Within the keyword pair [Begin Interconnect Model]/[End Interconnect Model]:

**ORIGINAL PROPOSAL INCLUDES:**

*Subparameter:* **Source <IBIS-ISS | Touchstone>**

*Required:* Yes for each [Begin Interconnect Model]/[End Interconnect Model] group

*Description:* Indicates if the model is an IBIS-ISS subckt or a Touchstone file.

*Other Notes:*

*Example:*

Source IBIS-ISS

*Subparameter:* **File Typ|Min|Max <file name>**

*Required:* Yes for each [Begin Model]/[End Model] group

*Description:* Defines the file(s) containing the model.

*Other Notes:* The Files must be either IBIS-ISS files or Touchstone files.

*Example:*

File my\_file.iss

File my\_file\_typ.iss my\_file\_min.iss my\_file\_max.iss

*Subparameter:* **Subckt Typ|Min|Max <subckt name>**

*Required:* Yes if Source IBIS-ISS.

*Description:* Defines the subckt in the File.

*Other Notes:*

*Example:*

Subckt my\_subckt

Subckt my\_subckt\_typ my\_subckt\_slow my\_subckt\_fast

*Subparameter:* **Parameter <name> Typ|Min|Max <param value>**

*Required:* No, but legal only if Language is IBIS-ISS.

*Description:* Defines the parameters that are to be passed into an instance of the IBIS-ISS subckt. <name> is the name of the parameter. String parameters shall be enclosed in “’”.

*Other Notes:* Number shall use IBIS number notation. The EDA tool is repsponsible for converint numbers using IBIS scale factors to sumbers using IBIS-ISS scale factors when instantiating subckts.

Parameters are not passed into a Touchstone file; however, there are two optional reserved parameters that are used in conjunction with Language Touchstone. They are FBASE and FMAX. They must have one value. See the IBIS-ISS manual to understand how FBASE and FMAX should be used in conjunction with Touchstone files.

**REVISED PROPOSAL**

*Sub-Params:* File\_TS, File\_ISS, Param | Other sub-params not fully documented here

*Usage Rules:* Number\_Of\_Nodes, Terminal and either File\_TS or File\_ISS are required (both File\_TS and File\_ISS together are not permitted).

For referencing Touchstone files:

File\_TS is followed by three entries for typ, min, and max file names. The typical entry is required and must point to a Touchstone file located in the same directory as the .ibs file and representing typical conditions. The minimum and maximum entries may point to the same file or other files representing minimum (slow) and maximum (fast) interconnect conditions or contain NA. If the entry is NA, the typical file entry shall be used.

For referencing IBIS-ISS files:

File\_ISS is followed by three entries consisting of corner\_name, file\_name, and circuit\_name (.subckt name) for that file and located in the same directory as the .ibs file. The corner\_name shall be Typ, Min, or Max. File\_ISS for the Typ corner\_name is required, and File\_ISS for the Min and Max corner\_names are optional. If present, each File\_ISS must have a unique corner\_name. If File\_ISS for either the Min or Max corner\_name is missing, the File\_ISS for the Typ corner\_name shall be used to describe the missing corner\_name file reference. The Min and Max file\_names should represent slow and fast interconnect conditions.

The subparameter Param is optional and only legal for File\_ISS references. Param shall be followed by a param\_name of the parameter to be passed into the IBIS-ISS and its numerical values or a string values (surrounded by double quotes) located in the typ, min, and max columns. Several Param lines are permitted as long as each of the param\_name entries is distinct. Each Param line shall have a typ entry. Either or both the min and max entries can be NA, in which cases the typ entry is used. The typ, min, and max parameters are, by default, associated with the corner\_name Typ, Min, and Max files and their corresponding circuit\_names. However, the EDA tool is expected to support passing any of the Param typ, min, or max values, as selected by the User or EDA tool, into any File\_ISS corner\_name file. The Param values associated with any param\_name must all be numerical or all string values (or NA). If possible, the Param min and max values should represent slow and fast interconnect conditions. Because of parameter interactions, this may not always be possible.

