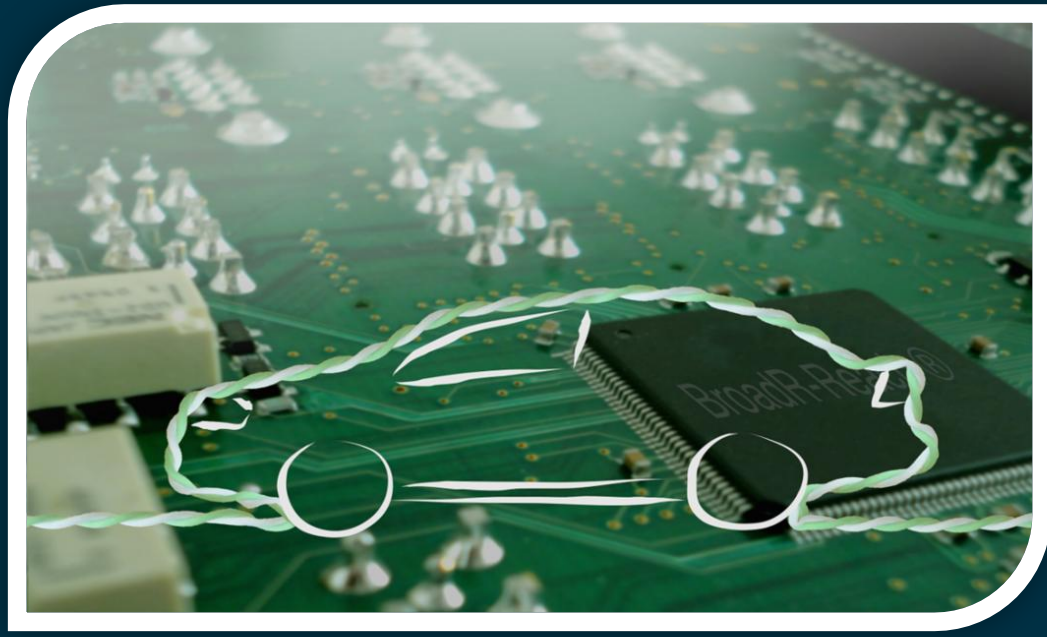
C&S

Enabling Interoperability in a Multi-vendor Environment of BroadR-Reach PHYs



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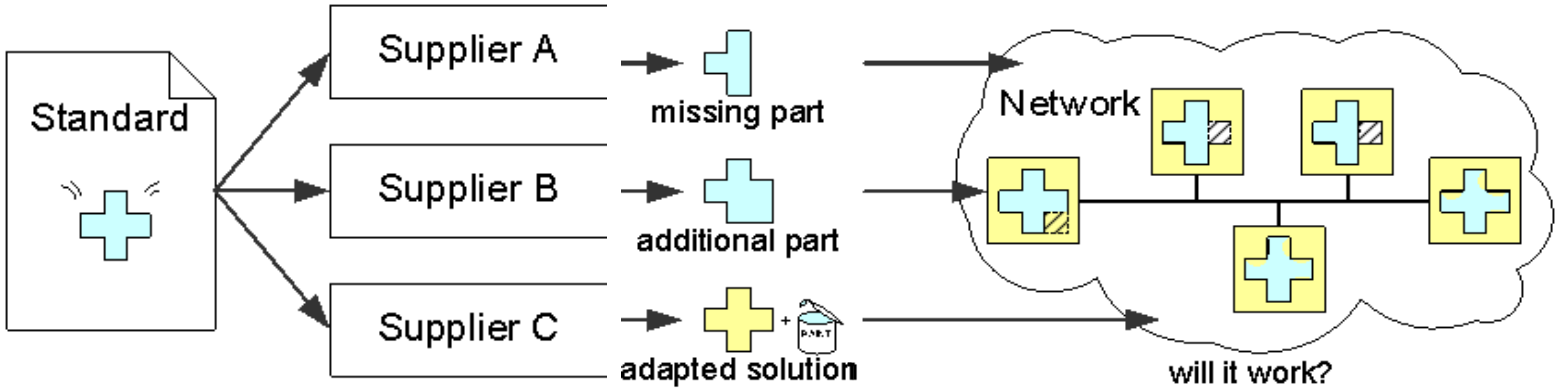
Interoperability – Problem description

