



## TE0821 Test Board

Revision v.9

Exported on 2023-09-15

Online version of this document:

<https://wiki.trenz-electronic.de/display/PD/TE0821+Test+Board>

# 1 Table of Contents

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1	Table of Contents .....	2
2	Table of Figures .....	4
3	Table of Tables .....	5
4	Overview .....	7
4.1	Key Features .....	7
4.2	Revision History .....	7
4.3	Release Notes and Know Issues .....	8
4.4	Requirements .....	9
4.4.1	Software .....	9
4.4.2	Hardware .....	9
4.5	Content .....	12
4.5.1	Design Sources .....	12
4.5.2	Additional Sources .....	12
4.5.3	Prebuilt .....	13
4.5.4	Download .....	14
5	Design Flow .....	15
6	Launch .....	17
6.1	Programming .....	17
6.1.1	Get prebuilt boot binaries .....	17
6.1.2	QSPI-Boot mode .....	17
6.1.3	SD-Boot mode .....	18
6.1.4	JTAG .....	18
6.2	Usage .....	18
6.2.1	Linux .....	18
6.2.2	Vivado HW Manager .....	19
7	System Design - Vivado .....	21
7.1	Block Design .....	21
7.1.1	PS Interfaces .....	21
7.2	Constrains .....	22
7.2.1	Basic module constrains .....	22
7.2.2	Design specific constrain .....	22
8	Software Design - Vitis .....	23
8.1	Application .....	23
8.1.1	zynqmp_fsbl .....	23
8.1.2	zynqmp_fsbl_flash .....	23
8.1.3	zynqmp_pmufw .....	23
8.1.4	hello_te0821 .....	23
8.1.5	u-boot .....	24
9	Software Design - PetaLinux .....	25
9.1	Config .....	25

9.2	U-Boot.....	25
9.3	Device Tree .....	25
9.4	FSBL patch.....	28
9.5	Kernel.....	28
9.6	Rootfs.....	29
9.7	Applications.....	29
9.7.1	startup .....	29
9.7.2	webfwu .....	29
10	Additional Software .....	30
10.1	SI5338 .....	30
11	Appx. A: Change History and Legal Notices .....	31
11.1	Document Change History.....	31
11.2	Data Privacy.....	32
11.3	Document Warranty .....	32
11.4	Limitation of Liability .....	32
11.5	Copyright Notice .....	32
11.6	Technology Licenses.....	33
11.7	Environmental Protection .....	33
11.8	REACH, RoHS and WEEE .....	33

## 2 Table of Figures

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Figure 1: Vivado Hardware Manager .....20

Figure 2: Block Design .....21

### 3 Table of Tables

---

Table 1: Design Revision History ..... 7

Table 2: Known Issues..... 9

Table 3: Software ..... 9

Table 4: Hardware Modules..... 10

Table 5: Hardware Carrier..... 11

Table 6: Additional Hardware..... 11

Table 7: Design sources ..... 12

Table 8: Additional design sources ..... 13

Table 9: Prebuilt files (only on ZIP with prebuilt content) ..... 13

Table 10: PS Interfaces..... 21

Table 11: Document change history. .... 31



## 4 Overview

ZynqMP PS Design with Linux Example and simple frequency counter to measure SI5338 Reference CLK with Vivado HW-Manager.

Wiki Resources page: <http://trenz.org/te0821-info>

### 4.1 Key Features

- Vitis/Vivado 2021.2.1
- PetaLinux
- SD
- ETH
- USB
- I2C
- RTC
- FMeter
- MAC from EEPROM
- User LED
- Modified FSBL for SI5338 programming
- Special FSBL for QSPI programming

### 4.2 Revision History

<b>Date</b>	<b>Vivado</b>	<b>Project Built</b>	<b>Authors</b>	<b>Description</b>
2022-11-07	2021.2.1	TE0821-test_board-vivado_2021.2-build_20_20221107115647.zip TE0821-test_board_noprebuilt-vivado_2021.2-build_20_20221107115647.zip	Manuela Strücker	<ul style="list-style-type: none"> <li>• bugfix uncomment block design modifications in mod_bd.tcl</li> <li>• added jtag2axi for test purposes</li> </ul>
2022-10-24	2021.2.1	TE0821-test_board-vivado_2021.2-build_19_20221024161132.zip TE0821-test_board_noprebuilt-vivado_2021.2-build_19_20221024161132.zip	Manuela Strücker	<ul style="list-style-type: none"> <li>• Release Vivado 2021.2.1</li> <li>• new variants</li> <li>• script update</li> </ul>
2021-10-21	2020.2	TE0821-test_board-vivado_2020.2-build_8_20211013085513.zip TE0821-test_board_noprebuilt-vivado_2020.2-build_8_20211013085523.zip	John Hartfiel	<ul style="list-style-type: none"> <li>• Replace 19.2 FSBL with 20.2 FSBL version</li> <li>• bugfix template, to support different DDR size</li> <li>• bugfix 2GB linux image</li> </ul>

