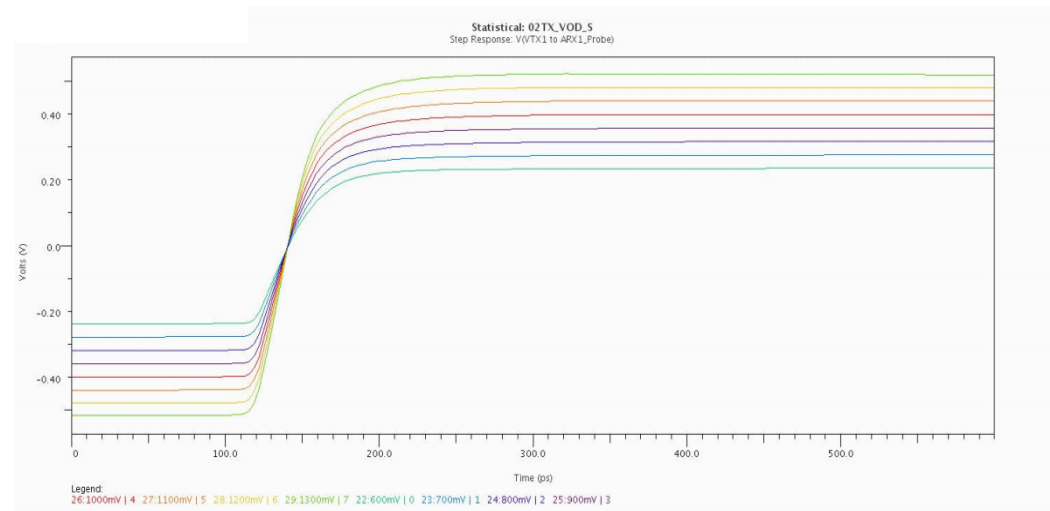
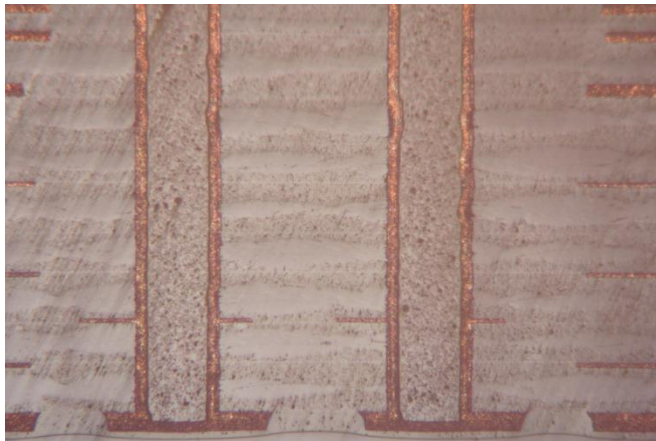


# IBIS AMI VALIDATION

## ASIAN IBIS SUMMIT

YOKOHAMA, JAPAN, NOVEMBER 20, 2014



Yokohama, Japan, November 20, 2014  
Zilwan Mahmud, 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 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.:
  - 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?
  - Is it compatible with the used simulation environment?
  - If model is interoperable with other vendors models?
- › Output is a certification report

