

# TE0715 Test Board

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Zynq Design PS with Linux and simple frequency counter to measure MGT Reference CLK with Vivado HW-Manager

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Refer to <http://trenz-electronic.com/te0715-info> for the current online version of this manual and other available documentation.

## Key Features

- Vitis/Vivado 2022.2
- PetaLinux
- SD
- Design Flow
- MAC from EEPROM
- USB
- I2C
- RTC
- FMeeter
- Modified FSBL (some additional outputs and SI5338 reconfiguration)

## Revision History

| Date       | Project Built   | Authors           | Description             |
|------------|---|-------------------|-------------------------|
| 2023-07-05 | TE0715-test_board-vivado_2022.2-build_2_20230705115102.zip  | Waldemar Hanemann | • 2022.2 update         |
| 2023-05-06 | TE0715-test_board-vivado_2021.2-build_20_20230506205024.zip | Manuela Strücker  | • new Assembly variants |
| 2022-02-09 | TE0715-test_board-vivado_2021.2-build_11_20220208131345.zip | Manuela Strücker  | • 2021.2 update         |

|            |        |   |                                    |  |
|------------|--------|---|------------------------------------|--|
| 2021-12-16 | 2020.2 | TE0715-test_board-vivado_2020.2-build_9_20211216124925.zip<br>TE0715-test_board_noprebuilt-vivado_2020.2-build_9_20211216124901.zip   | Manuela Strücker                   | <ul style="list-style-type: none"> <li>new Assembly variants</li> </ul>  |
| 2021-06-16 | 2020.2 | TE0715-test_board-vivado_2020.2-build_5_20210611100936.zip<br>TE0715-test_board_noprebuilt-vivado_2020.2-build_5_20210611100742.zip   | Manuela Strücker                   | <ul style="list-style-type: none"> <li>update mount function (from busybox to util-linux 2.34)</li> </ul>  |
| 2021-05-31 | 2020.2 | TE0715-test_board-vivado_2020.2-build_5_20210531083131.zip<br>TE0715-test_board_noprebuilt-vivado_2020.2-build_5_20210531083148.zip   | John Hartfiel/<br>Manuela Strücker | <ul style="list-style-type: none"> <li>bugfix TE0715_board_files.csv for TE0715-04-71I33-L ID</li> </ul>   |
| 2021-04-27 | 2020.2 | TE0715-test_board-vivado_2020.2-build_5_20210428094945.zip<br>TE0715-test_board_noprebuilt-vivado_2020.2-build_5_20210428095209.zip   | John Hartfiel/<br>Manuela Strücker | <ul style="list-style-type: none"> <li>update to vivado version 2020.2</li> <li>implemented boot.scr file for distro_boot</li> </ul>   |
| 2020-06-10 | 2019.2 | TE0715-test_board-vivado_2019.2-build_12_20200610070857.zip<br>TE0715-test_board_noprebuilt-vivado_2019.2-build_12_20200610071014.zip | John Hartfiel                      | <ul style="list-style-type: none"> <li>bugfix usb reset</li> <li>changes device tree for eeprom mac</li> <li>new variants</li> </ul>   |
| 2019-05-09 | 2018.3 | TE0715-test_board-vivado_2018.3-build_05_20190509094447.zip<br>TE0715-test_board_noprebuilt-vivado_2018.3-build_05_20190509094505.zip | John Hartfiel                      | <ul style="list-style-type: none"> <li>TE Script update</li> <li>rework of the FSBLs</li> <li>some additional Linux features</li> <li>MAC from EEPROM</li> </ul>   |
| 2018-10-01 | 2018.2 | TE0715-test_board-vivado_2018.2-build_03_20181001131411.zip<br>TE0715-test_board_noprebuilt-vivado_2018.2-build_03_20181001131421.zip | John Hartfiel                      | <ul style="list-style-type: none"> <li>Rework Board Part Files (PS)</li> <li>small design changes</li> <li>SI5338 reconfiguration default activated on FSBL</li> <li>update linux startup app</li> </ul> |

