

# **Vision SDK Linux Cascade Radar Data Acquisition Tool**

## **User Guide**

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**TABLE OF CONTENTS**

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<b>1</b>	<b>Introduction .....</b>	<b>4</b>
1.1	Block Diagram .....	4
1.2	Program Flow .....	5
1.3	Data Output Format .....	6
<b>2</b>	<b>Requirements for Running Data Acquisition Tool .....</b>	<b>7</b>
<b>3</b>	<b>Build Linux Vision SDK for Cascade Radar EVM .....</b>	<b>7</b>
<b>4</b>	<b>Build Linux Vision SDK for Cascade Radar EVM with Radar Studio .....</b>	<b>7</b>
<b>5</b>	<b>Data Acquisition Tool .....</b>	<b>8</b>
5.1	Run Data Acquisition using Radar Studio .....	8
5.2	Run Data Acquisition Tool.....	8
5.3	Retrieve Data .....	10
<b>6</b>	<b>Revision History .....</b>	<b>11</b>

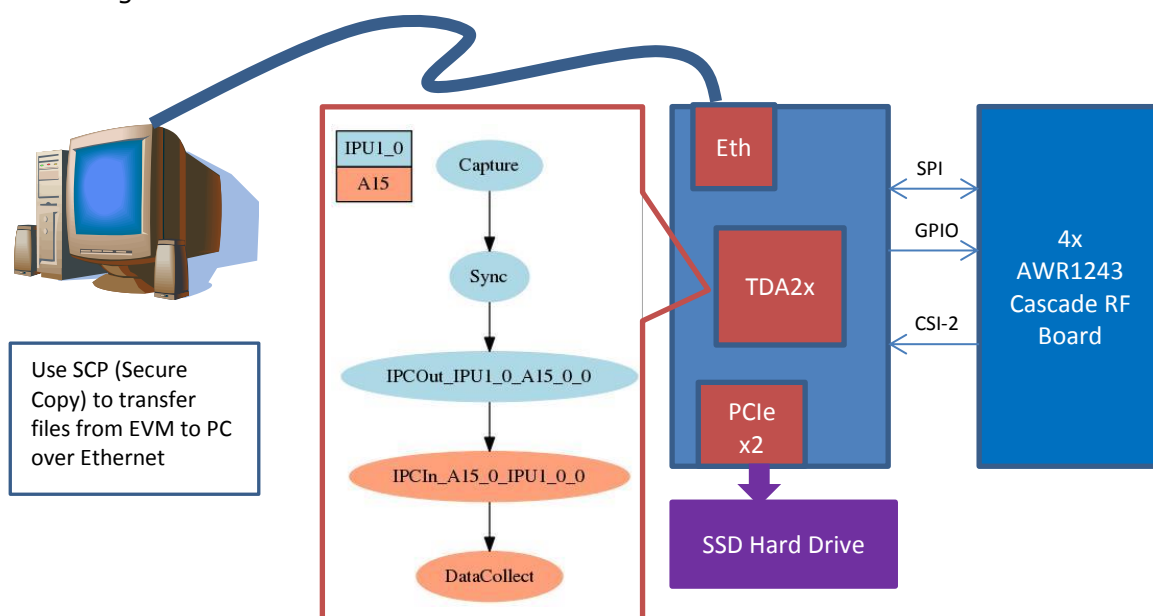
## 1 Introduction

This user guide provides details on how to build and utilize the data acquisition tool to capture raw data (ADC samples) from 4x AWR1243 Cascade Radar RF board with TDA2x Digital board.

For 4x AWR1243 Cascade Radar, depending on the Radar configuration, the raw data throughput could be up to ~6 Gbps. To save the raw data in real-time to a storage device, it requires an interface with very high BW capability. On TDA2x, PCIe interface can provide maximum 5Gbps BW per lane with total of 2 lanes. Using 2-lane PCIe interface on TDA2x to connect to a SSD storage device, it is sufficient to achieve real-time data acquisition for 4-chip cascade radar use case.

