



PCI Express Test

PCI Express Evolution and Challenges

PCIe Version	1.0a	1.1	2.0	3.0
Data Rate	2.5 Gbps per lane	2.5Gbps per lane	5.0 Gbps per lane	8.0 Gbps per lane
Data Encoding	8b/10b	8b/10b	8b/10b	Scrambling
Challenges	Transmitter test	Transmitter test	Receiver test	Receiver test, scrambling

Broadly adopted standard for high performance data links

Finding adoption in embedded applications and diverse environments

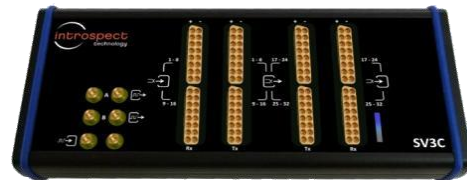
Physical layer test requirements are largely unchanged

Larger need for system-level protocol exerciser tests

Introspect Solutions for PCI Express



SV1C



SV3C



SV1D

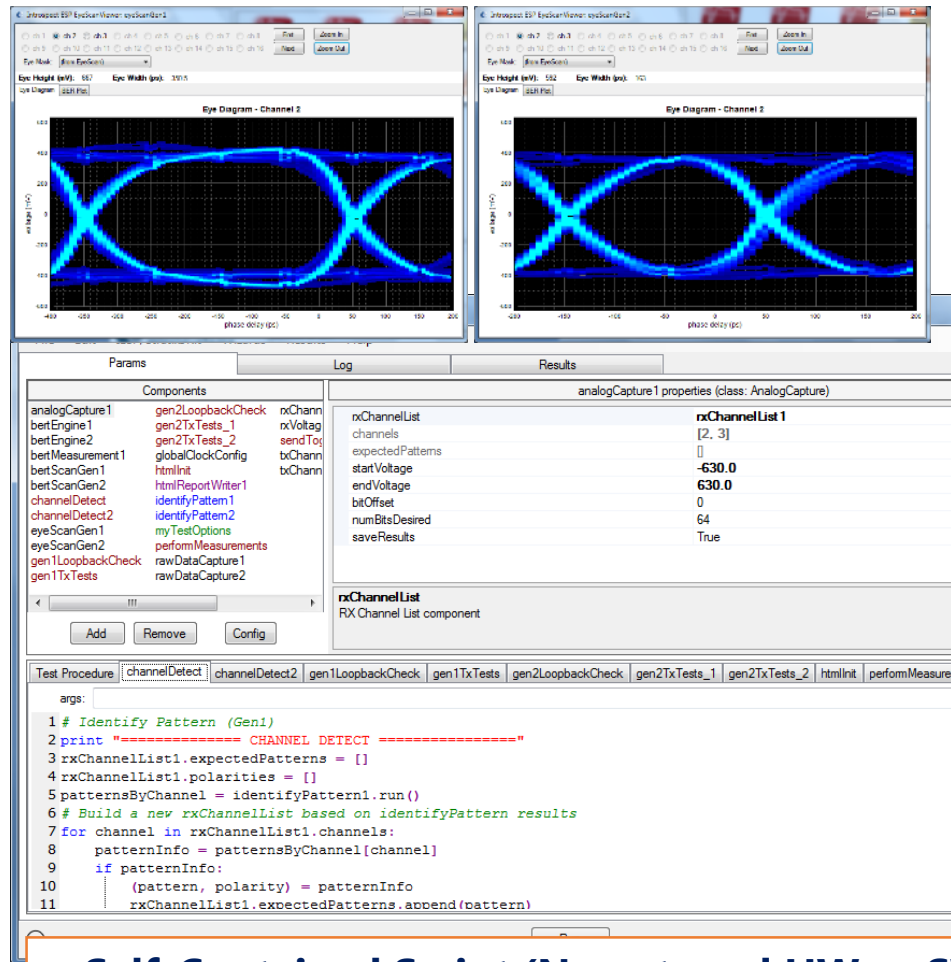


SV3D

SV1C	SV3C	SV1D	SV3D
Benchtop tool / connects with DUT through cables	Benchtop tool / connects with DUT through cables	Tester on board / tester on backplane (no cables)	Tester on board / tester on backplane (no cables)
8 Lanes (Tx/Rx) + Clock	32 Lanes (Tx/Rx) + Clock	8 Lanes (Tx/Rx)	32 Lanes (Tx/Rx)
<ul style="list-style-type: none"> • Component phy-level validation • Component phy-level validation on CBB* • Add-in card phy-level validation on CBB* • System-level (protocol) exerciser test 	<ul style="list-style-type: none"> • Component phy-level validation • Component phy-level validation on CBB* • Add-in card phy-level validation on CBB* • System-level (protocol) exerciser test 	<ul style="list-style-type: none"> • Component phy-level production test on ATE • Board-level test on backplane • System-level (protocol) exerciser test 	<ul style="list-style-type: none"> • Component phy-level production test on ATE • Board-level test on backplane • System-level (protocol) exerciser test

