



# **TetraMAX II ADV ATPG Fault Coverage Report and Test Vectors Tool Safety Guide**

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N-2017.09

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# Contents

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Contents.....	2
Accessing SolvNet .....	3
Contacting the Synopsys Technical Support Center.....	3
1 Scope of This Document .....	4
2 Glossary .....	6
Terms and Definitions .....	6
3 Method .....	8
Process to Achieve Confidence in the Use of Software Tools .....	9
Detailed Overview of Part 8 Clause 11 .....	9
4 Guide to Obtaining Confidence in the Use of the TetraMAX II ADV Fault coverage report.....	12
Step 1: Prerequisites.....	12
Step 2: General Requirement .....	13
Step 3: Validate the Predetermined Tool Confidence Level.....	13
Implications of, and Rationale for, TCL1 .....	14
Step 4: Plan and Verify the Usage of the Fault coverage report and Test Vector Data .....	14
Step 5: Ensure that the TetraMAX II ADV is used in Compliance with the Safety Manual.....	15
Step 6: Completing the Work Products .....	15
5 References .....	16
A Software Tool Criteria Evaluation Report for Using the TetraMAX II ADV Fault coverage report and test vector data: Template.....	17
Prerequisites (P8C11.3).....	18
General Requirement (P8C11.4.1) .....	18
Planning and Verification of the Use of the TetraMAX II ADV Fault coverage report and test vector data (P8C11.4.4 and P8C11.4.3) .....	19
Compliance with the Safety Manual (P8C11.4.3) .....	20
Revision Requirements.....	20

*Customer support is available through SolvNet online customer support and through contacting the Synopsys Technical Support Center.*

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SolvNet includes an electronic knowledge base of technical articles and answers to frequently asked questions about Synopsys tools. SolvNet also gives you access to a wide range of Synopsys online services, which include downloading software, viewing Documentation on the Web, and entering a call to the Support Center.

To access SolvNet:

Go to the SolvNet Web page at <http://solvnet.synopsys.com/>.

If prompted, enter your user name and password. (If you do not have a Synopsys user name and password, follow the instructions to register with SolvNet.)

If you need help using SolvNet, click SolvNet Help in the Support Resources section.

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## Contacting the Synopsys Technical Support Center

If you have problems, questions, or suggestions, you can contact the Synopsys Technical Support Center in the following ways:

- Open a call to your local support center from the Web by going to <http://solvnet.synopsys.com/> (Synopsys user name and password required), then clicking “Enter a Call to the Support Center.”
- Send an e-mail message to your local support center.
  - E-mail [support\\_center@synopsys.com](mailto:support_center@synopsys.com) from within North America.
  - Find other local support center e-mail addresses at <http://www.synopsys.com/Support/GlobalSupportCenters>.
- Telephone your local support center.
  - Call (800) 245-8005 from within the continental United States.
  - Call (650) 584-4200 from Canada.
  - Find other local support center telephone numbers at <http://www.synopsys.com/Support/GlobalSupportCenters>.

# Scope of This Document

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*This document assists the end user of the execution of the TetraMAX II ADV tool to fulfill the requirements of the ISO 26262 standard if the tool is used in the development of a safety-critical component. This assistance implies achieving confidence in the use of the compilation tool in the TetraMAX II ADV tool, as defined in ISO 26262 - Part 8, Clause 11.*

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This document assists with creating confidence in the use of the fault coverage report and test vector data generated by the TetraMAX II ADV tool. TetraMAX II ADV ATPG is used to generate test vector data that are instrumental in the identification of a properly-functioning (safety critical) component. The fault coverage report for these test vector data establishes a metric for the thoroughness of these tests. Thus, the fault coverage report requires qualification according to the ISO 26262 standard. The TetraMAX II ADV Tool contains other features that are not part of the compilation tool. The IDE is an example of this. These other features are not safety critical and are not qualified under ISO 26262.

The main goals of the present guidelines are to ensure that the following are satisfied:

- The requirements of the ISO 26262 safety standard for ASIL D as defined by the standard
- The restrictions posed on the use of the fault coverage report and test vector data resulting from the qualification of the Tool, which are described in the fault coverage report and test vectors *Safety Manual*

Confidence in the use (as defined by the ISO 26262 standard) of the fault coverage report and test vector data is achieved by:

- Verifying the pre-defined Tool Confidence Level (TCL) for the fault coverage report and test vector data
- Compliance with the restrictions and recommendations in the *Safety Manual* for the fault coverage report and test vector data

The process to achieve the required confidence in the fault coverage report and test vector data are described in this Safety Guide. The results of this process must be documented in the Tool Criteria Evaluation Report for the fault coverage report, of which a template can be found in Appendix A.

