Thoughts on IEEE 802.3 ap Draft 2.0 Comments #128 and #129

John D'Ambrosia

Tyco Electronics

Contributors on Work Addressing Comment #129

- Rich Mellitz

- Charles Moore

- Matt Brown

- Joe Abler

Comment #128

- Comment #128

  Use of calculated ICR increases ambiguity of informative channel model results. See dambrosia_01_0705 for reference.

- Resolution-

  Use log fit of calculated ICR to compare against equation 69-20

  See dambrosia_02_0905.pdf for proposed verbiage.

Comments Regarding Channel Return Loss

- ## Comment #129 (D'Ambrosia) –

  "Channel return loss is not factored into informative channel model"

- ## Comment #446 (Thaler)

  "I don't find any parameters for return loss even though that is a parameter which can exert a significant impact on the received signal and which can be heavily influenced by implementation choices. Given the potential for impedence mismatches with minimal attenuation between them (e.g. a reflection between the transmitter and first mated connector in Figure 69-2), guidence on this parameter should be given."

History

- Different return loss numbers have been demonstrated
  - dambrosia_02_0904.pdf
  - goergen_02_0904.pdf
  - peters_01_0904.pdf
- Symbiotic relationships
  - Overall System Length
  - Materials
  - Daughtercard Length
  - Daughtercard Stub
  - Backplane Length
  - Backplane Stub
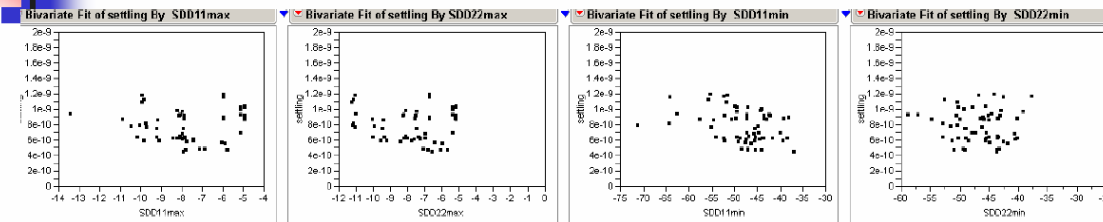 - Trace width
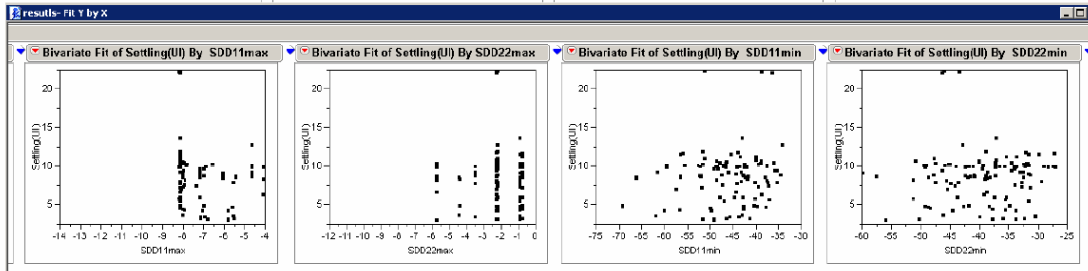 - Device packaging and terminations

History (2)

Settling time identified as indicator of difficulty to equalize channel

No correlation between channel return loss and settling time identified
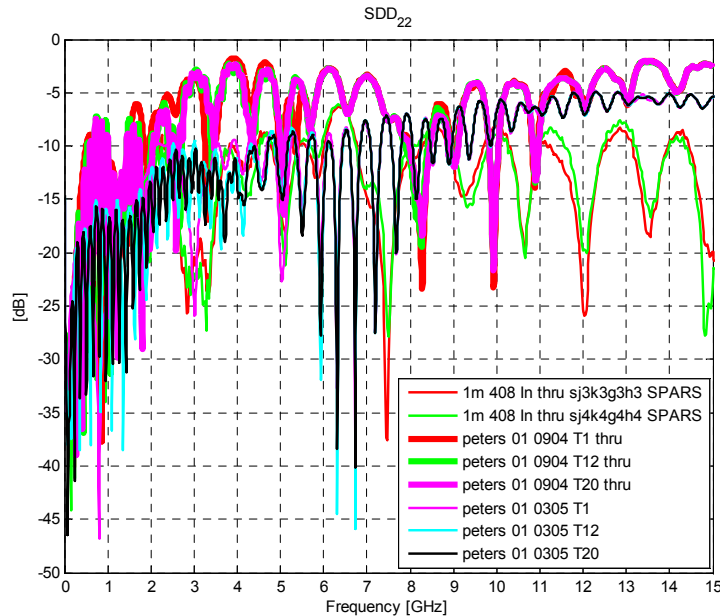
dambrosia_c1_0105

