Report

on the

Certificate

Z10 088989 0022 Rev. 03

of the

Safety Component
RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432

Applicant

Texas Instruments Incorporated
12500 TI Boulevard
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Report No.: TD98073C

Version 1.3 of 2024-10-04

Testing Laboratory for Safety Components

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Modification History

Rev.	Status	Date	Author	Modification / Description
1.0	Replaced	2022-01-18	Axel Köhnen	Initial
1.1	Replaced	2022-07-21	Axel Köhnen	IWR6843AoP devices added
1.2	Replaced	2022-11-29	Axel Köhnen	IWR6243 devices added
1.3	Active	2024-10-04	Daniel Girón	IWRL6432 devices added

Table 1:   Modification history

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1   Target of Evaluation (ToE)

In August 2018 Texas Instruments Incorporated requested TÜV SÜD Rail GmbH to test and certify the RADAR ASIC IWR1843, IWR2243, IWR6843 up to SIL2 according to IEC 61508:2010. Additionally, the systematic capability for SIL 3 according to IEC 61508:2010 is requested to be tested. The project number related to this Technical Report is 717518286. It covers the ASIC hardware as well as the software. The ToE is a product used in safety related applications. The following devices are covered:

- IWR1843
- IWR2243
- IWR6843

In February 2022 Texas Instruments Incorporated requested TÜV SÜD Rail GmbH to test and certify the AoP variants of IWR6843 up to SIL2 according to IEC 61508:2010. Additionally, the systematic capability for SIL 3 according to IEC 61508:2010 is requested to be tested. The project number related to this Technical Report is 717524791. The following devices are additionally covered in this report:

- IWR6843AoP

In March 2022 Texas Instruments Incorporated requested TÜV SÜD Rail GmbH to test and certify the IWR6243 up to SIL2 according to IEC 61508:2010. Additionally, the systematic capability for SIL 3 according to IEC 61508:2010 is requested to be tested. The project number related to this Technical Report is 717524911. The following devices are additionally covered in this report:

- IWR6243

In October 2023 Texas Instruments Incorporated requested TÜV SÜD Rail GmbH to test and certify the IWRL6432 up to SIL2 according to IEC 61508:2010. Additionally, the systematic capability for SIL 3 according to IEC 61508:2010 is requested to be tested. The project number related to this Technical Report is 717528833. The following devices are additionally covered in this report:

- IWRL6432

2   Scope of Testing

2.1   Test Specimen

The mission of the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 based application is to identify an object in a specified range. When used in

conjunction with MCU/Processor that implements radar signal processing algorithms, Radar front end sensors are used to measure the object's

1. Range
2. Velocity (Relative)
3. Angle of Arrival

The above three information's about the object opens up scope for many industrial applications.

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2.2 Nomenclature and Identification of RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432

2.2.1 Nomenclature and Identification of Single Chip Sensor IWR1843

The RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 tested is identified by hardware and software version as follows:

Name	Silicon Rev.	Package	Datasheet
IWR1843ABGABL	2	FCBGA-161	SWRS228
IWR1843ABGABLR			

Table 2: HW Identification of IWR1843

Name	Date	SW	Remarks
RadarSS Firmware	2020-06-11	ROM: 2.0.0.1 PATCH: 1.2.6.11	Binary delivered as part of the Device Firmware Package, version 01.02.06.03
MSS Firmware	2020-06-11	ROM: 1.10.0.20 PATCH: 1.2.6.12	MD5 for DFP 01.02.06.03: ace1d018571487691e8bfbb255df4beb *mmwave_dfp_01_02_06_03_win32.exe

Table 3: SW Identification of IWR1843

2.2.2 Nomenclature and Identification of Front End Sensor IWR2243

Name	Silicon Rev.	Package	Datasheet
IWR2243APBGABL	2	FCBGA-161	SWRS289
IWR2243APBGABLR			

Table 4: HW identification of IWR2243

Name	Date	SW	Remarks
RadarSS Firmware	2021-05-21	ROM: 2.2.0.13 PATCH: 2.2.3.3	Binary delivered as part of the Device Firmware Package, version 02.02.03.01
MSS Firmware	2021-05-21	ROM: 2.2.1.7 PATCH: 2.2.2.0	MD5 for DFP 02.02.03.01: 4085eed2f300ad8e1e33577985d64767 *mmwave_dfp_02_02_03_01_win32.exe 31cedf3ec7b3f0a2e79978925ae1f52d *mmwave_dfp_02_02_03_01.zip

