Subject: About the Convert S2P to S4P Tool

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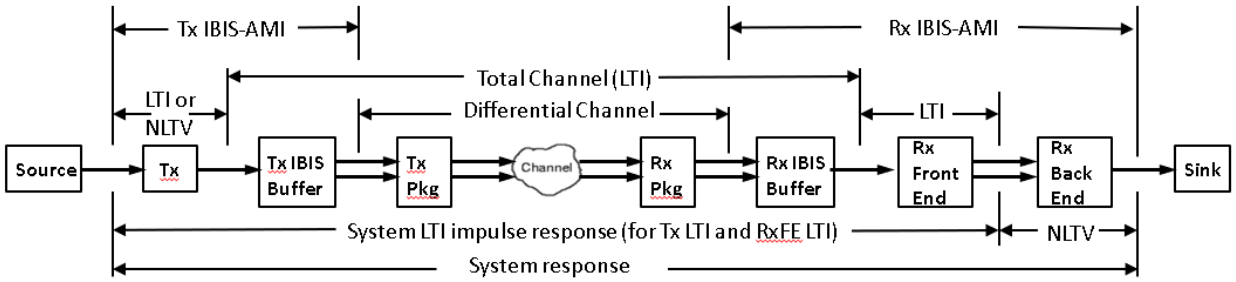
The Convert S2P to S4P IBIS S-Parameters Tool converts the differential input(Rx) or output (Tx) SerDes circuit impedance (as represented with S2P data) into S4P data that can be used to represent the SerDes circuit IBIS input(Rx) or output (Tx) buffer.

This tool is one of the many SerDes tools available for download and use on a Windows PC from the web site: **https://www.serdesdesign.com**

Discussion

A SerDes System has the typical structure shown in this figure.



The differential channel often includes a transmit (Tx) package and a receive (Rx) package and is linear and time invariant (LTI).

- The differential channel represents a hardware SerDes channel and is typically characterized by measuring its N-port S-parameters and is typically a 4-port. The 4-port differential input ports are typically port 1 (+) and port 3 (-). The associated differential output ports are typically port 2 (+) and port 4 (-). The differential characteristic (Port 1 – Port 3 vs. Port 2 – Port 4) is the channel transmission characteristic and is observed versus frequency.
- See S-parameter detail in References > **S-Parameter Channel Examples**
- The S-parameters may also be obtained from various simulators. A high speed digital SerDes channel typically has substantial high frequency attenuation at and beyond the bit/symbol rate Nyquist frequency and requires compensation using equalizers at the transmit and/or receive side of the channel.

The Tx SerDes circuit is represented with the Tx IBIS-AMI section.

The Rx SerDes circuit is represented with the Rx IBIS-AMI section.

The total channel is inclusive of the Tx IBIS Buffer and Rx IBIS Buffer. Per the IBIS-AMI standard, the IBIS Buffers are to be considered LTI for use in a SerDes Channel Simulator. Thus, the total channel is LTI.

One of the key challenges is to represent the SerDes circuit into its independent AMI and IBIS portions.

More typically, the SerDes circuit differential input (Rx) or output (Tx) impedance versus frequency can be measured and represented with a S2P S-parameter file.

This Tool is used to:

- Convert a Tx SerDes circuit output impedance S2P data into S4P data that can be used to represent the Tx SerDes circuit IBIS buffer, or
- Convert a Rx SerDes circuit input impedance S2P data into S4P data that can be used to represent the Rx SerDes circuit IBIS buffer.

Separate tools are available from SerDesDesign.com to create the entire IBIS-AMI model from SerDes circuit data.

Use the tool by following these steps.

Define the S-parameter files to be converted

Name	Description	Entry Value(s)	Status	Type	Limits	Comment
ConversionType	Conversion type	1		Integer	[0, 1]	0 = Tx 1 = Rx
S2P_FileA	S2P S-parameter file	Rx_IBIS_RxR_53p9647.s2p Choose File No file chosen		File		Upload a S2P file (Touchstone 1.0 format) or list previously uploaded file.
S2P_FileB	S2P S-parameter file B	NULL		File	-	List S2P file that was previously uploaded (Touchstone 1.0 format)
S2P_FileC	S2P S-parameter file B	NULL		File	-	List S2P file that was previously uploaded (Touchstone 1.0 format)
S2P_FileD	S2P S-parameter file B	NULL		File	-	List S2P file that was previously uploaded (Touchstone 1.0 format)
S2P_FileE	S2P S-parameter file B	NULL		File	-	List S2P file that was previously uploaded (Touchstone 1.0 format)

Up to five S2P files can be converted at a time.

First set ConversionType to select whether the S2P represents a SerDes Tx circuit output impedance (ConversionType = 0), or whether the S2P represents a SerDes Rx circuit input impedance (ConversionType = 1)

Use the S2P_FileA ‘Choose File’ button to upload each of the files to be converted.

On Windows: The S-Parameters files are to be placed on the users Windows PC in directory: C:\SerDesDesign\user-<xxx>\files\channel_data, where <xxx> is the specific assigned user number.

Each file must be a S2P file where the S2P port 1 is for the SerDes circuit differential + port and th S2P port 2 is for the SerDes circuit differential – port.

At least S2P_FileA must be defined.

If any of the following files are not to be used, then use 'NULL' as the file name.

Setup the analysis.

Name	Description	Entry Value(s)	Status	Type	Limits	Comment
AnalysisName	Analysis name	Convert_S2P_to_S4P		String		Alpha-numeric characters or underbar - case sensitive - start with alpha character

Define the name of the analysis; you can use the default name.

Run the analysis.

Select to run analysis	Run		Waiting to run

The S2P to S4P conversion process follows these steps for each file:

- The S2P file is read in.
- The S2P data 0 Hz data is checked and corrected as needed. Oftentimes, many S-parameter simulation or hardware measurement tool do not include a 0 Hz data value or uses a 0 Hz data value that is inconsistent with the higher frequency S2P data.
- The S2P 0 Hz differential resistance per pin is reported, call the RL.
- The S2P data is converted to S4P data. See this report:
  - Convert S2P Data to IBIS Buffer Model
- The S4P file is based on the S2P filename: <S2P_filename.s2p>.s4p

Obtain the S4P file

For Windows:

- The S4P file will be in the users channel_data directory (C:\SerDesDesign\user-<xxx>\files\channel_data).

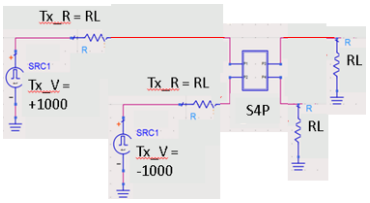
For Web-based Linux:

- Use the 'View S-Parameter Tool' to Run with the S4P and use the 'Download' button to download to your local computer.

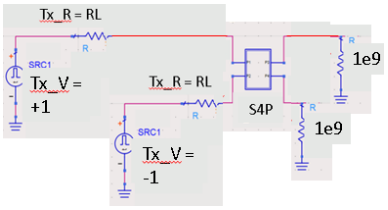
Display the results.

A SerDes system is set up using this S4P data.

Block diagram for the SerDes system using the Tx S4P IBIS data:

- 

Block diagram for the SerDes system using the Rx S4P IBIS data:

- 

The SerDes system differential frequency domain characteristic is derived.

View these results by selecting the ‘Open’ button for each SerDes system.

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