8023cg_D3p2_CMP_Substantive MDI Comments

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Chris DiMinico
MC Communications/PHY-SI/SenTekse/Panduit
cdiminico@ieee.org

Scope

- MDI comment response to 8023cg_D3p2_CMP_Substantive.pdf to specify MDI deleted from D3p1.

146.8.1 MDI connectors

The mechanical interface to the balanced cabling is a 3-pin connector (BI_DA+, BI_DA–, and optional SHIELD) or alternatively a 2-pin connector with an optional additional mechanical shield connection which conforms to the link segment specification defined in 146.7.

Specific systems or applications can use connectors or ~~terminals, in addition to those listed below,~~ terminals that support the link segment specification defined in 146.7.

~~Connectors meeting the requirements of IEC 63171-1 or IEC 63171-6 may be used as the mechanical interface to the balanced cabling in environments meeting the E_1 and E_2 electromagnetic classifications specified in Table 146–7. Connectors meeting the requirements of IEC 63171-6 may be used as the mechanical interface to the balanced cabling in environments meeting the E_3 electromagnetic classification specified in Table 146–7. The plug connector is used on the balanced cabling and the MDI jack connector on the PHY. The IEC 63171-1 plug and jack are depicted (for informational use only) in Figure 146–29 and Figure 146–30 respectively, and the mating interface is depicted in Figure 146–31. The IEC 63171-6 plug and jack are depicted (for informational use only) in Figure 146–32 and Figure 146–33 respectively and the mating interface is depicted in Figure 146–34. The assignment of PMA signals to connector contacts for PHYs are given in Table 146–8. These two connectors may be used, with adaptations if needed, for electromagnetic classifications for the link segment given in Table 146–7. These connectors should support link segment DCR characteristics for 1.02 mm (18 AWG) to 0.40 mm (26 AWG) in Table 146B–1.~~

Contributors

- Paul Wachtel, Mike Borgman, Ron Nordin, Sean Lenz, Bob Voss– Panduit
- Steffen Graber – P+F

Supporters

- Ron Nordin, Bob Voss– Panduit
- Steffen Graber – P+F
- Masood Shariff – Commscope
- Brett McClellan, Peter Wu - Marvell

Discussion

- The continued success of BASE-T technology is largely predicated on leveraging the cost-effectiveness and plug-and-play simplicity ensured by compatibility at the MDI.

- We need to be forward thinking in developing a compatible user interface for BASE-T1.

Discussion

Standardized Automotive Ethernet Cables and Connectors
The 8th Ethernet & IP @ Automotive Technology Day
Steven B. Carlson
High Speed Design, Inc.
Chair, IEEE P802.3ch
October 10, 2018
London, UK

Summary

- Standardized cabling and connectors have been a major part of Ethernet's success since the 1990s, by working in cooperation with global cabling standards organizations
- Standardized and interoperable connector and cabling systems have lowered production and installed costs, increased reliability, and reduced testing and compliance issues
- There is no technical reason why the automotive industry can't repeat this success
- It doesn't matter what the path is---what matters is getting it done!

Comment to 802.3cg D3p2

- Comment: The continued success of BASE-T technology is largely predicated on leveraging the cost-effectiveness and plug-and-play simplicity ensured by compatibility at the MDI. We need to be forward thinking in developing a compatible user interface for BASE-T1. The MDI is to specify mechanical compatibility and electrical specifications not EMC conformance.

- Remedy:
  146.8.1 MDI connectors – Page 179, Line 1 add text;

  - Connectors meeting the mechanical requirements of IEC 63171-1 may be used as the mechanical interface to the balanced cabling. The plug connector is used on the balanced cabling and the MDI jack connector on the PHY.

  - Re-instate IEC 63171-1 plug and jack figures from D3.1. with text below. Editorial license to revise figure numbers as needed.

  - The IEC 63171-1 plug and jack are depicted (for informational use only) in Figure 146–29 and Figure 146– 30 respectively, and the mating interface is depicted in Figure 146–31. The assignment of PMA signals to connector contacts for PHYs are given in Table 146–8. These connectors should support link segment DCR characteristics for 1.02 mm (18 AWG) to 0.40 mm (26 AWG) in Table 146B–1.

