

VITESSE

05-425r1

SAS-2 Channel Model Simulations


Kevin Witt


SAS-2 PHY Working Group


January 9, 2006



YOUR PARTNER FOR SUCCESS

-  SAS-2 Physical layer Specification must be driven by Representative Channels from the user base.
 - Chassis, Backplane & Cable connections

-  Expense of Equalizer (size, power ...) is directly proportional to the channel difficulty.

-  S-Parameter Sources Considered (Thank You)
 - Chassis, Backplane & Cable (HP, Dell and VTSS measurements)
 - iPASS™ (Molex and VTSS measurements)
 - Infiniband (VTSS measurements)

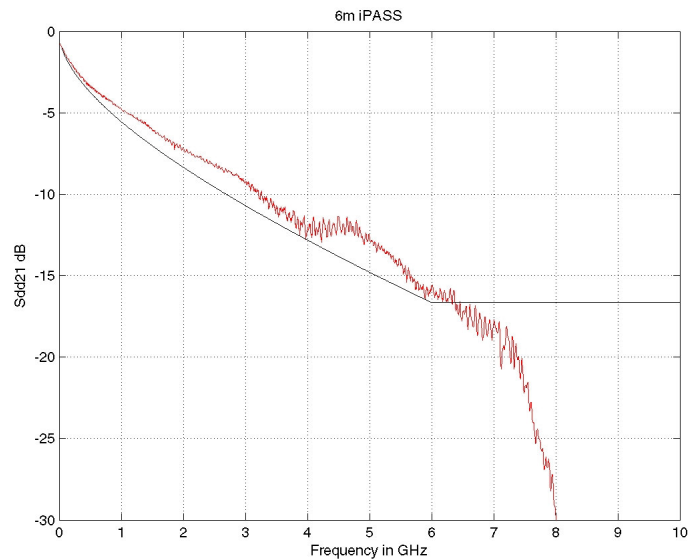
SAS-2 Channels Simulation Methodology

VITESSE

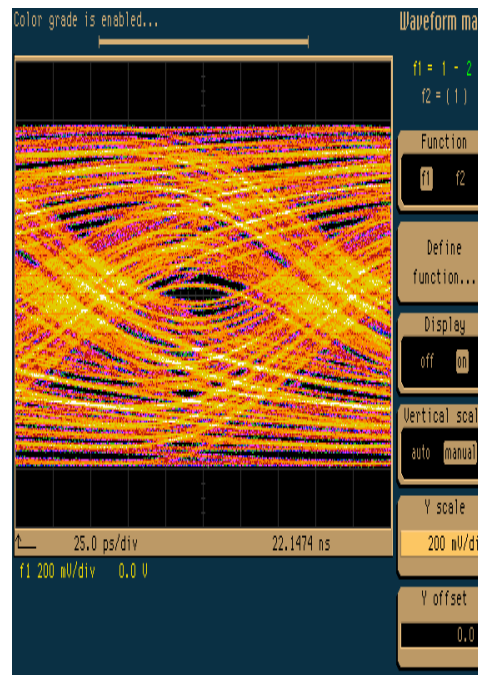
Simulation Approach

- Use Piece Wise Linear (PWL) file of transmitted waveforms (PRBS-7)
 - w/ & w/o De-Emphasis
- Use ideal Rx/Tx termination
- HSpice simulation of S-parameter File
- Comparison to measured when possible

