
**Intelligent transport systems — ITS
station management —**

**Part 4:
Station-internal management
communications**

Systèmes intelligents de transport — Gestion des stations ITS —

Partie 4: Communications de gestion interne à la station

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

This second edition cancels and replaces the first edition (ISO 24102-4:2013) which has been technically revised. It also incorporates the Amendment ISO 24102-4:2013/Amd1:2017.

A list of all parts in the ISO 24102 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

NOTE The former ISO 24102-5 has been converted into a separate standard ISO 22418^[1], as it is not a station management standard.

Introduction

This document is part of a series of International Standards for communications in intelligent transport systems (ITS) based on the ITS station and communications architecture specified in ISO 21217 and illustrated in [Figure 1](#).

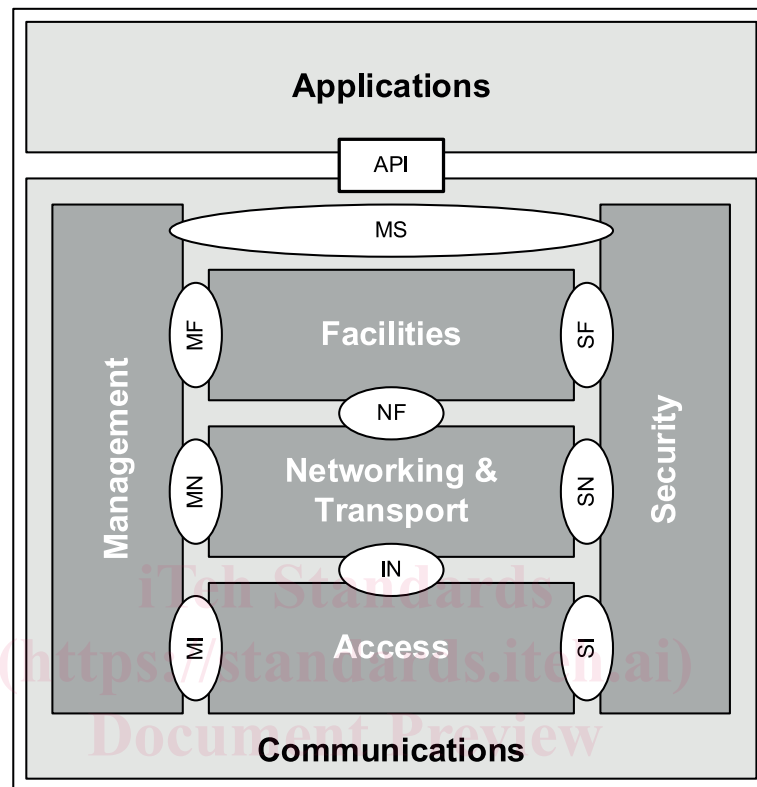


Figure 1 — ITS station reference architecture with named interfaces

This document is Part 4 of a multi-part standard which determines the intelligent transport systems (ITS) station-internal management communications that is architecturally located in the ITS station Management entity.

The ITS station management entity provides functionality related to the management of communication protocol layers (Access, Networking & Transport, Facilities), the Security entity, and the ITS Applications entity introduced in ISO 21217:2014 and presented in [Figure 1](#).

ITS station management is specified as a distributed process, where no supervisory entity is employed.

Intelligent transport systems — ITS station management —

Part 4: Station-internal management communications

1 Scope

This document provides specifications for secure ITS station-internal management communications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

ISO 17419:2018, *Intelligent transport systems — Cooperative ITS — Globally unique identification*

ISO 21217:2014, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

ISO 21218, *Intelligent transport systems — Hybrid communications — Access technology support*

ISO 24102-1, *Intelligent transport systems — ITS station management — Part 1: Local management*

ISO 24102-3, *Intelligent transport systems — ITS station management — Part 3: Service access points*

ISO 24102-6, *Intelligent transport systems — ITS station management — Part 6: Path and flow management*