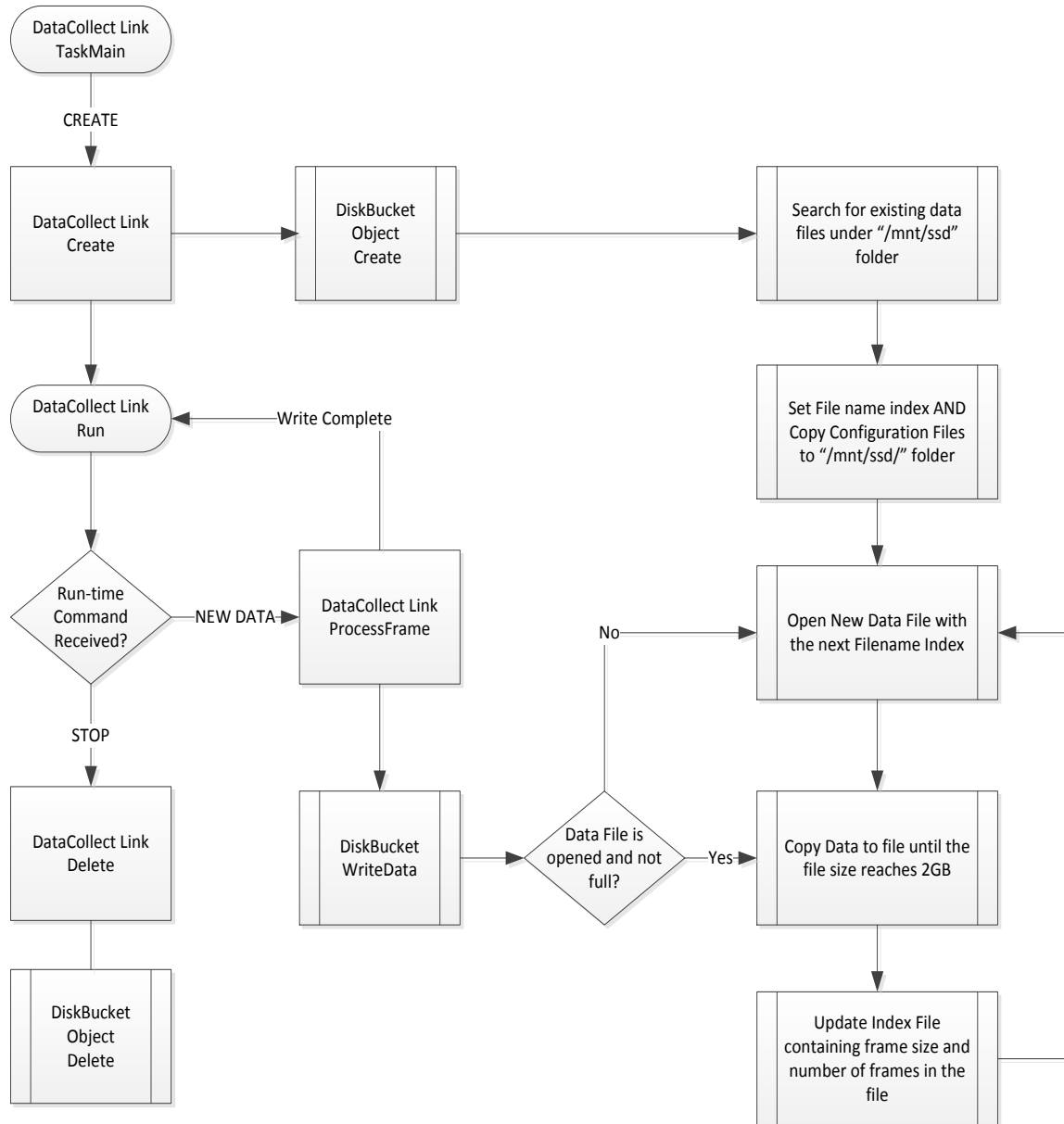
### 1.1 Block Diagram

The data acquisition tool implements the data scheme as shown in the following block diagram.



## 1.2 Program Flow

The main component of Data acquisition Tool is DataCollect Link running on A15 in TDA2x. DataCollect Link implemented the program flow as shown in the following figure.



### 1.3 Data Output Format

Data Acquisition Tool will save 3 types of files to the SSD card.

- Radar Configuration Files

Radar Configuration files used for the acquiring data set will be copied to SSD as "bxxxx\_cfg\_00.txt" ~ "bxxx\_cfg\_03.txt".

- Data Files

Data will be saved to a new file every 2GB as "bxxxx\_data.bin".

- Index Files

Each data file has an index file, "bxxxx\_idx.bin" to provide the frame size and numbers of total frames stored in the file.

The following screenshot shows an example of the files saved to SSD by Data Acquisition Tool.