Use of Return Loss Mask?
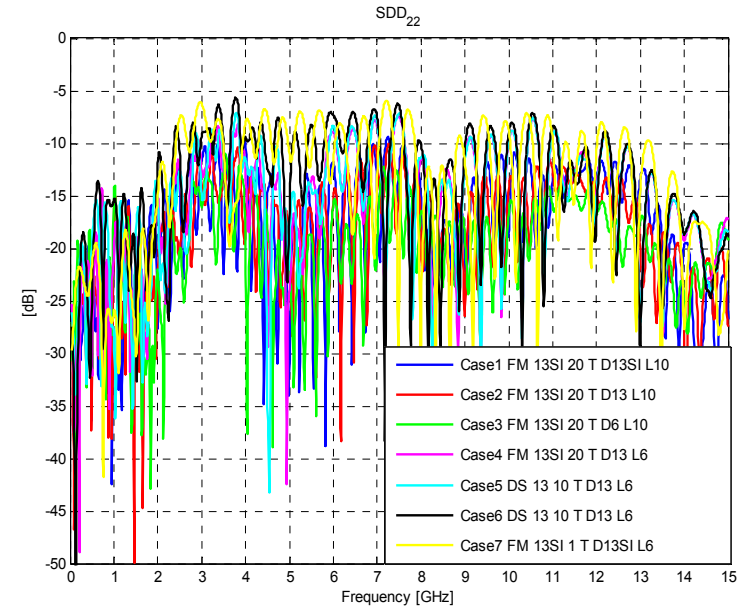
All Channels that Failed

SDD$_{22}$

Legend:
- 1m 408 ln thru sj3k3g3h3 SPARS
- 1m 408 ln thru sj4k4g4h4 SPARS
- peters 01 0904 T1 thru
- peters 01 0904 T12 thru
- peters 01 0904 T20 thru
- peters 01 0305 T1
- peters 01 0305 T12
- peters 01 0305 T20

Channels that Passed

SDD$_{22}$

Legend:
- Case1 FM 13SI 20 T D13SI L10
- Case2 FM 13SI 20 T D13 L10
- Case3 FM 13SI 20 T D6 L10
- Case4 FM 13SI 20 T D13 L6
- Case5 DS 13 10 T D13 L6
- Case6 DS 13 10 T D13 L6
- Case7 FM 13SI 1 T D13SI L6

- Per IBM analysis (abler_01_0305, seemann_01_0305) only two channels failed with no xtalk conditions (Peters_01_0904 T1 / T12). Analysis did not include Peters 0305 M/B channels.

- One universal mask does not take into account symbiotic relationships that exist in complete channel.

- Channels passing with similar to higher return loss
  - Case#3 failed Amin
  - Case#6 – gray zone for Ilmin and –Peak Deviation

- Of 8 channels failing
  - 3 failed fitted ICR only
  - 1 failed fitted ICR, ILmin, Amin
  - 2 failed peak deviation mask
  - 2 in "grey zone" for ILmin and peak deviation mask
- All 6 Intel "T" channels failed–
  - 1 of 6 failed fitted ICR,
  - 5 of 6 failed or were "may" of multiple parameters for each case

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Revisiting ICR Analysis by Quake