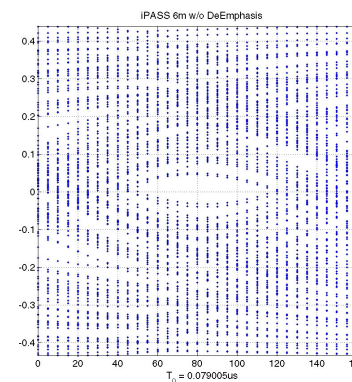
Example 6M iPASS™



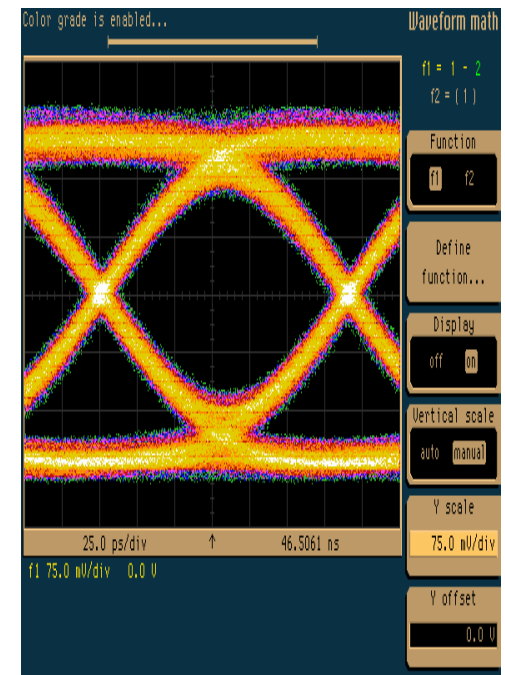
Measured Output w/o De-Emphasis



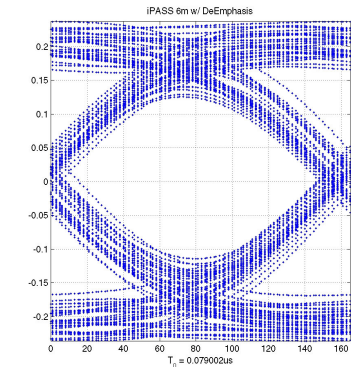
Simulated Output w/o De-Emphasis



Measured Output w/ De-Emphasis

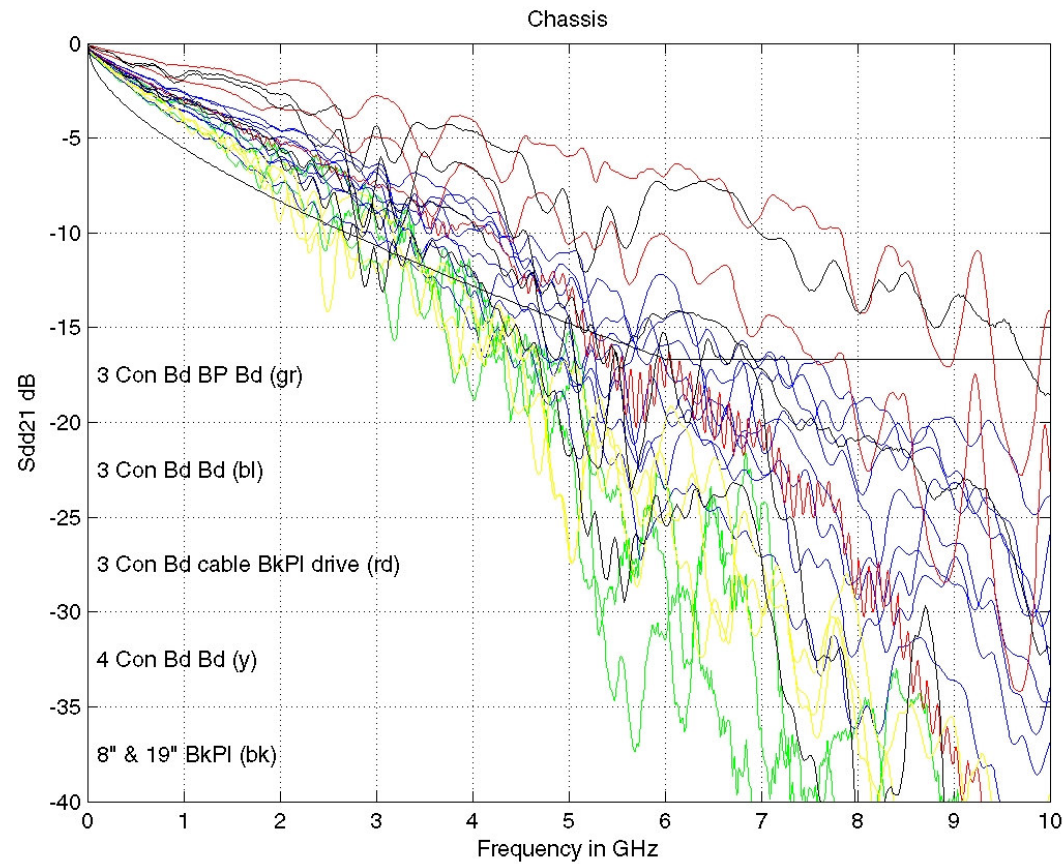


Simulated Output w/ De-Emphasis




Chassis S-Parameters

- 05-384r0, 05-390r0, 05-389r0, 5-393r0 & In House JBOD Chassis



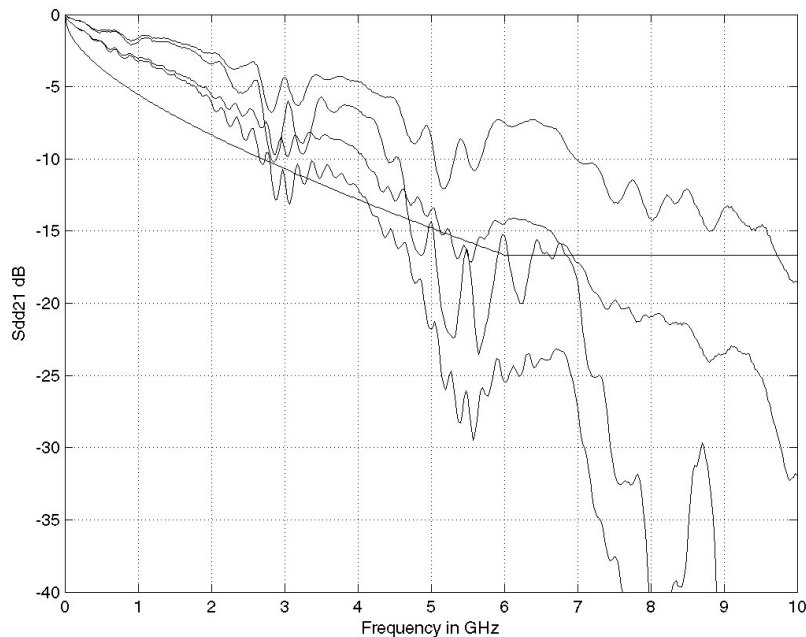
SAS-2 Channels Simulation Results

VITESSE

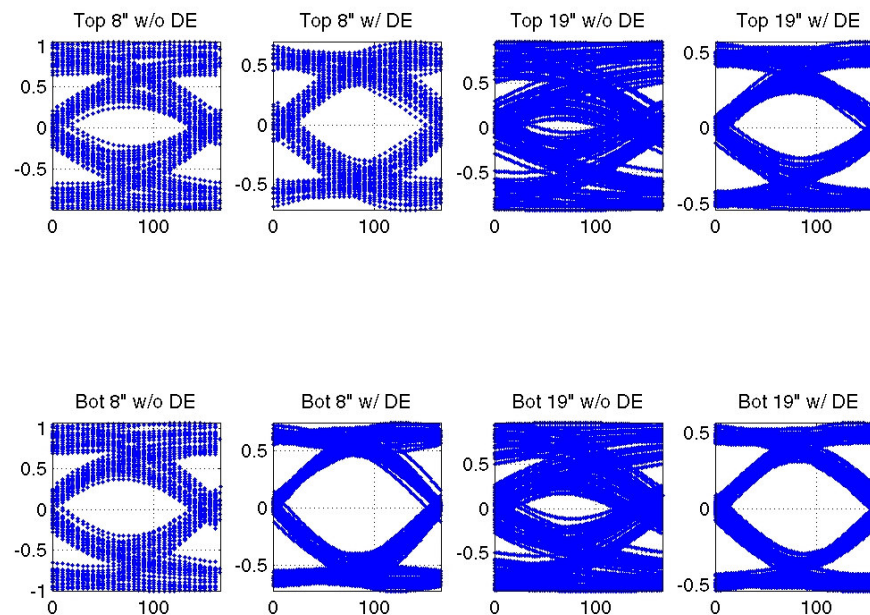
 Simulated Chassis 05-393r0 : 4 Boards 3 Mated Connectors