- Interoperability is a property that is based on intended functional behavior. It is relevant, if multiple entities shall inter-operate. Consequently, interoperability is a result of the compliance of implementations to their specified standard.



Multi-Supplier-Solutions

- (Mis-)Interpretation is especially a problem in an environment in which products of different suppliers have to interoperate
- One single specified standard can be interpreted differently by different implementers, because:
  - Human language itself is ambiguous
  - A specified standard might contain coverage gaps, missing details
  - The implementer might misunderstand the specification

Content

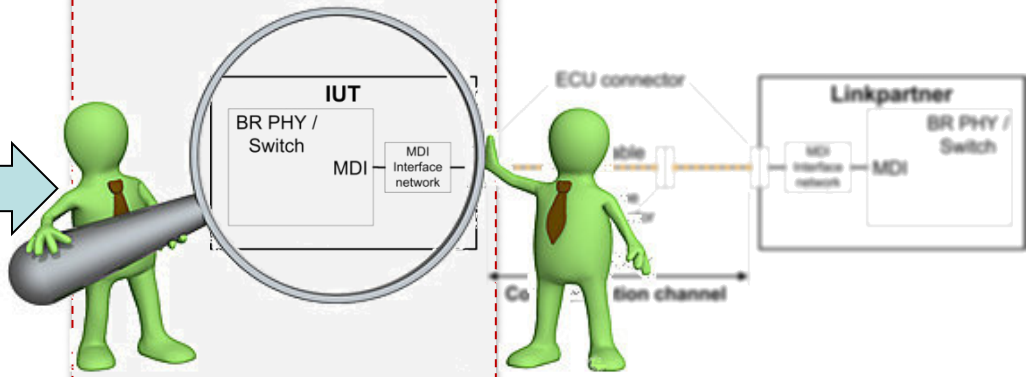
IOPT - Test Coverage

OABR Physical Layer Transceiver Specification for Automotive Applications (IEEE - 802.3_1TPCE)

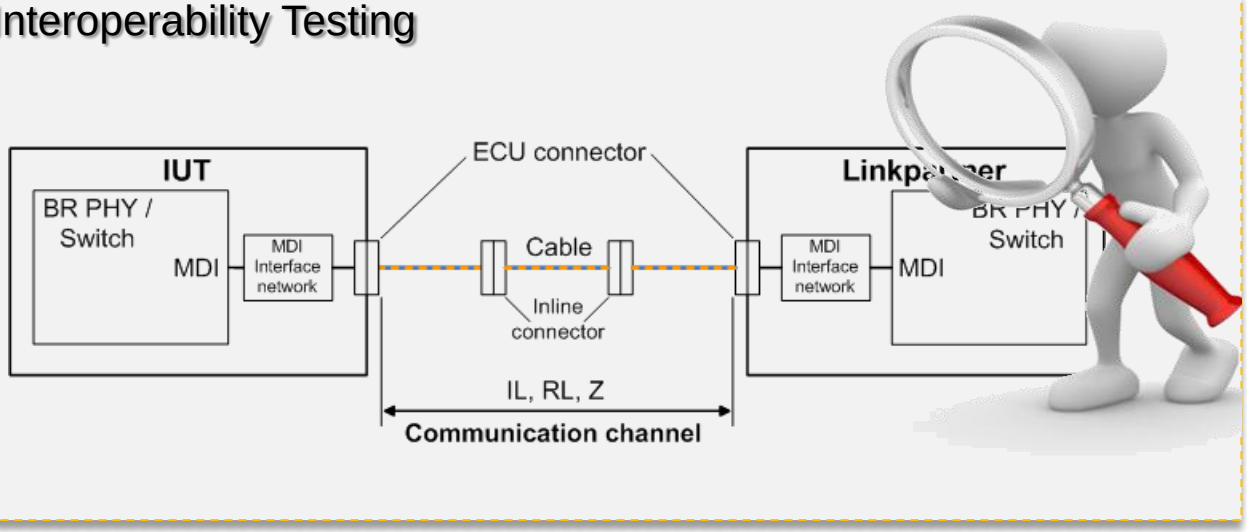
PHY Features set (Data Sheet)

