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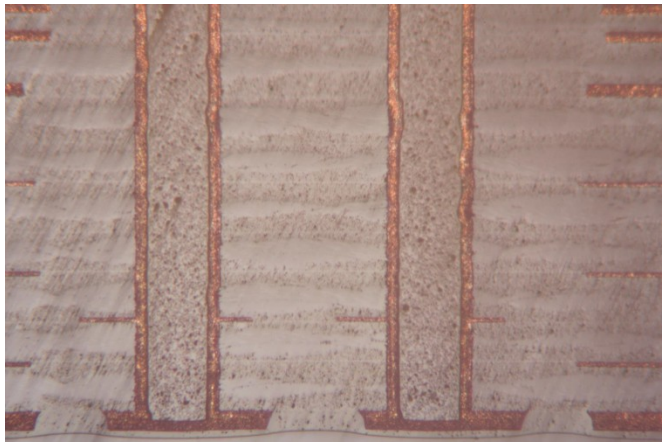
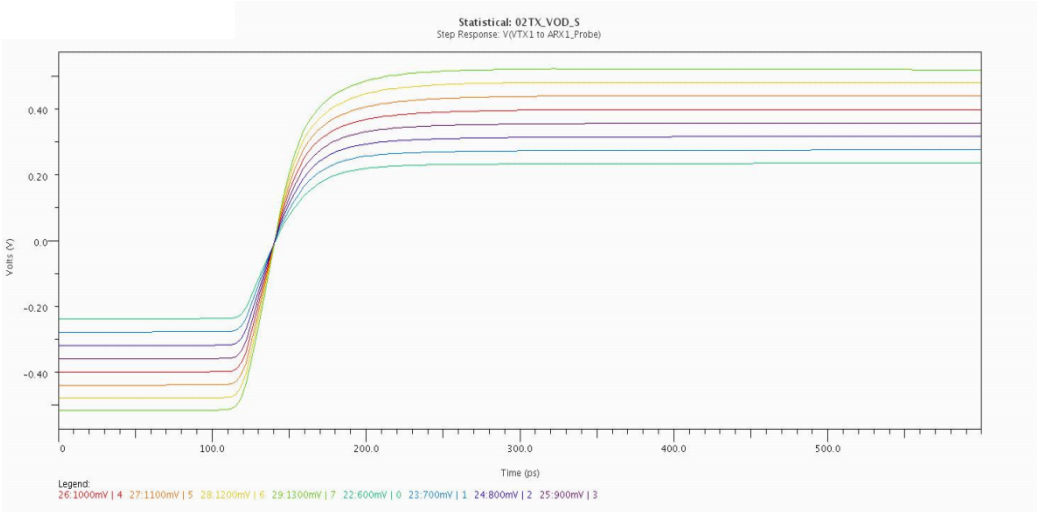
IBIS AMI VALIDATION
IBIS SUMMIT DESIGNCON 2014





Santa Clara, CA, January 31, 2014
Zilwan Mahmod, Anders Ekholm

AGENDA

- Design goals
- IBIS AMI Validation
  - IBIS AMI Certification
  - PCB Passive correlation
  - TX Active correlation
  - RX Active correlation
- Experiences

DESIGN GOALS

- What design goal do we have with IBIS AMI analysis?
  - To verify a robust design over manufacturing variations.
  - To verify a given design criteria like BER, Eye mask.
  - To optimize the design eye to the given criteria.
  - To verify the design with a high fault coverage.
  - To verify the design in a short predictable timeframe.
  - To minimize design iterations.

IBIS AMI VALIDATION

To achieve the design goals we need correct and accurate models with high performance.

- How do we validate IBIS AMI models?
  - IBIS Checker
  - Certification
  - Active correlation
    - TX correlation
    - RX correlation

IBIS AMI CERTIFICATION

Certification is the first step an IBIS AMI model needs to go through, this is to check that the model behavior is reasonable.

