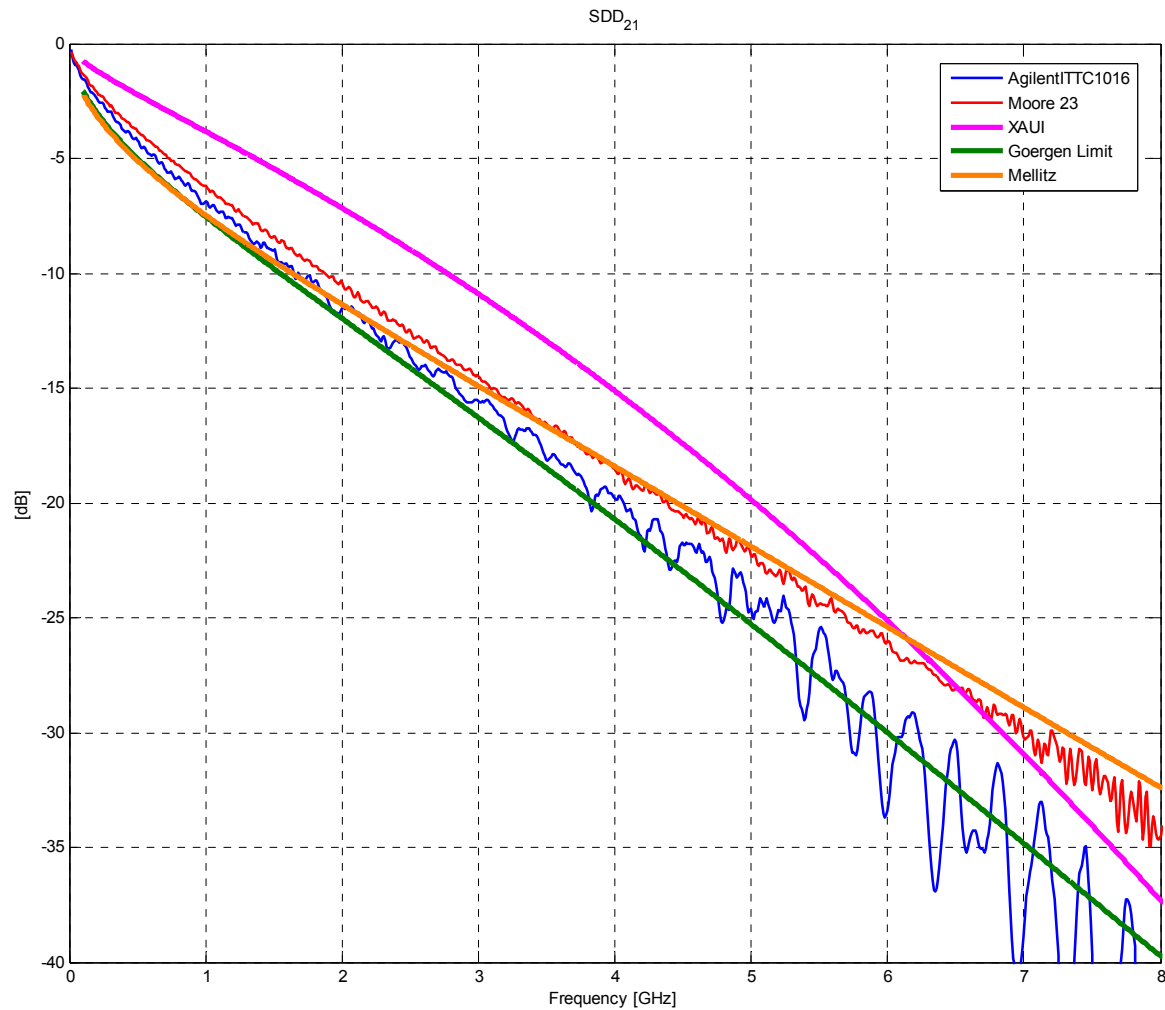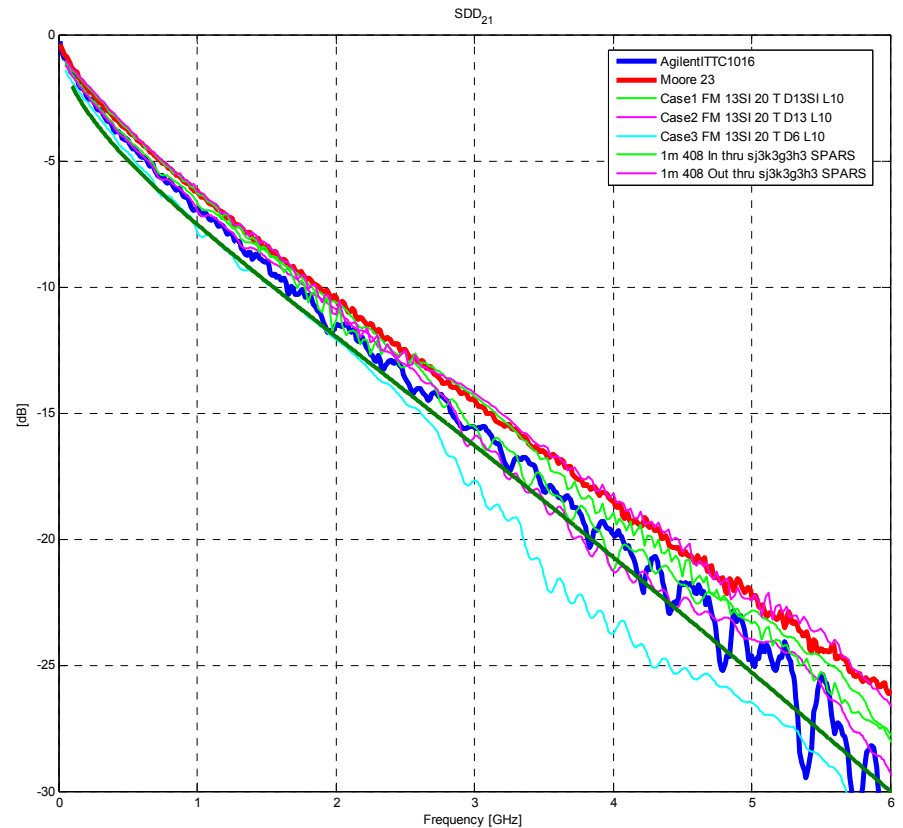