Rational. Rhapsody

IBM

IBM® Rational® Rhapsody® TestConductor Add On

IBM Rational Rhapsody TestConductor Add On Safety Manual

Version 1.11

IBM®

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1. Purpose

This document serves as a brief safety manual when using IBM Rational Rhapsody TestConductor Add On (1) for testing activities in a model based development process when developing safety-related software. It complements the documents

- TÜV SÜD Certificate for IBM Rational Rhapsody TestConductor Add On (2). The official certificate that IBM Rational Rhapsody TestConductor Add On is qualified to be applied in safety-related software development according to ISO 26262 **(6),** IEC 61508 **(7),** IEC 62304 **(11)**, and EN 50128 **(12)**.

- TÜV SÜD Report to the Certificate for IBM Rational Rhapsody TestConductor Add On (3). Provides results of the independent testing and certification of IBM Rational Rhapsody TestConductor Add On.

- IBM Rational Rhapsody TestConductor Add On Reference Workflow Guide (4). It provides information how to safely use IBM Rational Rhapsody TestConductor Add On when performing model-based testing of safety-related software developed with IBM Rational Rhapsody.

- IBM Rational Rhapsody Reference Workflow Guide (5). The document focuses on the UML model-based development and testing of safety-related software with IBM Rational Rhapsody including automatic code generation. To discuss the requirements, available methods, solutions, and tools a so-called IBM Rational Rhapsody Reference Workflow is used.

The subsequent sections provide additional information for installing and using IBM Rational Rhapsody TestConductor Add On in safety-related projects.

The main objective for providing all the information as available in the IBM Rational Rhapsody TestConductor Add On standard documentation (e.g. IBM Rational Rhapsdody TestConductor Add On User Guide (8)), the above mentioned documents, and this safety manual is to enable users to work with this model-based testing tool in safety-related projects according to the constraints as defined in IEC 61508, IEC 62304, EN 50128 or ISO 26262. Users shall assess if the provided information addresses all project specific concerns. Also it is important to asses if users can directly leverage from the performed IBM Rational Rhapsody TestConductor Add On tool qualification, or if they have to perform additional qualification activities, e.g. to address customer specific environmental conditions regarding hardware and software.

2. Introduction

IBM Rational Rhapsody TestConductor Add On has been certified by an independent certification body according to ISO 26262 **(6)**, IEC 61508 **(7)** Edition 2.0, IEC 62304 **(11)**, and EN 50128 **(12)**. In order to safely use IBM Rational Rhapsody TestConductor Add On it is mandatory to understand

- which features of IBM Rational Rhapsody TestConductor Add On have been certified. More information about this can be found in section Certified Features of IBM Rational Rhapsody .

- which features of IBM Rational Rhapsody TestConductor Add On have not been certified. More information about this can be found in section Other Features of IBM Rational Rhapsody .

- Installation considerations. More information about this can be found in section .

- additional guidelines for using IBM Rational Rhapsody TestConductor Add On for such purpose. More information about this can be found in section Guidelines for using IBM Rational Rhapsody .

The approach for the certification process and the meaning of the certificate in particular for end users is described in detail in the TÜV SÜD Report to the Certificate for IBM Rational Rhapsody TestConductor Add On (3).

3. Certified Features of IBM Rational Rhapsody TestConductor Add On

The IBM Rational Rhapsody Reference Workflow Guide **(5)** describes model-based development including automatic code generation and model-based testing methods. **Figure 1** shows the general elements of processes following this reference workflow. The outline addresses design and implementation together with appropriate test and verification aspects.
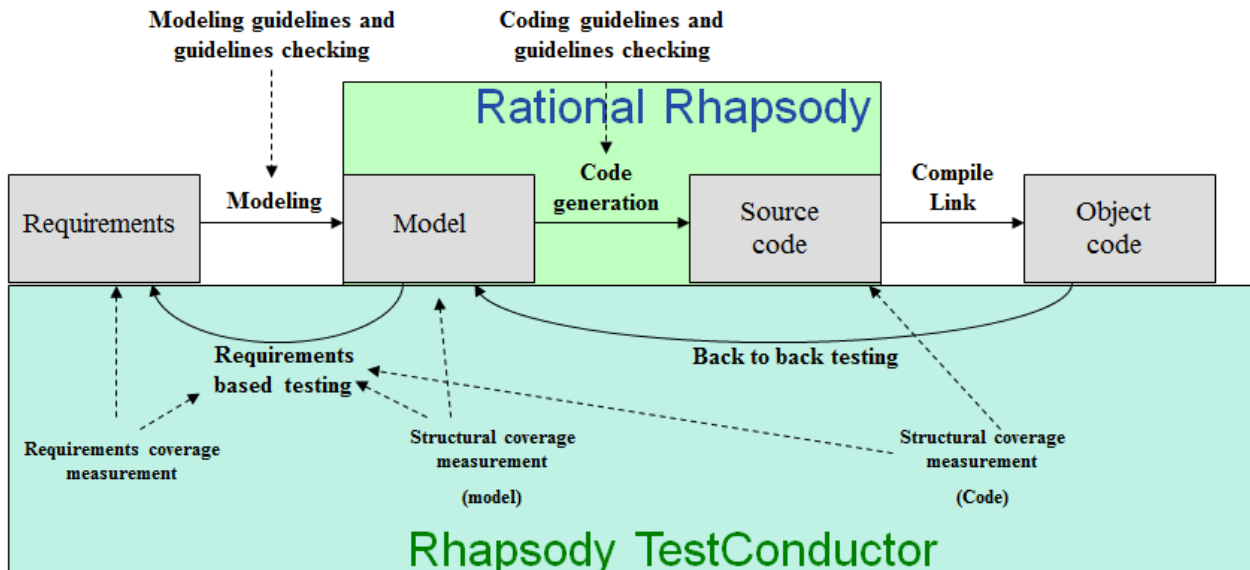