- Certification needs to check the following:
  - Is the model delivery complete, all files included?
  - Does this model describe enough variation, process corners?
  - Does this model describe all possible configuration parameters?
  - And only the possible configuration parameters?
  - Is it compliant with the IBIS AMI standard (IBIS 6.0 specification)?
  - Is it compliant with Ericsson requirements outside of IBIS AMI standard?
  - Is the model describing the buffer's electrical behavior accurately?

IBIS AMI CERTIFICATION

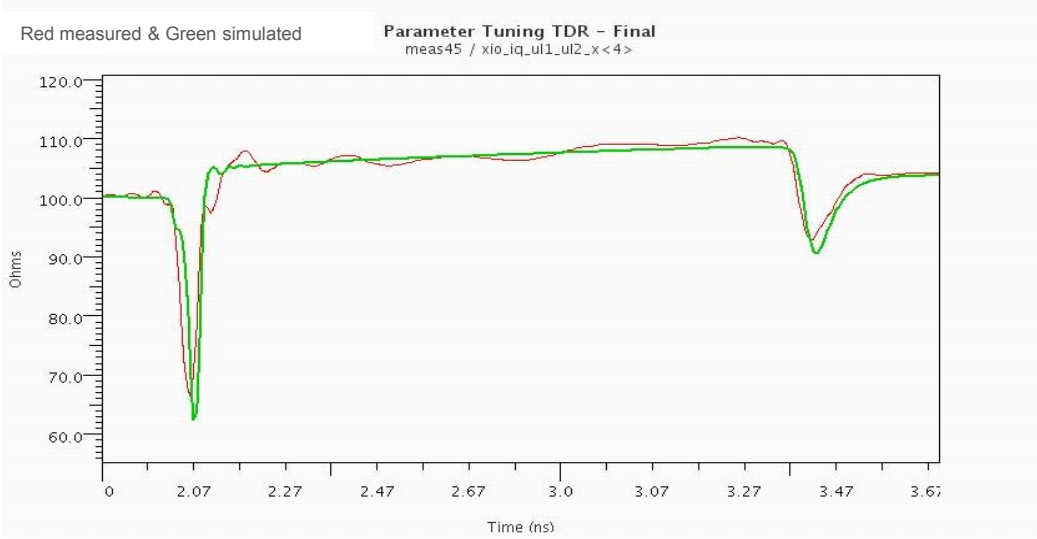
- Certification needs to check the following cont.:
  - Is it compatible with the used simulation environment?
  - Are the necessary jitter parameters included (for both TX and RX)?
  - Is documentation complete enough to use the model?
  - Is the model performance fast enough?
  - Are the configuration parameters the same as the real IC uses?
  - If not are there information on how to translate parameters from the model to the physical IC settings?
  - Are the settings reasonable and in correct order?
  - If model is interoperable with other vendors models?
- Output is a certification report

PCB PASSIVE VALIDATION

To be able to do active correlation we need to make sure our simulation environment are predicting our passive interconnect accurately enough.

›We achieve this by doing passive correlation, or simulator calibration (similar to measurement instrument calibration).

- Produce a PCB using the material and stackup selected for the design.
- Use TDR or VNA measurements to get a representation of the used trace structures in you design.

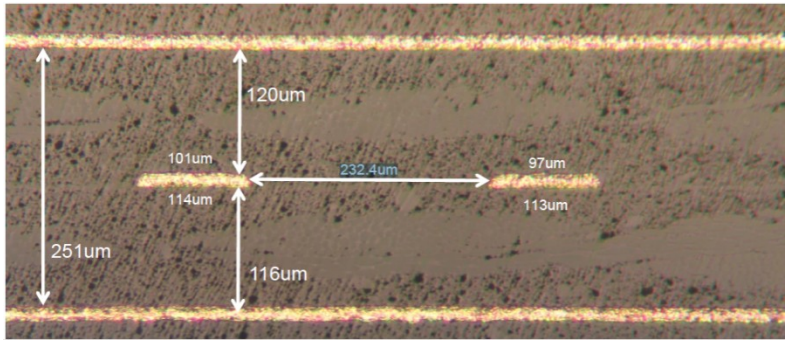


›Adjust PCB Physical Parameters

- propagation delay error – adjust ε_r
- impedance error - adjust cross-section
- attenuation error - adjust tan δ, roughness