Comment to 802.3cg D3p2

- Remedy continued:
  147.9.1 MDI connectors – Page 227, Line 1 add text;

  - Connectors meeting the mechanical requirements of IEC 63171-1 may be used as the mechanical interface to the balanced cabling. The plug connector is used on the balanced cabling and the MDI jack connector on the PHY.

  - Re-instate IEC 63171-1 plug and jack figures from D3.1. with text below. Editorial license to revise figure numbers as needed.

  - The IEC 63171-1 plug and jack are depicted (for informational use only) in Figure 147–21 and Figure 147–22 respectively and the mating interface is depicted in Figure 147–23. The assignment of PMA signals to connector contacts for PHYs are given in Table 147–3. These connectors should support link segment DCR characteristics for 1.02 mm (18 AWG) to 0.40 mm (26 AWG) in Table 146B–1.

Supporting Slides

Objective

- Understand correlation between EMC related cabling requirements & link segment electromagnetic classifications

Table 146–6—Coupling attenuation

Frequency (MHz)	(dB)		
	E_1	E_2	E_3
0.1 to 20	≥ 50	≥ 50	≥ 60

Table 146–8—Link segment electromagnetic classifications (ISO/IEC 11801-1)

Electromagnetic	E_1	E_2	E_3
Conducted RF	3 V at 150 kHz to 80 MHz	3 V at 150 kHz to 80 MHz	10 V at 150 kHz to 80 MHz

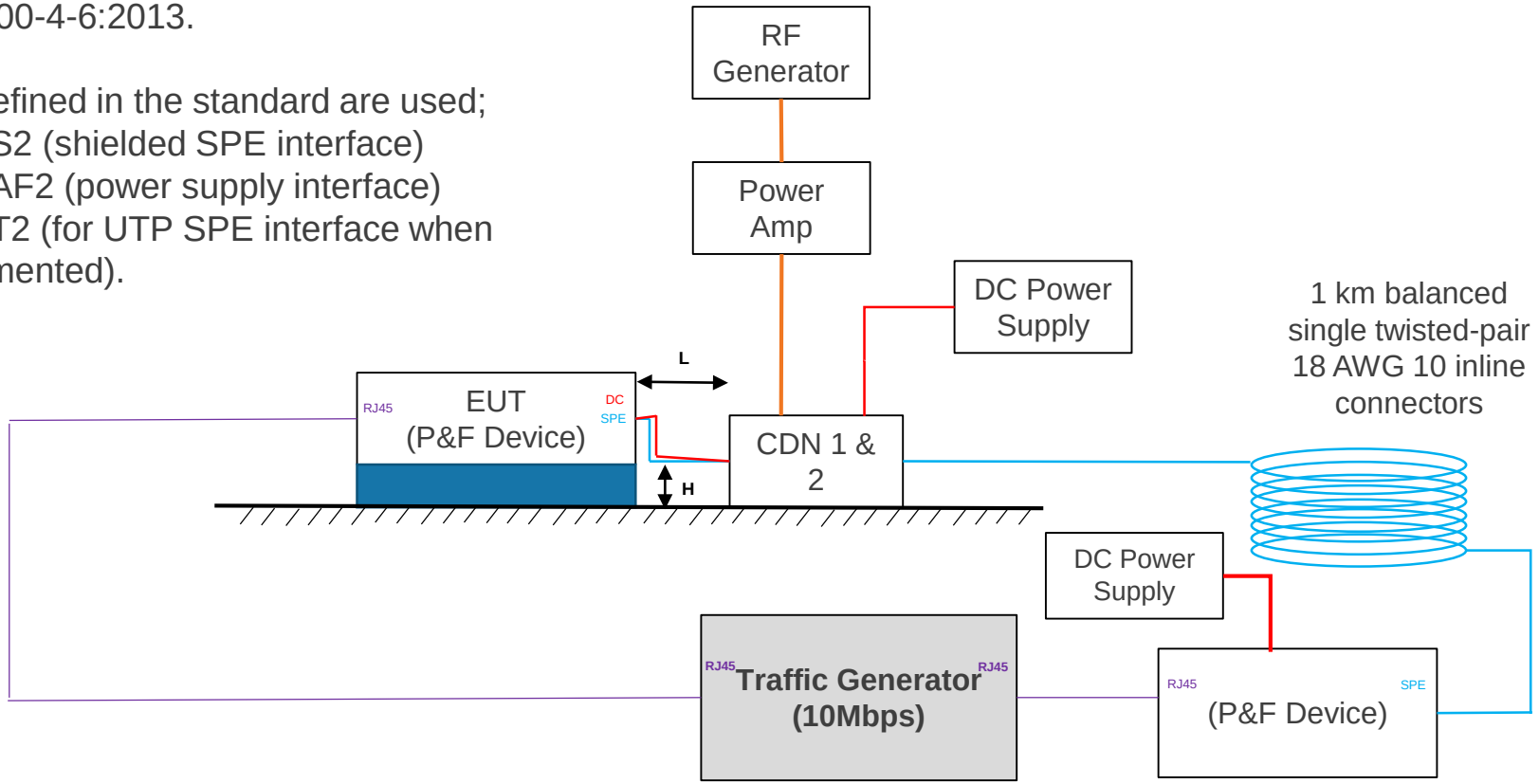
- Demonstrate 10BASE-T1L operation with E3 Conducted RF with IEC 63171-1 MDI.
  - Link segment of 1 Km - IL and RL not at worse case limit

