TE0835 Test Board

Revision v.33

Exported on 2023-09-19

Online version of this document:

https://wiki.trenz-electronic.de/display/PD/TE0835+Test+Board

1 Table of Contents

2 Table of Figures

3 Table of Tables

4 Overview

Refer to http://trenz.org/te0835-info[1] for the current online version of this manual and other available documentation.

4.1 Key Features

- Vitis/Vivado 2020.2
- PetaLinux
- RF Analyzer 2020.2
- PCIe (endpoint)
- SD
- ETH
- USB
- I2C
- RTC
- FMeter
- Modified FSBL for SI5395 programming
- Special FSBL for QSPI programming

4.2 Revision History

Date	Vivado	Project Built	Authors	Description
2022-02-24	2020.2	TE0835-test_board_noprebuilt-vivado_2020.2-build_9_20220223123143.zip TE0835-test_board-vivado_2020.2-build_9_20220223123124.zip	Mohsen Chamanbaz	• XCZU47DR variant was added. • HDL files for XCZU25DR has been updated. • RF analyzer software was updated to 2020.2 version.
2022-02-11	2020.2	TE0835-test_board_noprebuilt-vivado_2020.2-build_5_20220211054445.zip TE0835-test_board-vivado_2020.2-build_5_20220211054430.zip	Mohsen Chamanbaz/ John Hartfiel	• Bugfix, now with 20.2 FSBL

1 https://wiki.trenz-electronic.de/display/PD/TE0835+Resources

Date	Vivado	Project Built	Authors	Description
2021-07-14	2020.2	TE0835-test_board_noprebuilt-vivado_2020.2-build_5_20210714111839.zip TE0835-test_board-vivado_2020.2-build_5_20210714111826.zip	Mohsen Chamanbaz	• 2020.2 release
2020-10-27	2019.2	TE0835-test_board_noprebuilt-vivado_2019.2-build_15_20201027100145.zip TE0835-test_board-vivado_2019.2-build_15_20201027100128.zip	Mohsen Chamanbaz	• initial release

Table 1: Design Revision History

4.3 Release Notes and Know Issues

Issues	Description	Workaround	To be fixed version
Updating the signal property failed, while the generation of the signal is already in progress	It is difficult to update the property of the generated signal while the generation of the signal by DACs is already running. The Generation button must be clicked several times to make the change in the output.	• It is recommended to reprogram and initialize the boad again if such situation happens.	Solved with 2022-02-24 update

Table 2: Known Issues

4.4 Requirements

4.4.1 Software

Software	Version	Note
Vitis	2020.2	needed, Vivado is included into Vitis installation
PetaLinux	2020.2	needed
RF Analyzer	2020.2	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[2].

Complete List is available on <design name>/board_files/*_board_files.csv

Design supports following modules:

Module Model	Board Part Short Name	PCB Revision Support	DDR	QSPI Flash	EMMC	Others	Notes
TE0835-02-MXE21-A	25dr_1e_4gb	REV2	4GB	128MB	NA	NA	NA
TE0835-02-TXE21-A*	47dr_1e_4gb	REV2	4GB	128MB	NA	NA	NA

Table 4: Hardware Modules

*used as reference

Design supports following carriers:

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

Carrier Model	Notes
TEB0835-02*	

Table 5: Hardware Carrier
*used as reference

Additional HW Requirements:

Additional Hardware	Notes
Micro USB Cable for JTAG/UART	
Cooler	It is strongly recommended that the RFSoC should not be used without heat sink.
SMA male connector cable	Some ADC inputs/DAC outouts have the SMA connector
UFL female connector cable	Some ADC inputs/DAC outouts have the UFL connector
Ethernet cable	
SD card	16GB
Signal generator (optional)	To feed a desired signal to the input of ADC
Oscilloscope (optional)	To monitor the output signal of DACs.
PC	With ATX Power supply and PCIe X8 slot

Table 6: Additional Hardware
*used as reference

4.5 Content

For general structure and of the reference design, see Project Delivery - AMD devices[3]

4.5.1 Design Sources

3 https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices

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

Table 7: Design sources

4.5.2 Additional Sources

Type	Location	Notes
SI5395 (PLL of the RFSoc Module)	<design name>/misc/Si5395	SI5395 Project with current PLL Configuration
SI5395 (PLL of the carrier board)	<design name>/misc/Si5395	SI5395 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 (Zynqmp RFSoC-FPGAs)

File	File-Extension	Description
BIT-File	*.bit	FPGA (PL Part) Configuration File
DebugProbes-File	*.ltx	Definition File for Vivado/Vivado Labtools Debugging Interface
Diverse Reports	---	Report files in different formats
Hardware-Platform-Specification-Files	*.xsa	Exported Vivado Hardware Specification 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 Zynqmp RFSoC or MicroBlaze Processor Systems
Clock Builder Pro project file	*.slabtimeproj	Defines the necessary clock frequencies for the PLLs on the RFSoC module and carrier board

Table 9: Prebuilt files (only on ZIP with prebult 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:

- TE0835 "Test Board" Reference Design[4]

4.5.5 Software Setup

Download RF Analyzer GUI from the following link and install it.

- RF Analyzer[5]

4 https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/6.5x9/TE0835/Reference_Design/2020.2/test_board
5 https://www.xilinx.com/products/silicon-devices/soc/rfsoc.html#resources

5 Design Flow

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

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

See also:

- AMD Development Tools[6]
- Vivado Projects - TE Reference Design[7]
- Project Delivery - AMD devices[8]

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 Xilinx Vivado/SDK GUI. For currently Scripts limitations on Win and Linux OS see: Project Delivery - AMD devices[9]

> ⚠ **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"
3. Create project and follow instructions of the product selection guide, settings file will be configured automatically during this process.

6 https://wiki.trenz-electronic.de/display/PD/AMD+Development+Tools#AMDDevelopmentTools-XilinxSoftware-BasicUserGuides
7 https://wiki.trenz-electronic.de/display/PD/Vivado+Projects+-+TE+Reference+Design
8 https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices
9 https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices#ProjectDeliveryAMDdevices-Currentlylimitationsoffunctionality

- optional for manual changes: Select correct device and Xilinx install path on "design_basic_settings.cmd" and create Vivado project with "vivado_create_project_guimode.cmd"

  Note: Select correct one, see also Vivado Board Part Flow[10]

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[11]
   - 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[12]
7. Copy PetaLinux build image files to prebuilt folder
   - copy **u-boot.elf**, **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[13]

10 https://wiki.trenz-electronic.de/display/PD/Vivado+Board+Part+Flow
11 https://wiki.trenz-electronic.de/display/PD/PetaLinux+KICKstart
12 https://wiki.trenz-electronic.de/display/PD/Distro+Boot+with+Boot.scr
13 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: AMD Development Tools[14]

6.1.1 Get prebuilt boot binaries

1. _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_te0820 (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 15)
   - 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.

14 https://wiki.trenz-electronic.de/display/PD/AMD+Development+Tools#AMDDevelopmentTools-XilinxSoftwareProgrammingandDebugging

6.1.3 SD-Boot mode

1. Copy **image.ub** and **Boot.bin** on **SD-Card**
   - use files from (<project foler>/_binaries_<Articel Name>)/boot_linux from generated binary folder,see: Get prebuilt boot binaries(see page 15)
   - or use prebuilt file location, see <design_name>/prebuilt/readme_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.

