

Improved HVM ATCA Measurement Data

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Situation

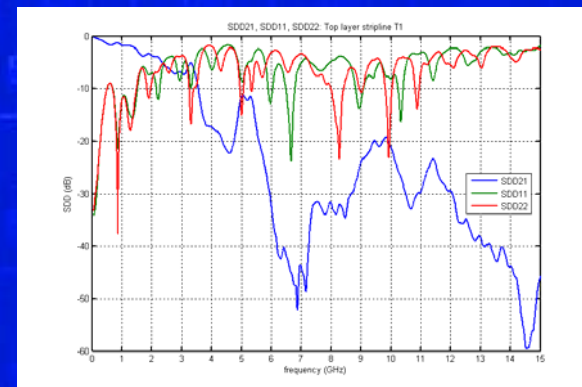
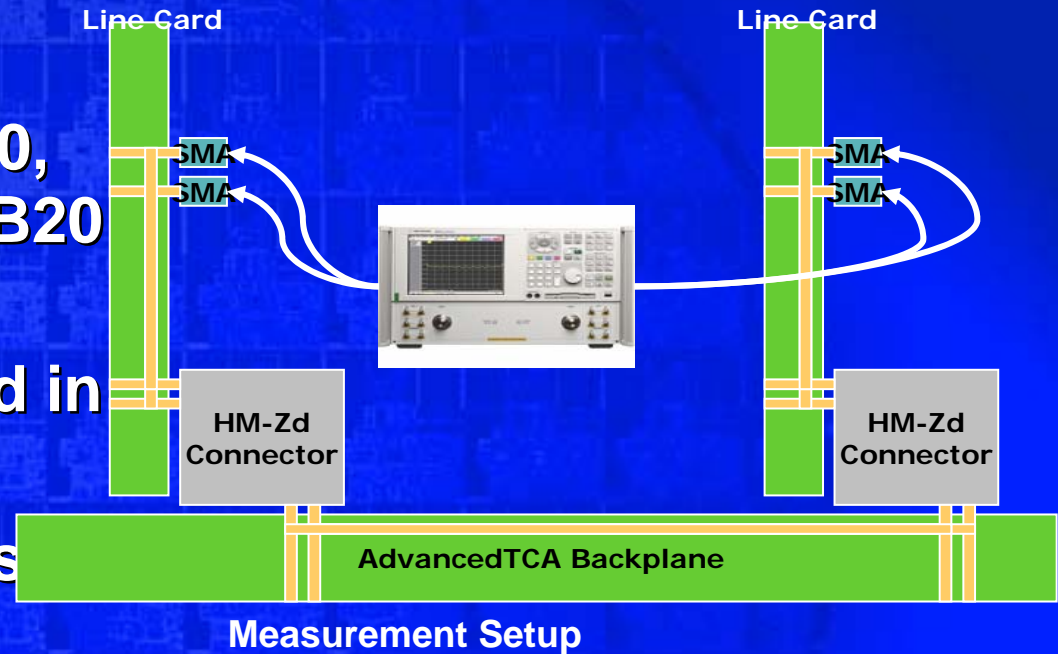
- 8 sets of channel models (peters_01_0904) were submitted to the task force
 - Measurements of a test system without some optimizations
- ‘Improved’ models of HVM ATCA systems were presented in March that represent the expected performance of these systems.
 - The models’ thru response and return loss were correlated to a limited set of measurements of a production backplane with most of the ‘improvements’ incorporated.
 - The models were used to predict the thru performance of a variety HVM ATCA systems with the design improvements that correspond to the 8 submitted measured channel models. Peters_01_0904 crosstalk data was used with the new thru models.
 - Simulations (seeman_01_0305) indicated that the improved models were passing except for the T channels which required additional equalization and elimination of crosstalk.

Objectives

- **Validate the predictions of the ‘improved’ models**
- **Provide new data sets based on the new measurements including crosstalk**
- **Compare data to informative model proposals**
 - **A new test system has been designed and fabricated which incorporates the design ‘improvements’**
 - **Crosstalk data is available**

Intel Channel Models

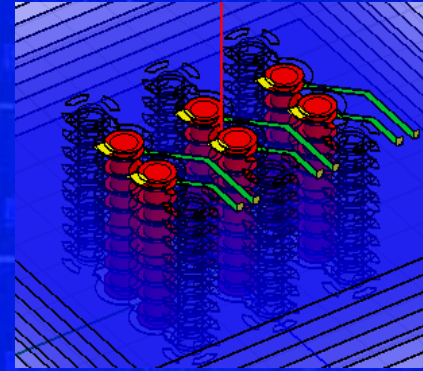
- 8 channels T1, T12, T20, M1, M20, B1, B12 and B20
- Original measured channels are described in [peters_01_0904](#)
- Channel improvements and synthesized 'improved' models are described in [peters_01_0305](#).



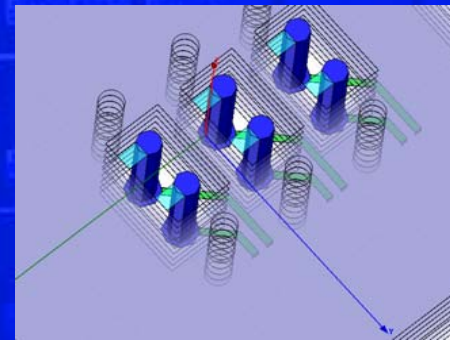
T1 Channel THRU Measurement

'Improved' Via / Pad Design

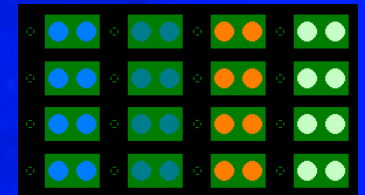
- The peters_01_0904 channels use default manufacturing techniques for HM-Zd connector footprint via design.
- The improved design features a rectangular anti-pad and removal of non-essential pads.
- The improved design is compatible with HVM design practices and has been implemented in Intel's production backplane as well as backplanes from other vendors.



