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Report

on the

Certificate

Z10 084753 0006 Rev. 00

of the

Software Tool
LDRA tool suite

Applicant

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Modification History

Rev.	Status	Date	Author	Modification / Description
1.0	-	2013-08-28	Martin Braun	initial, version 9.2.0, 9.3.0
1.1	-	2014-04-23	Martin Braun	new SW version 9.4.x
1.2	-	2015-01-14	Martin Braun	editorial
1.3	-	2015-05-12	Martin Braun	Additional consideration of IEC 62034
1.4	-	2016-09-30	Walter Schlögl	New features, bug fixes, new tool LDRAlite, new versions 9.5.0, 9.5.1, 9.5.2, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7
1.4.1	-	2016-09-30	Claudio Gregorio	Correct certificate number (typo)
1.4.2	-	2016-10-20	Walter Schlögl	Minor Modifications / Clarifications
1.4.3	-	2016-10-21	Walter Schlögl	Minor Modifications (IEC 62304)
1.5	-	2017-01-30	Walter Schlögl	Update to version 9.5.8
1.6	-	2017-04-24	Walter Schlögl	Update to version 9.6.0
1.7	-	2017-12-21	Walter Schlögl	Update to version 9.7.0 and 9.7.1
1.8	-	2018-07-31	Walter Schlögl	Update to version 9.7.2 and 9.7.3
1.9	-	2018-08-02	Walter Schlögl	Correction of some typos
1.10	-	2018-10-15	Walter Schlögl	Update to version 9.7.4
1.11	-	2019-08-19	Walter Schlögl	Inclusion of versions 9.7.5, 9.7.6 and 9.7.7 Update to ISO 26262:2018
1.12	-	2020-04-16	Walter Schlögl	Inclusion of versions 9.7.8, 9.8.0, 9.8.1, 9.8.2 and 9.8.3
2.0	-	2021-02-10	Walter Schlögl	Inclusion of versions 9.8.4, 9.8.5 New report format
2.1	active	2022-09-01	Walter Schlögl	Inclusion of versions 9.8.6, 9.8.7, 9.8.8, 9.8.9, 10.0.2 and 10.0.3

Table 1: Modification history

1 Target of Evaluation (ToE)

In December 2012 the company LDRA Ltd. assigned TÜV SÜD for testing and certifying of the Source Code Testing Tools package “LDRA tool suite“ according to ISO 26262 series, IEC 61508 series and EN 50128.

In April 2014, the certification has been extended to cover the new version 9.4.0 of the tools.

In May 2015, the certification has been extended to cover also the medical standard IEC 62304.

In September 2016, the certification has been extended to cover a new tool (LDRAlite) and new versions (9.5.0, 9.5.1, 9.5.2, 9.5.3, 9.5.4, 9.5.5, 9.5.6, 9.5.7) of the tools. The related TÜV SÜD project number is 717513309.

In January 2017, the certification has been extended to cover the new version 9.5.8 of the tools. The related TÜV SÜD project number is 717513765.

In April 2017, the certification has been extended to cover the new version 9.6.0 of the tools. The related TÜV SÜD project number is 717514134.

In December 2017, the certification has been extended to cover the new versions 9.7.0 and 9.7.1 of the tools. The related TÜV SÜD project numbers are 717514134 (version 9.7.0) and 717515487 (version 9.7.1).

In July 2018, the certification has been extended to cover the new versions 9.7.2 and 9.7.3 of the tools. The related TÜV SÜD project number is 717516466.

In October 2018, the certification has been extended to cover the new version 9.7.4 of the tools. The related TÜV SÜD project number is 717517783.

In August 2019, the certification has been extended to cover the new versions 9.7.5, 9.7.6 and 9.7.7 of the tools. Furthermore, the second edition of ISO 26262 (ISO 26262:2018) was included in the certification. The related TÜV SÜD project numbers are 717517810 and 717518719.

In February to April 2020, the certification has been extended to cover the versions 9.7.8, 9.8.0, 9.8.1, 9.8.2 and 9.8.3 of the tools. The related TÜV SÜD project number is 717519782.