6.1.5 Hardware Setup

The Hardware contains of a TE0835 module and TEB0835 carrier board and has 8 ADC inputs and 8 DAC outputs.

1. Plug the TE0835 module on the TEB0835 carrier board
2. Install the cooler on the RFSoC chip
   a. Attention: It is strongly recommended that the RFSoC should not be used without heat sink.
3. Connect the micro USB cable to the J29 connector
4. Plug the board on the PCIe port of the PC
5. Plug the prepared SD card on the SD card socket (J28)
6. Connect a cable with SMA or UFL connector to one of the DAC connector(for example DAC0 J9) and feed it back to the related ADC input (for example ADC0 J1)
7. (optional) A signal generator can be used to feed desired sinal to ADC input.
8. (optional) An oscilloscope can be used to monitor the output signal of DAC.

6.1.6 Usage

1. Prepare HW like described on section Hardware Setup(see page 16)
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[15]

4. Power On PCB
   boot process

   1. Zynqmp RFSoC Boot ROM loads FSBL from SD into OCM

15 https://wiki.trenz-electronic.de/display/PD/Distro+Boot+with+Boot.scr

2. FSBL loads U-boot from SD into DDR,
3. U-boot loads Linux (**image.ub**) from SD/QSPI/... into DDR

6.1.7 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:

```
petalinux login: root
Password: root
```

   > Note: Wait until Linux boot finished

3. You can use Linux shell now.

```
i2cdetect -y -r 0   (check I2C Bus; BUS 0 up to 5 possible)
dmesg | grep rtc    (RTC check)
udhcpc              (ETH0 check)
lsusb               (USB check)
```

4. Option Features
   - Webserver to get access to Zynqmp RFSoC
     - 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")

6.1.8 Vivado HW Manager

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

- Monitoring:
  - The output frequency of MMCM blocks can be monitored.
    - Set radix from VIO signals to unsigned integer.
    - The tempreature of ARM processor and FPGA can be measured too.

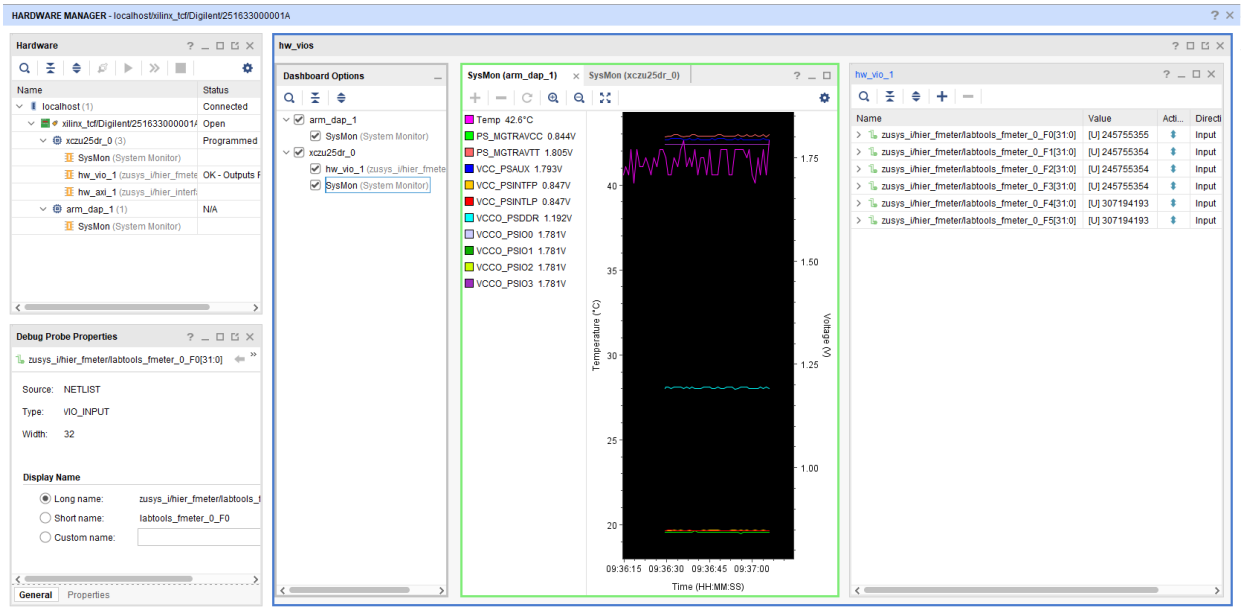


Figure 1: Vivado Hardware Manager

6.1.9 RF Analyzer

1. Open the RF Analyzer GUI
2. Click on Connect button
3. Adjust the desired JTAG frequency (for example 30MHZ)
4. Give the generated bitstream file path
5. Click on Download Bitstream button to load the Bitstream file on the FPGA
6. When downloading is finished, click on Select Target button
7. After initilalisation, all ADCs/DACs tiles are visible
8. Click on desired DAC tile and choose a DAC (for example DAC0)
9. Adjust desired DAC properties (for example output frequency)
10. Click on Generate button to generate the signal in output of DAC
11. Click on the related ADC tile and choose the related ADC (for example ADC0)
12. Click on Acquire button to aqcuire the input signal
13. The spectum of the DAC output signal can be seen now. The signal can be visible in time domain too.
    a. Tip: In menu Window click on Multiview to see all of DACs and ADCs simultaneously.

ADC/DAC connection overview for TE0835-02-MXE21-A

RF Analyzer GUI	**Board TE0835 (RFSoC U1)**			**TEB0835**		
Tile / Converter	**SoC Pin Name**	**SoC Pin Number**	**B2B**	**Signal Name**	**Connector Designator**	**Connector Type**
ADC Tile 0-ADC 01	ADC0_P/ ADC0_N	AK2/AK1	31/29	ADC0_P/ ADC0_N	J1	SMA

RF Analyzer GUI	Board TE0835 (RFSoC U1)			TEB0835		
Tile / Converter	**SoC Pin Name**	**SoC Pin Number**	**B2B**	**Signal Name**	**Connector Designator**	**Connector Type**
ADC Tile 0-ADC 23	ADC1_P/ ADC1_N	AH2/AH1	43/41	ADC1_P/ ADC1_N	J2	UFL
ADC Tile 1-ADC 01	ADC2_P/ ADC2_N	AF2/AF1	49/47	ADC2_P/ ADC2_N	J3	SMA
ADC Tile 1-ADC 23	ADC3_P/ ADC3_N	AD2/AD1	59/61	ADC3_P/ ADC3_N	J4	UFL
ADC Tile 2-ADC 01	ADC4_P/ ADC4_N	AB2/AB1	67/65	ADC4_P/ ADC4_N	J5	SMA
ADC Tile 2-ADC 23	ADC5_P/ ADC5_N	Y2/Y1	79/77	ADC5_P/ ADC5_N	J6	UFL
ADC Tile 3-ADC 01	ADC6_P/ ADC6_N	V2/V1	85/83	ADC6_P/ ADC6_N	J7	SMA
ADC Tile 3-ADC 23	ADC7_P/ ADC7_N	T2/T1	97/95	ADC7_P/ ADC7_N	J8	UFL
DAC Tile 0-DAC 0	DAC0_P/ DAC0_N	N2/N1	103/101	DAC0_P/ DAC0_N	J9	SMA
DAC Tile 0-DAC 1	DAC1_P/ DAC1_N	L2/L1	109/107	DAC1_P/ DAC1_N	J10	UFL
DAC Tile 0-DAC 2	DAC2_P/ DAC2_N	J2/J1	121/119	DAC2_P/ DAC2_N	J11	SMA
DAC Tile 0-DAC 3	DAC3_P/ DAC3_N	G2/G1	127/125	DAC3_P/ DAC3_N	J12	UFL