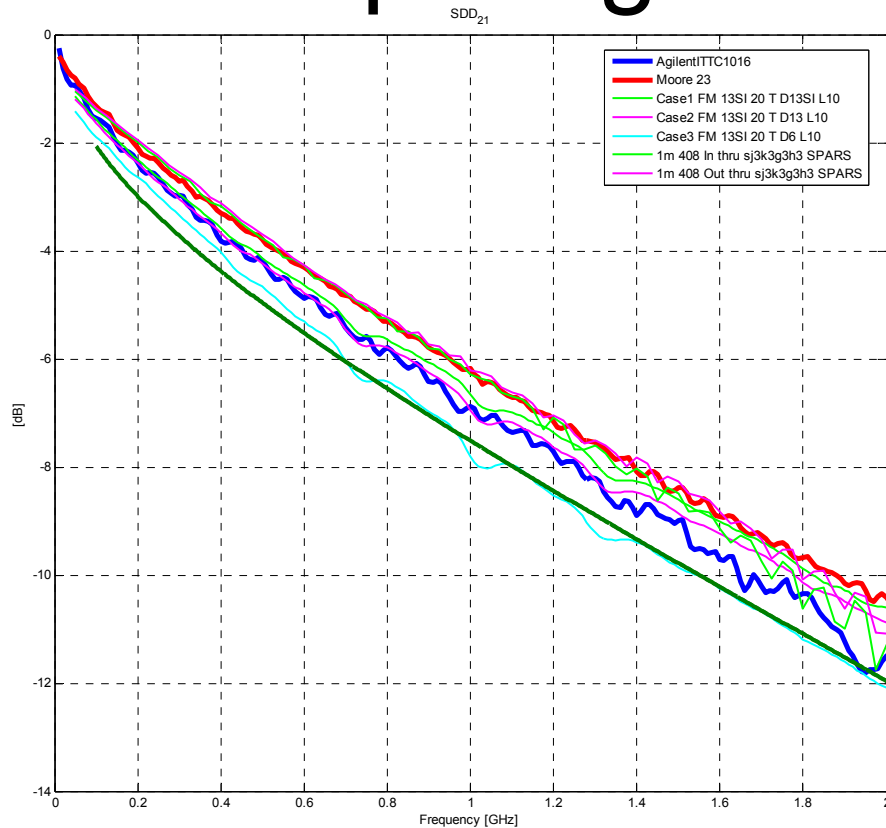# EIT Channel Discussions