 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File



**Simulated Output
w/o & w/ De-Emphasis**



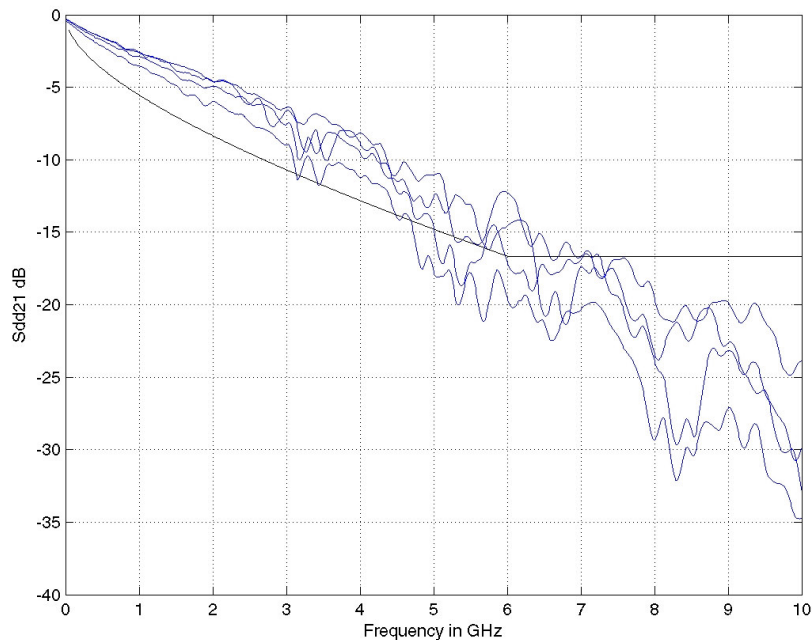
SAS-2 Channels Simulation Results

VITESSE

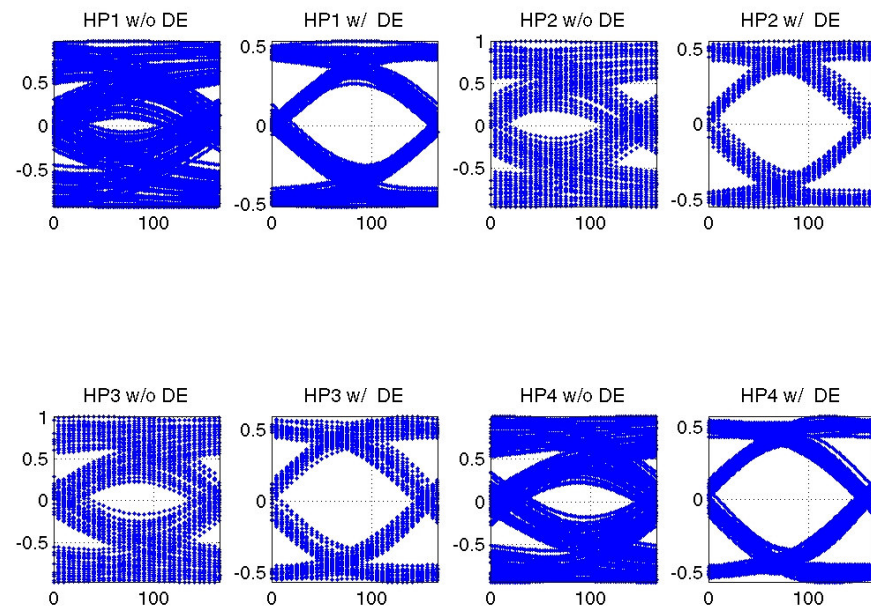
 Chassis Channels 05-384r0: 3 Connectors Board to Board (1 of 2)

 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File



**Simulated Output
w/o & w/ De-Emphasis**



SAS-2 Channels Simulation Results

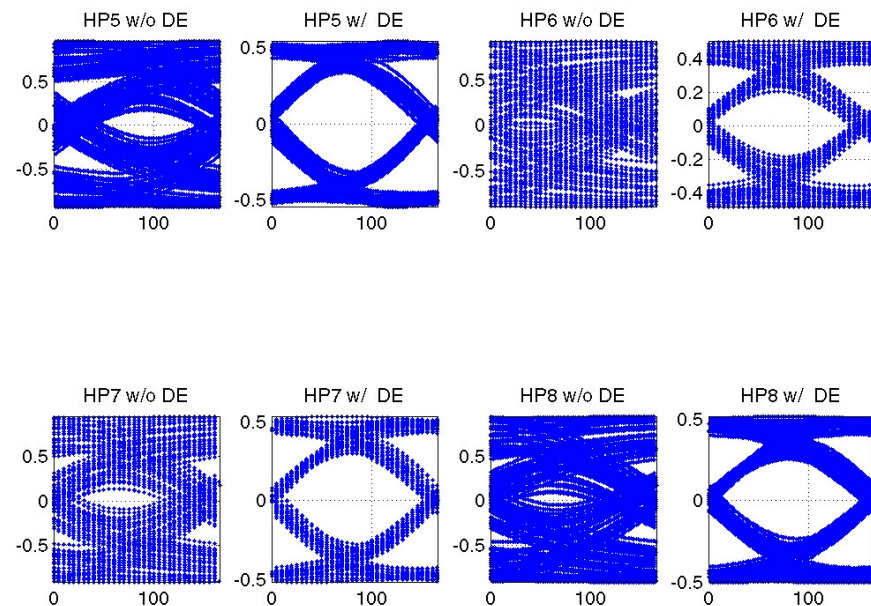
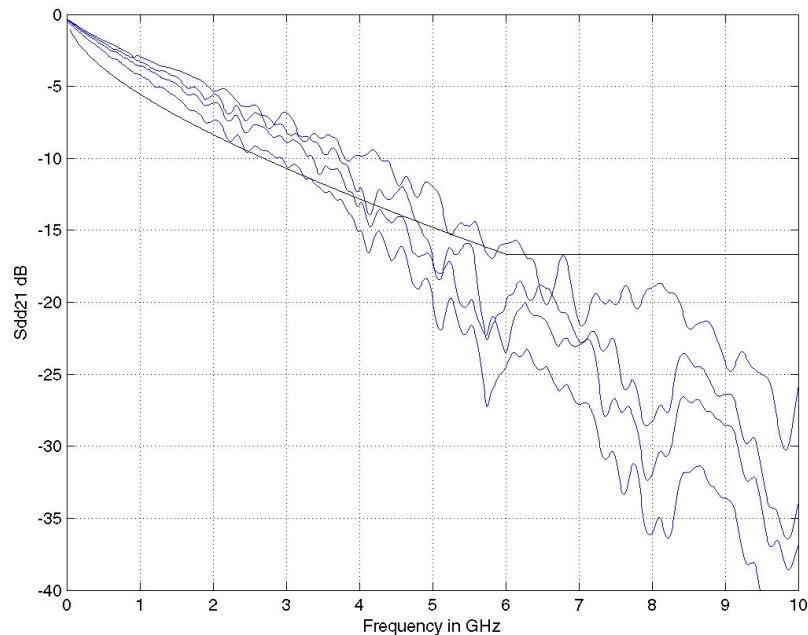
VITESSE