	Configuration	Sim	Sim (10% margin)	ICR	SNR1	SNR2
tyco	case1	Y	Y	67.37	30.47	47.57
tyco	case2	Y	Y	67.78	30.53	47.4
tyco	case3	Y	Y	67.51	31.6	47.64
tyco	case4	Y	Y	69.16	29.29	47.49
tyco	case5	Y	Y	61.95	28.75	48.65
tyco	case6	Y	Y	69.57	30.7	49.45
tyco	case7	Y	Y	66.5	29.23	49.86
intel_0904	t1	N	N	66.52	26.94	46.04
intel_0904	t12	N	N	68.45	27.51	45.23
intel_0904	t20	N	N	69.04	27.1	43.87
intel_0904	m1	Y	N	62.99	27.83	48.83
intel_0904	m20	Y	N	66.9	27.26	45.56
intel_0904	b1	Y	N	64.7	24.46	46.18
intel_0904	b12	Y	Y	65.69	25.71	45.81
intel_0904	b20	Y	Y	66.22	26.19	45.19
molex_isola_fr408	in2	Y	N	59.09	26.17	39.37
molex_isola_fr408	in3	N	N	57.62	24.59	37.74
molex_isola_fr408	in4	N	N	56.33	23.38	36.46
molex_isola_fr408	in5	Y	N	58.46	26.25	39.46
molex_isola_fr408	out2	Y	Y	64.08	28.28	41.7
molex_isola_fr408	out3	Y	N	61.56	25.63	38.98
molex_isola_fr408	out4	Y	N	61.39	25.82	39.21
molex_isola_fr408	out5	Y	Y	63.56	28.58	41.97

Sims based on work by IBM, Agere, Intel. Molex channels analyzed by IBM only. See dambrosia_02_0605 for further detail.

ICR – integral of ICR

SNR1 - a ratio of total signal power to total noise power

SNR2 - signal_power / interference_power

signal_power = integral(|SDD21*TxRollOff*RxRollOff*sin(pi*T*f)*sinc(T*f)*T|)^2

interference_power = integral(sum(|xtalk(f)^2|)*(TxRollOff*RxRollOff*sinc(T*f)*T)^2)

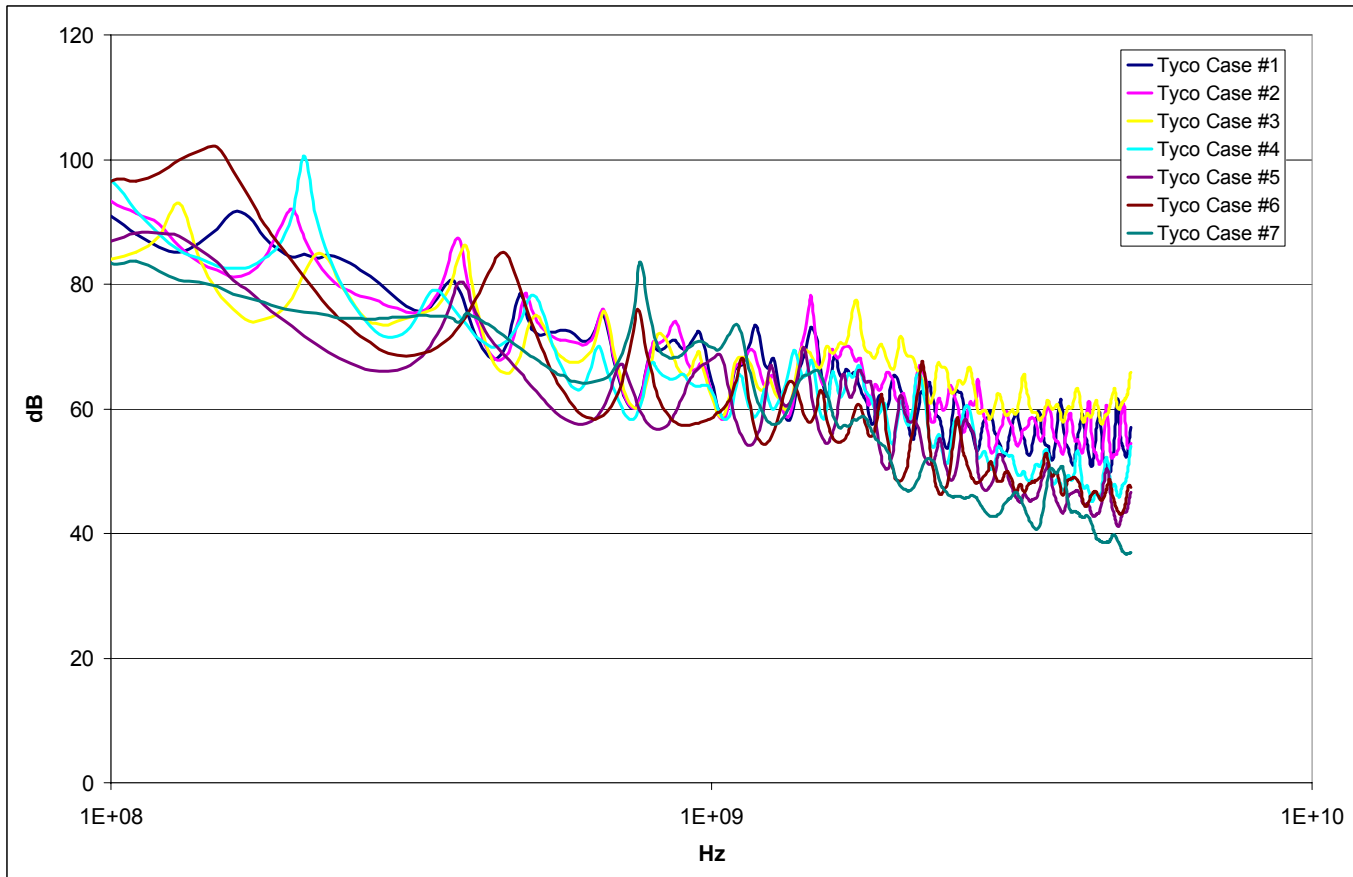Did not include device return loss for xtalk

