 1.5 mV RMS for MDNEXT, 4.2 mVRMS for MDFEXT and 4.4 mVRMS for ICN. Clause 92.11 of 802.3bj provides the baseline compliance board requirements which are slightly modified by 802.3bs.

OIF-CEI-04.0 also describes requirements for compliance boards which are used in C2M applications. The terminology changes in OIF and Very Short Reach (VSR) is used in place of C2M. Clause 16 (CEI-56G-VSR-PAM4) of OIF-CEI-04.0 defines requirements for VSR interfaces operating at 56 Gb/s with PAM 4 encoding. Compliance points are the same in IEEE 802.3bs and OIF-CEI-04.0.

4.2 CCB De-embedding

CCBs are used for a variety of applications and it is very convenient to have the S-parameters for a portion of the HCB/MCB. The CCBs are required to have a means of adjusting the reference plane location however the method of doing this is not prescribed. Adjusting the reference plane location for a compliance board can be accomplished using on board calibration structures or using vendor provided S-parameters for a portion of the mated HCB/PCB path. Either technique is viable however it is recommended that the post-de-embedding S-parameter set is well behaved mathematically. Passivity, causality and reciprocity should be checked as a means of quantifying "well behaved". Methods are defined below.

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40 International Symposium on Electromagnetic Compatibility (EMC 2013), Denver, CO, 2013, p.563-
41 568.

P. Triverio S. Grivet-Talocia, M. S. Nakhla, F. G. Canavero, R. 1 Achar: "Stability,
2 Causality, and Passivity in Electrical Interconnect Models," IEEE Trans. on Advanced Packaging,
3 vol. 30. 2007, N4, p. 795-808.

Y. Shlepnev: "Quality Metrics for S-parameter Models," presentation at DesignCon 2010 5 IBIS
Summit, Santa Clara, February 4, 2010

Mikheil Tsiklauri ; et al. "Causality and delay and physics in real systems, 2014 IEEE International
Symposium on Electromagnetic Compatibility (EMC), 4-8 Aug. 2014

4.3 CCB SI Requirements.

The SI requirements are detailed in paragraphs 4.3.1-4.3.2.5. The measurement reference plane is defined to be at the separable interface of the coaxial test point on the HCB and MCB. A coaxial SOLT calibration is typically used for these measurements.

4.3.1 HCB and MCB insertion loss

The reference differential insertion loss of the HCB printed circuit board trace follows Equation (4-1) for 50MHz < f < 29 GHz. The reference differential insertion loss of the MCB printed circuit board trace follows Equation (4-2) for 50 MHz < f < 29 GHz. Equation (4-1) and (4-2) describe the OIF reference loss and is informative. Differences between the reference loss and the actual HCB/MCB loss can be accounted for during host/module compliance testing. Both the OIF and IEEE equations are illustrated below in Figure 4-1.

$$\text{HCB SDD21} = 2.00(0.001 - 0.096(\sqrt{f}) - 0.046(f))\ \text{dB} \quad (4\text{-}1)$$

$$\text{MCB SDD21} = (1.25)(0.001 - 0.096(\sqrt{f}) - 0.046(f))\ \text{dB} \quad (4\text{-}2)$$

Ethernet PCB trace loss equations are defined to 26.5625 GHz and are shown below:

$$\text{MCB SDD21} = -\left(-0.00125 + 0.12\sqrt{f} + 0.0575(\text{f})\right)\text{dB}$$

