# MMWAVE Studio Release Notes

## 1 Introduction

The mmWaveStudio GUI is designed to characterize and evaluate the TI Radar devices. The mmWave device is configured and controlled from the mmWaveStudio by sending commands to the device over SPI. ADC data is captured using DCA1000 EVM board for single chip systems and TDA2XX EVM for Cascade systems. The data is processed in Matlab and the results are displayed in the GUI.

## 2 Release Overview

This is the 3.0.0.14 version of mmwavestudio

### 2.1 Platform and Device Support

The device and platforms supported with this release are

| Supported Devices | Supported EVMs |
|---|---|
| xWR2243 ES1.0 | AWR2243BOOST<br>Cascade RF Board |
| xWR2243 ES1.1 | AWR2243BOOST<br>Cascade RF Board |

The solution to capture raw ADC data for single chip systems is by using Booster pack along with DCA1000 EVM. In case of Cascade systems, the TDA2XX EVM needs to be used along with Cascade RF EVM Board.

## 2.2 Release contents and component versions

| Component | Version/Details | Device | Type |
|---|---|---|---|
| RadarSS Firmware | 2.2.0.13 | xWR2243 ES1.0 | Binary |
| MSS Firmware | 2.2.1.7 | xWR2243 ES1.0 | Binary |
| RadarSS Firmware | 2.2.2.6 | xWR2243 ES1.1 | Binary |
| MSS Firmware | 2.2.2.0 | xWR2243 ES1.1 | Binary |
| FTDI Driver | 2.12 | NA | Binary |
| mmWaveStudio | 3.0.0.14 | NA | Executable |
| Documents | Release Notes<br>mmWaveStudio User's Guide<br>mmWaveStudio Cascade User's Guide<br><br>DCA1000 Quick start Guide<br>DCA1000 Debugging Handbook | NA | PDF<br>PDF<br>PDF<br><br>PDF<br>PDF |
| Reference Code | DCA1000 CLI source code and documentation<br>FTDI Library Source code and documentation<br>Ethernet Library source code and documentation | NA | Source code + Docs<br><br>Source Code + Docs<br><br>Source Code + Docs |
| Matlab Examples | MIMO Post Processing scripts<br>TX-Beamforming Data Capture and Post-processing scripts<br>Matlab example for parsing ADC data using JSON based log file<br>Signal Processing 4-chip Cascade Guide<br>AWRx TX Channel Calibration Script User Guide | NA | Source Code<br>Source Code<br><br>Source Code<br><br>PDF<br><br>PDF |
| Platform Binaries | DCA1000 FPGA Image (2.8)<br>TDA2 Firmware (3.7.1) | DCA1000 EVM<br>TD2XX EVM | Binary<br>Binary |

## 2.3 Directory Structure

| Directory Name | Content |
|---|---|
| docs | mmwave_studio_release_notes.pdf<br>mmwave_studio_user_guide.pdf<br>mmwave_studio_cascade_user_guide.pdf<br>DCA1000_Quick_Start_Guide.pdf<br>DCA1000_Debugging_Handbook.pdf |

| ftdi | FTDI Drivers |
|------|--------------|
| mmWaveStudio | mmWaveStudio GUI (*Runtime\mmWaveStudio.exe*) |
| | DCA1000 FPGA file (*PlatformBinaries\DCA1000FPGA\*) |
| | TDA2XX Firmware file (*PlatformBinaries\TDA2Firmware\*) |
| | Reference code for DCA1000 CLI (*ReferenceCode\DCA1000\*) |
| | Reference code for FTDI Library (*ReferenceCode\FTDILib\*) |
| | Reference code for Ethernet Library (*ReferenceCode\EthernetLib\*) |
| | Matlab example for MIMO Post-Processing (*MatlabExamples\*) |
| | Matlab example for Tx-Beamforming Post-Processing (*MatlabExamples\*) |
| | Matlab example for single chip data parsing (*MatlabExamples\*) |
| | signal_processing_4chip_cascade.pdf (*MatlabExamples\*) |
| | AWRx_TX_Channel_Calibration_Script_User_Guide.pdf (*MatlabExamples\*) |
| | Sample Lua scripts (Cascade + Single Chip) (*Scripts\*) |
| | Sample JSON files (*JSONSampleFiles\*) |
| rf_eval_firmware | RF evaluation firmware for supported Devices |

## 2.4   Tools and dependencies

Below tools are required to run mmWaveStudio

| Tools | Version | Download Link |
|-------|---------|---------------|
| Matlab Runtime Engine | 8.5.1 only | download link |
| FTDI Driver | 2.12 | Included in the package |
| Matlab (only for Matlab examples) | R2017a or later | License Required |

## 2.5   Licensing

Please refer to the mmwave_studio_manifest.html, which outlines the licensing information for mmWave Studio package.