Peters_01_0904 channels via design



Improved via design



Differences in the 'improved' design

- **Improved HMZD footprint via design**
 - Rectangular antipad
 - Remove non-essential pads
- **Increased loss on the line cards**
 - Lower cost N4000-6 material
 - Increased trace length

Channel data comparisons

Channel characteristics

	Line card material	Line card trace length	Line card routing layer	HM-Zd footprint
T channels	Nelco 4000-13	2.7", 3.2"	top, middle	default
M channels	Nelco 4000-13	4.8", 3.8"	bottom, middle	default
B channels	Nelco 4000-13	2.3", 3.0"	top, middle	default
'Improved' T channels	Nelco 4000-6	5",5"	top, middle	improved
'Improved' M channels	Nelco 4000-6	5",5"	middle, bottom	improved
'Improved' B channels	Nelco 4000-6	5",5"	top, middle	improved
Synthesized channels	High Tg FR-4	5",5"	bottom, bottom	improved
Alternate synthesized channels	High Tg FR-4	5",5"	top, top	improved

Data Processing

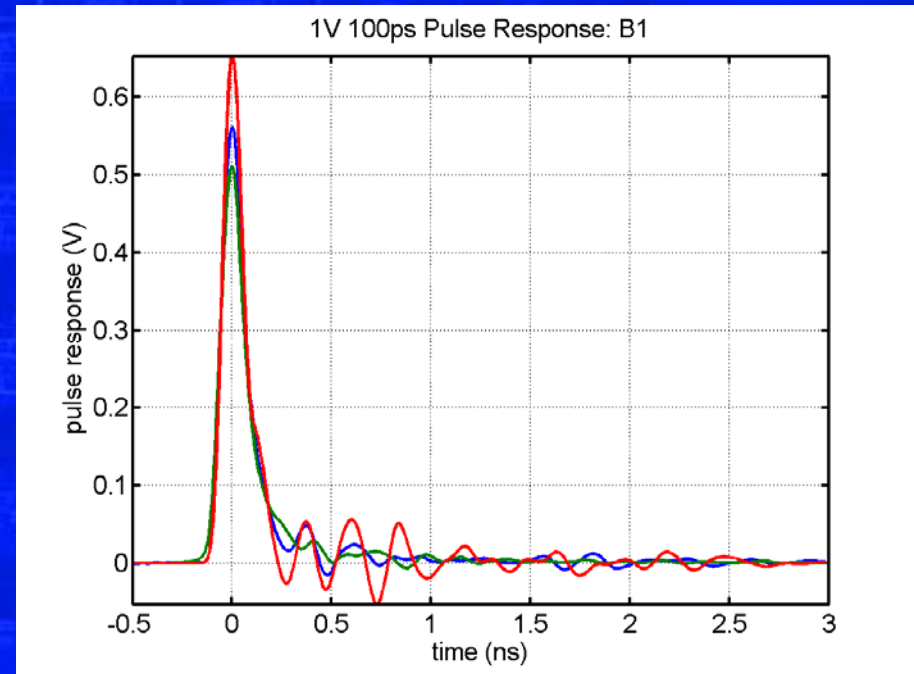
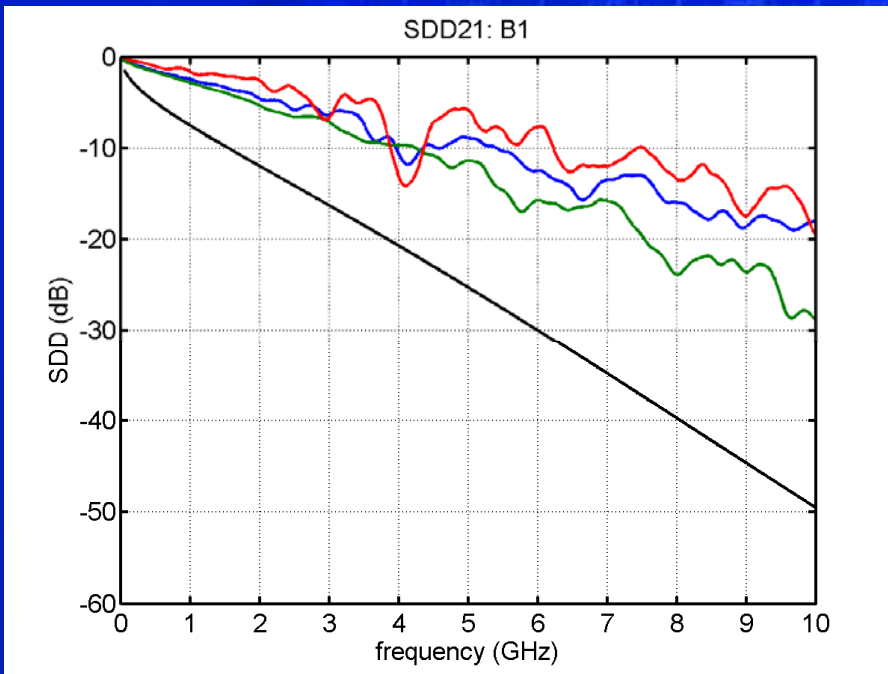
- **Insertion loss**
 - Reference attenuation from goergen_03_0904
- **Pulse Response**
 - 100ps 1V ideal pulse
 - No pkg effects
- **Crosstalk**
 - MNEXT: power sum of all six NEXT aggressors
 - MFEXT: power sum of all two FEXT aggressors
 - MXT: power sum of all 8 aggressors
- **Insertion loss to crosstalk ratio (ICR)**
 - Ratio of IL to MXT
 - Limit line = $12.5 - 20 \cdot \log(\text{freq}/5\text{GHz})$

