mipi® DEVCON

MIPI ALLIANCE DEVELOPERS CONFERENCE

TAIPEI

18 OCTOBER 2019

Mohamed Hafed
Introspect Technology

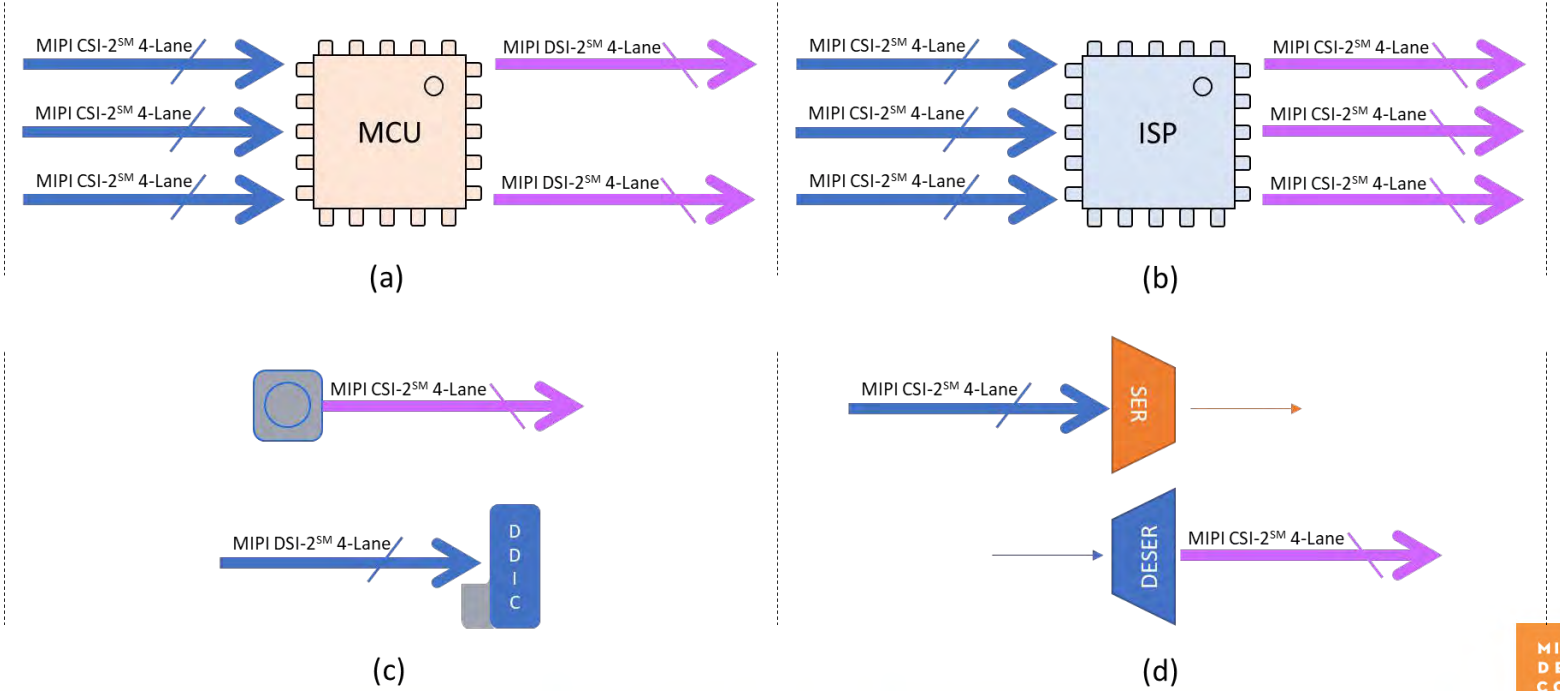
New Trends in the High-Volume Manufacturing Test of MIPI-Based Devices

MIPI.ORG/DEVCON

Agenda

- Introduction
- Hardware Requirements for MIPI Testing in Production
- Protocol Requirements for MIPI Testing in Production
- System-Oriented Testing & Case Studies

Typical Device Classes



Test Methodology Spectrum

ATE or Bench Instrument Add-On (e.g. Scope)

