

Informative Back Plane Channel: Ad-hoc Recommendations

Abstract: This presentation covers the conference calls and work of the channel ad-hoc group between the July 2004 meeting and the Sept 2004 meeting, as well as recommendations for the next steps in defining an informative channel model.

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Outline

- 04 Aug 2004 Conference Call Highlights
- 19 Aug 2004 Conference Call Highlights
- 07 Sept 2004 Conference Call Highlights
- 09 Sept 2004 Conference Call Highlights
- 17 Sept 2004 Conference Call Highlights
- Informative VNA Measurement Recommendations
- Informative Channel Six Mask Set Recommendations
- Outline of Work to Complete Before Nov 2004 Plenary

04 Aug 2004 Conference Call Highlights

- Review of the VNA measurements.
 - ◆ 16 averages takes on the order of 15minutes
 - ◆ Cal time takes 80 minutes
 - ◆ Straw Poll of 7y/0n/9a shows we can drop from 16 averages down to 4 averages. Straw poll – Do you agree to reducing the number of averages from 16 to 4?
- SDD11.
 - ◆ Worst data presented rolls out to -4dB
 - ◆ No de-embedding or clean launch criteria exists at the TP1 and TP4 points measured. Questions were raised regarding what side of TP1/4 has the pad.
 - ◆ Straw Poll of 2y/3n/8a taken on: Vote “Yes” if it is OK to include the via/dogbone/pad with the TX and RX with ~3/8” of trace for de-embedding (TP1 and TP4). If DC block is on board we would include up to the DC block cap pad in addition to the via/dogbone/pad with the RX. With test structures to be defined later both from the channel side and from chip side as an informative.
 - ◆ Discussion on the location of the DC blocking cap – which side of TP4 should the device be?

19 Aug 2004 Conference Call Highlights

- Discussion on TP1 through TP4.
 - ◆ Discussion of a clean launch at the test points to avoid a de-embedding debate.
 - ◆ Discussion on design practice and the location of the DC Blocking cap.
 - ◆ Discussion on effects of the BGA pads and Cap pads to the channel.
 - ◆ Straw Poll: We place the pad on the tx side of TP1? 18 Yes, 0 No, 1 Abstain.
 - ◆ Straw Poll: For the channel side of TP1 we define a clean launch and the definition of clean launch no greater imp change than already exists for backplane connectors, typically about 8-9 Ohms. 11 Yes, 0 No, 8 Abstain
 - ◆ Straw Poll: We define a clean launch for the channel into TP4 and the definition of clean launch no greater imp change than already exists for backplane connectors, typically about 8-9 Ohms. 11 yes, 0 no, 7 abstain
 - ◆ Straw Poll: The pad and DC cap, if it exists, are on the RX side of TP4. 8 yes, 7 no, 4 abstains

07 Sept 2004 Conference Call Highlights

- Test Point simulation model Discussion.
 - ◆ Email from Healey on 8/26/04 giving a summary of where we are on this. There wasn't reflector debate, thus indicating consensus.
 - ◆ Straw Poll was taken to verify agreement for the current channel simulation model of TP1 through TP4. 5y/5n/3a. The majority issue was the split responsibility between the chip vendor and the systems vendor, resulting in contention downstream.
 - ◆ More discussion would occur on the next call for this issue.
- SDD21 Discussion
 - ◆ Three proposals to modify the currently accepted SDD21 mask.
 - ◆ Straw Poll to accept the current ad-hoc? 2y/12n/1a
 - ◆ Straw Poll to accept the D'Ambrosia Proposal? 1y/11n/3a. This proposal was withdrawn before straw poll, but the ad-hoc chair requested it be included in the polling.
 - ◆ Straw Poll to accept the Anderson Proposal? 8y/4n/3a
 - ◆ Straw Poll to accept the Goergen Proposal? 5y/8n/2a
- Time limit was reached and SMA issues were not discussed.

