
**Space data and information transfer
systems — TC (telecommand) space data
link protocol**

*Systèmes de transfert des données et informations spatiales —
Protocole de liaison pour données spatiales TC (télécommande)*

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Foreword

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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. www.iso.org/directives

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ISO 22664 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 232.0-B-3, September 2015) and was adopted (without modifications except those stated in clause 2 of this International Standard) by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 13, *Space data and information transfer systems*.

This third edition cancels and replaces the second edition (ISO 22664:2013), which has been technically revised. It also incorporates the amendment ISO 22664:2013/Amd.1:2015.

STATEMENT OF INTENT

The Consultative Committee for Space Data Systems (CCSDS) is an organization officially established by the management of its members. The Committee meets periodically to address data systems problems that are common to all participants, and to formulate sound technical solutions to these problems. Inasmuch as participation in the CCSDS is completely voluntary, the results of Committee actions are termed **Recommended Standards** and are not considered binding on any Agency.

This **Recommended Standard** is issued by, and represents the consensus of, the CCSDS members. Endorsement of this **Recommendation** is entirely voluntary. Endorsement, however, indicates the following understandings:

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 - The **standard** itself.
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FOREWORD

This document is a technical Recommendation for use in developing flight and ground systems for space missions and has been prepared by the Consultative Committee for Space Data Systems (CCSDS). The TC Space Data Link Protocol described herein is intended for missions that are cross-supported between Agencies of the CCSDS.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CCSDS has processes for identifying patent issues and for securing from the patent holder agreement that all licensing policies are reasonable and non-discriminatory. However, CCSDS does not have a patent law staff, and CCSDS shall not be held responsible for identifying any or all such patent rights.

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DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 232.0-B-1	TC Space Data Link Protocol, Recommended Standard, Issue 1	September 2003	Original Issue, superseded
CCSDS 232.0-B-2	TC Space Data Link Protocol, Recommended Standard, Issue 2	September 2010	Issue 2, superseded
CCSDS 232.0-B-3	TC Space Data Link Protocol, Recommended Standard, Issue 3	September 2015	Current issue: – adds specifications to support the Space Data Link Security Protocol; – removes obsolete informative annex detailing changes from Historical Recommendation CCSDS 202.0-B-3-S (1987–2005).

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NOTE – Substantive changes from the previous issue are marked by change bars in the inside margin.

CONTENTS

<u>Section</u>	<u>Page</u>
1 INTRODUCTION	1-1
1.1 PURPOSE.....	1-1
1.2 SCOPE.....	1-1
1.3 APPLICABILITY.....	1-1
1.4 RATIONALE.....	1-2
1.5 DOCUMENT STRUCTURE.....	1-2
1.6 CONVENTIONS AND DEFINITIONS.....	1-2
1.7 REFERENCES.....	1-5
2 OVERVIEW	2-1
2.1 CONCEPT OF TC SPACE DATA LINK PROTOCOL.....	2-1
2.2 OVERVIEW OF SERVICES.....	2-5
2.3 OVERVIEW OF FUNCTIONS.....	2-12
2.4 SERVICES ASSUMED FROM LOWER LAYERS.....	2-16
3 SERVICE DEFINITION	3-1
3.1 OVERVIEW.....	3-1
3.2 SOURCE DATA.....	3-1
3.3 MAP PACKET SERVICE.....	3-3
3.4 VIRTUAL CHANNEL PACKET SERVICE.....	3-9
3.5 MAP ACCESS SERVICE.....	3-15
3.6 VIRTUAL CHANNEL ACCESS SERVICE.....	3-20
3.7 VIRTUAL CHANNEL FRAME SERVICE.....	3-25
3.8 MASTER CHANNEL FRAME SERVICE.....	3-28
3.9 COP MANAGEMENT SERVICE.....	3-31
4 PROTOCOL SPECIFICATION WITHOUT SDLS OPTION	4-1
4.1 PROTOCOL DATA UNIT (TC TRANSFER FRAME).....	4-1
4.2 PROTOCOL DATA UNIT (CLCW).....	4-12
4.3 PROTOCOL PROCEDURES AT THE SENDING END.....	4-18
4.4 PROTOCOL PROCEDURES AT THE RECEIVING END.....	4-28
5 MANAGED PARAMETERS WITHOUT SDLS OPTION	5-1
5.1 MANAGED PARAMETERS FOR A PHYSICAL CHANNEL.....	5-1
5.2 MANAGED PARAMETERS FOR A MASTER CHANNEL.....	5-2
5.3 MANAGED PARAMETERS FOR A VIRTUAL CHANNEL.....	5-2

CONTENTS (continued)

<u>Section</u>	<u>Page</u>
5.4 MANAGED PARAMETERS FOR A MAP CHANNEL	5-4
5.5 MANAGED PARAMETERS FOR PACKET TRANSFER.....	5-4
6 PROTOCOL SPECIFICATION WITH SDLS OPTION.....	6-1
6.1 OVERVIEW	6-1
6.2 USE OF SDLS PROTOCOL.....	6-1
6.3 TC TRANSFER FRAME WITH SDLS	6-1
6.4 SENDING-END PROTOCOL PROCEDURES WITH SDLS	6-5
6.5 RECEIVING-END PROTOCOL PROCEDURES WITH SDLS	6-8
6.6 ADDITIONAL MANAGED PARAMETERS FOR SDLS	6-11
ANNEX A ACRONYMS (INFORMATIVE).....	A-1
ANNEX B INFORMATIVE REFERENCES (INFORMATIVE)	B-1