Reduce Cost / Increase Quality

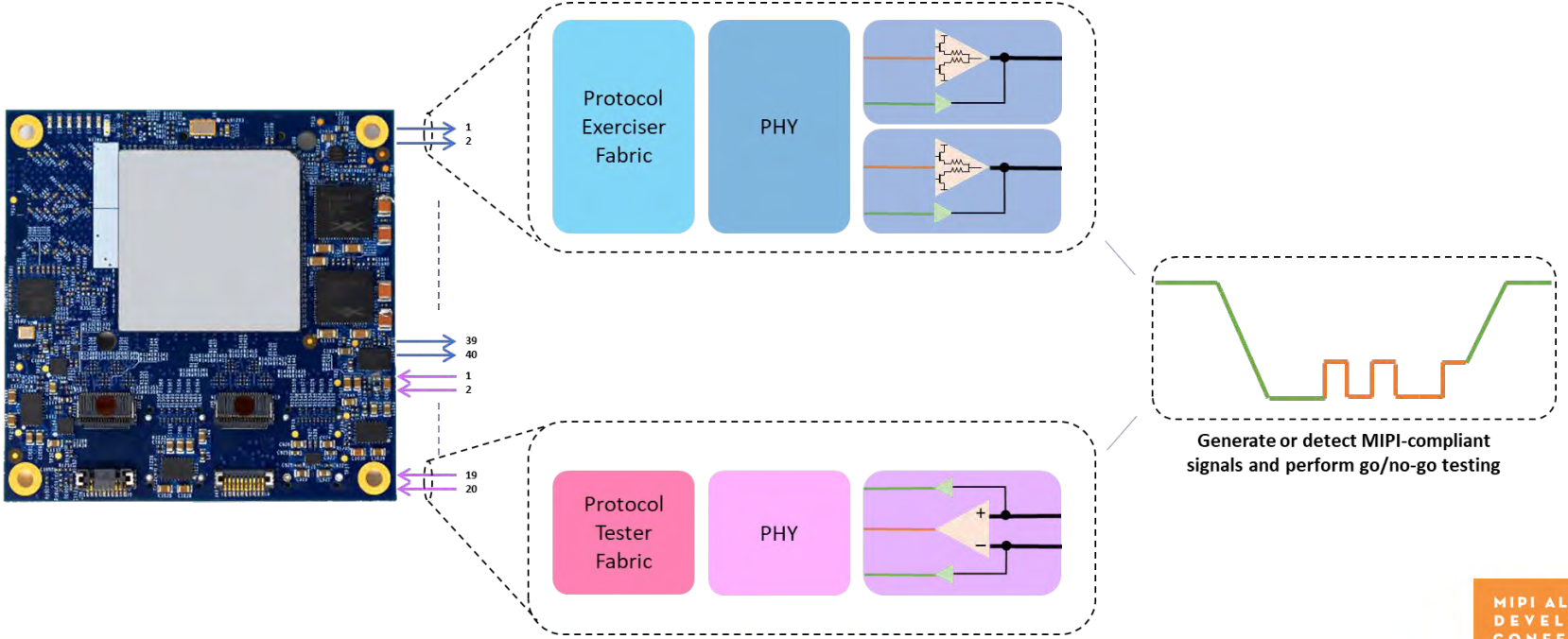
Test Module

Achieve Instrument Grade

Golden Device Methodology

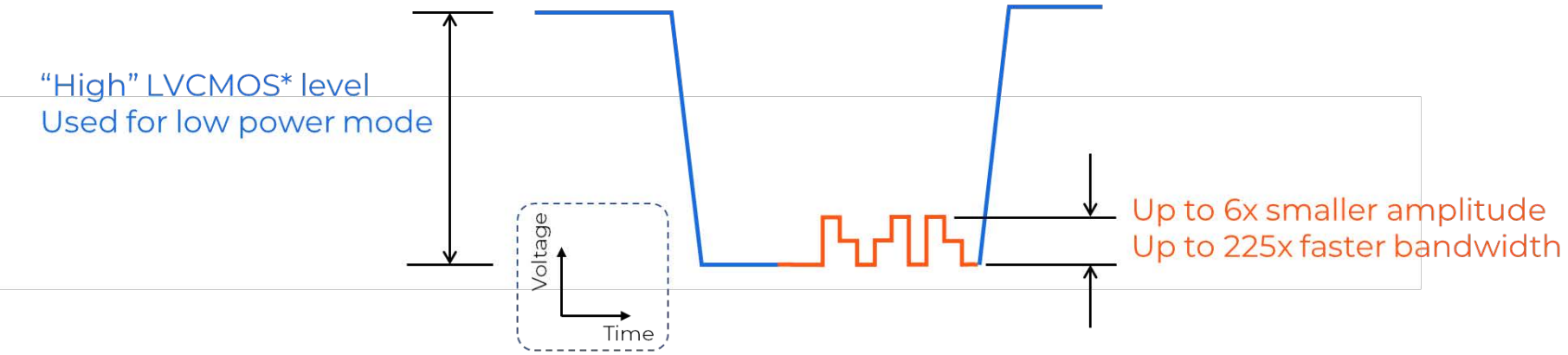
Test Methodology Spectrum

Test Methodology Spectrum – On-Board Channel Card



Hardware Requirements

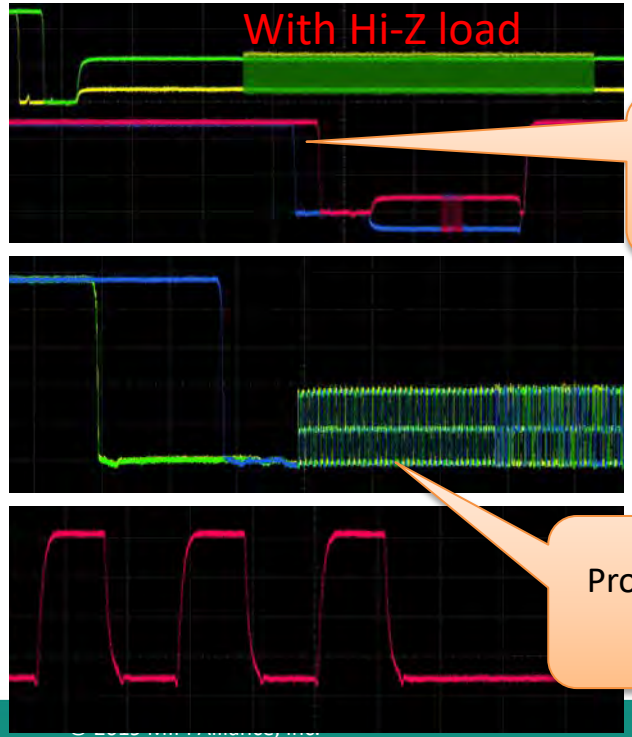
Low-Power (LP) and High-Speed (HS) Signaling