# PCB PASSIVE VALIDATION



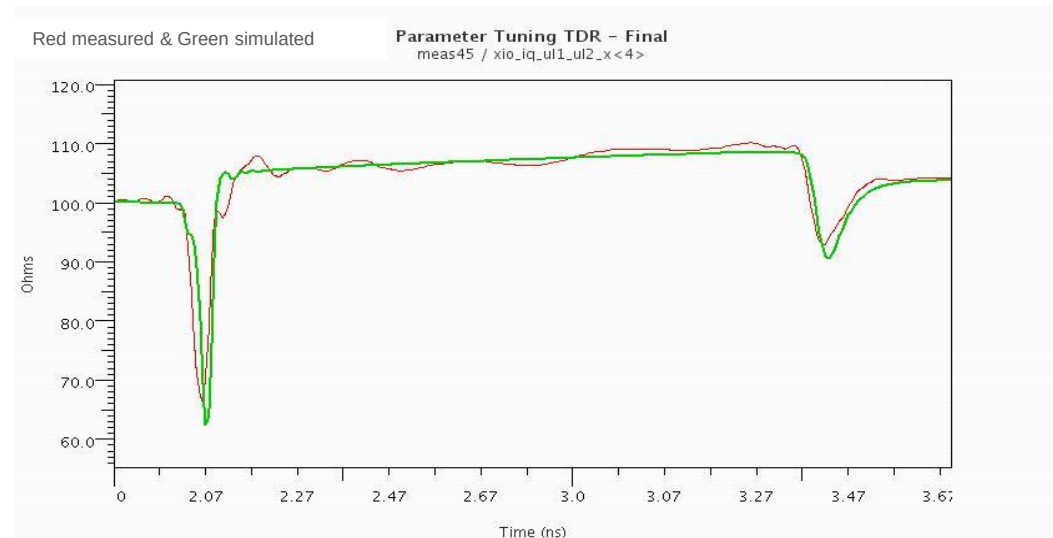
To be able to do active correlation we need to make sure our simulation environment are predicting our passive interconnect accurately enough.

› 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

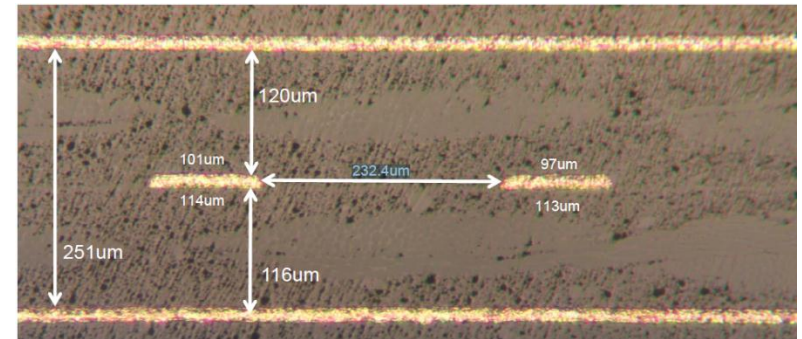
- propagation delay error – adjust  $\epsilon_r$
- impedance error - adjust cross-section
- attenuation error - adjust  $\tan \delta$ , roughness



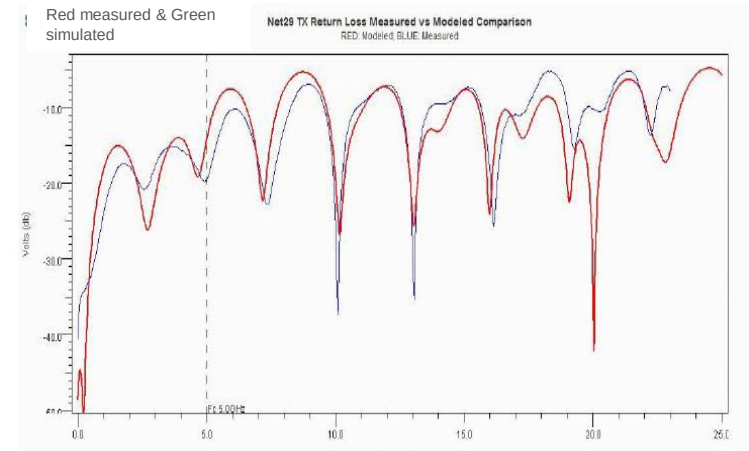
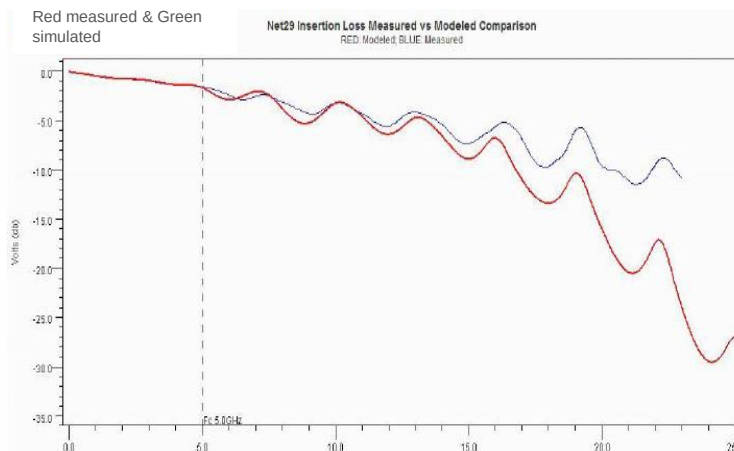
# PCB PASSIVE VALIDATION



- 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.





