Informative Back Plane Channel: Ad-hoc Recommendations

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

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Outline

- 21 June 2004 Conference Call Highlights
- 01 July 2004 Conference Call Highlights
- 09 July 2004 Conference Call Highlights
- Informative VNA Measurement Recommendations
- Informative Channel Six Mask Set Recommendations
- Further Work
- Outline of Work to Complete Before July 2004 Plenary

21 June 2004 Conference Call Highlights

- Review a test card plan to validate the informative channel model six mask set.
  - Two flavors of test cards from Joel Goergen were reviewed. These Cards will be available to others to gather data. This includes data collection on the three connector model covering 3 connectors over 33inches.
  - John D'Ambrosia is designing a set of cards. Data will be available to non-competing companies.
- A presentation was given on recommended changes to the Dk/Df values presented in May04. Reference goergen_01_0704.
- There was group discussion about changing the upper limit of the frequency band specified from 20000Mhz to 10000Mhz.
- Time was devoted to Group Delay Variation. The group has not spent enough time evaluating this.

01 July 2004 Conference Call Highlights

- The majority of the call was spent discussing VNA Parameters. See Proposed Informative VNA Setup slide below. An issue yet to resolve is there a difference in crosstalk measurements with -5dBm, 0dBm, +5dBm.
- There was group discussion about changing the upper limit of the frequency band specified from 20000Mhz to 15000Mhz or 12500Mhz.
- There was not time to review the proposed changes to Group Delay Variation.