RF Analyzer GUI	Board TE0835 (RFSoC U1)			TEB0835		
Tile / Converter	**SoC Pin Name**	**SoC Pin Number**	**B2B**	**Signal Name**	**Connector Designator**	**Connector Type**
DAC Tile 1-DAC 0	DAC4_P/ DAC4_N	E2/E1	133/131	DAC4_P/ DAC4_N	J13	UFL
DAC Tile 1-DAC 1	DAC5_P/ DAC5_N	C2/C1	139/137	DAC5_P/ DAC5_N	J14	UFL
DAC Tile 1-DAC 2	DAC6_P/ DAC6_N	B4/A4	151/149	DAC6_P/ DAC6_N	J15	UFL
DAC Tile 1-DAC 3	DAC7_P/ DAC7_N	B6/A6	157/155	DAC7_P/ DAC7_N	J16	UFL

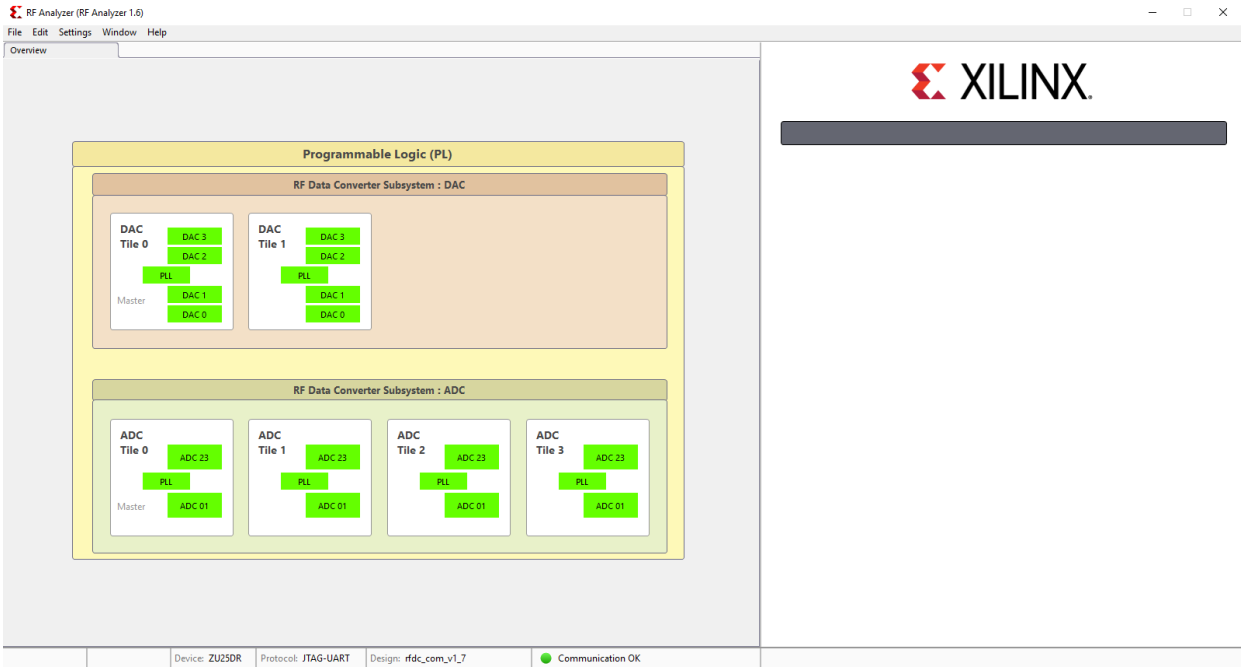
ADC/DAC connection overview for TE0835-02-TXE21-A

RF Analyzer GUI	Board TE0835 (RFSoC U1)			TEB0835		
Tile / Converter	**SoC Pin Name**	**SoC Pin Number**	**B2B**	**Signal Name**	**Connector Designator**	**Connector Type**
ADC Tile 0-ADC 01	ADC0_P/ ADC0_N	AK2/AK1	31/29	ADC0_P/ ADC0_N	J1	SMA
ADC Tile 0-ADC 23	ADC1_P/ ADC1_N	AH2/AH1	43/41	ADC1_P/ ADC1_N	J2	UFL
ADC Tile 1-ADC 01	ADC2_P/ ADC2_N	AF2/AF1	49/47	ADC2_P/ ADC2_N	J3	SMA
ADC Tile 1-ADC 23	ADC3_P/ ADC3_N	AD2/AD1	59/61	ADC3_P/ ADC3_N	J4	UFL
ADC Tile 2-ADC 01	ADC4_P/ ADC4_N	AB2/AB1	67/65	ADC4_P/ ADC4_N	J5	SMA

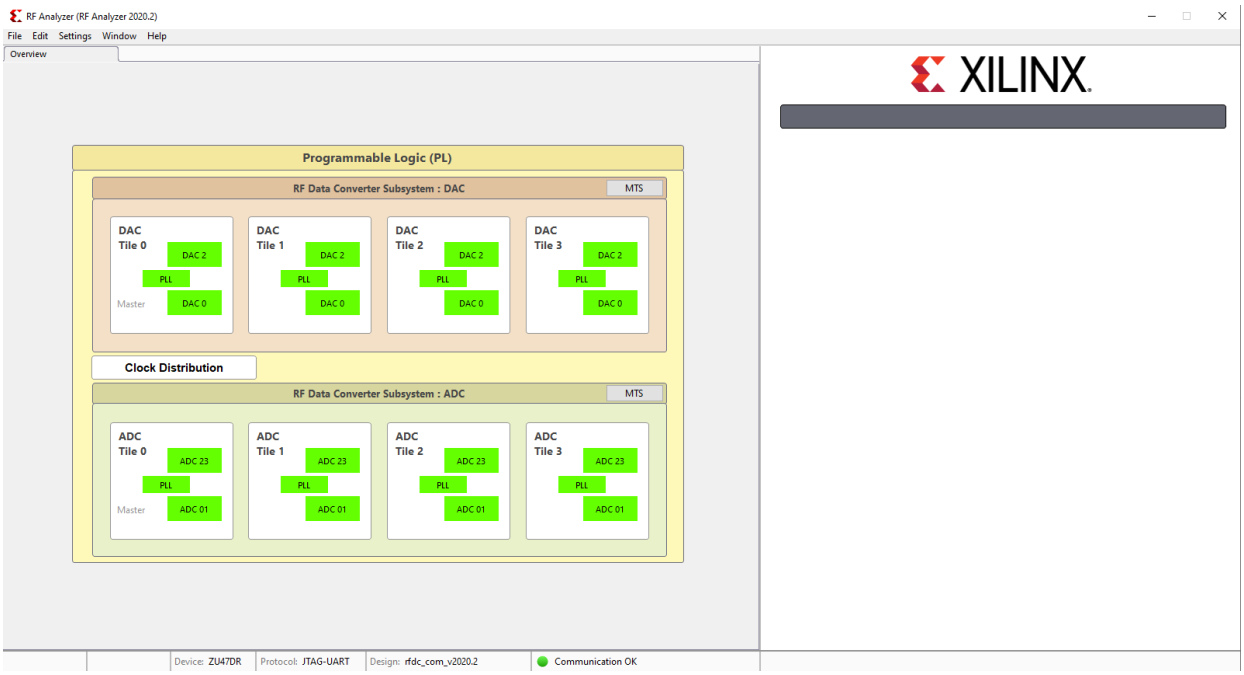
RF Analyzer GUI	Board TE0835 (RFSoC U1)			TEB0835		
Tile / Converter	**SoC Pin Name**	**SoC Pin Number**	**B2B**	**Signal Name**	**Connector Designator**	**Connector Type**
ADC Tile 2-ADC 23	ADC5_P/ ADC5_N	Y2/Y1	79/77	ADC5_P/ ADC5_N	J6	UFL
ADC Tile 3-ADC 01	ADC6_P/ ADC6_N	V2/V1	85/83	ADC6_P/ ADC6_N	J7	SMA
ADC Tile 3-ADC 23	ADC7_P/ ADC7_N	T2/T1	97/95	ADC7_P/ ADC7_N	J8	UFL
DAC Tile 0-DAC 0	DAC0_P/ DAC0_N	N2/N1	103/101	DAC0_P/ DAC0_N	J9	SMA
DAC Tile 0-DAC 2	DAC1_P/ DAC1_N	L2/L1	109/107	DAC1_P/ DAC1_N	J10	UFL
DAC Tile 1-DAC 0	DAC2_P/ DAC2_N	J2/J1	121/119	DAC2_P/ DAC2_N	J11	SMA
DAC Tile 1-DAC 2	DAC3_P/ DAC3_N	G2/G1	127/125	DAC3_P/ DAC3_N	J12	UFL
DAC Tile 2-DAC 0	DAC4_P/ DAC4_N	E2/E1	133/131	DAC4_P/ DAC4_N	J13	UFL
DAC Tile 2-DAC 2	DAC5_P/ DAC5_N	C2/C1	139/137	DAC5_P/ DAC5_N	J14	UFL
DAC Tile 3-DAC 0	DAC6_P/ DAC6_N	B4/A4	151/149	DAC6_P/ DAC6_N	J15	UFL
DAC Tile 1-DAC 2	DAC7_P/ DAC7_N	B6/A6	157/155	DAC7_P/ DAC7_N	J16	UFL