In February 2021, the certification has been extended to cover the versions 9.8.4 and 9.8.5 of the tools. The related TÜV SÜD project number is 717522106.

In July to September 2022, the certification has been extended to cover the versions 9.8.6, 9.8.7, 9.8.8, 9.8.9, 10.0.2 and 10.0.3 of the tools. The related TÜV SÜD project number is 717525150.

The ToE is a software test and verification tool suite for source code analysis and testing within C/C++, Java, Ada and Assembler development.

The testing comprised the requirements for tools according to IEC 61508, EN 50128, IEC 62304 and ISO 26262.

2 Scope of Testing

2.1 System overview

The LDRA tool suite provides both static and dynamic software analysis, in addition to unit testing as well as compliance management.

The functional scope of certification is referring to the tool suites' functionality of static analysis, dynamic analysis, unit testing as well as compliance management. This is how the tool suite is organized, licensed and utilised by most customers. The most concise description of these functionalities is provided by the licensing documentation.

LDRA tool suite primary functionalities in the scope of certification:

- Code Review (Programming Standards Checking)
- Quality Review (Code Assessment Metrics)
- Design Review (Data Flow Analysis, Code Documentation & Graphical Visualisation)
- Test Verification (Statement, Branch/Decision, Modified Condition/Decision Coverage, LCSAJ Coverage/Test Path Coverage, Procedure/Function Call Code Coverage Metrics)
- Unit Testing (Automatic Test Harness Generation, Automatic Test Stub Generation and Test Documentation Reporting)
- Compliance management (objectives linkage to analysis results)

The LDRA tool suite can be used to perform code review, code coverage and unit testing before and during deployment on the target. The LDRA tool suite exercises the code, generating test cases and confirming code coverage down to the assembly level in a test environment.

2.2 Test Specimen

2.2.1 LDRA tool suite

LDRA Testbed provides the core static and dynamic analysis engines. LDRA Testbed utilises LDRA's own proprietary parsing engine and provides test and metrics reporting.

TBrun provides a GUI-driven interface for creating unit and module test cases for either host or target-based software. Test harnesses (wrapper code) are automatically generated. TBrun also supports the creation of stubs for code that is outside the scope of the tests.

TBvision presents code standard violations and software flaws in the context of the original source code. The interactive environment, enabling the execution of both static and dynamic analysis on a user-defined scope, allows switching between reported violations, the original source code and any of the LDRA Testbed supported coding standards. TBvision presents the identified software flaws and identifies the issues that need to be addressed to ensure that a software project meets its objectives.

TBmanager adds a task-oriented management capability providing a common user experience across all LDRA tool suite modules and across the development team that aggregates verification results and data as the individual verification tasks are assigned and executed.

2.2.2 Standalone products

LDRARules is a Programming Standards checking component.

LDRACover is a Code Coverage analysis component.

LDRAUnit is a Unit Test only component.

LDRALite is a plugin to check compliance against coding standards.

The capabilities of the standalone programs are covered equally by the LDRA tool suite but offering a standalone product provides more degrees of freedom to customers who need to accomplish the tasks in their own specific way.

The standalone products are built from the same code base as the components of the LDRA tool suite. Depending on the functionalities of the Tool Suite Component and the standalone tool, different subsets of the code base are used for the build, so the programs are not identical.

The relations between the tools are documented in the table below:

Standalone Product Name	Related LDRA tool suite Component
LDRARules	TBvision
LDRACover	TBvision
LDRAUnit	TBrun
LDRALite	TBvision

Table 2: Standalone products

LDRArules functionality in the scope of certification:

- Code Review (Programming Standards Checking)
- Quality Review (Code Assessment Metrics)
- Design Review (Data Flow Analysis, Code Documentation & Graphical Visualisation)

LDRACover functionality in the scope of certification:

- Test Verification (Statement, Branch/Decision, Modified Condition/Decision Coverage, LCSAJ Coverage/Test Path Coverage, Procedure/Function Call Code Coverage Metrics)

LDRAUnit functionality in the scope of certification:

- Unit Testing (Automatic Test Harness Generation, Automatic Test Stub Generation and Test Documentation Reporting)
- Test Verification (Statement, Branch/Decision, Modified Condition/Decision Coverage, LCSAJ Coverage/Test Path Coverage, Procedure/Function Call Code Coverage Metrics)

LDRALite functionality in the scope of certification:

- Code Review (Programming Standards Checking)

2.3 Nomenclature and Identification of LDRA tool suite

Table 4 shows the valid releases and their build numbers for every tool component under certification in the LDRA tool suite.