<b>Date</b>	<b>Vivado</b>	<b>Project Built</b>	<b>Authors</b>	<b>Description</b>
2021-08-24	20.2	TE0821-test_board_noprebuilt-vivado_2020.2-build_7_20210824103059.zip TE0821-test_board-vivado_2020.2-build_7_20210824103042.zip	Mohsen Chamanbaz	<ul style="list-style-type: none"> <li>startup application added</li> <li>webfwu application added</li> </ul>
2021-08-17	20.2	TE0821-test_board_noprebuilt-vivado_2020.2-build_7_20210817112843.zip TE0821-test_board-vivado_2020.2-build_7_20210817112826.zip	Mohsen Chamanbaz	<ul style="list-style-type: none"> <li>2020.2 release</li> </ul>
2020-10-06	20.2	TE0821-test_board_noprebuilt-vivado_2019.2-build_15_20201006104048.zip TE0821-test_board-vivado_2019.2-build_15_20201006103533.zip	John Hartfiel	<ul style="list-style-type: none"> <li>new assembly variants</li> </ul>
2020-05-29	20.2	TE0821-test_board_noprebuilt-vivado_2019.2-build_12_20200529054245.zip TE0821-test_board-vivado_2019.2-build_12_20200529054223.zip	John Hartfiel	<ul style="list-style-type: none"> <li>initial release</li> </ul>

**Table 1: Design Revision History**

## 4.3 Release Notes and Known Issues

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Issues	Description	Workaround	To be fixed version
Xilinx Software	Incompatibility of board files for ZynqMP with eMMC activated for Vivado versions below/equal to 2021.2 and 2021.2.1 patch, see <a href="#">Xilinx Forum Request</a> <sup>1</sup>	use corresponding board files for the Vivado versions	--

**Table 2: Known Issues**

## 4.4 Requirements

### 4.4.1 Software

Software	Version	Note
Vitis	2021.2.1	needed Vivado is included into Vitis installation
PetaLinux	2021.2	needed
SI ClockBuilder Pro	---	optional

**Table 3: Software**

### 4.4.2 Hardware

Basic description of TE Board Part Files is available on [TE Board Part Files](#).<sup>2</sup>

Complete List is available on "<project folder>\board\_files\\*\_board\_files.csv"

Design supports following modules:

<sup>1</sup> [https://support.xilinx.com/s/feed/0D54U00005Wbon6SAB?language=en\\_US](https://support.xilinx.com/s/feed/0D54U00005Wbon6SAB?language=en_US)

<sup>2</sup> <https://wiki.trenz-electronic.de/display/PD/TE+Board+Part+Files>

Module Model	Board Part Short Name	PCB Revision Support	DDR	QSPI Flash	EMMC	Others	Notes
TE0821-01-2AE31KA	2cg_1e_4gb	REV01	4GB	128MB	64GB	NA	NA
TE0821-01-3BI21FA	3eg_1i_2gb	REV01	2GB	128MB	8GB	NA	NA
TE0821-01-3BI21FL	3eg_1i_2gb	REV01	2GB	128MB	8GB	2.5 mm connectors	NA
TE0821-01-3BE21FA	3eg_1e_2gb	REV01	2GB	128MB	8GB	NA	NA
TE0821-01-3BE21FL*	3eg_1e_2gb	REV01	2GB	128MB	8GB	2.5 mm connectors	NA
TE0821-01-3BE21FC	3eg_1e_2gb	REV01	2GB	128MB	8GB	NA	without encryption/NCNR
TE0821-01-3AE31KA	3cg_1e_4gb	REV01	4GB	128MB	64GB	NA	NA
TE0821-01-4DE31FL	4ev_1e_4gb	REV01	4GB	128MB	8GB	2.5 mm connectors	NA
TE0821-01-3BE21MA	3eg_1e_2gb	REV01	2GB	128MB	8GB	NA	NA

Module Model	Board Part Short Name	PCB Revision Support	DDR	QSPI Flash	EMMC	Others	Notes
TE0821-01-3BE21ML	3eg_1e_2gb	REV01	2GB	128MB	8GB	2.5 mm connectors	NA

**Table 4: Hardware Modules**

\*used as reference

Design supports following carriers:

Carrier Model	Notes
TE0701	<ul style="list-style-type: none"> <li>Important: See restrictions on usage with 7 Serie Carriers: <a href="#">4 x 5 SoM Carriers</a><sup>3</sup></li> </ul>
TE0703*	<ul style="list-style-type: none"> <li>Important: See restrictions on usage with 7 Serie Carriers: <a href="#">4 x 5 cm carriers</a><sup>4</sup></li> <li>Used as reference carrier.</li> </ul>
TE0705	<ul style="list-style-type: none"> <li>Important: See restrictions on usage with 7 Serie Carriers: <a href="#">4 x 5 SoM Carriers</a><sup>5</sup></li> </ul>
TE0706	<ul style="list-style-type: none"> <li>Important: See restrictions on usage with 7 Serie Carriers: <a href="#">4 x 5 SoM Carriers</a><sup>6</sup></li> </ul>
TEBA0841	<ul style="list-style-type: none"> <li>Important: See restrictions on usage with 7 Serie Carriers: <a href="#">4 x 5 SoM Carriers</a><sup>7</sup></li> <li>No SD Slot available, pins goes to Pin Header</li> <li>For TEBA0841 REV01, please contact TE support</li> </ul>

**Table 5: Hardware Carrier**

\*used as reference

Additional HW Requirements:

Additional Hardware	Notes
USB Cable for JTAG/UART	Check Carrier Board and Programmer for correct type