/mnt/ssd/					
Name	Size	Changed	Rights	Owner	
..		11/3/2018 7:55 PM	rwxx-xr-x	1000	
lost+found		10/25/2018	rwxx-----	root	
b0000_cfg_00.txt	7 KB	11/3/2018 8:06 PM	-----x--x	root	
b0000_cfg_01.txt	7 KB	11/3/2018 8:06 PM	-----x--x	root	
b0000_cfg_02.txt	7 KB	11/3/2018 8:06 PM	-----x--x	root	
b0000_cfg_03.txt	7 KB	11/3/2018 8:06 PM	-----x--x	root	
b0000_data.bin	2,096,12...	11/3/2018 8:06 PM	-----f--	root	
b0000_idx.bin	39 KB	11/3/2018 8:06 PM	-----	root	
b0001_data.bin	2,096,12...	11/3/2018 8:07 PM	-----f--	root	
b0001_idx.bin	39 KB	11/3/2018 8:07 PM	-----	root	
b0002_data.bin	2,096,12...	11/3/2018 8:07 PM	-----f--	root	
b0002_idx.bin	39 KB	11/3/2018 8:07 PM	-----	root	
b0003_data.bin	2,096,12...	11/3/2018 8:07 PM	-----f--	root	
b0003_idx.bin	39 KB	11/3/2018 8:07 PM	-----	root	
b0004_data.bin	2,096,12...	11/3/2018 8:08 PM	-----f--	root	
b0004_idx.bin	39 KB	11/3/2018 8:08 PM	-----	root	
b0005_data.bin	2,096,12...	11/3/2018 8:08 PM	-----f--	root	
b0005_idx.bin	2 KB	11/3/2018 8:08 PM	-----	root	
b0006_cfg_00.txt	7 KB	11/3/2018 8:15 PM	-----x--x	root	
b0006_cfg_01.txt	7 KB	11/3/2018 8:15 PM	-----x--x	root	
b0006_cfg_02.txt	7 KB	11/3/2018 8:15 PM	-----x--x	root	
b0006_cfg_03.txt	7 KB	11/3/2018 8:15 PM	-----x--x	root	
b0006_data.bin	2,096,12...	11/3/2018 8:16 PM	-----f--	root	
b0006_idx.bin	39 KB	11/3/2018 8:16 PM	-----	root	
b0007_data.bin	2,096,12...	11/3/2018 8:16 PM	-----f--	root	
b0007_idx.bin	2 KB	11/3/2018 8:16 PM	-----	root	

## 2 Requirements for Running Data Acquisition Tool

It is important to make sure the required components are available before trying to use the data acquisition tool.

- Hardware Requirements:
  - 4-Chips AWR1243 Cascade Radar Board and TDA2xx Processing board
  - Nvme M.2 PCIe SSD card (ex. [Link](#))
  - Windows or Ubuntu PC
- Processor SDK Vision 3.6 release or later (Linux version)
- Please Refer to VisionSDK\_Linux\_UserGuide.pdf for SDK requirements

## 3 Build Linux Vision SDK for Cascade Radar EVM

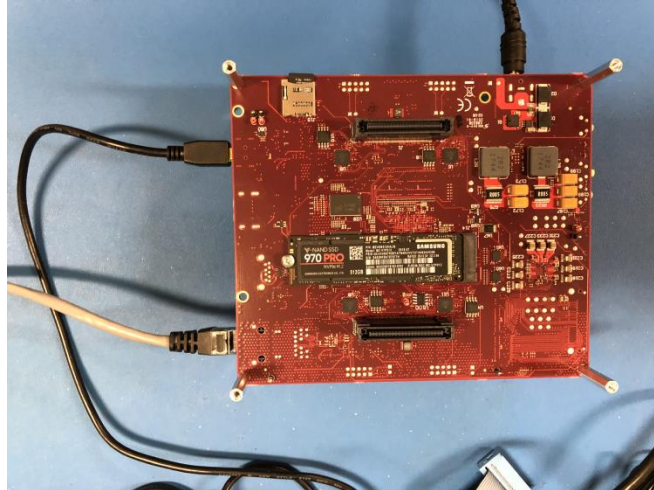
1. Follow the instructions in the Chapter 2 of VisionSDK\_Linux\_UserGuide.pdf to install Linux Vision SDK and set up the build environment.
2. Apply kernel patch. Patch can be found under the following location.  
[SDK\_INSTALL]/ti\_components/os\_tools/linux/kernel/linux-kernel-addon/kernel-patches/
3. Apply u-boot patches. Patch can be found under the following location.  
[SDK\_INSTALL]/ti\_components/os\_tools/linux/kernel/linux-kernel-addon/u-boot-patches/
4. Follow the build instructions in Chapter 3 of the SDK User Guide. Set **MAKECONFIG=tda2xx\_cascade\_linux\_radar** in Rules.make.
5. Follow the instructions in SDK User guide to prepare the SD card.
6. Place the radar configuration files under "/opt/vision" folder in file system on SD card. The example configuration files can be found under ~\vision\_sdk\apps\src\rtos\radar\src\usecases\cascade\_radar\_object\_detect\radar\_test\_vector. Please refer to ProcessorSDKRadar\_UserGuide.pdf for the details regarding the configuration files.