The completeness of the process is achieved by tracing the requirements of the ISO 26262 standard to the *Safety Guide* (this document), the *Safety Manual*, and the SGS-TÜV certification of the fault coverage report.

The fault coverage report and test vector data are qualified for the highest safety level, ASIL D. This implies that it can also be used for lower safety levels, if the processes described in this *Safety Guide* are implemented.

This document is structured as follows:

- Chapter 2 has a glossary of terms used.
- Chapter 3 describes the requirements of the ISO 26262 standard for tools and gives an overview of the method used in this guide to comply with The Standard for the use of the fault coverage report and test vector data.
- Chapter 4 has a detailed guide that leads to the creation of the *Software Tool Criteria Evaluation Report* for the fault coverage report and test vector data. This evaluation report is the use-case specific result (“work product”) of Part 8 Clause 11 of the Standard.

# 2

## Glossary

*This section defines technical terms used within this document.*

### Terms and Definitions

Term	Definition
Component	(Part of) an electronic system that implements a function in the vehicle. See also Part 1 of the ISO 26262 standard for the definition. The Standard also refers to elements and items, but for the purpose of this <i>Safety Guide</i> this makes no difference.
TetraMAX II ADV fault coverage report	The compilation tool in the TetraMAX II ADV ATPG Tool
(Potential) error	An error that might occur as a result of using the tool
STAR	Synopsys Technical Action Request. Reports, documents and tracks a product Bug or Enhancement request (called a “B” or “E”). Stored in a CRM database. Well maintained, documented, tracked and monitored comprehensive graphical interface. Web-based access and searches Business Warehouse (BW) allows complex reporting. CRM stores all relevant information and the testcase data is stored in UNIX. CRM is accessible by Synopsys employees, but <i>*not*</i> customers. However, customer contacts are automatically notified when STARs are filed or when status changes. Limited STAR info is displayed on SolvNet for the customer who are associated with the STAR's User Site.
Tool	The TetraMAX II ADV ATPG Tool according to ISO 26262
The Standard	The ISO 26262 <i>Standard for Road Vehicles – Functional Safety</i> (ISO26262)
Test vector data	A set of inputs or test sequences automatically generated by TetraMAX II ADV ATPG that are applied to a digital circuit, The vectors target specific areas of a software design so that automated test equipment (ATE) can accurately distinguish

	between the correct circuit behavior and the faulty circuit behavior.
Tool classification	Determination of the required tool confidence level (TCL)
Tool evaluation	See tool classification
TCL	<p>Tool Confidence Level (ISO 26262): required confidence in the tool when used in the analyzed tool chain</p> <ul style="list-style-type: none"> <li>• TCL1=low confidence required</li> <li>• TCL2=medium confidence required</li> <li>• TCL3=high confidence required</li> </ul>
Use case	An application scenario of the tool



# 3

## Method

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*The goal of this Safety Guide is to assist the application developer with fulfilling the safety requirements for the use of the fault coverage report and test vector data. These requirements are defined by the ISO 26262 standard (ISO 26262), referred to as "The Standard" in the following. This chapter describes the general method used to fulfill the requirements.*

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The process described in this *Safety Guide* is based in Part 8 Clause 11 of The Standard. This clause defines two "Work Products" as its result (in Part 8 Clause 11).

The first work product, the *Software Tool Qualification Report*, describes the qualification process and results for the fault coverage report and test vector data. Synopsys has already qualified the fault coverage report and test vector data internally. The Synopsys qualification process also resulted in the *Safety Manual* for the tool (TMAX-SM). The *Safety Manual* describes how to correctly use the tool for the development of safety-critical components. The Synopsys internal tool development process, the validation activities, and the *Safety Manual* are reviewed (according to Part 8 Clause 11.4.10) by the independent organization SGS-TÜV, for application of the Fault coverage report and test vector data in ASIL D components with Tool Confidence Level 1. The *Safety Manual* and the certificate of SGS-TÜV (SGS-Cert) are included in the documentation of the TetraMAX II ADV ATPG Tool.