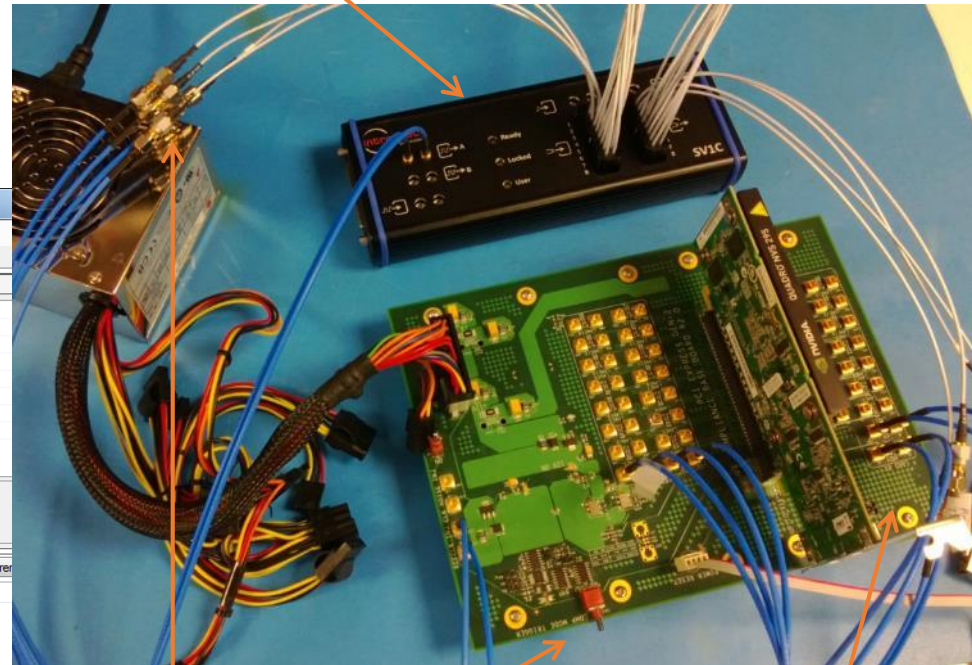
*CBB: Compliance Base Board (sold by PCI-SIG). Standard test board with cable connectors.

Bench-Top Setup (with CBB)



Self-Contained Script (No external HW or SW)

SV1C Tester (driving PCIe Ref Clock on CBB)



CBB

PCIe Test of x2 Lane Tx and Rx

Bench-Top Setup (with CBB)

Self-contained tester allows for both Tx and Rx verification

Receiver jitter tolerance test

Transmitter eye opening test

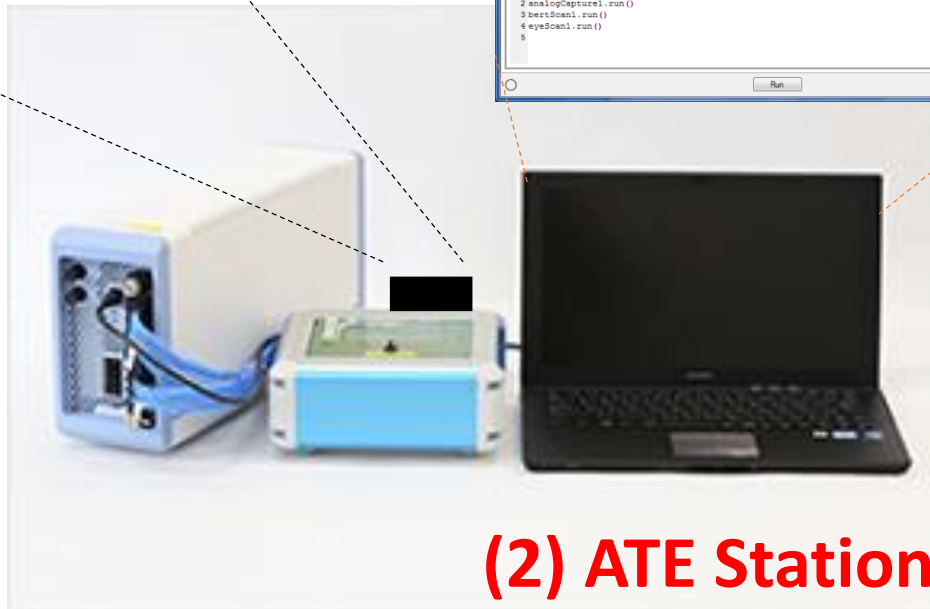
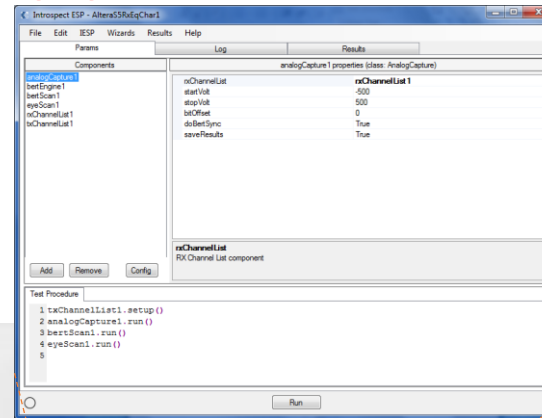
System-level (exerciser) protocol test