 Chassis Channels 05-384r0: 3 Connectors Board to Board (2 of 2)

 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File

**Simulated Output
w/o & w/ De-Emphasis**



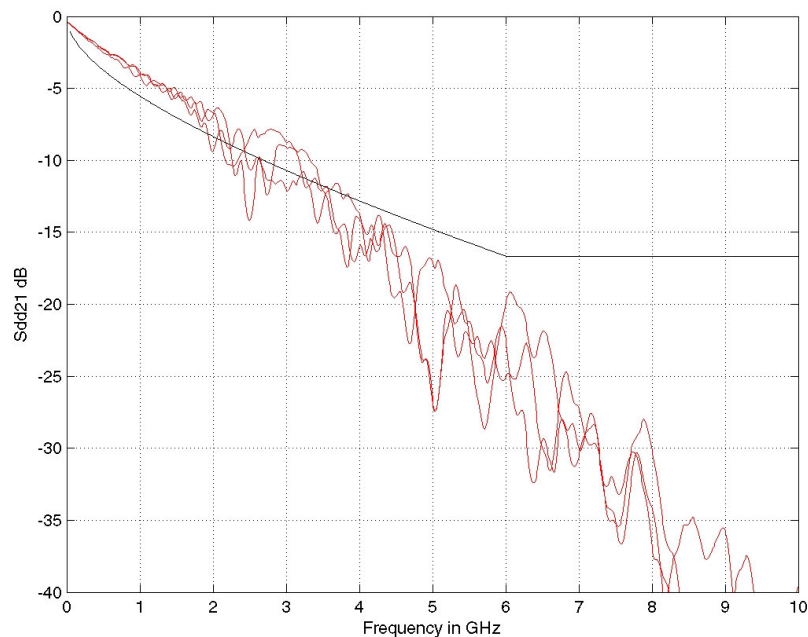
SAS-2 Channels Simulation Results

VITESSE

 Chassis Channels 05-389r0: 4 Connectors Board to Board (HP9,HP10& HP11)

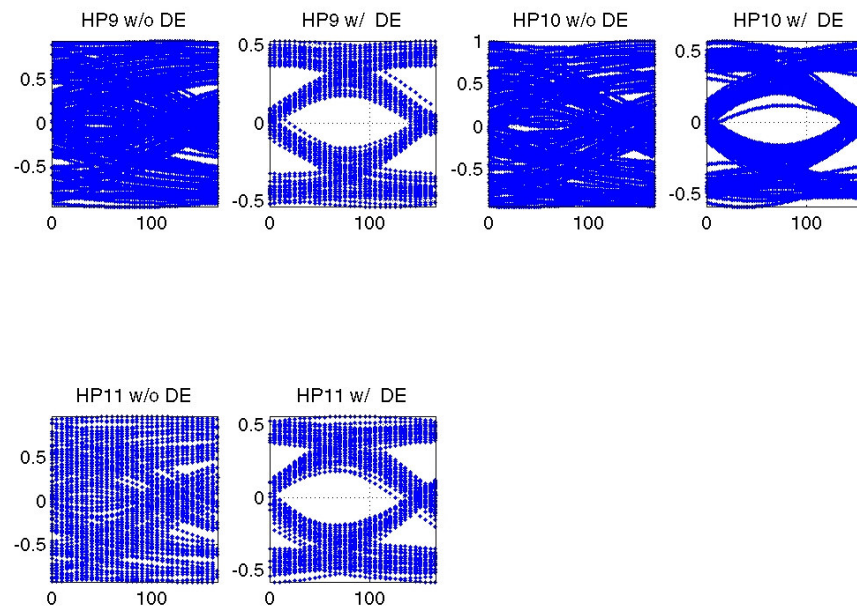
 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File



Note: these are yellow in composite Sdd21 plot

**Simulated Output
w/o & w/ De-Emphasis**



SAS-2 Channels Simulation Results

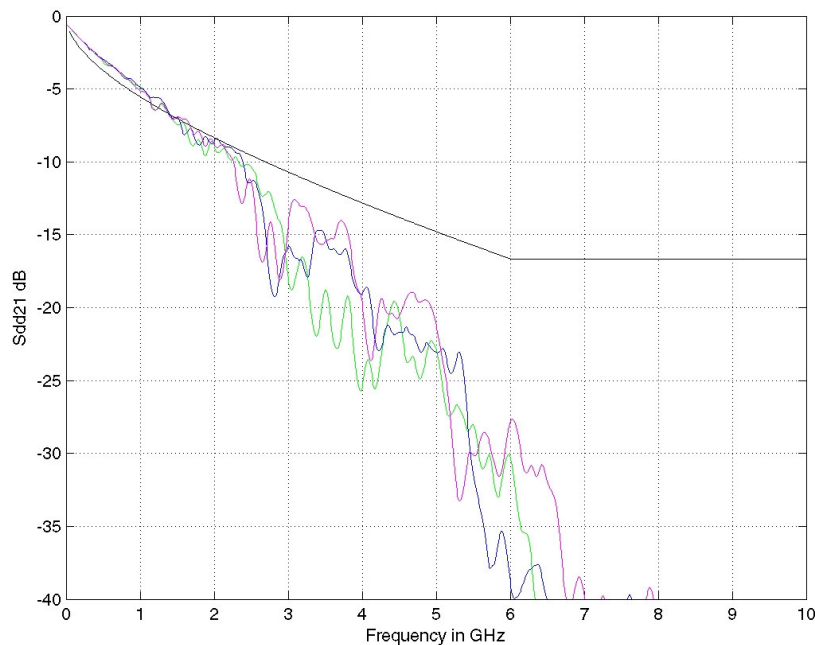
VITESSE

📖 Chassis Channels 06-017r0: 4 Connectors Board to Board (HP24,HP25 & HP26)