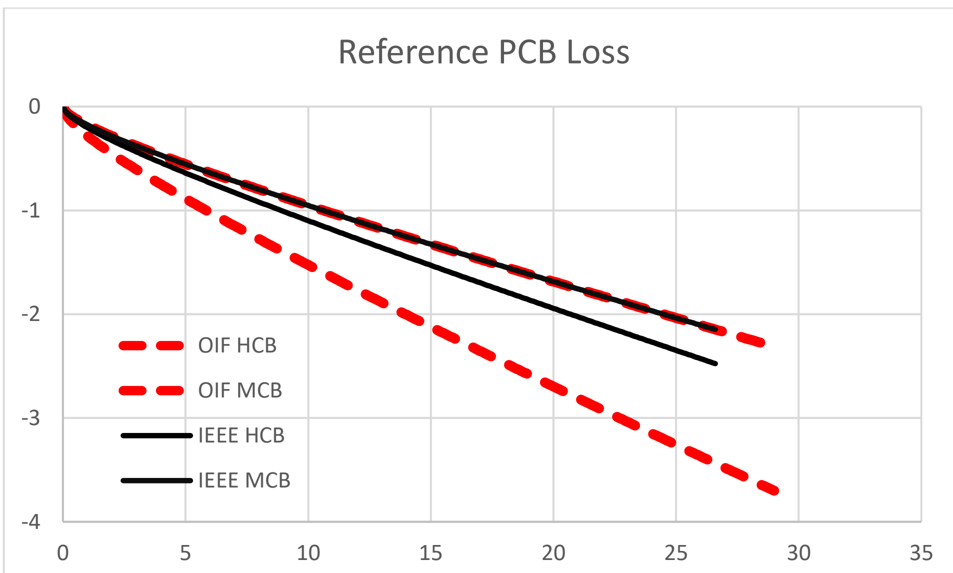

FIGURE 4-1 – OIF/IEEE REFERENCE PCB LOSS

4.3.2 Mated HCB and MCB S parameters

The specifications given for the mated HCB and MCB shall be verified in both directions (exception being differential insertion loss can be in either direction).

4.3.2.1 Insertion Loss

The insertion loss of the mated test fixtures shall meet the values determined using Equation (4-3)(4-3) and Equation (4-4). Both the HCB and MCB equations are illustrated in Figure 4-2 **Error! Reference source not found.**below.

$$IL(f) \le IL_{MTFmax}(f) = \begin{cases} 0.12 + 0.475\sqrt{f} + 0.221f & 0.01 \le f \le 14 \\ -4.25 + 0.66f & 14 < f \le 29 \end{cases} (dB)\ dashed \quad (4\text{-}3)$$

$$IL(f) \geq IL_{MTFmin}(f) = -0.08 - 0.2f \quad 0.01 \leq f \leq 29\ (dB)\ \ dashed \tag{4-4}$$

Ethernet IL Equations:

$$IL(f) \leq IL_{MTFmax}(f) = \begin{Bmatrix} 0.12 + 0.475\sqrt{f} + 0.221f & 0.01 \leq f \leq 14 \\ -4.25 + 0.66f & 14 < f \leq 26.5625 \end{Bmatrix} (dB) \tag{4-5}$$

$$IL(f) \geq IL_{MTFmin}(f) = 0.0656\sqrt{f} + 0.164f\ 0.01 \leq f \leq 26.5625\ (dB)$$