# 3   Release Contents

## 3.1   Features and enhancements (from mmWaveStudio 2.1)

- Support for Continuous streaming using DCA1000 (for single chip) and TDA2XX (for cascade chip)
- Support for Advanced chirp configuration

- Support for TX Phase shifter monitoring

- Support for TDA2XX based cascade solution

- Customizable (xml based) Monitoring Data Format

- Source code provided for FTDI port layer used to communicate with single chip solution

- Source code provided for Ethernet port layer used to communicate with cascade solution

- Source code provided for DCA1000 Command line interface

- Added BPM Manager and Phase Shifter Manager options

- Improved Profile Manager and Chirp Manager options

- Option to Post process previously captured data

- Logging of all Asynchronous events in separate files

- Packer Reorder utility is no longer required for the data from DCA1000

- Support for TX Phase shifter calibration

## 3.2 Changes in this release (from mmWaveStudio 2.1)

| Item type | Key | Issue Details/Description |
|---|---|---|
| BUG | MMWSTUDIO-280 | Fixed Continuous streaming capture using DCA1000. |
| BUG | MMWSTUDIO-380 | Fixed the LVDS IOs to be turned off when using discontinuous clocking mode. |
| FEATURE | MMWSTUDIO-381 | Added program mode for Dynamic per chirp phase shifter API |
| FEATURE | MMWSTUDIO-384 | Added new feature "INTFRC_MASTER_EN" bit in Cascading pin out field in channel configuration API.<br>Added support for APLL and Synthesizer BW control API.<br>Added new field "LO DIST bias code" in Calibration Data Save API.<br>Updated Profile configuration API to include 2243 related features.<br>Added new feature "Monitoring mode" in Calibration time unit configuration API.<br>Added new feature "Calibration Temperature Index Override enable" in Run time calibration API.<br>Added new feature Advance chirp configuration API.<br>Added new boot up and latent fault DCC monitor feature.<br>Added new feature "Monitor mode" in Synth frequency monitor API.<br>Added new asynchronous event – Monitor Type Trigger Done report.<br>Added new asynchronous event - Synth frequency Non live report. |
| BUG | MMWSTUDIO-385 | Fixed Dynamic chirp configuration API for 2243 device variant |
| FEATURE | MMWSTUDIO-388 | Added new field "Rx FE Disable" in Loopback select in Loopback burst configuration API. |