|            |        |   |               |   |
|------------|--------|---|---------------|---|
| 2018-04-26 | 2017.4 | TE0715-test_board-vivado_2017.4-build_07_20180426171530.zip<br>TE0715-test_board_noprebuilt-vivado_2017.4-build_07_20180426171546.zip | John Hartfiel | <ul style="list-style-type: none"> <li>new assembly variant</li> </ul>  |
| 2018-03-27 | 2017.4 | te0715-test_board-vivado_2017.4-build_07_20180327223552.zip<br>te0715-test_board_noprebuilt-vivado_2017.4-build_07_20180327223606.zip | John Hartfiel | <ul style="list-style-type: none"> <li>Board Part Bug fix with UART 1</li> </ul>  |
| 2018-01-05 | 2017.4 | te0715-test_board-vivado_2017.4-build_01_20180105195436.zip<br>te0715-test_board_noprebuilt-vivado_2017.4-build_01_20180105195452.zip | John Hartfiel | <ul style="list-style-type: none"> <li>No Design changes</li> <li>Add FSBL for Flash Programming</li> </ul>                                 |
| 2017-11-10 | 2017.2 | te0715-test_board-vivado_2017.2-build_05_20171110134232.zip<br>te0715-test_board_noprebuilt-vivado_2017.2-build_05_20171110134247.zip | John Hartfiel | <ul style="list-style-type: none"> <li>New Web Link on Board Part Files</li> <li>Add optional FSBL Code to reprogram S15338</li> </ul>      |
| 2017-10-19 | 2017.2 | te0715-test_board-vivado_2017.2-build_04_20171019141808.zip<br>te0715-test_board_noprebuilt-vivado_2017.2-build_04_20171019141825.zip | John Hartfiel | <ul style="list-style-type: none"> <li>changed Flash typ on TE0715_board_files.csv (older one is not supported on Vivado 2017.2)</li> </ul> |
| 2017-09-22 | 2017.2 | te0715-test_board-vivado_2017.2-build_02_20170927143412.zip<br>te0715-test_board_noprebuilt-vivado_2017.2-build_02_20170927143427.zip | John Hartfiel | <ul style="list-style-type: none"> <li>initial release</li> </ul>   |

#### Design Revision History

## Release Notes and Know Issues

| Issues                                 | Description  | Workaround   | To be fixed version    |
|--|--|--|------------------------|
| QSPI Flash                             | Programming QSPI fails with Vivado 2021.2 and 2022.2 | use Vivado 2020.2 or 2019.2 or older for programming |                        |
| Timing problems with Frequency counter | can be ignored                                       | ---  | with 2018-10-01 update |

## Known Issues

# Requirements

## Software

| Software            | Version | Note   |
|---------------------|---------|--|
| Vitis               | 2022.2  | needed, Vivado is included into Vitis installation |
| PetaLinux           | 2022.2  | needed   |
| SI ClockBuilder Pro | ---     | optional   |

## Software

## Hardware

Basic description of TE Board Part Files is available on [TE Board Part Files](#).

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

Design supports following modules:

| Module Model     | Board Part Short Name | PCB Revision Support | DDR | QSPI Flash | EMMC | Others | Notes         |
|------------------|-----------------------|----------------------|-----|------------|------|--------|---------------|
| TE0715-02-15-1C  | 03_15_1c_1gb          | REV02 REV01          | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-02-15-1I  | 03_15_1i_1gb          | REV02 REV01          | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-02-15-1I1 | 03_15_1i_1gb          | REV02 REV01          | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-02-30-1C  | 03_30_1c_1gb          | REV02 REV01          | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-02-30-1I  | 03_30_1i_1gb          | REV02 REV01          | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-03-15-1I  | 03_15_1i_1gb          | REV03                | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-03-15-1I3 | 03_15_1i_1gb          | REV03                | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-03-15-2I  | 03_15_2i_1gb          | REV03                | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-03-30-1C  | 03_30_1c_1gb          | REV03                | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-03-30-1I  | 03_30_1i_1gb          | REV03                | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-03-30-1I3 | 03_30_1i_1gb          | REV03                | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-03-30-3E  | 03_30_3e_1gb          | REV03 REV02 REV01    | 1GB | 32MB       | NA   | NA     | NA            |
| TE0715-04-12S-1C | 04_12s_1c_1gb         | REV04                | 1GB | 32MB       | NA   | NA     | Low Power DDR |