*Other Notes:* The numerical value rules follow the scaling conventions in Section 3, GENERAL SYNTAX RULES AND GUIDELINES. The EDA tool is responsible for translating IBIS specified parameters into IBIS-ISS parameters. For example, 1 megohm, represented as 1M in Param would be converted to 1meg (1x is not recommended) in IBIS-ISS. The value 1Kohm is 1 ohm in IBIS and would therefore be passed into IBIS-ISS as 1 ohm, even though 1K is 1 kilohm in IBIS-ISS. Quoted string parameters are converted to the string parameter syntax in IBIS-ISS. For example, the Param value “typ.s2p” is converted to str(‘typ.s2p’) in IBIS-ISS.

The base unit of frequency is Hertz, and the base unit of length is meter. Values can be passed in terms of other base units of length if scaling conversions are added to the IBIS-ISS .subckt definition. For example, the intended value of 10 mils might be entered as the Param value of 10 if the conversion to 10 mils is done through multiplication within the .subckt.

*Examples:*

Examples of Touchstone Reference:

| file\_type typ min max

File\_TS typ.s8p min.s8p max.s8p

or

| file\_type typ min max

File\_TS typ.s4p min.s4p NA

Example of IBIS-ISS Reference:

| file\_type corner\_name file\_name circuit\_name (.subckt name)

File\_ISS Typ net.iss netlist\_typ

File\_ISS Min net.iss netlist\_min | in same file as net.sp

File\_ISS Max net\_max.iss netlist\_max | in separate file

Example of Parameter Passing:

| Param param\_name typ min max

Param abc 2m 1m 2m

Param def 4k NA NA

Param ts\_file “typ.s2p” “min.s2p” “max.s2p” | used in IBIS-ISS

NOTES AND QUESTIONS

Source Touchstone | IBIS-ISS is not necessary since the file format is recognized by File\_TS or File\_ISS. File\_ISS captures both the file\_name and circuit\_name for each corner.

For File\_ISS, an alternative syntax could have been File\_ISS\_Typ, File\_ISS\_Min, File\_ISS\_Max to eliminate the corner\_name column, where only File\_ISS\_Typ is required for file references to IBIS-ISS.

Parameter is shorted to Param (.param is legal in IBIS-ISS) to differentiate it further from Parameters in the multi-lingual syntax. (Parameter has several meanings in IBIS/IBIS-AMI.)

File\_names are not quoted to be consistent with Corner in the multi-lingual syntax.

For File\_TS, all columns typ, min, and max are entered (or NA for either or both min and max) to follow the corner syntax convention used for most IBIS keywords and subparameters. The typ entry is required, and the typ entry is used for any NA entry. The same typ, min, max convention is used for the subparameter Param.

Entries for strings in Param are surrounded by double quotes to be consistent with string\_literal Parameters in the multi-lingual syntax (or where the AMI string\_literal parameter surrounded by double quotes is passed into the multi-lingual Parameters reference). The EDA tool needs to convert string\_literals into the parameter string syntax in IBIS-ISS.

FBASE and FMAX are not defined in IBIS-ISS or Touchstone, so they are not documented here as reserved names for parameters.

Interaction of Param entries was not discussed. For example, for a T-line TD and Z0 could each have max and min entries, but the EDA tool could make available combinations of min/min, min/max, max/min or max/max for any corner . Due to parameter interactions, some mixing of corner combinations might not be realistic. (E.g., Z0min or Z0max might not correlate with TDmin or TDmax values.) (TDmin=sqrt(LminCmin), Z0min=sqrt(Lmin/Cmax), etc.).

How corners of File\_ISS and Params are processed might be based on vendor supplied documentation. For example some, but not all, combinations are shown below:

1. One file\_name for all corners, one .subckt name, and all corner settings controlled by Param settings
2. One file\_name, three .subckts (with internal default .param settings), additional corner settings controlled by Param settings or Param is not used
3. Three file\_names with the same .subckt name, but with distinct default .param settings, additional settings controlled by Param settings or Param is not used
4. Three file\_names with three distinct .subckt name and with distinct default .param settings, additional corner settings controlled by Param settings or Param is not used

No interpretation is given for Param typ, min, and max values. It is possible to independently use typ, min, or max values for any of the Param names that have been defined (e.g., the max value of one parameter may be used with the min value of another parameter).