09 Sept 2004 Conference Call Highlights

- SDD21 Discussion
 - ◆ Continued discussion on the Anderson and Goergen proposals for change to the current ad-hoc limit.
 - ◆ After a Chicago rules poll was taken to identify which proposal to straw poll, a poll was taken to adopt the Goergen_01-0904 page 4 proposed change to the SDD21 limit. 14y/6n/0a
- Test Point Simulation Model TP1-TP4
 - ◆ Discussion on the following:
 - » Continue to define parameters as measured from TP1 to TP4
 - » Define TP1-TP4 and an informative TP5 with a supercap equivalent circuit model defined in Melitz's reflector message between TP4 and informative TP5
 - » Define TP1-TP4 and an informative TP5 with an equivalent cap circuit model that will be defined as informative between TP4 and informative TP5
 - ◆ After a Chicago rules poll was taken to identify which proposal to straw poll, a poll was taken to Define TP1-TP4 and an informative TP5 with an equivalent cap circuit model that will be defined as informative between TP4 and informative TP5. 16y/1n/0a

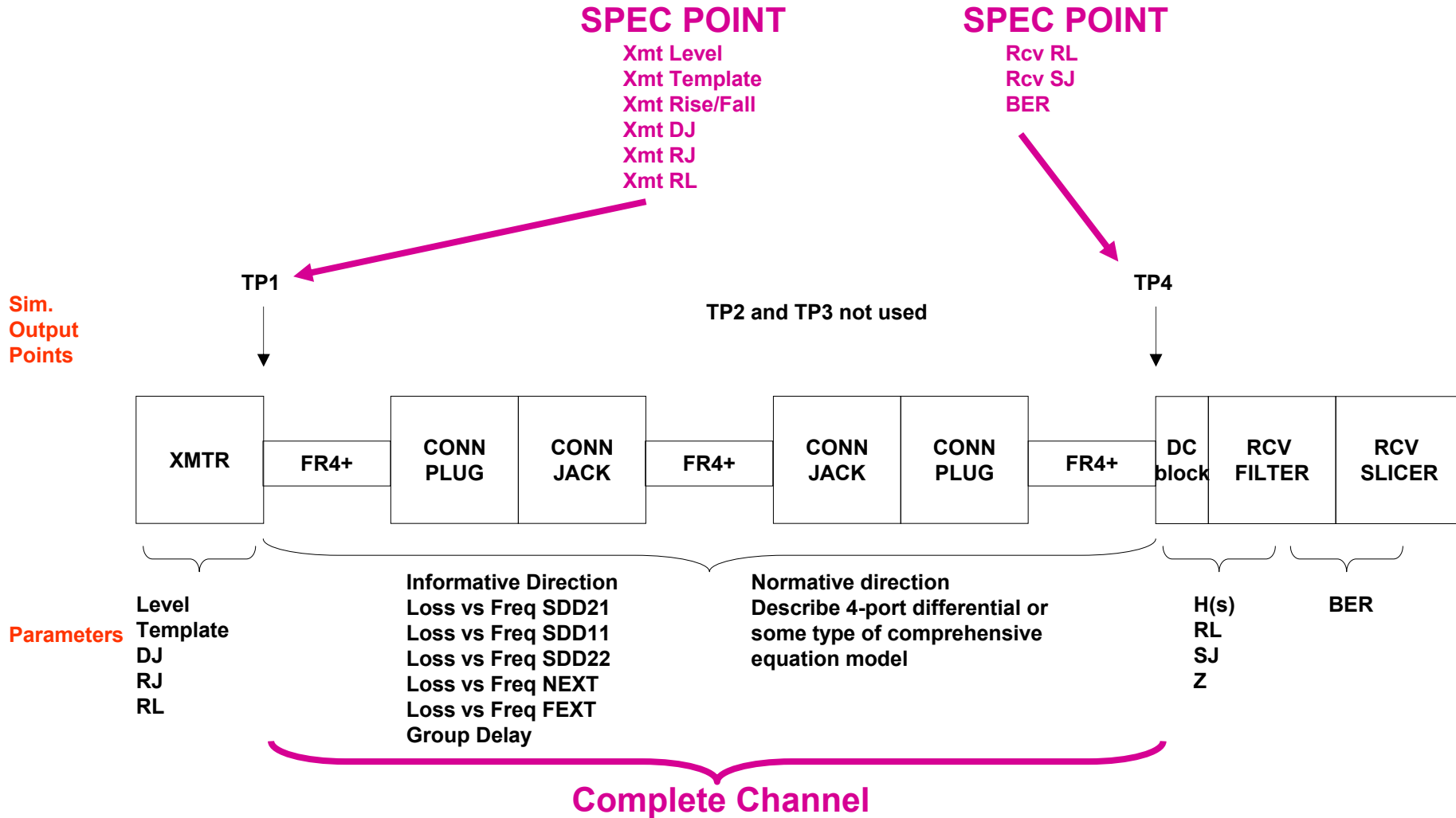
17 Sept 2004 Conference Call Highlights

- Further SDD21 Discussion:
 - ◆ Concern was raised the new curve moved down ~2dB@5Ghz.
 - ◆ Data shown to date correlates much better to the new curve than the previous adopted ad-hoc. Objective of the Dk/Df boundary as part of the definition of 'improved fr-4' was adopted to support this.
 - ◆ Discussion was ended and request was made to submit additional proposals if you disagree with the new SDD21.