John D'Ambrosia

Tyco Electronics

January 19, 2006

Models, Models, Models

Comparing Channels at the Limits

1m channels falling right on moore 23. If adopted as EIT limit, then forces even better channels in order to account for material and environmental variation. Also, significant impact on channels for 1000BASE-KX and 10GBASE-KX4.

EIT

- A controlled test methodology to simulate the effects of interference –
    - NEXT
    - FEXT
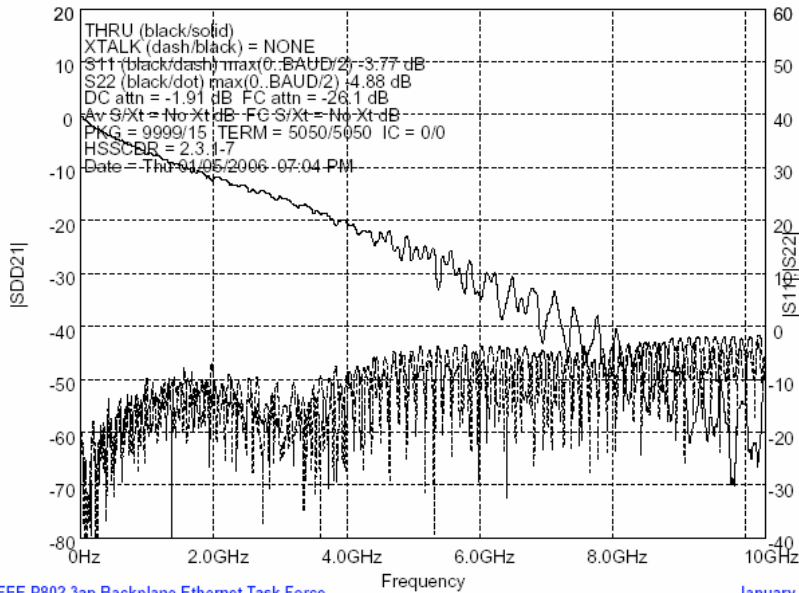   - Self-Interference
    - Alien Crosstalk

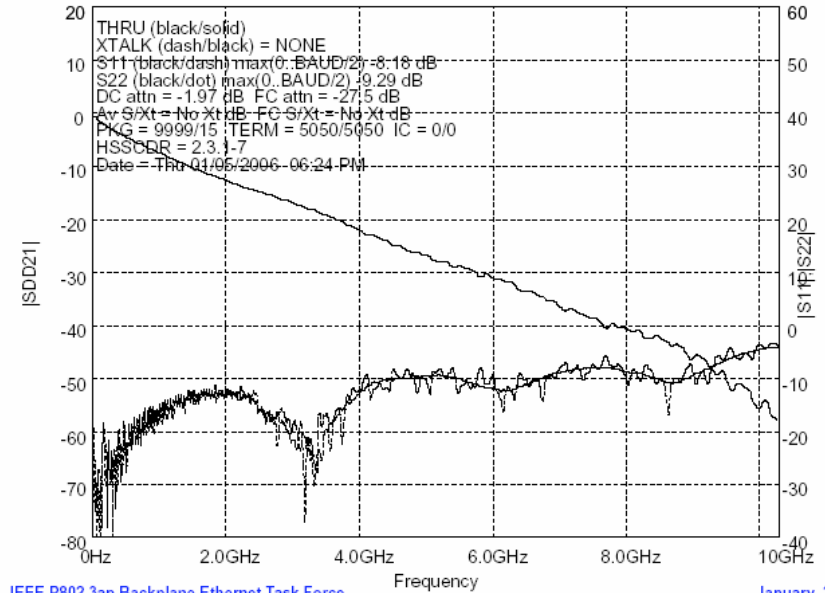# Per abler_01_0106

Agilent ITTC1016 Channel (Simulated) — ITTC1016 Channel Response
THRU (black/solid)
XTALK (dash/black) = NONE
S11 (black/dash) max(0..BAUD/2) -3.77 dB
S22 (black/dot) max(0..BAUD/2) -4.88 dB
DC attn = -1.91 dB FC attn = -26.1 dB
Av S/Xt = No Xt dB FC S/Xt = No Xt dB
PKG = 9999/15 TERM = 5050/5050 IC = 0/0
HSSCDR = 2.3.1-7
Date = Thu 01/05/2006 07:04 PM