B1 Thru Response

Peters_01_0904 measurement models

Peters_01_0305 synthesized models

Improved system measurements

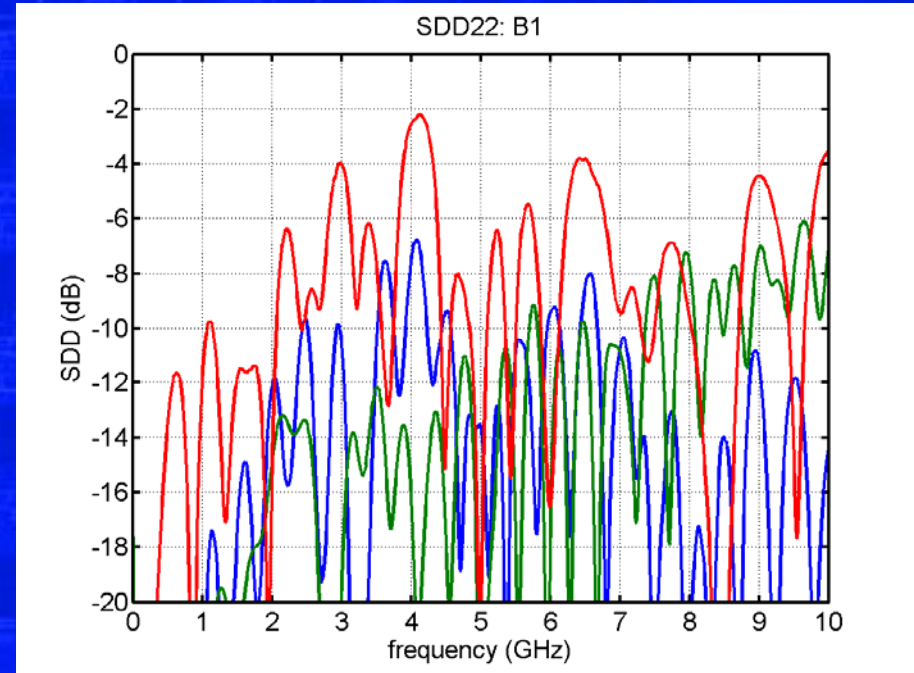
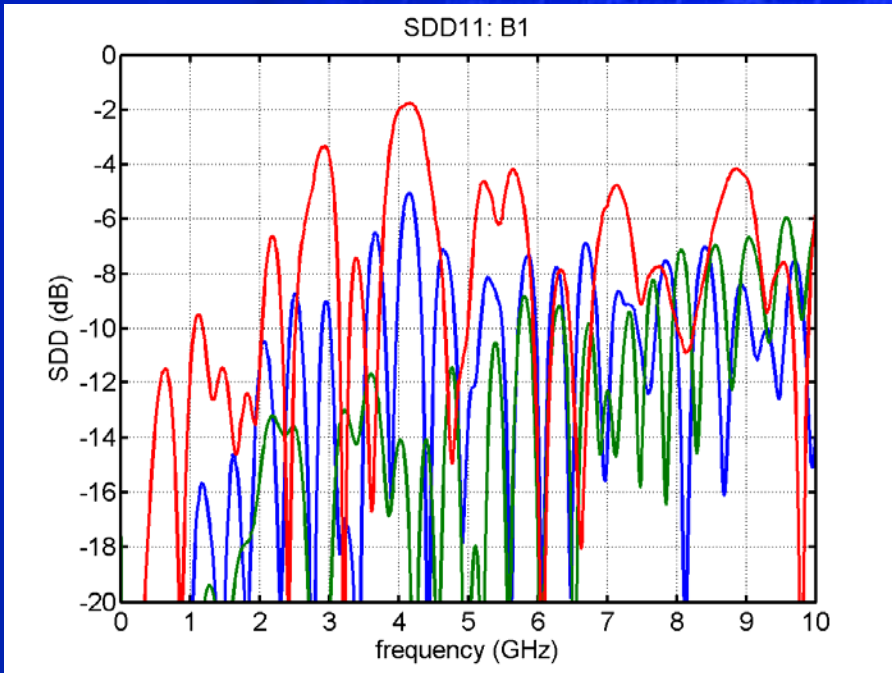