PHY Definition

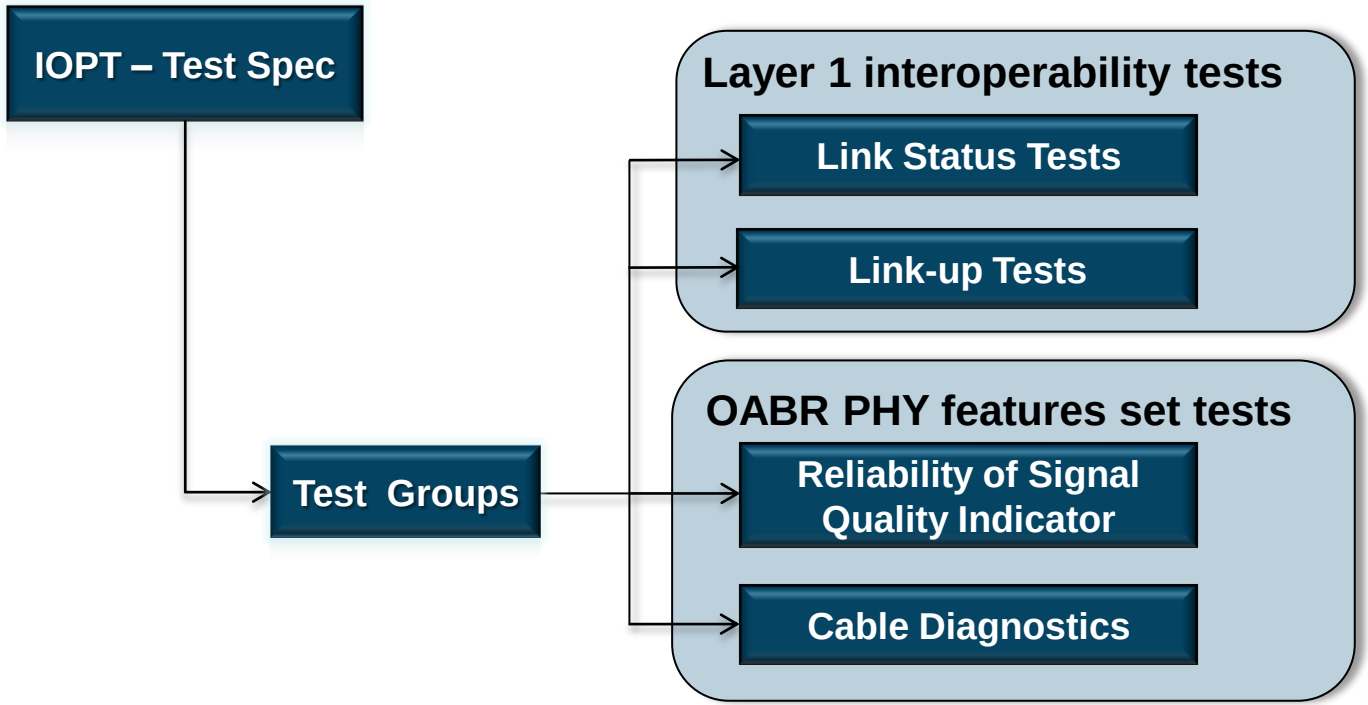
Conformance Testing



Interoperability Testing