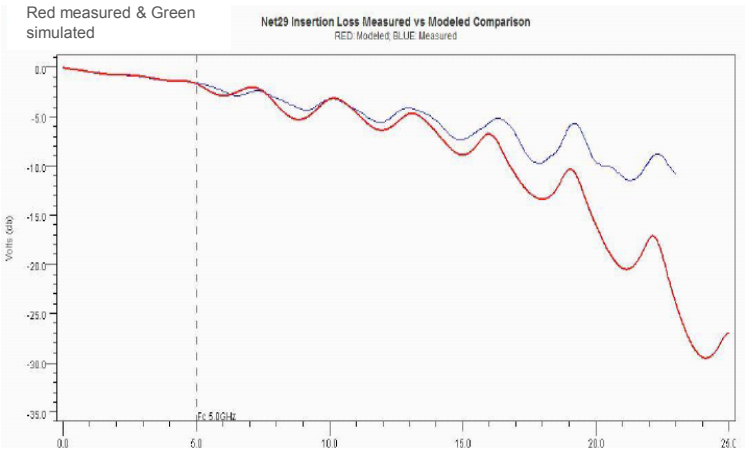
PCB PASSIVE VALIDATION

- Perform cross section cuts of all relevant structures in the PCB to get physical properties of geometries in the used simulation tool.

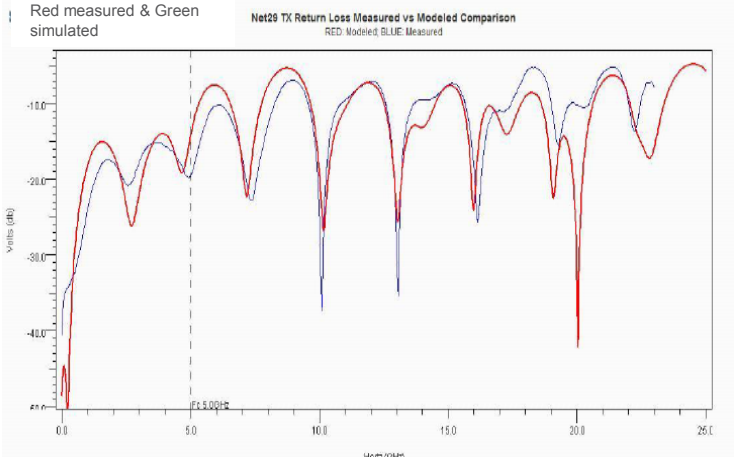


- Create the same data set in your simulation environment.
- Adjust/tweak the simulation model parameters to achieve an accurate enough result. So the passive model will predict your system performance.

Red measured & Green simulated



Red measured & Green simulated



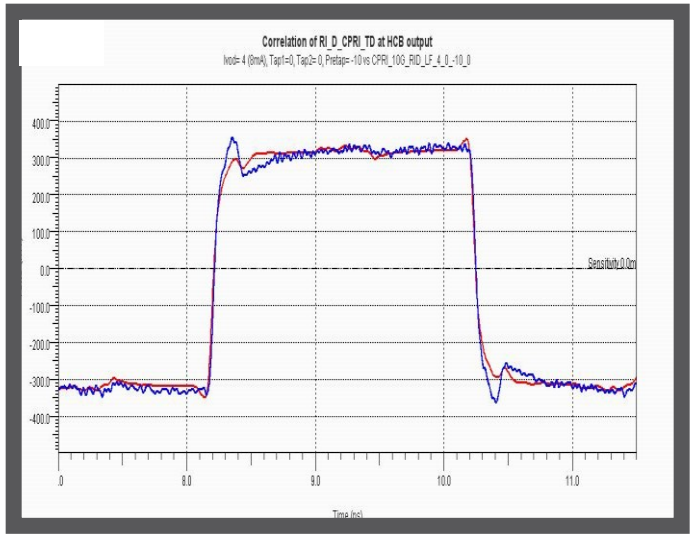
TX ACTIVE VALIDATION
MEASUREMENT ENVIRONMENT

- Select suitable trace loads for correlation.
- Run a set of cases of IC configuration settings.
  - Run a slow clock from TX and measure waveforms.
  - Run a PRBS (eg. PRBS7) and measure waveforms.
  - Transfer waveform data to simulation environment.