*LVCMOS = Low-Voltage Complementary Metal Oxide Semiconductor Logic

Switching Challenges on ATE

Integrated Driver



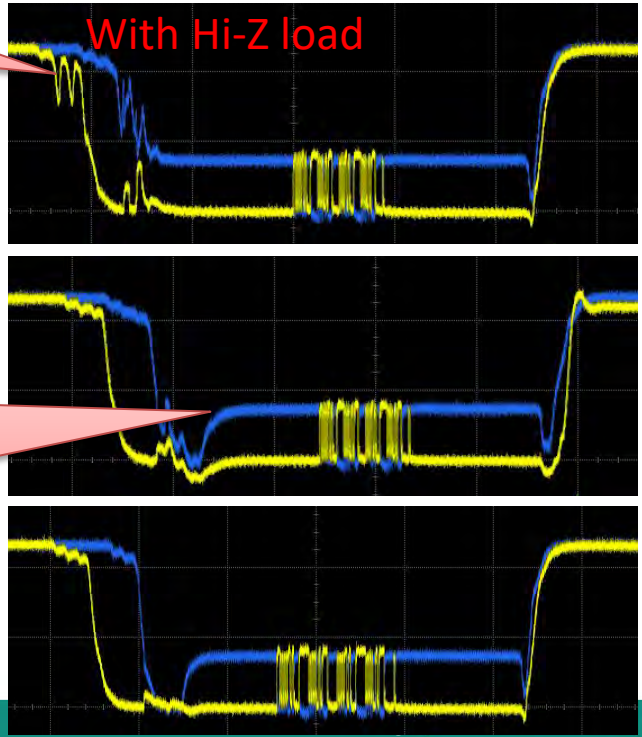
Switch timing & charge injection cause poor timing control

Proper D-PHY LP/HS transition

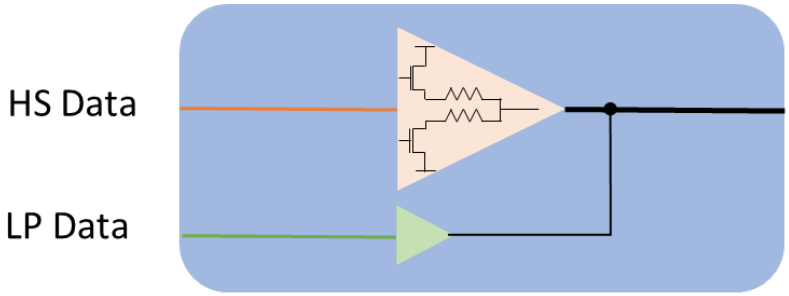
Challenges exist because of receiver switchable termination as well