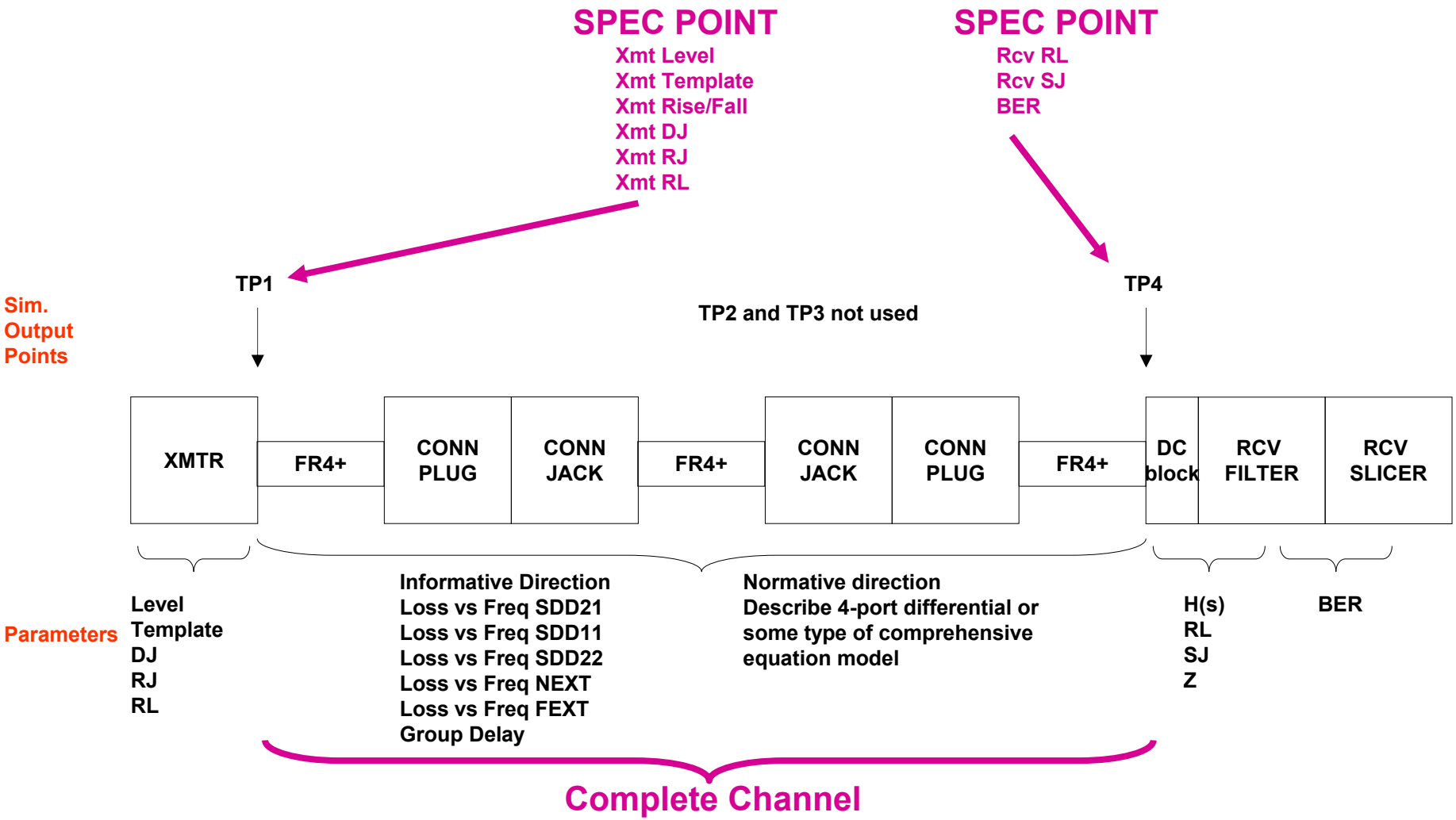
09 July 2004 Conference Call Highlights

- The group did a straw poll to recommend a change in frequency range of interest: 50Mhz to 15000Mhz. Was 100Mhz to 20000Mhz.
- The group did a straw poll to recommend that the frequency range in the mask sets be the same as that used in simulation and measurement … ie, the frequency range should be the same for mask, model, and measurement.
- There was a discrepancy raised in the NEXT/FEXT curves. In the June minutes, it was recommended to drop the limit lines by 10dB. In doing so, I kept the equations intact, dropping the start point by 10dB. This was then presented to the 802.3ap body. The issue is the 10Ghz point is 2.5dB lower then lowering the entire limit by 10dB. The group recommends we stay with the current implementation … ie, leave what was presented as is.
- A recommendation on group delay was discussed. There is still confusion on the calculation of group delay variation and the usefulness. Most of the issue is the MAY04 Ad-hoc presentation titles the group delay variation slide incorrectly as group delay. The title will be corrected.
- There was discussion to recommend that VNA measurements be done at -5dBm as long as the dynamic range of the test set is at least 80dB or better. It was also noted that the power level should not be raised above -5dBm as the newer VNA equipment is limited to the -5 / -3 dBm range. A presentation was given, dambrosia_07_04, based on xtalk measurements from data collected at UNH with varying IF BW and Launch power. The conclusion was we still have more work to do with group delay. Xtalk needs more evaluation at the -5dBm launch power.

Proposed Informative VNA Setup

- IF BW = 300Hz
- Leveled Output Power = -5dBm
- Averaging = 16
- Step Size = 10Mhz
  - F=15000Mhz, Step = 10Mhz, # points = (Fend-Fstart)/step+1 < 1600
  - Value chosen as Nwhole = Fstart/step to ease invFFT conversion
- Frequency Range = 50Mhz to 15000Mhz