As an example the GUi should be seen after initialization as below:

Overview for TE0835-02-MXE21-A

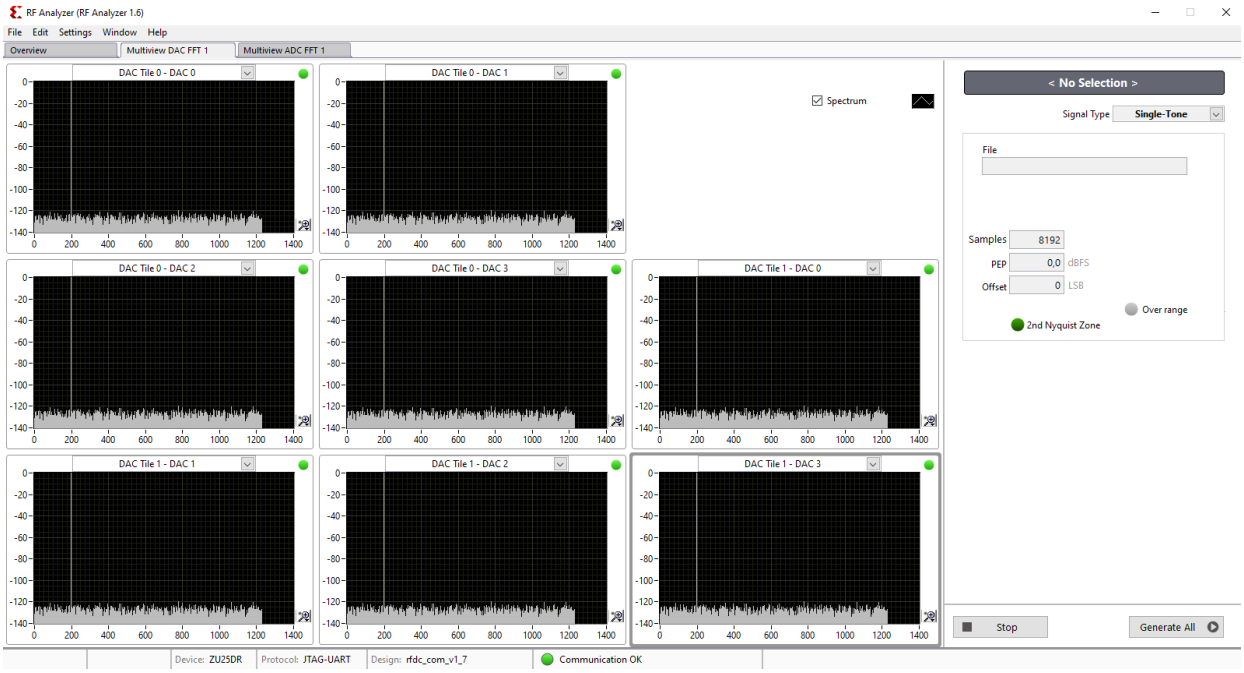


Overview for TE0835-02-TXE21-A



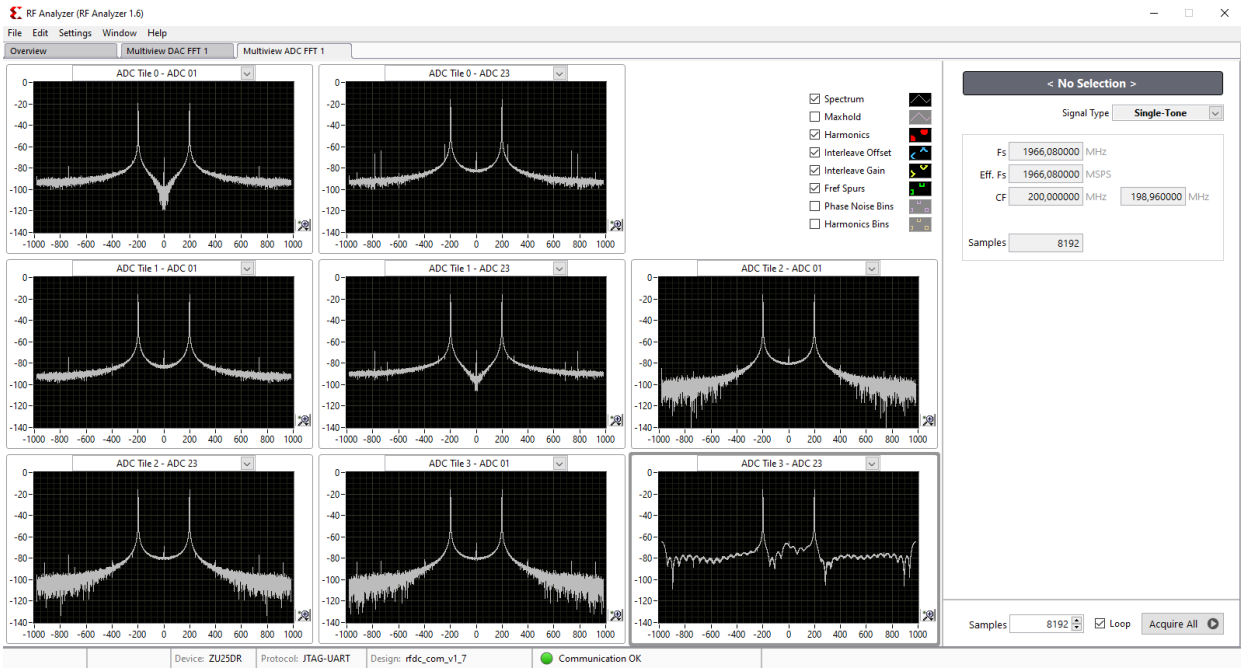
For example, when all DACs are in operation, the GUI can be seen as below:

DACs



For example, when all ADCs are in operation, the GUI can be seen as below:

ADCs



7 System Design - Vivado

7.1 Block Design

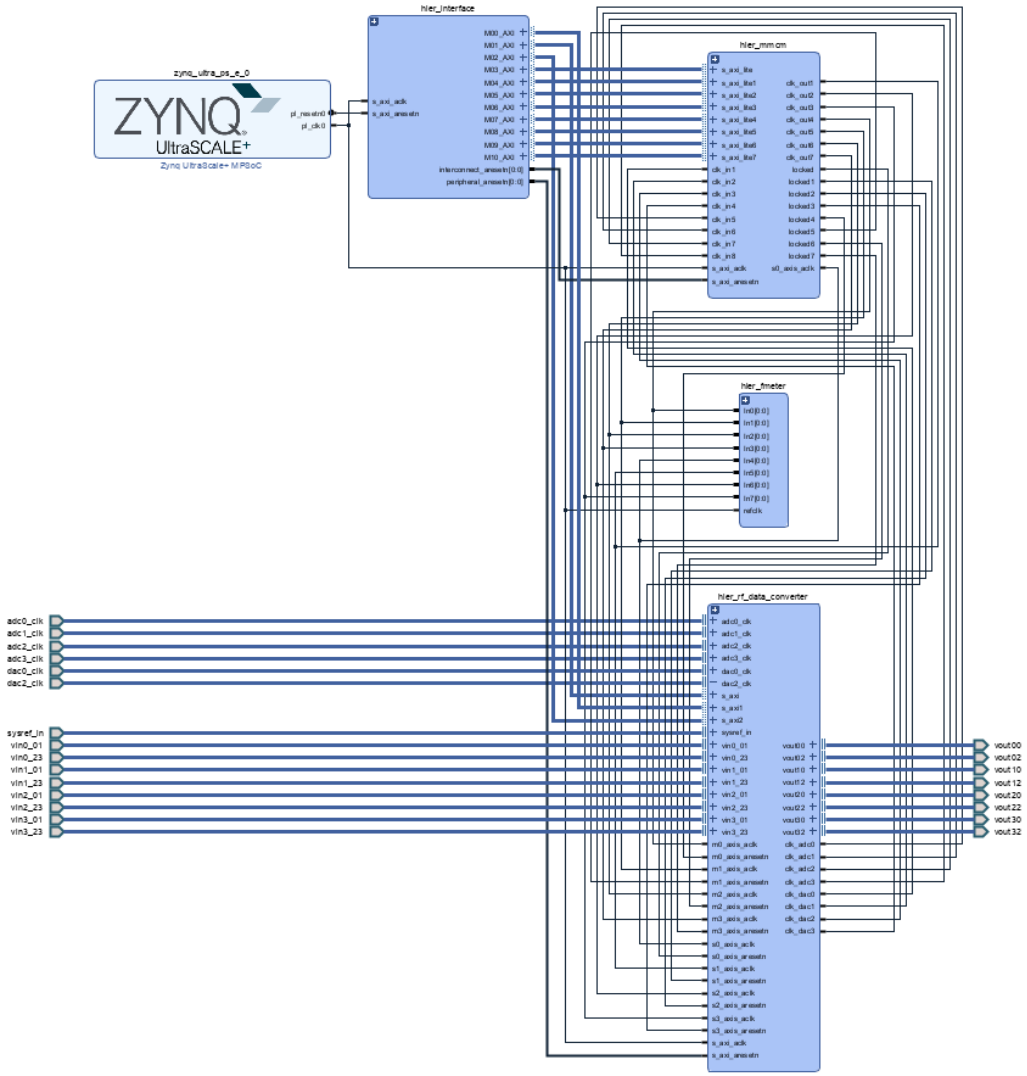


Figure 2: Block Design

7.1.1 PS Interfaces

Activated interfaces:

Type	Note
DDR	
QSPI	MIO
SD1	MIO
I2C0	MIO
I2C1	MIO
UART0	MIO
GPIO0	MIO
GPIO1	MIO
GPIO2	MIO
SWDT0..1	
TTC0..3	
GEM3	MIO
USB0	MIO
PCIe	MIO

Table 10: PS Interfaces

7.2 Constraints

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

Constraint files for TE0835-02-MXE21-A

_i_false_path.xdc

```
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/CLK}]
-to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/F_reg[*]/D}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_A_B_DATA_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_ALU_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_OUTPUT_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_C_DATA_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
FMETER_gen[4].COUNTER_F_inst/bl.DSP48E_2/DSP_ALU_INST/CLK}] -to [get_pins -hier
-filter {name=~*labtools_fmeter_0/U0/FMETER_gen[4].COUNTER_F_inst/bl.DSP48E_2/
DSP_OUTPUT_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
FMETER_gen[5].COUNTER_F_inst/bl.DSP48E_2/DSP_ALU_INST/CLK}] -to [get_pins -hier
-filter {name=~*labtools_fmeter_0/U0/FMETER_gen[5].COUNTER_F_inst/bl.DSP48E_2/
DSP_OUTPUT_INST/*}]
```

