



## Building the First Stage Bootloader and Vivado projects for the ADMVPX39Z2

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## Introduction

This guide describes how to build the First Stage Bootloader and Vivado designs for the ADM-VPX3-9Z2.

## Requirements

Xilinx SDK 2018.3

Xilinx Vivado 2018.3.

## Sources

The sources can be downloaded from github using one of the following commands, depending on Vivado version:

```
git clone -b rel-v2018.3 https://github.com/adps/fsbl-vivado_admvp39z2.git
```

## Vivado Project

The Vivado project contains the processing system configuration, which is required by the First Stage Bootloader. There is also a simple FPGA design attach to an AXI Master bus which contains a block RAM and a block to reverse the data received from the block RAM during a read operation. i.e. writing 0x12345678 to the design will be read back as 0x87654321.

## Generating the Vivado project

To generate the Vivado project:

- 1: Open Vivado, and in the tcl console navigate to the fpga/vivado/ directory, e.g:

```
cd C:/ZynqMPSoc/fpga/vivado
```

- 2: Source the tcl script to generate the project:

```
source ./simple-9z2.tcl
```

This will generate the Vivado project in the fpga/vivado/simple-9z2 directory. A bitstream can then be generated in the usual way.

After bistream generation, the hardware description file can be generated for use with XSDK. Click File->Export->Export Hardware, then click Ok.

## Outputs

After building has completed, the following files can be found:

<b>admvp39z2_zu15_simple.bit</b>	This file is the FPGA bitstream.
<b>simple_9z2_wrapper.hdf</b>	This is the hardware description file to be loaded by the First Stage Bootloader.

## Customising the Processor Configuration

The processor can be configured to use different peripherals, such as the EMMC or SD card, or different configurations of the GTR transceivers. If any modifications are made to the processing system, the block design should be generated by clicking "Generate Block Design" in the left bar, and then exporting the hdf file again.

After this, the First Stage Bootloader should be re-generated with the new hdf file.

## Constraint files

The pinout for the FMC connector is found in simple\_9z2\_fmc.xdc, and the pinout for the clocks/DisplayPort are found in 9z2.xdc.

## Building the Example Application

There is an application to interact with the Vivado design, located in the apps/simple folder. This application simply writes data to the FPGA design, and then reads it back and prints the results. The FPGA design will swap the written data around, which confirms that it is working properly. After building the cross-compile toolchain, run:

```
make all
```

## First Stage Bootloader

The FSBL (First Stage Boot Loader) configures the processor with the settings from Vivado before loading U-Boot.

### Building the FSBL

1: Open a command line interface and change directory to the fsbl folder.

2: Source the XSDK setup script. e.g for Windows:

```
call C:\Xilinx\SDK\2018.3\settings64.bat
```

3: Start XSDK in batch mode, using build\_fsbl\_2018\_3.tcl

```
xsdk -batch -source build_fsbl_2018_3.tcl
```

This will build all the required projects, and generate the BOOT.bin file required to boot.

The BOOT.bin file will include the bitstream file located in the "bit" folder, and the u-boot.elf file located in xsdk/build\_bootimg folder.

### Outputs

After building has completed, the following files can be found in the build directory:

- |                      |  |
|----------------------|--|
| <b>9z2_fsbl.elf</b>  | This file is the first stage bootloader executable.  |
| <b>BOOT.bin</b>      | This is the boot file that the Zynq process will first try to load for booting. It contains first stage bootloader |
| <b>9z2_workspace</b> | This directory contains the workspace and all required projects to build the 9z2 FSBL.                             |

### Customising the FSBL and Processor Configuration

The FSBL can be customised after generating the output files. Open Xilinx SDK 2018.3 and set the workspace to the "9z2\_workspace" folder that was created when running the fsbl build script. The project called **9z2\_fsbl** will contain the first stage bootloader source files, which can be modified as needed.

The project will use a pre-built hdf file that configures the processor to use DisplayPort, USB and the SD Card. This can be changed by right clicking on the 9z2\_hw project, and selecting "Change Hardware Platform Specification", click yes to the warning, navigate to the new hdf file and click OK. This will re-generate the first stage bootloader with the updated processor configuration.

After generating the FSBL, a BOOT.bin file must be generated manually:

- 1 Within Xilinx SDK, Select Xilinx->Create Boot Image.
- 2 Select Import from existing BIF file
- 3 In the "Import BIF file path" section, select "browse" and select to "build\_bootimg/mking-u-boot\_bitstream.bif"
- 4 Click "Create Image"

The updated BOOT.bin file will be generated in the xsdk/build\_bootimg directory.

## Revision History

Revision	Date	Description of Change
1.0	15th June 2018	Initial draft
1.1	11th February 2019	Updated for Vivado 2018.3