Agilent TC (Measured) — AgTC_measured Channel Response
THRU (black/solid)
XTALK (dash/black) = NONE
S11 (black/dash) max(0..BAUD/2) -8.18 dB
S22 (black/dot) max(0..BAUD/2) -9.29 dB
DC attn = -1.97 dB FC attn = -27.5 dB
Av S/Xt = No Xt dB FC S/Xt = No Xt dB
PKG = 9999/15 TERM = 5050/5050 IC = 0/0
HSSCDR = 2.3.1-7
Date = Thu 01/05/2006 06:24 PM

Observations of abler_01_0106

- Per abler_01_0106
  - Agilent ITTC1016 Channel
    - Throuch channel only
    - No DCD
    - 7.2 % eye opening
  - Agilent TC Channel
    - Throuch channel only
    - No DCD
    - 17.0 % eye opening
- Eyeball Observations of channel measurements
  - Similar SDD21
  - ITTC1016 has higher return loss than TC
- With no Xtalk or alien xtalk present - Self Interference is having significant effect.

Per abler_01_0106

- **There is not margin in the definition of the test channel to drive all attributes to the limit**

  - Recommend dropping the test channel definition by a set amount (TBD, but on order of 3dB) to enable realistic interference testing

  - Else, only test receiver operation against max channel attenuation without any interference (i.e. EIT baseline for KR = 0).

Previous Simulation Efforts

- Per abler_01_0305
  - Tyco Case #3, no xtalk or DCD
    - Timing margin (BER 10^-12) - 22psp-p
    - Voltage margin - (BER 10^-12) 53mVp-p
  - Molex Inbound j4k4, no xtalk or DCD
    - Timing margin (BER 10^-12) – 15.4psp-p
    - Voltage margin - (BER 10^-12) 54mVp-p