_i_usp_rf_data_converter_0_example_design.xdc

```
#-----------------------------------------------------------------------
# Title      : Example top level constraints for UltraScale+ RF Data Converter
#-----------------------------------------------------------------------
# File       : usp_rf_data_converter_0_example_design.xdc
#-----------------------------------------------------------------------
# Description: Xilinx Constraint file for the example design for
#              UltraScale+ RF Data Converter core
#-----------------------------------------------------------------------
#
# DISCLAIMER
# This disclaimer is not a license and does not grant any
# rights to the materials distributed herewith. Except as
# otherwise provided in a valid license issued to you by
# Xilinx, and to the maximum extent permitted by applicable
```

```
# law: (1) THESE MATERIALS ARE MADE AVAILABLE "AS IS" AND
# WITH ALL FAULTS, AND XILINX HEREBY DISCLAIMS ALL WARRANTIES
# AND CONDITIONS, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING
# BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, NON-
# INFRINGEMENT, OR FITNESS FOR ANY PARTICULAR PURPOSE; and
# (2) Xilinx shall not be liable (whether in contract or tort,
# including negligence, or under any other theory of
# liability) for any loss or damage of any kind or nature
# related to, arising under or in connection with these
# materials, including for any direct, or any indirect,
# special, incidental, or consequential loss or damage
# (including loss of data, profits, goodwill, or any type of
# loss or damage suffered as a result of any action brought
# by a third party) even if such damage or loss was
# reasonably foreseeable or Xilinx had been advised of the
# possibility of the same.
#
# CRITICAL APPLICATIONS
# Xilinx products are not designed or intended to be fail-
# safe, or for use in any application requiring fail-safe
# performance, such as life-support or safety devices or
# systems, Class III medical devices, nuclear facilities,
# applications related to the deployment of airbags, or any
# other applications that could lead to death, personal
# injury, or severe property or environmental damage
# (individually and collectively, "Critical
# Applications"). Customer assumes the sole risk and
# liability of any use of Xilinx products in Critical
# Applications, subject only to applicable laws and
# regulations governing limitations on product liability.
#
# THIS COPYRIGHT NOTICE AND DISCLAIMER MUST BE RETAINED AS
# PART OF THIS FILE AT ALL TIMES.
#
#-----------------------------------------------------------------------

#-----------------------------------------
# TIMING CONSTRAINTS
#-----------------------------------------
# Set AXI-Lite Clock to 100MHz
#create_clock -period 10.000 -name usp_rf_data_converter_0_axi_aclk [get_pins
axi_aclk_i/CFGMCLK]

# ADC Reference Clock for Tile 0 running at 245.760 MHz
create_clock -period 4.069 -name usp_rf_data_converter_0_adc0_clk [get_ports
adc0_clk_p]

# ADC Reference Clock for Tile 1 running at 245.760 MHz
create_clock -period 4.069 -name usp_rf_data_converter_0_adc1_clk [get_ports
adc1_clk_p]

# ADC Reference Clock for Tile 2 running at 245.760 MHz
create_clock -period 4.069 -name usp_rf_data_converter_0_adc2_clk [get_ports
adc2_clk_p]

# ADC Reference Clock for Tile 3 running at 245.760 MHz
```

```
create_clock -period 4.069 -name usp_rf_data_converter_0_adc3_clk [get_ports
adc3_clk_p]

# DAC Reference Clock for Tile 0 running at 307.200 MHz
create_clock -period 3.255 -name usp_rf_data_converter_0_dac0_clk [get_ports
dac0_clk_p]

# DAC Reference Clock for Tile 1 running at 307.200 MHz
create_clock -period 3.255 -name usp_rf_data_converter_0_dac1_clk [get_ports
dac1_clk_p]

set_multicycle_path -to [get_pins -filter {REF_PIN_NAME== D} -of [get_cells -hier
-filter {name =~ *usp_rf_data_converter_0_ex_i/ex_design/usp_rf_data_converter_0/
inst/IP2Bus_Data_reg*}]] -setup 2
set_multicycle_path -to [get_pins -filter {REF_PIN_NAME== D} -of [get_cells -hier
-filter {name =~ *usp_rf_data_converter_0_ex_i/ex_design/usp_rf_data_converter_0/
inst/IP2Bus_Data_reg*}]] -hold 1
##############################################################################
# False paths
# For debug in synth use
# report_timing_summary -setup -slack_lesser_than 0
##############################################################################
# Data generator/capture constraints
set rfa_from_list   [get_cells -hier -regexp .*rf(?:da|ad)c_exdes_ctrl_i\/(?:da|
ad)c_exdes_cfg_i\/.+num_samples_reg.*]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_00*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_00*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_01*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_01*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_02*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_02*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_03*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_03*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_10*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_10*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
```

```
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_11*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_11*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_12*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_12*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_13*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_13*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
set rfa_from_list   [get_cells -hier -regexp .*rf(?:da|ad)c_exdes_ctrl_i\/(?:da|
ad)c_exdes_cfg_i\/.+num_samples_reg.*]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_00*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_00*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_00*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_00*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_01*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_01*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_01*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_01*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_02*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_02*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_02*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_02*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_03*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
```

```
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_03*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_03*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_03*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_10*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_10*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_10*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_10*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_11*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_11*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_11*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_11*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_12*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_12*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_12*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_12*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_13*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_13*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_13*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_13*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_20*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
```

```
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_20*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_20*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_20*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_21*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_21*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_21*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_21*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_22*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_22*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_22*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_22*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_23*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_23*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_23*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_23*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_30*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_30*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_30*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_30*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_31*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
```

```
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_31*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_31*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_31*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_32*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_32*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_32*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_32*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_33*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_33*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_33*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_33*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
```

Constraint files for TE0835-02-TXE21-A

_i_false_path.xdc

```
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/CLK}]
-to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/F_reg[*]/D}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_A_B_DATA_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_ALU_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_OUTPUT_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
toggle_reg/C}] -to [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/*/bl.DSP48
E_2/DSP_C_DATA_INST/*}]
```

```
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
FMETER_gen[4].COUNTER_F_inst/bl.DSP48E_2/DSP_ALU_INST/CLK}] -to [get_pins -hier
-filter {name=~*labtools_fmeter_0/U0/FMETER_gen[4].COUNTER_F_inst/bl.DSP48E_2/
DSP_OUTPUT_INST/*}]
set_false_path -from [get_pins -hier -filter {name=~*labtools_fmeter_0/U0/
FMETER_gen[5].COUNTER_F_inst/bl.DSP48E_2/DSP_ALU_INST/CLK}] -to [get_pins -hier
-filter {name=~*labtools_fmeter_0/U0/FMETER_gen[5].COUNTER_F_inst/bl.DSP48E_2/
DSP_OUTPUT_INST/*}]
```