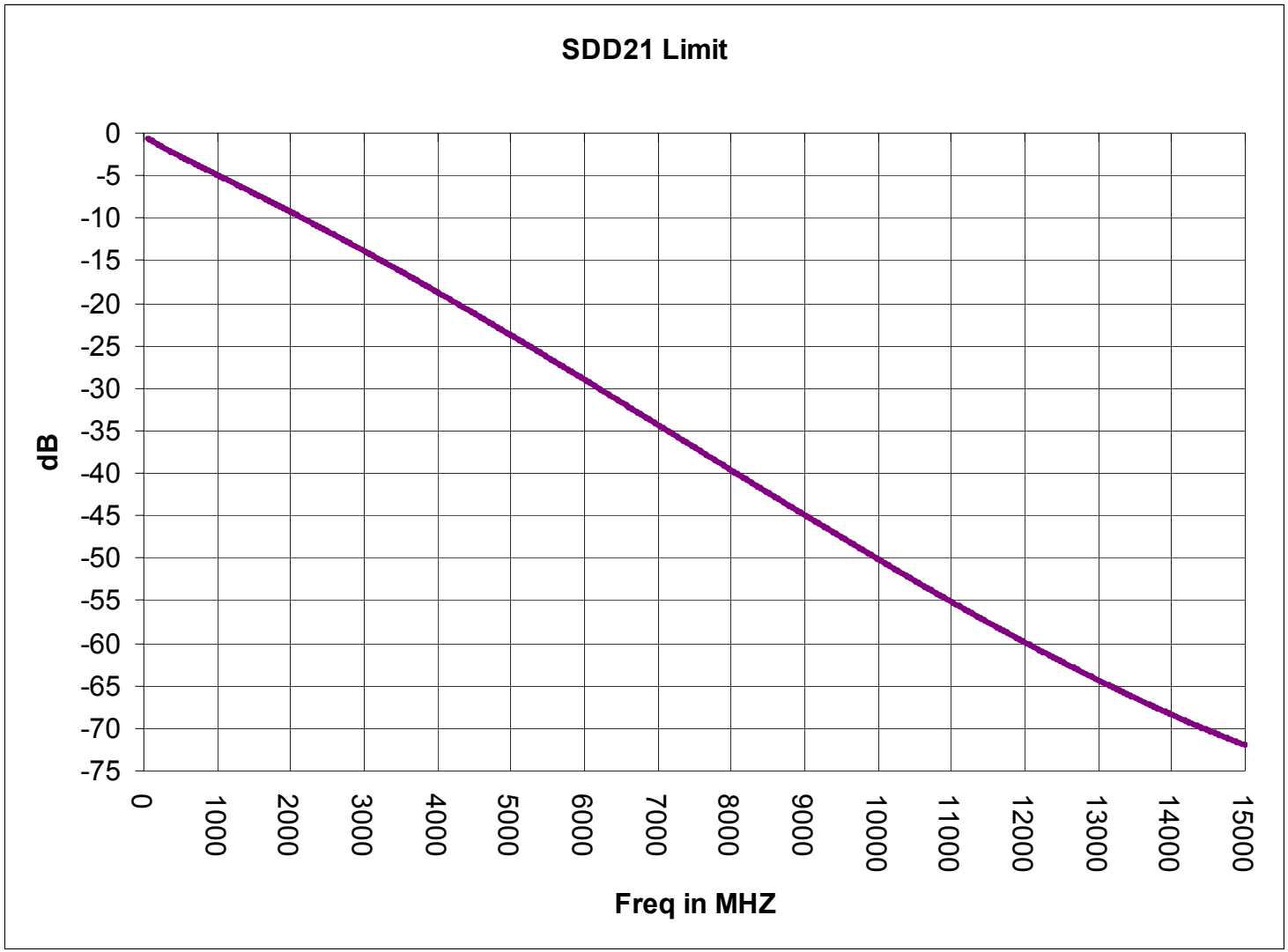
Proposed Model for Simulation



Proposed Informative SDD21 Channel Equation

- b1 = 6.5E-06
- b2 = 3.3E-10
- b3 = 3.2E-20
- b4 = 1.38E-30
- SDD21 = -20*log10(e)*(b1*sqrt(f) + b2*f + b3*f^2 - b4*f^3)
- f = 50Mhz to 15000Mhz