ATE Setup

(1) SV1D on Board



(5) IESP GUI



(2) ATE Station

Self-contained tester allows
for both Tx and Rx
verification

Receiver jitter tolerance test

Transmitter eye opening test

System-level (exerciser)
protocol test

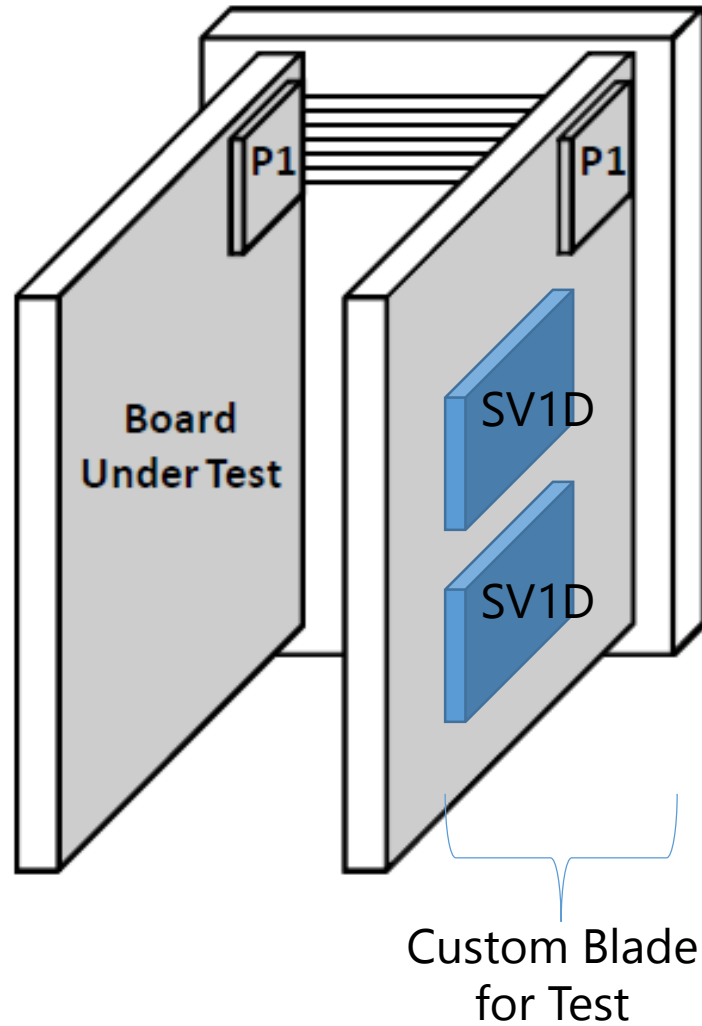
Embedded/Backplane with Cable Instrument Setup

