Immunity Testing Results for a TDD PHY w/ COAX

IEEE 802.3dm

May 14, 2025

Conrad Zerna, Kamal Dalmia, Tiaq Ng

Aviva Links Inc.

Background…

- EMC is a hot topic for automotive PHYs.
- Car manufacturers and Tier 1s are perpetually worried about the EMC performance due to their experience so far with FDD PHYs.
- To address these concerns, this contribution presents Immunity testing results for a TDD PHY using COAX cabling
- All tests performed at a **highly-reputed** and **well-known automotive EMC test lab** in Germany.
- All Tests PASS with margin and demonstrate excellent EM compatibility of the TDD duplexing PHY

TDD based DUT Description

Duplexing Method - TDD

- Data Rate – 10 Gbps
- Baud Rate – 6 GSps
- Modulation – PAM4
- Line Rate – 12 Gbps
- Low speed – 50 Mbps w/ PAM2

✓ Tests performed using bare PCBs

✓ No Metal/shielded enclosure used to house DUT PCBs!

✓ PCBs, 6-layer FR4, used in this test are not designed by the PHY chip company

✓ PCB design uses conventional layout techniques only. No EMI suppressing materials used.

ASA Motion Link Silicon used as DUT. Further details such as PSD etc. are according to ASA-ML specifications liaised with 802.3

BCI – COAX Test Setup

Test set-up, complete arrangement for test channel 2 (2 m), Deserializer is DUT

channel 2 / 2 m

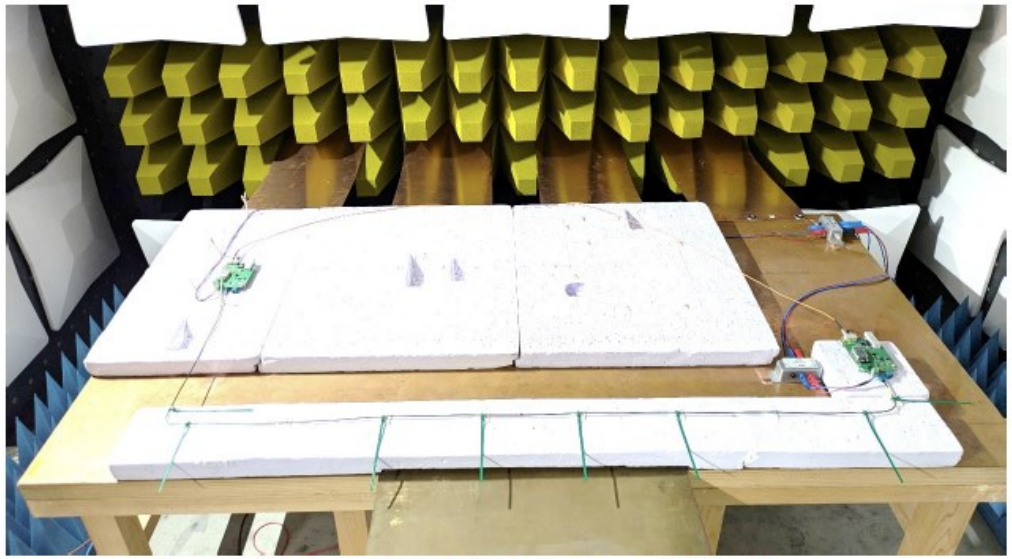
- connector Rosenberger FAKRA
- cable DACAR 462
- no inline connectors
- segment length: 2 m

BCI – results COAX

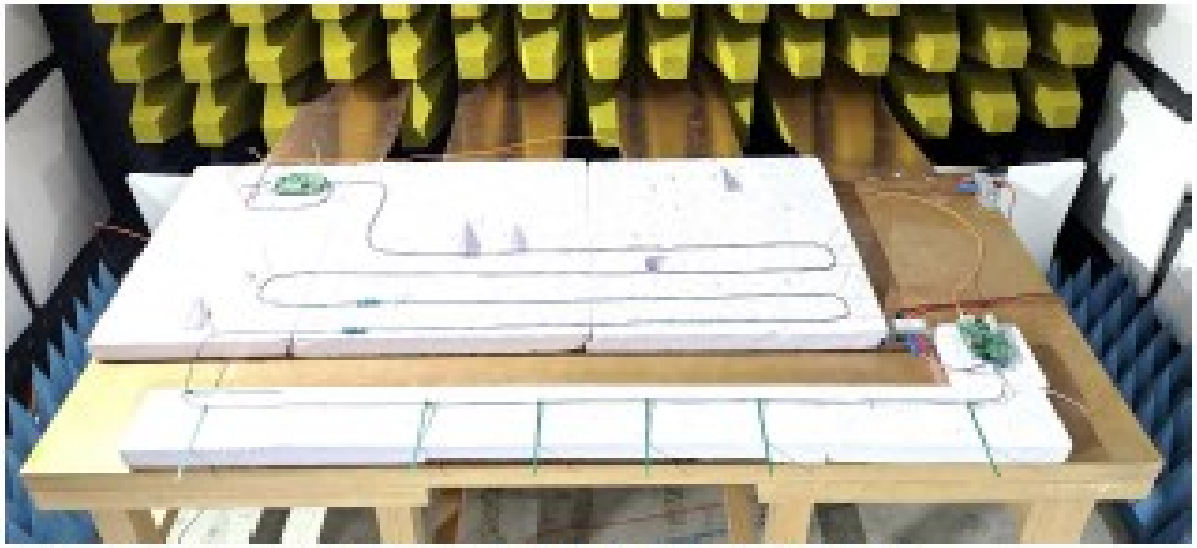
Test results:

Test parameter					Test result
Frequency range [MHz]	Type of coupling	Clamp	Modula-tion	Main DUT	Class II or better (ISO11452-4)
0.1 to 400	D-BCI	15 cm	CW	Deserializer	Pass
		45 cm	CW		Pass
		75 cm	CW		Pass
		15 cm	AM		Pass
		45 cm	AM		Pass
		75 cm	AM		Pass
		15 cm	CW	Serializer	Pass
		45 cm	CW		Pass
		75 cm	CW		Pass
		15 cm	AM		Pass
		45 cm	AM		Pass
		75 cm	AM		Pass

Radiated Immunity – ALSE (2m and 7m)



Test set-up, complete arrangement for test channel 2 (2 m)



Test set-up, complete arrangement for test channel 3 (7 m)

Test parameter			Test result
Frequency range [MHz]	Modula-tion	Data channel	Class IV ISO11452-4
200 to 6000	CW	2 m / no inline connector	**Pass**
	CW	7 m / 2 inline connector	**Pass**

How does this compare to FDD?

	FDD	TDD	Comments
Baud Rate	6 Gbps	12 Gbps	2x higher for TDD
Data Rate	~5 Gbps	10 Gbps	2x higher for TDD
Coax Cable	2m	2m and 7m	
BCI	Pass	Pass	
ALSE 2m	Not available	Pass	Please help locate if available
ALSE 7m	Not available	Pass	Please help locate if available

FDD comments are based on the public information available. Any help in locating more material or information is welcome.

Summary

- Radiated RF Immunity testing results for a TDD PHY w/ COAX cabling have been presented
- All tests performed on low-cost PCB without any metal enclosure
- All Tests **PASS** and demonstrate excellent EM immunity of TDD duplexing
- **TDD is recommended as an excellent path forward**

Thank You!