- SDD11 Discussion:
 - ◆ Suggestions to raise the limit from -12dB to -4/-6/-8dB.
 - ◆ Suggestions for creating a non-flat line or breaking the range up into three areas.
 - ◆ A Chicago rules straw poll really showed no consensus. A Straw Poll was taken to Develop a new limit line for SDD11. 10y/3n/3a
- Plea for data support and additional proposals in the following areas:
 - VNA setup; averaging vs. single sweep – please bring any contributions and opinions. The reflector should also be used liberally.
 - Simulation Model – additional things have to happen between TP4 & TP5. Richard has done some modeling. Would like to see a proposal on the reflector prior to the meeting.
 - SDD21 mask set – If there are other proposals, please send them to the reflector to include a large audience
 - SDD11 & SDD22 – We definitely need contributions. Joel, John, Adam, and Steve will send data to website.
 - NEXT & FEXT – We seem to be within 6 or 7 dB of adjustment. Please come prepared to discuss how your data fits.
 - Group Delay Ripple – Bring any information you have.

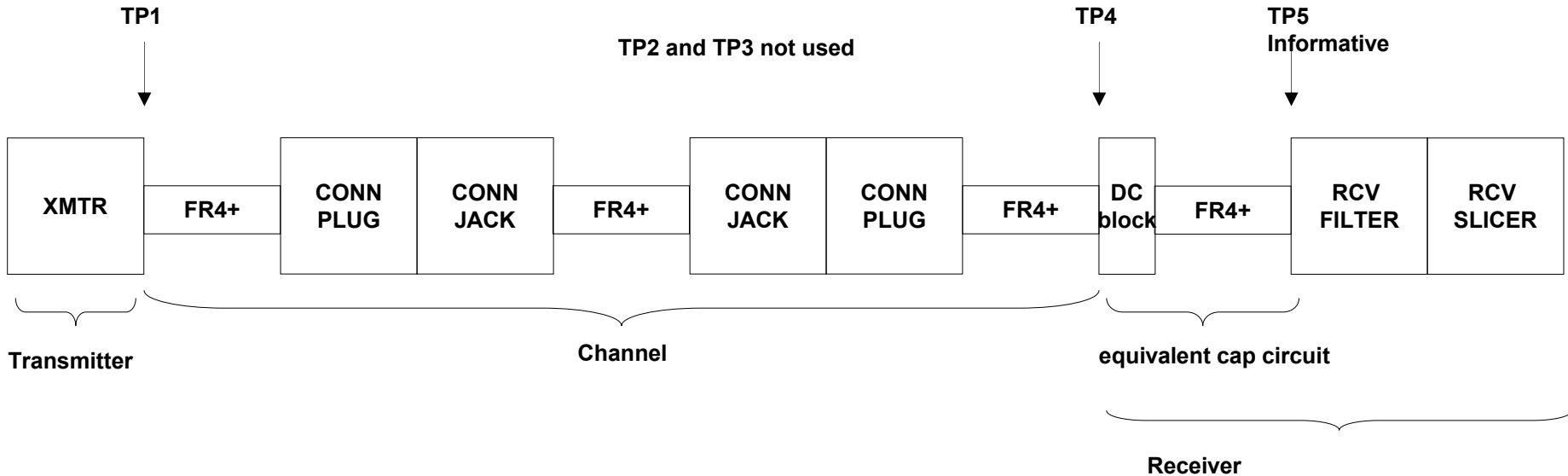
Proposed Informative VNA Setup

- IF BW = 300Hz
- Leveled Output Power = -5dBm
- Averaging = 4 (old value was 16)
- Step Size = 10Mhz
 - ◆ $F=15000\text{Mhz}$, Step = 10Mhz, # points = $(F_{\text{end}}-F_{\text{start}})/\text{step}+1 < 1600$
 - ◆ Value chosen as $N_{\text{whole}} = F_{\text{start}}/\text{step}$ to ease invFFT conversion
- Frequency Range = 50Mhz to 15000Mhz