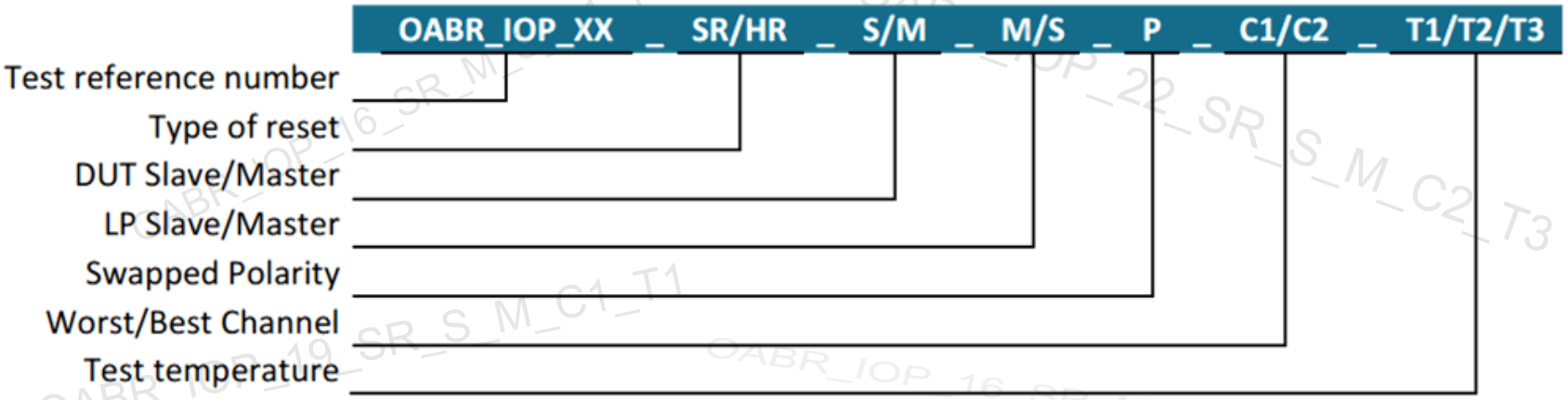


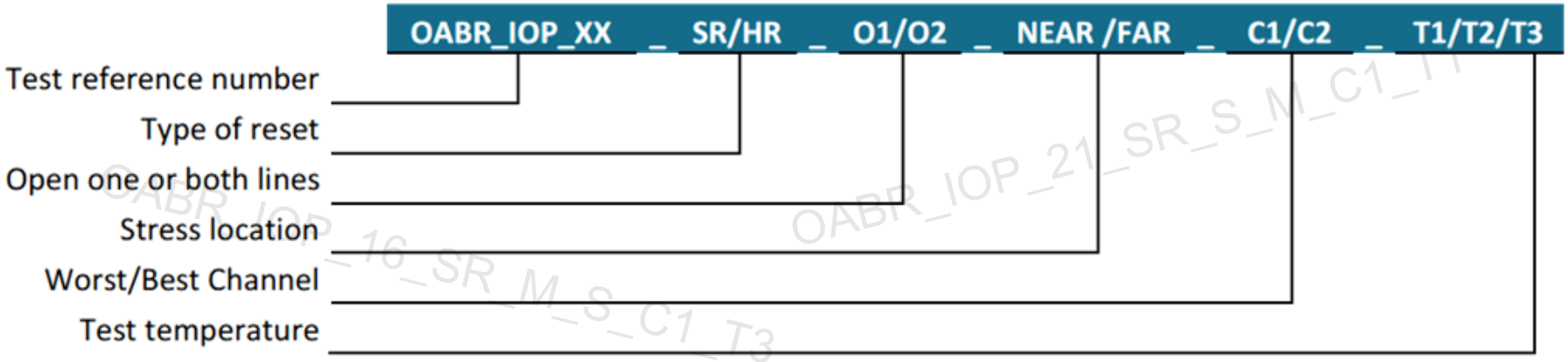
IOPT - Test Coverage (1)



