MMWAVE DFP 01.00.00 Release Notes

1. Introduction

TI mmWave Device Firmware Package (DFP) enables the development of millimeter wave (mmWave) radar applications using AWR1243 SOC/EVM. It includes necessary components which will facilitate end users to integrate AWR1243 SOC with their choice of processor. It also includes RF evaluation tool (RadarStudio) to help user measure RF and key system performance on TI mmWave Radar devices.

In addition, DFP provides mmWaveLink framework and example application which will serve as a guide for integrating the AWR1243 with external processor.

> Note: mmWave Software Development Kit (SDK) enables the development of radar applications on AWR1443, AWR1642, IWR1443, IWR1642 SOCs/EVMs. The basic components of DFP are included in mmWave SDK.

> Note: This is a pre-production release and has undergone limited validation under nominal conditions for nominal device process

2. Release Overview

2.1 Platform and Device Support

The device and platforms supported with this release include:

Supported Devices	Supported EVMs
AWR1243 ES2.0	AWR1243BOOST : AWR1243 Booster pack + MMWAVE-DEVPACK

> Note: DFP supports the foundation components for the device mentioned in the table above. At system level, the mmWave SOC/EVM may interface with other SOCs/EVMs and software for other devices will not be a part of the DFP

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2.2 Release contents and component versions

Component	Version	Type
RadarSS Firmware	2.0.0.15	Binary
MSS Firmware (AWR1243 only)	1.10.0.23	Binary
mmWaveLink Framework	1.0.0.0	Source and Library
FTDI Driver	2.12	Binary
RadarStudio	1.9.2.0	Executable
Docs	Release Notes DFP user guide RadarStudio user guide Interface Control Document mmWaveLink Programmer's guide	PDF PDF PDF PDF Doxygen HTML

2.3 Directory Structure

Directory Name	Content
docs	AWR1xx_Radar_Interface_Control.pdf mmwave_dfp_ReleaseNotes.pdf mmwave_dfp_user_guide.pdf
firmware	RadarSS and Master SS firmware binary files
ti	mmWaveLink framework and example source code
rf_eval	RF evaluation firmware FTDI Driver RadarStudio GUI TSW1400 firmware files RadarStudio User's Guide.pdf

2.4 Component Descriptions

2.4.1 RadarSS Firmware

Refer to Radar SS firmware release notes in 'firmware\radarss' directory.

2.4.2 Master SS Firmware

The main software components of the MSS firmware are:

- System services – provides infrastructure services (error handling, mmWaveLink Host communication protocol manager) used by the functional firmware.
- Functional firmware – Is responsible for the external host API communication, RADAR SS API handshake, data path control.

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2.4.3 mmWaveLink framework

Radar SS is a closed subsystem whose internal blocks are configurable using messages coming over mailbox.
TI mmWaveLink framework acts as driver for Radar SS and exposes services of Radar SS. It includes APIs to configure HW blocks of Radar SS and provides communication protocol for message transfer between external processor and AWR1243

- Link between application and Radar SS
- Platform and OS independent which means it can be ported into any processor which provides communication interface such as SPI and basic OS routines. The mmWaveLink framework can also run in single threaded environment

2.4.4 Radar Studio

The Radar Studio GUI supports RF/System evaluation of TI mmWave radar devices. Radar Studio is designed to communicate with TI mmWave Radar devices for characterization and performance evaluation. The Radar device is configured and controlled from the Radar Studio by sending commands to mmWave radar device over SPI. ADC data is captured using TSW1400 EVM Board and the post processing is performed through Matlab and the results can be viewed in the GUI.

RadarStudio GUI utilizes mmWaveLink framework to communicate with the device through FTDI FT4232H device.