OLD Proposed Model for Simulation



NEW Proposed Model for Simulation



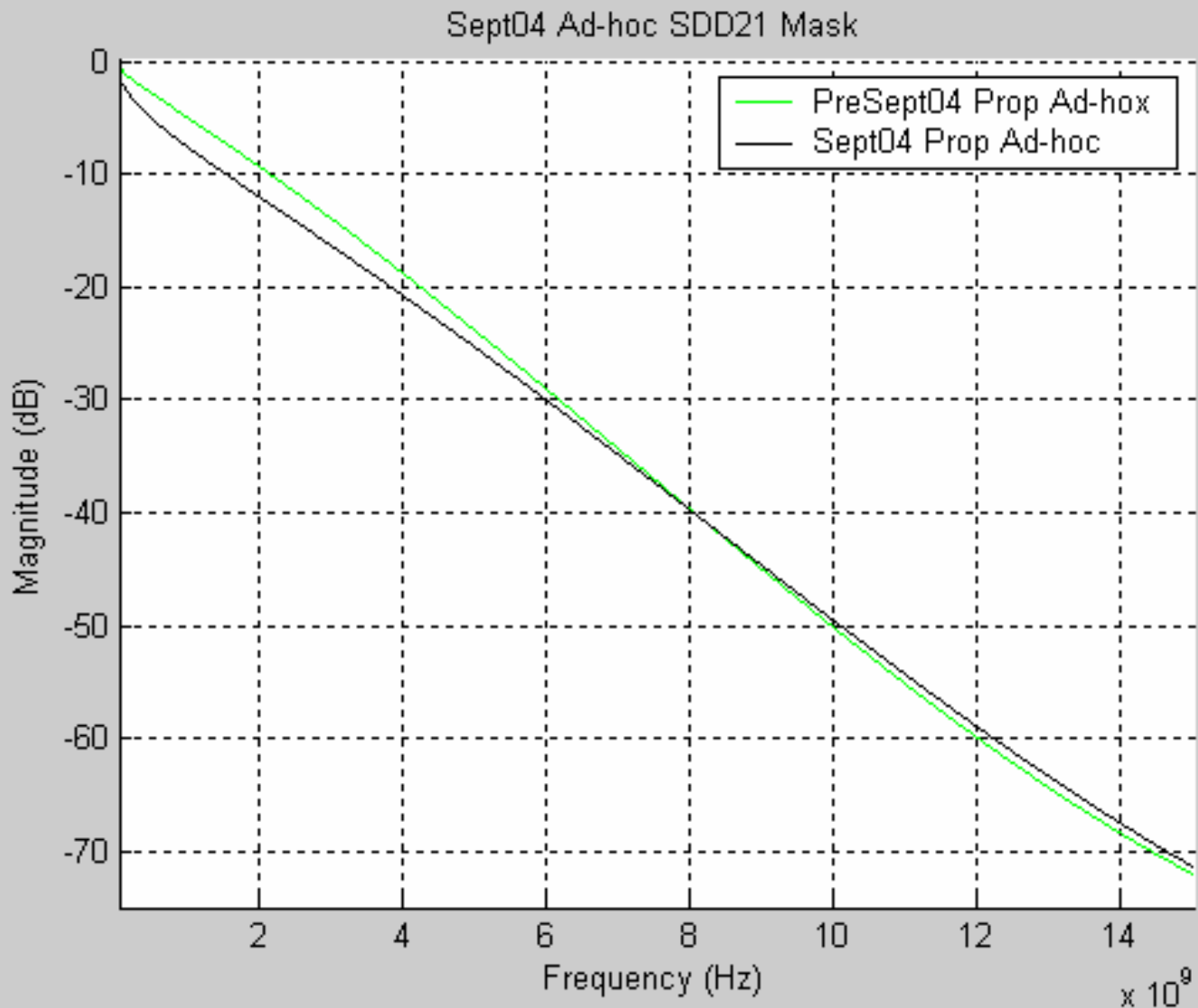
OLD Proposed Informative SDD21 Channel Equation

- $b1 = 6.5E-06$
- $b2 = 3.3E-10$
- $b3 = 3.2E-20$
- $b4 = 1.38E-30$
- $SDD21 = -20 \cdot \log_{10}(e) \cdot (b1 \cdot \sqrt{f}) + b2 \cdot f + b3 \cdot f^2 - b4 \cdot f^3$
- $f = 50\text{Mhz to } 15000\text{Mhz}$