Figure 1: IBM Rational Rhapsody Reference Workflow

The IBM Rational Rhapsody Reference Workflow shows in particular some relevant IBM Rational Rhapsody TestConductor Add On workflow steps:

- Requirements based testing: this workflow step comprises the features test architecture creation, test definition, test execution, and result reporting and verification.
- Requirements coverage: this workflow step comprises the requirements coverage feature of IBM Rational Rhapsody TestConductor Add On.
- Model coverage: this workflow step comprises the model coverage feature of IBM Rational Rhapsody TestConductor Add On.
- Back to back testing: this workflow step comprises the back to back testing feature of IBM Rational Rhapsody TestConductor Add On.
- Code coverage: this workflow step comprises the code coverage feature of IBM Rational Rhapsody TestConductor Add On.

More information about these IBM Rational Rhapsody TestConductor Add On features can be found in the IBM Rational Rhapsody TestConductor Add On User Guide (8) and in the IBM Rational Rhapsody TestConductor Add On Code Coverage Limitations document (9).

In order to perform the above listed workflow steps users run and execute specific IBM Rational Rhapsody TestConductor Add On features. Technically these IBM Rational

Rhapsody TestConductor Add On features have been certified such that they can be safely used to go through the above explained testing workflow. **Figure 2** shows a mapping between those workflow steps and the specific IBM Rational Rhapsody TestConductor Add On features as certified by the TÜV SÜD Product Service GmbH, Germany (see " the TÜV SÜD report "Report to the Certificate Z10 13 09 81878 002" for IBM Rational Rhapsody TestConductor Add On, Table 1 "Use case- and certification-relevant features of IBM Rational Rhapsody TestConductor Add On").

TestConductor Workflow Steps	Description	Certified TestConductor Features (see "Report to the Certificate", Table 1 "Use case- and certification-relevant features of TestConductor")
Requirements based testing	Testing the design model or the implementation code on the basis of the given requirements	Support of the UML Testing Profile
		Modeling of test architectures & test cases
		Execution of test cases and complete test suites (interactive & batch)
		Result reporting and result verification
Requirements coverage	Computing the coverage of the requirements for a given set of test cases	Linking of requirements to model elements & test cases to support traceability
Model coverage	Computing the coverage of the model for a given set of test cases	Model coverage computation
Back to back testing	Generated object code is verified by executing the same set of test cases as for the verification of the model, and performing an equivalence check of the test results	Back-to-back testing between different modeling stages (MiL, SiL, PiL)
Code coverage	Computing the coverage of the code for a given set of test cases	Code coverage computation

Figure 2: Mapping between IBM Rational Rhapsody TestConductor Add On workflow steps and the specific IBM Rational Rhapsody TestConductor Add On features as certified by the TÜV SÜD Product Service GmbH, Germany.

4. Other Features of IBM Rational Rhapsody TestConductor Add On

IBM Rational Rhapsody TestConductor Add On provides other features for test specification, test execution, and test reporting in addition to the certified features. These additional features do not play a significant role in the safety-related reference workflow context, and consequently have not been certified. These non-certified features have been developed following IBM's standard quality assurance processes. Users wanting to use the non-qualified features in context can do so provided they complete an individual qualification of those features if they want to use them in such context.

5. Installation Considerations

As the IBM Rational Rhapsody TestConductor Add On installation is part of the standard IBM Rational Rhapsody installation, the IBM Rational Rhapsody TestConductor Add On version is always correct for the version of IBM Rational Rhapsody that is installed. When choosing to install IBM Rational Rhapsody TestConductor Add On, the whole installation procedure is fully automated and does not require further user interaction. After installation has been completed, IBM Rational Rhapsody TestConductor Add On can be used without further configuration or modification.