So, for the first work product no additional work needs to be done because the qualification of the tool is independent of its actual use, and has already been performed by Synopsys. The only case where the Fault coverage report and test vector data user must create the work product according to ISO26262-8 clause 11.5.2, "Software tool qualification report" is if the Fault coverage report and test vector data user cannot comply with the restrictions and recommendations described in the *Safety Manual*.

The second Work product, the *Software Tool Criteria Evaluation Report for the Fault coverage report and test vector data*, places the Fault coverage report and test coverage data into the actual context of its use. Therefore this second Work Product can only be created when the following are documented:

- What the Component is for which the Fault coverage report and the test vector data is used
- How the tool is used

This has to be done by the developer of the Component.

This *Safety Guide* provides the guidelines by which this second Work product can be created.

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## Process to Achieve Confidence in the Use of Software Tools

The general process to achieve safe use of a software tool is to determine if the tool can handle the specific use case of the tool for the specific Component. This general process is defined in Part 8 Clause 11 of the Standard. For the Fault coverage report and test vector data (the compilation tool in the TetraMAX II ADV ATPG Tool, which is the software tool) this process is simplified because the qualification of the tool has already been performed. What remains is to verify that the actual use case is within the constraints set by the qualification.

The Fault coverage report and test vector data is qualified by SGS-TÜV for ASIL D and a predetermined Tool Confidence Level TCL1. This qualification is confirmed by SGS-TÜV. Using a predetermined confidence level is described in Part 8 Clause 11.4.2.

The process to achieve confidence in the tool requires documentation and confirmation of the predetermined TCL level. Confirmation of TCL level 1 depends on the actual use case of the tool, which has to match the requirements and constraints that are described in the *Safety Manual*.

An important step in the process is to collect some detailed information, including a description of how use the tool is used.

Another step is to implement the requirements of the *TetraMAX II ADV ATPG Safety Manual* (TMAX-SM). This conforms to Part 8 Clause 11.4.3, which requires that the Fault coverage report and test vector data be used within the constraints that follow from the qualification of the compilation tool.

If the predetermined TCL level 1 is confirmed, no additional work is needed to qualify the Fault coverage report and test vector data, as defined in Part 8 Clause 11.4.6.1. If TCL level 1 cannot be met by the actual use because that use is outside the scope of the Safety Manual, the user of the Fault coverage report and test vector data may need to do additional qualification of the Tool. This is not further elaborated in this guide, but it may require setting up a test environment for the tool by the user.

Section 4 provides a detailed guide through the steps that are needed to achieve confidence in the use of the Fault coverage report and test vector data.

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### Detailed Overview of Part 8 Clause 11

The following is an overview of the sub-clauses of Part 8 Clause 11 and how they fit into the process described in this *Safety Guide*. This overview can be used as a reference.

- 11.1 Describes the objectives of Clause 11. The objectives are to determine the applicable TCL, and to create evidence for the suitability of the tool for the task.
- 11.2 Gives an overview and some background to Clause 11.

- 11.3 Describes which inputs are needed before commencing on achieving confidence in the use of the Fault coverage report and test vector data. These inputs are expected to be available from external sources (like the user manuals of the TetraMAX II ADV ATPG Tool from Synopsys), or from previous steps in the safety process.
- 11.4 Establishes the general requirements on the safe use of the Fault coverage report and confirms that these requirements are met.
  - 11.4.1 States the general requirement for when the Fault coverage report and test vector data should comply with Part 8 Clause 11.
  - 11.4.2 Requires checking of the validity of the predetermined TCL 1 if that was established independently of the context of use. For the Fault coverage report and test vector data the TCL is confirmed by SGS-TÜV.
  - 11.4.3 Requires that the use of the software tool must comply with the constraints of its qualification, which are defined in the *Safety Manual* for the Fault coverage report and test vector data.
    - 11.4.4.1 Requires a detailed description of the usage of the Fault coverage report and test vector data including identification of its version number and the environment in which it is used. It also requires a description of how the Fault coverage report and test vector data is qualified.
    - 11.4.4.2 Describes the prerequisite information that is needed for proper use of the Fault coverage report and test vector data.
  - 11.4.5 Determines the TCL of the Fault coverage report and test vector data in the context of its use. Because TCL1 is already predetermined, confirmation that usage of the Tool complies with the requirements of the *Safety Manual* is necessary.
  - 11.4.6 Describes how to choose the Fault coverage report and test vector data qualification method based on the TCL. For the predetermined TCL1, no additional qualification is needed.
  - 11.4.9 Qualification method based on validation of the Fault coverage report and test vector data. Validation must show that the tool complies with its specification; that malfunctions and their consequences are documented. This is one of the qualification methods used for the Fault coverage report and test vector data, which in turn results in the predetermined TCL1.
  - 11.4.10 Requires a review of the predetermined TCL and the method for the qualification of the Fault coverage report and test vector data. It refers back to Part 2 Table 1 of The Standard.
- 11.5 Defines the two work products of Part 8 Clause 11: the Fault coverage report and test vector data criteria evaluation report, which can be created using the guidelines in this *Safety Guide*; and the *Software Tool Qualification Report*, which is not required when the user meets the restrictions and recommendations