IOPT - Test Coverage (2)

Test cases nomenclature

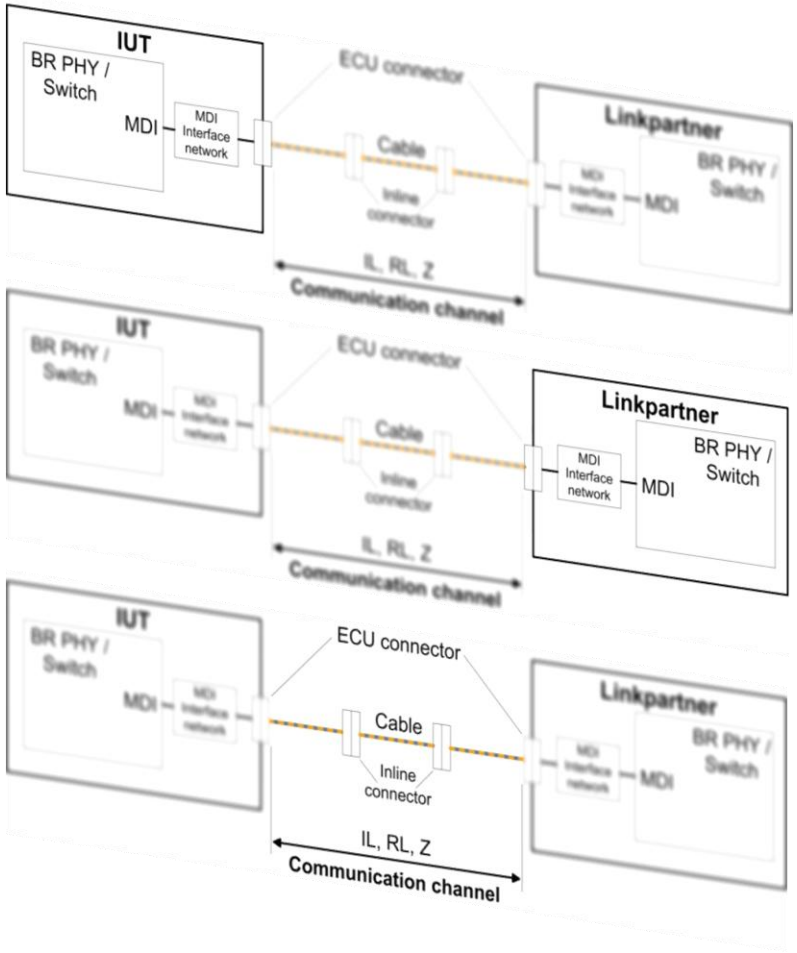




Variations and testable parameters combinations

The results of the Interoperability Test Suite will not only depend on the PHY, but also on :

- General configuration of Implementation Under Test
- Link Partner
- Magnetics
- Communication channel conditions
- Configuration files.



