SAS-2 Short Interconnect Characterization (07-188r0)

Barry Olawsky
Hewlett Packard
(4/17/2007)
Premise

• Interconnects with multiple impedance discontinuities separated by a low loss interconnect have proven problematic in certain situations.

• Given such an interconnect, will pre-emphasis reduce signaling margins (amplitude or jitter)?

• If so, how much margin is consumed?
Short Interconnect Characterization

Short Interconnect Insertion Loss

-22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0

backplane1
backplane2
12in mini, p1
14in mini, p1
12in mini, p2
14in mini, p2

GHz

dB
Short Interconnect Characterization

- Resonances on short internal miniSAS cable and short backplanes are considered
- Focus on backplane samples
Sample Simulation
Sample Simulation
Short Interconnect Characterization

- Compare backplane simulation results to low resonance interconnect with same loss at
  - Data Rate / 2
- Simulate at multiple data rates of interest (selected 4.2 Gbps, 5 Gbps, 5.3 Gbps for comparison)
Short Interconnect Characterization

Curvefit at Data Rate / 2

-8
-6
-4
-2
0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 GHz

dB

-8
-6
-4
-2
0

Backplane1
Backplane2
Fit @ 2.1GHz
Fit @ 2.5GHz
Fit @ 2.65GHz
Short Interconnect Characterization

- Compare amplitude and jitter
- K28.5 reference transmitter with V_diff = 1000 mV used
- De-emphasis of 0 dB (off) and 6 dB (50% reduction on bits 2, 3, 4 and 5)
Short Interconnect Characterization

S-Parameter vs. Trace Model Amplitude

Data Rate (Gbps)

mV

S-param, 0dB
Model, 0dB
S-param, 6dB
Model, 6dB
Short Interconnect Characterization

S-Parameter vs. Trace Model Jitter

Data Rate (Gbps)

ps

S-param, 0dB
Model, 0dB
S-param, 6dB
Model, 6dB
Conclusions

• A resonance free interconnect with identical loss at “Date Rate / 2” produced less amplitude with no de-emphasis. Probably due to a wide spectral content distribution. Results were inconclusive with 6dB de-emphasis.

• The resonance free interconnect produced less jitter (in particular at 6dB de-emphasis)

• Majority of jitter observed at 6dB de-emphasis is not due to resonances but excessive de-emphasis