EMC Test Setup

The conducted immunity measurements per IEC 61000-4-6:2013.

CDNs defined in the standard are used;

- CDN-S2 (shielded SPE interface)
- CDN-AF2 (power supply interface)
- CDN-T2 (for UTP SPE interface when implemented).



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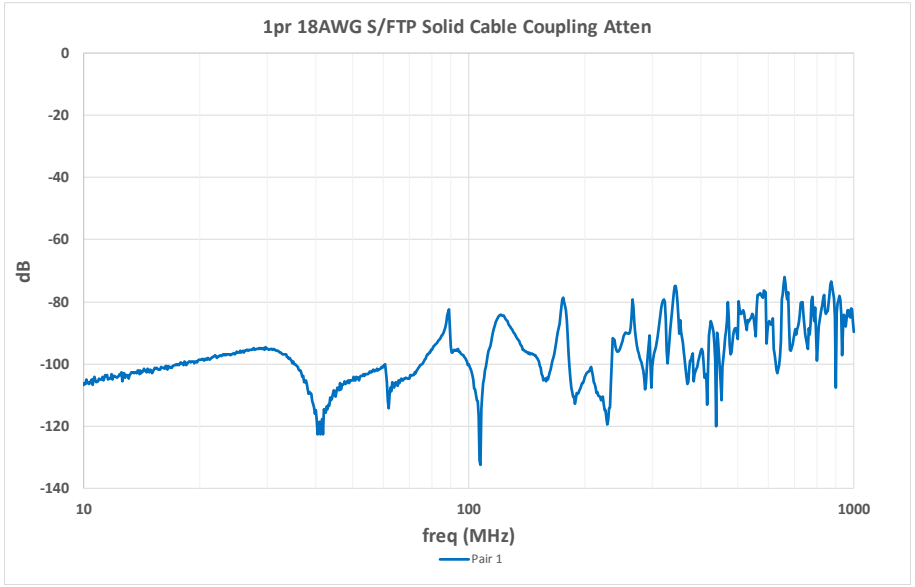
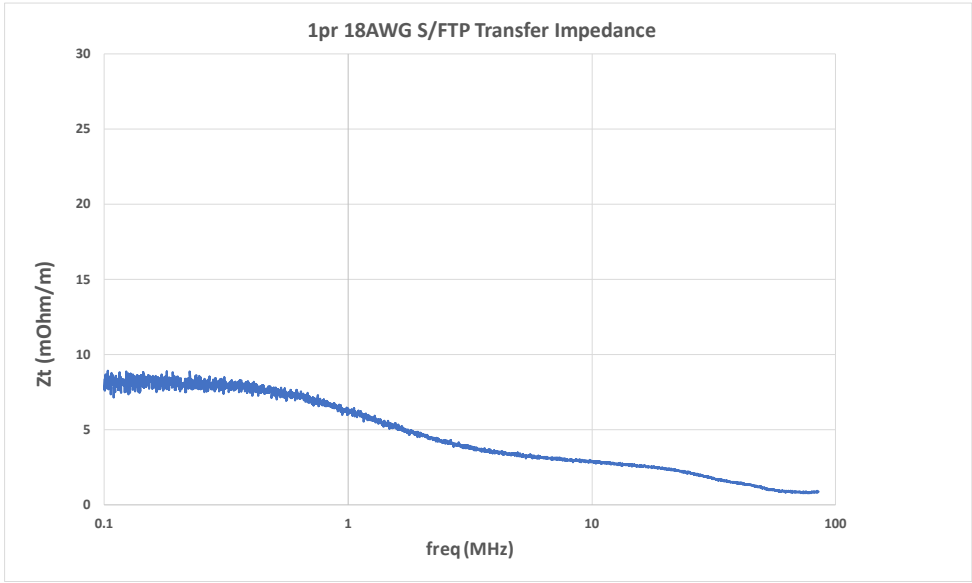
Shielded SPE Cabling