- Rev 1 Addition

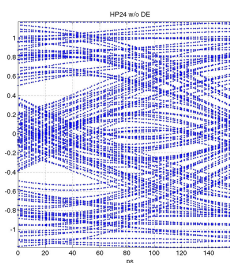
📖 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File

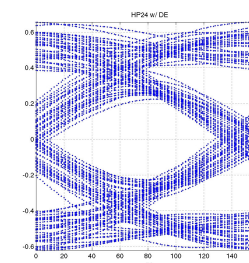


Simulated Output w/o & w/ De-Emphasis

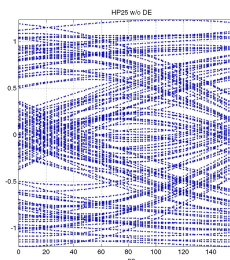
HP 24 w/o DE



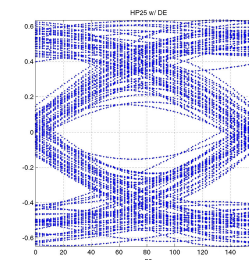
HP24 w/ DE



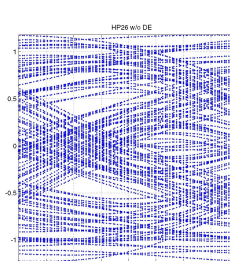
HP 25 w/o DE



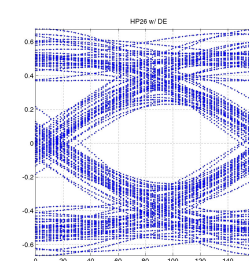
HP25 w/ DE



HP 26 w/o DE



HP26 w/ DE



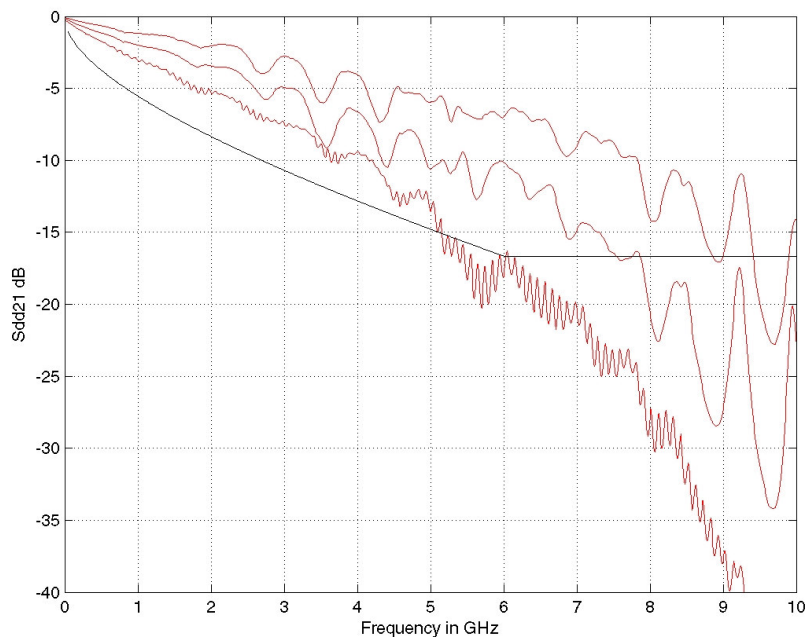
SAS-2 Channels Simulation Results

VITESSE

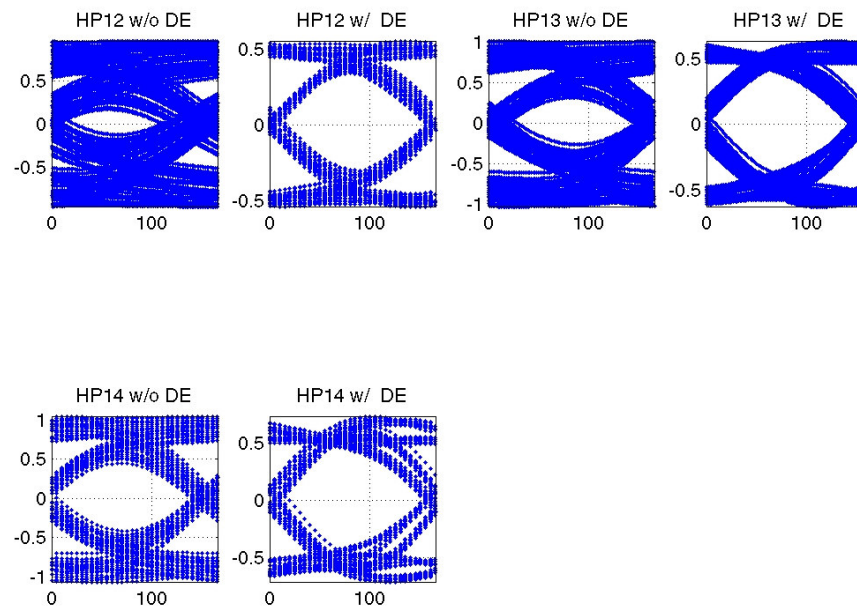
 Chassis Channels 05-390r0: 3 Connectors Board/Cable/Backplane/Drive