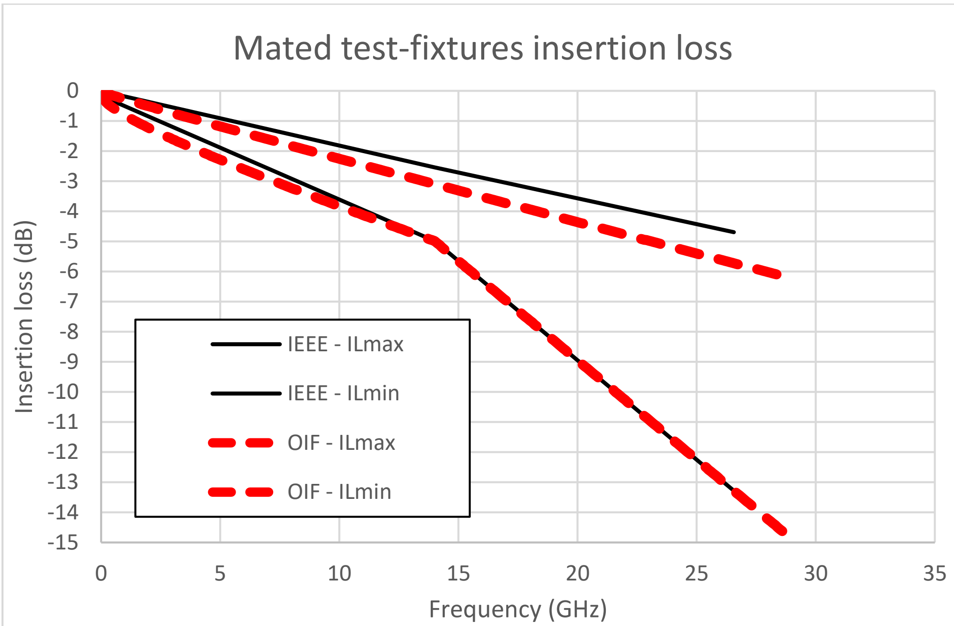

FIGURE 4-2 – MATED MCB/HCB DIFFERENTIAL INSERTION LOSS

4.3.2.2 Return Loss

The differential return loss of the mated HCB and MCB pair shall follow Equation (4-6)/(4-7) and are illustrated in Figure 4-3.

$$\text{SDD11, SDD22} \leq -20 + f\ dB \quad \text{for } f\ < 4GHz \text{ (dashed)} \tag{4-6}$$

$$\text{SDD11, SDD22} = -18 + \frac{f}{2}\ dB \quad \text{for } 4GHz < f < 29\ GHz \text{ (dashed)}$$

Ethernet return loss Equations:

$$Return\_loss(f) \geq \begin{Bmatrix} 20 - f & 0.01 \leq f < 4 \\ 18 - 0.5f & 4 \leq f \leq 26.5625 \end{Bmatrix} (dB) \tag{4-7}$$

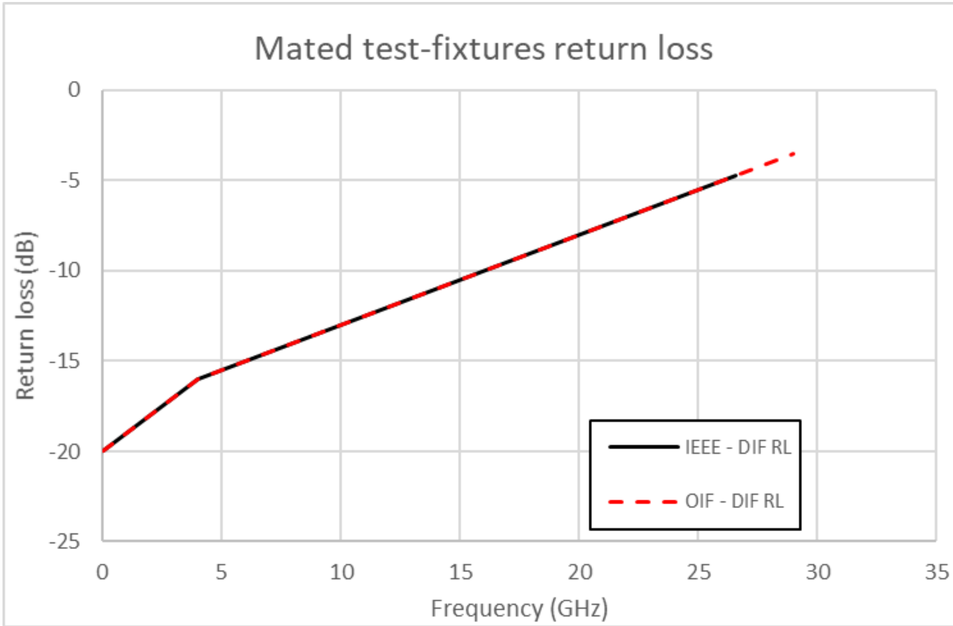

FIGURE 4-3 – HCB/MCM PAIR DIFFERENTIAL RETURN LOSS

4.3.2.3 Differential to common mode conversion loss

The differential to common mode conversion loss for a mated HCB and MCB pair is given in Equation (4-8) and shown in Figure 4-4 below.