ETSI TS 102 797-2, *Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Intelligent Transport Systems, Communications access for land mobiles (CALM), ITS station management (ISO 24102); Part 2: Test Suite Structure and Test Purposes (TSS & TP)*

ETSI TS 102 797-3, *Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Intelligent Transport Systems, Communications access for land mobiles (CALM), ITS station management (ISO 24102); Part 3: Abstract Test Suite (ATS) and partial PIXIT information*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21217, ISO 21218, ISO 24102-1, and ISO 24102-3 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

ITS-S communication unit

physical unit in an ITS-SU containing a part or all of the functionality of an ITS-S

[SOURCE: ISO 21217:2014, 3.21, modified — Note 1 to entry was deleted.]

4 Symbols and abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO 21217:2014, ISO 21218, ISO 24102-1, and ISO 24102-3 and the following apply.

ITS-SCU	ITS station Communication Unit
ITS-SCU-ID	ITS-SCU Identifier
ITS-SCUID	Globally unique identifier of an ITS-SCU

NOTE ITS-SCUID is specified in ISO 17419 as a globally unique identifier, whilst ITS-SCU-ID is specified in this document as an addressing element for IIC.

IIC	ITS station-internal management communications
IICM	IIC manager
IICA	IIC agent
IICP	IIC protocol
n/a	not applicable

5 ITS station management

The ITS station management includes functionality specified in the various parts of this multi-part International Standard:

- 1) The functionality of local ITS station management specified in ISO 24102-1.
- 2) The functionality of remote ITS station management specified in ISO 24102-2[2].
- 3) The functionality of service access points specified in ISO 24102-3.
- 4) **The functionality of ITS station-internal management communications specified in this document (Part 4).**
- 5) Void.
- 6) The functionality of path and flow management specified in ISO 24102-6.

ITS station-internal management communications interconnects ITS station communication units (ITS-SCUs) of the same ITS station (ITS-S) via the ITS station-internal network illustrated in ISO 21217. This communication is also referred to as "ITS-S Internal management Communications" (IIC) in this document. IIC allows remote access to management SAPs specified in ISO 21217 with details specified in ISO 24102-3.

IIC may be secured following the principles of trusted distributed systems.

Detailed mandatory requirements are specified in the following clauses of this document.

- [Clause 6](#) specifies the IIC reference architecture.
- [Clause 7](#) specifies IIC protocol data units (PDUs).
- [Clause 8](#) specifies communication procedures.
- [Clause 9](#) specifies management procedures.
- [Clause 10](#) specifies security elements and procedures.

- [Clause 11](#) specifies conformance declaration.
- [Clause 12](#) specifies test methods.
- [Annex A](#) specifies an ASN.1 module.
- [Annex B](#) specifies IIC PDUs.
- [Annex C](#) specifies the implementation conformance statement (ICS) proforma.
- [Annex D](#) exemplifies communication service parameters for IIC for usage in implementations compliant with ISO 17423[5].

6 Reference architecture

"ITS-S Internal management Communications" (IIC) is communications between ITS-S Management Entities of different ITS-SCUs of the same ITS-SU via the ITS station-internal network. A specific purpose of IIC is remote access to management service access points MI-SAP, MN-SAP, MF-SAP, MA-SAP and MS-SAP. The concept of ITS-SCUs is specified in ISO 21217. An ITS-SCU can support IICP disregard of the ITS-S roles it supports.

NOTE The MA-SAP is part of the API presented in [Figure 2](#).

The reference architecture for IIC is illustrated in [Figure 2](#).

