# COM

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| * **SRS**: Xác định cái gì cần phải được thực hiện. * **SWS**: Mô tả làm thế nào để thực hiện cái đã được xác định trong SRS.  1. ***AUTOSAR COM (Communication):***  * AUTOSAR COM là một giao thức truyền thông được sử dụng để trao đổi dữ liệu giữa các thành phần phần mềm (SW-C) trong cùng một ECU (Electronic Control Unit) hoặc giữa các ECU khác nhau. * Nó cung cấp một cách tiếp cận tiêu chuẩn để gửi và nhận dữ liệu, giúp đảm bảo tính tương thích và khả năng tái sử dụng giữa các thành phần phần mềm khác nhau. * AUTOSAR COM hỗ trợ cả truyền thông trong cùng một ECU (Internal Communication) và giữa các ECU (External Communication) thông qua các giao thức khác như CAN, FlexRay, Ethernet, v.v.  1. ***LargeDataCOM:***  * LargeDataCOM là một phần mở rộng của AUTOSAR COM, được sử dụng để truyền dữ liệu lớn (Large Data) giữa các thành phần phần mềm. * Khi dữ liệu cần truyền tải quá lớn so với khả năng truyền thông thông thường của AUTOSAR COM, LargeDataCOM sẽ được sử dụng để chia nhỏ dữ liệu thành các gói dữ liệu nhỏ hơn, sau đó truyền tải từng gói một cách độc lập. * LargeDataCOM cung cấp cơ chế đảm bảo tính toàn vẹn và đồng bộ hóa dữ liệu sau khi tất cả các gói dữ liệu đã được nhận đầy đủ. * Nó giúp giải quyết vấn đề giới hạn kích thước bộ đệm truyền thông và tăng khả năng truyền tải dữ liệu lớn trong hệ thống AUTOSAR. |

## Phạm vi tài liệu

Đặc điểm kỹ thuật sau đây là xác định các yêu cầu chức năng và phi chức năng trên các mô-đun AUTOSAR COM và LargeDataCOM.

Đặc tả Yêu cầu Phần mềm (SRS) này của AUTOSAR COM dựa trên đặc tả OSEK1 COM 3.0.3 [DOC\_OSEK\_COM] và chỉ xác định các tiện ích bổ sung cho đặc tả OSEK này hoặc hành vi khác nhau.

Vị trí của các mô-đun AUTOSAR COM và LargeDataCOM trong toàn bộ AUTOSAR ECU SW Architecture được xác định trong [DOC\_LAYER].

Trọng tâm của tài liệu này là chỉ định:

* Hành vi của AUTOSAR COM và LargeDataCOM
* Giao diện của AUTOSAR COM và LargeDataCOM
* Đầu vào của trình tạo và đầu vào cấu hình của nó
* Các quy tắc để kiểm tra tính nhất quán của đầu vào cấu hình.

Trọng tâm là KHÔNG chỉ định:

* Trình chỉnh sửa và trình kiểm tra quy tắc cho đầu vào của việc triển khai các mô-đun AUTOSAR COM và LargeDataCOM. Tuy nhiên, trình kiểm tra quy tắc phải sử dụng các quy tắc cho cấu hình vào/ra được xác định bởi [DOC\_SWS\_COM] và [DOC\_SWS\_LDCOM].

## Từ viết tắt và viết tắt

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| Kiểu dữ liệu AUTOSAR | See 6.1, section 6.4 |
| I-PDU | Interaction Layer Protocol Data Unit (được lắp ráp và tháo rời trong AUTOSAR COM), bao gồm một hoặc nhiều tín hiệu (xem bên dưới và [DOC\_LAYER]) |
| Nhóm I-PDU | Nhóm I-PDU là một tập hợp tùy ý các I-PDU trong COM |
| LOM | Listen Only Mode |
| L-PDU | Data Link Layer Protocol Data Unit (được lắp ráp và tháo rời trong lớp trừu tượng phần cứng AUTOSAR, xem [DOC\_LAYER]) |
| signal | Một tín hiệu trong ngữ cảnh AUTOSAR COM tương đương với một tin nhắn trong OSEK COM.  Tín hiệu AUTOSAR được thực hiện bởi một hoặc nhiều tín hiệu trong COM. Việc chuyển đổi từ tín hiệu AUTOSAR sang tín hiệu trong COM được thực hiện bởi RTE. Thông thường, việc chuyển đổi giữ nguyên cú pháp của dữ liệu. Tuy nhiên, trong trường hợp kiểu dữ liệu phức tạp, việc chuyển đổi có thể thay đổi cú pháp của tín hiệu. Do đó, tín hiệu trong AUTOSAR COM không phải lúc nào cũng giống với tín hiệu AUTOSAR. |
| Nhóm Tín hiệu | Nhóm tín hiệu đề cập đến một tập hợp các tín hiệu phải luôn được giữ cùng nhau trong một I-PDU chung. Một nhóm tín hiệu được sử dụng để đảm bảo việc truyền nhất quán các kiểu dữ liệu tổng hợp AUTOSAR. Một nhóm tín hiệu có các thuộc tính sau:   * Một tín hiệu có thể thuộc về nhiều nhất một nhóm tín hiệu * Một nhóm tín hiệu không thể thuộc nhiều hơn chính xác một I-PDU * Các nhóm tín hiệu không chồng chéo lên nhau trong I-PDU * Nhóm tín hiệu là một tập hợp các tín hiệu liền kề thuộc nhóm này, Tuy nhiên, có thể có các bit không sử dụng ("lỗ") trong một nhóm. * Các nhóm tín hiệu có thể không chứa tín hiệu ("có thể trống").   Việc nhóm các tín hiệu cho các nhóm tín hiệu được giả định là đầu vào cho quá trình tạo COM. |

## Các quy ước sẽ được sử dụng

* Việc trình bày các yêu cầu trong tài liệu AUTOSAR tuân theo bảng được chỉ định trong [TPS\_STDT\_00078].
* Trong các yêu cầu, ngữ nghĩa cụ thể sau đây sẽ được sử dụng (dựa trên IETF của Lực lượng đặc nhiệm kỹ thuật Internet).