Look at the Channels
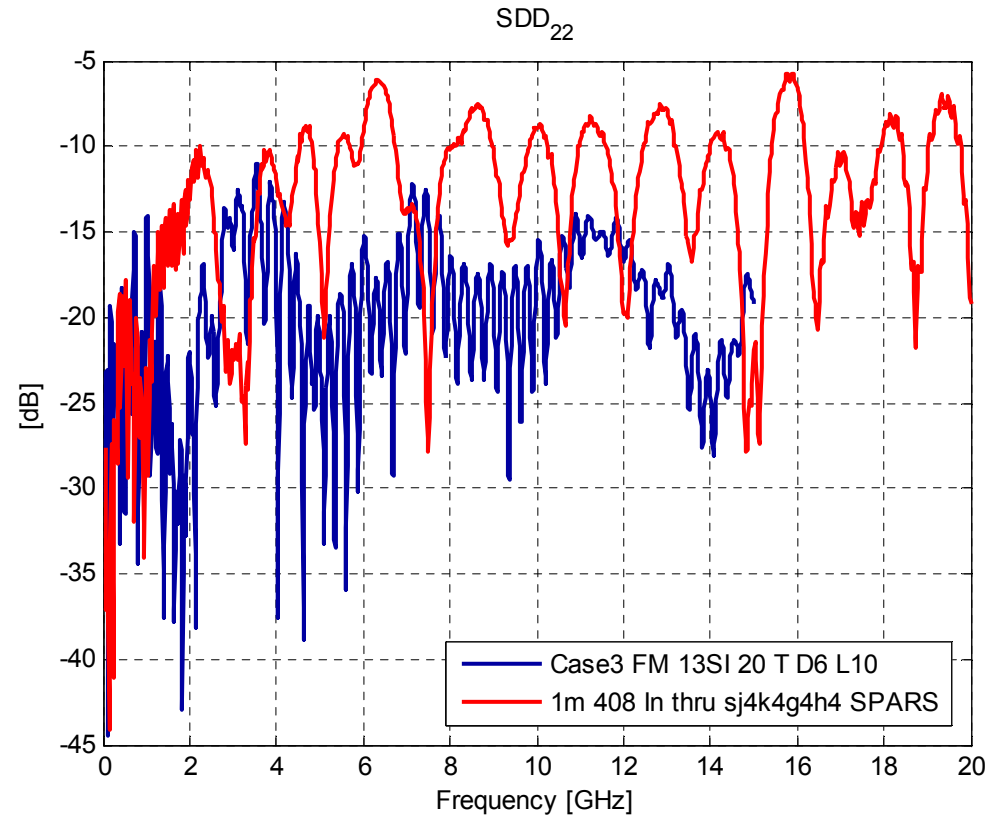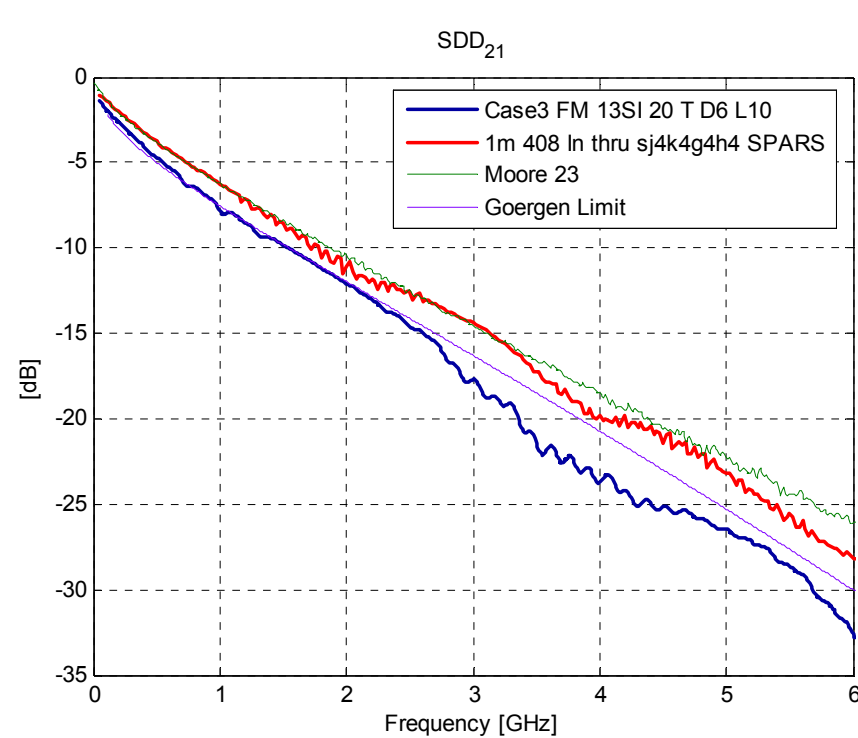
Tyco Channel #3 with loss near or below the Goergen limit performed as well as Molex In#4 channel at proposed Moore 23 limit with only self interference present.