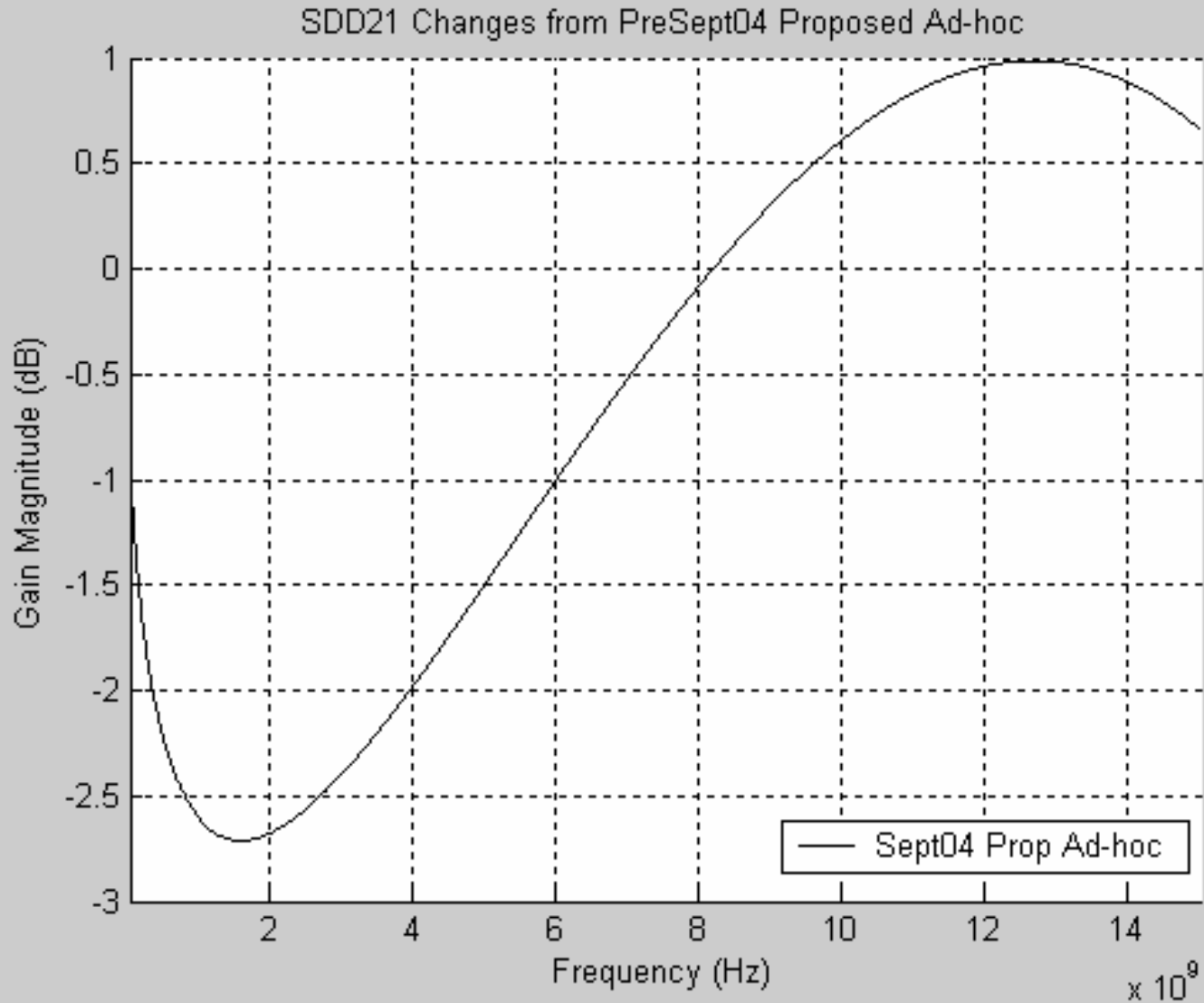
NEW Proposed Informative SDD21 Channel Variables to Existing Equation

- $b1 = 2.25e-5$
- $b2 = 1.20e-10$
- $b3 = 3.50e-20$
- $b4 = 1.25e-30$
- $SDD21 = -20 \cdot \log_{10}(e) \cdot (b1 \cdot \sqrt{f}) + b2 \cdot f + b3 \cdot f^2 - b4 \cdot f^3$
- $f = 50\text{Mhz to } 15000\text{Mhz}$