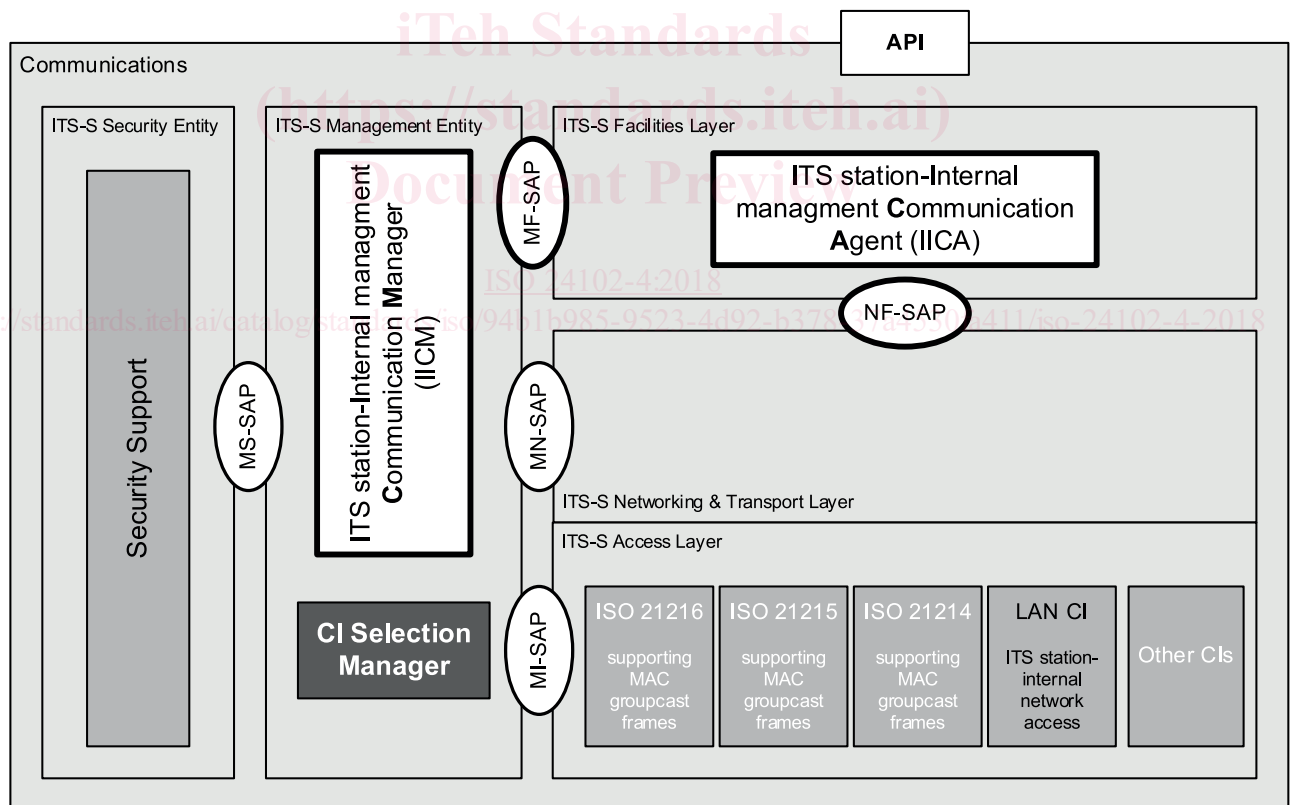


Figure 2 — Reference architecture for ITS station-internal management communications

Source and destination of IIC protocol data units are instances of the "ITS-S Internal management Communications Manager" (IICM). Transmission requests from the IICM are forwarded to the "ITS-S Internal management Communications Agent" (IICA) via the MF-SAP. Notifications of received IIC PDUs are sent by the IICA via the MF-SAP to the IICM.

Communications on the ITS station-internal network is performed between peer instances of the IICA via NF-SAP, a suitable networking & transport layer protocol, the IN-SAP, and a suitable access technology. Source- and destination endpoints of the ITS-S networking & transport layer protocol are identified by an ITS-S port (ITS-SP) with the number PORT_IIC of the IICA identified in [3].

7 Protocol data units

"ITS-S Internal management Communications" (IIC) uses the following protocol data units (PDU) illustrated in [Figure 3](#):

- IIC-Request;
- IIC-Response.