Comparison of Avago Channels
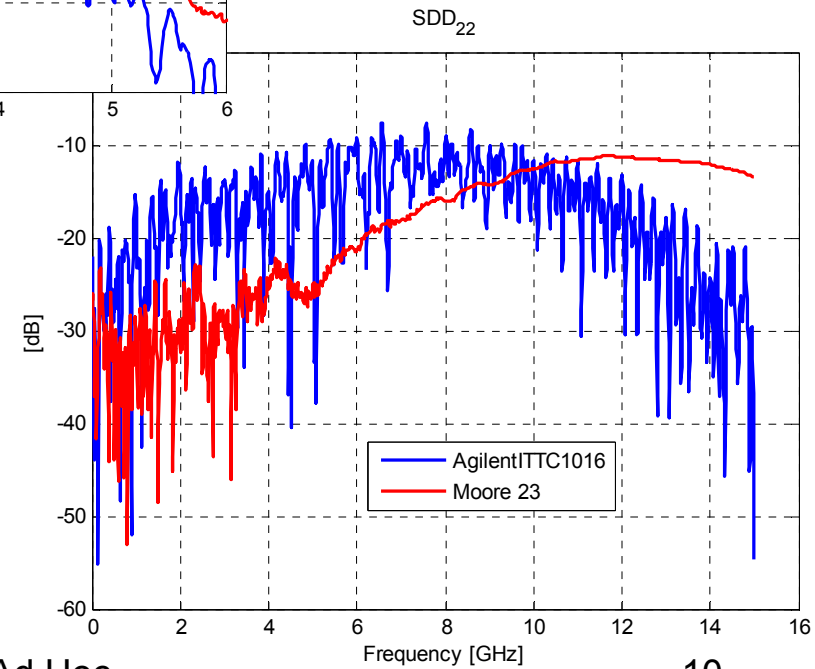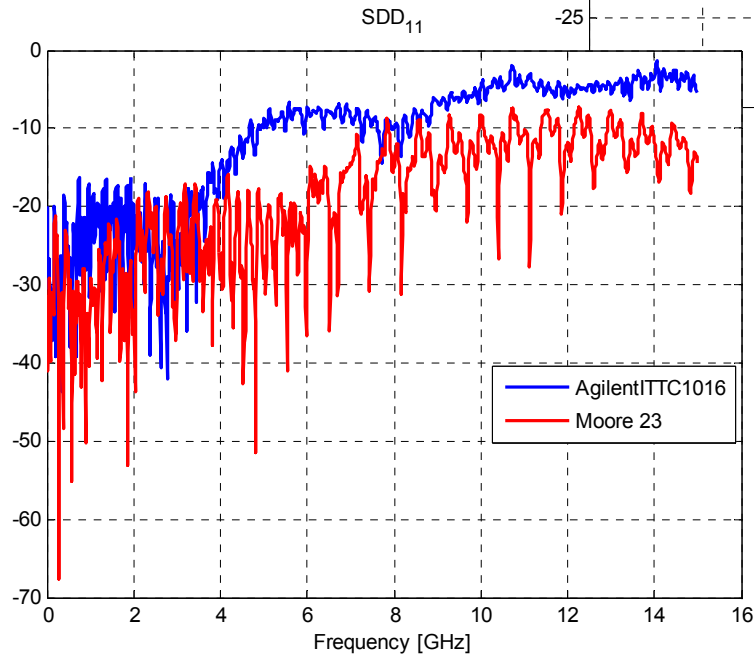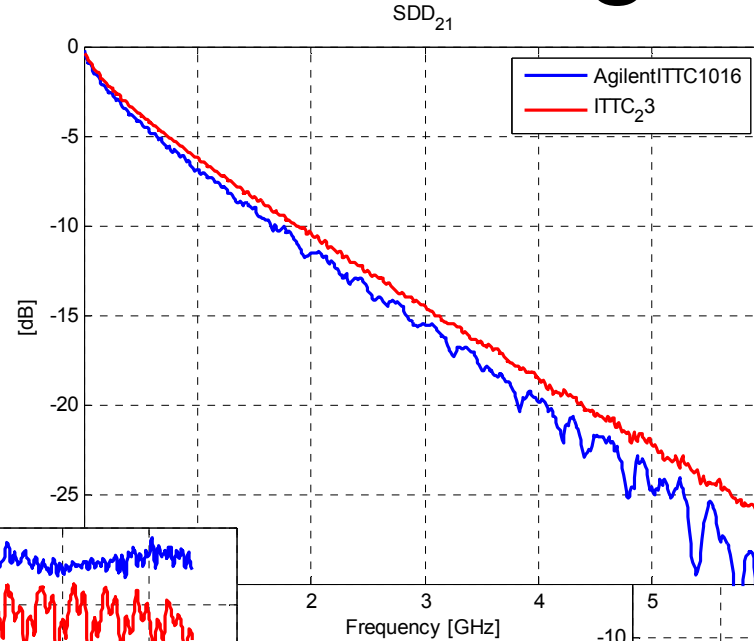
Taking a Step Back

- EIT Test is a controlled way to mimic interference

- Need to minimize all interference sources to allow injected interference to be control
  - self-interference needs to be minimized.