The common-mode conversion insertion loss of the mated test fixtures measured at either test fixture test interface shall meet the values determined using Equation (4-9).

$$\text{SCD21, SCD12} \leq -35 + 1.07f\ dB \text{ for } f < 14GHz \qquad \text{(4-8)}$$

$$\text{SCD21, SCD12} \leq -20\ dB \text{ for } 14GHz < f < 29\ GHz \text{ (dashed)}$$

Ethernet common mode conversion insertion loss equations:

$$Conversion\_loss(f) \geq \begin{Bmatrix} 30 - (\frac{29}{22})f & 0.01 \leq f < 16.5 \\ 8.25 & 16.5 \leq f \leq 26.5625 \end{Bmatrix} (dB) \qquad \text{(4-9)}$$

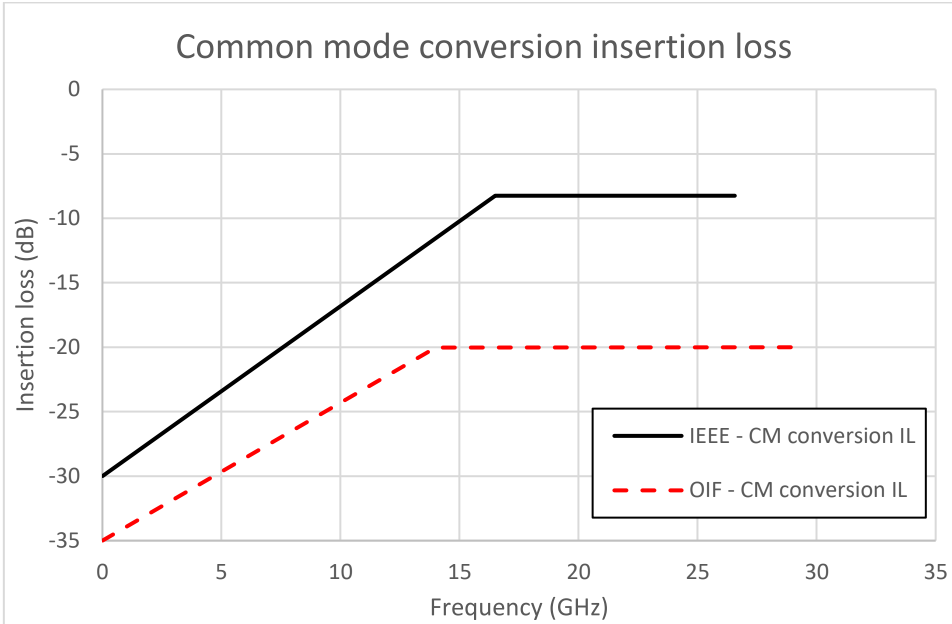

FIGURE 4-4 – DIFFERENTIAL TO COMMON MODE CONVERSION

4.3.2.4 Differential to Common mode return loss

The differential to common mode return loss for a mated HCB and MCB pair is given in Equation (4-10) and shown in Figure 4-5 below.

SCD11, SCD22 and SDC11, SDC22 $\leq -30 + \left(\frac{5}{7}\right) f\ dB$ for $f < 14GHz$ (4-10)

SCD11, SCD22 and SDC11, SDC22 $\leq -25 + \left(\frac{5}{14}\right) f\ dB$ for $14GHz < f < 29\ GHz$ (dashed)

Ethernet differential to common mode return loss equations:

$$Return_{loss(f)} \geq \begin{Bmatrix} 30 - \left(\frac{20}{25.78}\right) f & 0.01 \leq f < 12.89 \\ 18 - \left(\frac{6}{25.78}\right) f & 12.89 \leq f \leq 26.625 \end{Bmatrix} (dB) \quad (4\text{-}11)$$

