100G VPX Optimization and Interoperability (or How to Live la Vida MOSA for 100G)

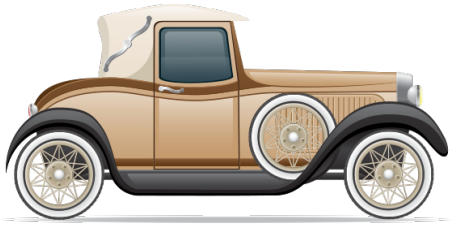
ETT 2023

Ivan Straznicky

Curtiss-Wright Defense Solutions

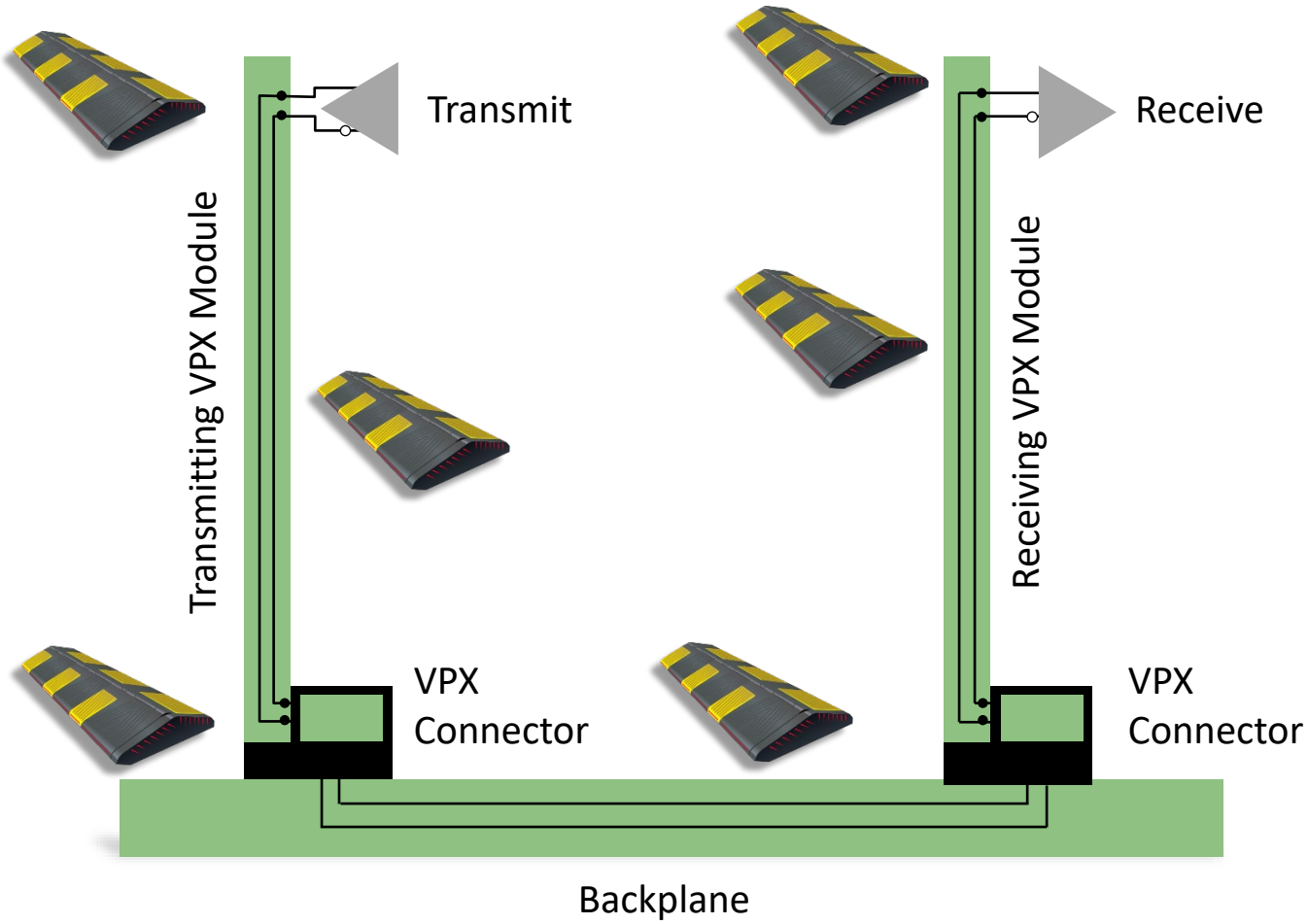
100G VPX and How We Got Here

VPX Gen 1	VPX Gen 2	VPX Gen 3	VPX Gen 4	VPX Gen 5
2.5- 3.125 Gbaud/sec/lane	**5-6.25** Gbaud/sec/lane	**8-10** Gbaud/sec/lane	**16** Gbaud/sec/lane	**25** Gbaud/sec/lane