3 <https://wiki.trenz-electronic.de/display/PD/4+x+5+SoM+Carriers>

4 <https://wiki.trenz-electronic.de/display/PD/4+x+5+SoM+Carriers>

5 <https://wiki.trenz-electronic.de/display/PD/4+x+5+SoM+Carriers>

6 <https://wiki.trenz-electronic.de/display/PD/4+x+5+SoM+Carriers>

7 <https://wiki.trenz-electronic.de/display/PD/4+x+5+SoM+Carriers>

Additional Hardware	Notes
XMOD Programmer	Carrier Board dependent, only if carrier has no own FTDI
Cooler	It's recommended to use cooler on ZynqMP device

**Table 6: Additional Hardware**

\* used as reference

## 4.5 Content

For general structure and of the reference design, see [Project Delivery - AMD devices](#)<sup>8</sup>

### 4.5.1 Design Sources

Type	Location	Notes
Vivado	<project folder>\block_design <project folder>\constraints <project folder>\ip_lib <project folder>\board_files	Vivado Project will be generated by TE Scripts
Vitis	<project folder>\sw_lib	Additional Software Template for Vitis and apps_list.csv with settings automatically for Vitis app generation
PetaLinux	<project folder>\os\petalinux	PetaLinux template with current configuration

**Table 7: Design sources**

### 4.5.2 Additional Sources

<sup>8</sup> <https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices>

Type	Location	Notes
SI5338	<project folder>\misc\PLL\SI5338_B	SI5338 Project with current PLL Configuration
init.sh	<project folder>\misc\sd	Additional Initialization Script for Linux

**Table 8: Additional design sources**

### 4.5.3 Prebuilt

File	File-Extension	Description
BIF-File	*.bif	File with description to generate Bin-File
BIN-File	*.bin	Flash Configuration File with Boot-Image (Zynq-FPGAs)
BIT-File	*.bit	FPGA (PL Part) Configuration File
Boot Script-File	*.scr	Distro Boot Script file
DebugProbes-File	*.ltx	Definition File for Vivado/Vivado Labtools Debugging Interface
Diverse Reports	---	Report files in different formats
Device Tree	*.dts	Device tree (2 possible, one for u-boot and one for linux)
Hardware-Platform-Description-File	*.xsa	Exported Vivado <a href="#">hardware description file</a> for Vitis and PetaLinux
LabTools Project-File	*.lpr	Vivado Labtools Project File
OS-Image	*.ub	Image with Linux Kernel (On Petalinux optional with Devicetree and RAM-Disk)

File	File-Extension	Description
Software-Application-File	*.elf	Software Application for Zynq or MicroBlaze Processor Systems

**Table 9: Prebuilt files (only on ZIP with prebuilt content)**

#### 4.5.4 Download

---

Reference Design is only usable with the specified Vivado/Vitis/PetaLinux version. Do never use different Versions of Xilinx Software for the same Project.

Reference Design is available on:

- [TE0821 "Test Board" Reference Design](#)<sup>9</sup>

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<sup>9</sup> [https://shop.trenz-electronic.de/Download/?path=Trenz\\_Electronic/Modules\\_and\\_Module\\_Carriers/4x5/TE0821/Reference\\_Design/2021.2/test\\_board](https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5/TE0821/Reference_Design/2021.2/test_board)

## 5 Design Flow

**⚠** Reference Design is available with and without prebuilt files. It's recommended to use TE prebuilt files for first launch.

Trenz Electronic provides a tcl based built environment based on Xilinx Design Flow.

See also:

- [AMD Development Tools](#)<sup>10</sup>
- [Vivado Projects - TE Reference Design](#)<sup>11</sup>
- [Project Delivery](#).<sup>12</sup>

The Trenz Electronic FPGA Reference Designs are TCL-script based project. Command files for execution will be generated with "\_create\_win\_setup.cmd" on Windows OS and "\_create\_linux\_setup.sh" on Linux OS.

TE Scripts are only needed to generate the vivado project, all other additional steps are optional and can also be executed by Xilinx Vivado/Vitis GUI. For currently Scripts limitations on Win and Linux OS see: [Project Delivery Currently limitations of functionality](#)<sup>13</sup>

**⚠ Caution!** Win OS has a 260 character limit for path lengths which can affect the Vivado tools. To avoid this issue, use Virtual Drive or the shortest possible names and directory locations for the reference design (for example "x:\<project folder>")

1. Run \_create\_win\_setup.cmd/\_create\_linux\_setup.sh and follow instructions on shell:

### \_create\_win\_setup.cmd/\_create\_linux\_setup.sh

```
-----Set design paths-----
-- Run Design with: _create_win_setup
-- Use Design Path: <absolute project path>
-----
-----TE Reference Design-----
-----
-- (0)  Module selection guide, project creation...prebuilt export...
-- (1)  Create minimum setup of CMD-Files and exit Batch
-- (2)  Create maximum setup of CMD-Files and exit Batch
-- (3)  (internal only) Dev
-- (4)  (internal only) Prod
-- (c)  Go to CMD-File Generation (Manual setup)
-- (d)  Go to Documentation (Web Documentation)
-- (g)  Install Board Files from Xilinx Board Store (beta)
-- (a)  Start design with unsupported Vivado Version (beta)
-- (x)  Exit Batch (nothing is done!)
-----
Select (ex.: '0' for module selection guide):
```

