Document Title	Requirements on TTCAN
Document Owner	AUTOSAR
Document Responsibility	AUTOSAR
Document Identification No	441
Document Classification	Auxiliary
Document Version	1.2.0
Document Status	Final
Part of Release	4.1
Revision	2

Document Change History			
Date	**Version**	**Changed by**	**Change Description**
31.10.2013	1.2.0	AUTOSAR Release Management	• Adopted new RS_Feature document nameEditorial changes • Editorial changes
31.01.2013	1.1.0	AUTOSAR Administration	• Formal Update regarding TPS_StandardizationTemplate_535 • Editorial Change • Traceability of BSWAndRTE_Features
07.12.2009	1.0.0	AUTOSAR Administration	Initial Release

Disclaimer

This specification and the material contained in it, as released by AUTOSAR, is for the purpose of information only. AUTOSAR and the companies that have contributed to it shall not be liable for any use of the specification.

The material contained in this specification is protected by copyright and other types of Intellectual Property Rights. The commercial exploitation of the material contained in this specification requires a license to such Intellectual Property Rights.

This specification may be utilized or reproduced without any modification, in any form or by any means, for informational purposes only.
For any other purpose, no part of the specification may be utilized or reproduced, in any form or by any means, without permission in writing from the publisher.

The AUTOSAR specifications have been developed for automotive applications only. They have neither been developed, nor tested for non-automotive applications.

The word AUTOSAR and the AUTOSAR logo are registered trademarks.

Advice for users

AUTOSAR specifications may contain exemplary items (exemplary reference models, "use cases", and/or references to exemplary technical solutions, devices, processes or software).

Any such exemplary items are contained in the specifications for illustration purposes only, and they themselves are not part of the AUTOSAR Standard. Neither their presence in such specifications, nor any later documentation of AUTOSAR conformance of products actually implementing such exemplary items, imply that intellectual property rights covering such exemplary items are licensed under the same rules as applicable to the AUTOSAR Standard.

Table of Contents

- AUTOSAR confidential -

1 Scope of document

This document specifies the additional TTCAN requirements for the CAN BSW stack.

2 How to read this document

Each requirement has its unique identifier starting with the prefix "BSW" (for "Basic Software"). For any review annotations, remarks or questions, please refer to this unique ID rather than chapter or page numbers!

2.1 Conventions used

- The representation of requirements in AUTOSAR documents follows the table specified in [6].

- In requirements, the following specific semantics are used (taken from Request for Comment RFC 2119 from the Internet Engineering Task Force IETF)

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119. Note that the requirement level of the document in which they are used modifies the force of these words.

- MUST: This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
- MUST NOT: This phrase, or the phrase „SHALL NOT", means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
- MAY: This word, or the adjective „OPTIONAL", means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation, which does not include a particular option, MUST be prepared to interoperate with another implementation, which does include the option, though perhaps with reduced functionality. In the same vein an implementation, which does include a particular option, MUST be prepared to interoperate with another implementation, which does not include the option (except, of course, for the feature the option provides.)

3 Acronyms and abbrevations

Acronym:	Description:
CAN	Controller Area Network
TTCAN	Time Triggered CAN

Document ID 441:AUTOSAR_SRS_TTCAN

4 Requirements Specification

4.1 Functional requirements

This chapter describes functional requirements that shall be fulfilled to support TTCAN. Only requirements are listed that are additional with respect to the CAN requirements [3].

4.1.1 TTCAN support

4.1.1.1 [SRS_TtCan_41001] The CAN stack shall support TTCAN according to ISO11898.

[

Type:	Valid
Description:	The CAN stack shall additionally support part 4 of ISO11898 Time-triggered communication [7]. TTCAN level 1 and level 2 shall be supported.
Rationale:	--
Use Case:	Time triggered communication, Event synchronized time triggered communication
Dependencies:	--
Supporting Material:	ISO11898-4:2004 [7], RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01744)

4.1.2 CAN Driver with TTCAN functionality

4.1.2.1 Configuration

4.1.2.1.1 [SRS_TtCan_41003] The Hardware Object Handles shall be mappable to all types of time windows defined in ISO 11898 by configuration.

[

Type:	Valid
Description:	The hardware objects (SRS_Can_01039 CAN SRS) shall be mappable to the specific time windows defined in ISO 11898-4:2004. The configuration parameters shall be allowed to be of types Pre-Compile-Time, Link-Time or Post-Build-Time.
Rationale:	A Hardware object shall be configurable to transmit or receive messages in a specific time window.
Use Case:	See Rationale.
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01560)

4.1.2.1.2 [SRS_TtCan_41014] Configuration interfaces defined in ISO 11898-4:2004 shall be configurable.

[

Type:	Valid
Description:	The "configuration interfaces" of chapter 10 of ISO 11898-4:2004 shall be

	configurable. The configuration parameters shall be allowed to be of types Pre-Compile-Time.
Rationale:	Parameters like e.g. "operation mode" , "master/slave", "trigger" etc. need to be configured.
Use Case:	See Rationale.
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01744)

4.1.2.1.3 [SRS_TtCan_41004] The "Appl_Watchdog_Limit" (see chapter 10.1.2.7 of ISO 11898-4:2004) shall be configurable.

⌈

Type:	Valid
Description:	Activation of "Application_Watchdog" needs to be configured. The configuration parameter shall be allowed to be of type Pre-Compile-Time, Link-Time or Post-Build-Time.
Rationale:	See description
Use Case:	--
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01464)

4.1.2.2 Normal Operation

4.1.2.2.1 [SRS_TtCan_41005] The CAN Driver with TTCAN functionality shall provide means for influencing timing parameters and providing information from the TTCAN controller for synchronization purposes.

