An optical wireless system replacing cabled connections for the data transmission in the AIT

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Introduction

An Optical Wireless (OW) solution for the AIT application is presented in this work.
The proposed system will be able to replace the MIL-STD-1553B connection cables by means of optical Transceiver (TRX)s.

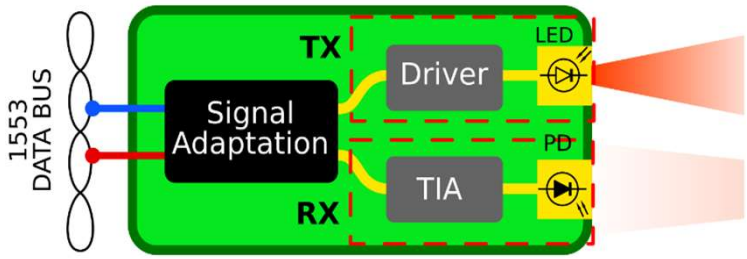


Figure 1: Optical transceiver (TRX)

Proposed Approach

The core of the proposed system is the TRX board, which was designed to meet the AIT scenario requirements.
Bidirectional OW connection between the S/C units under test and the Electrical Ground Support Equipment (EGSE).

The TRX is composed of (Fig.1):

- TX, infrared LED and a driver electrical circuit;
- RX, P-I-N junction PD and a TIA, to amplify and convert the current signal generated by the PIN-PD into a voltage signal
- Signal Adaptation Board (SAB), with the tasks of adapting the signal amplitude and performing a data flow control between the bus and the optical component.

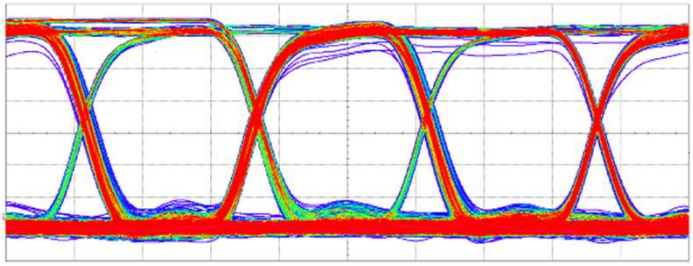
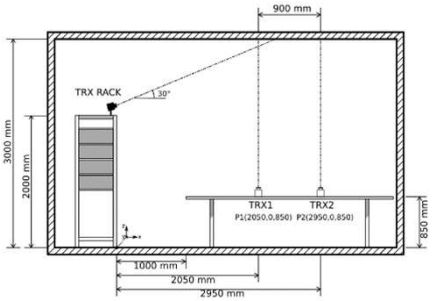


Figure 2: Received signal eye diagram

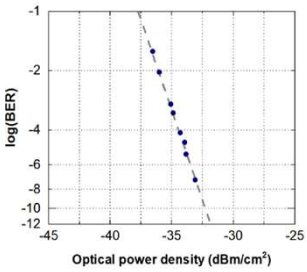
Experimental results

The measurements were performed according to typical AIT scenario and three different configurations were identified:

1. TRX RACK is transmitting and TRX1/TRX2 is receiving;
2. TRX RACK is receiving and TRX1/TRX2 is transmitting;
3. TRX1 is receiving and TRX2 is transmitting



Sensitivity measurements



Variation of the received optical power density.
The receiver sensitivity was estimated from a linear fit of the logarithm of the measured BER value.
It results to be equal -32 dBm/cm^2

AIT measurements

An eye diagram is reported as example in Fig. 2.
The results for the 3 configurations are reported in table

Configuration	Measured BER	P_d dBm/cm^2	Link Margin (dB)
1 P1	$< 10^{-8}$	-28.3	4
1 P2	$< 10^{-8}$	-31	1
2 P1	$< 10^{-8}$	-27.6	4.4
2 P2	$< 10^{-8}$	-29.6	2.4
3	$< 10^{-8}$	-28.2	3.8

Conclusions

- A new transceiver for MIL-STD-1553B transmission over OWC was designed, realized and tested.
- A new OWC system for the AIT activities was successfully realized and tested

Acknowledgment

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