

## Compliance of IBIS/AMI Model Components

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IBIS 5.0 has everything it needs to allow for models to be “Compliant”, and for models to support innovations. Unfortunately, IBIS 5.0 did not include how innovation needed to be documented in such a way that these models were portable. The InOut BIRD is an attempt to do this, but it is incomplete without defining an AMI Simulation. This document is an attempt to define the components of an AMI Analysis as a framework to set Compliance rules.

The following is a discussion of the various phases of AMI Analysis, and how Compliance can be defined for .ami files, DLLs, Analysis Input, Analysis Simulation and Analysis Output. Any official position that IBIS takes on Compliance must be in the context of the following.

First, we need to define the components of an AMI Analysis.

1. Analysis Input
  - a. Generating the Impulse Response of the channel.
  - b. Generating the stimulus input to Tx GetWave.
2. AMI Simulation (using “Simulation” hereafter)
  - a. Running Tx Init and Rx Init
  - b. Iteratively running Tx GetWave and Rx GetWave
3. Analysis Output
  - a. Processing the outputs of Tx Init, Rx Init, Tx GetWave and Rx GetWave

Second, we need to define Compliance:

1. A .ami file is Compliant to an approved IBIS Specification if and only if it uses the syntax as defined in the approved IBIS Specification.
2. A DLL is Compliant to an approved IBIS Specification if and only if it generated the outputs as defined in the IBIS Specification in accordance with the inputs as defined in the IBIS Specification and gives the same output on all platforms when presented with the same input (within reasonable floating point precision).
3. An Analysis Input is Compliant to an approved IBIS Specification if and only if it generates the same input to Tx and Rx Init and GetWave in accordance with the Flows that are defined in the approved IBIS Specification. A Simulation is Compliant to an approved IBIS Specification if and only if it gives the same output of Rx Init and Rx GetWave when presented with the same inputs to Tx Init and Tx GetWave in accordance with the Flows that are defined in the approved IBIS Specification.
  - a. For example, using the Out value of a Model Specific parameter to control the Simulation results is a non-Compliant Simulation.
4. An Analysis Output is Compliant to an approved IBIS Specification if and only if it processes the output of Tx and Rx Init and GetWave in accordance with the Flows that are defined in the approved IBIS Specification.

In the context of the above, I will review each of the BIRDS that are now under consideration within IBIS.

1. BIRD 121 (Data Management)
  - a. Supporting\_Files (Usage Info)

- i. Supporting\_Files has no effect on any phase of Analysis. This is a convenience for the EDA Tool and Librarian to move IBIS files.
  - b. DLLPath (Usage In)
    - i. DLLs have been written that require knowledge of the full path to the location of the DLL so that they can access additional files required to be in this directory. Making this a Reserved Parameter will insure that Mode Makers can write Compliant models that work in Compliant Simulations.
  - c. DLLid (Usage In)
    - i. DLLs have been written that generate additional files. The parameter is required by the DLL to insure that there are no name collisions with files generated by other DLLs in the same Simulation. Making this a Reserved Parameter will insure that Mode Makers can write Compliant models that work in Compliant Simulations.
  - d. Samples\_Per\_Bit (Usage Info)
    - i. DLLs have been written that do not operate properly unless presented with Impulse Responses and GetWave waveforms that do not have a specific number of samples per bit. This is a convenience for the EDA Tool in order to create input Impulse Responses and Waveforms that are acceptable to the DLL.
- 2. BIRD 122 (Analog BIRD)
  - a. These parameters are strictly Info, they only affect Analysis Input (specifically generating the Impulse Response of the Channel), and have no effect on Simulation or Analysis Output.
  - b. Once IBIS ISS is ratified, then IBIS 6.0 can define a Compliant channel consisting of an IBIS ISS subckts, and can further define Compliant methods to generate the Impulse Response of a channel using existing IBIS analog models (IV/VT Tables, External Models, ISS models and BSS models). IBIS BSS (IBIS Buffer Spice Subckts) is IBIS ISS extended to include specific Independent Voltage and Current Sources and other specific SPICE elements to enable behavioral buffer models using an approved IBIS SPICE syntax.
- 3. BIRD 123 (Jitter BIRD)
  - a. These parameters affect either the Analysis Input or the Analysis Output. When defined as Info they do not affect Simulation (except as defined in 3.b). When defined as Out they do affect Simulation. Defining these parameters as Out will certainly make Simulations not Compliant under IBIS 5.0. (These parameters can only be Info or Out, In and InOut are not allowed).
  - b. An exception to 3.a is Rx\_External\_Reference\_Clock, which is not Simulation Compliant with IBIS 5.0.
  - c. Making these Reserved Parameters will insure that Mode Makers can write Compliant models that define Jitter budgets in a consistent way and in accordance with the way Jitter budgets are currently defined in the industry.
- 4. BIRD 124 (Dependency Table)
  - a. The Dependency Tables are always Info, and do not affect Simulation in any way. They do determine the value of any dependent parameter based on the value selected by the User or EDA tool of independent parameters.
  - b. BIRD 124 will be rewritten, using the format Table, and a new Usage as soon as the Table BIRD is approved by the open Forum.
  - c. Defining this new Usage will insure that Mode Makers can write Compliant models that define the dependency between AMI parameters.
- 5. BIRD 128 (Redefining use of \*\*AMI\_Parameters\_Out to be \*\*AMI\_Parameters\_IO)

- a. \*\*AMI\_Parameters\_IO is clearly not Simulation Compliant with IBIS 5.0.
  - b. This is required to support the various Backchannel BIRDs that are under consideration.
- 6. BIRD 130 (Repeater BIRD)
  - a. IBIS keyword [Repeater Pins] is clearly not Compliant with IBIS 5.0 .ibs files
  - b. Adding [Repeater Pins] to the IBIS specification will allow Model Makers to write Compliant Repeater Models.
- 7. Backchannel BIRD
  - a. The various Backchannel BIRD proposals under consideration require BIRD 128, and are therefore not Simulation Compliant with IBIS 5.0
  - b. Approving a Backchannel BIRD will enable Model Makers to write Compliant Models that support time domain training.

I hope this document can be used as a framework for defining Compliance rules for IBIS files, .ami files, .dlls, Analysis and Simulations.