- Therefore, the EIT Channel is not necessarily the Informative Channel Model

- Equation 1 :
  - Sdd21 – (self-interference Tx / channel interaction) – self-interference Rx / Channel Interaction) – crosstalk – alien crosstalk

- With no crosstalk and assuming no alien crosstalk when evaluating EIT Channel we still need to minimize self interference or calibrate the EIT # to include its effects
  - Measurement / calibration – not simple
  - Leaves option then to minimize

Previous Efforts
(dambrosia_01_0905)

- Related Return Loss to ICR, therefore including crosstalk

- Self-interference looked at self-interference alone, but did not take into account ratio to SDD21
  - Consider specifications for
    - Equation 1A : Sdd21 – (self-interference Tx / channel interaction) – self-interference Rx / Channel Interaction)
    - Self-Interference Tx / Channel Interaction
    - Self-Interference Rx / Channel Interaction
 - Equation definition being examined

Problems Seen

- modITTC23 with Coupler file sent by Charles appears incorrect (-20dB at Nyquist)
- Assuming Return loss for modITTC23 similar to corrected version
- Return loss of ITTC23 significantly better than cascaded return loss
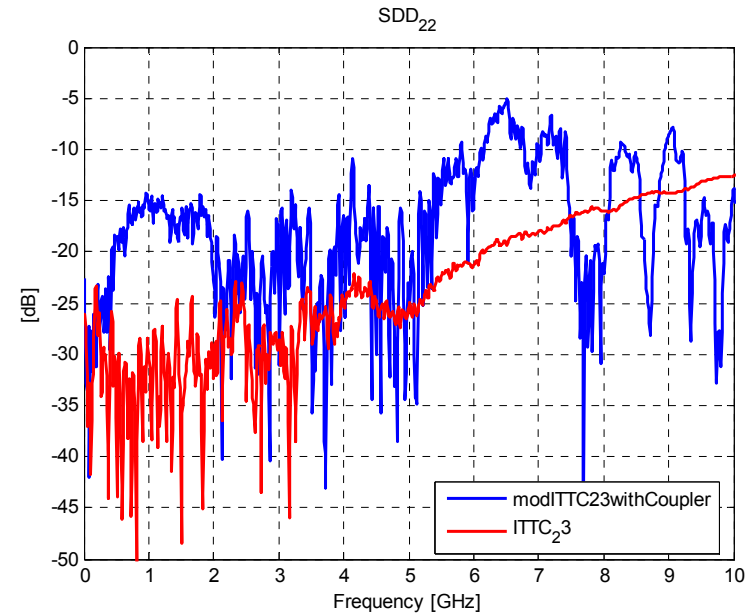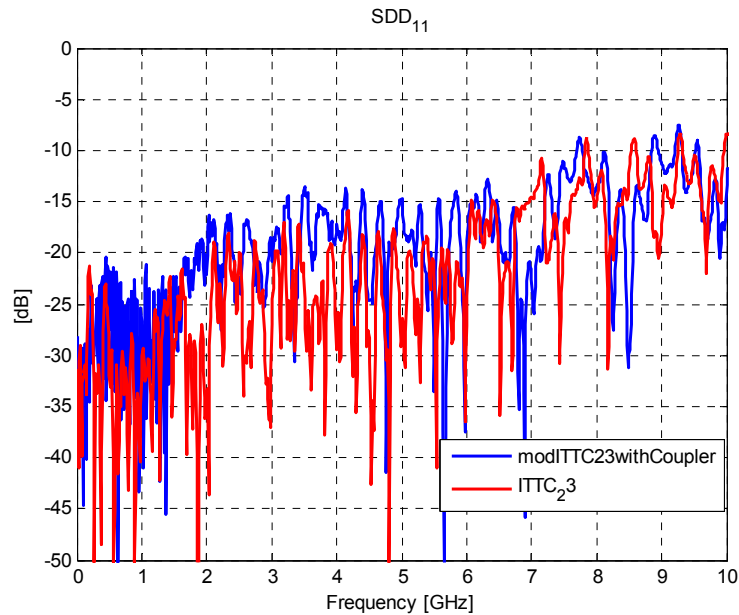
- Return loss shape of this file does not match shape presented in abler_c1_0106.
  - Assume driven by package
  - S11 Max (0 to baud /2) -7.94 dB
  - S22 Max (0 to baud/2) = -9.34 dB
- What would be impact on cascaded SDD22 including package if return loss from TP1 to TP4 lowered?
- What would be result on simulation results?