Các từ khóa "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT ", " RECOMMENDED ", " MAY " và " OPTIONAL" trong tài liệu này được hiểu là:

* SHALL: Là một yêu cầu tuyệt đối của đặc điểm kỹ thuật.
* SHALL NOT: Là một sự cấm tuyệt đối của đặc điểm kỹ thuật.
* MUST: Là một yêu cầu tuyệt đối của đặc điểm kỹ thuật do các vấn đề pháp lý.
* MUST NOT: Là sự cấm tuyệt đối đối với đặc điểm kỹ thuật do các ràng buộc pháp lý.
* SHOULD và RECOMMENDED ", có nghĩa là có thể tồn tại các lý do hợp lệ trong các trường hợp cụ thể để bỏ qua một mục cụ thể, nhưng ý nghĩa đầy đủ phải được hiểu và cân nhắc cẩn thận trước khi chọn một khóa học khác.
* SHOULD NOT và NOT RECOMMENDED có nghĩa là có thể tồn tại các lý do hợp lệ trong các trường hợp cụ thể khi hành vi cụ thể được chấp nhận hoặc thậm chí hữu ích, nhưng ý nghĩa đầy đủ cần được hiểu và trường hợp được cân nhắc cẩn thận trước khi thực hiện bất kỳ hành vi nào được mô tả với nhãn này.
* MAY và OPTIONAL: có nghĩa là một mục thực sự là tùy chọn. Một nhà cung cấp có thể chọn bao gồm mặt hàng vì một thị trường cụ thể yêu cầu nó hoặc vì nhà cung cấp cảm thấy rằng nó nâng cao sản phẩm trong khi một nhà cung cấp khác có thể bỏ qua cùng một mặt hàng. Một triển khai, không bao gồm một tùy chọn cụ thể, PHẢI được chuẩn bị để tương tác với một triển khai khác, bao gồm tùy chọn, mặc dù có lẽ với chức năng giảm. Trong cùng một tĩnh mạch, một triển khai, bao gồm một tùy chọn cụ thể, PHẢI được chuẩn bị để tương tác với một triển khai khác, không bao gồm tùy chọn (tất nhiên, ngoại trừ tính năng mà tùy chọn cung cấp.)

### Cấu trúc yêu cầu

Cấu trúc yêu cầu được xác định trong TPS\_StdT\_00077

## Tổng quan về chức năng

AUTOSAR COM và LargeDataCom nằm giữa RTE và PDU Router.

Các tính năng chính của AUTOSAR COM là:

* Cung cấp giao diện dữ liệu định hướng tín hiệu cho RTE
* Điều khiển truyền thông (bắt đầu / dừng các nhóm I-PDU)
* Gửi tín hiệu theo loại truyền như được chỉ định trong đặc điểm kỹ thuật VFB
* Đảm bảo khoảng cách tối thiểu giữa các yêu cầu truyền
* Giám sát tín hiệu nhận (hết thời gian chờ tín hiệu)
* Giám sát xác nhận truyền
* Cơ chế lọc tín hiệu đến
* Cơ chế thông báo khác nhau
* Cung cấp khởi tạo-giá trị và cập nhật-Chỉ báo
* Chuyển đổi độ bền + mở rộng dấu hiệu
* Đóng gói và giải nén tín hiệu AUTOSAR đến I-PDU sẽ được truyền
* Hỗ trợ các kiểu dữ liệu có độ dài lớn và động
* Hỗ trợ các cơ chế sao chép và truy cập I-PDU

Các tính năng chính của AUTOSAR LargeDataCOM là:

* Cung cấp giao diện dữ liệu định hướng tín hiệu chuyên dụng cho RTE
* Hỗ trợ các tín hiệu lớn và động
* Chỉ hỗ trợ một tín hiệu cho mỗi I-PDU
* Chỉ hỗ trợ mảng byte
* Hỗ trợ Giao tiếp IF- và TP

## Đặc điểm kỹ thuật yêu cầu

### Yêu cầu chức năng áp dụng cho AUTOSAR COM và LargeDataCOM

#### Cấu hình

Chương Cấu hình đề cập đến các tham số / chức năng có thể định cấu hình của AUTOSAR COM và LargeDataCOM. Chương này chỉ đề cập đến các yêu cầu cấu hình chung, các yêu cầu về cấu hình của một tính năng duy nhất được xác định trong yêu cầu của chính tính năng đó.

##### [SRS\_Com\_02040] AUTOSAR COM và LargeDataCOM sẽ được cấu hình bằng cách sử dụng XML làm ngôn ngữ cấu hình.

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| ***Type:*** | Valid |
| ***Description:*** | AUTOSAR COM và LargeDataCOM sẽ được cấu hình bằng cách sử dụng XML làm ngôn ngữ cấu hình như được xác định bởi Mẫu cấu hình ECU. Tùy thuộc vào [DOC\_SWS\_COM] và [DOC\_SWS\_LDCOM] để tự xác định các tham số cấu hình. |
| ***Rationale:*** | Có một ngôn ngữ cấu hình duy nhất trong AUTOSAR. |
| ***Use Case:*** | Cấu hình của AUTOSAR COM và LargeDataCOM |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | [[DOC\_ECUC]](#_bookmark76) |

⌋ (RS\_BRF\_01616,RS\_BRF\_01544)

##### [SRS\_Com\_00177] AUTOSAR COM and LargeDataCOM sẽ hỗ trợ nhiều giai đoạn cấu hình

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| ***Type:*** | valid |
| ***Description:*** | AUTOSAR COM và LargeDataCOM sẽ cho phép cấu hình giao tiếp ở các giai đoạn khác nhau sau:   * Pre-Compile-Time * Link Time * Post-build-Time   + Load-able Configuration   + Multiple configuration sets   Các tham số cấu hình phải được tổ chức theo cách có thể thay đổi trong tất cả các giai đoạn khác nhau, ví dụ: một OEM có thể chọn định cấu hình thời gian biên dịch trước trong khi một OEM khác sẽ định cấu hình thời gian sau khi xây dựng.  Tập hợp cụ thể các tham số có thể cấu hình trong trạng thái nào sẽ được xác định trong [DOC\_SWS\_COM]. |
| ***Rationale:*** | Đảm bảo tính linh hoạt của việc sử dụng AUTOSAR COM và LargeDataCOM. |
| ***Use Case:*** | Phải có khả năng cấu hình các khung BUS được xử lý sau thời gian biên dịch hoặc xây dựng, đặc biệt đối với các khái niệm trong tương lai chạy tại BMW (tái sử dụng ECU trong một dòng sản phẩm xe khác với bố cục giao tiếp khác nhau và không tương thích) |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544,RS\_BRF\_01120)

##### [SRS\_Com\_02067] AUTOSAR COM và LargeDataCOM sẽ xác định các quy tắc để kiểm tra tính nhất quán của dữ liệu cấu hình

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| ***Type:*** | valid |
| ***Description:*** | A set of rules needs to be specified that enable the Configuration Editor to reject inconsistent configurations or configurations that cannot be implemented.  These rules shall be defined in the SWS and shall be implemented by the Configuration Editor. |
| ***Rationale:*** | Needed to make sure that the generator only works with correct  configuration files. |
| ***Use Case:*** | The configuration must not contain overlapping signals within one I-PDU. The period of I-PDUs must not be negative. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### Interface between AUTOSAR COM and LargeDataCOM and the lower layer (PDU-Router)

OSEK COM leaves the interface between COM and the lower layers undefined. In AUTOSAR the only lower layer that COM and LargeDataCOM interfaces to is the PDU Router. The interfaces refer to the definitions in [[DOC\_COM\_TYPES](#_bookmark75)]. The requirements are derived from [[DOC\_COM\_TYPES](#_bookmark75)].