## 4 Build Linux Vision SDK for Cascade Radar EVM with Radar Studio

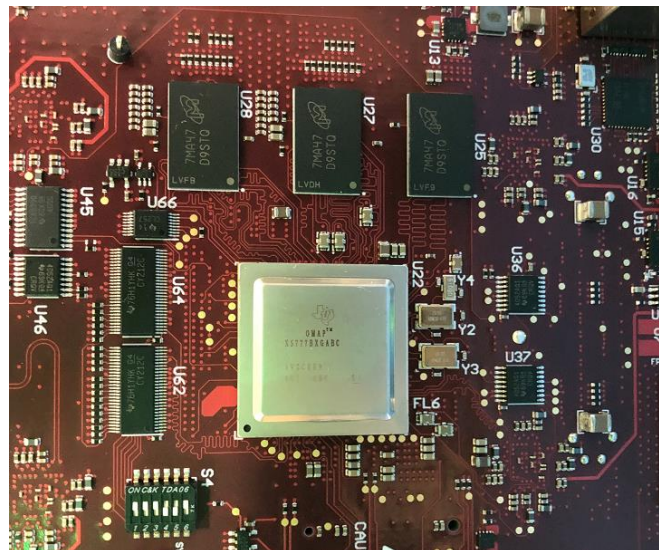
1. Follow the instructions in the Chapter 2 of VisionSDK\_Linux\_UserGuide.pdf to install Linux Vision SDK and set up the build environment.
2. Apply kernel patch. Patch can be found under the following location.  
[SDK\_INSTALL]/ti\_components/os\_tools/linux/kernel/linux-kernel-addon/kernel-patches/
3. Apply u-boot patches. Patch can be found under the following location.  
[SDK\_INSTALL]/ti\_components/os\_tools/linux/kernel/linux-kernel-addon/u-boot-patches/
4. Make **RADAR\_STUDIO=yes** in  
[SDK\_INSTALL]/vision\_sdk/apps/configs/tda2xx\_cascade\_linux\_radar/cfg.mk
5. Follow the build instructions in Chapter 3 of the SDK User Guide. Set **MAKECONFIG=tda2xx\_cascade\_linux\_radar** in Rules.make.
6. Follow the instructions in SDK User guide to prepare the SD card.

## 5 Data Acquisition Tool

Before running data acquisition tool, the NVMe M.2 SSD card should be installed on the EVM as shown in the following figure. Remove the Cascade RF board first to have access to the SSD card slot on the TDA2x processing board. After installing SSD card, secure the RF board back to the connectors on the TDA2x processing board.



Before powering up the board, make sure the S4 Dip Switch, as shown in the following figure, is set to [1:6] = [111001] to boot from SD card.



After powering up the board and booting to Linux kernel prompt, please make sure the SSD card is detected. If the SSD is detected correctly, the device will be `/dev/nvme0`.

### 5.1 Run Data Acquisition using Radar Studio

Follow the Radar studio 2.1.0 release userguide.

### 5.2 Run Data Acquisition Tool

1. Format the partition on SSD card as needed. Use `fdisk` and `mkfs` tools. Please refer to the manual of `fdisk` and `mkfs` for details.