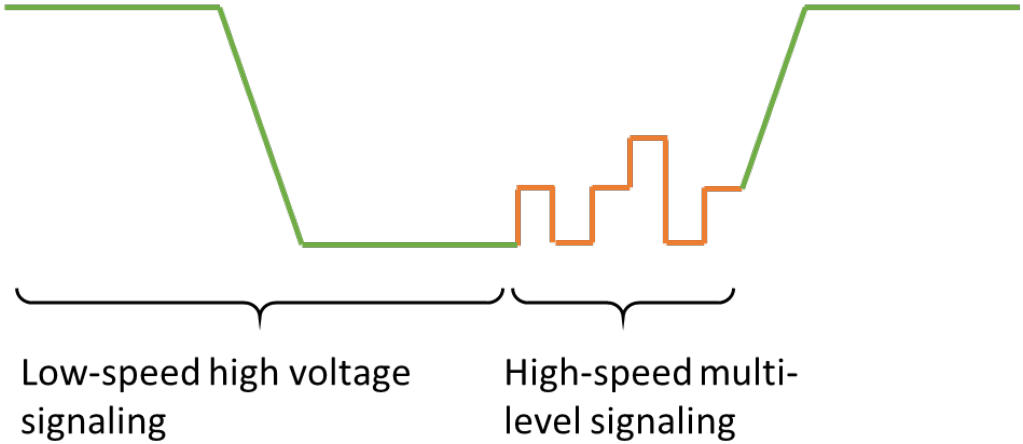
Proper C-PHY LP/HS transition

Conventional Switch-Based Solution



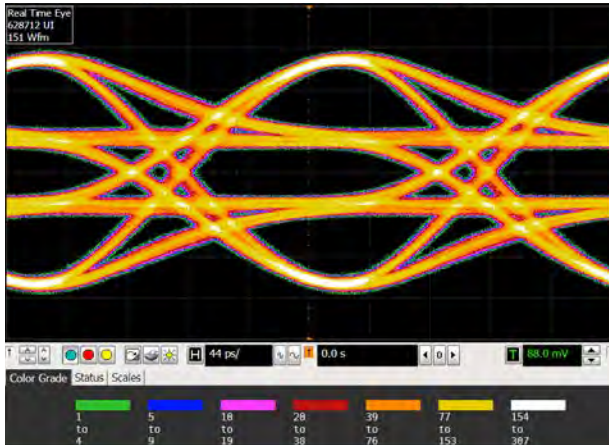
Multi-Level HS Drivers and Comparators



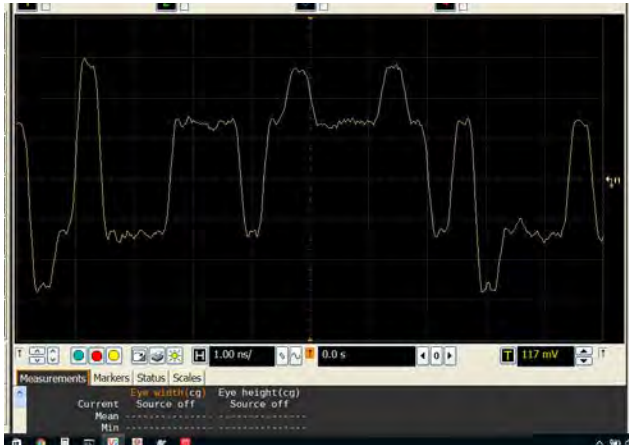


Equalization Waveforms

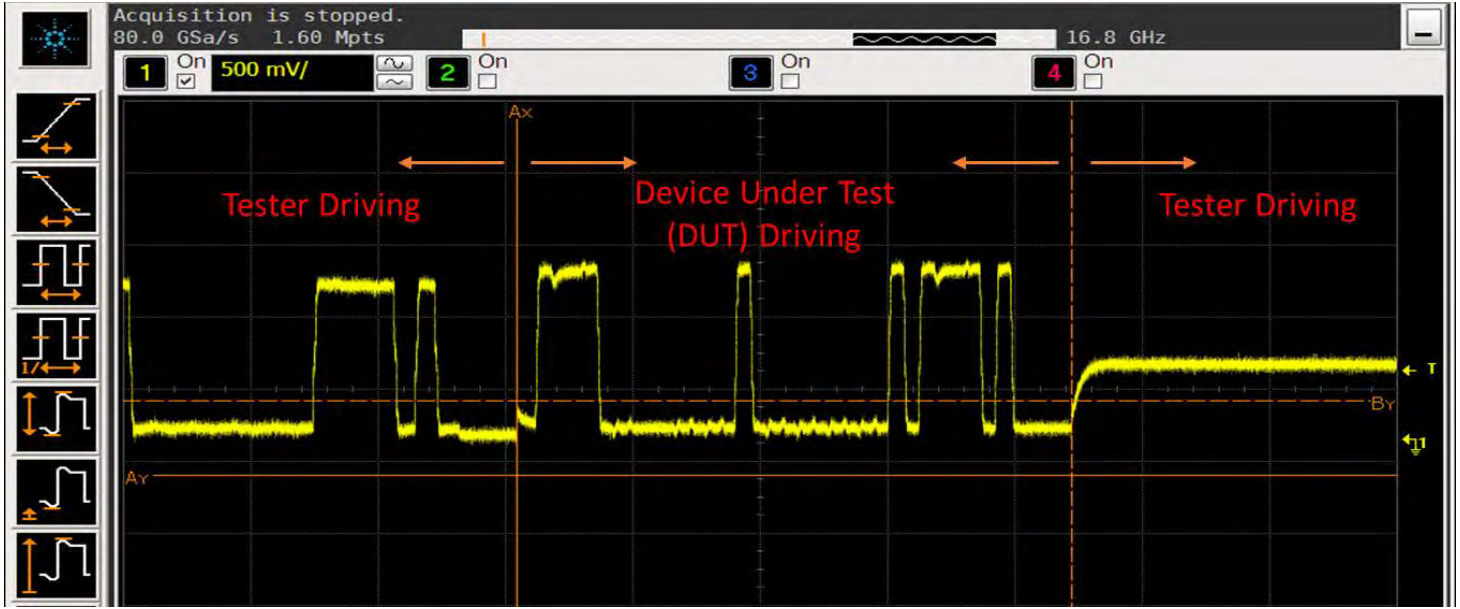
D-PHY



C-PHY

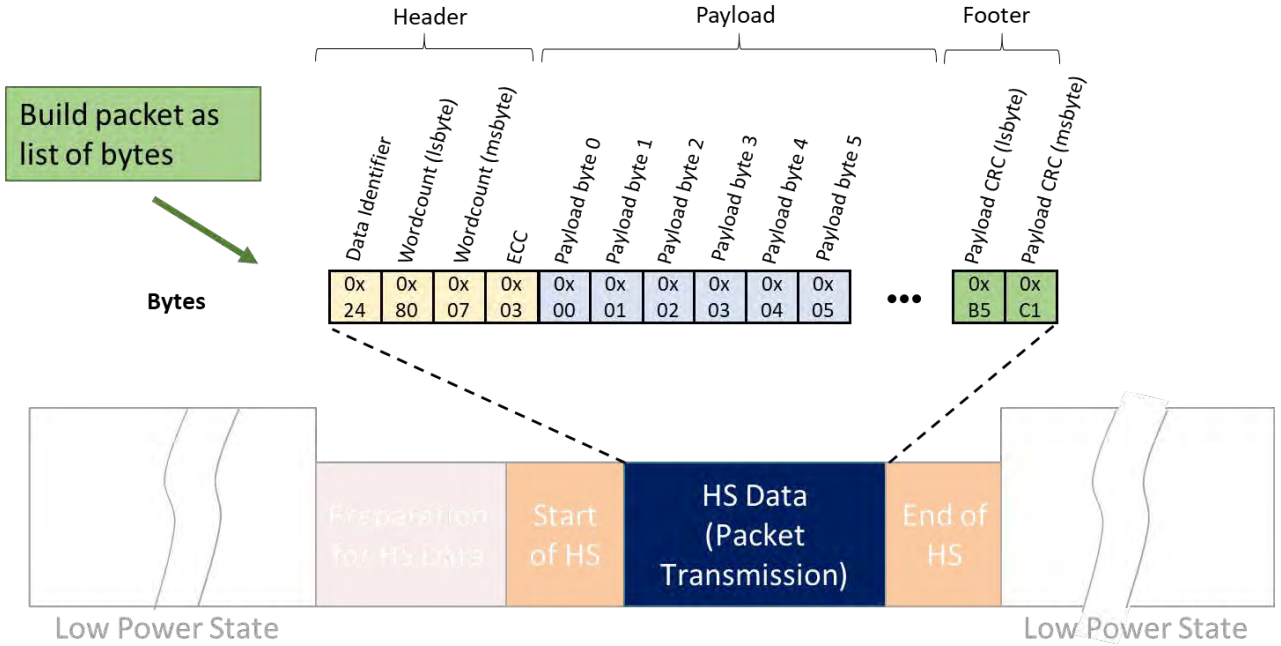


Bidirectional Bus Control



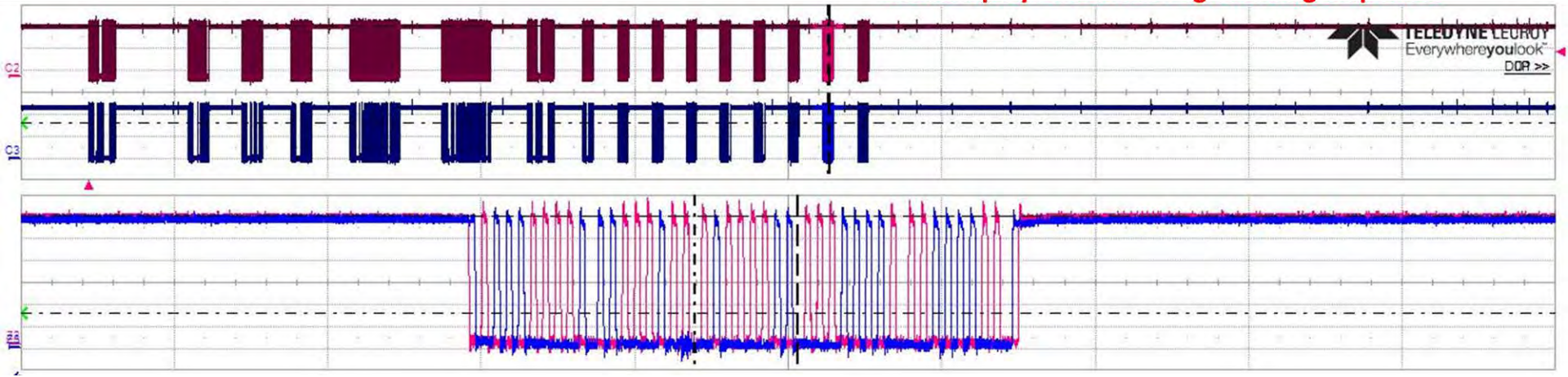
Protocol Requirements

Packet Based Communication



