Using the Protocol To Simplify PHY Testing: A Practical Example with MIPI UniPro℠
Agenda

• Problem Statement
• General Solution
• MIPI UniPro PHY Test Mode
• Proposed Solution
Problem Statement

- It’s often challenging to do MIPI PHY® test, due to the lack of a standardized, widely adopted test mode
- Specs contain “Recommended Test Functionality” as annex, but informative
  - It still requires the user to implement a dll for a test automation software to control the DUT and to perform the tests
  - It also requires out-of-band DUT control capabilities
- Loopback is widely used, but some features can’t be tested with standard equipment (e.g. MIPI M-PHY PWM), and manual reconfiguration is needed between tests
- Manufacturers’ validation teams need to invest time (and $$) to prepare for testing
- Certification workshops (e.g. UFSA) become increasingly complicated

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General Solution

• A Test Mode defined in the protocol layer simplifies testing
• Requirements:
  – In-band configuration of the DUT for each test must be possible
  – DUT must remain in test mode until explicitly disabled
  – DUT must implement counters and it must be possible to retrieve them in-band
UniPro PHY Test Mode

- Mandatory
- Enter test mode through PACP_TEST_MODE_req frame
- Allows lane distribution setting (single- and multi-lane test possible)
- Configure transmission mode and speed
- RX test:
  - Implements Frame and Error counters
  - Counters can be retrieved in-band through TX
- TX test:
  - The DUT can be configured to transmit a CRPAT pattern for testing with the oscilloscope
Proposed Solution

• Use the UniPro Test Mode to test the Physical Layer
• Train DUT into each required test mode
• Poll DUT frame and error counters
• UniPro counters are global, can test all lanes simultaneously to save time
• Everything must be done in-line, no sideband connection needed
• Must require little or no customization
Proposed Solution

- Hardware:
  - Oscilloscope for TX test and calibration of the RX test setup
  - High speed data generator for test pattern generation for RX test
  - Protocol generator and analyzer for device configuration and frame and error counter reception
Proposed Solution

- Debug Software:
  - Individual adjustment of each PHY parameter (timings, levels, jitter)
  - Test script wizard for automated generation of configuration pattern for each gear and mode
  - Ability to control DUT configuration flow
  - Poll and decode frame and error counters from DUT

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Proposed Solution

- Test Automation Software:
  - Automated calibration of stress signal
  - Automated DUT configuration for each CTS test
  - Automated testing for each CTS item
  - Test report generation

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Proposed Solution

• Use Case RX test
  – DUT Data0 RX is connected to switch that can alternate between test pattern generator and protocol generator
  – DUT Data1-3 RX connected directly to test pattern generator
  – DUT Data 0 TX connected to protocol analyzer
  – DUT RST_n also controlled to alternate test modes

• Test Flow
  – Automation connects protocol generator to DUT
  – Hardware Reset sent to RST_n of DUT
  – Protocol generator sends link configuration pattern to DUT
  – Automation connects test pattern generator to DUT
  – Test pattern generator sends test pattern to DUT, interleaving Frame and Error counter requests
  – DUT responds, protocol analyzer captures response and test automation decodes it
  – Test goes on until DUT reports errors or target BER is achieved
Proposed Solution

• Use Case TX test
  – DUT Data0 RX is connected protocol generator
  – DUT TX Lane under test is connected to oscilloscope
  – DUT RST_n also controlled to alternate test modes

• Test Flow
  – Protocol generator sends Hardware Reset to DUT
  – Protocol generator sends link configuration pattern to DUT
  – Automation controls oscilloscope TX Test software to run selected tests
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- Live demo in our booth!
Questions?

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