|                    |               |       |     |      |    |    |   |
|--------------------|---------------|-------|-----|------|----|----|---|
| TE0715-04-15-1I    | 04_15_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-15-1I3   | 04_15_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. 2.5mm connector              |
| TE0715-04-15-1IC   | 04_15_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. 3M NOVEC coating             |
| TE0715-04-15-2I*   | 04_15_2i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-21C33-A  | 04_12s_1c_1gb | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-30-1C    | 04_30_1c_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-30-1I    | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-30-1I3   | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. 2.5mm connector              |
| TE0715-04-30-1IA   | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. Micron Flash                 |
| TE0715-04-30-3E    | 04_30_3e_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-51I33-A  | 04_15_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-51I33-AN | 04_15_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. 3M NOVEC coating             |
| TE0715-04-51I33-L  | 04_15_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. 2.5mm connector              |
| TE0715-04-52I33-A  | 04_15_2i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-71C33-A  | 04_30_1c_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-71I33-A  | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-71I33-L  | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. 2.5mm connector              |
| TE0715-04-73E33-A  | 04_30_3e_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR                               |
| TE0715-04-30-1IY   | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR, without RTC                  |
| TE0715-04-51I33-AY | 04_15_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR, without RTC                  |
| TE0715-04-52I33-AY | 04_15_2i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR, without RTC                  |
| TE0715-04-71C33-AY | 04_30_1c_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR, without RTC                  |
| TE0715-04-71I33-AY | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR, without RTC                  |
| TE0715-04-71I33-LY | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | Low Power DDR. 2.5mm connector, without RTC |

|                    |               |       |     |      |    |    |                                 |
|--------------------|---------------|-------|-----|------|----|----|---------------------------------|
| TE0715-04-S003     | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | CAO: Low Power DDR              |
| TE0715-05-51I33-AN | 04_15_1i_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR. 3M NOVEC coating |
| TE0715-05-71C33-A  | 04_30_1c_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR                   |
| TE0715-04-S015     | 04_30_1i_1gb  | REV04 | 1GB | 32MB | NA | NA | CAO and Low Power DDR           |
| TE0715-05-52I33-A  | 04_15_2i_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR                   |
| TE0715-05-21C33-A  | 04_12s_1c_1gb | REV05 | 1GB | 32MB | NA | NA | Low Power DDR                   |
| TE0715-05-51I33-A  | 04_15_1i_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR                   |
| TE0715-05-71I33-A  | 04_30_1i_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR                   |
| TE0715-05-71I33-L  | 04_30_1i_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR. 2.5mm connector  |
| TE0715-05-S002C1   | 04_15_2i_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR                   |
| TE0715-05-51I33-L  | 04_15_1i_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR 2.5mm connector   |
| TE0715-05-73E33-A  | 04_30_3e_1gb  | REV05 | 1GB | 32MB | NA | NA | Low Power DDR                   |
| TE0715-05-S003C1   | 04_15_2i_1gb  | REV05 | 1GB | 32MB | NA | NA | CAO:Low Power DDR               |

\*used as reference

#### Hardware Modules

Design supports following carriers:

| Carrier Model | Notes |
|---------------|-------|
| TE0701        |       |
| TE0703*       |       |
| TE0705        |       |
| TE0706        |       |
| TEBA0841-02   |       |

\*used as reference

#### Hardware Carrier

Additional HW Requirements:

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

|                 |  |
|-----------------|--|
| XMOD Programmer | Carrier Board dependent, only if carrier has no own FTDI |
|-----------------|--|

#### Additional Hardware

## Content

For general structure and usage of the reference design, see [Project Delivery - AMD devices](#)