No observed trends from any analysis seen.

Consider Extension to ICR

- Insertion loss to interference

- Interference (use Power Sum)
  - Crosstalk summation
  - Reflections from Tx / TP1
    $(SDD21_{channel} * SDD22_{Tx\_device} * SDD11_{channel})^2$
  - Reflections from TP4 / Rx
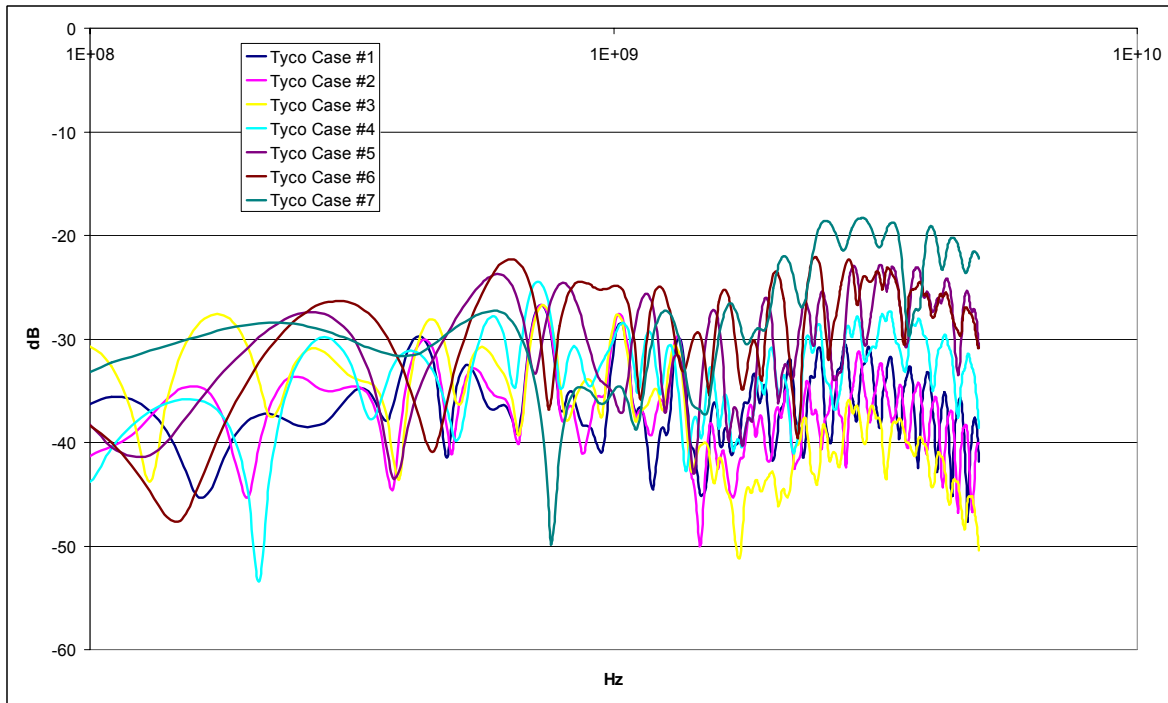 $(SDD21_{channel} * SDD11_{Rx\_device} * SDD22_{channel})^2$

