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BIRD ID#: 140.1  
ISSUE TITLE: Format Corner and Range Clarification for IBIS-AMI  
REQUESTOR: Arpad Muranyi, Mentor Graphics  
DATE SUBMITTED: June 28, 2011  
DATE REVISED: September 6, 2011  
DATE ACCEPTED BY IBIS OPEN FORUM:

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STATEMENT OF THE ISSUE:

The IBIS 5.0 specification is very vague on pg. 140 and 141 with the description of the various Format types, especially Corner. The rules on how Corner is expected to work with the simulator's corner setting is unclear and needs explanation.

In addition, the definition on pg. 140 shows three values for Corner: Corner <typ value> <slow value> <fast value>, while on pg. 147 the definition of Rx\_Receiver\_Sensitivity only shows two values: (Format Corner <slow> <fast>). This inconsistency cannot be resolved by an EDA tool without additional information which is not available.

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STATEMENT OF THE RESOLVED SPECIFICATIONS:

On pg. 140 replace these lines:

```
| Format: (default is range)
| Value <value> Single value data
| Range <typ value> <min value> <max value>
| List <typ value> <value> <value> <value> ... <value>
| Corner <typ value> <slow value> <fast value>
```

with these lines:

```
| Format: (default is range)
| Value <value> Single value data
|* The user may assign any value without any restrictions
|* within the constraints of the Type of the variable
| Range <typ value> <min value> <max value>
|* This defines a continuous range for which the user may
|* select any value greater than or equal to <min value>
|* and less than or equal to <max value> within the
|* constraints of the Type of the variable
| List <typ value> <value> <value> <value> ... <value>
|* This defines a discrete set of values from which the user
|* may select one value
| Corner <typ value> <slow value> <fast value>
|* The selection of one value is automatically carried out
|* by the EDA tool based on its internal simulation corner
|* setting
```

On pg. 141 replace these lines:

| Note that in the context of Algorithmic Model for type 'Corner', <slow  
| value> and <fast value> align implicitly to slow and fast corners, and  
| <slow value> does not have to be less than <fast value>. For type 'Range'  
| and 'Increment', <min value>, <max value> does not imply slow and fast  
| corners.

with these lines:

```
*** Note that modeling and simulating different corner cases is a fundamental
*** concept in IBIS. Almost all of the information contained in an IBIS file
*** has provisions for typical, minimum and maximum values. "Corner" appears
*** as a subparameter under the [External Model] and [External Circuit]
*** keywords, and the last column of the A_to_D and D_to_A converter
*** subparameters of these keywords contains a "corner_name" also. The valid
*** corner names are "Typ", "Min" and "Max". For each model instance, the
*** EDA tool will select the appropriate data from the IBIS file of the model
*** according the user's instructions to the EDA tool.
***
*** In IBIS-AMI, Format Corner relies on these internal corner names also.
*** For the purpose of IBIS-AMI, these internal corner names are treated as
*** Type String and have values "Typ", "Min" and "Max". "Typ" represents
*** typical operating conditions, "Min" describes the slow or weak
*** performance, and "Max" describes the fast or strong performance.
***
*** For IBIS-AMI parameters defined as Format Corner, for any given model
*** instance the EDA tool will pick one of the three supplied values
*** (<typ value>, <slow value>, <fast value>) in the .ami file using the
*** internal corner name as the selector argument. The first value will
*** be picked when the internal corner name is "Typ", the second when it
*** is "Min" and the third when it is "Max". For AMI parameters <slow
*** value> does not have to be less than <fast value>. For type 'Range'
*** and 'Increment', <min value>, <max value> does not imply slow and fast
*** corners.
***
*** Example:
***
*** (My_Corner (Usage Info) (Type Integer) (Corner 0 1 2) )
***
*** When the IBIS corner is "Typ", My_corner = 0
*** When the IBIS corner is "Min", My_corner = 1
*** When the IBIS corner is "Max", My_corner = 2
***
```

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ANALYSIS PATH/DATA THAT LED TO SPECIFICATION:

It was determined in the May 17, 2011 IBIS ATM teleconference that the example on pg. 147 was clearly a typo. BIRD 127.1 was issued to incorporate the correction for that oversight.

The changes documented in BIRD 140 are also based on the discussions which took place in the IBIS ATM teleconference and subsequent emails.

There was an extensive discussion in IBIS ATM teleconferences and emails about the problem that the IBIS specification deliberately leaves "fast" and "slow" undefined (see discussion on C\_comp in Section 9, Notes on Data Derivation Method). These discussions concluded (on June 21, 2011 in the ATM teleconference) that until the analog modeling in IBIS solves this ambiguity, the method of

associating the AMI Format Corner with the analog model corners will be left to the EDA tool vendors.

On the request of the IBIS Open Forum this BIRD was returned in the month of August 2011 to the ATM Task Group for further discussion. Following the discussion in the August 30, 2011 ATM teleconference, Walter Katz and Arpad Muranyi drafted a language in a private phone conversation with private emails following that. BIRD 140.2 is the result of that work. These discussions addressed the related issues found in BIRD 124, and the verbiage in the "ANY OTHER BACKGROUND INFORMATION" below is a forward looking solution to address those problems.

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ANY OTHER BACKGROUND INFORMATION:

When BIRD 124 for Dependency Table is finalized, the following text may be considered to be added after the "Example" in the above notes:

```
|** For Dependency Tables in IBIS-AMI, "Corner" may also be used as a control
|** input parameter column. In this case, the column in which "Corner"
|** appears must be declared as Type String and the values in that column
|** must match the available internal corner names ("Typ", "Min" and "Max").
|**
|** Example:
|**
|** (Tx_Strength_Table (Usage Dependency_Table) (Type String Float Float))
|** (Labels "Corner In" "Rs Out_Match" "Voh Out_Match")
|**   ("Min" 45.0 0.40)
|**   ("Typ" 46.0 0.42)
|**   ("Max" 47.0 0.44)
|** )
|**
|** When the IBIS corner is "Typ", Rs = 46 and Voh = 0.42
|** When the IBIS corner is "Min", Rs = 45 and Voh = 0.40
|** When the IBIS corner is "Max", Rs = 47 and Voh = 0.44
|**
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