- Coupling attenuation and transfer impedance measurements of shielded SPE cabling per IEC 62153-4-15 (triaxial test method).





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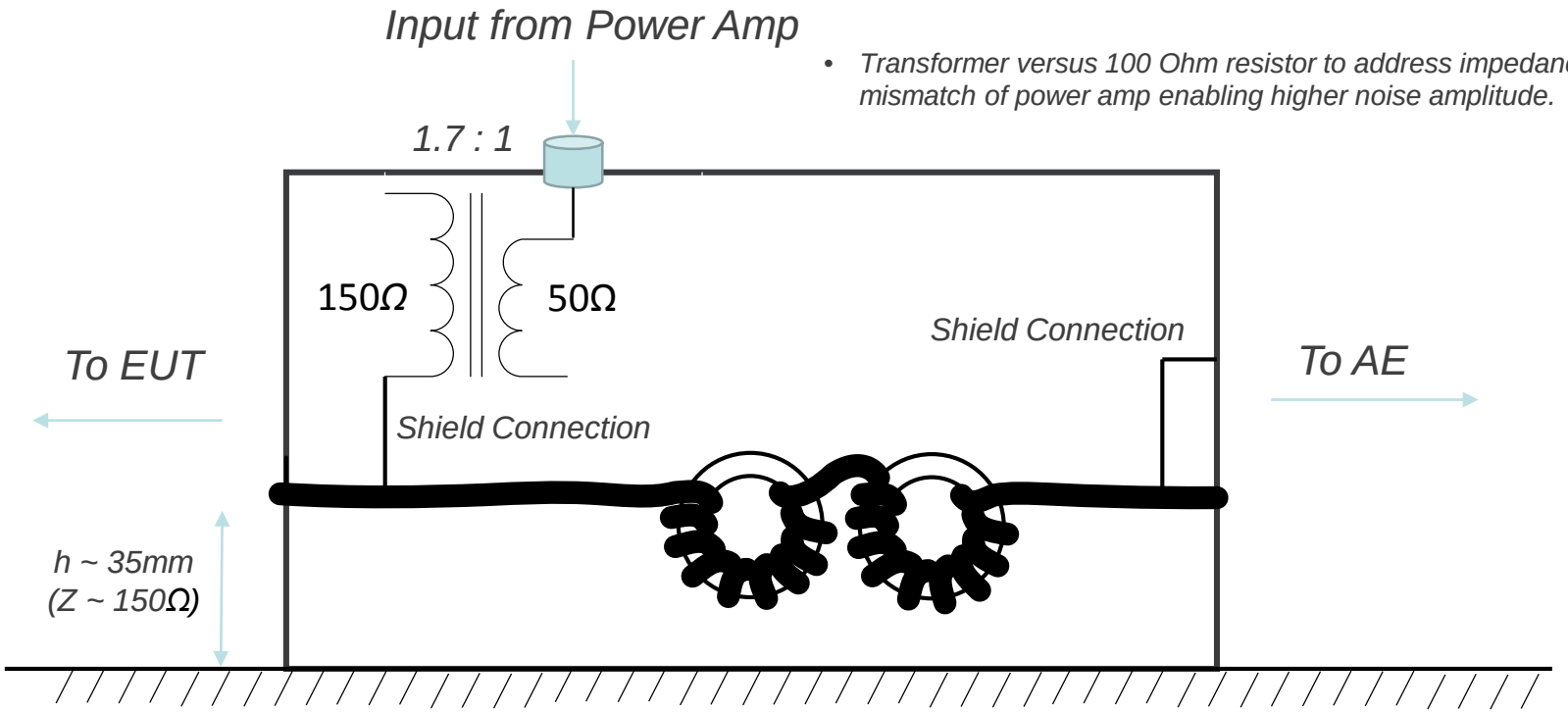
CDN