B1 Return Loss

Peters_01_0904 measurement models

Peters_01_0305 synthesized models

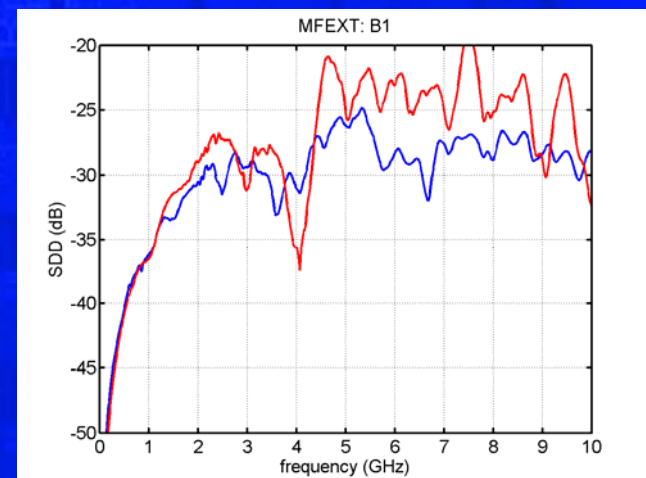
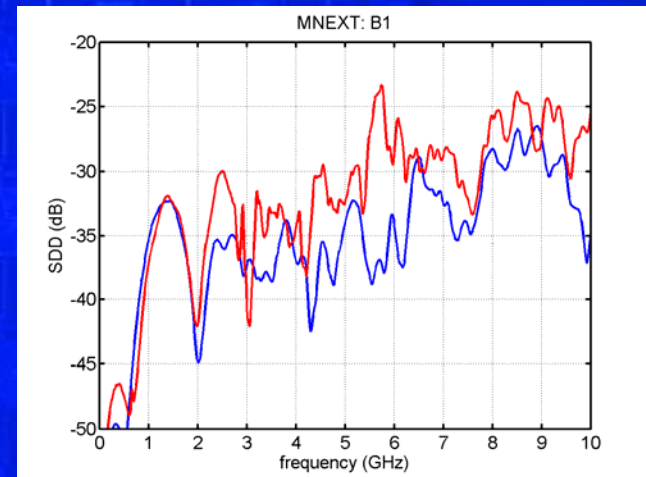
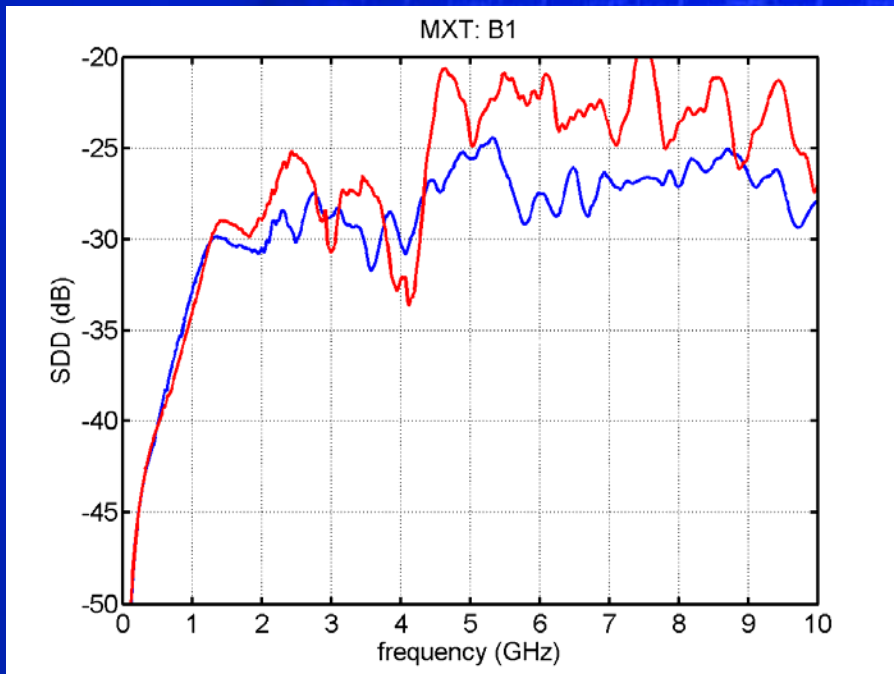
Improved system measurements



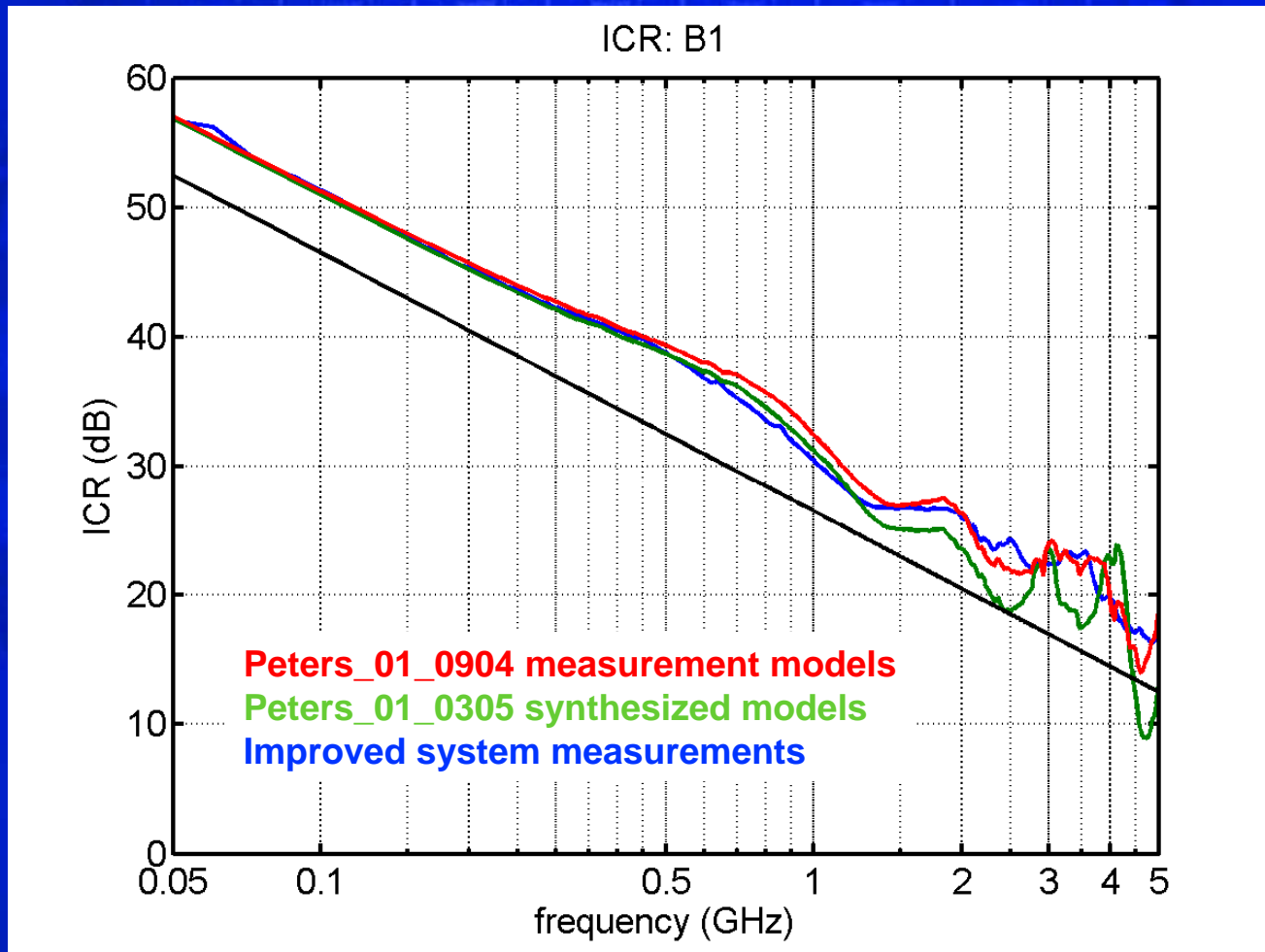
A similar trend is observed for all improved channels