##### [SRS\_Com\_02043] AUTOSAR COM and LargeDataCOM shall provide a receive indication function

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| ***Type:*** | Valid |
| ***Description:*** | AUTOSAR COM and LargeDataCOM shall provide a function that is called by the lower layer (PDU-Router) after an I-PDU has been received.  The name of the function has to be Com\_RxIndication for COM and LdCom\_RxIndication for LargeDataCOM. |
| ***Rationale:*** | Basic functionality of a communication layer |
| ***Use Case:*** | Receiving a PDU by the lower layer |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | [[DOC\_COM\_TYPES]](#_bookmark75) |

⌋ (RS\_BRF\_01056,RS\_BRF\_01544)

##### [SRS\_Com\_02044] AUTOSAR COM and LargeDataCOM shall provide a transmit confirmation function

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| ***Type:*** | valid |
| ***Description:*** | AUTOSAR COM and LargeDataCOM shall provide a function that is called by the lower layer (PDU-Router) after an I-PDU has been transmitted on the network.  The name of the function has to be Com\_TxConfirmation for COM and LdCom\_TxConfirmation for LargeDataCom. |
| ***Rationale:*** | Basic functionality of a communication layer |
| ***Use Case:*** | Transmitting a PDU on the network. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | [[DOC\_COM\_TYPES]](#_bookmark75) |

⌋ (RS\_BRF\_01544, RS\_BRF\_01072)

##### [SRS\_Com\_02045] AUTOSAR COM and LargeDataCOM shall provide a function to request the transmit buffer data for lower layer triggered transmission

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| ***Type:*** | Valid |
| ***Description:*** | AUTOSAR COM and LargeDataCOM shall provide a function that is called by the lower layer (PDU-Router) when an I-PDU shall be transmitted. Within this function, AUTOSAR COM and LargeDataCOM shall copy the contents of its I-PDU transmit buffer to the L-PDU buffer given by the calling layer.  The name of the function has to be Com\_TriggerTransmit for COM and LdCom\_TriggerTransmit for LargeDataCOM. |
| ***Rationale:*** | Basic functionality of a communication layer |
| ***Use Case:*** | This function is used e.g. by the LIN Master for sending out a LIN frame. In this case, the trigger transmit can be initiated by the Master schedule table it self or a received LIN header.  This function is also used by the FlexRay Interface for requesting PDUs to be sent in the static part (synchronous to the FlexRay global time). |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | [[DOC\_COM\_TYPES]](#_bookmark75) |

⌋ (RS\_BRF\_01544)

#### Support of Large Data Types

AUTOSAR COM and LargeDataCOM shall support signals larger than the N-PDUs of the underlying busses. For these large signals also a dynamic length shall be supported. The requirements of this chapter define the support of these data types.

##### [SRS\_Com\_02091] AUTOSAR COM and LargeDataCOM shall not support splitting of large signals into different I-PDUs

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| ***Type:*** | Valid |
| ***Description:*** | Large signals supported by AUTOSAR COM and LargeDataCOM shall never be split into different I-PDUs, but it shall be supported that an I-PDU can be split into different N-PDUs |
| ***Rationale:*** | The I-PDU shall be transported by the TP. The TP will work on N-PDU level, and therefore can fragment the I-DPU into a number of N-PDUs |
| ***Use Case:*** | There is no use-case to have fragmentation on I-PDU level. |
| ***Dependencies:*** | SRS\_Com\_02092, SRS\_Com\_02093 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01648, RS\_BRF\_01568,RS\_BRF\_01544)[SRS\_Com\_02094] Dynamic length signals must be of type UINT8[n]

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| ***Type:*** | Valid |
| ***Description:*** | AUTOSAR COM and LargeDataCOM shall only support dynamic length signals of type UINT8[n]. |
| ***Rationale:*** | It would be possible to also add support for bit length dynamical length signals, but this will introduce unnecessary complexity |
| ***Use Case:*** | This restriction is made because actually there is no strong use-case that requires non byte-array data for large signals. |
| ***Dependencies:*** | SRS\_Com\_02091, SRS\_Com\_02092, SRS\_Com\_02093 |
| ***Supporting Material:*** | [[DOC\_OSEK\_GLOS]](#_bookmark83) |

⌋ (RS\_BRF\_01648,RS\_BRF\_01544)

##### [SRS\_Com\_02095] AUTOSAR COM and LargeDataCOM shall use the TP to fragment and reassemble large signals

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| ***Type:*** | Valid |
| ***Description:*** | All large signals must be transported using the TP. Note that large signals does not mean “normal signals” (e.g. UINT8[n] type).  Therefore AUTOSAR COM and LargeDataCOM shall route all large signals via the PduR to the underlying TPs using the PduR’s TP-APIs.  Note: Signals with static length and equal or less length than 8 bytes are transported in L-PDUs on CAN and LIN. In case of CAN FD this range is extended up to 64 bytes. On FlexRay this is valid for signals with length equal to or less than 254 bytes. Also dynamic length signals may be  transported without TP as long as the maximum length does not exceed the bus specific limits. |
| ***Rationale:*** | There is no need to reinvent fragmentation since the existing TP modules already supports this. |
| ***Use Case:*** | For CAN TP it is no problem to have multiple users (DCM and COM) of the TP.  On LIN TP there will be a problem sharing the TP since all TP communication is done through two specific (specified by LIN) frames. A workaround may be to use a specific NAD to differ between diagnostic communication and normal signal communication (containing large signal or dynamic length signal).  For FlexRay TP it is no problem to have multiple users (DCM and COM) of the TP. |
| ***Dependencies:*** | SRS\_Com\_02096 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01648,RS\_BRF\_01544)