- *Transformer versus 100 Ohm resistor to address impedance mismatch of power amp enabling higher noise amplitude.*

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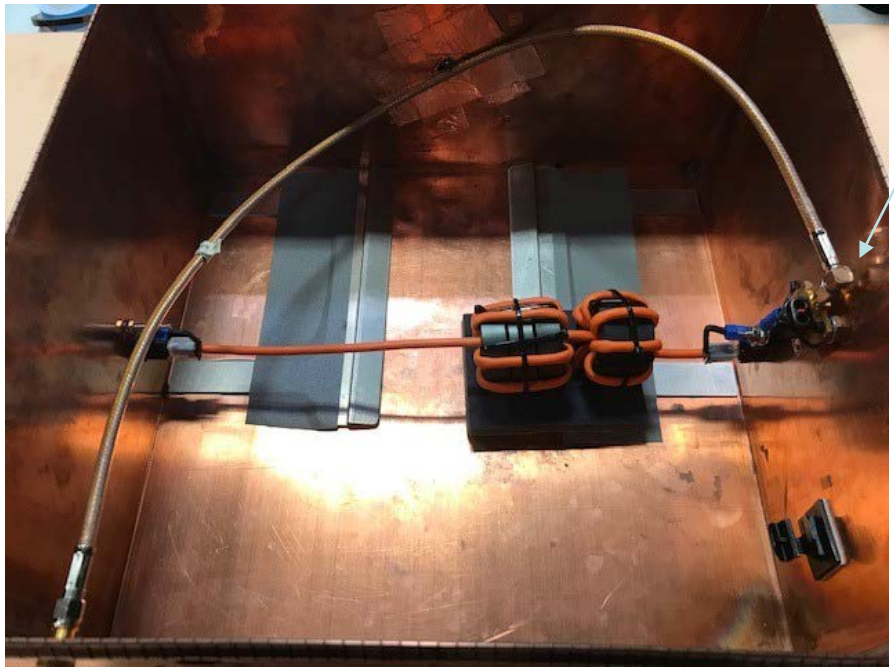
CDN



Impedance Matching Transformer

To 1km cable & AUX Eq.