IIC-Request:

SourceITS-SCU-ID	DestinationITS-SCU-ID	PDU-Counter	IIC-PDU-ID (0)	Data	Sec
------------------	-----------------------	-------------	----------------	------	-----

IIC-Response:

SourceITS-SCU-ID	DestinationITS-SCU-ID	PDU-Counter	IIC-PDU-ID (1)	Data	Error Status	Sec
------------------	-----------------------	-------------	----------------	------	--------------	-----

Data in IIC-Request:

RqDataID	Length of RqData	RqData
----------	------------------	--------

Data in IIC-Response:

RsDataID	Length of RsData	RsData
----------	------------------	--------

Sec in IIC-Request:

SecRqID	Length of SecRequest	SecRequest
---------	----------------------	------------

Sec in IIC-Response:

SecRsID	Length of SecResponse	SecResponse
---------	-----------------------	-------------

Figure 3 — IIC PDU structure

The IIC-Request PDU is of ASN.1 type `IIC-Request` specified in [A.2](#).

The IIC-Response PDU is of ASN.1 type `IIC-Response` specified in [A.2](#).

Details on parameters of these PDUs are specified in [Table 1](#).

Table 1 — IIC PDUs

PDU element/ASN.1 type	IIC-Request	IIC-Response
Source ITS-SCU-ID/ ITS-scuId	ITS-SCU-ID of source ITS-SCU, which produces the request.	ITS-SCU-ID of ITS-SCU, which produces the response.
Destination ITS-SCU-ID/ ITS-scuId	ITS-SCU-ID of destination ITS-SCU.	Same as SourceITS-SCU-ID of related request if not requested otherwise in this document.
PDU-Counter/ PduCounter	Even number generated from a cyclic counter at the ITS-SCU, which produces the request.	PDU-Counter of related request incremented by one.
IIC-PDU-ID / INTEGER Value dependent on PDU type	One octet INTEGER value 0. ASN.1 type RequestID.	One octet INTEGER value 1. ASN.1 type ResponseID.
Data/ SEQUENCE based on ASN.1 CLASS IICPREQ	Data type identifier RqDataID followed by length of RqData in Integer multiples of an octet and RqData. ASN.1 type PduRequest.	Data type identifier RsDataID followed by length of RsData in Integer multiples of an octet and RsData. ASN.1 type PduResponse.
ErrorStatus/ PduErrStatus	Not existent.	Existent. 0: No error happened >0: Number indicating type of error.
Seq/ SEQUENCE based on ASN.1 CLASS SECIICP	Security type identifier SecRqID followed by the length of SecRequest in Integer multiples of an octet and SecRequest. ASN.1 type SecRq.	Security type identifier SecRsID followed by the length of SecResponse in Integer multiples of an octet and SecResponse. ASN.1 type SecRs.

The ASN.1 specification of the PDUs as provided in [Annex A](#) of this document shall apply.

ITS-SCU-ID values used in parameters "SourceITS-SCU-ID" and "DestinationITS-SCU-ID" shall be as specified in [Table 2](#).

Table 2 — ITS-SCU-ID value assignment

SourceITS-SCU-ID	DestinationITS-SCU-ID	Description
	0	Reserved. Used to indicate "own/local ITS-SCU". Must not be used in communications with other ITS-SCUs.
n/a	1	ITS-SCU-ID identifying ITS-SCUs with ITS-S host role.
n/a	2	ITS-SCU-ID identifying ITS-SCUs with ITS-S router role.
	3	ITS test system Dispatcher (using IICP for upper tester access), see ISO/TS 20026[4].
	4	ITS Test CI unit, see ISO/TS 20026[4].
	5 to 15	Reserved.
		ITS-SCU-ID identifying ITS-SCUs with an implementation specific role
	16 to 65534	ITS-SCU-ID identifying uniquely a specific ITS-SCU in an ITS station.
n/a	65535	ITS-SCU-ID identifying all ITS-SCUs.

"Data" values shall be set as specified in [Annex B](#) of this document.

"ErrorStatus" values shall be set as specified in [Table 3](#).

