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Using the Protocol To Simplify PHY Testing: A Practical Example with MIPI UniProSM

2017

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HSINCHU CITY, TAIWAN

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Agenda

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

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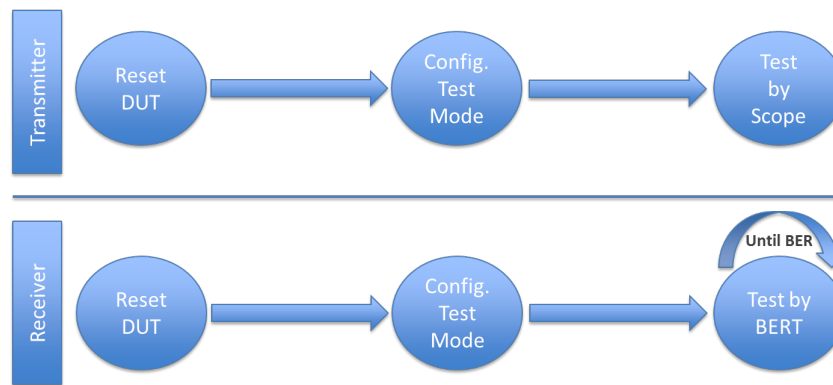
Problem Statement

- 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



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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

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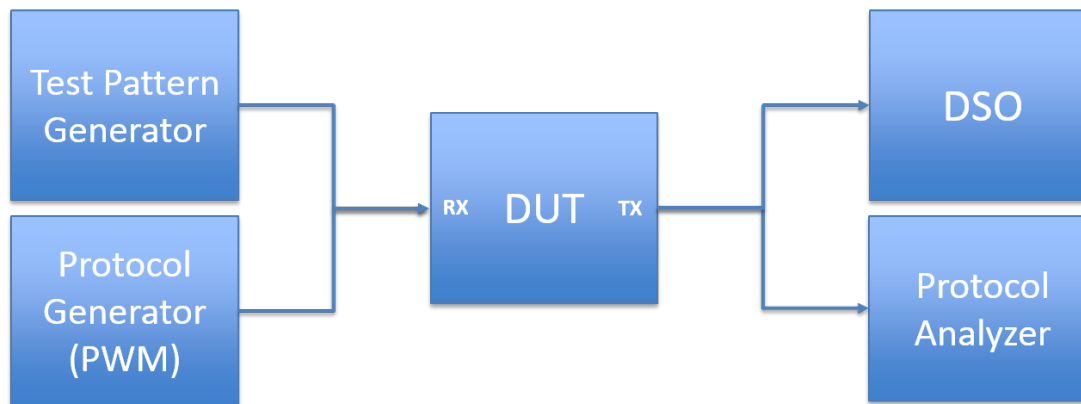
Proposed Solution

- 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

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Proposed Solution

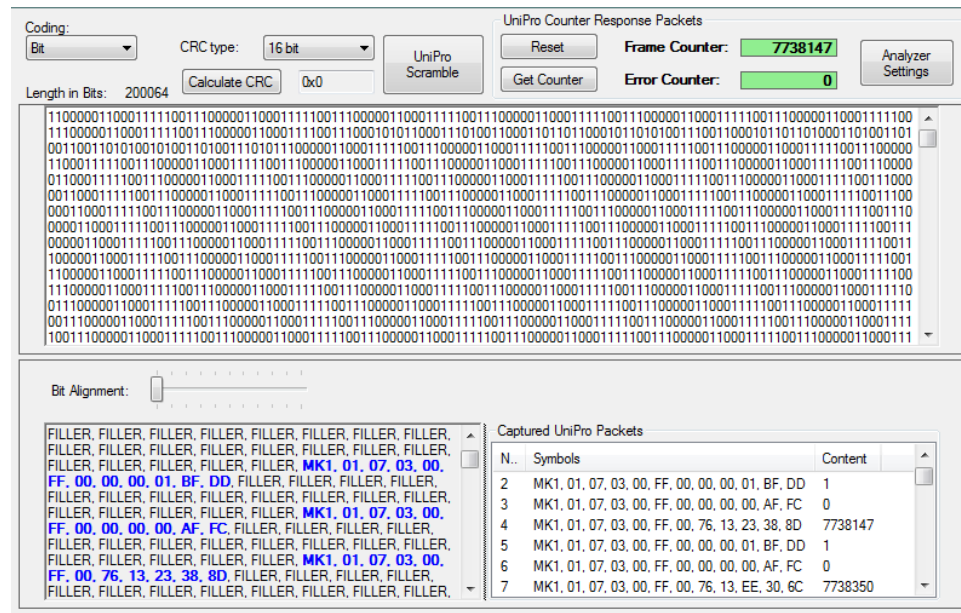
- Hardware:
 - Oscilloscope for TX test and calibration of the RX test setup
 - High speed data generator for test pattern generation for RX test
 - Protocol generator and analyzer for device configuration and frame and error counter reception