_i_usp_rf_data_converter_0_example_design.xdc

```
#-----------------------------------------------------------------------
# Title      : Example top level constraints for UltraScale+ RF Data Converter
#-----------------------------------------------------------------------
# File       : usp_rf_data_converter_0_example_design.xdc
#-----------------------------------------------------------------------
# Description: Xilinx Constraint file for the example design for
#              UltraScale+ RF Data Converter core
#-----------------------------------------------------------------------
#
# DISCLAIMER
# This disclaimer is not a license and does not grant any
# rights to the materials distributed herewith. Except as
# otherwise provided in a valid license issued to you by
# Xilinx, and to the maximum extent permitted by applicable
# law: (1) THESE MATERIALS ARE MADE AVAILABLE "AS IS" AND
# WITH ALL FAULTS, AND XILINX HEREBY DISCLAIMS ALL WARRANTIES
# AND CONDITIONS, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING
# BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, NON-
# INFRINGEMENT, OR FITNESS FOR ANY PARTICULAR PURPOSE; and
# (2) Xilinx shall not be liable (whether in contract or tort,
# including negligence, or under any other theory of
# liability) for any loss or damage of any kind or nature
# related to, arising under or in connection with these
# materials, including for any direct, or any indirect,
# special, incidental, or consequential loss or damage
# (including loss of data, profits, goodwill, or any type of
# loss or damage suffered as a result of any action brought
# by a third party) even if such damage or loss was
# reasonably foreseeable or Xilinx had been advised of the
# possibility of the same.
#
# CRITICAL APPLICATIONS
# Xilinx products are not designed or intended to be fail-
# safe, or for use in any application requiring fail-safe
# performance, such as life-support or safety devices or
# systems, Class III medical devices, nuclear facilities,
# applications related to the deployment of airbags, or any
# other applications that could lead to death, personal
# injury, or severe property or environmental damage
# (individually and collectively, "Critical
# Applications"). Customer assumes the sole risk and
# liability of any use of Xilinx products in Critical
```

```
# Applications, subject only to applicable laws and
# regulations governing limitations on product liability.
#
# THIS COPYRIGHT NOTICE AND DISCLAIMER MUST BE RETAINED AS
# PART OF THIS FILE AT ALL TIMES.
#
#-----------------------------------------------------------------------

#-----------------------------------------
# TIMING CONSTRAINTS
#-----------------------------------------
# Set AXI-Lite Clock to 100MHz
create_clock -period 10.000 -name usp_rf_data_converter_0_axi_aclk [get_pins
axi_aclk_i/CFGMCLK]

# ADC Reference Clock for Tile 0 running at 245.760 MHz
create_clock -period 4.069 -name usp_rf_data_converter_0_adc0_clk [get_ports
adc0_clk_p]

# ADC Reference Clock for Tile 1 running at 245.760 MHz
create_clock -period 4.069 -name usp_rf_data_converter_0_adc1_clk [get_ports
adc1_clk_p]

# ADC Reference Clock for Tile 2 running at 245.760 MHz
create_clock -period 4.069 -name usp_rf_data_converter_0_adc2_clk [get_ports
adc2_clk_p]

# ADC Reference Clock for Tile 3 running at 245.760 MHz
create_clock -period 4.069 -name usp_rf_data_converter_0_adc3_clk [get_ports
adc3_clk_p]

# DAC Reference Clock for Tile 0 running at 307.200 MHz
create_clock -period 3.255 -name usp_rf_data_converter_0_dac0_clk [get_ports
dac0_clk_p]

set_multicycle_path -to [get_pins -filter {REF_PIN_NAME== D} -of [get_cells -hier
-filter {name =~ *usp_rf_data_converter_0_ex_i/ex_design/usp_rf_data_converter_0/
inst/IP2Bus_Data_reg*}]] -setup 2
set_multicycle_path -to [get_pins -filter {REF_PIN_NAME== D} -of [get_cells -hier
-filter {name =~ *usp_rf_data_converter_0_ex_i/ex_design/usp_rf_data_converter_0/
inst/IP2Bus_Data_reg*}]] -hold 1
##############################################################################
# False paths
# For debug in synth use
# report_timing_summary -setup -slack_lesser_than 0
##############################################################################
# Data generator/capture constraints
set rfa_from_list   [get_cells -hier -regexp .*rf(?:da|ad)c_exdes_ctrl_i\/(?:da|
ad)c_exdes_cfg_i\/.+num_samples_reg.*]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_00*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
```

```
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_00*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_00*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_00*addrbend_reg}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_02*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_02*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_02*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_02*addrbend_reg}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_10*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_10*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_10*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_10*addrbend_reg}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_12*addrb_reg[*]}]
```

```
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_12*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_12*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_12*addrbend_reg}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_20*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_20*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_20*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_20*addrbend_reg}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_22*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_22*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_22*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
```

```
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_22*addrbend_reg}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_30*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_30*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_30*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_30*addrbend_reg}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_32*addrb_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_32*addrb_reg[*]}]]]
set rfa_dac_signal_list [get_cells -hier -filter
{name=~*dg_slice_32*addrbend_reg}]
set_false_path -from $rfa_from_list -to $rfa_dac_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*dg_slice_32*addrbend_reg}]]]
set rfa_from_list   [get_cells -hier -regexp .*rf(?:da|ad)c_exdes_ctrl_i\/(?:da|
ad)c_exdes_cfg_i\/.+num_samples_reg.*]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_00*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_00*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_00*working_i_reg}]
```

```
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_00*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_00*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_00*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_00*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_00*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_01*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_01*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_01*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_01*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_01*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
```

```
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_01*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_01*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_01*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_02*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_02*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_02*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_02*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_02*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_02*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_02*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_02*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_03*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
```

```
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_03*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_03*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_03*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_03*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_03*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_03*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_03*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_10*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_10*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_10*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_10*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_10*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
```

```
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_10*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_10*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_10*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_11*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_11*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_11*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_11*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_11*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_11*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_11*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_11*wea_r_reg}]]]
```

```
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_12*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_12*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_12*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_12*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_12*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_12*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_12*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_12*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_13*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_13*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_13*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
```

```
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_13*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_13*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_13*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_13*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_13*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_20*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_20*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_20*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_20*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_20*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_20*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_20*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
```

```
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_20*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_21*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_21*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_21*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_21*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_21*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_21*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_21*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_21*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_22*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_22*addra_reg[*]}]]]
```

```
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_22*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_22*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_22*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_22*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_22*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_22*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_23*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_23*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_23*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_23*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_23*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
```

```
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_23*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_23*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_23*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_30*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_30*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_30*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_30*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_30*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_30*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_30*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_30*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_31*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
```

```
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_31*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_31*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_31*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_31*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_31*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_31*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_31*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_32*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_32*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_32*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_32*working_i_reg}]]]
```

```
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_32*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_32*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_32*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_32*wea_r_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_33*addra_reg[*]}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_33*addra_reg[*]}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_33*working_i_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_33*working_i_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter
{name=~*ds_slice_33*cap_complete_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_33*cap_complete_reg}]]]
set rfa_adc_signal_list [get_cells -hier -filter {name=~*ds_slice_33*wea_r_reg}]
set_false_path -from $rfa_from_list -to $rfa_adc_signal_list
create_waiver -user USP_RF_DATA_CONVERTER -type CDC -id CDC-1 \
  -description "Number of samples register is a constant during normal operation"
 \
  -from [list [get_pins -filter {REF_PIN_NAME=~*} -of [get_cells -hier -filter
{name=~*c_exdes_cfg_i*num_samples_reg*}]]] \
```

```
  -to   [list [get_pins -filter {REF_PIN_NAME==D} -of [get_cells -hier -filter
{name=~*ds_slice_33*wea_r_reg}]]]
```

8 Software Design - Vitis

For SDK project creation, follow instructions from:

Vitis[16]

8.1 Application

Template location: ./sw_lib/sw_apps/

8.1.1 zynqmp_fsbl

TE modified 2020.2 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_*
    - Si5395 on the TE0835 RFSoC module configuration
    - Si5395 on the TEB0835 carrier board configuration

8.1.2 zynqmp_fsbl_flash

TE modified 2020.2 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_te0835

Hello TE0835 is a Xilinx Hello World example as endless loop instead of one console output.

8.1.5 u-boot

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

16 https://wiki.trenz-electronic.de/display/PD/Vitis

9 Software Design - PetaLinux

For PetaLinux installation and project creation, follow instructions from:

- PetaLinux KICKstart[17]

9.1 Config

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

Changes:

- CONFIG_SUBSYSTEM_ETHERNET_PSU_ETHERNET_3_MAC=""

9.2 U-Boot

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

Changes:

- CONFIG_ENV_IS_NOWHERE=y
- # CONFIG_ENV_IS_IN_SPI_FLASH is not set
- CONFIG_I2C_EEPROM=y
- CONFIG_ZYNQ_GEM_I2C_MAC_OFFSET=0xFA
- CONFIG_SYS_I2C_EEPROM_ADDR=0
- CONFIG_SYS_I2C_EEPROM_BUS=0
- CONFIG_SYS_EEPROM_SIZE=256
- CONFIG_SYS_EEPROM_PAGE_WRITE_BITS=0
- CONFIG_SYS_EEPROM_PAGE_WRITE_DELAY_MS=0
- CONFIG_SYS_I2C_EEPROM_ADDR_LEN=1
- CONFIG_SYS_I2C_EEPROM_ADDR_OVERFLOW=0

Change platform-top.h:

9.3 Device Tree

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


/* SDIO */

&sdhci1 {
   disable-wp;
   no-1-8-v;
```

17 https://wiki.trenz-electronic.de/display/PD/PetaLinux+KICKstart

```
};

/* ETH PHY */
&gem3 {

    status = "okay";
  ethernet_phy0: ethernet-phy@0 {
        compatible = "marvell,88e1510";
        device_type = "ethernet-phy";
            reg = <1>;
    };
};
/* USB 2.0 */

/* USB  */
&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";
};




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

// This I2C Port can be found in the RFSoC Module TE0835 to control PLL chip
SI5395A-A-GM on the
// RFSoC Module.