Recommended SDD21 Mask



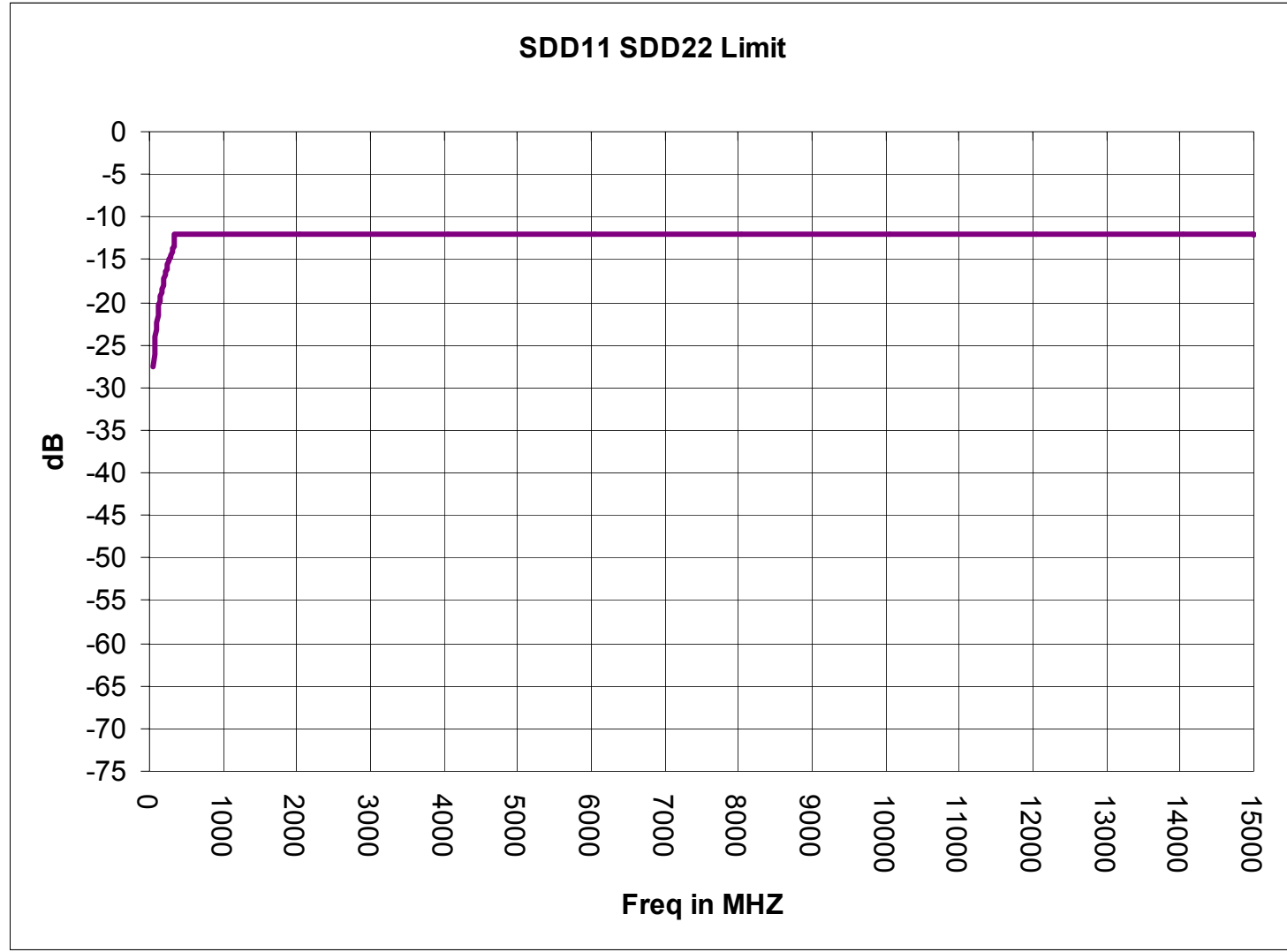
Recommended SDD21 Mask



Proposed Informative SDD11 and SDD22 Channel Equations

- $\text{ReturnLoss}(f) \geq 22.35 - 17.19 \times \log(f/100)$, f in Mhz
 - ◆ For $50\text{Mhz} \leq f < 400\text{Mhz}$
- $\text{ReturnLoss}(f) \geq 12$
 - ◆ For $400\text{Mhz} \leq f \leq 15000\text{Mhz}$