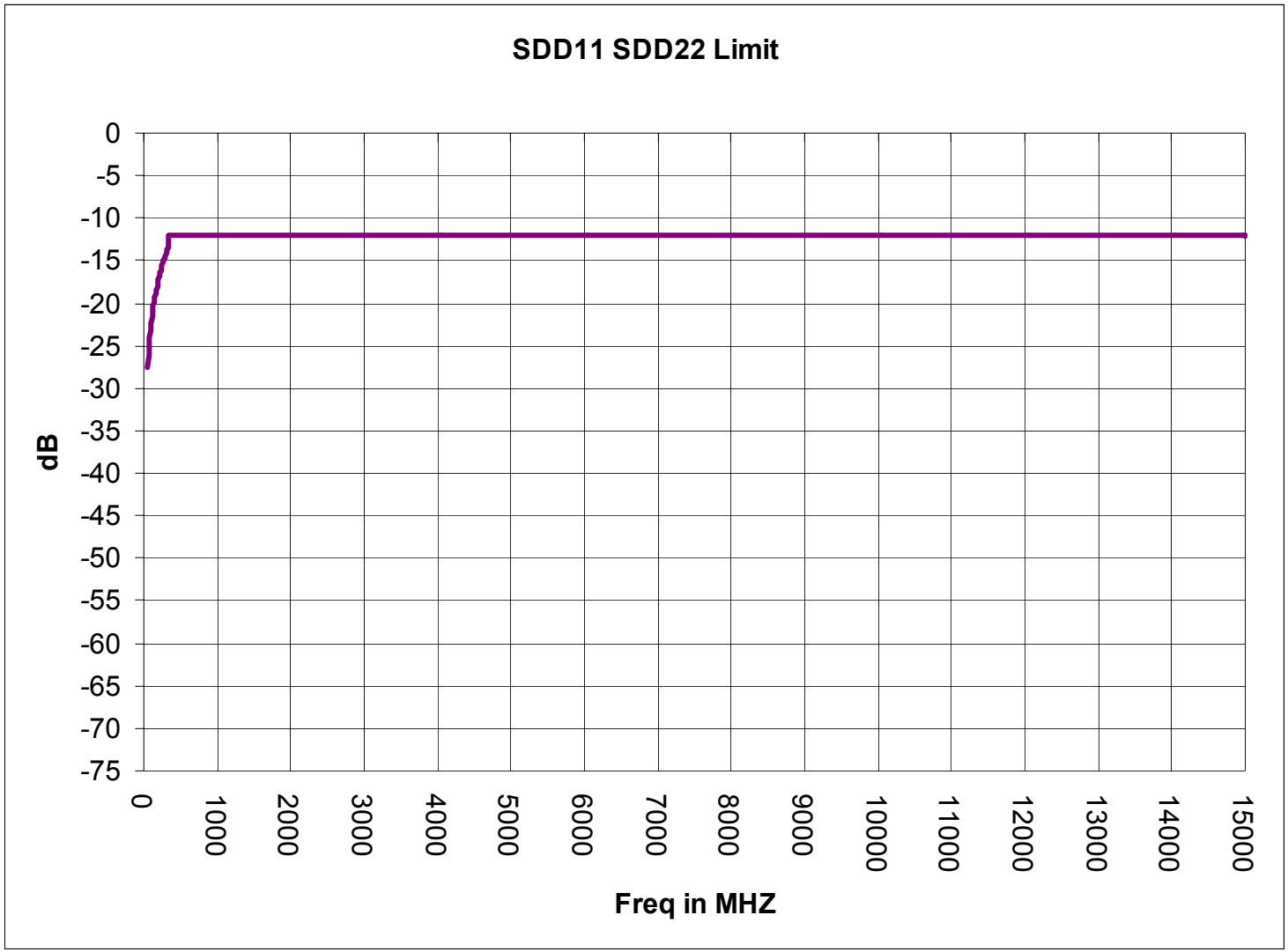
Proposed Informative SDD21 Channel Magnitude Mask



Proposed Informative SDD11 and SDD22 Channel Equations

- ReturnLoss(f) ≥ 22.35 – 17.19xlog(f/100), f in Mhz
  - For 50Mhz ≤ f < 400Mhz
- ReturnLoss(f) ≥ 12
  - For 400Mhz ≤ f ≤ 15000Mhz