Table 3 — ErrorStatus value assignment; ASN.1 type PduErrStatus

ErrorStatus	Description
0	No error
1	IIC-PDU-ID unknown or not implemented
2	Duplicate ITS-SCU-ID
3	Invalid or unknown AliveMessage
4	Invalid or unknown ITS-SCU type
5 to 127	Reserved for future use
128 to 254	For implementation-specific, non-standardized usage
255	Unspecified error

The ITS port number PORT_IICP is specified in ISO 17419: to identify the IICA. Port numbers for TCP-IP or UDP-IP are not allocated so far.

8 Communication procedures

8.1 Initialization

8.1.1 IICM

ITS station-internal management communications between addressable ITS-SCUs shall be initialized as specified in [Clause 9](#) on management procedures.

8.1.2 IICA

Prior to the initialization specified in [Clause 9](#), the IICA shall initialize communications as requested for the selected ITS-S networking & transport layer protocol.

8.2 Transmission

8.2.1 IIC-Request PDU

Upon request from a protocol in the ITS-S management entity, the IICM shall construct the IIC-Request PDU specified in [Clause 7](#). In case secure transmission is needed, the "Security Support" illustrated in [Figure 2](#) shall be involved via the MS-SAP. Details on security shall be as specified in [Clause 10](#).

The "PDU-Counter" value shall be set to an even value uniquely in an ITS-SCU under the control of the IICM issuing the request. The initial value shall be zero. For every next IIC-Request PDU, the counter value shall be incremented by two. It shall wrap from 65534 to zero. The IICM shall note the value of the PDU-Counter in case a response is expected.

The IICM shall forward the IIC-Request PDU to the IICA using MF-COMMAND `IICrequestTX` specified in [Annex A](#).

The IICA shall request transmission of the IIC-Request PDU using the appropriate service of the NF-SAP.

8.2.2 IIC-Response PDU

Upon reception of an IIC-Request PDU which requires transmission of an IIC-Response PDU, the IICM shall construct the IIC-Response PDU specified in [Clause 7](#). In case secure transmission is needed, the "Security support" illustrated in [Figure 2](#) shall be involved via the MS-SAP. Details on security shall be as specified in [Clause 10](#).

The "PDU-Counter" value shall be set equal to the value of the "PDU-Counter" contained in the related IIC-Request PDU incremented by one.

The IICM shall forward the IIC-Response PDU to the IICA using MF-COMMAND IICresponseTX specified in [Annex A](#).

The IICA shall request transmission of the IIC-Response PDU using the appropriate service of the NF-SAP.

8.3 Reception

8.3.1 Initial processing at the IICA

The IICA shall perform the following steps:

- 1) Check DestinationITS-SCU-ID:
 - i) If the DestinationITS-SCU-ID value is a valid address value (3, 4, 16 to 65534) and matches the own address, step 2) shall be performed.
 - ii) If the DestinationITS-SCU-ID value is either 1 or 2, and the value matches with the own ITS-S role, step 2) shall be performed.
 - iii) If the DestinationITS-SCU-ID value is 65535, step 2) shall be performed.
 - iv) Otherwise the PDU is ignored.
- 2) Check the PDU type value and PDU-Counter value.
 - i) In case the PDU type is inconsistent with the PDU-Counter value, the PDU is ignored.
 - ii) The IICA shall forward an IIC-Request PDU received via NF-SAP to the IICM using MF-REQUEST IICrequestRX specified in [Annex A](#).
 - iii) The IICA shall forward an IIC-Response PDU received via NF-SAP to the IICM using MF-REQUEST IICresponseRX specified in [Annex A](#).

8.3.2 Initial processing at the IICM

The IICM shall perform the following steps:

- 1) In case the element SecRq is not empty, involve the "Security Support" illustrated in [Figure 2](#) via the MS-SAP as specified in [Clause 10](#).
- 2) In case of unsuccessful security checking, the IICM ignores the received PDU.
- 3) In case of successful security checking, the IICM shall perform the respective procedure for IIC-Request or IIC-Response.