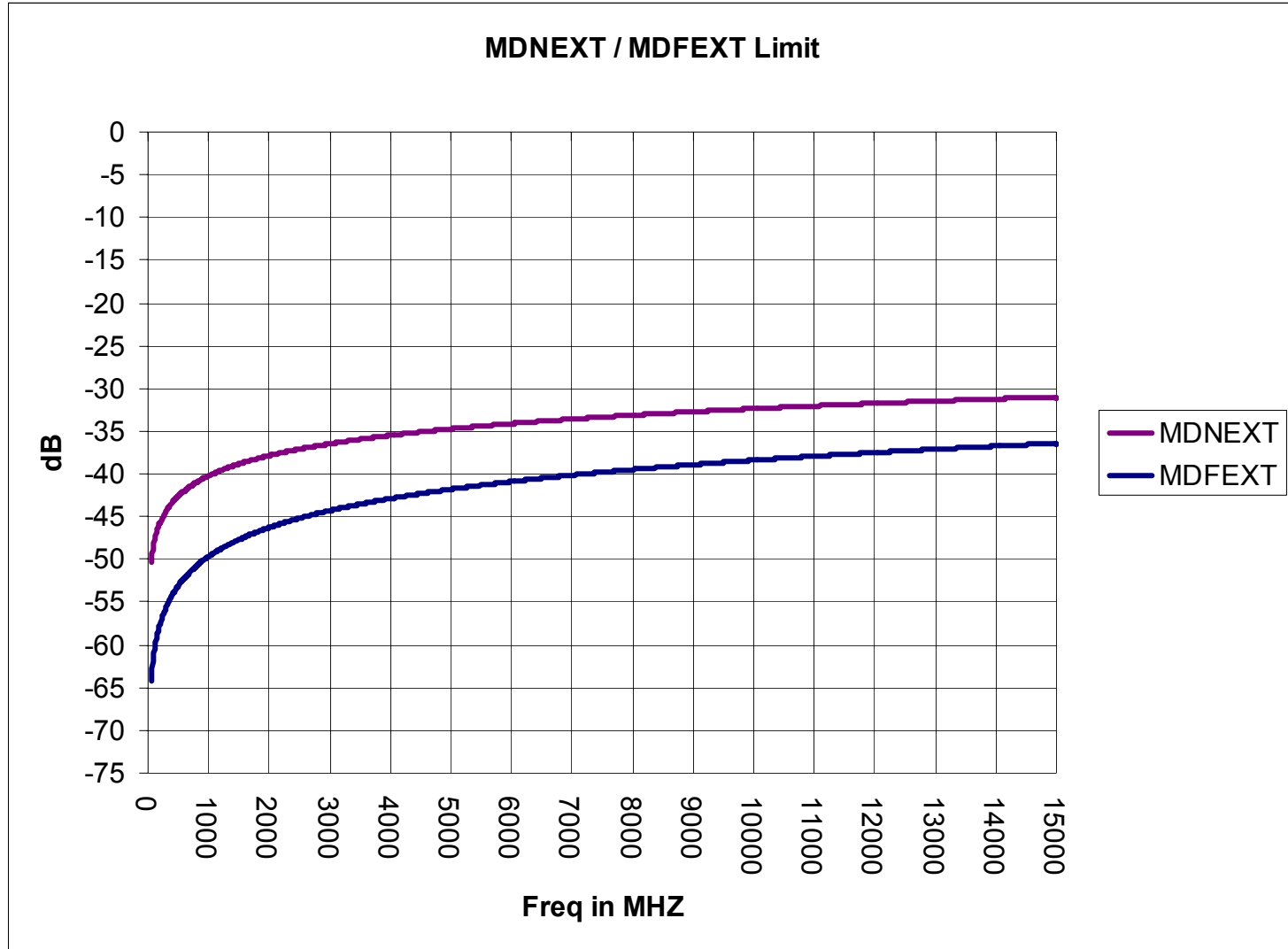
Proposed Informative SDD11 and SDD22 Channel Magnitude Mask



Proposed Informative NEXT/FEXT Channel Equations

- $MDNEXT = 30 - 7.85 * \text{LOG}(f/20000)$; f in MHz
- $MDFEXT = 35 - 11.27 * \text{LOG}(f/20000)$; f in MHz
- f = 50Mhz to 15000Mhz