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| | | Updated LPF monitoring threshold and reporting values in RX IF stage configuration API.<br><br>Removed support for Inter RX gain phase control API and added Digital Compensation control API.<br><br>Added new enable control field "Synth Frequency Non live monitor" in Analog monitoring enable API. |
|---|---|---|
| BUG | MMWSTUDIO-392 | Fixed the appending of trace file by splitting the trace file real time in chunks of 20MB for effective debugging. |
| BUG | MMWSTUDIO-396 | Fixed inconsistent units in Test source LUA help documentation. |
| BUG | MMWSTUDIO-397 | Fixed TX Gain phase monitor report in accordance with the latest firmware. |
| BUG | MMWSTUDIO-398 | Fixed the frequency limits by +/- 1GHz to allow wider frequency ranges. |
| BUG | MMWSTUDIO-402 | Fixed "Sync 20G Power" field in PMCLKO Internal Analog signals monitor report. |
| BUG | MMWSTUDIO-410 | Fixed the RF Gain target field in Profile configuration / Continuous streaming / Loopback burst API |
| FEATURE | MMWSTUDIO-416 | Removed support for legacy BPM monitors and added support for TX Phase shifter monitor API.<br><br>Added new inter burst power save disable option in BSS device configuration API. |
| BUG | MMWSTUDIO-419 | Fixed number of chirp loops in Basic Frame and Advanced Frame API to allow values from 1 to 32768 when Advanced chirp is enabled. |
| BUG | MMWSTUDIO-420 | Fixed SF0 delta to SF3 delta fields in Advanced chirp API to accept higher values than 65535. |
| BUG | MMWSTUDIO-422 | Fixed the logging of Tx Phase shifter monitor configuration API |
| BUG | MMWSTUDIO-424 | Fixed the trace file handling in mmwavestudio |
| FEATURE | MMWSTUDIO-428 | Added Lua API for AWR_RF_BOOTUPBIST_STATUS_GET_SB Command |
| FEATURE | MMWSTUDIO-433 | Added LUA script to demonstrate Advanced Chirp Config feature |
| BUG | MMWSTUDIO-435 | Fixed update of DFE Statistics values in the studio |
| FEATURE | MMWSTUDIO-446 | Added support for advance chirp dynamic LUT address offset update API |
| BUG | MMWSTUDIO-464 | Fixed Firmware download chunk calculation to take care of all corner cases |
| FEATURE | MMWSTUDIO-472 | Added support for Matlab API to specify the devicemap |
| BUG | MMWSTUDIO-474 | Fixed error in calculation of samples to capture in TDA continuous streaming mode |
| FEATURE | MMWSTUDIO-480 | Added support for Deleting old bin files in TDA |
| FEATURE | MMWSTUDIO-481 | Added LUA script to demonstrate the flashing mode in cascade |
| BUG | MMWSTUDIO-497 | Fixed error while issuing the monitoring trigger type API |

| FEATURE | MMWSTUDIO-504 | Added LUA script to demonstrate the single Chip Continuous mode |
|---|---|---|
| FEATURE | MMWSTUDIO-505 | Added LUA script to demonstrate the single Chip advance frame mode |
| BUG | MMWSTUDIO-511 | Fixed Trigger Delay Value Mismatch in Advanced Frame API Log |
| FEATURE | MMWSTUDIO-513 | Added support for single chip matlab script |
| FEATURE | MMWSTUDIO-537 | Addition of Tx phase shifter calibration scripts |

## 3.3   Limitations

- The matlab post-processing only works with the following value of CQ configuration
  - CQ0 – 132
  - CQ1 – 132
  - CQ2 – 72
- Only Interleaved mode is supported for xWR2243 device.

### 3.3.1  Cascade Specific Limitations

- If the *"num_frames_to_capture"* parameter is 0, then the number of frames captured by the TDA2 is one less than the number of frames sent by the AWR devices when the AWR devices are configured to send out a finite number of frames. However if the *"num_frames_to_capture"* parameter is set to a non-zero value, then the TDA2 will correctly capture exactly the mentioned number of frames.
- The first frame may be corrupted in every capture. It is recommended to ignore the first frame for all captures.
- Post-processing for the data doesn't work for 12-bit data packing (16 bit data packed into 12 bit while saving the data)
- The basic built-in post processing tool in mmWave Studio assumes that the configuration is the same for all devices. The angle estimation done by the tool only takes into account data from the 4 RXs of one device at a time.
- Logs from the TDA2 "*apps.out*" application are only generated when running the "*apps.out*" binary manually. The default behavior in which this application is started automatically at boot-up does not generate the logs. These logs are required only for debug.
- The 12-bit and 14-bit ADC data format modes are not supported. Only 16-bit ADC data is supported and verified.
- The maximum number of samples per chirp is currently limited to 512 in complex 1x/2x modes, and 1024 in real mode.

## 3.4   Known issues

| Key | Description |
|---|---|
| MMWSTUDIO-216 | Font on Connect tab overlap on some Windows 7 PC |