EIT Channel Definition

- TP1 : Attenuator >>> Coupler : TP4

- Consider:
  - TP1: Attenuator >>> Coupler >>> Attenuator: TP4
  - Use trace loss after coupler to further lower impact of coupler return loss caused by top layer stub on backplane
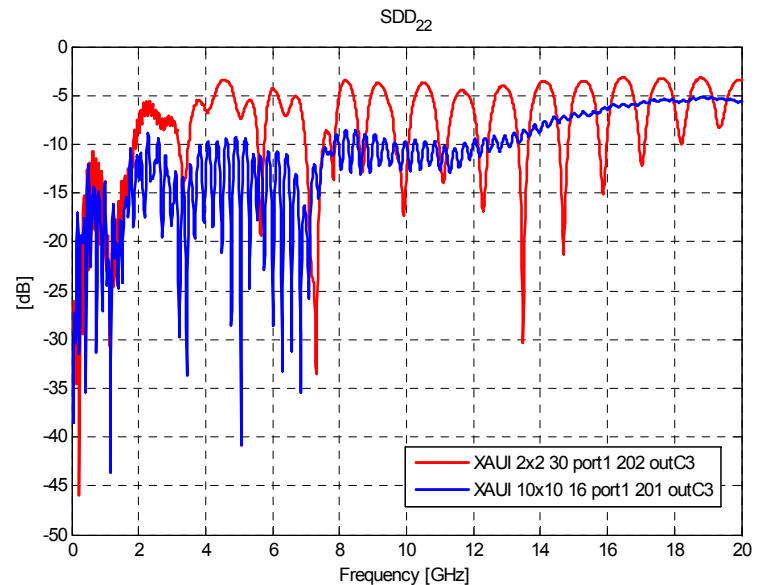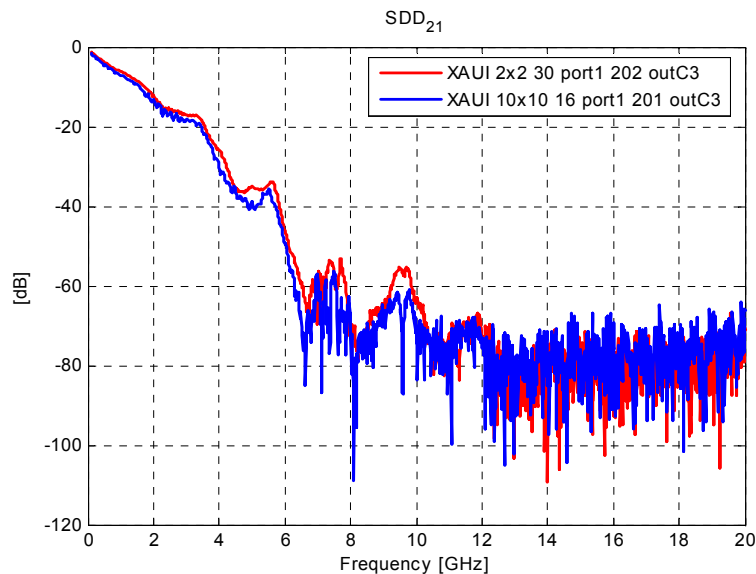
Findings

- EIT is intended to be a controlled test environment, but return loss is not specified, so self-interference is not controlled.
- Proposed Moore 23 limit does not address realities of backplane system design, i.e trace width needs and material characteristics / variations
- Implementations of channels have different self-interference levels.
- Need to revisit dambrosia_01_0905
  - to look at self-interference related to SDD21
  - Revisit integral approach excluding crosstalk
- Channels with lower SDD21 and lower SDD11 /22 have been simulated and shown to perform similar to channels with higher SDD21 and higher SDD11/22.

Recommendations

- Premature to modify EIT SDD21 channel as self-interference not controlled yet.
- Revisit dambrosia_01_0905 for Insertion loss to self-interference ratio
- Return loss specification needed for EIT channel. (-20 from 50MHz to 6 GHZ)
  - Careful design suggests possible with engineered launches
- Look into channel that meets current EIT Channel requirements with suggested return loss
- Ask Joe Abler to repeat his analysis once channel definition redefined and test cases created.
- Realities of channel implementation need to be considered and used.
  - Calibrating self-interference can be difficult
  - Need to minimize self-interference