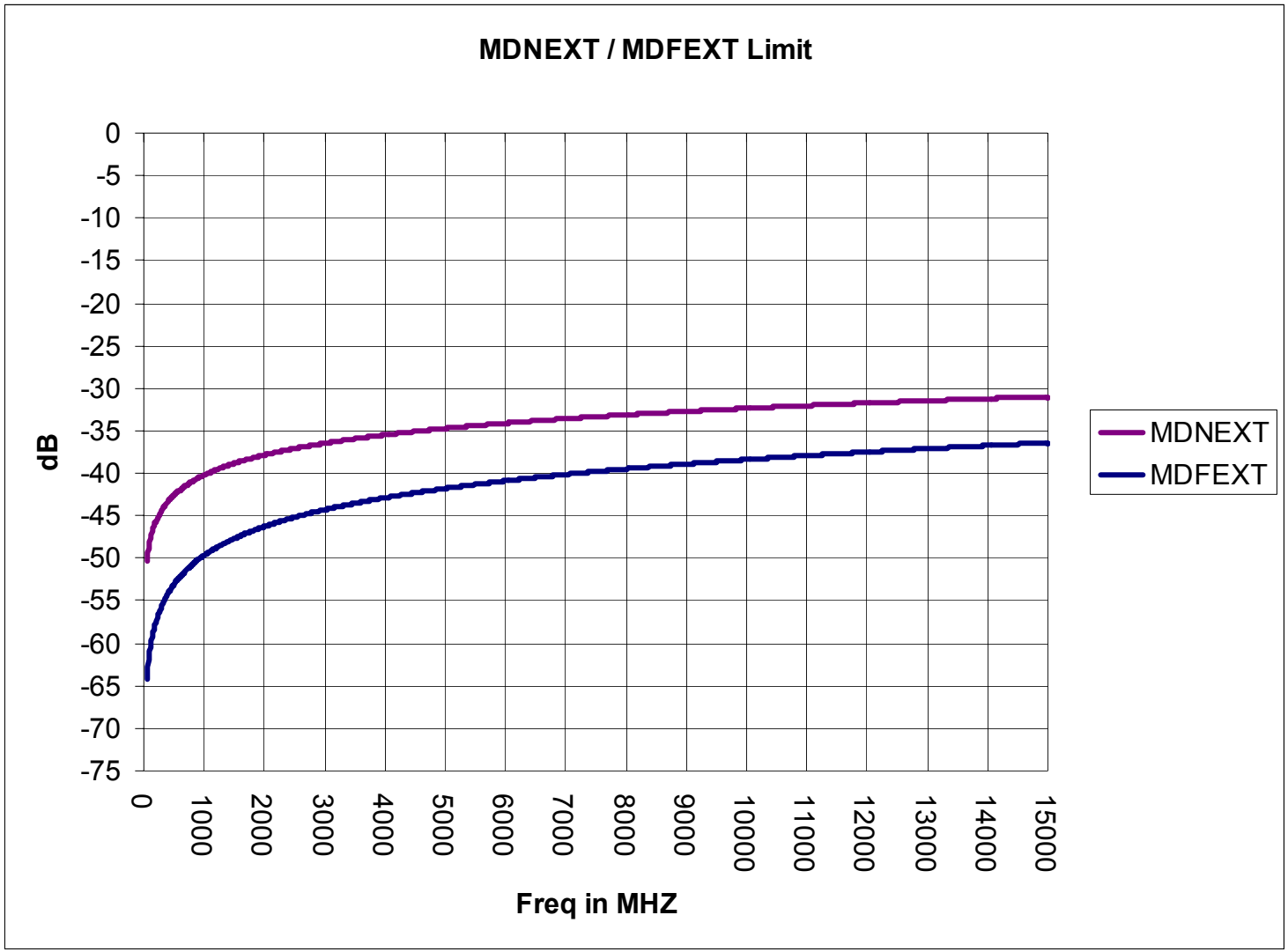
Proposed Informative SDD11 and SDD22 Channel Magnitude Mask