## 4    Migration Guide

This section explains the steps to migrate from mmWaveStudio 2.1 release to this package

| Impact | Change list |
|---|---|
| MEDIUM | Added new API to control the bandwidth of the APLL and the Synthesizer - **ar1.SetApllSynthBWCtlConfig** in the Static configuration tab. |
| MEDIUM | Added new API that maintains monitoring timing synchronization in cascaded devices to avoid mutual interference of monitors running in different devices in the cascade sensor - **ar1.SetMonTypeTriggerConfig** in the Calibration configuration tab. |
| MEDIUM | Added new API to increase the time between the availability of chirp data and the transfer of chirp data over CSI2 interface - **ar1.SetCSI2DelayConfig** in the Data configuration tab. |
| MEDIUM | Added new API to enable the pin-mux and bring out debug signals for the chirp cycle - **ar1.SetDebugSignalsConfig** in the Clock out configuration tab. |
| MEDIUM | Added new asynchronous event report – Monitor Type Trigger Done report. The triggered monitor types are done with execution and Host can use this signal to trigger next type of monitor. |
| MEDIUM | Added new asynchronous event report – Synthesizer Frequency Non-live report. This is a Non live Monitoring report which device sends to the host, containing information related to measured frequency error during the monitoring chirp for two profiles configurations. |
| MEDIUM | Added new API for Advanced chirp configuration - **ar1.AdvChirpConfig** in the Advance chirp configuration tab. |
| MEDIUM | Added new API for Advanced chirp LUT configuration - **ar1.AdvChirpLUTConfig** in the Advance chirp configuration tab. |
| HIGH | Added new field 'disableDither' at the end in **ar1.SetTestSource** API in Test Source configuration tab. |
| HIGH | Added new bit 28 'Synth Frequency Non live' monitor in 'AnaMonEnables' field in **ar1.SetRfAnaMonConfig** API. Also added |
| HIGH | Added new fields in Inter RX Gain phase Frequency control (Digital Compensation EST Control) - **ar1.SetRfInterRxGainPhFreqConfig** API in Chirp configuration Tab.<br><br>Fields added - "Rx Gain Comp Enable", "Rx Phase Comp Enable", "Rx Delay Comp Enable", "Rx Freq Comp Enable". "Tx Freq Comp Enable", "RX1 Digital Delay", "RX2 Digital Delay", "RX3 Digital Delay", "RX4 Digital Delay", "RX1 Digital Freq Shift", "RX2 Digital Freq Shift", "RX3 Digital Freq Shift", "RX4 Digital Freq Shift", "TX1 Digital Freq Shift" and "TX2 Digital Freq Shift". |
| HIGH | Added new fields in Rx IF Stage monitoring configuration - **ar1.SetRfRxIfStageMonConfig** API in Analog RX Monitoring tab.<br><br>Fields added/updated - "LPF Cut off Band edge threshold" and "LPF Cut off Stop band threshold" |
| HIGH | Added new fields in Synth Frequency monitor configuration - **ar1.SetRfSynthFreqMonConfig** API in Analog RX Monitoring tab. |

| | |
|---|---|
| | Fields added – "MonitorMode", "Profile 0 Enable" and "Profile 1 Enable". |
| HIGH | Added new field 'RX FE Disable' in Loopback select in Loopback burst configuration – 'LoopBackSelect' field of **ar1.LbBurstCfgSet** API in Advance frame configuration tab. |
| HIGH | Removed support for few MSS Latent fault monitoring tests – MibSPI test and ESM test in 'TestEna1' field of **ar1.DeviceLatentFaultConfig** API in MSS Monitoring tab. |
| HIGH | Updated RX IF Stage monitoring report. |
| HIGH | Removed support for MSS VMON error status report. |
| HIGH | Removed VCO1 and VCO2 slope in 'Status flags' field of PLL Control voltage signal monitoring report. |
| HIGH | Updated reserved field to 'errorCode' in BSS CPU fault report. |
| HIGH | Added new field 'AdvChirpConfigEnable' in **ar1.SetMiscConfig** API – Miscellaneous control in Static configuration tab. |
| HIGH | Added new field 'startStop' in **ar1.StopFrame** API – Sensor stop in Chirp configuration tab. |
| MEDIUM | Updated Frequency configuration to be relaxed by +/-1GHz (75GHz to 82GHz) and (56GHz to 65GHz). |
| MEDIUM | Updated Minimum value for Number of ADC samples is reduced to 2 – Chirp configuration tab. |
| MEDIUM | Updated **ar1.SetRFPALoopbackConfig** API and **ar1.LbBurstCfgSet** API are updated to accept PA loopback frequencies in decimal form instead of integer form. |
| HIGH | Updated TX Gain phase mismatch report. |
| HIGH | Updated RF gain target in Profile/ContStream/LoopbackBurst API's. **ar1.ProfileConfig**, **ar1.ContStrConfig** and **ar1.LbBurstCfgSet** API's |
| MEDIUM | Added new API – TX Phase Shifter monitoring (TX0, TX1 and TX2) - **ar1.SetRfTx0PhShiftMonConfig** API in Analog TX Monitoring tab |
| HIGH | Removed TX BPM Monitoring API (TX0, TX1 and TX2) – **ar1.SetRfTx0BpmMonConfig** API in Analog TX Monitoring tab. |
| HIGH | Added new field 'BSSAnaControl' in RF Device configuration - **ar1.SetRFDeviceConfig** API in Static configuration tab. |
| HIGH | Added new field 'MonChirpSlope' in TX Gain Phase mismatch monitoring – **ar1. SetRfTxGainPhaseMismatchMonConfig** API in Analog TX monitoring tab. |
| HIGH | Added new bit 6 – 'INTFRC Master Enable' in cascading pinout configuration field in Channel configuration - **ar1.ChanNAdcConfig** API in Static configuration tab. |
| HIGH | Added new field 'MonitorMode' in Calibration time unit configuration - **ar1.SetCalMonTimeUnitConfig** API in Calibration Monitoring tab. |
| HIGH | Added new fields in Run time calibration configuration - **ar1.RunTimeCalibConfTrig** API in Calibration Monitoring tab. Fields added – "TX Temp Index Override Enable", "RX Temp Index Override Enable", "LODIST Temp Index Override Enable", "TX Cal Temp Index", "RX Cal Temp Index" and "LODIST Cal Temp Index". |