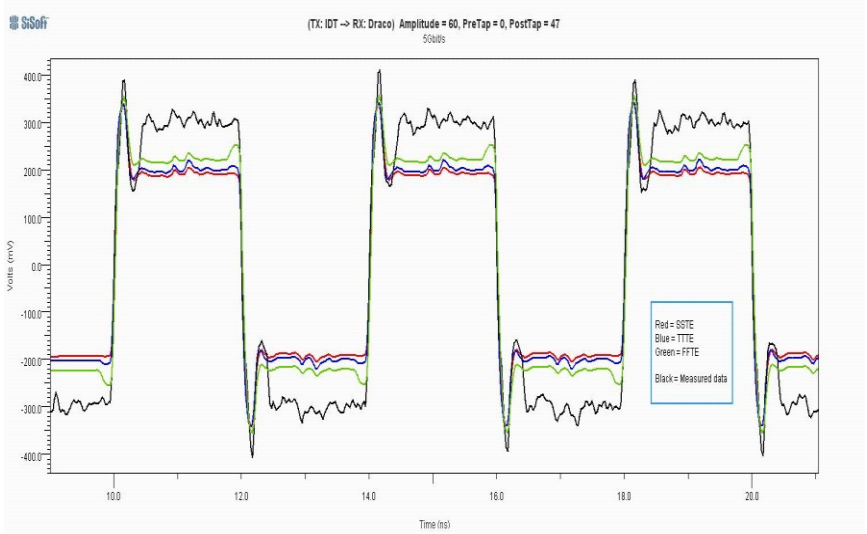
- “deembed” measurement or “embed” simulation.
- Make sure to use the same measurement point.

TX ACTIVE VALIDATION
SIMULATION ENVIRONMENT

- Simulate the same traces with the same probe point
- Simulate for the same stimuli cases
- Make an overlay correlation of the waveforms



CPRI_10G_RID_LF_4_0_-10_0



RX ACTIVE VALIDATION

RX correlation methods is still being determined.

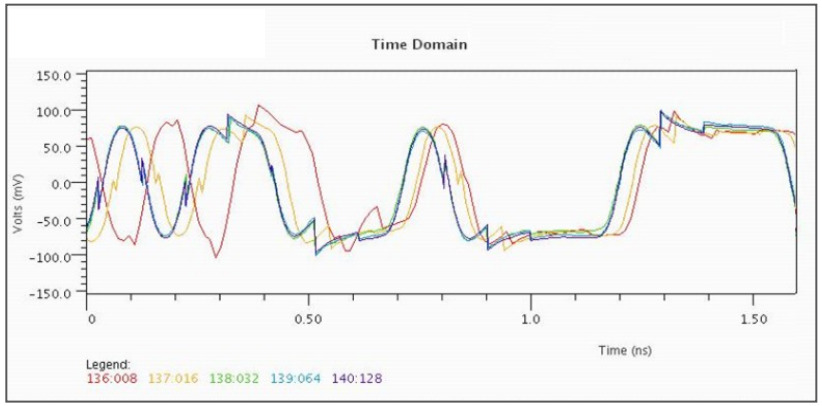
- How can we correlate at Decision Point?
- Standard waveform overlay correlation will not be possible.
- Maybe a Feature Selective Validation (FSV) is possible?
- Which Features should be Selected for correlation?