Proposed Informative NEXT/FEXT Channel Equations

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

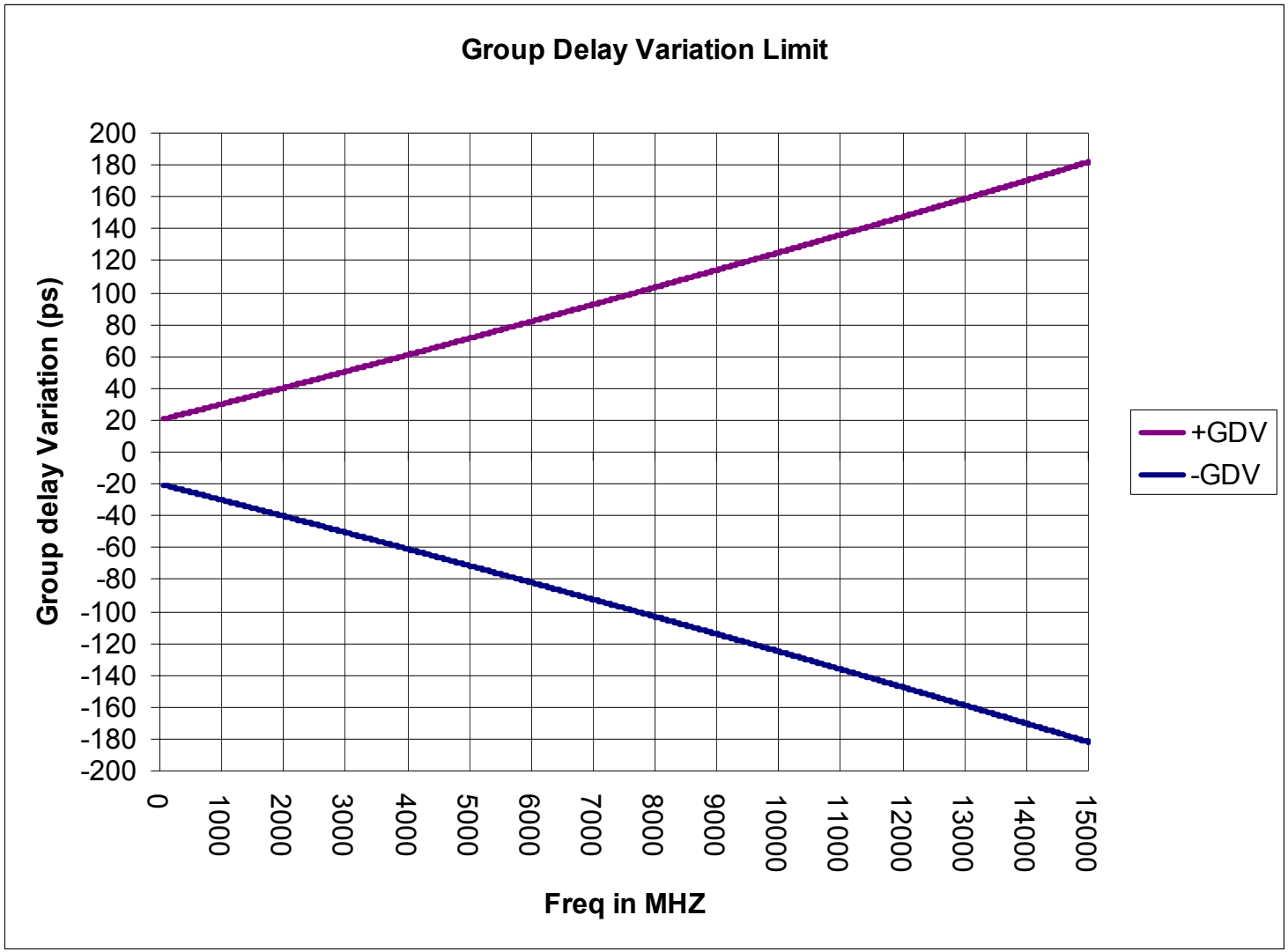
Proposed Informative NEXT/FEXT Channel Magnitude Mask



Proposed Informative Group Delay Variation Equations

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

Proposed Informative Group Delay Variation Mask



Further Work

- Verify known channels meeting 'Improved FR-4' material guidelines to SDD21, SDD11, and SDD22 proposed masks. Started.
- Verify NEXT and FEXT masks. Started.
- Verify Group Delay Variation mask and gather data to support it. Null of -25dBm followed by +25dBm within 300Mhz is suspect data.
  - Group delay and phase effected only … VNA phase detector loses lock.
  - SDD11, SDD22, SDD21, FEXT and NEXT magnitude are okay.
  - Data to support the mask.
- Devote at least one call to the effects temperature and humidity have on 'Improved FR-4' and the proposed six masks. Started.
- Devote at least one call to the effects packaging will have on the proposed six masks.
- Devote time to DC-Blocking, and location in model.
- Develop and distribute a test and measurement board that meets close to the worst case of each mask, as well as the best cases possible. The intent is to establish confidence in presented data across presenters and various measurement equipment / techniques. Started.
- We need to make clear that all limit lines are hard. Dropping below them is considered a failed channel.

Outline of Work to Complete Before Next Plenary

- To be determined ….