RapidIO	IEEE	InfiniBand Trade Association	PCI Express	IEEE 100G KR-4

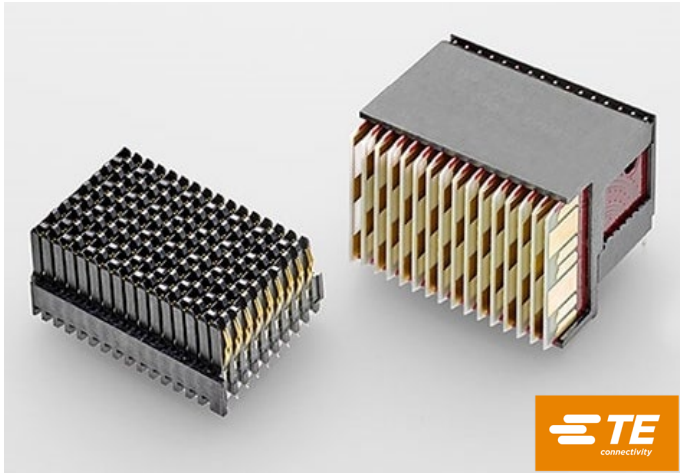


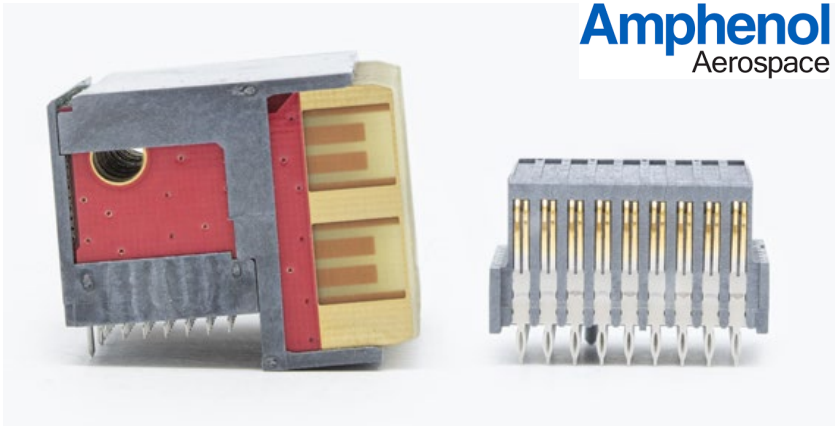
Embedded TechTrends

The VPX Transmission Channel



VPX Connectors for 100G





ANSI/VITA 46.30-2020 (Higher Data Rate VPX)

VPX Gen 6

32
Gbaud/sec/lane

PCI EXPRESS® 5.0

VPX Gen 7

50
Gbaud/sec/lane

IEEE
200G KR-4

How to build successful, interoperable, high speed MOSA VPX systems

VPX Gen 3 (8-10G/lane)

