

# EMIF Device Selector User Guide

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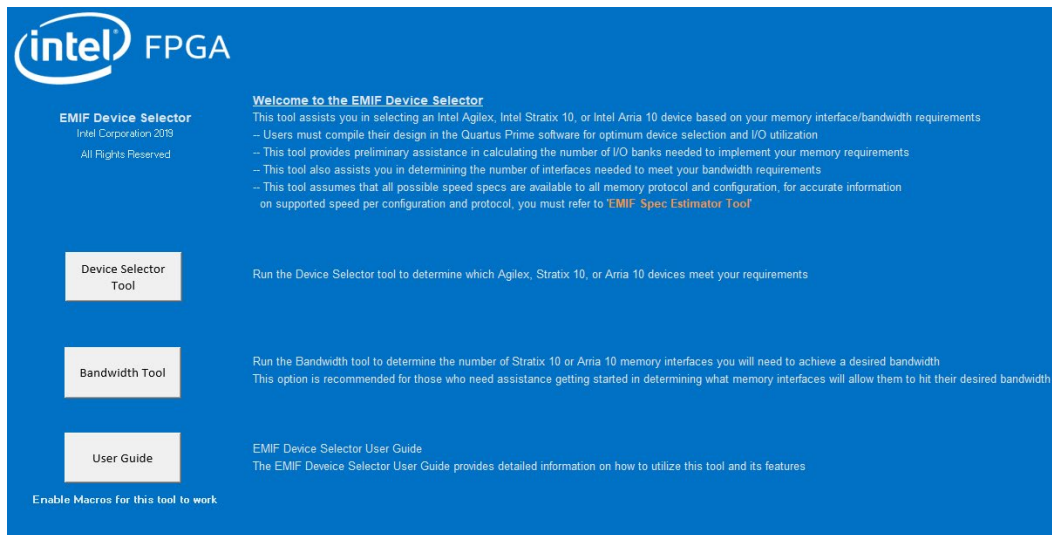
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# 1.0 About the EMIF Device Selector Tool

Device selection can be challenging because it can be difficult to estimate the I/O bank requirements for your application’s memory interfaces: the number of available I/O banks varies across FPGA products and devices, and I/O bank utilization varies for each memory interface depending on protocol, interface width, memory format, and number of ranks. The External Memory Interfaces (EMIF) Device Selector Tool helps you to select Intel® FPGA products and devices based on your application’s external memory interface and transceiver requirements.

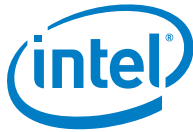
Figure 1-1. EMIF Device Selector Tool



The EMIF Device Selector Tool assists you with selecting a device based on your EMIF requirements by calculating the number of I/O banks and sub-banks required. The tool takes as input your fabric EMIF requirements and outputs the number of I/O bank and sub-banks required to implement these interfaces. The tool provides a list of devices that support your EMIF requirements. The tool also allows you to include HPS EMIF into your I/O bank and sub-bank utilization. You can use the EMIF Device Selector Tool for Intel Agilex®, Intel Stratix® 10, and Intel Arria® 10 devices.

**Note:** The EMIF Device Selector Tool is helpful to identify suitable packages for specific fabric EMIF (non-HPS) requirements.

The EMIF Device Selector also offers a Bandwidth feature, which determines the number of interfaces that you need based on a given bandwidth number. If you know that you need to achieve a certain bandwidth, the Bandwidth feature a good starting point to estimate your memory interface requirements. The bandwidth tool is currently available only for Intel Stratix 10 and Intel Arria 10 devices.



## 2.0 Entering Your Requirements into the EMIF Device Selector Tool

As depicted in Figure 1-1, from the EMIF Device Selector Tool’s introduction page, you can select either the Device Selector Tool or the Bandwidth Tool. The introduction page also provides links to Intel Stratix 10 and Intel Agilex floorplans for details on I/O bank placement, orientation, and continuation.

1. Device Selector Tool: You can select the Device Selector Tool to directly enter the desired number of fabric memory interfaces and a selection for HPS memory interface, as well as selections for other memory configuration parameters.

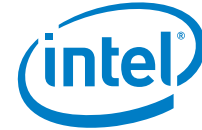
Figure 2-1. Device Selector Tool

	Protocol	Total Interface Width	Number of Channels	Memory Format	Number of Ranks	Interface Speed (MHz)	Controller Efficiency (%)	ECC
Interface_0	DDR4	72		Component	1	1600	90	<input type="checkbox"/>
Interface_1	DDR4	72		Component	1	1600	90	<input type="checkbox"/>
Interface_2	DDR4	72		Component	1	1600	90	<input type="checkbox"/>
Interface_3	DDR4	72		Component	1	1600	90	<input type="checkbox"/>
Interface_4	DDR4	72		Component	1	1600	90	<input type="checkbox"/>

2. Bandwidth Tool: You can select this tool to determine the number of interfaces you'll need based on a desired bandwidth in Gbps (Gigabits per second)

Figure 2-2. Bandwidth Tool

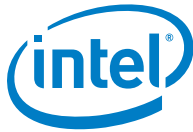
**Note:** Maximum bandwidth allowed for Stratix 10 is 247 Gbps (or 506Gbps for HBM2)  
Typical controller efficiency falls between 70%



## 2.1 Device Selector Tool

After you select Device Selector Tool on the introduction page, a separate configuration GUI opens up as shown in Figure 2-1. The Device Selector Tool has customizable parameters and a built-in bandwidth calculator for the values you input into the tool. You can toggle the number of interfaces and the device family you want to use. Below are the parameters that you can select.