 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File



**Simulated Output
w/o & w/ De-Emphasis**



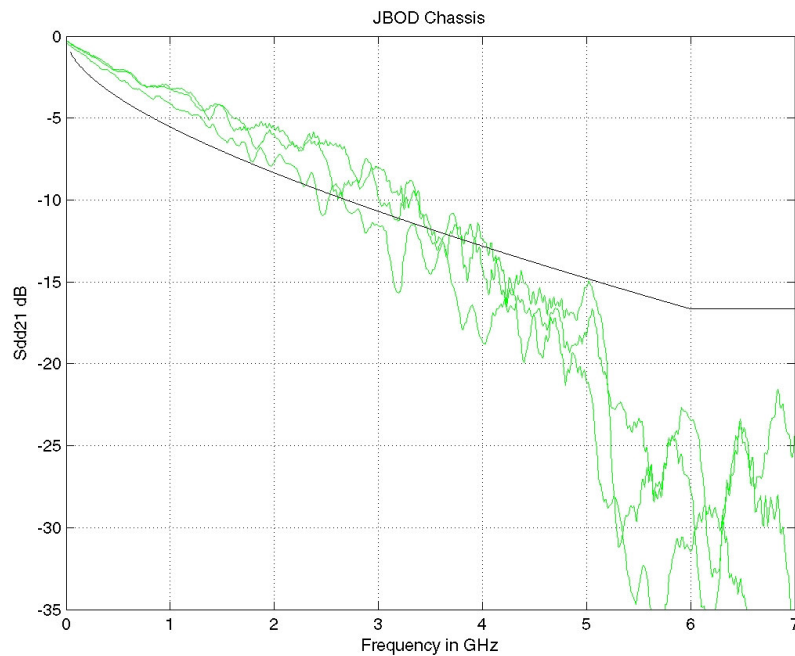
SAS-2 Channels Simulation Results

VITESSE

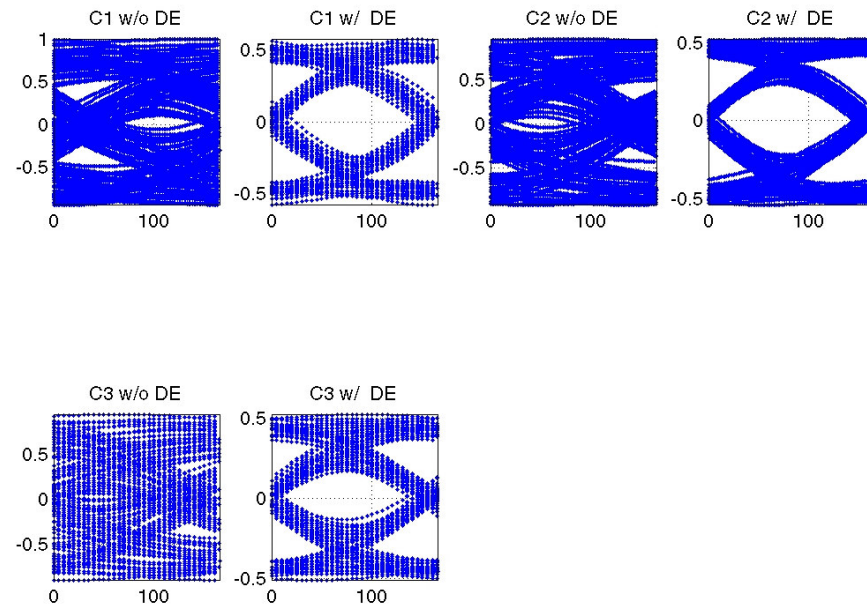
 Chassis JBOD (In House)