For releases after 9.2.0 there are additional components named LDRAcover, LDRARules and LDRAunit, and from 9.5.5 onwards for LDRAlite.

The build no. has the format: "00<short year e.g. 13><month number e.g. 06><day e.g. 17>".

Re-lease	LDRA Testbed	TBrun	TBvision	TBmanager	LDRAcover	LDRARules	LDRAunit	LDRAlite
9.2.0	00130111	00130111	00130111	00130111				
9.3.0	00130524	00130524	00130524	00130524	00130524	00130524	00130607	
9.4.0	00131001	00131001	00131001	00131001	00131001	00131001	00131001	
9.4.1	00131018	00131018	00131018	00131018	00131018	00131018	00131018	
9.4.2	00131118	00131118	00131118	00131118	00131118	00131118	00131118	
9.4.3	00140122	00140122	00140122	00140122	00140122	00140122	00140122	
9.5.0	00150522	00150522	00150522	00150522	00150522	00150522	00150522	
9.5.1	00150822	00150822	00150822	00150822	00150822	00150822	00150822	
9.5.2	00151015	00151015	00151015	00151015	00151015	00151015	00151015	
9.5.3	00151029	00151029	00151029	00151029	00151029	00151029	00151029	
9.5.4	00160218	00160218	00160218	00160218	00160218	00160218	00160218	
9.5.5								00160314
9.5.6	00160513	00160513	00160513	00160513	00160513	00160513	00160513	00160513
9.5.7	00160801	00160801	00160801	00160801	00160801	00160801	00160801	00160801
9.5.8	00161118	00161118	00161118	00161118	00161118	00161118	00161118	00161118
9.6.0	00170313	00170313	00170313	00170313	00170313	00170313	00170313	00170313
9.7.0	00170613	00170613	00170613	00170613	00170613	00170613	00170613	00170613
9.7.1	00170929	00170929	00170929	00170929	00170929	00170929	00170929	00170929
9.7.2	00171215	00171215	00171215	00171215	00171215	00171215	00171215	00171215
9.7.3	00180419	00180419	00180419	00180419	00180419	00180419	00180419	00180419
9.7.4	00180806	00180806	00180806	00180806	00180806	00180806	00180806	00180806
9.7.5	00181219	00181219	00181219	00181219	00181219	00181219	00181219	00181219
9.7.6	00190225	00190225	00190225	00190225	00190225	00190225	00190225	00190225
9.7.7	00190307	00190307	00190307	00190307	00190307	00190307	00190307	00190307
9.7.8	00190501	00190501	00190501	00190501	00190501	00190501	00190501	00190501
9.8.0	00190530	00190530	00190530	00190530	00190530	00190530	00190530	00190530
9.8.1	00190724	00190724	00190724	00190724	00190724	00190724	00190724	00190724
9.8.2	00191002	00191002	00191002	00191002	00191002	00191002	00191002	00191002
9.8.3	00191224	00191224	00191224	00191224	00191224	00191224	00191224	00191224
9.8.4	00200625	00200625	00200625	00200625	00200625	00200625	00200625	00200625
9.8.5	00201113	00201113	00201113	00201113	00201113	00201113	00201113	00201113
9.8.6	00210505	00210505	00210505	00210505	00210505	00210505	00210505	00210505
9.8.7	00211001	00211001	00211001	00211001	00211001	00211001	00211001	00211001
9.8.8	00211110	00211110	00211110	00211110	00211110	00211110	00211110	00211110
9.8.9	00220615	00220615	00220615	00220615	00220615	00220615	00220615	00220615
10.0.2	00211202	00211202	00211202	00211202	00211202	00211202	00211202	00211202
10.0.3	00220509	00220509	00220509	00220509	00220509	00220509	00220509	00220509

Table 3: SW Identification of LDRA tool suite

3 Certification Requirements

The certification of the LDRA tool suite 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
 - Applied safety development process
 - Analysis of the software
 - Verification and validation procedures/activities
 - Functional tests

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

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.