Custom enclosure
designed by customer



Backplane under test

Embedded/Backplane with Tester on Board Setup

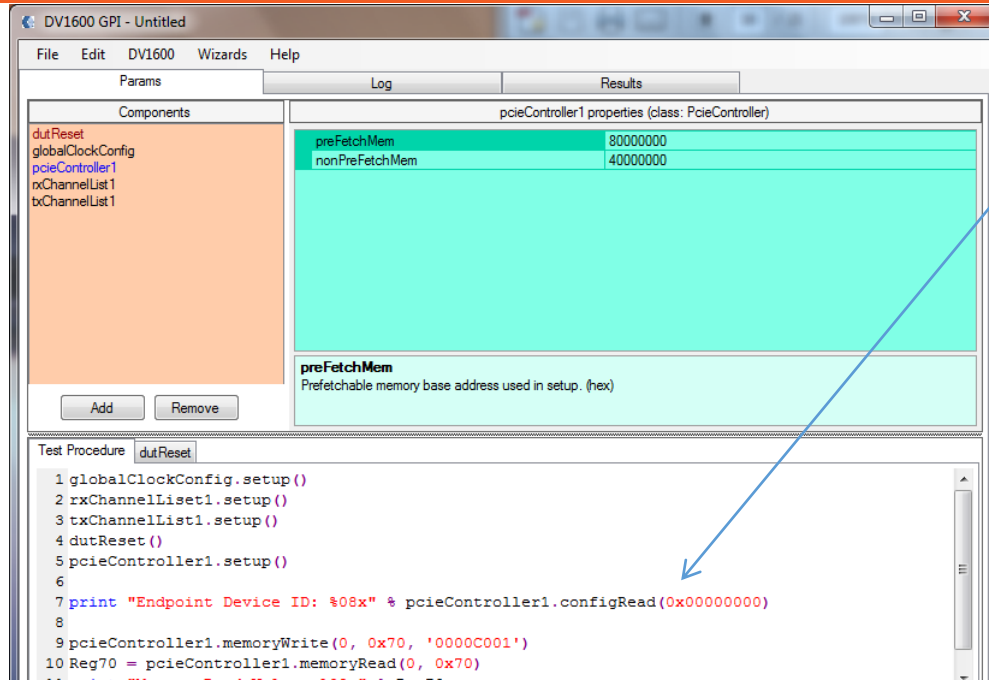


- SV1D/SV3D: "Test Card"
 - 8/32 lane, 14 Gbps – Mezzanine Module
 - Removable and Reusable
 - **Application PCB or ATE PCB**

Bottom View (smaller than iphone 5S)