##### [SRS\_Com\_02097] AUTOSAR COM and LargeDataCOM shall support dynamical signals with a static maximum length

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| ***Type:*** | Valid |
| ***Description:*** | The maximum length of this type of signal must be set in the configuration |
| ***Rationale:*** | If not given all dynamic length signals can only be considered to be maximum length supported by the used TP and therefore buffers cannot be handled efficient. |
| ***Use Case:*** | If LIN is used and if not maximum length is given, it must be assumed that the dynamical length signal is 4095 bytes. |
| ***Dependencies:*** | SRS\_Com\_02098 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01648,RS\_BRF\_01544)

### AUTOSAR COM specific functional requirements

#### General requirements

##### [SRS\_Com\_02037] AUTOSAR COM module shall be based on the functionality and APIs of OSEK COM 3.0.3

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| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall be based on the functionality and APIs specified in OSEK COM 3.0.3. Specifications not done there, respectively specifications of functionality different from that specified in the above mentioned document shall be defined in the AUTOSAR COM SRS and SWS specifications.  Features of OSEK COM 3.0.3 which are not provided by the AUTOSAR COM module shall be defined in [[DOC\_SWS\_COM]](#_bookmark78). |
| ***Rationale:*** | This SRS is only an add-on to OSEK COM 3.0.3 as an existing standard. |
| ***Use Case:*** | -- |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | [[DOC\_OSEK\_GLOS](#_bookmark83) ], [[DOC\_OSEK\_COM]](#_bookmark84) |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02078] The AUTOSAR COM module shall support endianness conversion

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| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall support endianness conversion for the following data types defined in [[DOC\_SWS\_RTE]](#_bookmark77) Table “C/C++ mapping from primitive” AUTOSAR data-types”  uint16 uint32 sint16 sint32  float32 float64 |
| ***Rationale:*** | ensure end to end data consistency |
| ***Use Case:*** | -- |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | [[DOC\_TPS\_SWC](#_bookmark80)] (Chapter [6.1](#_bookmark74)), [[DOC\_SWS\_RTE]](#_bookmark77) (Chapter [6.1](#_bookmark74)) |

⌋ (RS\_BRF\_01624)

##### [SRS\_Com\_02086] The AUTOSAR COM module shall support sign- extension

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | Sign-Extension means, to map negative values of signed signals correctly, if the bit-size of the signal in an I-PDU received and the bit-size of the signal used in the interface of the receiving software component differ from each other. In this case, the size of the signal received shall be extended to the size of the receiver interface.  The AUTOSAR COM module shall support Sign-Extension for the following data types defined in [[DOC\_SWS\_RTE](#_bookmark77)] Table “C/C++ mapping from primitive”:  sint8 sint16  sint32 |
| ***Rationale:*** | ensure end to end data consistency |
| ***Use Case:*** | -- |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | [[DOC\_TPS\_SWC](#_bookmark80)] (Chapter [6.1](#_bookmark74)), [[DOC\_SWS\_RTE]](#_bookmark77) (Chapter [6.1](#_bookmark74)) |

⌋ (RS\_BRF\_01624)

#### [Initialization](http://dict.leo.org/se?lp=ende&p=/Mn4k.&search=initialization)

##### [SRS\_Com\_02042] The AUTOSAR COM module shall fill unused areas/ bits within an I-PDU with a configurable value

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall fill unused areas/ bits within an I-PDU with a configurable value (e.g. 0xFF).  This value shall be configurable per I-PDU. |
| ***Rationale:*** | Limit impact of a wrong configuration, if a not used area of an I-PDU is wrongly assigned to a signal this can be detected by the application SW component. |
| ***Use Case:*** | For error detection purposes, all data values must be filled with a defined value. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01616,RS\_BRF\_01544)

#### Signal and I-PDU Transmission

This chapter deals with the add-ons to the OSEK COM specification related to signal and I-PDU transmission.

##### [SRS\_Com\_02083] The AUTOSAR COM module shall support multiple transmission modes

⌈

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Type:*** | Valid | | | |
| ***Description:*** | The AUTOSAR COM module shall provide the transmission modes given in the following tabular for each I-PDU. It shows the transmission modes available and a short description of those transmission modes. | | | |
|  | ***Transmission***  ***Modes*** | ***Description*** |  |
| Periodic | Transmissions occur indefinitely with a fixed period  between them. |
| Direct / n-times | Event driven transmission with n-1 repetitions |
| Mixed | Periodic transmission with direct/n-times  transmissions in between |
| None | No transmission |
| ***Rationale:*** | These modes are commonly used by all existing automotive bus systems. | | | |
| ***Use Case:*** | -- | | | |

|  |  |
| --- | --- |
| ***Dependencies:*** | [SRS\_Com\_02082], [SRS\_Com\_02084], [SRS\_Com\_02080] |
| ***Supporting Material:*** | Transmission modes “periodic”, “mixed” are the same as already defined in [[DOC\_OSEK\_COM]](#_bookmark84). See also Use Cases in [[DOC\_OSEK\_GLOS]](#_bookmark83). |

⌋ (RS\_BRF\_01592,RS\_BRF\_01544)

##### [SRS\_Com\_02082] The AUTOSAR COM module shall support defining two different transmission modes for each I-PDU

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall provide the possibility to define two different transmission modes for each I-PDU. This shall also include the situation where only the parameters of a transmission mode are changed,  e.g. different cycle times.  It shall be possible to switch between both Transmission Modes during runtime. |
| ***Rationale:*** | This is commonly used by many existing automotive bus systems. |
| ***Use Case:*** | -- |
| ***Dependencies:*** | SRS\_Com\_02083, SRS\_Com\_02084, SRS\_Com\_02080 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544, RS\_BRF\_01592)

##### [SRS\_Com\_02084] The AUTOSAR COM module shall support a configurable signal data based selection mechanism of the two transmission modes

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | To select one of the two transmission modes, the AUTOSAR COM module shall provide the possibility to attach a condition to each signal within an  I-PDU separately. The possibilities to define those conditions shall be the same as defined in [[DOC\_OSEK\_COM]](#_bookmark84) reception filter algorithms (see [[DOC\_OSEK\_GLOS]](#_bookmark83), Section 2.2.2).  If all conditions defined for signals within one specific I-PDU evaluate to TRUE, one transmission mode shall be used for this I-PDU. In all other cases, the other transmission mode shall be used.  The conditions shall be evaluated immediately every time a related signal or  signal group is sent by RTE and the new transmission request shall be sent using the new transmission mode already. |
| ***Rationale:*** | These modes are commonly used by many existing automotive bus systems. |
| ***Use Case:*** | -- |
| ***Dependencies:*** | SRS\_Com\_02082, SRS\_Com\_02083, SRS\_Com\_02080 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01592, RS\_BRF\_01544)

