Space engineering

Adoption Notice of CCSDS 132.0-B-2, TM Space Data Link Protocol

ECSS Secretariat
ESA-ESTEC
Requirements & Standards Division
Noordwijk, The Netherlands

Foreword

This Adoption Notice is one document of the series of ECSS Standards intended to be applied together for the management, engineering, product assurance and sustainability in space projects and applications. ECSS is a cooperative effort of the European Space Agency, national space agencies and European industry associations for the purpose of developing and maintaining common standards. Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

This Adoption Notice has been prepared by the ECSS Space Communications Working Group, reviewed by the ECSS Executive Secretariat and approved by the ECSS Technical Authority.

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Published by: ESA Requirements and Standards Section
ESTEC, P.O. Box 299,
2200 AG Noordwijk
The Netherlands

Change log

ECSS-E-AS-50-22C 1 March 2021	First issue NOTE: This document, together with ECSS-E-AS-50-23C, replace ECSS-E-ST-50-03C.

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Scope

This document identifies the clauses and requirements modified with respect to the standard CCSDS 132.0-B-2, *TM Space Data Link Protocol*, Issue 2, September 2015, for application in ECSS.

2
Context information

In the standard CCSDS 132.0-B-2, *TM Space Data Link Protocol*, CCSDS specifies a data link layer protocol for the efficient transfer of space application data of various types and characteristics over space links.

With this Adoption Notice ECSS is adopting and applying CCSDS 132.0-B-2 with a minimum set of modifications, identified in the present document, to allow for reference and for a consistent integration in the ECSS system of standards.

The TM Transfer Frame specified in CCSDS 132.0-B-2 is similar to the TM Transfer Frame specified in the ECSS standard ECSS-E-ST-50-03C *Space data links – Telemetry transfer frame protocol* (31 July 2008), that is superseded by the following two Adoption Notices: ECSS-E-AS-50-22C and ECSS-E-AS-50-23C.

Differences between these two standards that are not covered by the normative modifications in clause 4 are described in the informative Annex A.

Overview of superseded ECSS-E-50-xx Standards

Superseded ECSS	**ECSS Adopted Notice**	**Based on CCSDS**
ECSS-E-ST-50-01C 31 July 2008	ECSS-E-AS-50-21C	CCSDS 131.0-B-3 (Sept. 2017)
ECSS-E-ST-50-03C 31 July 2008	ECSS-E-AS-50-22C	CCSDS 132.0-B-2 (Sept. 2015)
	ECSS-E-AS-50-23C	CCSDS 732.0-B-3 (August 2016)
ECSS-E-ST-50-04C 31 July 2008	ECSS-E-AS-50-24C	CCSDS 231.0-B-3 (Sept. 2017)
	ECSS-E-AS-50-25C	CCSDS 232.0-B-3 (Sept. 2015)
	ECSS-E-AS-50-26C	CCSDS 232.1-B-2 (Sept. 2010)

3
Abbreviated terms

Abbreviation	Meaning
AOS	Advanced Orbiting Systems
SDLS	Space Data Link Security

4
Application requirements

a. CCSDS 132.0-B-2, TM Space Data Link Protocol, Issue 2, September 2015 shall apply with the following modifications listed in Table 4-1.

Table 4-1: Applicability table for CCSDS 132.0-B-2

Clause or requirement number	Applicability	Applicable text (the new/added text is underlined)	Comments	Text as in the original document (deleted text with strikethrough)
4.1.3.1.7	New requirement	The Transfer Frame Secondary Header may be used to provide an extended virtual channel frame count as specified in 4.1.3.4.	New requirement added: the extended virtual channel frame count added	
4.1.3.4	New section	Extended virtual channel frame count	New section added	
4.1.3.4.1	New section	General The following requirements apply if the Transfer Frame Secondary Header is used to provide an extended virtual channel frame count, see 4.1.3.1.7.		
4.1.3.4.2	New section	Using the extended virtual channel frame count		

Clause or requirement number	Applicability	Applicable text (the new/added text is underlined)	Comments	Text as in the original document (deleted text with strikethrough)
4.1.3.4.2.1	New requirement	The length of the Transfer Frame Secondary Header shall be 32 bits. NOTE The Transfer Frame Secondary Header has a length of 4 octets, so the Transfer Frame Secondary Header Length contains the value 3.		
4.1.3.4.2.2	New requirement	The Transfer Frame Secondary Header Data Field shall contain the 24-bit extension to the virtual channel frame count.		
4.1.3.4.2.3	New requirement	The extension to the virtual channel frame count shall be a binary count of the roll-overs of the 8-bit value contained in the Virtual Channel Frame Count in the Transfer Frame Primary Header. NOTE This provides a 32-bit count, with the most significant 24 bits in the Transfer Frame Secondary Header Data Field and the least significant 8 bits in the Virtual Channel Frame Count.		