described in the *Safety Manual* since the qualification was done by Synopsys and already independently certified by SGS-TÜV.

## Guide to Obtaining Confidence in the Use of the TetraMAX II ADV Fault coverage report

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*This section contains the guide to obtaining confidence in the safe use the fault coverage report and test vector data, as required by Part 8 Clause 11 of the Standard. Following the steps in the guide results in the Tool Criteria Evaluation Report for the fault coverage report and test vector data; this is the use-case-specific product of Part 8 Clause 11.*

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This guide is broken into a number of steps. For each different use of the fault coverage report and test vector data in the Component, and for each different Component, these steps must be repeated.

The results of following the steps must be documented in the *Software Tool Criteria Evaluation Report for the fault coverage report and test vector data* (TMAX-TCER), for which a template can be found in Appendix A of this *Safety Manual*.

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### Step 1: Prerequisites

This step implements Part 8 Clause 11.3 of the Standard.

Obtain the following documents and information and add the relevant information such as title, origin, publication date, and version number in the TMAX-TCER:

- The *Safety Plan* for the Component in accordance with Part 4 Clause 5.5.2 of the Standard. This document is specific for the development of the Component and not part of the TetraMAX II ADV ATPG Tool.
- In the *Safety Plan*, find the prerequisites for the use of the fault coverage report and test vector data according to the safety lifecycle (See Part 3 Clause 6). Verify that these requirements are met.
- Determine the maximum ASIL from the Safety plan.
- The user manuals for the TetraMAX II ADV Tool provided by Synopsys (TMAX-UM).
- The *Safety Manual* for the Fault coverage report and test vector data provided by Synopsys (TMAX-SM).

- The SGS-TÜV Certificate of ISO 26262 Compliance for the fault coverage report and test vector data provided by Synopsys (SGS-Cert).
- Determine, from the *Safety Manual* for the Fault coverage report and test vector data, the system requirements on the (host) computer that is used to run the Fault coverage report and test vector data.

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## Step 2: General Requirement

This step implements Part 8 Clause 11.4.1 of the Standard.

Part 8 Clause 11.4.1.1 states the condition under which the fault coverage report and test vector data must comply to clause Part 8 Clause 11 "Confidence in the use of software tools". The Standard states the following:

If the safety lifecycle incorporates the use of a software tool for the development of a system, or its hardware or software elements, such that activities or tasks required by ISO 26262 rely on the correct functioning of a software tool, and where the relevant outputs of that tool are not examined or verified for the applicable process step(s), such software tools shall comply with the requirements of this clause.

Thus, in the general case where the software issue that is created with the fault coverage report and test vector data becomes part of the Component under development, Part 8 Clause 11 applies. The clause makes an exception if there is a procedure that ensures that no possible tool error remains undetected in the executable.

If Part 8 Clause 11 does not apply, one does not have to create the *Software Tool Criteria Evaluation Report for the fault coverage report* and test vector data and one can stop here. Otherwise, continue with the next step.

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## Step 3: Validate the Predetermined Tool Confidence Level

This step implements Part 8 Clause 11.4.2 and Part 8 Clause 11.4.10 of the Standard, as well as Part 8 Clause 11.4.5-9.

The fault coverage report and test vector data comes with a predetermined Tool Confidence Level of 1 (TCL1) for applications with maximum ASIL D. This level is documented in the *fault coverage report* and test vector data *Safety Manual* (TMAX-SM) and is confirmed by SGS-TÜV. The tool can also be used for a lower maximum ASIL.

For this step, consult Table 1 in Part 2 of the Standard. From the table it follows that, at the highest ASIL D, the required independence of the authority to perform the confirmation review is I1. Independence level I1 is defined as "a different person." Thus, SGS-TÜV, being independent from Synopsys, has the required independence.