# TX ACTIVE VALIDATION MEASUREMENT ENVIRONMENT

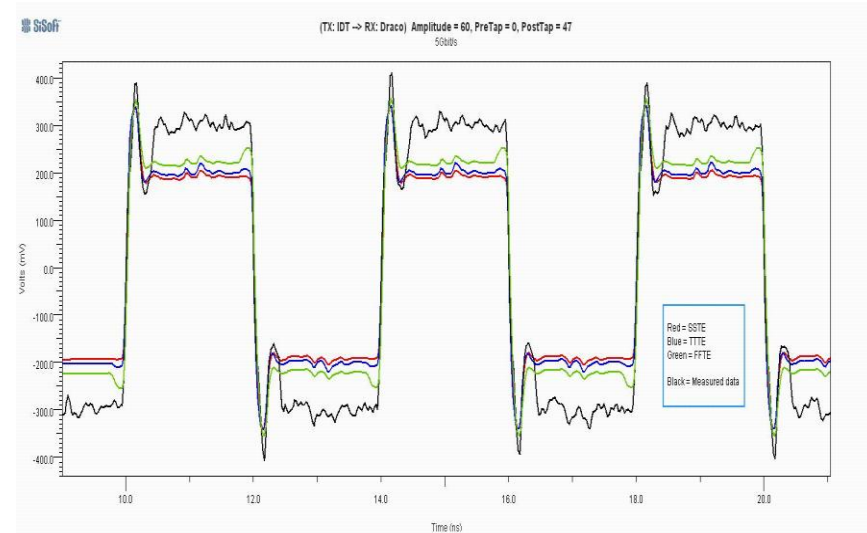
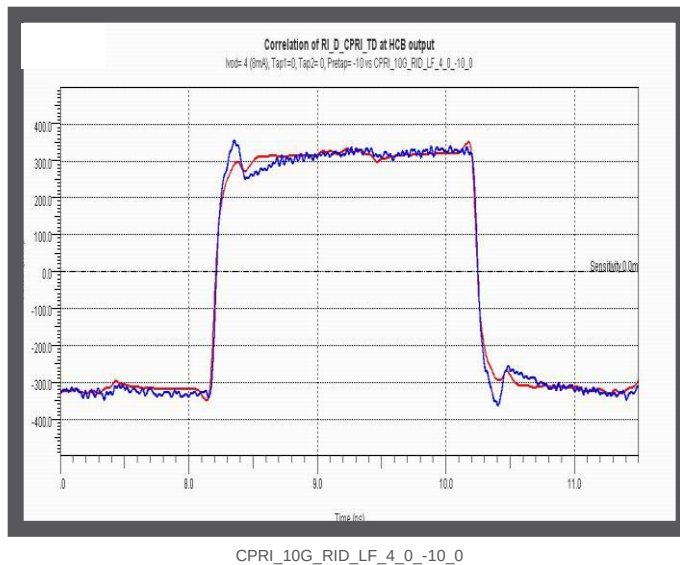


- › Select suitable trace loads for correlation.
- › Run a set of cases of IC configuration settings.
  - Run a slow clock from TX and measure waveforms.
  - Run a PRBS (eg. PRBS7) and measure waveforms.
  - Transfer waveform data to simulation environment.
- › “deembed” measurement or “embed” simulation.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