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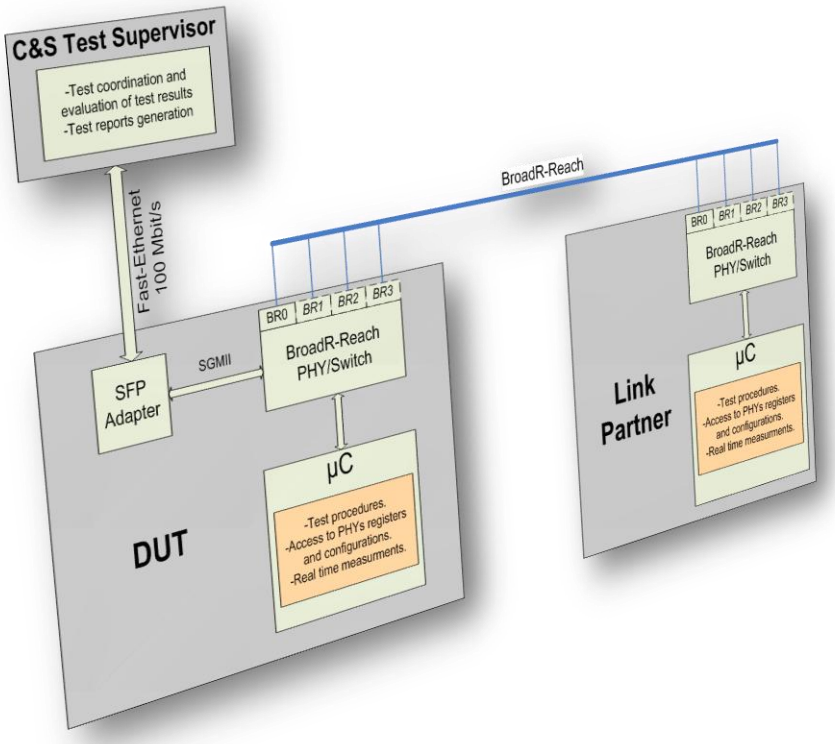
Test system main components

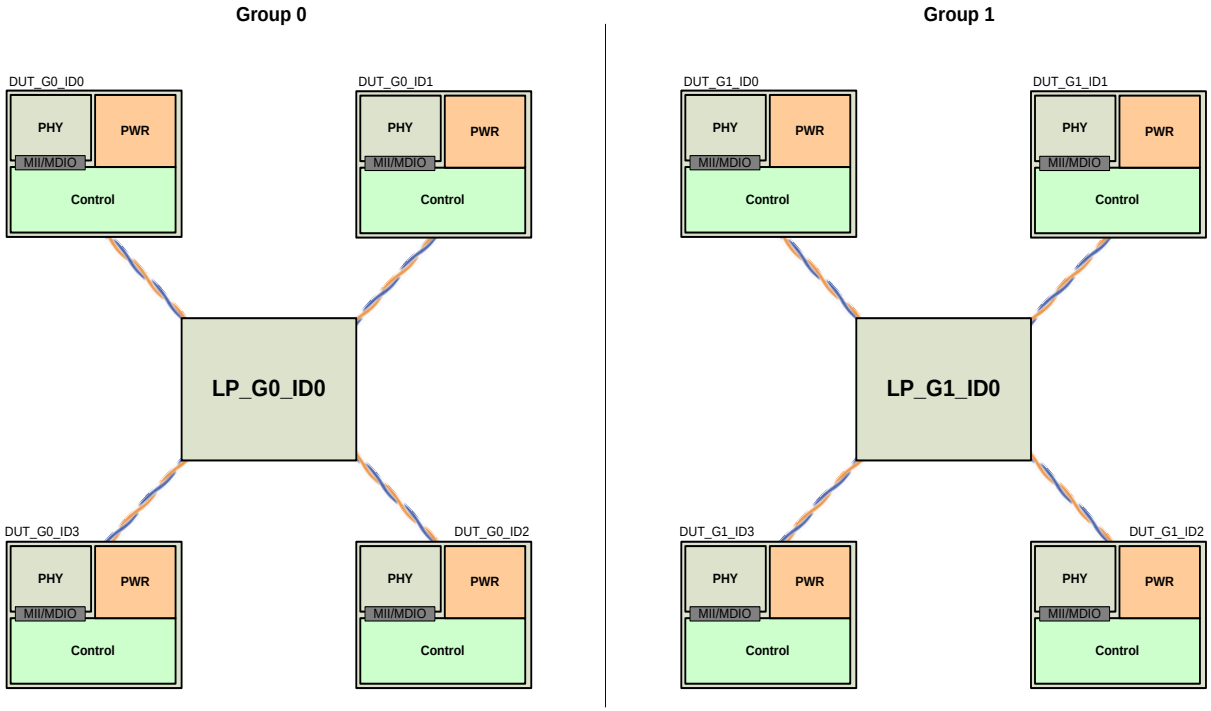


- The test system consists of three main elements:
  - DUT
  - Link Partner
  - Test Supervisor
- The Test Supervisor coordinates all the test procedures and collects the information obtained during the test for post processing and to provide the test outcome.
- The DUT and Link Partner also support the test coordination and provide valuable information about internal registers, channel quality and current internal status.