2. Create "/mnt/ssd" folder and mount the partition on SSD for data storage to this folder.
3. Start Vision SDK Demo Application.

```
$> cd /opt/vision_sdk
$> source ./vision_sdk_load.sh
$> ./apps.out
```

4. Select '6' for Radar Usecases.

```
[HOST] [HOST ]
[HOST] [HOST ] =====
[HOST] [HOST ] Vision SDK Usecases
[HOST] [HOST ] =====
[HOST] [HOST ] 1: Single Camera Usecases
[HOST] [HOST ] 2: Multi-Camera LVDS Usecases
[HOST] [HOST ] 3: Open-Compute Usecases
[HOST] [HOST ] 6: Radar Usecases
[HOST] [HOST ]
[HOST] [HOST ] p: CPU Status
[HOST] [HOST ] i: Show IP Addr (IPU + NDK + AVB)
[HOST] [HOST ]
[HOST] [HOST ] s: System Settings
[HOST] [HOST ]
[HOST] [HOST ] x: Exit
[HOST] [HOST ] z: Exit - AND SHUTDOWN Remote CPUs
[HOST] [HOST ]
[HOST] [HOST ] Enter Choice:
```

5. Select '2' for Cascade Radar Capture + Data Acquisition.

```
[HOST] [HOST ]
[HOST] [HOST ] Radar Usecases
[HOST] [HOST ] -----
[HOST] [HOST ] 1: Cascade Radar (4x AWR1243) Capture + Null
[HOST] [HOST ] 2: Cascade Radar (4x AWR1243) Capture + Data Acquisition
[HOST] [HOST ]
[HOST] [HOST ] x: Exit
[HOST] [HOST ]
[HOST] [HOST ] Enter Choice:
```

6. Once the use case starts, the tool will search the existing files under /mnt/ssd folder. If there are already data files from prior runs, it will create the new file with incrementing index for file name.

```
DiskBucketMgr: Open ...
DiskBucketMgr: Opening dir [/mnt/ssd] !!!
DiskBucketMgr: Disk @ [/mnt/ssd], total size = 469.3 GB, free size = 469.3 GB, block size = 4096 B !!!
DiskBucketMgr: Opening file 0000, max size = 2047.0 MB !!!
DiskBucket: Open ...
DiskBucket: Open ... SUCCESS (/mnt/ssd/b0000_data.bin opened) !!!
DiskBucket: Open ... Done !!!
DiskBucketMgr: Copy Configuration 4 files
DiskBucketMgr: Open ... Done !!!
```

```
[HOST] [IPU2 ]      824.868907 s:  CAPTURE: Start in progress !!!
[HOST] [HOST ]      824.879735 s:
[HOST] [HOST ]
[HOST] [HOST ]      =====
[HOST] [HOST ]      Chains Run-time Menu
[HOST] [HOST ]      =====
[HOST] [HOST ]
[HOST] [HOST ]      0: Stop Chain
[HOST] [HOST ]
[HOST] [HOST ]      p: Print Performance Statistics
[HOST] [HOST ]
[HOST] [HOST ]      Enter Choice:
[HOST] [HOST ]
[HOST] [IPU2 ]      824.877081 s:  CAPTURE: Start Done !!!
DiskBucket: Close ...
DiskBucket: Close ... Data file closed (/mnt/ssd/b0000_data.bin) !!!
DiskBucket: Close ... Index file closed (/mnt/ssd/b0000_idx.bin) !!!
DiskBucket: Close ... Done !!!
DiskBucketMgr: Disk @ [/mnt/ssd], total size = 469.3 GB, free size = 467.3 GB, block size = 4096 B  !!!
DiskBucketMgr: Opening file 0001, max size = 2047.0 MB !!!
DiskBucket: Open ...
DiskBucket: Open ... SUCCESS (/mnt/ssd/b0001_data.bin opened) !!!
DiskBucket: Open ... Done !!!
DiskBucket: Close ...
DiskBucket: Close ... Data file closed (/mnt/ssd/b0001_data.bin) !!!
DiskBucket: Close ... Index file closed (/mnt/ssd/b0001_idx.bin) !!!
DiskBucket: Close ... Done !!!
```

### 5.3 Retrieve Data

3 ways to retrieve the radar data collected in SSD card as the followings.

- Use Linux PC (Ubuntu) – Preferred  
From EVM prompt, run "ifconfig" to obtain EVM IP address. Use SCP to transfer file to PC.
- Use Windows PC  
Download "WinSCP" for Windows and use it to transfer file from EVM to PC.
- Remove SSD card from EVM  
Use M.2 SSD-to-USB adapter/enclosure to read SSD card on PC.

## **6      Revision History**

<b>Version</b>	<b>Date</b>	<b>Revision History</b>
1.0	Jan 3, 2019	First version
1.1	Jun 6, 2019	Updated for radar studio usecase
1.2	July 26, 2019	Updated for uboot patches

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