Clause or requirement number	Applicability	Applicable text (the new/added text is underlined)	Comments	Text as in the original document (deleted text with strikethrough)
4.1.3.4.2.4	New requirement	The use of the extended virtual channel frame count shall be associated with either a master channel or a virtual channel. NOTE 1 If the extended virtual channel frame count is associated with a master channel, then the Transfer Frame Secondary Header of every frame on the master channel contains the extended count. However, the value of the extended count in a given frame is the value for the virtual channel to which the frame belongs. NOTE 2 If the extended virtual channel frame count is associated with a virtual channel, then the Transfer Frame Secondary Headers of other virtual channels can be absent or used for other purposes.		
4.1.3.4.2.5	New requirement	The use of the extended virtual channel frame count shall be static in the associated master channel or in the associated virtual channel throughout a mission phase.		

Annex A (informative) Differences from ECSS-E-ST-50-03C

A.1 General

Clause 4 of this document contains normative additions and modifications concerning some of the differences between CCSDS 132.0-B-2 and the ECSS-E-ST-50-03 (superseded by this Adoption Notice). This Annex describes some additional differences that are not covered by Clause 4.

This Annex lists the differences of technical content, but it is not the purpose of this Annex to provide complete details on each item in the list or to describe the consequences of each item in the list.

A.2 Differences

A.2.1 Specification of service interfaces

Section 3 of CCSDS 132.0-B-2 provides a formal abstract specification of a set of service interfaces, including service primitives and parameters, provided by the TM Space Data Link Protocol. There was no equivalent in ECSS-E-ST-50-03.

A.2.2 Specification of protocol procedures

Sections 4.2 and 4.3 of CCSDS 132.0-B-2 specify protocol procedures at the sending and receiving ends. ECSS-E-ST-50-03 specified only the packet processing and extraction functions.

A.2.3 Interfaces for Space Data Link Security (SDLS)

CCSDS 132.0-B-2 specifies the optional interfaces for using the Space Data Link Security (SDLS) protocol with TM Transfer Frames. ECSS-E-ST-50-03 did not include support for interfacing to SDLS. Therefore, this Adoption Notice – unlike the ECSS-E-ST-50-03 - offers to ECSS users the option of using the Space Data Link Security (SDLS) protocol with TM and AOS Transfer Frames.A.2.4 Resetting a frame count.

A TM Transfer Frame has a Master Channel Frame Count and a Virtual Channel Frame Count. They are 8-bit fields, each containing a sequential binary count (modulo 256). Both standards have requirements about not resetting one of these counts before it reaches 255. In CCSDS 132.0-B-2 the wording is "*not … unless it*

is unavoidable". In ECSS-E-ST-50-03 the wording was *"not … unless there is a major system reset"*.

A.2.4 Synchronization Flag and asynchronously inserted data

In CCSDS 132.0-B-2, if the Synchronization Flag is '1' then the frame carries a VCA-SDU: this relates to the formal definition of the Virtual Channel Access Service (see A.2.1 above). ECSS-E-ST-50-03 specified that the Synchronization Flag is '1' whenever the frame does not satisfy the conditions for the flag to be '0'. For legacy reasons, ECSS-E-ST-50-03 included the specification of frames with Synchronization Flag '1' to carry asynchronously inserted data.

A.2.5 Managed parameters

Sections 5 and 6.6 of CCSDS 132.0-B-2 have a normative specification of the managed parameters used by the TM Space Data Link Protocol. Annex D of ECSS-E-ST-50-03 had an informative specification, and referred to the parameters as mission configuration parameters.

Bibliography

ECSS-E-AS-50-21C	Space engineering - Adoption Notice of CCSDS 131.0-B-3, TM Synchronization and Channel Coding
ECSS-E-AS-50-22C	Space engineering - Adoption Notice of CCSDS 132.0-B-2, TM Space Data Link Protocol
ECSS-E-AS-50-23C	Space engineering -Adoption Notice of CCSDS 732.0-B-3, AOS Space Data Link Protocol
ECSS-E-AS-50-24C	Space engineering - Adoption Notice of CCSDS 231.0-B-3, TC Synchronization and Channel Coding
ECSS-E-AS-50-25C	Space engineering - Adoption Notice of CCSDS 232.0-B-3, TC Space Data Link Protocol
ECSS-E-AS-50-26C	Space engineering - Adoption Notice of CCSDS 232.1-B-2, Communications Operation Procedure-1
ECSS-E-ST-50-01C 31 July 2008	Space engineering - Space data links - Telemetry synchronization and channel coding
ECSS-E-ST-50-03C 31 July 2008	Space engineering - Space data links - Telemetry transfer frame protocol
ECSS-E-ST-50-04C 31 July 2008	Space engineering - Space data links - Telecommand protocols synchronization and channel coding