## Implications of, and Rationale for, TCL1

The predetermined TCL1 is a low TCL, which implies a high degree of confidence that malfunction of the fault coverage report and test vector data is prevented. As a result, no additional qualification of the fault coverage report and test vector data is needed. However, TCL1 does require that the safety guidelines that follow from the qualification of the tool be followed (see Step 5).

Part 8 Clause 11.4.5 describes how the TCL of a software tool is determined by analysis. In Part 8 Clause 11.4.5.2b, the Tool Error Detection (TD) class is determined. TD1 is used here, because the tool is already qualified by Synopsys, and this qualification is reviewed by SGS-TÜV. Therefore, following the *Safety Manual*, results in a high degree of confidence that malfunction of the tool is prevented or detected.

Given TD1, TCL1 follows from Table 3 (at Part 8 Clause 11.4.5.5). Consequently, Part 8 Clause 11.4.6.1 states that no further qualification of the fault coverage report and test vector data is needed.

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## Step 4: Plan and Verify the Usage of the Fault coverage report and Test Vector Data

This step implements Part 8 Clause 11.4.4.1 of the Standard.

### 11.4.4.1a

Print the identification and version number of the TetraMAX II ADV ATPG Tool with the following command and write it down in the TMAX-TCER:

```
report_version -full
```

Verify that the *Safety Manual* for the fault coverage report and test vector data is valid for this installed version of the tool.

### 11.4.4.1b and c

These steps document use cases of the fault coverage report and test vector data. The goal of these steps is to verify that the actual use of the fault coverage report and test vector data falls within the guidelines and constraints that are defined by the *Safety Manual*.

The *Safety Manual* contains a list of tool commands and a list of options for each command that can be used safely.

### 11.4.4.1d

Add the version identification string of the system on which the fault coverage report and test vector data is installed to the TMAX-TCER. The version string can be retrieved on a Linux system with:

```
uname -osr
```

Verify that this version of the system matches with the system requirements that are stated in the *Safety Manual*.

#### 11.4.4.1e

The maximum ASIL of the Component in which the software generated by the fault coverage report and test vector data is used is already determined in Step 1, above. One should verify that the maximum ASIL does not exceed the ASIL for which the fault coverage report and test vector data is qualified. Since the Fault coverage report and test vector data has ASIL D, which is the highest ASIL, this verification is always true.

#### 11.4.4.1f

The methods used to qualify the fault coverage report and test vector data are in accordance with Part 8 Clause 11.4.8 (“Evaluation of the tool development process”) and Part 8 Clause 11.4.9 (“Validation of the software tool”) by Synopsys, and this is verified by SGS-TÜV. Nothing additional needs to be done.

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## Step 5: Ensure that the TetraMAX II ADV is used in Compliance with the Safety Manual

This step implements Part 8 Clauses 11.4.3 and 11.4.4.2 of The Standard.

Verify that the use of the fault coverage report and test vector data complies to the guidelines and constraints of the “fault coverage report and test vector data Safety Manual” (TMAX-SM).

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## Step 6: Completing the Work Products

This step implements Part 8 Clause 11.5 of the Standard.

Following and documenting Steps 1 to 5 in this Safety Guide results in the completion of the Software Tool Criteria Evaluation Report for the fault coverage report and test vector data. Together with the confirmation, by SGS-TÜV, of the fault coverage report and test vector data classification of TCL1, this fulfills the requirements of Part 8 Clause 11 to obtain confidence in the use of fault coverage report and test vector data.



# 5

## References

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*This section contains references for further information.*

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- (ISO26262) International Organization for Standardization. *ISO 26262 Road Vehicles –Functional Safety–*. 1st Edition, 2011-11-15.
- (TMAX) TetraMAX II ADV ATPG Tool.
- (TMAX-SM) *TetraMAX II ADV ATPG fault coverage Safety Manual*.
- (TMAX-TSG) *TetraMAX II ADV ATPG Fault coverage report and test vector data Tool Safety Guide* (this document).
- (TMAX-UM) TetraMAX II ADV User Manuals.
- (SGS-Cert) SGS-TÜV Certificate of ISO 26262 Compliance of the TetraMAX II ADV fault coverage report and test vector data.