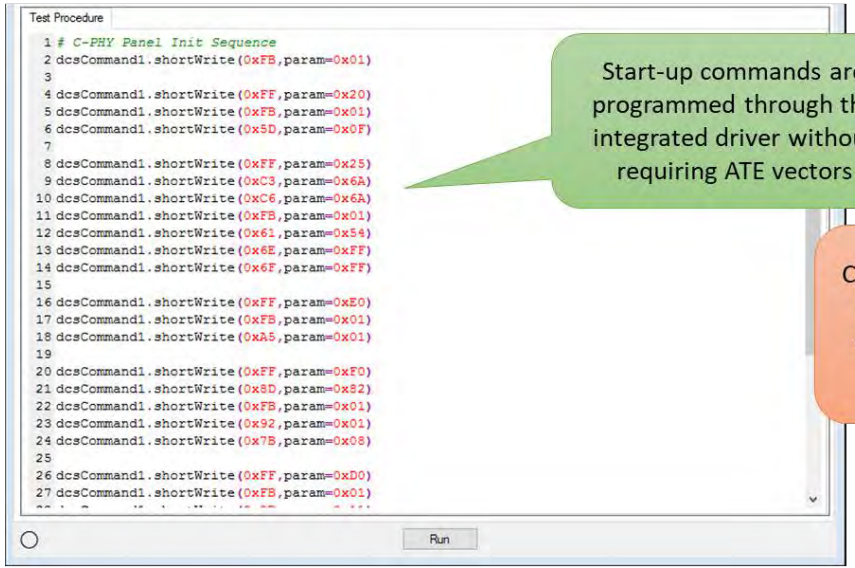
DUT Configuration Through the MIPI Bus

Real Display Driver IC Programming Sequence



Functional Testing on ATE

Protocol-Based Test Solution



Start-up commands are programmed through the integrated driver without requiring ATE vectors

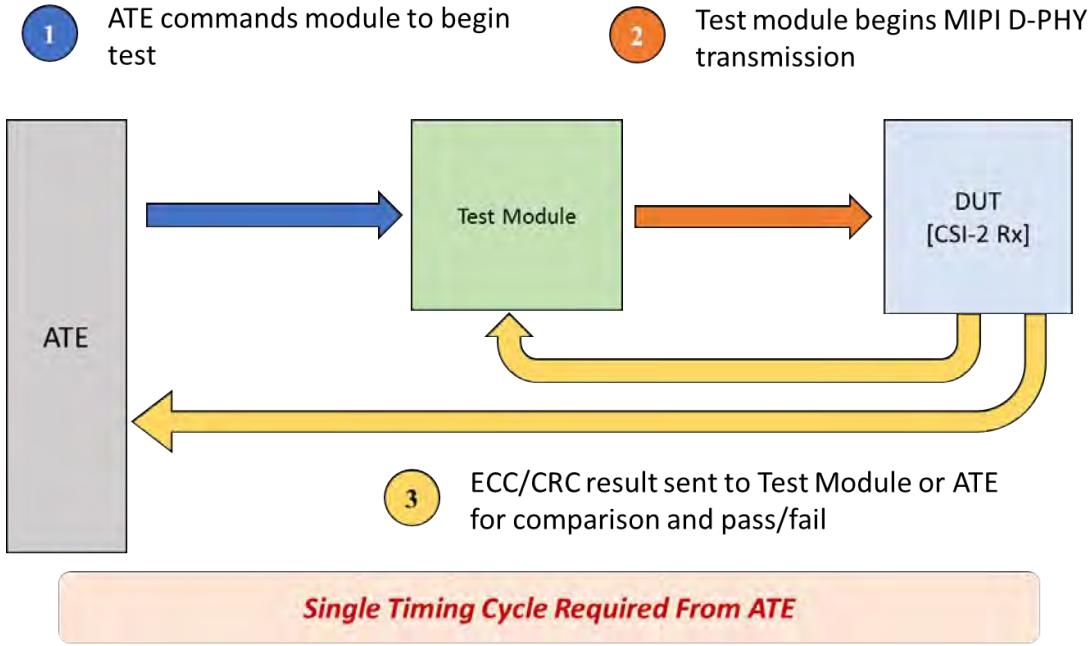
Conventional Switch-Based Solution

```
FORMAT gpio_89 gpio_92 gpio_90 gpio_91 gpio_135 gp
R3  tset1 1X1111111100010000000001000100000100;
R1  tset1 1X0100000000000000010000001001101001;
R40 tset1 1X11XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;
    t1 1X11HLHLLLLLLLHLLLHLLLHLLLLLLLLLLLL;
    1 1X00XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;
    1 1X11XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX;
      1X1111111100010000000001000100000100;
R1  tset1 1X1000000000000000010000001001101001;
R1 tset1 1X1110100000001000100010000000000000;
R1 tset1 1X1110100000001000100010000000000000;
```