 Spice Based

- Use PWL of transmit waveforms
- Simulate S-Parameter File

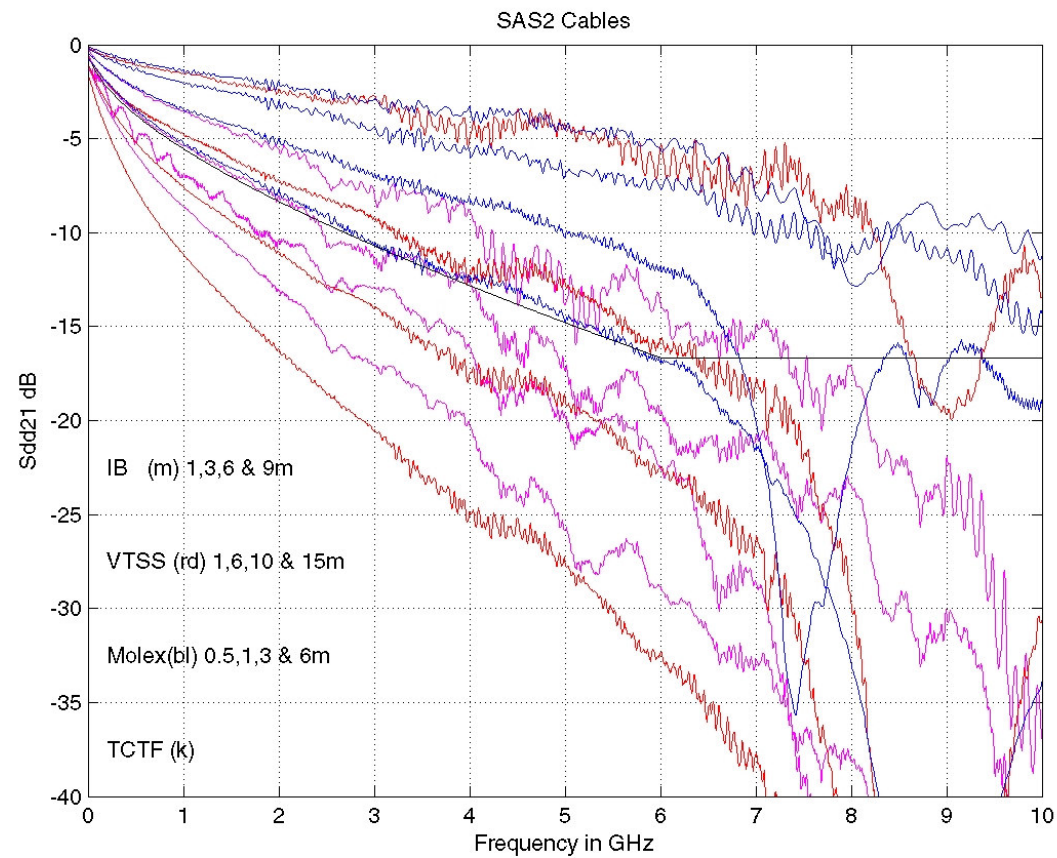


Simulated Output w/o & w/ De-Emphasis



Cable S-Parameters

- iPASS™ 05-398r0
- In House iPASS™ & InfiniBand



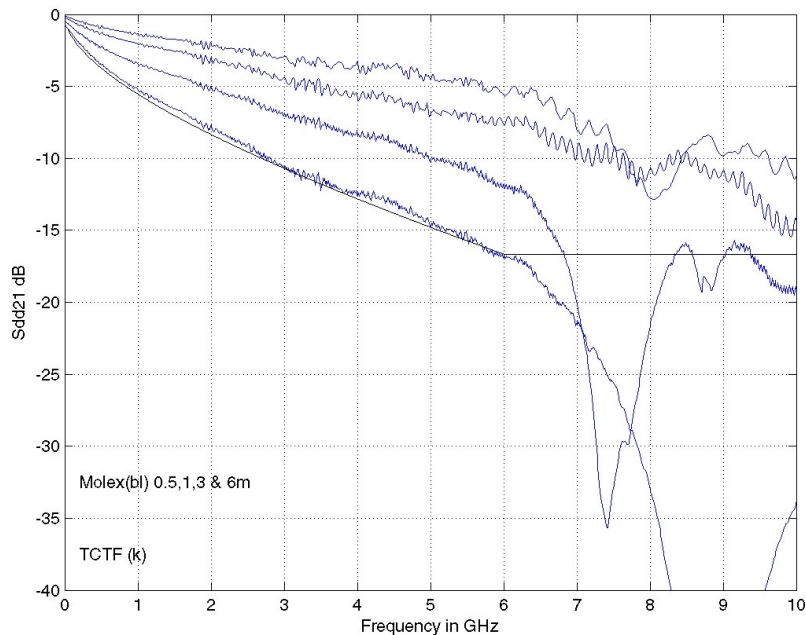
SAS-2 Channels Simulation Results

VITESSE

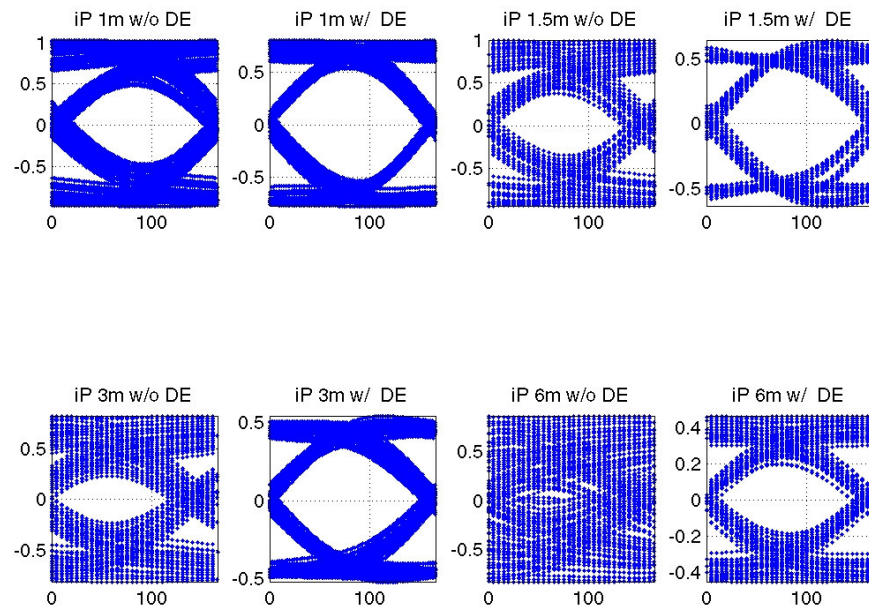
 0.5m, 1m, 3m, & 6m iPASS™ Channels 05-398r0