# Software Tool Criteria Evaluation Report for Using the TetraMAX II ADV Fault coverage report and test vector data: Template

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## Revision history:

Revised by:	Revision date:	Remarks:	ISO 26262 completed:
			<input type="checkbox"/>
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This *Software Tool Criteria Evaluation Report* is one of the outputs as defined for Clause 11 from Part 8 of The ISO 26262 safety standard. It applies to the following automotive Component:

Description of the Component: \_\_\_\_\_;

and to the following software issue(s) that is (are) generated by the fault coverage report and test vector data for use in that Component:

Description of software issue 1: \_\_\_\_\_

Description of software issue 2: \_\_\_\_\_

Description of software issue 3: \_\_\_\_\_

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### Prerequisites (P8C11.3)

- **(P8C11.3.1)** *Safety Plan* for the Component under construction according to Part 4 Clause 5.5.2:
  - Date and version number: \_\_\_\_\_
  - Title: \_\_\_\_\_
- ☐ **(P8C11.3.1)** Check if the prerequisites on the use of the fault coverage report and test vector data according to the safety lifecycle are met.
- **(P8C11.3.2)** Maximum ASIL of the Component according to the Safety Plan (select one):
  - ASIL A B C D
- **(P8C11.3.2)** *Safety Manual* for the TetraMAX II ADV fault coverage report and test vector data:
  - Date and version number: \_\_\_\_\_
- **(P8C11.3.2)** SGS-TÜV certificate of ISO 26262 compliance for the TetraMAX II ADV fault coverage report and test vector data:
  - Date and version number: \_\_\_\_\_

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### General Requirement (P8C11.4.1)

- ☐ Check if Clause 11 from Part 8 of the Standard applies to the use of the Fault coverage report and test vector data for the Component, in accordance to Part 8 Clause 11.4.1.1.

### Validation of the Predetermined TCL (P8C11.4.2 and P8C11.4.10)

- ☐ Check if the predetermined Tool Confidence Level TCL1 for use the Fault coverage report and test vector data is confirmed based on:
  - The maximum ASIL of the Component as determined under prerequisites above; SGS-TÜV certificate of ISO 26262 compliance of the Fault coverage report and test vector data; Table 1 from Part 2 of the ISO 26262 standard, which defines the required level of independence for the reviewer, SGS-TÜV.

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### Planning and Verification of the Use of the TetraMAX II ADV Fault coverage report and test vector data (P8C11.4.4 and P8C11.4.3)

**(P8C11.4.4.1a)** The identification string and version number of the Fault coverage report and test vector data are: \_\_\_\_\_

- ☐ Check if the Safety Manual (as listed under prerequisites above) applies to this version of the TetraMAX II ADV ATPG Tool.

#### **(P8C11.4.4.1b and c)**

The entries in this section must be repeated for every generated issue that is listed above.

#### **Issue 1**

File system location of the issue or script that governs the generation of Issue 1:

\_\_\_\_\_

Date and/or version of last modification of the issue or script: \_\_\_\_\_

File system location of the reference output from the generation of Issue 1:

\_\_\_\_\_

Date and/or version of last modification of the reference output file:

\_\_\_\_\_

List the commands and options that are used to generate the fault coverage report and test vector data. If the same command is used multiple times with different options, it must be listed multiple times:

Command	Options	Remarks

- 
- 
- ☐ Check if the command and option combinations are listed in the Safety Manual.

**(P8C11.4.4.1e)**

- ☐ Check if the ASIL of the Components (listed above) is lower than or equal to the maximum ASIL that is specified in the *Safety Manual* for the TetraMAX II ADV Fault coverage report and test vector data.

**(P8C11.4.4.1f)**

No additional information needed; see the SGS-TÜV certificate of ISO 26262 compliance of the TetraMAX II ADV fault coverage report and test vector data.

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**Compliance with the Safety Manual (P8C11.4.3)**

For this requirement to complete, check each and every one of the requirements and constraints of the Safety Manual.

- ☐ Check if the use of the TetraMAX II ADV fault coverage report and test vector data is in accordance to the requirements and constraints of the *Safety Manual* for the Fault coverage report and test vector data.

**(P8C11.4.10)** Review of the Software Criteria Evaluation Report for the TetraMAX II ADV fault coverage report and test vector data by a reviewer of I1 independence (different person from the author):

Date: \_\_\_\_\_

Reviewer: \_\_\_\_\_

Signature: \_\_\_\_\_

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**Revision Requirements**

This completes the Tool Criteria Evaluation Report for the TetraMAX II ADV fault coverage report and test vector data. At any change or update of the tool itself, the system on which the tool is installed, the use of the tool, the scripts to generate the fault coverage report and test vector data, the *Safety Plan*, or any other relevant item, this report must be revised.