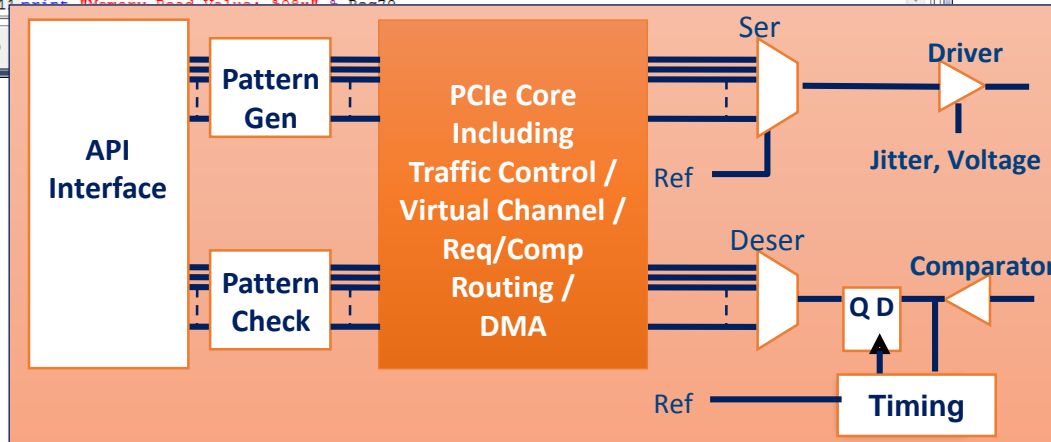


System-Level Exerciser Test



Script-based Read/write testing and result logging

```
# Check that the PLLs are locked
CSR_READ_CHECK 0x001d8004 0x58000013
CSR_READ_CHECK 0x001d8014 0x0000621f
CSR_READ_CHECK 0x001d8018 0x58000002
CSR_READ_CHECK 0x001d8024 0x58000002
CSR_READ_CHECK 0x001d8030 0x58000013
CSR_READ_CHECK 0x001d803c 0x58000013
CSR_READ_CHECK 0x001d8048 0x58000013
CSR_READ_CHECK 0x001d8054 0x58000013
# Read out JTAG ID register.
# Diags normally checks with a mask on the top nibble
CSR_READ_CHECK 0x001C0090 0x2033D049
# Read out PCIe ID and check
CSR_READ_CHECK 0x001CD000 0x002A1137
# Walking bits test on: HKP PCIe
# Step 1: write all ones and read back
CSR_WRITE 0x001CC480 0xFFFFFFFF
CSR_READ_CHECK 0x001CC480 0xFFFFFFFF
# Step 2: write all zeros and read back
CSR_WRITE 0x001CC480 0x00000000
CSR_READ_CHECK 0x001CC480 0x00000000
# Step 3: write 12-bits and check
CSR_WRITE 0x001CC480 0x00000001
CSR_READ_CHECK 0x001CC480 0x00000001
CSR_WRITE 0x001CC480 0x00000002
CSR_READ_CHECK 0x001CC480 0x00000002
CSR_WRITE 0x001CC480 0x00000004
CSR_READ_CHECK 0x001CC480 0x00000004
CSR_WRITE 0x001CC480 0x00000008
CSR_READ_CHECK 0x001CC480 0x00000008
CSR_WRITE 0x001CC480 0x00000010
CSR_READ_CHECK 0x001CC480 0x00000010
CSR_WRITE 0x001CC480 0x00000020
CSR_READ_CHECK 0x001CC480 0x00000020
CSR_WRITE 0x001CC480 0x00000040
CSR_READ_CHECK 0x001CC480 0x00000040
CSR_WRITE 0x001CC480 0x00000080
CSR_READ_CHECK 0x001CC480 0x00000080
CSR_WRITE 0x001CC480 0x00000100
CSR_READ_CHECK 0x001CC480 0x00000100
CSR_WRITE 0x001CC480 0x00000200
CSR_READ_CHECK 0x001CC480 0x00000200
CSR_WRITE 0x001CC480 0x00000400
CSR_READ_CHECK 0x001CC480 0x00000400
CSR_WRITE 0x001CC480 0x00000800
CSR_READ_CHECK 0x001CC480 0x00000800
CSR_WRITE 0x001CC480 0x00001000
CSR_READ_CHECK 0x001CC480 0x00001000
CSR_WRITE 0x001CC480 0x00002000
CSR_READ_CHECK 0x001CC480 0x00002000
CSR_WRITE 0x001CC480 0x00004000
CSR_READ_CHECK 0x001CC480 0x00004000
CSR_WRITE 0x001CC480 0x00008000
CSR_READ_CHECK 0x001CC480 0x00008000
CSR_WRITE 0x001CC480 0x00010000
CSR_READ_CHECK 0x001CC480 0x00010000
CSR_WRITE 0x001CC480 0x00020000
CSR_READ_CHECK 0x001CC480 0x00020000
CSR_WRITE 0x001CC480 0x00040000
CSR_READ_CHECK 0x001CC480 0x00040000
CSR_WRITE 0x001CC480 0x00080000
CSR_READ_CHECK 0x001CC480 0x00080000
CSR_WRITE 0x001CC480 0x00100000
CSR_READ_CHECK 0x001CC480 0x00100000
CSR_WRITE 0x001CC480 0x00200000
CSR_READ_CHECK 0x001CC480 0x00200000
CSR_WRITE 0x001CC480 0x00400000
CSR_READ_CHECK 0x001CC480 0x00400000
CSR_WRITE 0x001CC480 0x00800000
CSR_READ_CHECK 0x001CC480 0x00800000
CSR_WRITE 0x001CC480 0x01000000
CSR_READ_CHECK 0x001CC480 0x01000000
CSR_WRITE 0x001CC480 0x02000000
CSR_READ_CHECK 0x001CC480 0x02000000
CSR_WRITE 0x001CC480 0x04000000
CSR_READ_CHECK 0x001CC480 0x04000000
CSR_WRITE 0x001CC480 0x08000000
CSR_READ_CHECK 0x001CC480 0x08000000
CSR_WRITE 0x001CC480 0x10000000
CSR_READ_CHECK 0x001CC480 0x10000000
CSR_WRITE 0x001CC480 0x20000000
CSR_READ_CHECK 0x001CC480 0x20000000
CSR_WRITE 0x001CC480 0x40000000
CSR_READ_CHECK 0x001CC480 0x40000000
CSR_WRITE 0x001CC480 0x80000000
CSR_READ_CHECK 0x001CC480 0x80000000
CSR_WRITE 0x001CC480 0x00000000
CSR_READ_CHECK 0x001CC480 0x00000000
```



Summary

Introspect offers SerDes transmitter and receiver test solutions that are well-suited for PCI Express validation and production

Tools allow for ultra-compact and low cost setups

Introspect product form factor options allows for deployment in embedded applications such as VPX, ATCA

Thank You!

www.introspect.ca