 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File



Simulated Output
w/o & w/ De-Emphasis



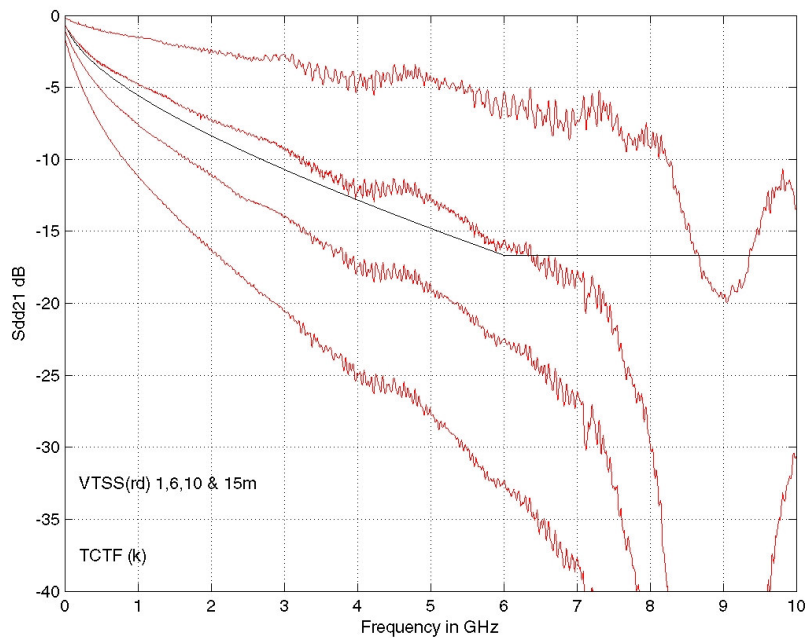
SAS-2 Channels Simulation Results

VITESSE

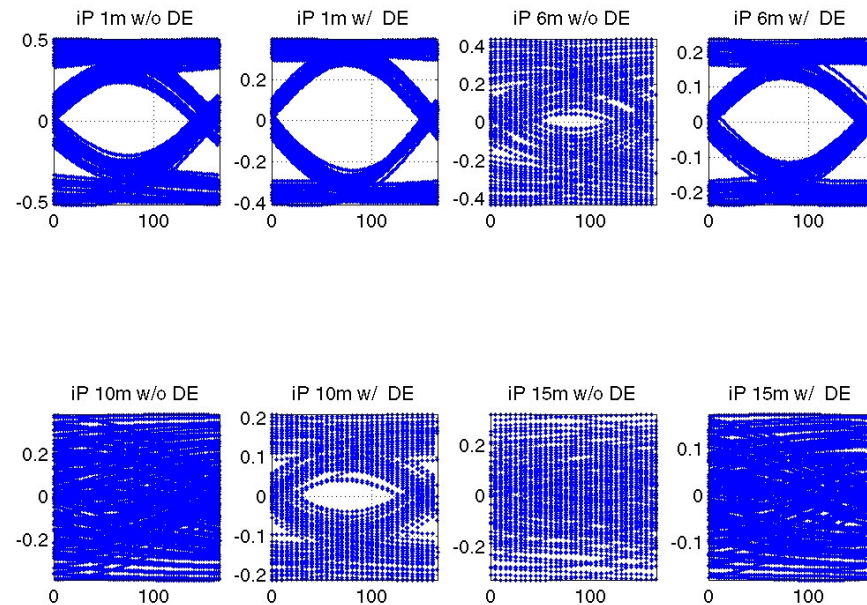
 1m, 6m, 10m, 15m iPASS™ Channels

 Spice Based Simulation

- Use PWL of transmit waveforms
- Simulate S-Parameter File



**Simulated Output
w/o & w/ De-Emphasis**



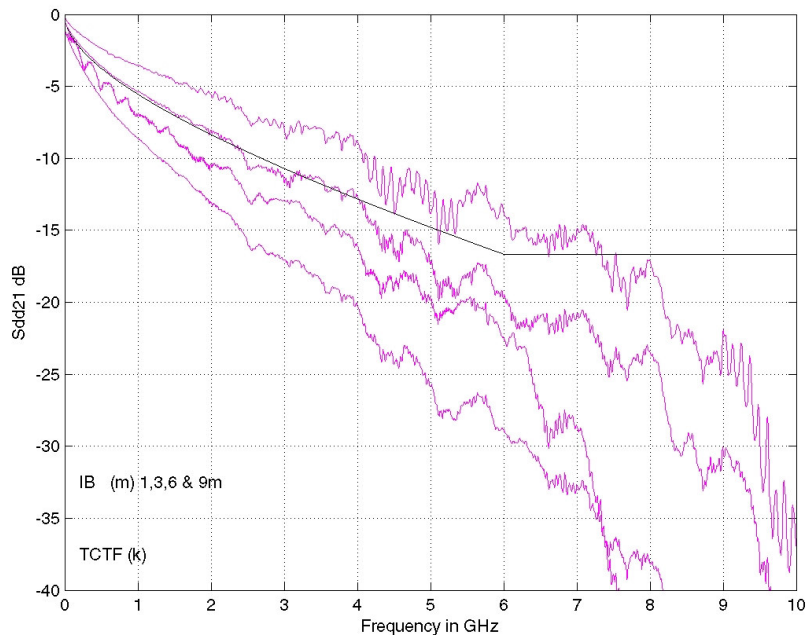
SAS-2 Channels Simulation Results

VITESSE

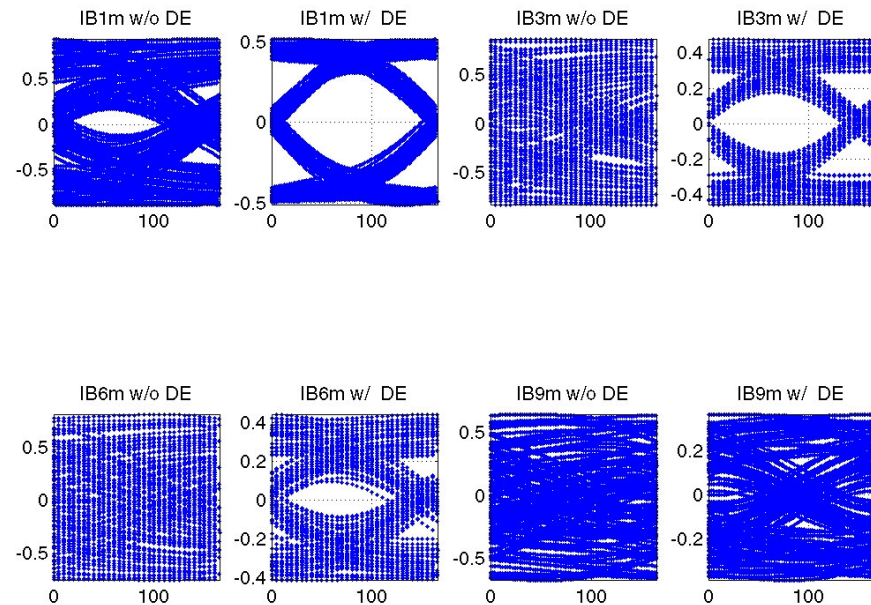
📖 1m, 3m, 6m & 9m InfiniBand Channels


📖 Spice Based Simulation


- Use PWL of transmit waveforms
- Simulate S-Parameter File





Simulated Output w/o & w/ De-Emphasis





-  SAS-2 Channels based on S-parameters have been explored
 - Chassis, Backplane & Cable (HP, Dell and VTSS)
 - iPASS™ (Molex and VTSS measurements)
 - Infiniband (VTSS measurements)

-  These Channels will result in closed eyes w/o Tx De-Emphasis @ 6G

-  These Chassis Channels will Require Equalization @ 6G
 - All Chassis Channels look Feasible

-  These External Cables will Require Equalization @ 6G
 - External Cable length up to 10m with iPASS is Feasible

-  A set of representative S-Parameters could serve as channel definition.

-  Question, Is this a representative set of all end-user channels?