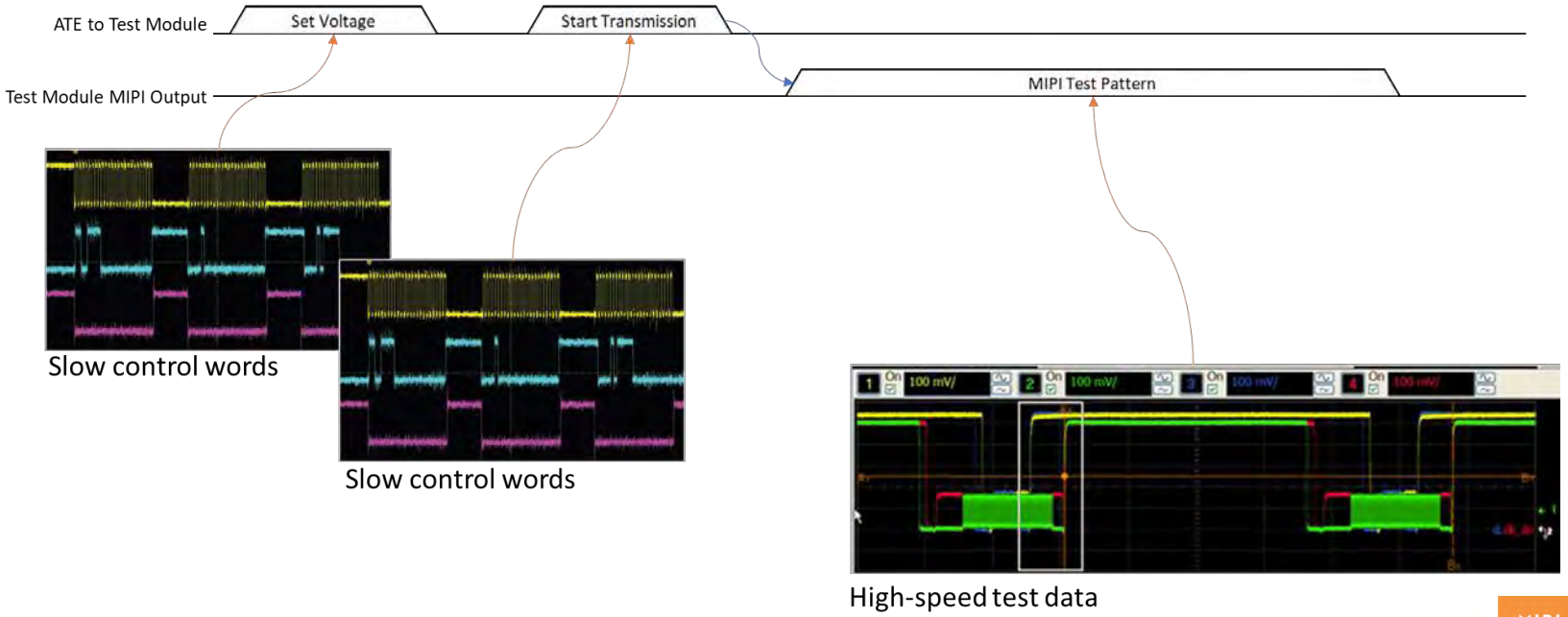
Cumbersome nature of ATE vectors often forces test engineers to choose very limited test coverage