Table 5: SW identification of IWR2243

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2.2.3 Nomenclature and Identification of Single Chip Sensor IWR6843

Name	Silicon Rev.	Package	Datasheet
IWR6843ABGABL			
IWR6843ABGABLR	2	FCBGA-161	SWRS219
IWR6843ABSABL			
IWR6843ABSABLR			

Table 6: HW Identification of IWR6843

Name	Date	SW	Remarks
RadarSS Firmware	2020-09-02	RAM 6.3.2.6	Binary delivered as part of the Device Firmware Package, version 06.03.02.01 MD5 for DFP 06.03.02.01: 2a094955e9b96e516fb3e3aeb53d274d (Windows) 4761f2e4e44c65feed58b7b0a8766e03 (Linux)
Bootloader	See device identification in Table 6		

Table 7: SW identification of IWR6843

2.2.4 Nomenclature and Identification of Single Chip Sensor IWR6843AoP

Name	Silicon Rev.	Package	Datasheet
IWR6843ARBGALP	2	FCBGA-180	SWRS237B
IWR6843ARBGALPR			

Table 8: HW Identification of IWR6843AoP

Name	Date	SW	Remarks
RadarSS Firmware	2020-09-02	RAM 6.3.2.6	Binary delivered as part of the Device Firmware Package, version 06.03.02.01 MD5 for DFP 06.03.02.01: 2a094955e9b96e516fb3e3aeb53d274d (Windows) 4761f2e4e44c65feed58b7b0a8766e03 (Linux)
Bootloader	See device identification in Table 8		

Table 9: SW identification of IWR6843AoP

Note: The software was not changed for IWR6843AoP and is identical to IWR6843.

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2.2.5 Nomenclature and Identification of Front End Sensor IWR6243

Name	Silicon Rev.	Package	Datasheet
IWR6243ABGABL	2	FCBGA-161	SWRS283
IWR6243ABGABLR			

Table 10: HW identification of IWR6243

Name	Date	SW	Remarks
RadarSS Firmware	2022-08-11	RAM: 6.4.1.13	Binary delivered as part of the Device Firmware Package, version 06.04.01.00
MSS Firmware	2022-08-11	ROM: 2.2.1.7 PATCH: 2.6.0.3	MD5 for DFP 06.04.01.00 173ab61bb75d85095306f12cdc58f265 *mmwave_dfp_06_04_01_00_win32.exe

Table 11: SW identification of IWR6243

2.2.6 Nomenclature and Identification of Low Power Sensor IWRL6432

Name	Silicon Rev.	Package	Datasheet
IWRL6432BDBAAMFR	2	FCCSP-102	SWRS298A
IWRL6432BDBAAMF			

Table 12: HW identification of IWRL6432

Name	Date	SW	Remarks
xWRL6432 (60GHz) RFS Patch Firmware	2023-12-17	RAM: 7.2.0.0	9f5064f88cd39507c6c42a3000844e3b
FECSSLib Library and Source code	2023-10-29	RAM: 3.1.8.1	07868b8a4920043d4148a55d79dfcf27
mmWaveLink Library and Source code	2023-01-10	RAM: 3.2.0.3	80878bd71a914a3049d823c9283c7acb
xWRL6432 ROM	2023-05-10	RBL 03.02.02.04	Binary delivered as part of the xWRL6432 device

Table 13: SW identification of IWRL6432

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3   Certification Requirements

The certification of the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 will be according to the regulations and standards listed in clause 4 of this document. This will certify the successful completion of the following test segments.

I.   Functional Safety including
- Functional safety management (FSM) and safety lifecycle
- Avoidance of systematic faults / Systematic capability
- Hardware safety requirements (including assumptions of use)
- Analysis of the device structure (IP/Element FMAs)
- Software Safety Requirements
- Analysis of the device structure (IP FMAs)
- Dependent Failure Analysis (DFA)
- Criteria for coexistence of elements
- Quantitative analysis of the hardware (FMEDA)
- Fault injection and simulation
- Hardware functional test and design verification
- Hardware qualification
- Software functional test and design verification
- Development tool qualification

II.   Safety information in the product documentation (safety manual, user manual, installation and operating instructions).

III.   Product-Related Quality Assurance in Manufacture and Product Development

Certification is dependent on successful completion of all above listed test segments. The testing follows the basic certification scheme for Safety Components of TÜV SÜD Rail GmbH.