Content

Test system architecture

In order to optimize the test procedure and reproduce a more realistic scenario, several DUTs are tested in parallel.



Tests instances are fully automated and the test cases are capable of running autonomously with no major intervention from Test Engineers.

Content

Main challenges - The testing dilemma

Mathematical coverage and the testing dilemma

- The DUT behavior is affected by the configuration
  - Different (typically) discrete configuration parameters may exist (configuration values, states/modes, commands, flags, etc.)
- The DUT behavior is affected by the environment and history
  - The environmental impacts are (typically) continuous, non-discrete (supply voltages, timings, signal slopes, temperature, etc.)
  - The history, especially in terms of timing, allows infinite scenarios

- Even in small systems with a few discrete configuration parameters, a huge number of different configuration sets and potential test sequences apply.
- It is typically neither technically nor commercially feasible to test “all” configurations and scenarios. A reasonable big set of tests needs to be selected. This fact is called the “testing dilemma”.

Main challenges

- **Optimum number of test iterations amount**
  - Testing Dilemma
  - Parallelization of iterations
- **Timing requirements from the test coordination side**
  - Test system validation under different temperature scenarios
- **Test setup changes depending on the test case**
  - Four kind of cables are used when testing
  - Low and high temperatures

All challenges have been overcome!

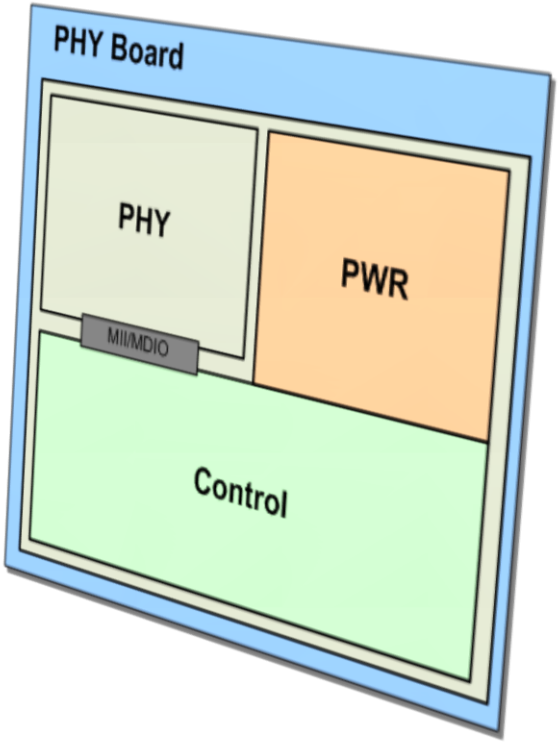
Content

PHY host board requirements (1)