##### [SRS\_Com\_02113] AUTOSAR COM shall support signal data based transmission modes for configured serialized data

⌈

|  |  |
| --- | --- |
| ***Type:*** | valid |
| ***Description:*** | The functionality of signal data based selection mechanism of the two  transmission modes (see SRS\_Com\_02084) shall also be available when the data is provided via the uint8-array based API (see SRS\_Com\_02112). |
| ***Rationale:*** | When the serialization of the data is done outside of the Com module and the uint8-array representation is passed to Com the transmission modes need to be selected as well. |
| ***Use Case:*** | Usage of transformer with Com-based serialization and Com Interaction to enable the communication with a fixed communication matrix. |
| ***Dependencies:*** | SRS\_Com\_02082, SRS\_Com\_02083, SRS\_Com\_02084, SRS\_Com\_02112 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544, RS\_BRF\_01560, RS\_BRF\_01592, RS\_BRF\_01632)

##### [SRS\_Com\_02080] The AUTOSAR COM module shall cancel outstanding repetitions in case of a new send request

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | A new send request called while existing repetitions are in progress shall cancel those outstanding repetitions and the transmission shall be started  with the new signal/signal group. |
| ***Rationale:*** | These modes are commonly used by many existing automotive bus systems. |
| ***Use Case:*** | -- |
| ***Dependencies:*** | SRS\_Com\_02082, SRS\_Com\_02083, SRS\_Com\_02084 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02046] The AUTOSAR COM module shall support immediate and deferred signal based notification to the RTE

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | It shall be configurable whether the signal based notification to the RTE is done either immediately within the I-PDU RxIndication/ TxConfirmation made by the PduRouter or is deferred to the COM main function context. |
| ***Rationale:*** | To allow unpacking of signals in interrupt and polled modes |
| ***Use Case:*** | Unpacking of signals out of an I-PDU |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | UML diagram:   * Polling Mode only in Com (R3b-R1a-R1a) and * Interrupt mode (R1b-R1a-R1a)   (For decryption of the codes in brackets refer to UML Model) |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02089] The AUTOSAR COM module shall provide two configurable options to handle signal timeouts

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | Receiver-side the AUTOSAR COM module shall provide two (configurable) options if a signal timeout is detected   * Indication to the RTE  AUTOSAR Software Component can use “spare values” * No indication to the RTE |
| ***Rationale:*** | The RTE shall have the opportunity to notify its environment about timeouts or the application shall be provided with a default value to avoid using outdated values. |
| ***Use Case:*** | see rationale |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01600)

#### Signal invalidation

##### [SRS\_Com\_02077] The AUTOSAR COM module shall support invalidation of signals at sender side

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | It shall be possible for the sender side RTE to indicate that it is not able to provide a valid value (e.g. sensor is faulty).  This shall be done by writing a per signal configurable invalid value (outside of the range of the valid values) into the I-PDU which is handled like a valid value in the further processing.  Therefore a special API shall be provided on the sender side AUTOSAR COM module. |
| ***Rationale:*** | The AUTOSAR Software Component shall have (via the RTE) the  opportunity to notify its environment about reduced functionality (e.g. sensor is faulty) |
| ***Use Case:*** | See rationale,  Starting a fail-safe routine if a sensor is broken. |
| ***Dependencies:*** | SRS\_Com\_02079 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02079] The AUTOSAR COM module shall support an optional notification when receiving invalidated data

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | Receiver-side the AUTOSAR COM module shall provide two (configurable) options if a sender indicates that it is not able to provide a valid value   * Indication to the RTE  AUTOSAR Software Component can use “spare values” * No indication to the RTE |
| ***Rationale:*** | The RTE shall have the opportunity to notify its environment about reduced functionality (e.g. sensor is faulty) |
| ***Use Case:*** | See rationale,  Starting a fail-safe routine if a sensor is broken. |
| ***Dependencies:*** | SRS\_Com\_02077, SRS\_Com\_02087 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02087] The AUTOSAR COM module shall support an optional substitution of received invalidated data

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | In case a signal is invalidated on sender-side and the receiver-side is configured in that way, that no indication is given to the upper layer, the AUTOSAR COM module shall substitute the invalid value by the init value. Whether this substitution takes place shall be configurable. |
| ***Rationale:*** | It shall be possible to provide the application with a configurable value in case the signal value received is invalid and no indication is given up to the upper layer. |
| ***Use Case:*** | See rationale |
| ***Dependencies:*** | SRS\_Com\_02077, SRS\_Com\_02079 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02088] The AUTOSAR COM module shall support substituting the last received value by the init value in case of a signal timeout

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | In case a signal timeout is configured in that way, that no indication is given to the upper layer, the AUTOSAR COM module shall substitute the last received value by the init value. Whether this substitution takes place shall  be configurable. |
| ***Rationale:*** | It shall be possible to provide the application with a configurable value in case of a signal timeout and no indication is given up to the upper layer. |
| ***Use Case:*** | see rationale |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01600)

#### I-PDU Groups and Mode Changes

This chapter collects the requirements for the definition and starting/ stopping of I-PDU groups.

##### [SRS\_Com\_02090] The AUTOSAR COM module shall define a data- structure allowing efficiently starting and stopping of I-PDU groups

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall define a data-structure that allows efficiently   * starting and stopping of transmission and reception of multiple I-PDU groups * enabling or disabling the reception deadline monitoring of multiple I-PDU groups   The maximum number of I-PDU groups within one ECU shall be compile time configurable.  Conceptually and per configuration it shall be allowed that one I-PDU group contains arbitrary other I-PDU groups. |
| ***Rationale:*** | To allow efficient mode changes, especially with respect to the AMM/ VMM concept, it is required to change the state of multiple I-PDU groups within one function call to the AUTOSAR COM module.  The arbitrary nesting of I-PDU groups is no problem, since this can be resolved by the configuration tool, thus that each I-PDU only has to store an I-PDU group vector that declares to which I-PDU group it belongs. |
| ***Use Case:*** | AMM/ VMM |
| ***Dependencies:*** | SRS\_Com\_00218, SRS\_Com\_00192 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_00218] The AUTOSAR COM module shall support starting and stopping multiple I-PDU groups during runtime