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3.1 Certification Documentation

The detailed technical evaluation is documented in the most recent version of the Technical Report:

Document No.	Description	Project No.
TD97859T	Technical Report IWR1843 Hardware	717518286
TD95756T	Technical Report DFP 01.02.06.03 Software	717518286
TD97629T	Technical Report IWR2243 Hardware	717518286
TD97177T	Technical Report DFP 02.02.03.01 Software	717518286
TD96309T	Technical Report IWR6843 Hardware	717518286
TD96416T	Technical Report DFP 06.03.02.01 Software	717518286
TD99097T	Technical Report IWR6843AoP Hardware	717524791
TD99824T	Technical Report IWR6243 Hardware	717524911
TD99840T	Technical Report DFP 06.04.01.00 Software	717524911
TD103559T	Technical Report IWRL6432 Hardware	717528833
TD103711T	Technical Report DFP Software	717528833
TD103712T	Technical Report RBL Software	717528833
Safety related requirements, conditions and restrictions can be found in the following user documentation		
-	xWR_Front_End_Sensor_Safety_Manual.pdf, v1.09	717524911
-	xWR_Single_Chip_Sensor_Safety_Manual.pdf, v1.99	717524791
-	xWRLx432_FSM(SFFS613)_v1.0	717528833

Table 14: Technical Reports and User Documents

Based on the specified purpose of use of the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 in safety critical applications, the certification is based on the set of standards listed in clause 4 of this document. The issuance of the certificate states compliance with these references unless specifically noted otherwise.

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4 Standards and Guidelines

The regulations and guidelines which form the basis of the type testing are listed below.

4.1 Functional Safety Standards

No.	Reference	Description
/N1/	IEC 61508-1:2010 (SIL 2, Systematic Capability 3)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
/N2/	IEC 61508-2:2010 (SIL 2, Systematic Capability 3)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/ programmable electronic safety-related systems
/N3/	IEC 61508-3:2010 (SIL 3)	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements

Table 15: Functional safety standards

4.2 Safety Information in the Product Documentation (safety manual, operating instructions, labelling)

No.	Reference	Description
/N4/	IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems

Table 16: Safety information standards

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4.3 Quality Management System

No.	Reference	Description
[M1]	QMS	Quality Management System TÜV SÜD Rail GmbH
	TR_RA_P_04.50	Test Program Functional Safety TR_RA_P_04.51 Definition Scope of testing TR_RA_P_04.07 Product Modification TR_RA_P_04.52 Concept Phase & Safety Lifecycle TR_RA_P_04.53 Detail Phase Hardware TR_RA_P_04.54 Detail Phase Software TR_RA_P_04.55 Safety Manual TR_RA_P_04.56 Result of Testing
[M2]	D-IS-11190-01-00	DAkkS accreditation according to DIN EN ISO/IEC 17020:2012; inspection body type A
[M3]	D-PL-11190-08-00	DAkkS accreditation according to DIN EN ISO 17025:2018 / EN ISO/IEC 17025:2017

Table 17: **Quality Management System**

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5 Results

5.1 Functional Safety

The tests performed and quality assurance measures implemented by Texas Instruments Incorporated have shown that the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 complies with the tailored testing criteria specified in clause 4 subject to the conditions defined in clause 6.

The RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 was proven to meet the systematic capability for SIL 3 according to IEC 61508. The RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 provides safety mechanisms implemented on-chip and safety mechanisms to be implemented by the system integrator. By using the different safety mechanisms, the Safety MCUs can be used to support safety functions up to SIL 2 in accordance with IEC 61508:2010.

6 Implementation Conditions and Restrictions

The use of the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 in a safety related application shall comply with the safety manual, and the following implementation and installation requirements have to be followed if the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 is used in safety-related systems:

- The guidelines and requirements specified in the user documentation shall be followed. Especially the requirements of the system integration section of the safety manual have to be regarded.
- The impact on the overall safety concept and the safety function has to be well understood and analyzed if a safety mechanism described in the safety manual is not used.
- All safety mechanisms implemented by the system integrator have to be developed and verified according to the targeted safety standards.
- All specific characteristics and behaviors of the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 required by the final safety function have to be developed and verified according to the targeted safety standards. This includes also timing aspects like reaction times, test intervals or test execution times.
- The system integrator has to understand the conditions and restrictions defined in the documentation of the RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432.

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7 Certificate Number

This report specifies technical details and implementation conditions required for the application of RADAR ASIC IWR1843, IWR2243, IWR6243, IWR6843, IWR6843AoP, IWRL6432 to the certificate:

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Munich, 2024-10-04

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