2. Press 0 and enter to start "Module Selection Guide"


<sup>10</sup> <https://wiki.trenz-electronic.de/display/PD/AMD+Development+Tools#AMDDDevelopmentTools-XilinxSoftware-BasicUserGuides>

<sup>11</sup> <https://wiki.trenz-electronic.de/display/PD/Vivado+Projects+-+TE+Reference+Design>

<sup>12</sup> <https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices>

<sup>13</sup> <https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices#ProjectDeliveryAMDdevices-Currentlylimitationsoffunctionality>


3. Create project and follow instructions of the product selection guide, settings file will be configured automatically during this process.
  - optional for manual changes: Select correct device and Xilinx install path on "design\_basic\_settings.cmd" and create Vivado project with "vivado\_create\_project\_gui\_mode.cmd"

 Note: Select correct one, see also [Vivado Board Part Flow](#)<sup>14</sup>


4. Create hardware description file (.xsa file) for PetaLinux project and export to prebuilt folder

**run on Vivado TCL (Script generates design and export files into "\prebuilt\hardware\")**

```
\prebuilt\hardware\")">
TE::hw_build_design -export_prebuilt
```

 Using Vivado GUI is the same, except file export to prebuilt folder.


5. Create and configure your PetaLinux project with exported .xsa-file, see [PetaLinux KICKstart](#)<sup>15</sup>
  - use TE Template from "<project folder>\os\petalinux"
  - use exported .xsa file from "<project folder>\prebuilt\hardware\<short name>". **Note:** HW Export from Vivado GUI creates another path as default workspace.
  - The build images are located in the "<plnx-proj-root>/images/linux" directory
6. Configure the **boot.scr** file as needed, see [Distro Boot with Boot.scr](#)<sup>16</sup>
7. Copy PetaLinux build image files to prebuilt folder
  - copy **u-boot.elf**, **u-boot.dtb**, **system.dtb**, **image.ub**, **bl31.elf** and **boot.scr** from "<plnx-proj-root>/images/linux" to prebuilt folder

 "<project folder>\prebuilt\os\petalinux\<ddr size>" or "<project folder>\prebuilt\os\petalinux\<short name>"

8. Generate Programming Files with Vitis

**run on Vivado TCL (Script generates applications and bootable files, which are defined in "test\_board\sw\_lib\apps\_list.csv")**

```
TE::sw_run_vitis -all
TE::sw_run_vitis (optional; Start Vitis from Vivado GUI or start with TE
Scripts on Vivado TCL)
```

 TCL scripts generate also platform project, this must be done manually in case GUI is used. See [Vitis](#)<sup>17</sup>

<sup>14</sup> <https://wiki.trenz-electronic.de/display/PD/Vivado+Board+Part+Flow>

<sup>15</sup> <https://wiki.trenz-electronic.de/display/PD/PetaLinux+KICKstart>


<sup>16</sup> <https://wiki.trenz-electronic.de/display/PD/Distro+Boot+with+Boot.scr>

<sup>17</sup> <https://wiki.trenz-electronic.de/display/PD/Vitis>



## 6 Launch

### 6.1 Programming


 Check Module and Carrier TRMs for proper HW configuration before you try any design. Reference Design is also available with prebuilt files. It's recommended to use TE prebuilt files for first launch.

Xilinx documentation for programming and debugging: [Vivado/Vitis/SDSoC-Xilinx Software Programming and Debugging](#)<sup>18</sup>

Note: Depending on CPLD Firmware and Boot Mode settings, QSPI boot with Linux image on SD or complete SD Boot is possible.

#### 6.1.1 Get prebuilt boot binaries

1. Run `_create_win_setup.cmd/_create_linux_setup.sh` and follow instructions on shell
2. Press 0 and enter to start "Module Selection Guide"
  - a. Select assembly version
  - b. Validate selection
  - c. Select Create and open delivery binary folder

 Note: Folder "<project folder>\\_binaries\_<Article Name>" with subfolder "boot\_<app name>" for different applications will be generated


#### 6.1.2 QSPI-Boot mode

Option for **Boot.bin** on QSPI Flash and **image.ub** and **boot.scr** on **SD** or **USB**.

1. Connect **JTAG** and power on carrier with module
2. Open Vivado Project with "vivado\_open\_existing\_project\_guimode.cmd" or if not created, create with "vivado\_create\_project\_guimode.cmd"

##### run on Vivado TCL (Script programs BOOT.bin on QSPI flash)

```
TE::pr_program_flash -swapp u-boot
TE::pr_program_flash -swapp hello_te0821 (optional)
```

 To program with Vitis/Vivado GUI, use special FSBL (fsbl\_flash) on setup

3. Copy **image.ub** and **boot.scr** on **SD** or **USB**
  - use files from "<project folder>\\_binaries\_<Article Name>\boot\_linux" from generated binary folder, see: [Get prebuilt boot binaries](#) (see page 17)
  - or use prebuilt file location, see "<project folder>\prebuilt\file\_location.txt"
4. Set Boot Mode to **QSPI-Boot** and insert **SD** or **USB**.
  - Depends on Carrier, see carrier TRM.