B1 Crosstalk

Peters_01_0904 measurement models
Improved system measurements



B1 ICR

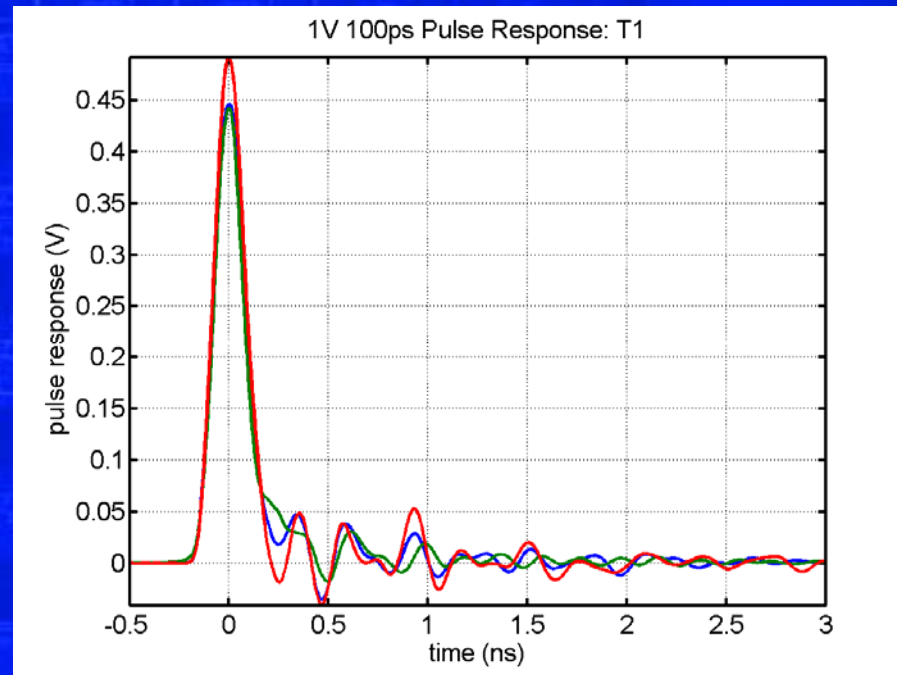
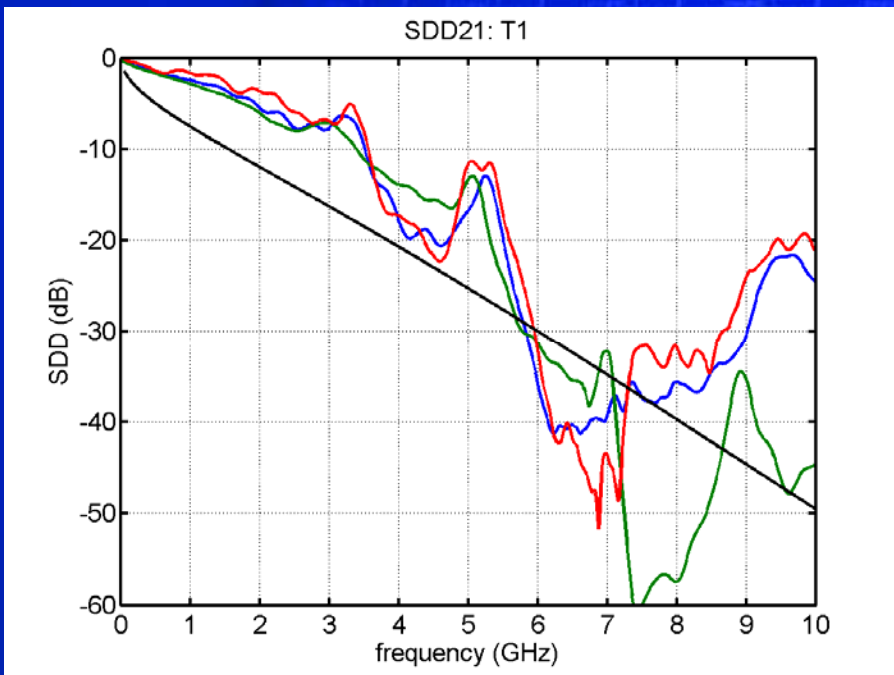