Key features of the Radar Studio Software are

- Board Control (SOP Change, Reset Control)
- RS232 Connection to device
- Firmware Download Capability
- Execute mmWaveLink APIs
- Flash Programming
- Interaction with TSW1400 EVM
- Post-Processing

2.5 Tools and dependencies

mmWave DFP contains the pre-built binaries for all the software components. Below tools are required to run RadarStudio and to build mmWaveLink example application

Tools	Version	Download Link
HSDC Pro Software	4.2 or later	download link
Matlab Runtime Engine	8.5.1 only	download link
Microsoft Visual Studio 2010	10.0.30319.1	download link
FTDI Driver	2.12	Included in the package

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2.6 Licensing

Please refer to the mmwave_dfp_manifest.html, which outlines the licensing information for mmWave DFP package.

3. Release Contents

3.1 New Features

- RF/Analog safety monitoring
- Master Subsystem Digital monitoring

3.2 Feature List by Components

3.2.1 Radar SS firmware

Refer to Radar SS firmware release notes in 'firmware\radarss' directory.

3.2.2 Master SS firmware (Compared to 00.09.00)

Type	Key	Summary
Feature	AUTORADAR-1383	Added provision to configure CQ data sizes and CQ data type. Until this release, the size of the CQ data being sent over the HSI interface was fixed to 132 halfwords (CQ0), 132 halfwords (CQ1) and 72 halfwords (CQ2). The size of the CQ data can now be configured using parameters in the AWR_DEV_RX_DATA_PATH_CONF_SET_SB API.
Feature	AUTORADAR-1357	Support added to transfer ADC data over SPI. This is targeted at usecases that need only a few chirps (per frame) worth information to be transferred out very sporadically. The ADC data per chirp is transferred to the L3 memory and then at the end of the frame, the data is sent out over SPI as async events.
Feature	AUTORADAR-1342	Added a new device config API to configure CRC length for MSS async events. Until this release, the MSS async events always used CRC16 as the integrity check. Support has been added to make this configurable. However, the first async event sent out will still use CRC16.
Bug	AUTORADAR-1396, AUTORADAR-1445, AUTORADAR-1291	Under certain timing scenarios, communication with the host over SPI was failing. The interface layer has been updated to be more robust post subjecting to different stress tests scenarios.

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3.2.3 mmWaveLink framework (Compared to 00.09.00)

Type	Key	Description
Feature	MMWL-57	Add a new element to RF LDO bypass API to support IR drop feature for external supply monitoring
Feature	MMWL-55	LVDS/CSI2 structure update for selection of CQ type and CQ size (for AWR1243 only)
Feature	MMWL-54	Support added at API level to receive ADC buffer data over SPI. (for AWR1243 only)
Feature	MMWL-52	Support added to change CRC type to 16/32/64 bits for Asynchronous event message received over SPI from MasterSS.
Feature	MMWL-51	Added compatibility to build mmWaveLink library in Linux environment.
Bug	MMWL-50	GPADC result structure for asynchronous event message does not match with what Host receives from RadarSS structure.
Bug	MMWL-49	mmWaveLink BPM common API structure doesn't match with ICD.
Feature	MMWL-48	Added an API rlSetMultiBpmChirpConfig to send multiple BPM configurations to device in a single API call.
Bug	MMWL-33	rlRfDevCfg_t structure's elements are not correctly align for Big endianness case.

3.2.4 Radar Studio (Compared to 00.09.00)

- Fixes in temperature reporting to report signed number instead of unsigned number
- Added support for saving all calibration and monitoring configuration APIs in xml which can be later loaded to get the same configuration back
- Fixes in frame trigger delay parameter
- Fixes in timestamp interpretation of TX power monitor report before writing to the monitoring report file.
- Implemented all asynchronous event messages which will now be reported in the output window.

3.3 Known Issues

Bug-ID	Description
AUTORADAR-970	On AWR1243 and XWR1443 devices, the NError is signaled due to an ESM group2 error (from VIM) being reported in the startup sequence. This will be resolved in the production version of the device.
AUTORADAR-1380	Chirp number index in Chirp Parameters starts at index 1 and not at index 0 for certain configurations.