<sup>18</sup> <https://wiki.trenz-electronic.de/display/PD/AMD+Development+Tools#AMDDDevelopmentTools-XilinxSoftwareProgrammingandDebugging>

### 6.1.3 SD-Boot mode

Use this description for CPLD Firmware with SD Boot selectable.


1. Copy **image.ub**, **boot.src** and **Boot.bin** on **SD**
  - use files from "<project folder>\\_binaries\_<Article Name>\boot\_linux" from generated binary folder, see: [Get prebuilt boot binaries](#)(see page 17)
  - or use prebuilt file location, see "<project folder>\prebuilt\file\_location.txt"
2. Set Boot Mode to SD-Boot.
  - Depends on Carrier, see carrier TRM.
3. Insert SD-Card in SD-Slot.


### 6.1.4 JTAG

Not used on this Example.

## 6.2 Usage

1. Prepare HW like described on section [Programming](#)(see page 17)
2. Connect UART USB (most cases same as JTAG)
3. Select SD Card or QSPI as Boot Mode (Depends on used programming variant)

 Note: See TRM of the Carrier, which is used.

 Starting with Petalinux version 2020.1, the industry standard "Distro-Boot" boot flow for U-Boot was introduced, which significantly expands the possibilities of the boot process and has the primary goal of making booting much more standardised and predictable. The boot options described above describe the common boot processes for this hardware; other boot options are possible. For more information see [Distro Boot with Boot.scr](#)<sup>19</sup>

4. Power On PCB  
**boot process**
  1. ZynqMP Boot ROM loads PMU Firmware and FSBL from SD/QSPI Flash into OCM
  2. FSBL init PS, programs PL using the bitstream and loads U-boot from SD into DDR,
  3. U-boot loads Linux (**image.ub**) from SD/QSPI/... into DDR

### 6.2.1 Linux


1. Open Serial Console (e.g. putty)
  - a. Speed: 115200
  - b. Select COM Port

 Win OS, see device manager, Linux OS see dmesg |grep tty (UART is \*USB1)

2. Linux Console:

<sup>19</sup> <https://wiki.trenz-electronic.de/display/PD/Distro+Boot+with+Boot.scr>

```
# password default disabled with 2021.2 petalinux release
petalinux login: root
Password: root
```

 Note: Wait until Linux boot finished

3. You can use Linux shell now.

```
i2cdetect -y -r 0    (check I2C 0 Bus)
dmesg | grep rtc     (RTC check)
udhcpc              (ETH0 check)
lsusb               (USB check)
```

4. Option Features

- Webserver to get access to Zynq
  - insert IP on web browser to start web interface
- init.sh scripts
  - add init.sh script on SD, content will be load automatically on startup (template included in "<project folder>\misc\SD")

## 6.2.2 Vivado HW Manager

Open Vivado HW-Manager and add VIO signal to dashboard (\*.ltx located on prebuilt folder)

Monitoring:

- SI5338\_CLK0 Counter:
  - Set radix from VIO signals to unsigned integer.  
Note: Frequency Counter is inaccurate and displayed unit is Hz for CLK signals
- SI5338 CLK1 is configured to 200MHz by default and SI5338 CLK3 is configured to 125MHz by default.

Control:

- Simple loopback vio\_test\_in test\_out
- LED over X0/X1 , see [TE0821 CPLD](#)<sup>20</sup>

<sup>20</sup> <https://wiki.trenz-electronic.de/display/PD/TE0821+CPLD#TE0821CPLD-LED>