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall be able to start and to stop sending and receiving for multiple I-PDU groups during runtime.  The corresponding API to this service shall take an I-PDU group vector reflecting the new state as input parameter.  The minimum delay time and deadline monitoring shall be respected for started groups of I-PDUs. It shall be parameter driver if the corresponding timers of the I-PDUs shall be reset or not.  After a reset of the AUTOSAR COM module (normally reset of the ECU) all I-PDUs are stopped per default. |
| ***Rationale:*** | OSEK COM can only start/ stop communication (StartCOM and StopCOM services) as a whole. Such a limitation is too restrictive. |
| ***Use Case:*** | Such configurable groups of I-PDUs provide for example the possibility to disable the transmission of all I-PDUs on a single channel, and enable only their reception (Silent Mode).  Such configurable groups of I-PDUs provide for example the possibility to start/ stop communication per logical channel of a single channel (e.g.  FlexRay applications).  Start sending and receiving on the body domain (e.g. use of the radio and multi-function screen), while powertrain is not still powered on.  Stop the transmission of I-PDUs but not the reception when bus load is too high.  This feature is also needed for Bus Off handling. |
| ***Dependencies:*** | SRS\_Com\_00192, SRS\_Com\_02090 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_00192] The AUTOSAR COM module shall support enabling and disabling reception deadline monitoring of I-PDU groups

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall provide the functionality to enable and disable reception deadline monitoring for multiple configurable I-PDU groups.  The corresponding API to this service shall take an I-PDU group vector reflecting the new state as input parameter.  After a reset of the AUTOSAR COM module (normally reset of the ECU), the configured state (enabled/ disabled) shall be active. |
| ***Rationale:*** | This is needed to suppress wrong error handling in Listen Only Mode (LOM, see use case). It is assumed that at least a second ECU on the same channel is also in LOM and does not provide the expected signals to the  first one. |
| ***Use Case:*** | For the LOM the transmission of all I-PDU groups is switched off, reception (maybe of only one I-PDU group) is still active but without supervision of the reception timeouts (reception deadline monitoring).  For example all ECUs on one channel (e.g. on CAN network) are in LOM, so there are no more periodic send signals on this channel, but the ECU has to be able to receive changes of the ECU state management. |
| ***Dependencies:*** | SRS\_Com\_00218, SRS\_Com\_02090 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

#### Packing signals into I-PDUs

##### [SRS\_Com\_02041] The AUTOSAR module shall handle complex data types as a consistent set of data

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | It is required by AUTOSAR to handle complex data types as a consistent set of data. Therefore, it is necessary to pass the data elements from the  RTE to the AUTOSAR COM module consistently. |
| ***Rationale:*** | AUTOSAR provides complex data types; those have to be sent and received atomically via RTE, COM, etc. |
| ***Use Case:*** | Complex AUTOSAR data types, data consistency of signal groups. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | For guarantee data consistency of complex AUTOSAR data types, signal groups are introduced. For definition of signal group see [[DOC\_TR\_GLOS]](#_bookmark79). |

⌋ (RS\_BRF\_01632,RS\_BRF\_01544)

##### [SRS\_Com\_02112] AUTOSAR COM shall provide a uint8-array based API for signal groups

⌈

|  |  |
| --- | --- |
| ***Type:*** | valid |
| ***Description:*** | AUTOSAR COM shall provide an API to pass the serialized uint8-array representation of a signal group to COM. |
| ***Rationale:*** | The AUTOSAR transformer chain provides means to serialize composite data into a uint8-array representation. This serialized uint8-array shall be passed as one entity to COM. |
| ***Use Case:*** | Usage of transformer with Com-based serialization and Com Interaction to enable the communication with a fixed communication matrix. |
| ***Dependencies:*** | SRS\_Com\_02082, SRS\_Com\_02083, SRS\_Com\_02084, SRS\_Com\_02113 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01632, RS\_BRF\_01544, RS\_BRF\_01560)

#### Interface between the AUTOSAR COM module and the lower layer (PDU- Router)

OSEK COM leaves the interface between COM and the lower layers undefined. In AUTOSAR the only lower layer that AUTOSAR COM module interfaces is the PDU Router. The interfaces refer to the definitions in [[DOC\_COM\_TYPES](#_bookmark75)]. The requirements are derived from [[DOC\_COM\_TYPES](#_bookmark75)].

##### [SRS\_Com\_02107] The AUTOSAR COM module shall cancel transmission requests in case of expired transmissions

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall cancel the transmission request of an I-  PDU in case a violation of the transmission deadline monitoring of an I-PDU is detected. |
| ***Rationale:*** | Needed to free buffers in the FlexRay interface. |
| ***Use Case:*** | Cancellation of outdated I-PDU |

|  |  |
| --- | --- |
| ***Dependencies:*** | RS\_BRF\_00303 see [[DOC\_RS\_Features]](#_bookmark81) |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

#### Support of Large Data Types

The AUTOSAR COM module shall support signals larger than the N-PDUs of the underlying busses. For these large signals also a dynamic length shall be supported. The requirements of this chapter define the support of these data types.

##### [SRS\_Com\_02092] The AUTOSAR COM module shall support at most one dynamic length signal per I-PDU

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | At most one dynamic length signal shall be supported per I-PDU. |
| ***Rationale:*** | If only one signal per I-PDU is allowed then the dynamical length does not have to be coded into the I-PDU. The receiver will calculate the length of  the signal from the length of the IPDU. This is the same approach as in [[DOC\_OSEK\_GLOS]](#_bookmark83). |
| ***Use Case:*** | Sending textual messages e.g. SMS. |
| ***Dependencies:*** | SRS\_Com\_02091, SRS\_Com\_02093 |
| ***Supporting Material:*** | [[DOC\_OSEK\_GLOS]](#_bookmark83) |

⌋ (RS\_BRF\_01648,RS\_BRF\_01544)

##### [SRS\_Com\_02093] Dynamic length signal must be placed last in I-PDU

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The dynamic length signal must be placed last in the dynamic length I-PDU. This is the same approach as in [[DOC\_OSEK\_GLOS]](#_bookmark83).  All other signals and update-bits must be packed in front of the dynamical length signal. |
| ***Rationale:*** | Placing the signal last in the frame removes the need of coding the dynamical length into the IPDU. The receiving COM can directly derive the length of the dynamic length signal from the length of the IPDU  Signal groups may still be used to contain (one) dynamic length signal and other signals. |
| ***Use Case:*** | see Rationale |
| ***Dependencies:*** | SRS\_Com\_02091, SRS\_Com\_02092 |
| ***Supporting Material:*** | [[DOC\_OSEK\_GLOS]](#_bookmark83) |

⌋ (RS\_BRF\_01648,RS\_BRF\_01544)