T1 Thru Response

Peters_01_0904 measurement models

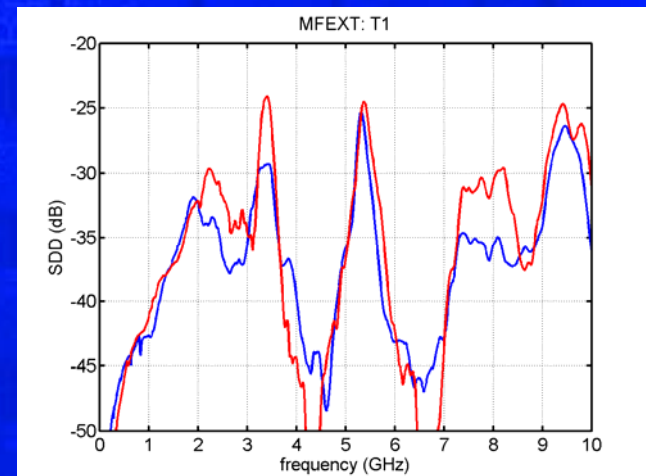
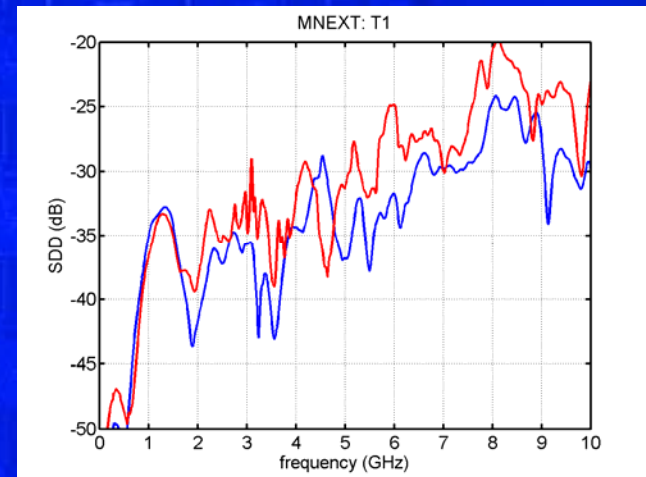
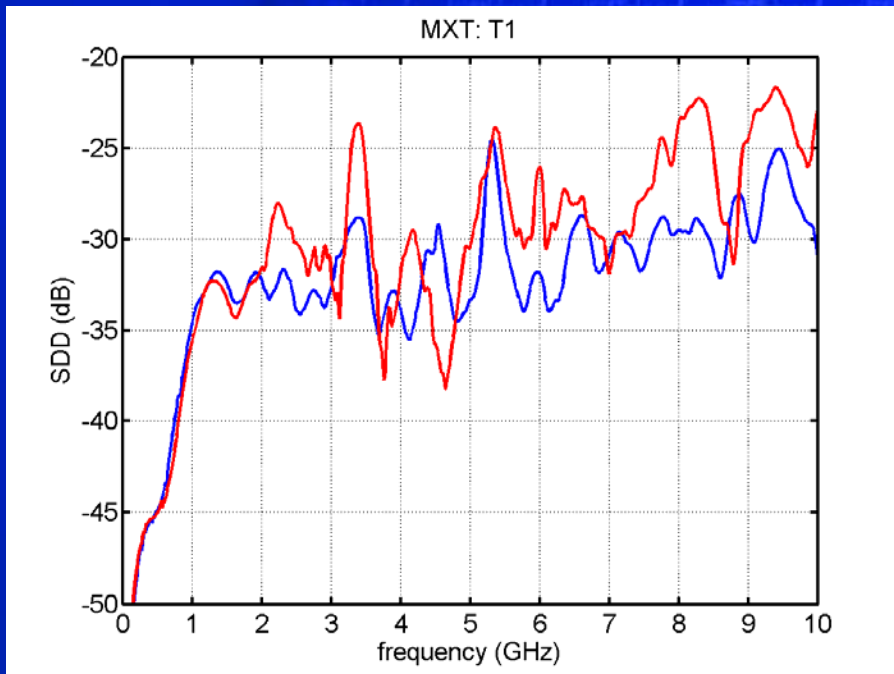
Peters_01_0305 synthesized models