&i2c1 {
  eeprom: eeprom@50 {
```

```
     compatible = "atmel,24c08";
     reg = <0x50>;
  };
};

// This I2C Port connects RFSoC FPGA on the RFSoC Module and I2C multiplexer Chip
on the carrier
// board through B2B connector.

&i2c0 {

    // This I2C multiplexer chip can be found in TEB0835 carrier board.

    i2c_mux@70 { /* TCA9544APWR U7 in the carrier board TEB0835 */
        compatible = "nxp,pca9544";
        #address-cells = <1>;
        #size-cells = <0>;
        reg = <0x70>;

        i2c@0 { /* FireFly_B*/
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <0>;
        };
        i2c@1 { /* FireFly_A*/
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <1>;
        };
        i2c@3 { /* LM96163CISD/NOPB U9 FAN Controller in the carrier board
TEB0835*/
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <3>;
            temp@4c {/* lm96163 - u9*/
                compatible = "national,lm96163";
                    reg = <0x4c>;
              };
        };
        i2c@4 { /* SI5395A-A-GM U5 DPLL in the carrier board TEB0835*/
            #address-cells = <1>;
            #size-cells = <0>;
            reg = <4>;
            clock-generator@68{/* SI5395A-A-GM U5 DPLL in the carrier board
TEB0835 */
                        compatible = "silabs,si5395";
                        reg = <0x68>;
                        };
        };
    };
};
```

9.4 FSBL patch

Must be add manually, see template

9.5 Kernel

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

Changes:

- CONFIG_CPU_IDLE is not set (only needed to fix JTAG Debug issue)
- CONFIG_CPU_FREQ is not set (only needed to fix JTAG Debug issue)
- CONFIG_EDAC_CORTEX_ARM64=y

9.6 Rootfs

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

Changes:

- CONFIG_i2c-tools=y
- CONFIG_busybox-httpd=y (for web server app)
- CONFIG_packagegroup-petalinux-utils(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 accemble for Zynqmp RFSoC access. Need busybox-httpd

10 Additional Software

No additional software is needed.

10.1 SI5395 of RFSoC module

File location <design name>/misc/Si5395/Si5395-*-835-*.slabtimeproj

General documentation how you work with these project will be available on Si5395[18]

10.2 SI5395 of carrier board

File location <design name>/misc/Si5395/Si5395-*-B835-*.slabtimeproj

General documentation how you work with these project will be available on Si5395[19]

18 https://wiki.trenz-electronic.de/display/PD/Si5395
19 https://wiki.trenz-electronic.de/display/PD/Si5395

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
2023-08-07	v.33 (see page 6)	Mohsen Chamanbaz[20]	• Document adapted
2022-02-24	v.31	Mohsen Chamanbaz	• Design Update • Documentation Update • XCZU47DR variant was added. • HDL files for XCZU25DR has been updated. • RF analyzer software was updated to 2020.2 version.
2022-02-11	v.28	John Hartfiel	• Bugfix design
2021-07-14	v.27	John Hartfiel	• Release 2020.2
2020-12-09	v.25	John Hartfiel	• Style changes • additional notes
2020-11-02	v.20	Mohsen Chamanbaz	• Release 2019.2
--	all	Mohsen Chamanbaz[21] , John Hartfiel[22]	--

Table 11: Document change history.

20 https://wiki.trenz-electronic.de/display/~M.Chamanbaz
21 https://wiki.trenz-electronic.de/display/~M.Chamanbaz
22 https://wiki.trenz-electronic.de/display/~j.hartfiel

11.2 Legal Notices

11.3 Data Privacy

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

11.4 Document Warranty

The material contained in this document is provided “as is” and is subject to being changed at any time without notice. Trenz Electronic does not warrant the accuracy and completeness of the materials in this document. Further, to the maximum extent permitted by applicable law, Trenz Electronic disclaims all warranties, either express or implied, with regard to this document and any information contained herein, including but not limited to the implied warranties of merchantability, fitness for a particular purpose or non infringement of intellectual property. Trenz Electronic shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein.

11.5 Limitation of Liability

In no event will Trenz Electronic, its suppliers, or other third parties mentioned in this document be liable for any damages whatsoever (including, without limitation, those resulting from lost profits, lost data or business interruption) arising out of the use, inability to use, or the results of use of this document, any documents linked to this document, or the materials or information contained at any or all such documents. If your use of the materials or information from this document results in the need for servicing, repair or correction of equipment or data, you assume all costs thereof.

11.6 Copyright Notice

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Trenz Electronic.

11.7 Technology Licenses

The hardware / firmware / software described in this document are furnished under a license and may be used / modified / copied only in accordance with the terms of such license.

11.8 Environmental Protection

To confront directly with the responsibility toward the environment, the global community and eventually also oneself. Such a resolution should be integral part not only of everybody's life. Also enterprises shall be conscious of their social responsibility and contribute to the preservation of our common living space. That is why Trenz Electronic invests in the protection of our Environment.

11.9 REACH, RoHS and WEEE

REACH

Trenz Electronic is a manufacturer and a distributor of electronic products. It is therefore a so called downstream user in the sense of REACH[23]. The products we supply to you are solely non-chemical products (goods). Moreover and under normal and reasonably foreseeable circumstances of application, the goods supplied to you shall not release any substance. For that, Trenz Electronic is obliged to neither register nor to provide safety data sheet. According to present knowledge and to best of our knowledge, no SVHC (Substances of Very High Concern) on the Candidate List[24] are contained in our products. Furthermore, we will immediately and unsolicited inform our customers in compliance with REACH - Article 33 if any substance present in our goods (above a concentration of 0,1 % weight by weight) will be classified as SVHC by the European Chemicals Agency (ECHA)[25].

RoHS

Trenz Electronic GmbH herewith declares that all its products are developed, manufactured and distributed RoHS compliant.

WEEE

Information for users within the European Union in accordance with Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE).

Users of electrical and electronic equipment in private households are required not to dispose of waste electrical and electronic equipment as unsorted municipal waste and to collect such waste electrical and electronic equipment separately. By the 13 August 2005, Member States shall have ensured that systems are set up allowing final holders and distributors to return waste electrical and electronic equipment at least free of charge. Member States shall ensure the availability and accessibility of the necessary collection facilities. Separate collection is the precondition to ensure specific treatment and recycling of waste electrical and electronic equipment and is necessary to achieve the chosen level of protection of human health and the environment in the European Union. Consumers have to actively contribute to the success of such collection and the return of waste electrical and electronic equipment. Presence of hazardous substances in electrical and electronic equipment results in potential effects on the environment and human health. The symbol consisting of the crossed-out wheeled bin indicates separate collection for waste electrical and electronic equipment.

Trenz Electronic is registered under WEEE-Reg.-Nr. DE97922676.

2019-06-07

23 http://guidance.echa.europa.eu/
24 https://echa.europa.eu/candidate-list-table
25 http://www.echa.europa.eu/