# 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

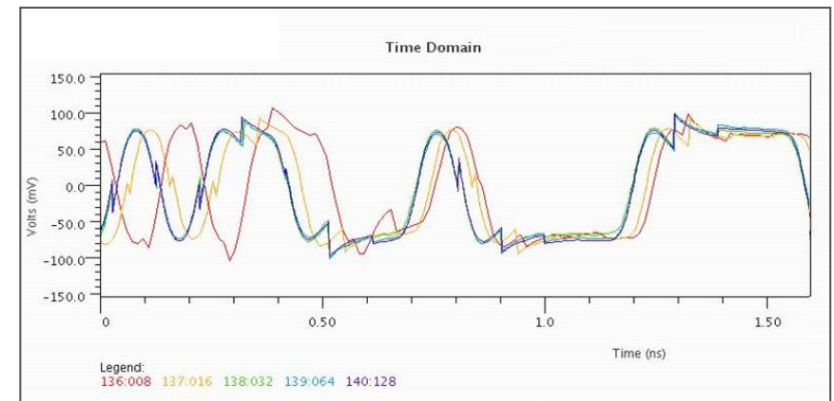
- › H/W has more settings than AMI model.
- › AMI model has more settings than H/W.
- › AMI file has fixed values for all settings.
- › Misses dependency tables.

### – Algorithmic models don't run

- › Compiled for wrong O/S.
- › External runtime libraries required.

### – Model controls don't work

- › Changing settings has no effect.

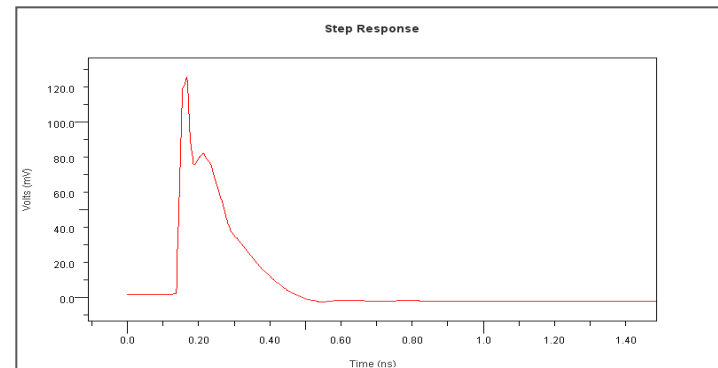


Changing samples/bit affects results

# 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.

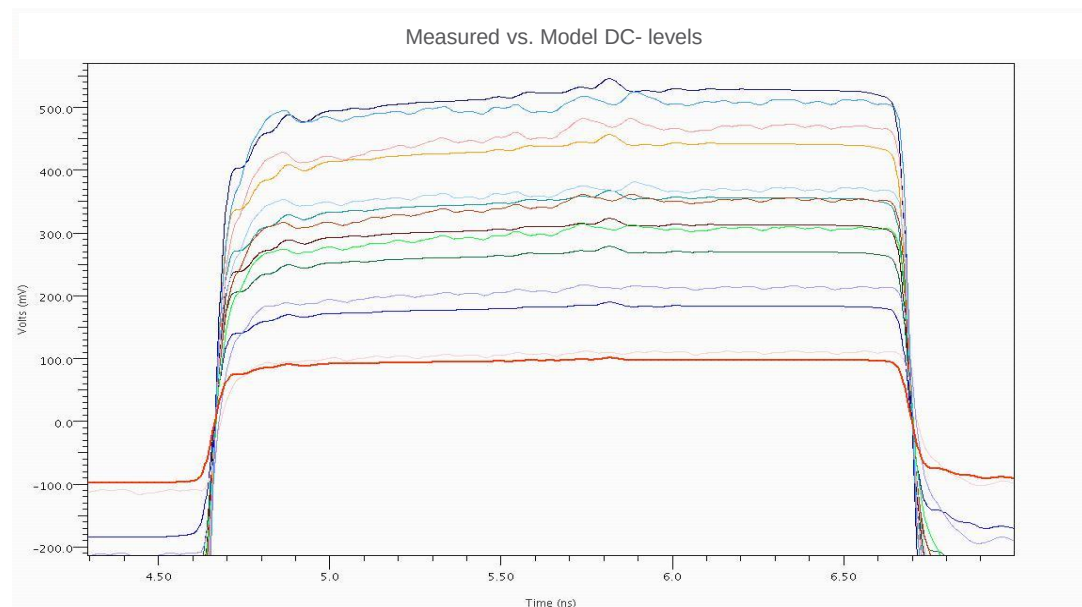


This is supposed to be a step response

# 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!



**ERICSSON**