



RPCT Verification Instruction Manual

RadICS

(Radiy FSC — FPGA-based Safety Controller)

Document D11.7

Version V5, Revision R3

April 2024

CONFIDENTIAL INFORMATION

Contents

1	Introduction	6
1.1	Overview	6
1.2	Scope and Purpose of this Document	6
1.3	References	7
1.4	Product Documents Referenced by this User Manual	8
1.5	Terms and Abbreviations.....	8
2	Overview of ROVT and verification of RPCT outputs	10
2.1	Nuclear Perspective for RPCT Outputs Verification	10
2.2	IEC 61508 Perspective of RPCT Outputs Verification	12
2.3	RPCT Outputs Verification Procedure Brief Description	13
2.4	Notation in this UM.....	14
3	Installation and Setup of ROVT	16
3.1	Hardware and Operating System Requirements.....	16
3.2	Software and Libraries Required.....	16
3.3	Installation and removing of ROVT on a Windows Platform.....	16
4	Brief description of ROVT workareas	17
4.1	Start Window	17
4.2	Project Setup Workarea	19
4.3	Review Summary Workarea.....	21
4.4	Settings Workarea.....	24
4.4.1	Reports settings	26
4.4.2	Static Analysis settings.....	27
4.4.3	Names length settings.....	28
4.4.4	Naming convention settings	29
4.4.5	Items usage settings.....	31
4.4.6	Calculation complexity settings	32
4.5	Main Menu	33
5	Possible ROVT workflows	35
5.1	Creating new verification project	35
5.2	Saving verification project.....	36
5.3	Closing verification project	36
5.4	Opening previously saved verification project.....	37
5.5	Set specific rules for the verification project.....	37
5.6	Generating verification reports	37
5.7	Multi-user reports review	38
5.8	RPCT projects builds comparison	39
6	Description of ROVT outputs	40
6.1	Compilation results report	40
6.1.1	Build date and ID check	40
6.1.2	Build errors and warnings check	41
6.1.3	Binary file size and checksum check.....	42
6.1.4	LM Resource Consumption check	42
6.2	Tuning signals report	43
6.3	Hardware equipment report	44
6.4	User Application Logic report.....	46
6.5	Build comparison report	51
6.6	Dependencies report	53

7	Static analysis of RPCT outputs	55
7.1	Build integrity check	55
7.2	Consistency check	56
7.3	Usage check of Exceptional pinouts of AFBs	57
7.4	Usage check of Pinouts and Parameters	58
7.5	Check of Correct Signal Type at AFB pinouts	59
7.6	Check of undefined AFB usage	60
7.7	Check of Tuning Values	61
7.8	Analysis of Potential Loopbacks	61
7.9	Resource usage check	62
7.10	Static analysis rules check	63
7.11	Binary translation check	65
7.12	AFB Number call check	65
7.13	AFB Configuration number check	66
7.14	AFB Input connection number check	67
7.15	Multiple use of the same signal check	67
8	Verifying RPCT outputs using ROVT	69
9	UAL unit testing with RPCT	70
9.1	Signal override (no script)	71
9.2	Signal override (script)	72
9.3	Tests tab	75
9.4	Simulator Console	75
9.5	Simulation script design	77
9.5.1	Functions of the common part	78
9.5.2	Methods of the custom part	80
9.6	Simulation test approaches	82
10	Testing with TestSuite	88
10.1	Writing universal test scripts	88
10.2	Observation of test script execution	90
11	Revision History	95

Figures

Figure 2-1	Safety Life Cycle Concept	10
Figure 2-2	Adaptation of the UAL Life-Cycle	11
Figure 4-1	ROVT Start Workarea	17
Figure 4-2	ROVT Software Information Workarea	18
Figure 4-3	ROVT Project Setup Workarea	20
Figure 4-4	ROVT Review Summary Workarea	21
Figure 4-5	ROVT Review Reports Window	23
Figure 4-6	ROVT Program Settings Workarea	24
Figure 4-7	ROVT Reports Settings	26
Figure 4-8	ROVT Static Analysis Settings	27
Figure 4-9	ROVT Names Length Settings	28
Figure 4-10	ROVT Naming Convention Settings	29
Figure 4-11	Items Usage Settings Components	31
Figure 4-12	Calculation Complexity Settings Components	32
Figure 5-1	General Algorithm of ROVT Workflows	35
Figure 6-1	Compilation Report Date and ID Information	41

Figure 6-2 Compilation Report Warning Messages.....	41
Figure 6-3 Compilation Report Warning Message	42
Figure 6-4 Compilation Report Files Properties Comparison.....	42
Figure 6-5 Compilation Report Resources Usage.....	43
Figure 6-6 Tuning Report Header	43
Figure 6-7 Tuning Report Signals Properties.....	44
Figure 6-8 Tuning Report Static Analysis Results.....	44
Figure 6-9 Equipment Report Header	45
Figure 6-10 Equipment Channel Properties	45
Figure 6-11 Equipment Static Analysis	45
Figure 6-12 User Application Logic Report Header.....	46
Figure 6-13 Optical Connections Part.....	46
Figure 6-14 Application Logic Inputs	47
Figure 6-15 Application Logic Internals.....	47
Figure 6-16 Application Logic Outputs	48
Figure 6-17 Application Logic AFB	49
Figure 6-18 Application Logic Execution Sequence List.....	50
Figure 6-19 Application Logic Static Analysis Part	51
Figure 6-20 Application Logic Metrics.....	51
Figure 6-21 Delta Report Example	52
Figure 6-22 Dependencies Report: Branches Section.....	53
Figure 6-23 Dependencies Report: Impact Section	54

Tables

Table 1-1 Version information.....	7
Table 1-2 Reference Standards and Technical Reports	7
Table 1-3 Reference Documents	8
Table 4-1 Start workarea components.....	18
Table 4-2 Actions workplace components	20
Table 4-3 Reports list columns	22
Table 4-4 Review Summary Workarea workplace components.....	22
Table 4-5 Settings buttons list.....	25
Table 4-6 Reports Settings	26
Table 4-7 Static analysis settings options	27
Table 4-8 Names length settings menu	29
Table 4-9 Naming convention settings menu.....	30
Table 4-10 Items usage settings menu	31
Table 4-11 Calculation complexity settings menu	33
Table 4-12 Main menu structure	33
Table 7-1 Build integrity check results	55
Table 7-2 Consistency check results	56
Table 7-3 Exceptional pinouts of AFBs usage check results.....	57
Table 7-4 Pinouts and parameters usage check results	58
Table 7-5 Signal type at AFB pinouts check results	59
Table 7-6 Undefined AFB usage check results.....	60
Table 7-7 Tuning values check results.....	61
Table 7-8 Potential loopback analysis results	62
Table 7-9 Resources usage check results	62

Table 7-10 Names length check results	63
Table 7-11 Naming convention check results	63
Table 7-12 Items usage check results.....	64
Table 7-13 Calculation complexity check results	64
Table 7-14 Binary translation check results	65
Table 7-15 AFB number call check results	66
Table 7-16 AFB configuration number check results	66
Table 7-17 Input connection number check results	67
Table 7-18 Signal multiple use check results.....	68