To EUT

RF input from Power Amp

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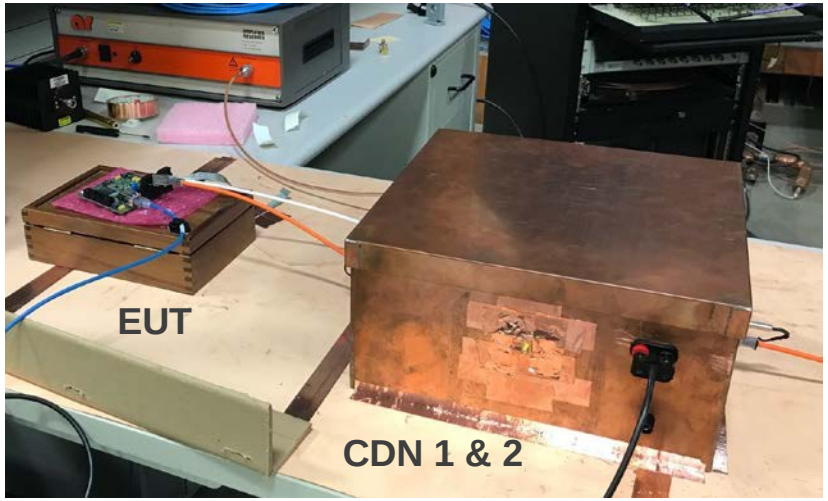
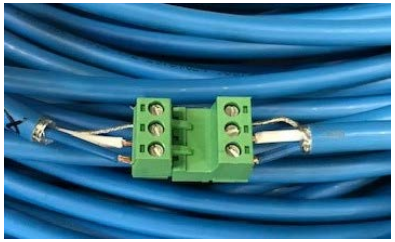
Test Configuration

AUX Eq

Traffic Generator



1 km balanced single twisted-pair 18 AWG
10 inline connectors



Inline connector

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EUT with IEC 63171-1 MDI

MJ interface
to traffic tester

IEC 63171-1 MDI - shielded plug and connector

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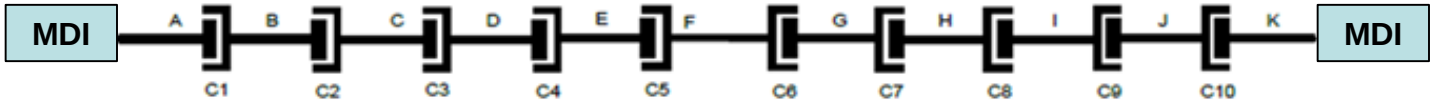
Channel



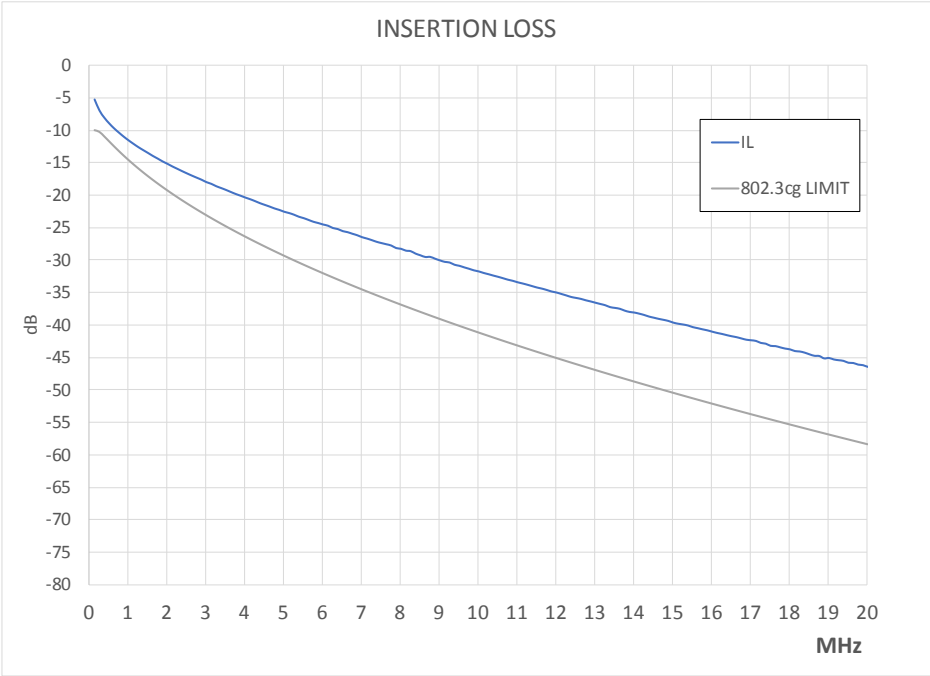
ID	Description	Channel configuration				
		1	2	3	4	5
A	Cable	2 m	50 m	15 m	25 m	5 m
C1	Connector	P	P	P	P	P
B	Cable	30 m	100 m	15 m	50 m	10 m
C2	Connector	P	P	P	P	P
C	Cable	30 m	100 m	20 m	50 m	10 m
C3	Connector	P	P	P	P	P
D	Cable	30 m	100 m	20 m	50 m	10 m
C4	Connector	P	P	P	P	P
E	Cable	30 m	100 m	20 m	50 m	10 m
C5	Connector	P	P	P	P	P
F	Cable	30 m	100 m	20 m	50 m	10 m
C6	Connector	P	P	P	P	P
G	Cable	30 m	100 m	20 m	50 m	10 m
C7	Connector	P	P	P	P	P
H	Cable	30 m	100 m	20 m	50 m	10 m
C8	Connector	P	P	P	P	P
I	Cable	30 m	100 m	20 m	50 m	10 m
C9	Connector	P	P	P	P	P
J	Cable	30 m	100 m	15 m	50 m	10 m
C10	Connector	P	P	P	P	P
K	Cable	2 m	50 m	15 m	25 m	5 m
P = Present in this channel model						