##### [SRS\_Com\_02096] The AUTOSAR COM module shall not support fragmentation towards the RTE

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module will always send and receive a complete signal (no fragmentation supported above TP).  The COM/RTE/application will always receive/transmit complete large signals and dynamic length signals. Modules above TP are not involved in the fragmentation process. |
| ***Rationale:*** | Fragmentation should be hidden in the BSW architecture and should not be put to the application |
| ***Use Case:*** | It was discussed to have fragmentation for transmit/receive on application level to be able to find a more efficient implementation. This was however not approved since it would make the port-concept complex and bus-aware (it is not required for intra-ECU communication) |
| ***Dependencies:*** | SRS\_Com\_02095 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01648,RS\_BRF\_01544)

##### [SRS\_Com\_02098] The AUTOSAR COM module shall distinct normal and large signals via its configuration

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | There must be a configuration parameter that states if the signal has dynamic length or predefined length (i.e. a “normal” signal or a large signal) |
| ***Rationale:*** | There is no use-case where a fixed length signal becomes a dynamic length signal in run-time |
| ***Use Case:*** | see Rationale |
| ***Dependencies:*** | SRS\_Com\_02097 |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01648,RS\_BRF\_01544)

#### Signal status information

##### [SRS\_Com\_02030] The AUTOSAR COM module shall support to detect if a received signal or signal group was updated by the sender

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | It shall be possible for the receiver to identify and indicate to the upper layer if a signal/ signal group has been up dated by the sender. Whether this feature is provided shall be configurable per signal. |
| ***Rationale:*** | When multiple signals /signal groups are placed in the same I-PDU, and that I-PDU is sent more frequently than a signal/ signal group is update, the  update bit provides a mechanism to detect only those signals/ signal groups that have changed values. |
| ***Use Case:*** | -- |
| ***Dependencies:*** | SRS\_Com\_02058 |
| ***Supporting Material:*** | Implementation proposal:  An update bit is optionally attached to a signal/ signal group and can only be attached at configuration time.  When COM is started all up date bits in all I-PDUs are cleared.  In the sending ECU, when a signal/ signal group is sent by the application, the update bit is set automatically by COM as part of the SendMessage() call.  In the sending ECU, once the call to the lower layers to transmit the ECU has completed, all update bits in the recently sent I-PDU are cleared.  In the receiving ECU, when an I-PDU is received, a signal/signal group with an associated update bit is only processed by COM if its update bit is set. Therefore filtering and informing the RTE etc. will only take place if the update bit is set.  In the receiving ECU, for a signal/signal group with an update bit, the reception deadline monitor for that signal/signal group (if configured) is only reset if the update bit is set.  Update bits do not have to reside in the I-PDU in a fixed relationship to the signal/signal group with which they are associated. The update bits could reside anywhere in the I-PDU subject to the same restrictions as any other signal/signal group. |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02058] The AUTOSAR COM module shall support deadline monitoring for updated signals/signal groups on receiver side

⌈

|  |  |
| --- | --- |
| ***Type:*** | valid |
| ***Description:*** | The AUTOSAR COM module shall monitor on receiver-side, if an updated value for a specific signal/signal group has been received within a configurable, signal/signal group specific deadline, i.e. the AUTOSAR COM module shall check, whether the sender-side upper layers have explicitly sent the signal/signal group.  If a deadline violation of a specific signal/signal group is detected, the AUTOSAR COM module shall notify the upper receiving layers (the SWC via the RTE) about that fact. This information given to the upper receiving layers shall be signal/signal group specific.  The AUTOSAR COM module shall not do any substitution of signal/signal group values. If upper layers read signals/signal groups that have violated their deadline, the AUTOSAR COM module shall return the last value  received. |
| ***Rationale:*** | Due to latency times of communication systems or interrupts data might be not received in a pre-defined time (e.g. jitter of period to big, older than max  age). |
| ***Use Case:*** | Detect delays in communication system to make sure the application works on up-to-date data. |
| ***Dependencies:*** | SRS\_Com\_02030 |
| ***Supporting Material:*** | If no update bits are used, the AUTOSAR COM module provides the deadline monitoring defined in [[DOC\_OSEK\_COM]](#_bookmark84) (Section 2.5.1). Here, deadline monitoring is done on the reception of I-PDUs but deadline violations are notified per signal to the upper layer. |

⌋ (RS\_BRF\_01544)

#### I-PDU Counter

##### [SRS\_Com\_02099] The AUTOSAR COM module shall provide a mechanism to detect out of sequence received I-PDUs

⌈

|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall provide a mechanism to detect out of sequence received I-PDUs. This mechanism shall be a configurable option of the AUTOSAR COM module. |
| ***Rationale:*** | Out of sequence I-PDUs is a communication failure mode which is not already covered by existing mechanisms. |
| ***Use Case:*** | Detection of communication failure modes is needed for safety-related applications.  The order I-PDUs are sent is important e.g. ordered information that logically is one unit but does not have to, or cannot, be transferred  atomically. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02100] The AUTOSAR COM module shall support configuring the properties of the I-PDU Counter

⌈

|  |  |
| --- | --- |
| ***Type:*** | valid |
| ***Description:*** | It shall be possible to configure:   * If I-PDU Counter mechanism is enabled or not * The I-PDUs to include I-PDU Counter, * The properties of the included I-PDU Counter (number of bits and position in I-PDU) |
| ***Rationale:*** | Configuration is needed so that the mechanism can be adapted to the I- PDU content and characteristics of the physical link. |
| ***Use Case:*** | Configuration of communication of safety related information when including I-PDU Counter. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02101] The AUTOSAR COM module shall support the incrementing and checking of the I-PDU Counter

⌈

|  |  |
| --- | --- |
| ***Type:*** | valid |
| ***Description:*** | The I-PDU Counter shall be a counter that is stored in the I-PDU and incremented at each I-PDU transmission. The I-PDU Counter mechanism shall perform a check for correct I-PDU Counter of received I-PDUs. The  I-PDU Counter shall be set up by the I-PDU transmitter and checked by the I-PDU receiver. |
| ***Rationale:*** | Including an I-PDU Counter in an I-PDU makes it possible to keep track of received I-PDUS i.e. that they arrive in the expected order and are not repeated. This will improve error detection capability. |
| ***Use Case:*** | Normal operation for communication of safety related information when including I-PDU Counter. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02102] The AUTOSAR COM module shall support the detection of out of sequence I-PDUs

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|  |  |
| --- | --- |
| ***Type:*** | valid |
| ***Description:*** | Detected out of sequence I-PDUs shall be discarded. |
| ***Rationale:*** | The I-PDU Counter shall be able to detect the following failure modes related to communication (where one I-PDU is related to one frame):   * one repeated I-PDU * one spurious I-PDU |
| ***Use Case:*** | Error handling for communication of safety related information when including I-PDU Counter. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