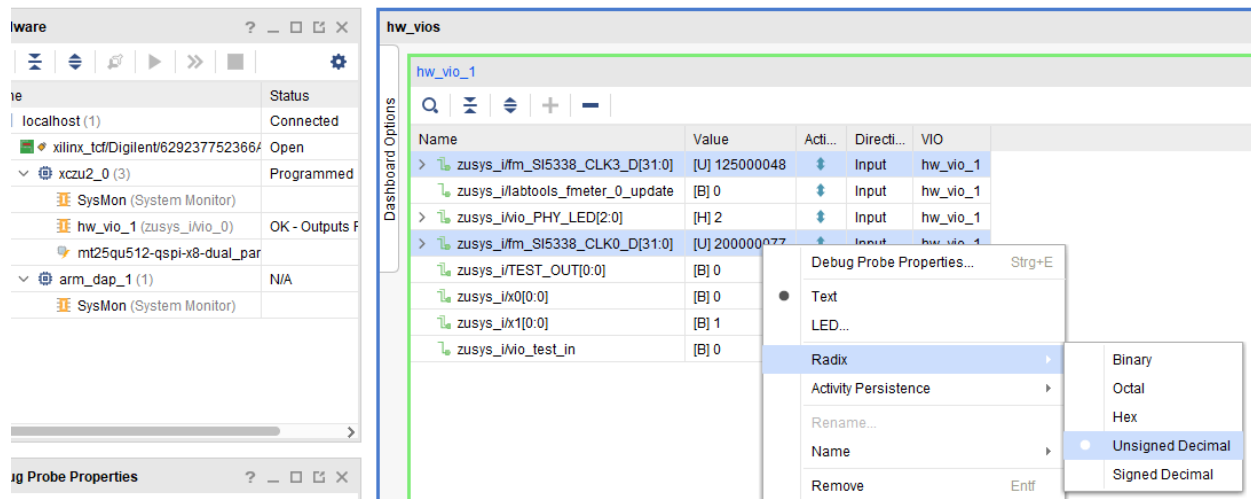
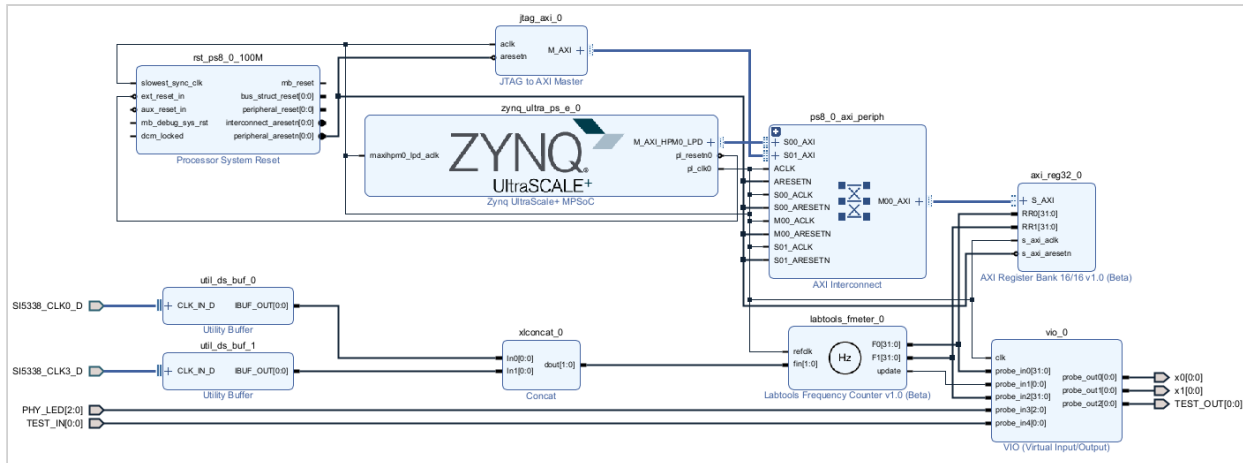


Figure 1: Vivado Hardware Manager

## 7 System Design - Vivado

### 7.1 Block Design



**Figure 2: Block Design**

#### 7.1.1 PS Interfaces

Activated interfaces:

Type	Note
DDR	
QSPI	MIO
SD0	MIO
SD1	MIO
I2C0	MIO
UART0	MIO
GPIO0	MIO
SWDT0..1	

Type	Note
TTC0..3	
GEM3	MIO
USB0	MIO, USB2 only

**Table 10: PS Interfaces**

## 7.2 Constrains

### 7.2.1 Basic module constrains

#### **\_i\_bitgen\_common.xdc**

```
set_property BITSTREAM.GENERAL.COMPRESS TRUE [current_design]
set_property BITSTREAM.CONFIG.UNUSEDPIN PULLNONE [current_design]
```

### 7.2.2 Design specific constrain

#### **\_i\_io.xdc**

```
set_property PACKAGE_PIN E5 [get_ports {SI5338_CLK0_D_clk_p[0]}]
set_property IOSTANDARD LVDS [get_ports {SI5338_CLK0_D_clk_p[0]}]
set_property PACKAGE_PIN C3 [get_ports {SI5338_CLK3_D_clk_p[0]}]
set_property IOSTANDARD LVDS [get_ports {SI5338_CLK3_D_clk_p[0]}]

set_property PACKAGE_PIN B1 [get_ports {x0[0]}]
set_property IOSTANDARD LVCMOS18 [get_ports {x0[0]}]
set_property PACKAGE_PIN C1 [get_ports {x1[0]}]
set_property IOSTANDARD LVCMOS18 [get_ports {x1[0]}]

set_property PACKAGE_PIN G8 [get_ports {PHY_LED[0]}]
set_property PACKAGE_PIN E9 [get_ports {PHY_LED[1]}]
set_property PACKAGE_PIN D9 [get_ports {PHY_LED[2]}]
set_property IOSTANDARD LVCMOS18 [get_ports {PHY_LED[*]}]

set_property PACKAGE_PIN A5 [get_ports {TEST_IN[0]}]
set_property PACKAGE_PIN B6 [get_ports {TEST_OUT[0]}]
set_property IOSTANDARD LVCMOS18 [get_ports {TEST_IN[0]}]
set_property IOSTANDARD LVCMOS18 [get_ports {TEST_OUT[0]}]
```

## 8 Software Design - Vitis

---

For Vitis project creation, follow instructions from:

[Vitis](#)<sup>21</sup>

### 8.1 Application

---

Template location: "<project folder>\sw\_lib\sw\_apps\"

#### 8.1.1 zynqmp\_fsbl

---

TE modified 2021.2 FSBL

General:

- Modified Files: xfsbl\_main.c, xfsbl\_hooks.h/.c, xfsbl\_board.h/.c (search for 'TE Mod' on source code)
- Add Files: te\_xfsbl\_hooks.h/.c (for hooks and board)
- General Changes:
  - Display FSBL Banner and Device Name

Module Specific:

- Add Files: all TE Files start with te\_
  - Si5338 Configuration
  - ETH+OTG Reset over MIO

#### 8.1.2 zynqmp\_fsbl\_flash

---

TE modified 2021.2 FSBL

General:

- Modified Files: xfsbl\_initialisation.c, xfsbl\_hw.h, xfsbl\_handoff.c, xfsbl\_main.c
- General Changes:
  - Display FSBL Banner
  - Set FSBL Boot Mode to JTAG
  - Disable Memory initialisation

#### 8.1.3 zynqmp\_pmufw

---

Xilinx default PMU firmware.