## Design Sources

| Type      | Location   | Notes   |
|-----------|--|---|
| Vivado    | <project folder>\block_design<br><project folder>\constraints<br><project folder>\ip_lib<br><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   |

#### Design sources

## Additional Sources

| Type    | Location                     | Notes  |
|---------|------------------------------|--|
| SI5338  | <project folder>\misc\SI5338 | SI5338 Project with current PLL Configuration  |
| init.sh | <project folder>\misc\sd\    | Additional Initialization Script for Linux ( <a href="#">working from sd card only</a> ) |

#### Additional design sources

## 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)      |
| Software-Application-File          | *.elf | Software Application for Zynq or MicroBlaze Processor Systems                     |

**Prebuilt files (only on ZIP with prebuilt content)**

## Download

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

Reference Design is available on:

- [TE0715 "Test Board" Reference Design](#)

## 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 AMD Design Flow.

See also:

- [AMD Development Tools#AMDSoftware-BasicUserGuides](#)
- [Vivado Projects - TE Reference Design](#)
- [Project Delivery](#).

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 executed by AMD Vivado/Vitis GUI. For currently Scripts limitations on Win and Linux OS see: [Project Delivery Currently limitations of functionality](#)



**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 AMD 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"
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 AMD 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](#)

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 "<project folder>\prebuilt\hardware\<short name>")**

```
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](#)
  - 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](#)
7. Copy PetaLinux build image files to prebuilt folder
  - copy **u-boot.elf**, **u-boot.dtb**, **system.dtb**, **image.ub** 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](#)

## Launch

### 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.



TE0715-0x-30-xx only: HP IO Banks max power supply voltage is 1.8V.

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

### 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

### QSPI-Boot mode

Optional 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\_gui mode.cmd" or if not created, create with "vivado\_create\_project\_gui mode.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_te0715 (optional)
```

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](#)
  - 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.

## SD-Boot mode

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

## JTAG

Not used on this Example.

## Usage

1. Prepare HW like described on section [Programming](#)
2. Connect UART USB (most cases same as JTAG)
3. Select SD Card as Boot Mode (or QSPI - depending on step 1)



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](#)


4. Power On PCB
  1. Zynq Boot ROM loads FSBL from SD/QSPI 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

## Linux

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

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

2. Linux Console:

 Note: Wait until Linux boot finished

3. You can use Linux shell now.

```
i2cdetect -y -r 0      (check I2C 1 Bus)
dmesg | grep rtc       (RTC check)
udhcpd                (ETH0 check)
lsusb                  (USB check)
```

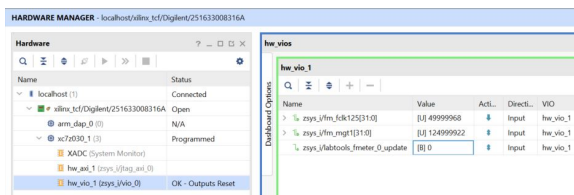
4. Option Features

- 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")