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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



The screenshot displays the BitifEye Digital Test Solutions software interface. The top section, titled "UniPro Counter Response Packets", includes controls for "Coding" (set to Bit), "CRC type" (set to 16 bit), and "Length in Bits" (set to 200064). It also features buttons for "Calculate CRC", "UniPro Scramble", "Reset", "Get Counter", "Frame Counter" (displaying 7738147), and "Error Counter" (displaying 0). Below this is a large text area showing a long sequence of binary data (0s and 1s).

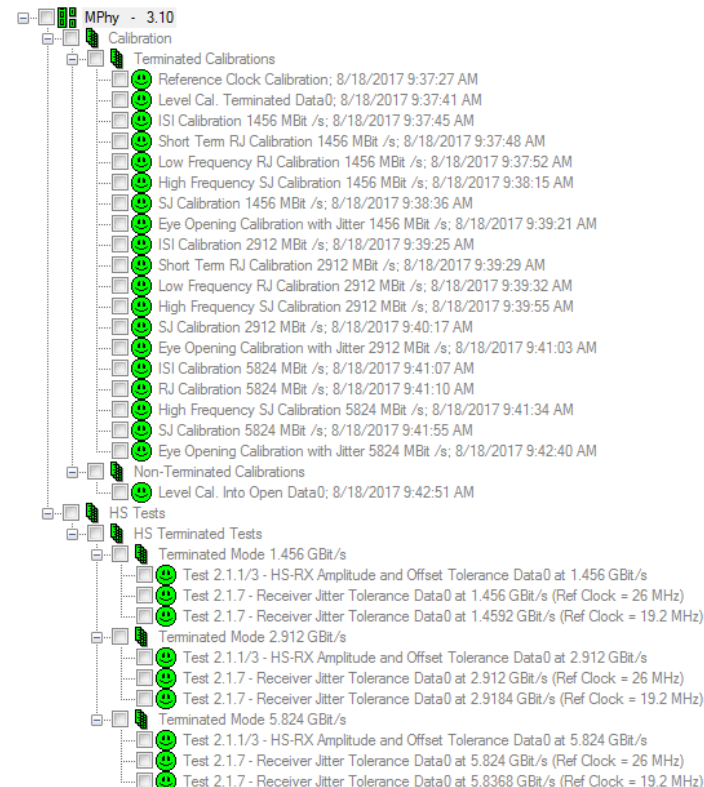
The bottom section, titled "Captured UniPro Packets", includes a "Bit Alignment" slider and a table of captured packets. The table has columns for "N.", "Symbols", and "Content".