ICR Extension

Only trend noted that ICR Extension varies with SDD21.

Lowest ICR Extension relates to channels with highest SDD21.

Highest ICR Extension relations to channels with lowest SDD21.

Did not include device return loss for xtalk

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Consider Self-Interference (SI)?

Only trend noted that SI varies with SDD21.

Lowest SI relates to channels with lowest SDD21.

Highest SI relates to channels with highest SDD21.

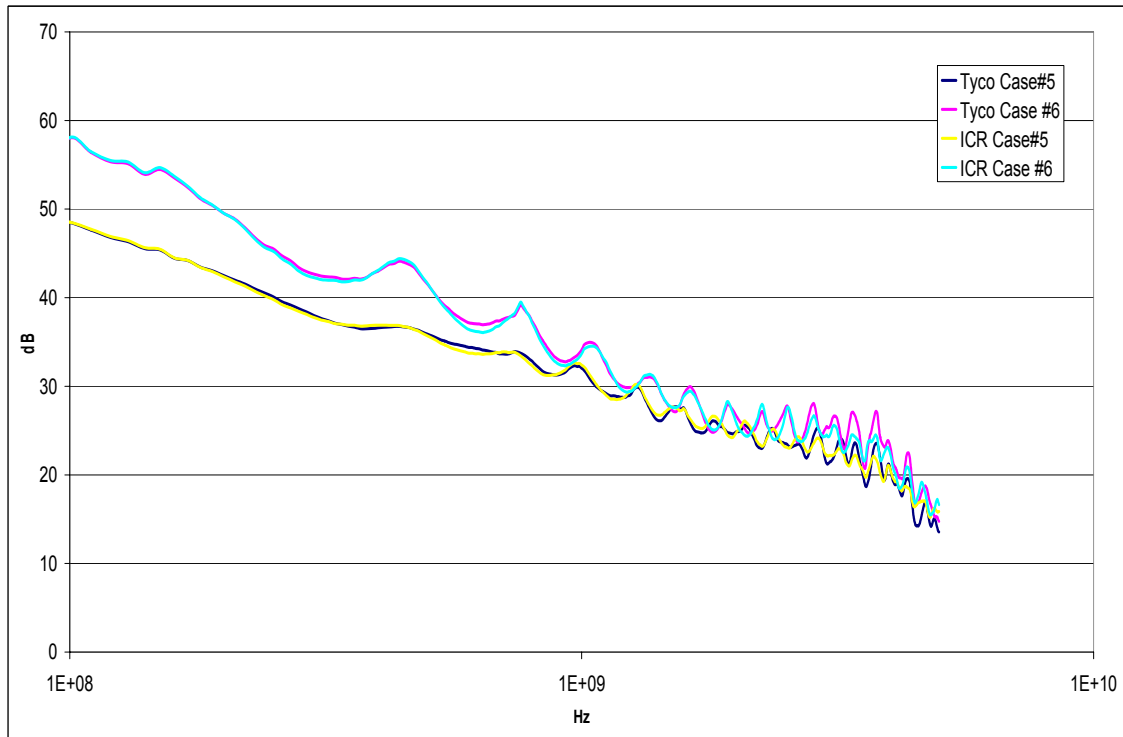Did not include device return loss for xtalk

Use Power Sum again

Reflections from Tx / TP1

$$(SDD21_{channel}*SDD22_{Tx\_device}*SDD11_{channel})\wedge 2$$

Reflections from TP4 / Rx

$$(SDD21_{channel}*SDD11_{Rx\_device}*SDD22_{channel})\wedge 2$$

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Calculate ICR Using Effective SDD21?