## Vivado HW Manager

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

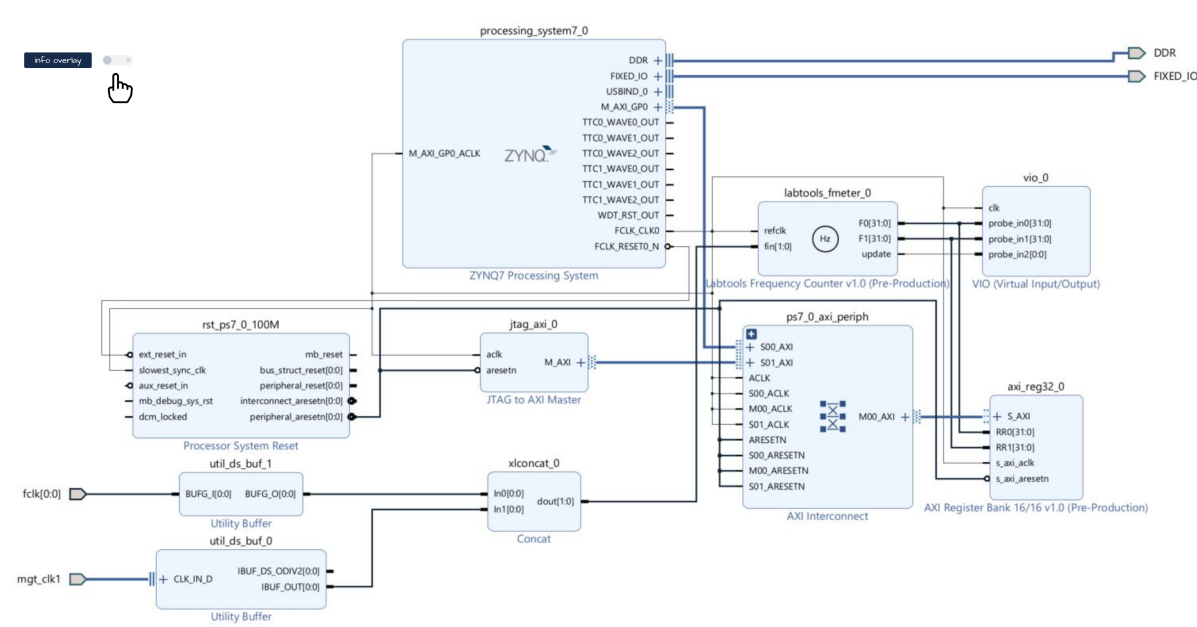
- Monitoring:
  - Si5338 CLKs:
    - Set radix from VIO signals to unsigned integer. Note: Frequency Counter is inaccurate and displayed unit is Hz
    - MGT CLK is configured to 125MHz by default, FCLK is not configured by default (optionally possible over FSBL 50MHz on delivered configuration, see FSBL description).



Vivado Hardware Manager

## System Design - Vivado

## Block Design



## PS Interfaces

Activated interfaces:

| Type         | Note |
|--------------|------|
| DDR          | ---  |
| QSPI         | MIO  |
| I2C1         | MIO  |
| UART0        | MIO  |
| GPIO         | MIO  |
| ETH, USB Rst | MIO  |
| SD0          | MIO  |
| USB0         | MIO  |
| ETH0         | MIO  |
| TTC0..1      | EMIO |
| SWDT         | EMIO |

PS Interfaces

## Constraints

### Basic module constraints

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

```
set_property BITSTREAM.GENERAL.COMPRESS TRUE [current_design]
set_property CONFIG_VOLTAGE 3.3 [current_design]
set_property CFGBVS VCCO [current_design]

set_property BITSTREAM.CONFIG.USR_ACCESS TIMESTAMP [current_design]
```

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

```
set_property BITSTREAM.CONFIG.UNUSEDPIN PULLNONE [current_design]
```

## Design specific constraints

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

```
set_property PACKAGE_PIN K2 [get_ports {fclk[0]}]
set_property IOSTANDARD LVCMOS18 [get_ports {fclk[0]}]
set_property CLOCK_DEDICATED_ROUTE FALSE [get_nets fclk_IBUF[0]]
```

#### **\_i\_timing.xdc**

```
# for fmeter only
set_false_path -from [get_clocks clk_fpga_0] -to [get_clocks
mgt_clk1_clk_p]
set_false_path -from [get_clocks mgt_clk1_clk_p] -to [get_clocks
clk_fpga_0]
```

## Software Design - Vitis

For Vitis project creation, follow instructions from:

[Vitis](#)

## Application

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

## fsbl

TE modified 2022.2 FSBL

General:

- Modified Files: main.c, fsbl\_hooks.h/c (search for 'TE Mod' on source code)
- Add Files: te\_fsbl\_hooks.h/c (for hooks and board)
- General Changes:
  - Display FSBL Banner and Device ID

Module Specific:

- Add Files: all TE Files start with te\_\*
  - SI5338 Configuration

## fsbl\_flash

TE modified 2022.2 FSBL

General:

- Modified Files: main.c
- General Changes:
  - Display FSBL Banner
  - Set FSBL Boot Mode to JTAG
  - Disable Memory initialisation

## hello\_te0715

Hello TE0715 is a AMD Hello World example as endless loop instead of one console output.

