IBIS AMI VALIDATION
EUROPEAN IBIS SUMMIT
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AGENDA

› Design goals
› IBIS AMI Validation
  - IBIS AMI Certification
  - PCB Passive correlation
  - TX Active correlation
  - RX Active correlation
› Experiences
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.
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
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.
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
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 $\varepsilon_r$
  • 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.
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 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!