No observed significant differences between ICR and ICR calculated using effective SDD21

Did not include device return loss for xtalk

Chart legend:
- Tyco Case#5
- Tyco Case #6
- ICR Case#5
- ICR Case #6

$$SDD21_{Effective} = \frac{SDD_{21}*(1+SDD_{11Rx})*(1-SDD_{22Tx})}{1-(SDD_{11}*SDD_{22TX})-(SDD_{22}*SDD_{11RX})-(SDD_{21}{}^2*SDD_{22TX}*SDD_{11RX})+(SDD_{11}*SDD_{22}*SDD_{11RX}*SDD_{22Tx})}$$

New Channel by Tyco

- Tyco looked at a case similar to Case#5, but using the full mesh ATCA backplane, instead of the dual star. Data taken with 4000-13 line cards and 4000-6 line cards.

- Tyco supplied data using 4000-6 6" line cards for Case #7

Channel Data & ICR Margin

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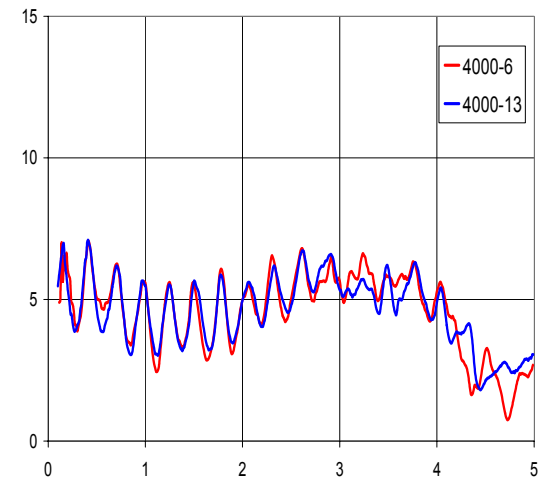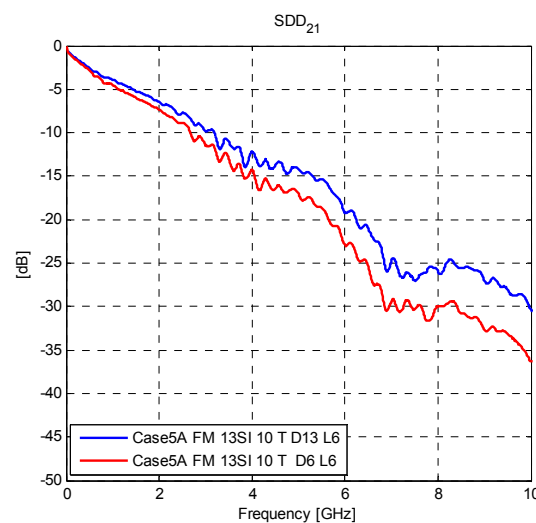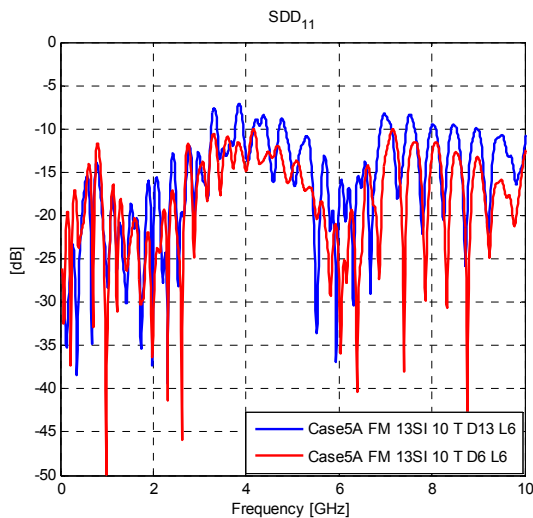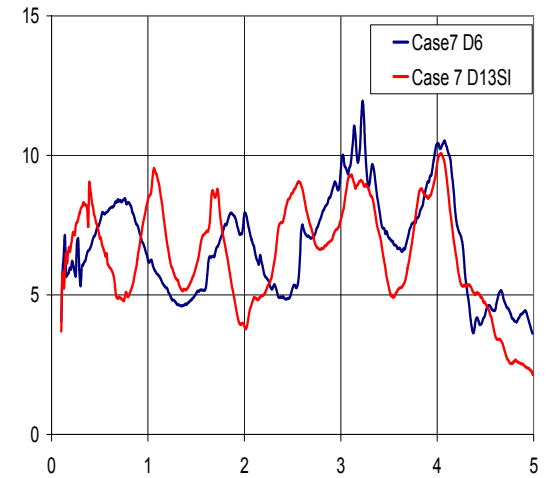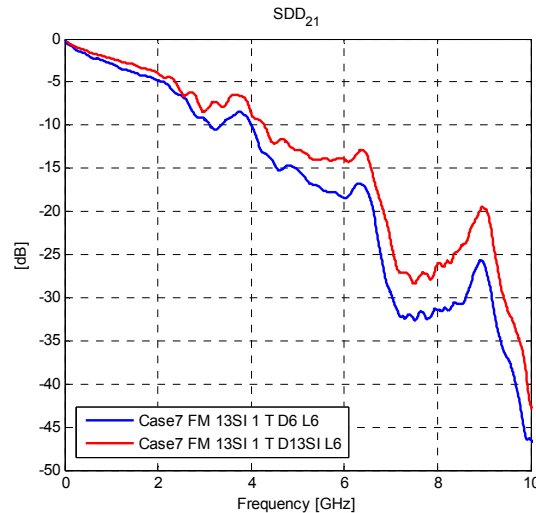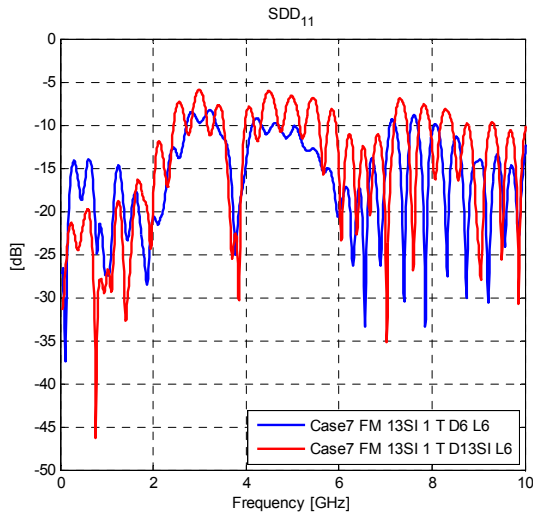
IBM Simulation Summary

File	System Length	Backplane Length	Line Card Length	Line Card	Horizontal Eye	Vertical Eye
7	13"	1"	6"	4000-6	22.9ps	73 mV
7	13"	1"	6"	4000-13SI	23.0ps	86 mv
5A	22"	10"	6"	4000-6	16.3ps	53 mV
5A	22"	10"	6"	4000-13	19.7ps	55 mV

Channels with higher peaks for S22 performed same to better.

(Higher SDD21)

See abler_01_0305 for simulation details.

Summary for Comments 129/446

- Return loss has a symbiotic relationship with other aspects of the channel, and is indirectly addressed by its impact on the forward channel response of TP1-TP4, which is specified by 69.3.3.

- For 8 channels that failed simulations, current methodology identified 5 of channels that failed simulations and 3 channels that failed were in "gray zone"

- Multiple methodologies considered to include channel return loss. None have yielded any insight that might be used as the basis for a specification for the inclusion of channel return loss.

- See dambrosia_02_0905.pdf for proposed verbiage to be added.