3.1 Certification Documentation

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

Document No.	Description	Project No.
LW84924T	Technical Report	717525150
Safety related requirements, conditions and restrictions can be found in the following user documentation		
LDRA_User_Handbook	Safety Manual / Installation Manual	-

Table 4: Technical Report

Based on the specified purpose of use of the LDRA tool suite in safety critical process 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.

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	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
/N2/	IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements
/N3/	EN 50128:2011	Railway applications -- Communication, signalling and processing systems -- Software for railway control and protection systems
/N4/	ISO 26262-2:2018	Road vehicles — Functional safety — Part 2: Management of functional safety
/N5/	ISO 26262-6:2018	Road vehicles — Functional safety — Part 6: Product development at the software level
/N6/	ISO 26262-8:2018	Road vehicles — Functional safety — Part 8: Supporting processes
/N7/	IEC 62304:2006 + AMD1: 2015 ¹	Medical device software - Software life-cycle processes

Table 5: Functional safety standards

4.2 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_04.54 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 6: Quality Management System

¹ Was approved by other testing services

5 Results

5.1 Functional Safety

The tests performed and quality assurance measures implemented by the LDRA Ltd. have shown that the LDRA tool suite complies with the testing criteria specified in clause 4 subject to the conditions defined in clause 6 and is suitable for use in safety-related development.

LDRA tool suite, classified as T2 off-line tool according to IEC 61508-4:2010, are suitable to be used in safety-related development according to IEC 61508:2010 for any SIL.

LDRA tool suite is qualified to be used in a standard-conform development process according to ISO 26262:2018 for any ASIL.

LDRA tool suite is suitable to be used in safety-related software development according to EN 50128:2011 for any SIL.

LDRA tool suite is suitable to be used in safety-related software development according to IEC 62304:2006+A1:2015 for any software safety class.

6 Implementation Conditions and Restrictions

The use of the LDRA tool suite shall comply with the current versions of the safety parts of the user documentation, and the following implementation and installation requirements have to be followed if the LDRA tool suite is used in safety-related application development.

- The user documentation shall be carefully read and understood.
- The guidelines and requirements specified in the user documentation shall be followed. Only modules certified for safety-related development shall be used.
- When using the LDRA tool suite, special care has to be taken on dependency to other parts of the used overall tool chain and development restrictions like coding style and compiler settings. Without additional measures as a minimum the following restrictions apply:
 - Testing has to be performed with the same build options active as used for the final product.
 - Compiler language extensions need to be examined to see if there is any possibility that they could affect the ability of the tool to perform its tasks.
 - When using the static analysis tool, special care has to be taken about which options and settings are used.

The tool suite provides the user with an interface which allows them to select whether or not header files are to be expanded and which header files are to be selected.

By default, LDRA Testbed will expand include files which are included by quotation marks where the include file is located in the same directory as the source file.

By default, *LDRA Testbed* does not analyze any <system> includes e.g. #include <stdio.h>, the user has to select “Expand all” in Static Analysis Options – System Include Search.

- In order to achieve a low TCL value (acc. ISO 26262), appropriate measures have to be applied in testing and verification. This is in the responsibility of the application tester.
- The LDRA tool suite has been qualified to ISO 26262 up to ASIL D. Customers however may qualify tool components for specific execution environments for ASIL D.

7 Certificate Number

This report specifies technical details and implementation conditions required for the application of LDRA tool suite to the certificate:

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Munich, 2022-09-01

Gert Effenberger
(Technical Certifier)