#### 8.1.4 hello\_te0821

---

Hello TE0821 is a Xilinx Hello World example as endless loop instead of one console output.

---

<sup>21</sup> <https://wiki.trenz-electronic.de/display/PD/Vitis>

## 8.1.5 u-boot

---

U-Boot.elf is generated with PetaLinux. Vitis is used to generate Boot.bin.



## 9 Software Design - PetaLinux

For PetaLinux installation and project creation, follow instructions from:

- [PetaLinux KICKstart](#)<sup>22</sup>

### 9.1 Config

Start with **petalinux-config** or **petalinux-config --get-hw-description**

Changes:

- select SD default instead of eMMC:
  - CONFIG\_SUBSYSTEM\_PRIMARY\_SD\_PSU\_SD\_1\_SELECT=y
- generate u-boot.dtb:
  - CONFIG\_SUBSYSTEM\_UBOOT\_EXT\_DTB=y
- add new flash partition for bootscr and sizing
  - CONFIG\_SUBSYSTEM\_FLASH\_PSU\_QSPI\_0\_BANKLESS\_PART0\_SIZE=0x2000000
  - CONFIG\_SUBSYSTEM\_FLASH\_PSU\_QSPI\_0\_BANKLESS\_PART2\_SIZE=0x2000000
  - CONFIG\_SUBSYSTEM\_FLASH\_PSU\_QSPI\_0\_BANKLESS\_PART3\_NAME="bootscr"
  - CONFIG\_SUBSYSTEM\_FLASH\_PSU\_QSPI\_0\_BANKLESS\_PART3\_SIZE=0x80000

### 9.2 U-Boot

Start with **petalinux-config -c u-boot**

Changes:

- MAC from eeprom together with uboot and device tree settings:
  - CONFIG\_ENV\_OVERWRITE=y
  - CONFIG\_ZYNQ\_GEM\_I2C\_MAC\_OFFSET=0xFA
  - CONFIG\_SYS\_I2C\_EEPROM\_ADDR=0x50
- Boot Modes:
  - CONFIG\_QSPI\_BOOT=y
  - CONFIG\_SD\_BOOT=y
  - # CONFIG\_ENV\_IS\_IN\_NAND is not set
  - CONFIG\_BOOT\_SCRIPT\_OFFSET=0x4040000

Change platform-top.h:

```
#include <configs/xilinx_zynqmp.h>
#no changes
```

### 9.3 Device Tree

**project-spec\meta-user\recipes-bsp\device-tree\files\system-user.dtsi**

```
/include/ "system-conf.dtsi"
```

<sup>22</sup> <https://wiki.trenz-electronic.de/display/PD/PetaLinux+KICKstart>

```

/*----- QSPI ----- */
&qspi {
    #address-cells = <1>;
    #size-cells = <0>;
    status = "okay";
    flash0: flash@0 {
        //compatible = "flash name, "micron,m25p80";
        compatible = "jedec,spi-nor";
        reg = <0x0>;
        #address-cells = <1>;
        #size-cells = <1>;
    };
};

/*----- SD1 sd2.0 -----*/
&sdhci1 {
    disable-wp;
    no-1-8-v;
};

/*----- ETH PHY -----*/
&gem3 {
    phy-handle = <&phy0>;

    nvmem-cells = <&eth0_addr>;
    nvmem-cell-names = "mac-address";

    phy0: phy0@1 {
        device_type = "ethernet-phy";
        reg = <1>;
    };
};

/*----- USB 2.0 only -----*/
&dwc3_0 {
    status = "okay";
    dr_mode = "host";
    maximum-speed = "high-speed";
    /delete-property/phy-names;
    /delete-property/phs;
    /delete-property/snps,usb3_lpm_capable;
    snps,dis_u2_susphy_quirk;
    snps,dis_u3_susphy_quirk;
};

&usb0 {
    status = "okay";
    /delete-property/ clocks;
    /delete-property/ clock-names;
    clocks = <0x3 0x20>;
    clock-names = "bus_clk";
};

```

```
};

/*----- I2C -----*/
&i2c0 {
    eeprom: eeprom@50 {
        compatible = "microchip,24aa025", "atmel,24c02";
        reg = <0x50>;

        #address-cells = <1>;
        #size-cells = <1>;
        eth0_addr: eth-mac-addr@FA {
            reg = <0xFA 0x06>;
        };
    };
};
```