VITA
Open Standards, Open Markets

Approved ANSI Standard

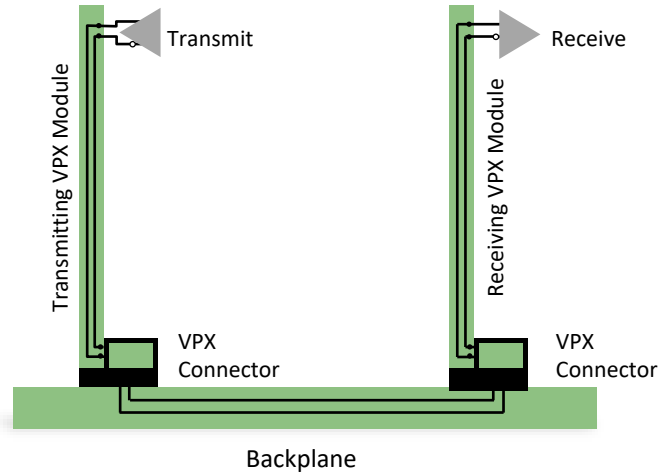
ANSI/VITA 68.1-2017

VPX Compliance Channel - Fixed Signal Integrity Budget Standard

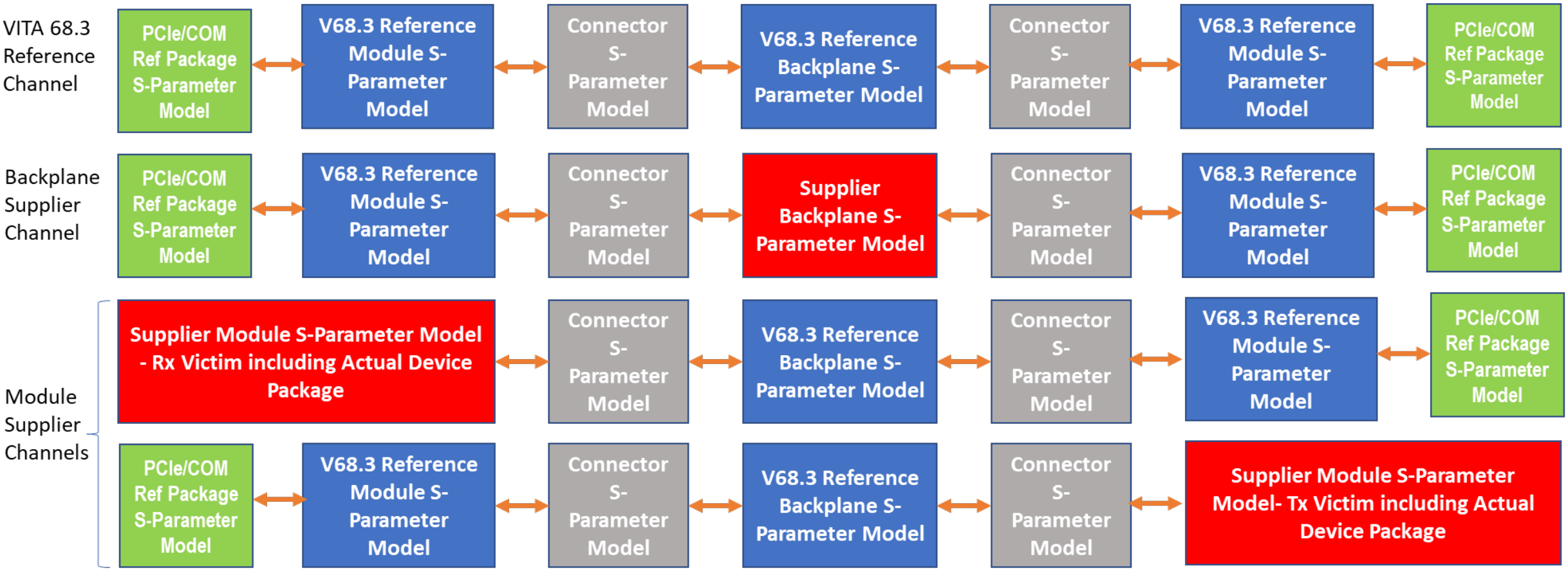
VPX Gen 4-5 (16-25G/lane)

VITA 68.3 (Working Group)