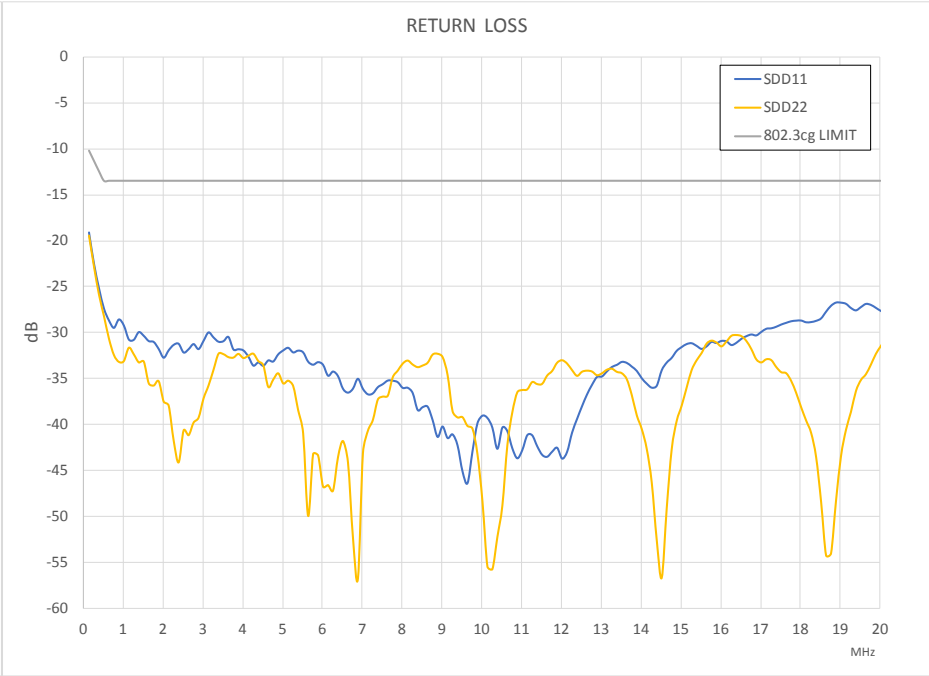
Figure C.1 - 1000 m channel configuration