## u-boot

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

# Software Design - PetaLinux

---

For PetaLinux installation and project creation, follow instructions from:

- [PetaLinux KICKstart](#)

## Config

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

Changes:

- CONFIG\_SUBSYSTEM\_ETHERNET\_PS7\_ETHERNET\_0\_MAC=""

## U-Boot

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

Changes:

- CONFIG\_QSPI\_BOOT=y
- CONFIG\_SD\_BOOT=y
- CONFIG\_ENV\_IS\_NOWHERE=y
- CONFIG\_ENV\_OVERWRITE=y (used to overwrite environment parameter)
- CONFIG\_ENV\_IS\_IN\_FAT=y (needed to boot from SD card)
- CONFIG\_ENV\_IS\_IN\_SPI\_FLASH=y (needed to boot from QSPI flash)
- # CONFIG\_ENV\_IS\_IN\_NAND is not set
- CONFIG\_BOOT\_SCRIPT\_OFFSET=0x1920000 (Calculate the start address of partition 3 "bootscr" in the QSPI flash. To do this, add the sizes of partitions 0, 1 and 2 together)
- CONFIG\_ZYNQ\_MAC\_IN\_EEPROM=y
- CONFIG\_ZYNQ\_GEM\_I2C\_MAC\_OFFSET=0xFA
- CONFIG\_SYS\_I2C\_EEPROM\_ADDR=0x50

## Device Tree (system-user.dtsi in device-tree and uboot-device-tree)

```
/include/ "system-conf.dtsi"
/ {
    chosen {
        xlnx,eeprom = &eeprom;
    };
};

/*----- default -----*/

/*----- QSPI PHY -----*/
&qspi {
    #address-cells = <1>;
    #size-cells = <0>;
    status = "okay";
flash0: flash@0 {
    spi-rx-bus-width = <4>;
    spi-tx-bus-width = <4>;
    compatible = "jedec,spi-nor";
    reg = <0x0>;
    #address-cells = <1>;
    #size-cells = <1>;
};
};

/*----- ETH PHY -----*/
&gem0 {

    status = "okay";
    ethernet_phy0: ethernet-phy@0 {
        compatible = "marvell,88e1510";
        device_type = "ethernet-phy";
        reg = <0>;
    };
};

/*----- USB PHY -----*/
/{
    usb_phy0: usb_phy@0 {
        compatible = "ulpi-phy";
        //compatible = "usb-nop-xceiv";
        #phy-cells = <0>;
        reg = <0xe0002000 0x1000>;
        view-port = <0x0170>;
        drv-vbus;
    };
};

&usb0 {
    dr_mode = "host";
    //dr_mode = "peripheral";
    usb-phy = <&usb_phy0>;
};
```



```

/*----- I2C -----*/
// i2c PLL: 0x70, i2c eeprom: 0x50

&i2c1 {
    rtc@6F {
        compatible = "isl12022";
        reg = <0x6F>;
    };

    eeprom: eeprom@50 {
        compatible = "atmel,24c08";
        reg = <0x50>;
    };
};

```

## FSBL patch

Must be add manually --> work in progress

## Kernel

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

Changes:

- CONFIG\_RTC\_DRV\_ISL12022=y

## Rootfs

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

Changes:

- CONFIG\_i2c-tools=y
- CONFIG\_busybox-httpd=y (for web server app)
- CONFIG\_usutils=y
- CONFIG\_util-linux-umount=y (uses mount/umount function from util-linux instead of busybox)
- CONFIG\_util-linux-mount=y
- CONFIG\_auto-login=y

## Applications

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

### startup

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

### webfwu

Webserver application suitable for Zynq access. Need busybox-httpd

# Additional Software

## SI5338

File location "<project folder>\misc\SI5338\SI5338-\*.slabtimeproj"