Reference SI Model Standard for Gen4 and Higher Speeds

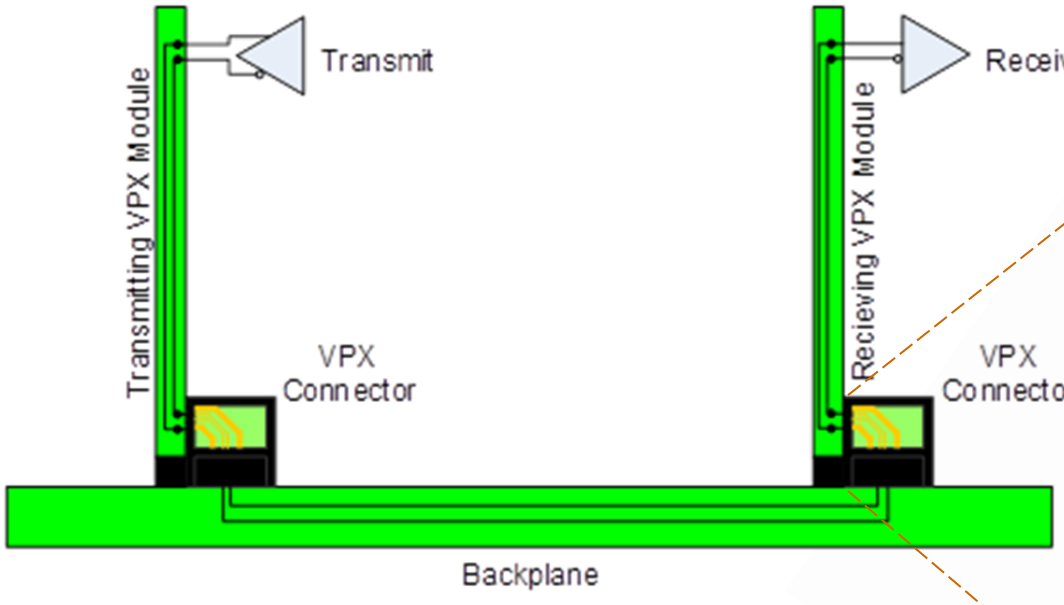


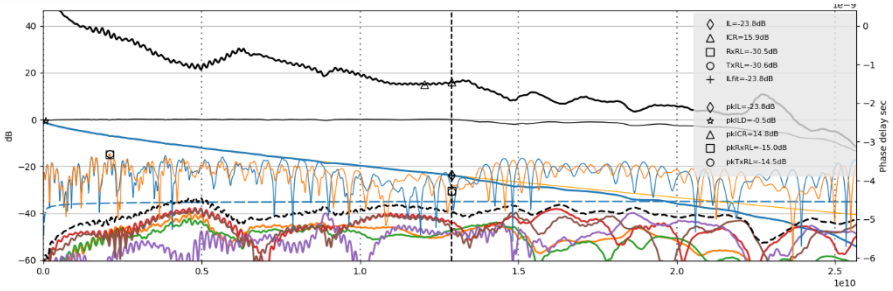
Looking under the hood…



VITA 68.3 Modular Open Standards Approach for 100G Interoperability

Looking under the hood…





S-parameters

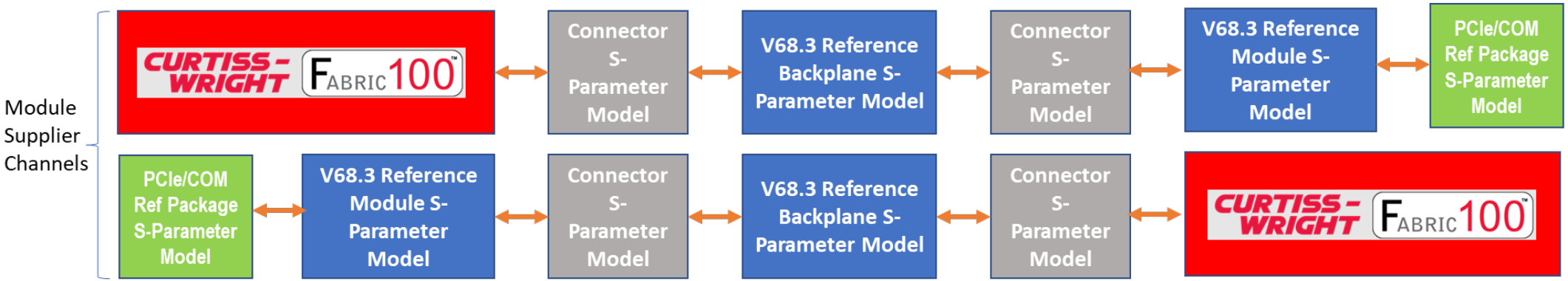
3D Electromagnetic Model

What is a “good” channel?