- **Select Number of Fabric Memory Interfaces:** Enter the number of fabric (non-HPS) memory interfaces you want to implement.
- **Bandwidth (Gbps):** Enter the desired bandwidth value.
- **device selection:** Select your choice of a device family.
- **Use 3V I/O banks for EMIF:** Enable this option to use any 3V I/O banks available to implement your EMIF requirements. This option is only available for Intel Arria 10 devices.
- **Use Fast Passive Parallel config mode:** Enable this option if your application uses Fast Passive Parallel config mode. Fast Passive Parallel config mode uses I/O config banks (Bank 2A) making the bank unavailable for EMIF use. This option is only available for Intel Arria 10 devices.
- **Use AVST x16 or x32 config mode:** Enable this option if your application uses an AVST configuration scheme. The banks assigned for AVST are not available to implement fabric EMIF memory interfaces. The unavailable banks are used to implement an AVST x16 or x32 configuration scheme. The location of configuration bank(s) is fixed and unique for each product family. For more accurate location information, please refer to the Intel Stratix 10 and Intel Agilex floorplan information links on the introduction page
- **Use HPS EMIF:** Enable this option to implement if your application has an HPS EMIF interface, which will cause certain I/O banks to become unavailable for additional fabric EMIF use (the banks that are "unavailable" are the ones used to implement the HPS EMIF).
- **Protocol:** This option lists available protocols such as DDR4, QDRIV, DDR3, HBM2, RLDRAM3, QDRII depending on device selection.
- **Total Interface Width:** Use this option to select the total interface width for each interface.
- **Memory Format:** You can choose memory format for your configuration using this option.
  - **Note:** If you select Ping Pong PHY format, you must input the total interface width of the combined DDR3/DDR4 interfaces. For example, 2 x16 DDR4 interfaces is equivalent to 1 x32 Ping Pong PHY DDR4 interface.



- **Number of Ranks:** Use this option to select number of ranks such as 1, 2, or 4.
- **Interface Speed (MHz):** Use this option to enter the interface speed. The values available are based on protocol.
- **Controller Efficiency (%):** Use this option to enter the desired efficiency.
- **ECC:** If you want to allocate a part of the memory interface and dedicate it to Error Checking and Control, you can check this corresponding box in the interface row. When you enable ECC, 8-bit ECC is added on top of your selected interface width.

## 2.2 Bandwidth Tool

The Bandwidth Tool is an addition to the larger Device Selector Tool. This tool allows you to estimate the number of memory interfaces needed for a specified bandwidth. The GUI has four changeable parameters:

**Device family:** Use this option to select the device family.

**Desired bandwidth** (in Gbps): Enter the bandwidth value you want to achieve.

**Memory Protocol:** Use this option to select your choice of memory protocol.

**Desired Controller Efficiency:** Enter the controller efficiency you're aiming for. The default is to 70%.

After you enter device family, a bandwidth, and choose the protocol and efficiency, press **Submit**. The Device Selector Tool GUI calculates the given parameters and tries to match the bandwidth as closely as possible (always rounding up and never down) with a certain interface combination.

### Equation 1. Bandwidth Algorithm

The used algorithm for bandwidth in the Bandwidth Tool is as follows:

$$\text{Bandwidth in Gbps} = \frac{\text{Number of bits in Interface} \times \text{Datarate} \times \text{Frequency in MHz} \times \frac{\text{Efficiency \%}}{100}}{1000}$$

Datarate value is set to 2.

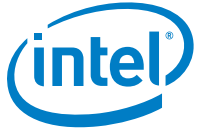




## 3.0 Results

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After you click **Submit**, the EMIF Device Selector Tool identifies the device and package combinations that support your memory interface requirements and provides the number of remaining GPIO and transceiver channels available. It also helps you determine the number of interfaces you will need to achieve a desired bandwidth. Note that you must compile their design in Quartus for optimum device selection and I/O bank utilization.



## **4.0 Error Handling**

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If you encounter a VB error or compile error, Visio drawing support might be missing from your installation. To fix this error, copy the VISOCX.DLL file into the installation directory.



## 5.0 Document Revision History

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Date	Version	Changes
07 April, 2021	1.0	Initial release.