6. Guidelines for using IBM Rational Rhapsody TestConductor Add On

6.1 IBM Rational Rhapsody Reference Workflow

IBM Rational Rhapsody TestConductor Add On certification has been performed on top of the mentioned IBM Rational Rhapsody TestConductor Add On Reference Workflow, as described in (4). The IBM Rational Rhapsody TestConductor Add On Reference Workflow complements the IBM Rational Rhapsody Reference Workflow that focuses on the model based development with IBM Rational Rhapsody in safety-related projects, as described in (5). End users have to assess if their workflow is substantially similar to the reference workflow. If this is the case, then IBM Rational Rhapsody and IBM Rational Rhapsody TestConductor Add On can be applied safely by following the recommended process, methods, and rules as described in those documents. If end user processes deviate from the reference workflow, then additional measures have to be carried out in order to understand if there is additional risk, and how such risk can be minimized, when applying IBM Rational Rhapsody and IBM Rational Rhapsody TestConductor Add On.

6.2 IBM Rational Rhapsody Editions, Target Programming Language, Development Platforms, Code Generation Settings

IBM Rational Rhapsody supports different editions (e.g. IBM Rational Rhapsody Software Architect Edition, IBM Rational Rhapsody Developer Edition), different target programming languages (e.g. C, C++) and different code generation profiles (e.g. MicroC, SXF, SMXF).

IBM Rational Rhapsody TestConductor Add On has been certified for:

- IBM Rational Rhapsody Software Architect Edition and for IBM Rational Rhapsody Developer Edition

- for the target programming languages C and C++

- for the code generation profiles SXF, MicroC and SMXF.

For other Editions, target languages, development platforms, and profiles IBM Rational Rhapsody TestConductor Add On has not been certified. A more detailed description about the supported combinations of IBM Rational Rhapsody editions, etc. can be found in IBM Rational Rhapsody TestConductor Add On Validation Suite (10).

6.3 IBM Rational Rhapsody TestConductor Add On Validation Suite

Note: the IBM Rational Rhapsody TestConductor Add On Validation Suite is an optional component of the kit.

The certification has been achieved by developing and applying a validation suite for IBM Rational Rhapsody TestConductor Add On. The validation suite verifies correct functioning of IBM Rational Rhapsody TestConductor Add On for several combinations of IBM Rational Rhapsody Editions, target languages, and profiles. Another dimension is the used hardware, operating system versions, and compilers. The validation suite is comprised of a set of detailed feature specifications, test specification, and test scripts. A more detailed description of the validation suite and the certified features can be found in (10).

If end users perform their model-based development on other hardware and software configurations, then there is additional risk added. In order to mitigate such risk it is an option to execute the IBM Rational Rhapsody TestConductor Add On validation suite on such a configuration in order to assess the quality of the hardware and software configuration. The IBM Rational Rhapsody TestConductor Add On validation suite will be provided to IBM Rational Rhapsody TestConductor Add On users on request in order to verify correct functioning of IBM Rational Rhapsody TestConductor Add On features in customer specific environments.

The IBM Rational Rhapsody TestConductor Add On Validation Suite is not part of the IBM Rational Rhapsody TestConductor Add On installation. For each Rhapsody major release an appropriate IBM Rational Rhapsody TestConductor Add On Validation Suite is available. IBM Rational Rhapsody TestConductor Add On customers can get access to the validation suite through this link:

https://www.ibm.com/services/forms/preLogin.do?source=swg-rhp8tstcdtr

The IBM Rational Rhapsody TestConductor Add On Validation Suite is delivered as a password protected zip file. A valid IBM Rational Rhapsody TestConductor Add On license is needed to unzip it. The IBM Rational Rhapsody TestConductor Add On Validation Suite can be opened with the function

"Rhapsody->Tools->TestConductor->Help->Open Report to the Certificate".

After invoking this function the tool displays a password to the user. This password should be used to unzip the file.

Further distribution of the unprotected IBM Rational Rhapsody TestConductor Add On Validation Suite is strictly prohibited.

7. Appendix A: List of Figures

8. Appendix B: List of references

1. *IBM Rational Rhapsody TestConductor AddOn.* [Online] http://www-01.ibm.com/software/awdtools/rhapsody/.

2. *TÜV SÜD Certificate for IBM Rational Rhapsody TestConductor Add On,*

   No. Z10-16-02-81878-003. 2016.

3. *TÜV SÜD Report to the Certificate for IBM Rational Rhapsody TestConductor Add On,*

   No. IW84460C-1.3.1. 2016.

4. *IBM Rational Rhapsody TestConductor Add On Reference Workflow Guide.*

5. *IBM Rational Rhapsody Reference Workflow Guide.*

6. *Road vehicles – Functional Safety, International Organization for Standardization, ISO 26262,* 2011.

7. *Functional safety of electrical/electronic/programmable electronic safety-related systems, IEC 61508, Edition 2.0.* 2010.

8. *IBM Rational Rhapsody TestConductor Add On User Guide.*

9. *IBM Rational Rhapsody TestConductor Add On Code Coverage Limitations.*

10. *IBM Rational Rhapsody TestConductor Add On Validation Suite.*

11. *Medical device software – Software life cycle processes, IEC 62304 Edition 1.0,* 2006.

12. *Railway Applications: Software for Railway Control and Protection Systems, EN 50128,*

    2011.