General documentation how you work with this project will be available on [SI5338](#)

# Appx. A: Change History and Legal Notices

## 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                 |
|---|---|---|-----------------------------|
| <div>Error rendering macro 'page-info'</div> <div>Ambiguous method overload ing for method jdk. proxy24 1.\$Proxy 3496#hasContentLevelPermission . Cannot resolve</div> | <div>Error rendering macro 'page-info'</div> <div>Ambiguous method overload ing for method jdk. proxy24 1.\$Proxy 3496#hasContentLevelPermission . Cannot resolve</div> | <div>Error rendering macro 'page-info'</div> <div>Ambiguous method overload ing for method jdk. proxy24 1.\$Proxy 3496#hasContentLevelPermission . Cannot resolve</div> | <div>• Release 2022.2</div> |

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| 2023-05-08  | v.41  | Manuela Strücker  | <ul style="list-style-type: none"> <li>new Assembly variants</li> </ul>                       |
| 2022-02-09  | v.40  | Manuela Strücker  | <ul style="list-style-type: none"> <li>Release 2021.2</li> </ul>                              |
| 2021-12-16  | v.39  | Manuela Strücker  | <ul style="list-style-type: none"> <li>new Assembly variants</li> </ul>                       |
| 2021-06-16  | v.38  | Manuela Strücker  | <ul style="list-style-type: none"> <li>changed mount /umount function in PetaLinux</li> </ul> |
| 2021-05-31  | v.37  | John Hartfiel   | <ul style="list-style-type: none"> <li>Design update (bugfix csv file)</li> </ul>             |

|            |      |                  |  |
|------------|------|------------------|--|
| 2021-05-04 | v.36 | Manuela Strücker | <ul style="list-style-type: none"> <li>• Release 2020.2</li> <li>• added boot.scr for distro boot</li> </ul>   |
| 2020-06-10 | v.33 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Release 2019.2</li> </ul>   |
| 2019-05-09 | v.32 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Release 2018.3</li> <li>• FSBL Rework</li> <li>• Script rework</li> <li>• some optional features</li> </ul>   |
| 2018-10-01 | v.31 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Release 2018.2</li> <li>• Redesign Board Part Files</li> <li>• New activate SI5338 example over FSBL</li> <li>• small Design changes</li> <li>• Update Documentation Style</li> </ul> |
| 2019-04-06 | v.30 | John Hartfiel    | <ul style="list-style-type: none"> <li>• New assembly variant</li> </ul>   |
| 2018-03-27 | v.29 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Bugfix Board Part Files</li> </ul>  |
| 2018-02-13 | v.28 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Release 2017.4</li> </ul>   |
| 2017-11-10 | v.22 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Design Update with new options</li> <li>• Add SI5338 section</li> <li>• Update FSBL section</li> </ul>  |
| 2017-10-19 | v.21 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Download Update</li> </ul>  |
| 2017-10-19 | v.20 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Document style update</li> </ul>  |
| 2017-10-06 | v.18 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Text correction</li> <li>• Update Launch section</li> <li>• Supported PCBs</li> </ul>   |
| 2017-10-02 | v.14 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Document update on Prebuilt section</li> </ul>  |
| 2017-09-28 | v.13 | John Hartfiel    | <ul style="list-style-type: none"> <li>• Initial Release 2017.2</li> </ul>   |
| --         | all  |                  | --   |

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Document change history.

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Error rendering macro 'page-info'

Ambiguous method overloading for method jdk.  
proxy241.\$Proxy3496#hasContentLevelPermission. Cannot resolve which method to  
invoke for [null, class java.lang.String, class com.atlassian.confluence.pages.Page] due  
to overlapping prototypes between: [interface com.atlassian.confluence.user.  
ConfluenceUser, class java.lang.String, class com.atlassian.confluence.core.  
ContentEntityObject] [interface com.atlassian.user.User, class java.lang.String, class  
com.atlassian.confluence.core.ContentEntityObject]