N.	Symbols	Content
2	MK1, 01, 07, 03, 00, FF, 00, 00, 00, 01, BF, DD	1
3	MK1, 01, 07, 03, 00, FF, 00, 00, 00, 00, AF, FC	0
4	MK1, 01, 07, 03, 00, FF, 00, 76, 13, 23, 38, 8D	7738147
5	MK1, 01, 07, 03, 00, FF, 00, 00, 00, 01, BF, DD	1
6	MK1, 01, 07, 03, 00, FF, 00, 00, 00, 00, AF, FC	0
7	MK1, 01, 07, 03, 00, FF, 00, 76, 13, EE, 30, 6C	7738350

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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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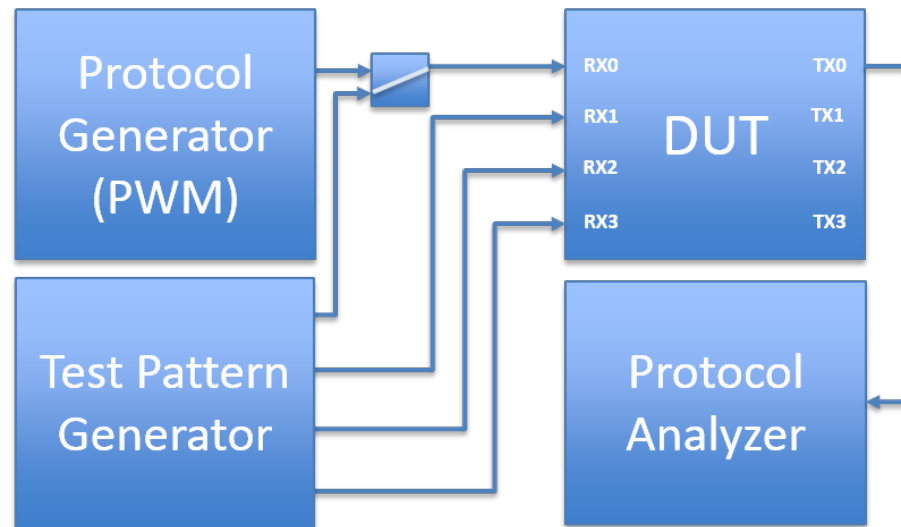
Proposed Solution

- 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

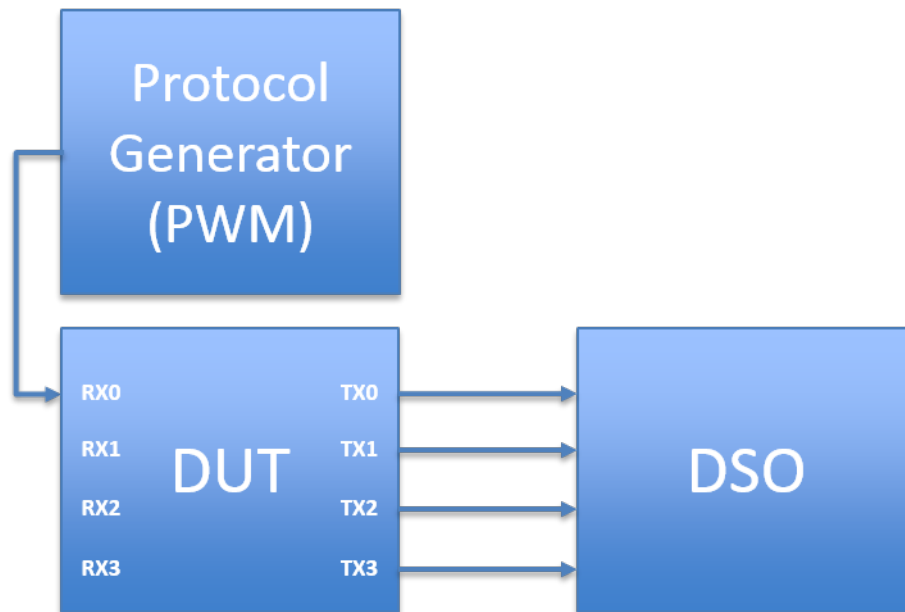
- Automation connects protocol generator to DUT
- Hardware Reset sent to RST_n of DUT
- Protocol generator sends link configuration pattern to DUT
- Automation connects test pattern generator to DUT
- Test pattern generator sends test pattern to DUT, interleaving Frame and Error counter requests
- DUT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



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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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BitifEye & Keysight Solution

- Live demo in our booth!

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Questions?

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THANK YOU

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BACKUP