| HIGH | Added new field "ProgramMode" in Dynamic per chirp phase shifter configuration - **ar1.DynPerChirpPhShifterCfgSet** API in Dynamic chirp configuration tab. |
|---|---|
| HIGH | Added new bit 21 – 'DCC test' – in RF Digital System Latent fault configuration - **ar1.SetRfDigLatentFaultMonEnableConfig** API in Digital Monitoring tab. |
| HIGH | Updated reserved to 'DCC test status' in BSS Power up asynchronous report and BSS Latent fault monitoring report. |
| HIGH | Updated BSS calibration store restore data structure definition |
| HIGH | Removed 'numDummyChirps' field in Frame configuration - **ar1.FrameConfig** API in Chirp configuration tab. |
| MEDIUM | Added new API's for continuous streaming support with TDA2 (for cascade) and DCA1000 (for single chip) in Continuous streaming tab. Added API's - **ar1.TDAContStream_StartRecord_mult**, **ar1.TransferFilesUsingWinSCPContStream_mult** and **ar1.StartMatlabPostProcForTDAContStream**. |
| HIGH | Added new field 'CSI2LineStartEndDis' in CSI2 Lane configuration - **ar1.CSI2LaneConfig** in Data path configuration tab. |
| HIGH | Added new field 'AdvChirpErrChkDisable' in Misc configuration - **ar1.SetMiscConfig** in Static configuration Tab. |
| MEDIUM | Added new API for Advanced chirp Dynamic LUT Address Offset configuration in Advance frame config Tab - **ar1.AdvChirpDynLUTAddOffConfig** |
| HIGH | Split the 64 bit fields into 2 32bit fields in MSS power up status report and MSS boot error status report. |
| MEDIUM | Added an extra option - CQ_CP_ADC in Data path configuration – Data config Tab. |
| HIGH | Added new field 'CalMonTimeUnitErrChkDisable' in Misc configuration - **ar1.SetMiscConfig** in Static configuration Tab. |
| MEDIUM | Added configurability of CRC in **ar1.PowerOn** API (16/32/64 bit) – Connect tab |
| MEDIUM | Added new LUA API's for deleting old bin files from TDA Added API's - **ar1.TDAFolderDelete** & **ar1.TDAFolderDeleteAll** |
| HIGH | Added WDT test field in **ar1.DeviceLatentFaultConfig** API – MSS monitoring tab |
| HIGH | Fixed mismatch of trigger delay print between GUI and Output Log in **ar1.AdvanceFrameConfig** API – Advance frame tab |
| MEDIUM | Added new LUA API's for updating the ADC file paths in GUI for both Chirp configuration Tab and Continuous Streaming tab Added API's - **ar1.SetChirpConfigADCPath** & **ar1.SetContStreamADCPath** |