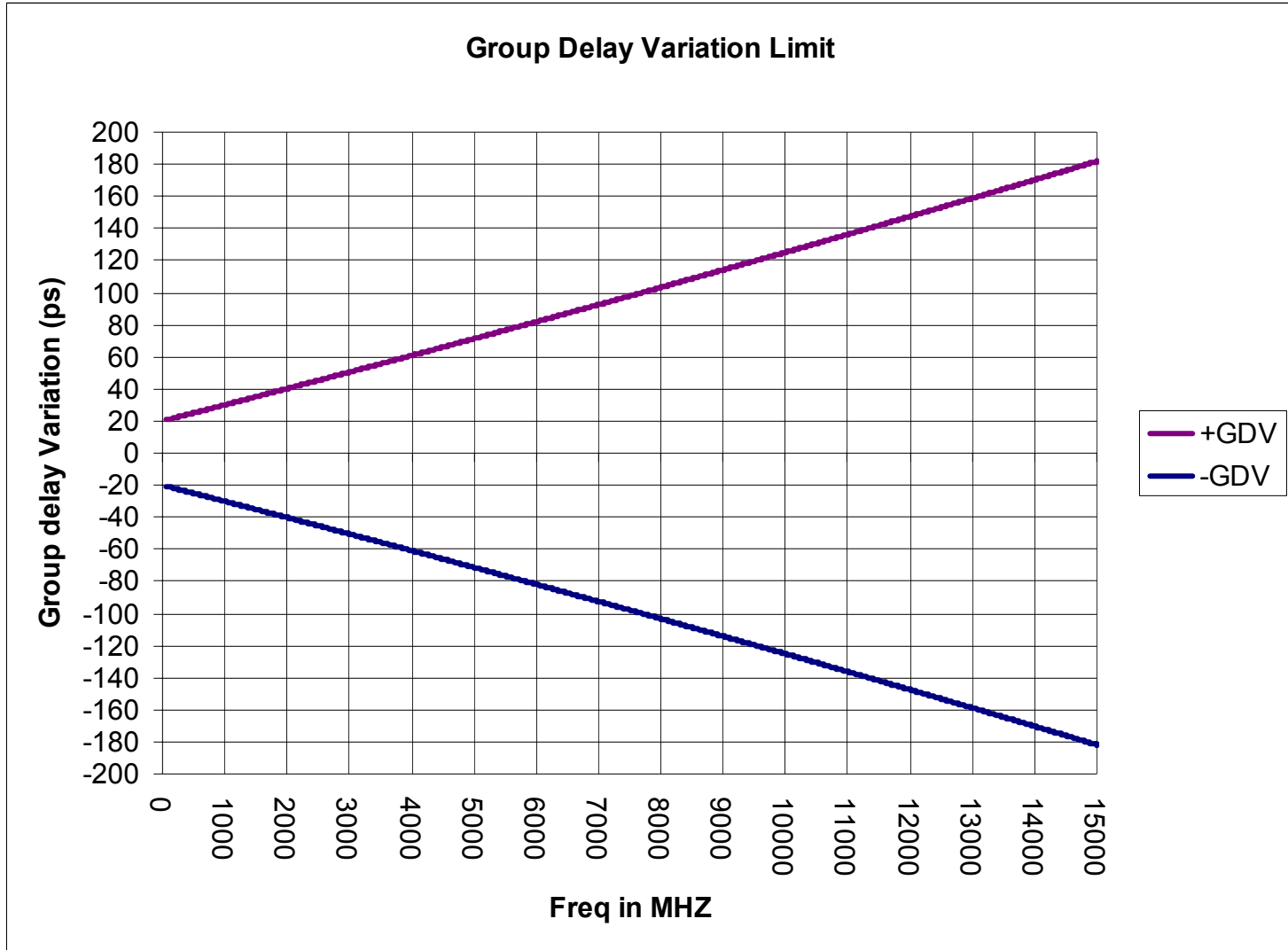
Proposed Informative NEXT/FEXT Channel Magnitude Mask



Proposed Informative Group Delay Variation Equations

- Top Slope = $1000 * (\text{EXP}(f/100000) - 0.98)$; in ps
- Bottom Slope = $-1000 * (\text{EXP}(-f/100000) - 0.98)$; in ps
 - ◆ Bottom Slope based on $1000 * (\text{EXP}(-f/100000) - 1.02)$ and modified as above for symmetry.
- $f = 50\text{Mhz}$ to 15000Mhz

Proposed Informative Group Delay Variation Mask



Further Work

- Identify during the Sept 04 Meeting.
- Consider adopting the informative masks as normative.