#### project-spec\meta-user\recipes-bsp\uboot-device-tree\files\system-user.dtsi

```
/include/ "system-conf.dtsi"

/*----- QSPI ----- */
&qspi {
    #address-cells = <1>;
    #size-cells = <0>;
    status = "okay";
    flash0: flash@0 {
        //compatible = "flash name, "micron,m25p80";
        compatible = "jedec,spi-nor";
        reg = <0x0>;
        #address-cells = <1>;
        #size-cells = <1>;
    };
};

/*----- SD1 sd2.0 -----*/
&sdhci1 {
    disable-wp;
    no-1-8-v;
};

/*----- ETH PHY -----*/
&gem3 {
    phy-handle = <&phy0>;

    nvmem-cells = <&eth0_addr>;
    nvmem-cell-names = "mac-address";
};
```

```

    phy0: phy0@1 {
        device_type = "ethernet-phy";
        reg = <1>;
    };
};

/*----- USB 2.0 only -----*/
&dwc3_0 {
    status = "okay";
    dr_mode = "host";
    maximum-speed = "high-speed";
    /delete-property/ phy-names;
    /delete-property/ phys;
    /delete-property/ snps,usb3_lpm_capable;
    snps,dis_u2_susphy_quirk;
    snps,dis_u3_susphy_quirk;
};

&usb0 {
    status = "okay";
    /delete-property/ clocks;
    /delete-property/ clock-names;
    clocks = <0x3 0x20>;
    clock-names = "bus_clk";
};

/*----- I2C -----*/
&i2c0 {
    eeprom: eeprom@50 {
        compatible = "microchip,24aa025", "atmel,24c02";
        reg = <0x50>;

        #address-cells = <1>;
        #size-cells = <1>;
        eth0_addr: eth-mac-addr@FA {
            reg = <0xFA 0x06>;
        };
    };
};
};

```

## 9.4 FSBL patch

Must be add manually, see template

## 9.5 Kernel

Start with **petalinux-config -c kernel**

Changes:

- Only needed to fix JTAG Debug issue:
  - CONFIG\_CPU\_IDLE is not set
  - CONFIG\_CPU\_FREQ is not set
  - CONFIG\_EDAC\_CORTEX\_ARM64=y

## 9.6 Rootfs

---

Start with **petalinux-config -c rootfs**

Changes:

- For web server app:
  - CONFIG\_busybox-httpd=y
- For additional test tools only:
  - CONFIG\_i2c-tools=y
  - CONFIG\_packagegroup-petalinux-utils=y (util-linux,cpufrequtils,bridge-utils,mtd-utils,usbutils,pciutils,canutils,i2c-tools,smartmontools,e2fsprogs)

## 9.7 Applications

---

See "<project folder>\os\petalinux\project-spec\meta-user\recipes-apps\"

### 9.7.1 startup

---

Script App to load init.sh from SD Card if available.

### 9.7.2 webfwu

---

Webserver application suitable for Zynq access. Need busybox-httpd

## 10 Additional Software

---

### 10.1 SI5338

---

File location "<project folder>\misc\PLL\Si5338\_B\Si5338-\*.slabtimeproj"

General documentation how you work with these project will be available on [Si5338](https://wiki.trenz-electronic.de/display/PD/Si5338)<sup>23</sup>



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<sup>23</sup> <https://wiki.trenz-electronic.de/display/PD/Si5338>

## 11 Appx. A: Change History and Legal Notices

### 11.1 Document Change History

To get content of older revision got to "Change History" of this page and select older document revision number.

Date	Document Revision	Authors	Description
 2022-11-07	v.9(see page 6)	 <sup>24</sup>	<ul style="list-style-type: none"> <li>• bugfix uncomment block design modifications in mod_bd.tcl</li> <li>• added jtag2axi for test purposes</li> </ul>
2022-10-25	v.8	Manuela Strücker	<ul style="list-style-type: none"> <li>• Release Vivado 2021.2.1</li> <li>• new variants</li> <li>• script update</li> </ul>
2022-06-02	v.6	Manuela Strücker	<ul style="list-style-type: none"> <li>• Update Design flow section</li> </ul>
2021-10-13	v.5	John Hartfiel	<ul style="list-style-type: none"> <li>• Update Design files (bugfix)</li> </ul>
2021-08-24	v.4	Mohsen Chamanbaz	<ul style="list-style-type: none"> <li>• startup application added</li> <li>• webfwu application added</li> </ul>
2021-08-17	v.3	Mohsen Chamanbaz	<ul style="list-style-type: none"> <li>• 2020..2 release</li> </ul>
2020-10-06	v.2	John Hartfiel	<ul style="list-style-type: none"> <li>• new assembly variants</li> </ul>
2020-05-29	v.1	John Hartfiel	<ul style="list-style-type: none"> <li>• initial release</li> </ul>

<sup>24</sup> <https://wiki.trenz-electronic.de/display/~m.struecker>

Date	Document Revision	Authors	Description
	All		

**Table 11: Document change history.**

Legal Notices

## 11.2 Data Privacy

Please also note our data protection declaration at <https://www.trenz-electronic.de/en/Data-protection-Privacy>

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<sup>25</sup> <https://wiki.trenz-electronic.de/display/~M.Chamanbaz>

<sup>26</sup> <https://wiki.trenz-electronic.de/display/~j.hartfiel>

<sup>27</sup> <https://wiki.trenz-electronic.de/display/~m.struecker>



## 11.6 Technology Licenses

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## 11.8 REACH, RoHS and WEEE

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<sup>28</sup> <http://guidance.echa.europa.eu/>

<sup>29</sup> <https://echa.europa.eu/candidate-list-table>

<sup>30</sup> <http://www.echa.europa.eu/>

 2019-06-07