$$COM = 20\log10(As/Ani) > 3 \text{ dB (IEEE 802.3)}$$

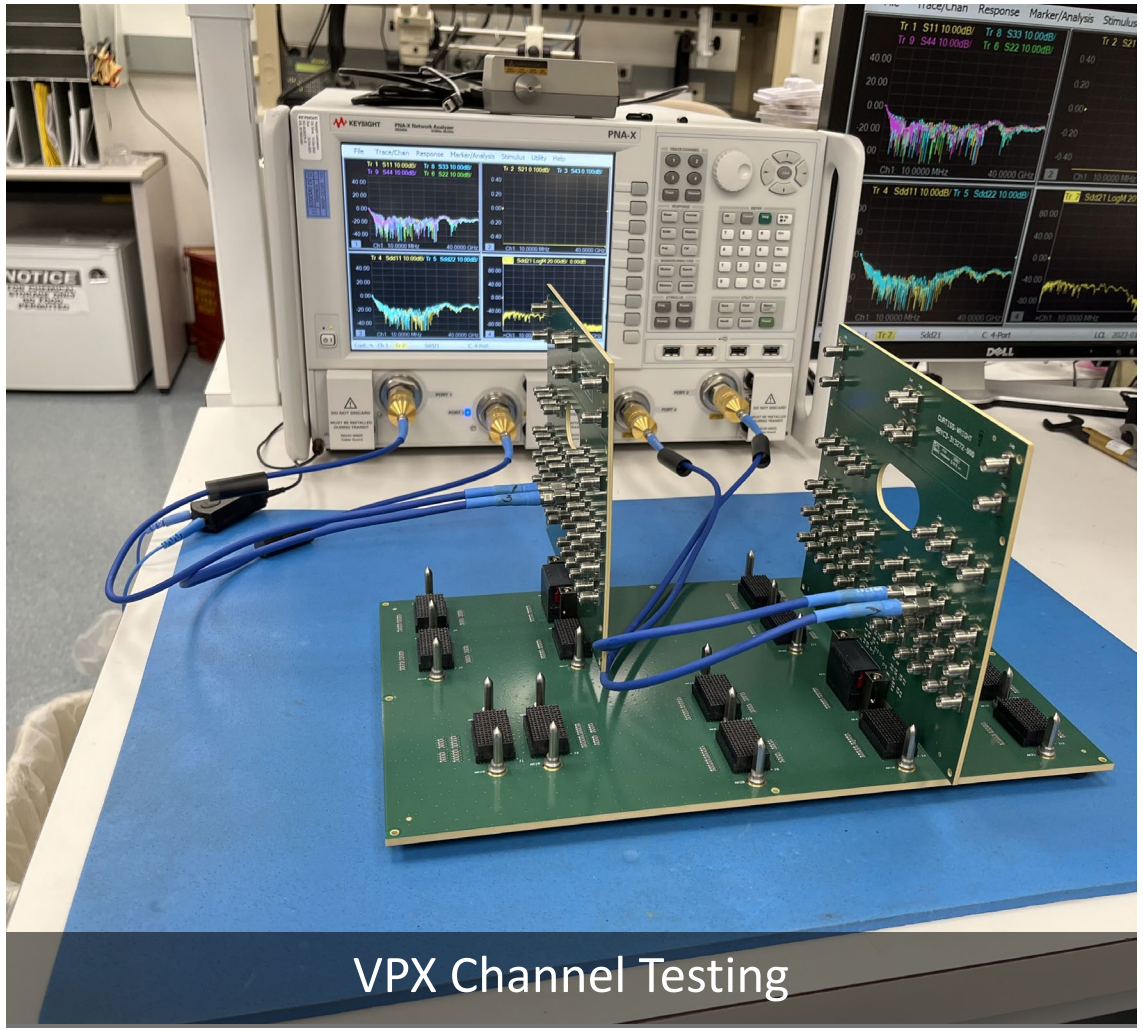
$$COM = 20\log10(As/Ani) > 3.5 \text{ dB (VITA 68.3)}$$