8.3.3 Final IIC-Request PDU procedure at the IICM

The IICM shall perform the following steps:

- 1) The IICM performs the required action as indicated by Data contained in the IIC-Request PDU.
- 2) In case a response is required, the IICM prepares the IIC-Response PDU as specified above.

8.3.4 IIC-Response PDU procedure

The IICM shall perform the following steps:

- 1) Check whether the PDU-Counter value matches a previously transmitted IIC-Request that was not acknowledged so far with an IIC-Response PDU. In case of no match the IICM ignores the received PDU.

- 2) The IICM performs the required action as indicated by Data contained in the IIC-Response PDU.

9 Management procedures

9.1 General

The management procedures specified in [Clause 9](#) include procedures

- for initial assignment of unique ITS-SCU-IDs,
- for ITS-SCU-ID maintenance, and
- for release of ITS-SCU-IDs.

Uniqueness of ITS-SCU-IDs in the range 15 to 65534 may be achieved by implementation-dependent means.

9.2 ITS-SCU-ID assignment

In case an ITS-SCU does not have a pre-defined unique ITS-SCU-ID, the procedure specified in this sub-clause shall be followed.

The IICM shall generate an ITS-SCU-ID as specified in [Table 2](#) as its own ITS-SCU-ID and shall put the selected ITS-SCU-ID to its local ITS-SCU-list. ITS-SCU-ID values already being in the local ITS-SCU-list indicate usage by another ITS-SCU in the same station and shall not be selected. Then the IIC-Request PDU `ITS-SCUalive` (new) shall be sent to all ITS-SCUs, indicating a first choice of ITS-SCU-ID in the "SourceITS-SCU-ID" element, or a new choice of ITS-SCU-ID, and the type of ITS-SCU in the "Data" element. In case of a negative acknowledgement, i.e. indication of usage of this ITS-SCU-ID value by another ITS-SCU, see below, the IICM shall repeat the procedure with a new ITS-SCU-ID value.

Upon activation, the IICM may listen to receive IIC-Request PDUs, or IIC-Response PDUs in order to identify already allocated ITS-SCU-IDs.

Upon reception of an IIC-Request PDU `ITS-SCUalive` (new), the IICM shall check the SourceITS-SCU-ID.

- If the SourceITS-SCU-ID is equal to the own ITS-SCU-ID, the receiving IICM shall send an IIC-Response PDU `ITS-SCUalive` to all ITS-SCUs, reporting the own ITS-SCU-ID and type of ITS-SCU to all ITS-SCUs, indicating `ErrorStatus=2`.
- If the SourceITS-SCU-ID is different to the own ITS-SCU-ID, the IICM shall take this information to its local ITS-SCU-list, if not already present there. An existing entry shall not be updated with this new information. The IICM shall acknowledge the IIC-Request PDU with the IIC-Response PDU `ITS-SCUalive`, reporting the own ITS-SCU-ID and type of ITS-SCU, indicating `ErrorStatus=0`.

Upon reception of an IIC-Request PDU `ITS-SCUalive` (alive), the IICM shall check the SourceITS-SCU-ID.

- If the SourceITS-SCU-ID is equal to the own ITS-SCU-ID, the receiving IICM shall send an IIC-Response PDU `ITS-SCUalive` to all ITS-SCUs, reporting the own ITS-SCU-ID and type of ITS-SCU to all ITS-SCUs, indicating `ErrorStatus=2`. All IICMs with this ITS-SCU-ID shall invalidate this ITS-SCU-ID and shall start the procedure to select a new ITS-SCU-ID.
- If the SourceITS-SCU-ID is different to the own ITS-SCU-ID, the IICM shall take this information to its local ITS-SCU-list, if not already present there. The IIC-Request PDU shall not be acknowledged with an IIC-Response.

Upon reception of an IIC-Response PDU `ITS-SCUalive`, the IICM shall check the `ErrorStatus`.

- In case of `ErrorStatus=0`, the IICM shall take this information about another ITS-SCU to its local ITS-SCU-list, if not already present there.