#### I-PDU replication

##### [SRS\_Com\_02103] The AUTOSAR COM module shall provide a mechanism to detect corrupted received I-PDUs and to recover from this failure mode

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|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The AUTOSAR COM module shall provide a mechanism to detect corrupted received I-PDUs and to recover from this failure mode.  This mechanism shall be a configurable option of the AUTOSAR COM module. |
| ***Rationale:*** | Corrupted and repeated I-PDUs are communication failure modes which are not already covered by existing mechanisms. |
| ***Use Case:*** | Detection of communication failure modes is needed for safety-related applications.  It is important not to repeat an I-PDU e.g. an event in I-PDU causing a state transition. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02104] The AUTOSAR COM module shall support the configuration of I-PDU replication mechanism

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| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | It shall be possible to configure:   * If I-PDU Replication mechanism is enabled or not * The I-PDUs to replicate, * The number of replicas per I-PDU * The voting properties (K out of N) * The properties of the included I-PDU counter (number of bits and position in I-PDU)   Details about the supported replication mechanisms, that is the supported K and N shall be defined in [[DOC\_SWS\_COM]](#_bookmark78). |
| ***Rationale:*** | Configuration is needed per I-PDU so that the mechanism can be adapted to the I-PDU content, I-PDU period and characteristics of the physical link. |
| ***Use Case:*** | Communication of safety related information where existing communication does not provide adequate integrity. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02105] The AUTOSAR COM module shall support transmission and reception of replicated I-PDUs

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| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The I-PDU Replication mechanism shall, on the transmitting side, replicate a set of I-PDUs, which are statically defined to be replicated, into several  (N) I-PDU instances with different I-PDU IDs and communicate them on the bus.  The I-PDU Replication mechanism shall, on the receiving side, receive replicated I-PDU instances, evaluate and reconstruct the original I-PDU using voting.  The I-PDU Replication mechanism shall include an I-PDU counter mechanism and use it to synchronize the voting and to detect repeated, spurious and missing replicas. |
| ***Rationale:*** | The I-PDU Replication mechanism is needed in order to support that periodic safety related signals can be packed into an I-PDU and communicated with increased protection against communication errors. |
| ***Use Case:*** | Communication of safety related information where existing communication does not provide adequate integrity. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

##### [SRS\_Com\_02106] The AUTOSAR COM module shall support the detection of failures when receiving replicated I-PDUs

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|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | The I-PDU Replication shall be able to detect the following failure modes related to communication (where one I-PDU is related to one frame):   * loss of all I-PDUs with a specific ID * one repeated I-PDU * one spurious I-PDU * one corrupted I-PDU   Detected errors shall be corrected if possible e.g. using voting. |
| ***Rationale:*** | The I-PDU Replication is required as a complement to existing mechanisms in order to detect and if possible recover from a set of failure modes. |
| ***Use Case:*** | Communication of safety related information where existing communication do not provide adequate integrity. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01544)

### AUTOSAR LargeDataCOM specific functional requirements

#### [SRS\_Com\_02108] Support of Large Data COM

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| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | In addition to AUTOSAR COM Module AUTOSAR shall offer a Module called Large Data COM (LargeDataCOM). LargeDataCOM shall provide support of a reduced set of features targeting communication of large and dynamic data in a mainly event oriented way.  It shall be possible to omit either one of the COM and LargeDataCOM modules if not needed. |
| ***Rationale:*** | Efficiently support large and dynamic data. |
| ***Use Case:*** | Communication of data produced by serializers/ transformers like for example Some/IP. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01649)

##### [SRS\_Com\_02109] Large Data COM shall support Transport Protocol-like communication

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|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | Large Data COM shall support reception/ transmission via TP-APIs |
| ***Rationale:*** | Support of communication via transport protocols. |
| ***Use Case:*** | Efficient communication via e.g. FrTp. Efficient communication of very large data not fitting in an Ethernet frame using TCP. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01649)

#### [SRS\_Com\_02110] Large Data COM shall support Interface-like communication

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|  |  |
| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | Large Data COM shall support reception/ transmission via If-APIs |
| ***Rationale:*** | Support of communication without transport protocols. |
| ***Use Case:*** | Efficient communication of long signals, still fitting into one frame of the according target bus. For example a 500 byte signal via SoAd. |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01649)

#### [SRS\_Com\_02111] Large Data COM shall support Transmission Triggered by lower layer

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| --- | --- |
| ***Type:*** | Valid |
| ***Description:*** | Large Data COM shall support Transmission being Triggered by lower layer |
| ***Rationale:*** | Support of TriggerTransmit API. |
| ***Use Case:*** | Provide current signal data to a new subscriber without waiting for the next transmission request of the application |
| ***Dependencies:*** | -- |
| ***Supporting Material:*** | -- |

⌋ (RS\_BRF\_01649)

### Non-Functional Requirements (Qualities)

None

# References

Deliverables of AUTOSAR

[DOC\_LAYER]

Layered Sofware Architecture AUTOSAR\_EXP\_LayeredSoftwareArchitecture.pdf

[DOC\_COM\_TYPES]

Specification of Communication Stack Types AUTOSAR\_SWS\_CommunicationStackTypes.pdf

[DOC\_VFB]

Specification of the Virtual Functional Bus AUTOSAR\_EXP\_VFB.pdf

[DOC\_ECUC]

Specification of ECU Configuration AUTOSAR\_TPS\_ECUConfiguration.pdf

[DOC\_SWS\_RTE]

Specification of RTE Software AUTOSAR\_SWS\_RTE.pdf

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Specification of Communication AUTOSAR\_SWS\_COM.pdf

[DOC\_SWS\_LDCOM]

Specification of Large Data COM AUTOSAR\_SWS\_LargeDataCOM.pdf

[DOC\_TR\_GLOS]

Glossary AUTOSAR\_TR\_Glossary.pdf

[DOC\_TPS\_SWC]

Software Component Template AUTOSAR\_TPS\_SoftwareComponentTemplate.pdf

[DOC\_RS\_Features]

Requirements on AUTOSAR Features AUTOSAR\_RS\_Features.pdf

[TPS\_STDT]

Standardization Template AUTOSAR\_TPS\_StandardizationTemplate.pdf

## OSEK

[DOC\_OSEK\_GLOS]

Glossary OSEK/VDX Communication Version 3.0.3 July 20, 2004

[DOC\_OSEK\_COM]

OSEK/VDX Communication Version 3.0.3 July 20, 2004

## ISO

No references at the moment

## HIS

[DOC\_HIS]

Requirements for Protected Applications under OSEK, Version 1, 25.09.2002