Example COM results



VITA 68.3 Channel Type	VITA 68.3 Reference Backplane	VITA 68.3 Reference Module	CW Module Position	COM Results (Pass >3.5 dB)
Reference Long Lossy	16 inch, Low Impedance, Medium via	6 inch, High Impedance, Long via	**BC diff pair, Rx victim**	**>4.5 dB**
Reference Long Lossy	16 inch, Low Impedance, Medium via	6 inch, High Impedance, Long via	**BC diff pair, Tx victim**	**>3.75 dB**
Reference Med-Long Lossy	12 inch, Low Impedance, Long via	6 inch, High Impedance, Long via	**BC diff pair, Rx victim**	**>4.25 dB**
Reference Med-Long Lossy	12 inch, Low Impedance, Long via	6 inch, High Impedance, Long via	**BC diff pair, Tx victim**	**>3.75 dB**

More COM results



VPX Channel Testing

- COM results validated with two rounds of VPX Channel testing and optimization
- Correlation exercise between simulations and testing revealed several areas of discrepancy
  - E.g. copper trace impedance variation
- Simulations are now much more accurate and allow for confident what-if analyses
- 100G products will benefit substantially

CURTISS-WRIGHT FABRIC 100™

Greater Connectivity for Data-Centric Digital Convergence

A-PNT

Mission Computing

Radios

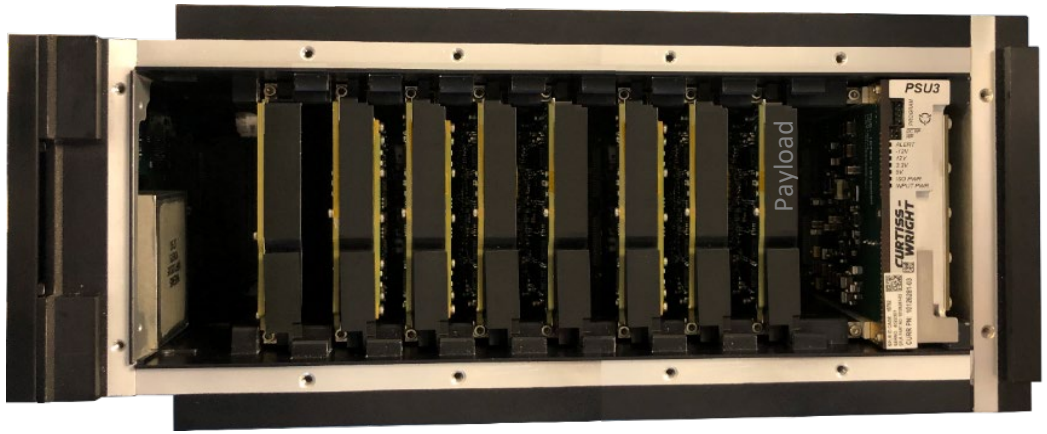
EW

Other Comms

Streaming Sensor Processing

Data-Centric Digital Convergence

VITA
Open Standards, Open Markets



CMOSS

SOSA™
Sensor Open Systems Architecture

Summary

100G VPX (Gen 5) results in much higher performance OpenVPX systems

Optimization of the 100G channel is required to achieve this high performance

- 3D electromagnetic simulations
- VPX channel testing
- Correlation between simulations and testing

Interoperability among modules and backplanes is essential for MOSA

- VITA 68.3 (Reference SI Model Standard for Gen4 and Higher Speeds)

Module, Backplane, and System 100G OpenVPX products

CURTISS-WRIGHT FABRIC 100™