1 km balanced single twisted-pair 18 AWG 10 inline connectors, 2 MDIs

Channel

Channel Performance - ~5 dB IL margin @ 4 MHz





1 km balanced single twisted-pair 18 AWG 10 inline connectors and two MDIs

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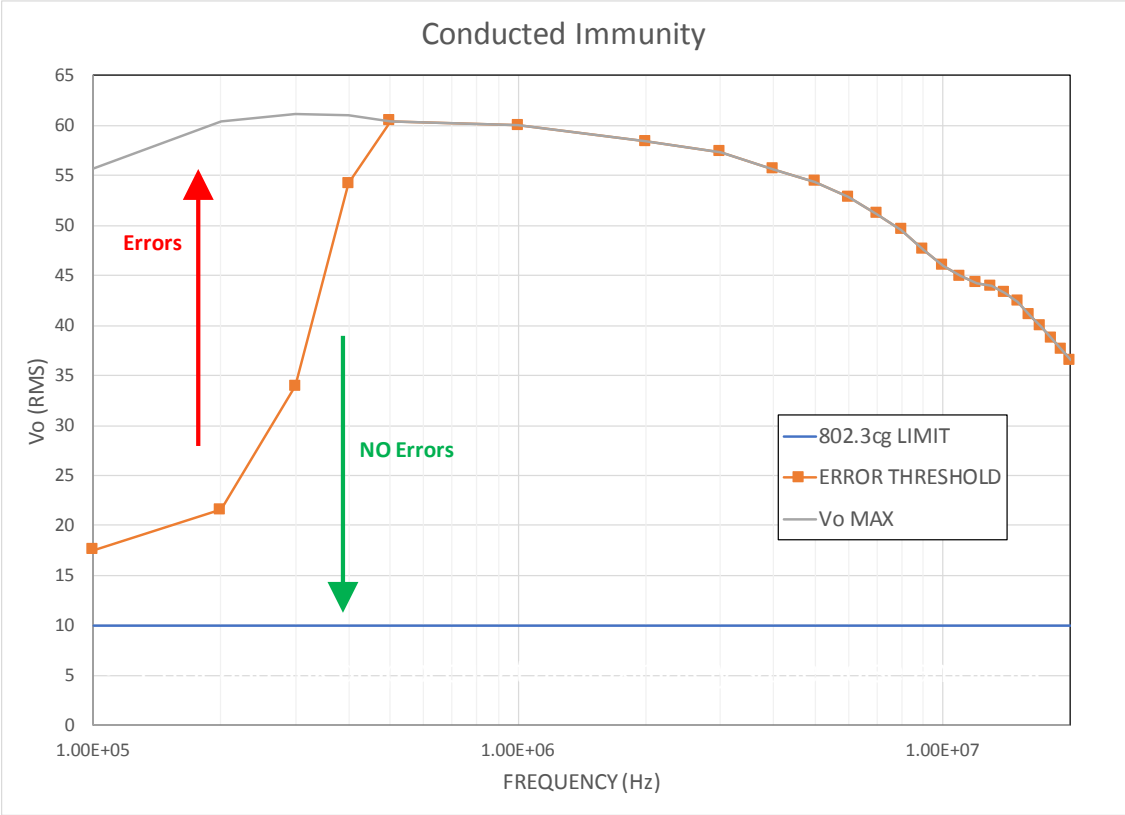
Conducted Immunity Result



- Vo MAX is maximum attainable noise amplitude from test setup
- Error instance and link drop approximately coincidental

IEEE Std 802.3™-2015 - MDI

- 1.4.269 Medium Dependent Interface (MDI): The mechanical and electrical or optical interface between the transmission medium and the MAU (e.g., 10BASE-T) or the PHY (e.g., 1000BASE-T) and also between the transmission medium and any associated (optional per IEEE Std 802.3, Clause 33) Powered Device (PD) or Endpoint Power Sourcing Equipment (PSE).

- 1.1.3.2 Compatibility interfaces: The following important compatibility interfaces are defined within what is architecturally the Physical Layer.

  a) *Medium Dependent Interfaces (MDI).* To communicate in a compatible manner, all stations shall adhere rigidly to the exact specification of physical media signals defined in the appropriate clauses in this standard, and to the procedures that define correct behavior of a station. The medium-independent aspects of the LLC sublayer and the MAC sublayer should not be taken as detracting from this point; communication in an Ethernet Local Area Network requires complete compatibility at the Physical Medium interface (that is, the physical cable interface).

- PMD is coupled to the cabling at the MDI.

- MDI requirements: mechanical (to ensure complete compatibility) and electrical.