⌈

Type:	Valid
Description:	Timing parameters, synchronization state and master state (see ISO 11898-4:2004 for details) shall be provided by the CAN Driver with TTCAN functionality. If a TTCAN controller is timing master, it shall be possible to adjust the timing parameters during runtime (see ISO 11898-4:2004 for details).
Rationale:	Synchronizing application with communication if required
Use Case:	See Rationale.
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01432)

4.1.2.2.2 [SRS_TtCan_41006] The CAN Driver with TTCAN functionality shall support the event synchronized time-triggered communication.

⌈

Type:	Valid
Description:	Event-Synchronized communication (see chapter 5.2.3 of ISO 11898-4:2004) shall be supported.
Rationale:	Synchronizing communication with external events.
Use Case:	See Rationale.
Dependencies:	--

Supporting Material:	RS Features: RS_BRF_00312 [5]

](RS_BRF_01432)

4.1.2.2.3 [SRS_TtCan_41007] The CAN Driver with TTCAN functionality shall indicate occurred events according to chapter 10.2.2 "Interrupt_Status_Vector" of ISO 11898-4:2004.

[

Type:	Valid
Description:	The events which will be supported by ISO 11898-4 shall be available to application if needed.
Rationale:	See description
Use Case:	Application can react on occurred events.
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

](RS_BRF_01328)

4.1.2.3 Fault Operation

4.1.2.3.1 [SRS_TtCan_41008] The CAN Driver with enabled TTCAN functionality shall provide a notification for severe error (S3).

[

Type:	Valid
Description:	The CAN Driver with TTCAN functionality shall notify the CAN Interface with TTCAN functionality if the TTCAN Controller enters error level S3 (Severe Error, see ISO 11898-4:2004 [7]). The notification is done by call of static (non-configurable) callback function implemented inside the CAN Interface with TTCAN functionality.
Rationale:	see ISO 11898-4:2004 [7]
Use Case:	Any state transition is notified to the CAN Interface with TTCAN functionality which forwards this notification to the responsible upper layer.
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

](RS_BRF_02168)

4.1.2.3.2 [SRS_TtCan_41009] The CAN Driver with TTCAN functionality shall not recover from severe error (S3) automatically.

[

Type:	Valid
Description:	The severe error (S3, see ISO 11898-4:2004 [7]) recovery shall be software driven.
Rationale:	see ISO 11898-4:2004 chapter 9 Failure handling [7]
Use Case:	See Rationale
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

](RS_BRF_02168)

4.1.3 CAN Interface with TTCAN functionality

4.1.3.1 [SRS_TtCan_41010] A Job List shall be configurable.

[

Type:	Valid
Description:	It shall be configurable Pre-Compile-Time and per controller, whether a Job List shall be available.
Rationale:	Handling of BasicCAN hardware objects
Use Case:	--
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01592)

4.1.3.2 [SRS_TtCan_41011] If a Job List is available (see SRS_TtCan_41010) it shall be executed by a separate Job List Execution Function.

[

Type:	Valid
Description:	The Job List Execution Function shall be called in task or interrupt context.
Rationale:	Handling of BasicCAN hardware objects
Use Case:	--
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01592)

4.1.3.3 [SRS_TtCan_41012] "Time Marks" (see ISO 11898-4:2004 [7]) shall be configurable Pre-Compile-Time.

[

Type:	Valid
Description:	The "Time Marks" of ISO 11898-4:2004 shall be configurable.
Rationale:	--
Use Case:	--
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01744)

4.1.3.4 [SRS_TtCan_41013] An occurred severe error (S3) shall be processed as a BusOff (see SRS_Can_01029 of CAN SRS)

[

Type:	Valid
Description:	Severe Error (see ISO 11898-4:2004 [7]), Handling and recovery is the same as for BusOff events.
Rationale:	The required behaviour for an occured severe error (see ISO 11898-4_2004 [7]) is the same as the AUTOSAR BSW behaviour of a detected BusOff.
Use Case:	--
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

⌋(RS_BRF_01640)

4.2 Non-functional requirements

4.2.1 CAN dependence

4.2.1.1 [SRS_TtCan_41002] The additional TTCAN components shall be integrated into the CAN stack.

[

Type:	Valid
Description:	TheCAN stack shall be extended by additional APIs, type definitions and functionality to support TTCAN.
Rationale:	TTCAN completely uses the CAN stack. The CAN stack shall not be available twice (code optimization).
Use Case:	--
Dependencies:	--
Supporting Material:	RS Features: RS_BRF_00312 [5]

](RS_BRF_01744)

5 References

5.1 Deliverables of AUTOSAR

[1]   **[Ttcan]** Specification of TTCAN Driver
        AUTOSAR_SWS_TTCANDriver.pdf

[2]   **[Ttcanlf]** Specification of TTCAN Interface
        AUTOSAR_SWS_TTCANInterface.pdf

[3]   **[SrsCan]** Requirements on CAN
        AUTOSAR_SRS_CAN.pdf

[4]   **[SrsGeneral]** General Requirements on Basic Software Modules
        AUTOSAR_SRS_BSWGeneral.pdf

[5]   **[RS_Features]**   Requirements   on   AUTOSAR   Features,
        AUTOSAR_RS_Features.pdf

[6]   **[TPS_STDT_0078]** Software Standardization Template
        AUTOSAR_TPS_StandardizationTemplate.pdf

5.2 Related standard and norms

[7]   ISO 11898-4 (2004-08-01), Road vehicles – Controller Area Network (CAN)
        Part4: Time triggered communication