Improved system measurements



T1 Crosstalk

Peters_01_0904 measurement models
Improved system measurements

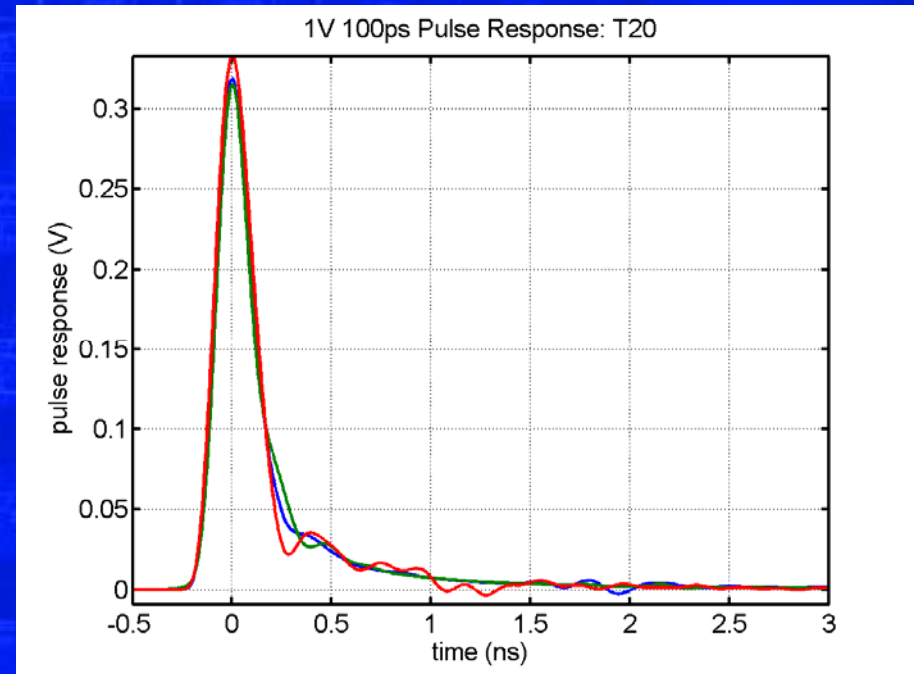
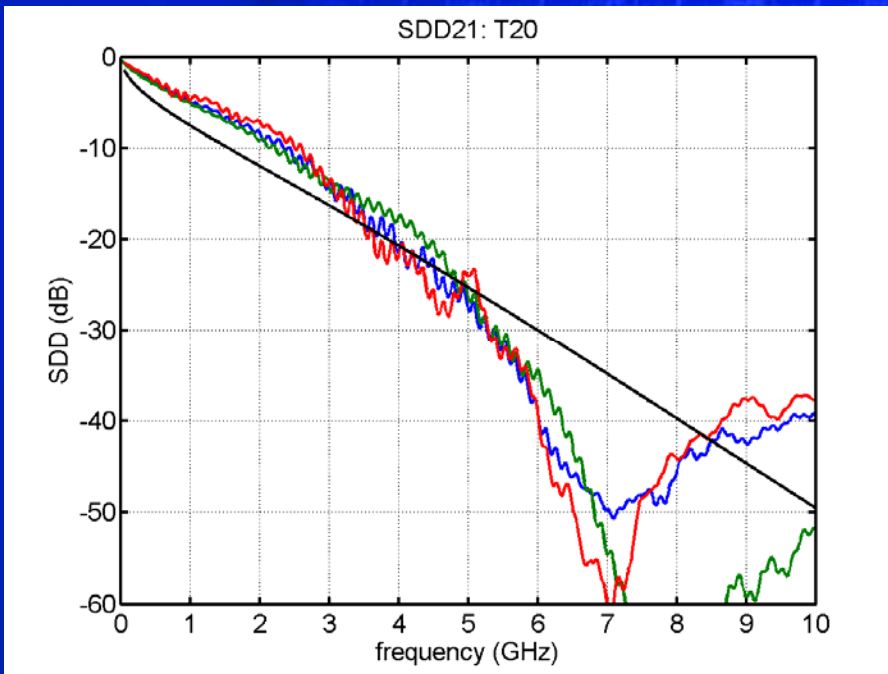


T20 Thru Response

Peters_01_0904 measurement models

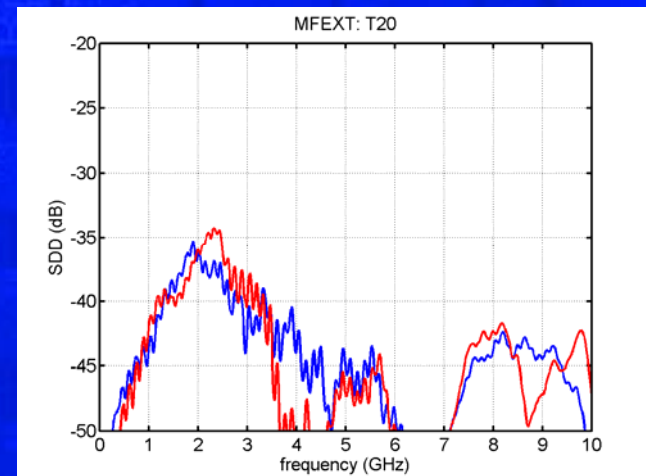
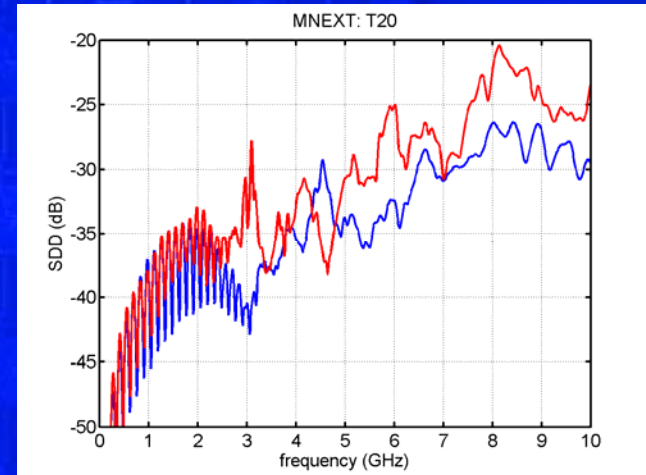
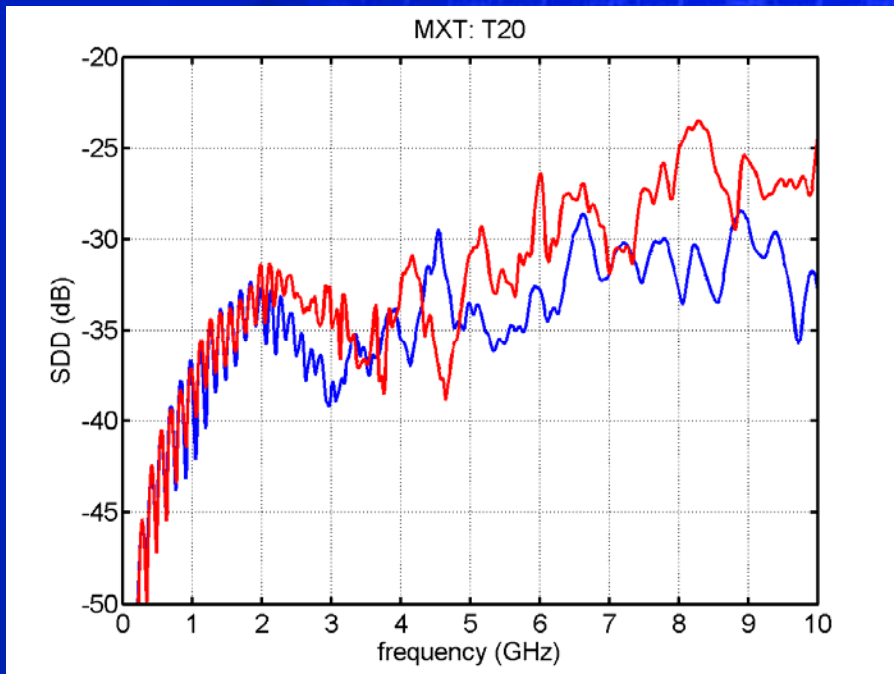
Peters_01_0305 synthesized models