IC internal meas. features are not standardized. ☹

- Makes the FSV correlation harder.
- Can IBIS Open Forum standardize this ? ☺

EXPERIENCES

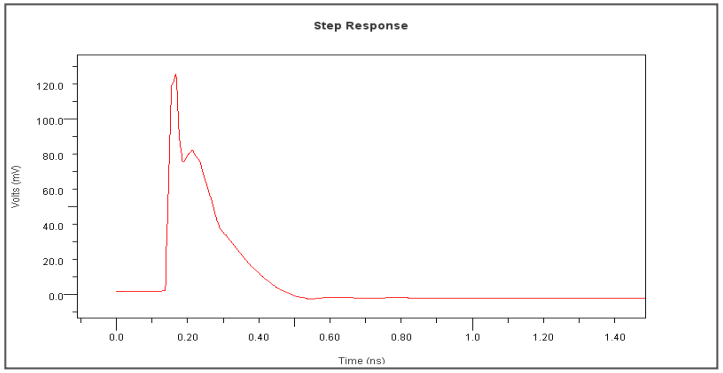
- Many models fails during certification
  - A.AMI controls incomplete
    - H/W has more settings than AMI model.
    - AMI model has more settings than H/W.
    - AMI file has fixed values for all settings.
    - Misses dependency tables.
  - Algorithmic models don’t run
    - Compiled for wrong O/S.
    - External runtime libraries required.
  - Model controls don’t work
    - Changing settings has no effect.



Changing samples/bit affects results

EXPERIENCES

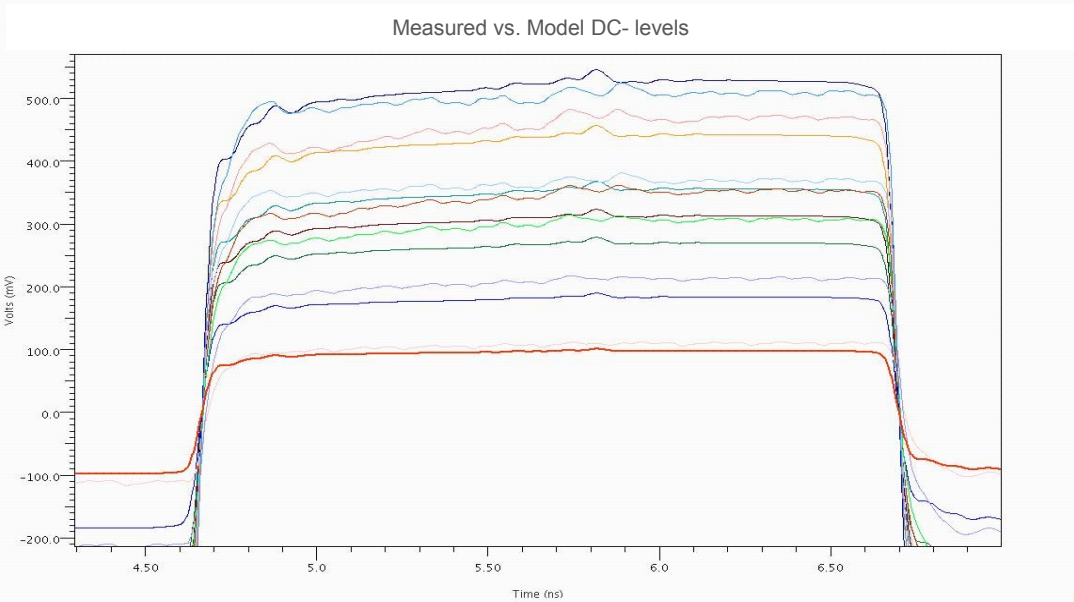
- Models don’t meet spec requirements
  - Models crash with some samples/bit settings.
- Syntax (IBIS Parser) errors
- Analog Models
  - Incomplete or missing data in A.ibs file.
  - Improbable analog models.
    - Improbable voltage, impedance or behavior.
    - “Idealized” analog models.



This is supposed to be a step response

EXPERIENCES

- Some models fail during TX correlation
  - Some of the simulated DC levels don't match the measured DC levels.



EXPERIENCES

- RX correlation process is still being worked on
  - Should be considered as not trustable until proven by active correlation!

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