PHY Board description

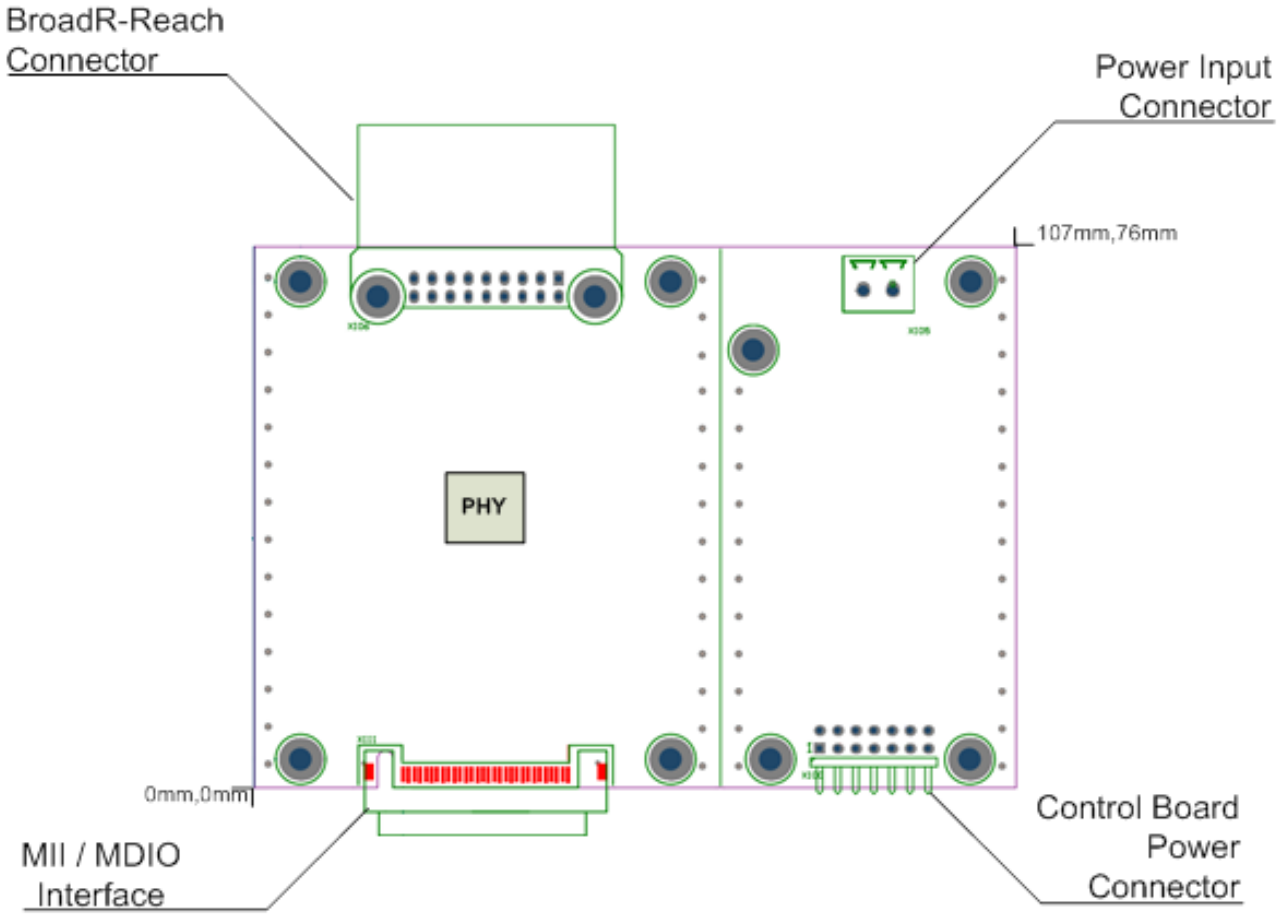
The PHY board consists of three parts that work together:

- PHY host section where the PHY and all its required circuitry is allocated.
- Control section as a link between the Test System and the PHY.
- Power supply section.



PHY host board requirements (2)

PHY host board and Power Supply



Content

C&S BroadR-Reach IOP test bench

Content

Summary

- Interoperability is relevant whenever multiple entities shall interoperate.
- The Interoperability Test Suite has been drafted and elaborated in the OA-TC1, with the inputs of the OEMs, TIER-1s, silicon vendors and test houses.
- The results of the Interoperability Test Suite
  - depend on the PHY and on the general environment in which it is tested.
  - qualify the grade of interoperability of the tested combination of PHY, link partner, magnetics, etc.
- Valuable experience has been gained during the development stage and testing procedures.

You can start testing with us at any time!

Thanks for your attention!

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