Improved system measurements

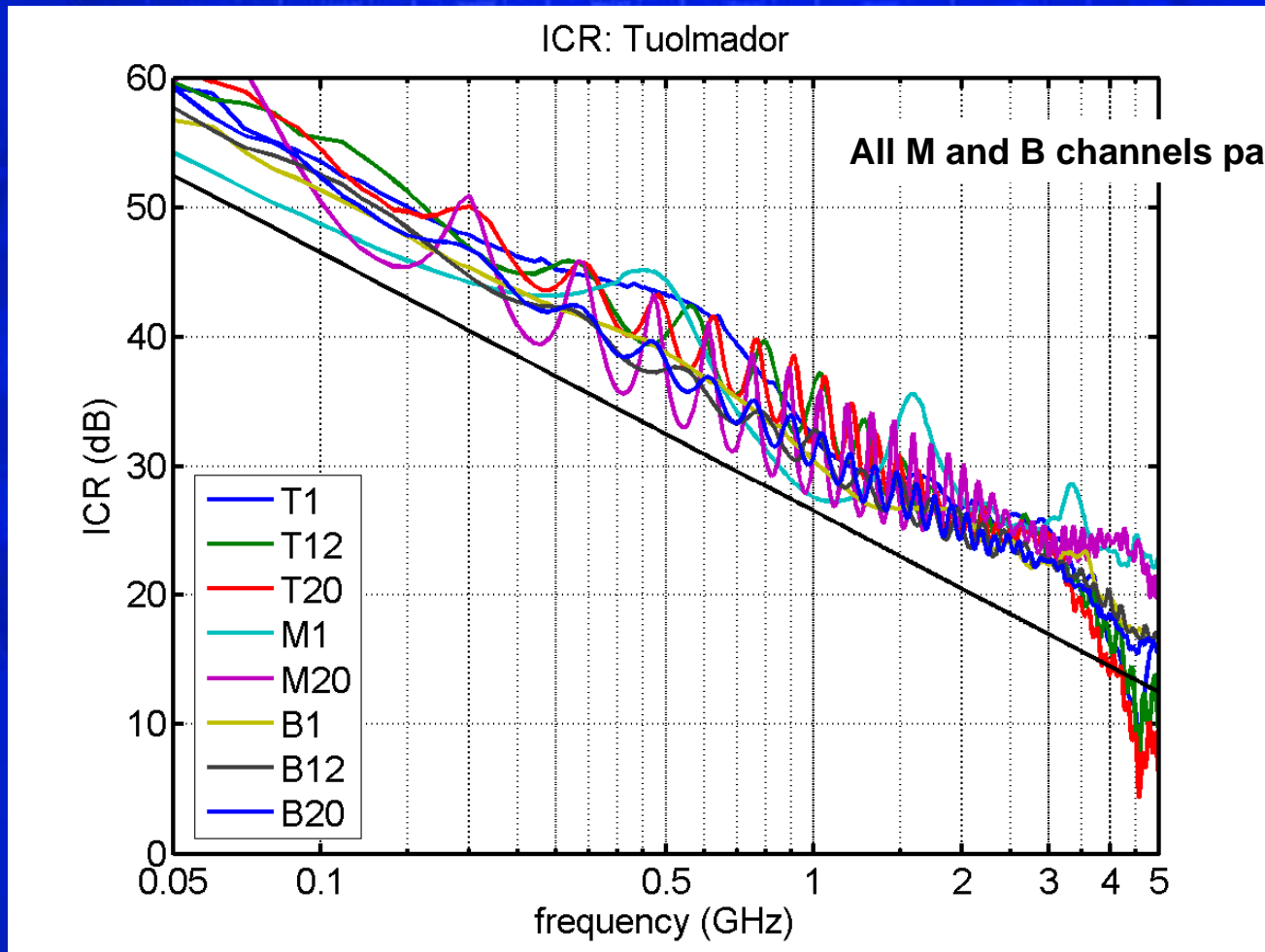


T20 Crosstalk

Peters_01_0904 measurement models
Improved system measurements



Improved System ICR



Conclusions

- **The new measured systems exhibit an improved performance over the peters_01_0904 channels**
 - Insertion loss ripple is reduced
 - Pulse response tail is smoother
 - Return loss is decreased significantly
 - Crosstalk is reduced
- **All improved channels pass the proposed informative channel specs except the T channels.**
- **The synthesized improved models (peters_01_0305) provided good estimates of real system thru performance. Return loss estimates were fair.**