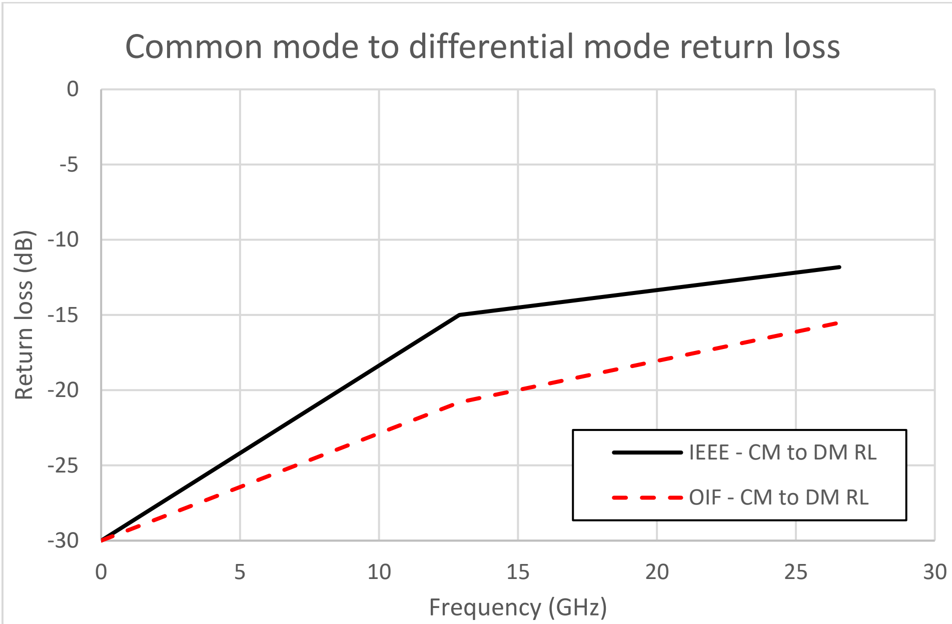

FIGURE 4-5 – DIFFERENTIAL TO COMMON MODE RETURN LOSS

4.3.2.5 Common Mode return loss

The maximum common mode return loss for a mated HCB and MCB pair shall be 3dB for frequencies < 29 GHz.

Ethernet common mode return loss equations:

$$Common\_mode\_return\_loss(f) \geq \begin{Bmatrix} 12 - 9f & 0.01 \leq f < 1 \\ 3 & 1 \leq f \leq 28 \end{Bmatrix} (dB) \tag{4-14}$$

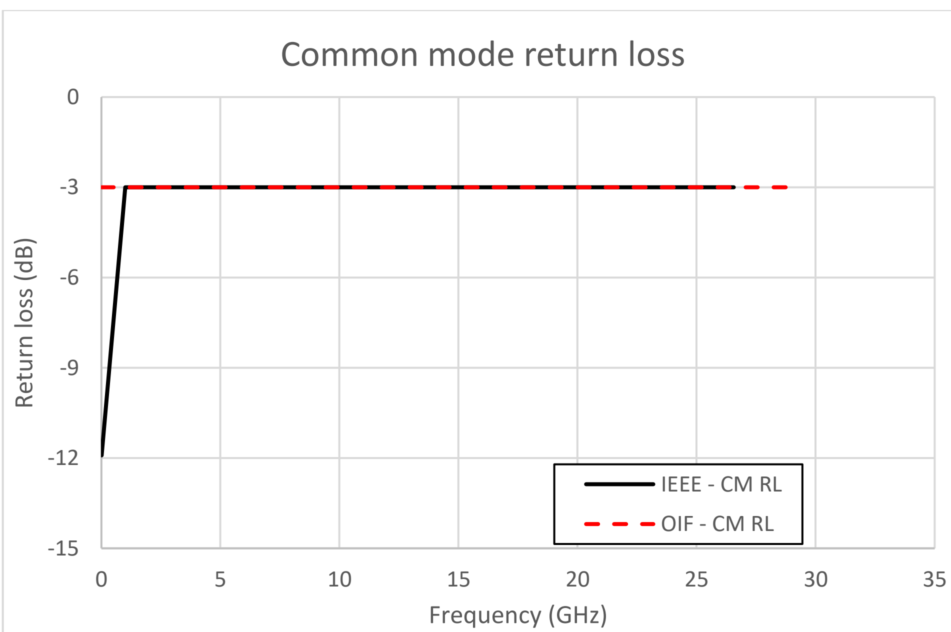

FIGURE 4-6 – COMMON MODE RETURN LOSS

4.3.3 ICN, MDNEXT, MDFEXT

Both Ethernet and OIF have crosstalk requirements defined for a mated MCB/HCB set.

Ethernet (802.3bs)

ICN $< 4.4mVrms$

MDNEXT $< 1.5mVrms$

MDFEXT $< 4.2mVrms$

Upper frequency – 26.5652GHz

ICN calc 699mVp aggressor

Risetime 9.6ps

OIF

ICN $< 3.9mVrms$

MDNEXT $< 1.35mVrms$

MDFEXT $< 3.6mVrms$

Upper frequency – 29GHz

ICN calc 900mVp aggressor

Risetime 12ps