System-Oriented Testing and Case Studies

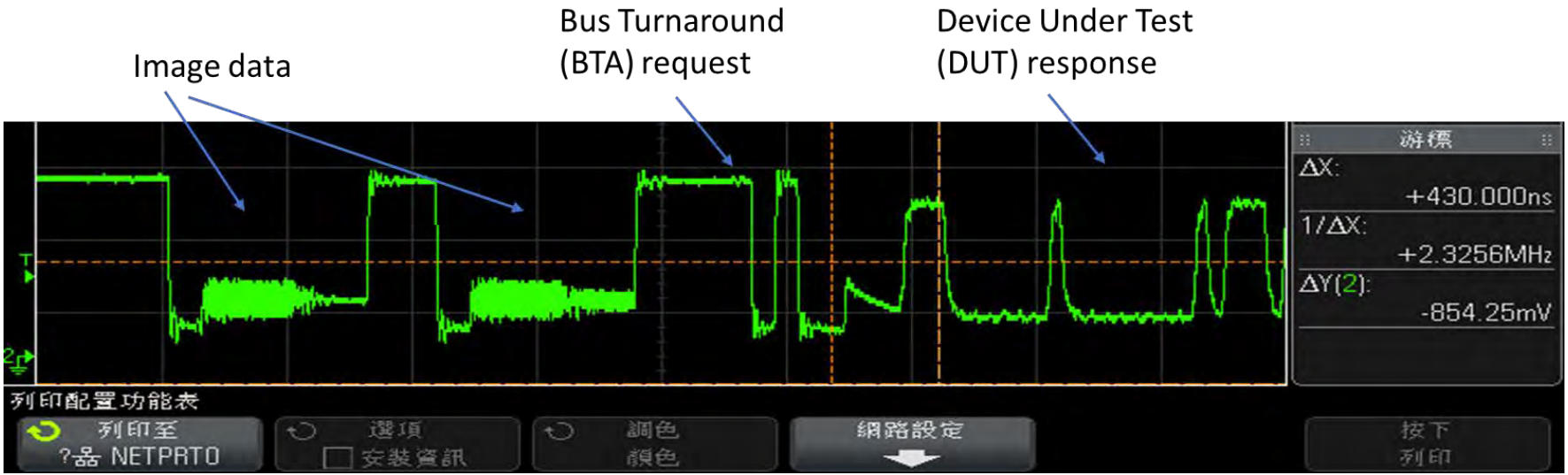
Microcontroller CSI-2 Input Test



Microcontroller CSI-2 Input Test

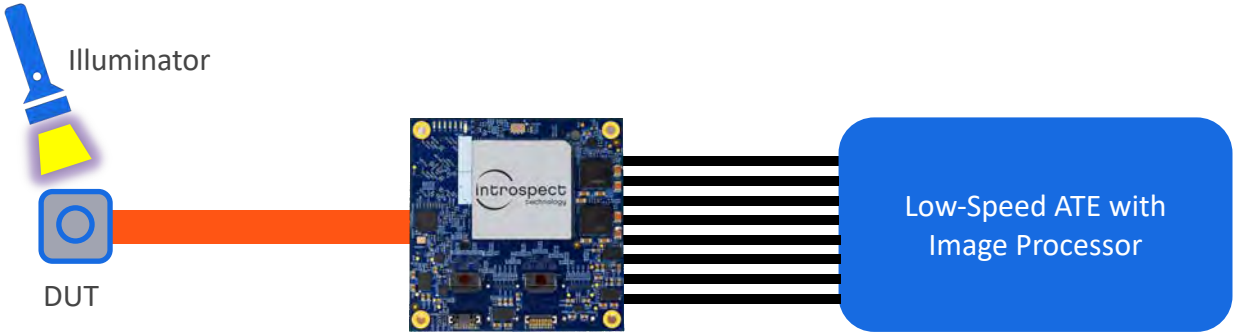


DDIC* with Integrated Device Response Checking



*DDIC = Display Driver IC

Image Sensor Test



Summary

- Increasing requirements have emerged for at-speed testing of MIPI-based devices
- System-like solutions are being developed by manufacturers of microcontrollers, image sensors, display drivers, and storage devices
- Hardware and protocol requirements for enabling the test of such solutions have been described in this presentation

ADDITIONAL RESOURCES

- https://introspect.ca/
  - Total solutions for most high-speed interface technologies
- https://introspect.ca/products-solutions/high-volume-manufacturing-test/
  - Solutions for at-speed testing during mass production
- https://introspect.ca/products-solutions/mipi-camera-and-imaging/
  - Image sensor test and validation solutions
- https://introspect.ca/products-solutions/mipi-display-and-touch/
  - Display test and validation solutions

introspect technology

https://introspect.ca


mipi®
DEVCON
THANK
YOU
MIPI ALLIANCE
DEVELOPERS
CONFERENCE
TAIPEI
18 OCTOBER 2019
MIPI.ORG/DEVCON