4. Migration Guide

This section explains the steps to migrate from DFP v0.9 to current DFP release.

Impact	Change List

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HIGH	As rlAdcBitFormat_t of rl_sensor.h is migrated from union to structure data type. Application needs to remove 'bitFormat' sub-structure from variable usage of rlAdcBitFormat_t.
HIGH	Few of structures/APIs are renamed; user needs to take care of these changes in the application. • rlAeDirCfg_t structure renamed to rlRfDevCfg_t in mmWaveLink (rl_sensor). • rlSetAsyncEventDir API renamed to rlRfSetDeviceCfg in mmWaveLink (rl_sensor).
MEDIUM	Few of the reserved fields have been defined to enable new features in the device. If the application is explicitly setting the reserved fields, it needs to be modified to define new elements. Below is the list of *new* elements which were reserved in last release: • cqConfig, cq0TransSize, cq1TransSize and cq2TransSize in rlDevDataPathCfg_t structure. • aeCrcConfig in rlRfDevCfg_t structure (old structure name: rlAeDirCfg_t). • supplyMonIrDrop in rlRfLdoBypassCfg_t structure.
MEDIUM	Few elements of rlBpmCommonCfg_t structure are now made as reserved. Application needs to remove this structure elements' usage.
HIGH	Few of reserved fields of rlGpAdcCfg_t structure are removed and now part of rlGpAdcSample_t structure. Application needs to accommodate this change while calling 'rlSetGpAdcConfig' API.

5. Notes

Serial Data FLASH Supported:

AWR1443/xWR1443
The AWR1243/xWR1443 ES1.0 and ES2.0 devices work only with Spansion and Macronix devices. In particular, the Flash variants that have been tested to work with the ROM bootloader are:

Spansion S25FL256S
Spansion S25FL132K0XNFB010
Macronix MX25L3233F
Macronix MX25R1635FZNIH0 (Wide voltage part variant)

xWR1642 ES1.0 devices:

There are the following factors that will determine if the XWR16xx ROM bootloader will be able to interface and work with the SFLASH on XWR16xx devices:

Pre-requisite:

SFLASH supports the SFDP command and responds with JEDEC compliant information regarding the capabilities and command set of the flash.

ROM assisted download to the FLASH (Device Management mode - SOP5):

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- The ROM assisted download should work with all flash variants that allow for “Memory mapped mode” and “Page program command (0x2)” with 1 dummy byte and 24bit addressing.

- In addition to writing to the Flash, the ROM bootloader also support setting the “Quad Enable” bit for Spansion and Macronix variants (certain specific part variants only).

In case any of the above steps fail, the device supports “Boot mode – UART” which can be used to download an application onto the MSS RAM and execute, which can be used to program the SFLASH.

ROM based load from FLASH (Functional mode – SOP4):

The ROM bootloader performs the read from the FLASH based on the highest capability mode (Quad/Dual/Single) as published by the SFLASH in response to the SFDP command. The commands used also are as published by the SFDP response. So if the Quad read is supported, the expectation is that the Quad Enable (QE) bit is already set in the FLASH. The ROM bootloader would use the Quad mode to perform the read.

Recommendation:

The flash vendors have an orderable part variant with the Quad Enable (QE) bit set. It is recommended to use these variants to work with TI mmWave SOCs.

Known Issues:

The ROM bootloader in XWR1642 pre-production devices in not compatible with SFLASH variants that support extended addressing mode. In particular, the “Number of Address length” field of the SFDP command response being non-zero is not supported. The total SFLASH addressable region in XWR1642 devices is 8 MBytes. So “Number of Address length” = 0 (corresponding to 3 bytes address length) will satisfy the addressable range. However, the compatibility issue is with variants that allow for “3 or 4 bytes address length”.

This incompatibility will be addressed in our production version of the XWR1642 silicon.

6. Technical Support

For any support/feedback/issues, contact us via mmWave Sensors e2e forum.

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