Figure

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1-1 Bit Numbering Convention.....	1-5
2-1 Relationship with OSI Layers	2-1
2-2 Relationships Between Channels.....	2-4
2-3 Internal Organization of Protocol Entity (Sending End).....	2-13
2-4 Internal Organization of Protocol Entity (Receiving End)	2-13
2-5 TC Space Data Link Protocol Channel Tree.....	2-14
4-1 TC Transfer Frame Structural Components.....	4-1
4-2 Transfer Frame Primary Header.....	4-2
4-3 Segment Header	4-7
4-4 Logic Diagram of the Encoder.....	4-11
4-5 Logic Diagram of the Decoder.....	4-12
4-6 Communications Link Control Word	4-13
4-7 Internal Organization of Protocol Entity (Sending End).....	4-18
4-8 Abstract Model of MAP Packet Processing Function	4-20
4-9 Example of MAP Packet Processing Procedures.....	4-20
4-10 Abstract Model of MAP Generation Function.....	4-21
4-11 Example of MAP Generation Procedures.....	4-21
4-12 Abstract Model of MAP Multiplexing Function	4-22
4-13 Abstract Model of VC Packet Processing Function	4-23
4-14 Example of VC Packet Processing Procedures.....	4-23
4-15 Abstract Model of Virtual Channel Generation Function.....	4-24
4-16 Abstract Model of Virtual Channel Multiplexing Function	4-25
4-17 Abstract Model of Master Channel Multiplexing Function.....	4-26

CONTENTS (continued)

<u>Figure</u>	<u>Page</u>
4-18 Abstract Model of All Frames Generation Function	4-27
4-19 Internal Organization of Protocol Entity (Receiving End)	4-28
4-20 Abstract Model of MAP Packet Extraction Function	4-29
4-21 Abstract Model of MAP Reception Function	4-30
4-22 Abstract Model of MAP Demultiplexing Function	4-30
4-23 Abstract Model of VC Packet Extraction Function	4-31
4-24 Abstract Model of Virtual Channel Reception Function	4-32
4-25 Abstract Model of Virtual Channel Demultiplexing Function	4-33
4-26 Abstract Model of Master Channel Demultiplexing Function	4-34
4-27 Abstract Model of All Frames Reception Function	4-35
6-1 SDLS Fields in a Type-D Transfer Frame with a Segment Header	6-2
6-2 SDLS Fields in a Type-D Transfer Frame without a Segment Header	6-2
6-3 Order of Processing between TC, COP-1, and SDLS Functions	6-6

Table

2-1 Summary of Services Provided by TC Space Data Link Protocol	2-8
4-1 Interpretation of the Bypass and Control Command Flags	4-4
4-2 Interpretation of the Sequence Flags	4-8
5-1 Managed Parameters for a Physical Channel	5-1
5-2 Managed Parameters for a Master Channel	5-2
5-3 Managed Parameters for a Virtual Channel	5-3
5-4 Managed Parameters for a MAP Channel	5-4
5-5 Managed Parameters for Packet Transfer	5-4
6-1 Additional Managed Parameters for a Virtual Channel without Segment Headers When TC Space Data Link Protocol Supports SDLS	6-11
6-2 Additional Managed Parameters for a MAP When TC Space Data Link Protocol Supports SDLS	6-11

1 INTRODUCTION

1.1 PURPOSE

The purpose of this Recommended Standard is to specify the Telecommand (TC) Space Data Link Protocol. This protocol is a Data Link Layer protocol (see reference [1]) to be used over ground-to-space or space-to-space communications links by space missions.

1.2 SCOPE

This Recommended Standard defines the TC Space Data Link Protocol in terms of:

- a) the services provided to the users of this protocol;
- b) the protocol data units employed by the protocol; and
- c) the procedures performed by the protocol.

It does not specify:

- a) individual implementations or products;
- b) the implementation of service interfaces within real systems;
- c) the methods or technologies required to perform the procedures; or
- d) the management activities required to configure and control the protocol.

1.3 APPLICABILITY

This Recommended Standard applies to the creation of Agency standards and to future data communications over space links between CCSDS Agencies in cross-support situations. The Recommended Standard includes comprehensive specification of the services and protocol for inter-Agency cross support. It is neither a specification of, nor a design for, real systems that may be implemented for existing or future missions.

The Recommended Standard specified in this document is to be invoked through the normal standards programs of each CCSDS Agency and is applicable to those missions for which cross support based on capabilities described in this Recommended Standard is anticipated. Where mandatory capabilities are clearly indicated in sections of the Recommended Standard, they must be implemented when this document is used as a basis for cross support. Where options are allowed or implied, implementation of these options is subject to specific bilateral cross support agreements between the Agencies involved.

1.4 RATIONALE

The CCSDS believes it is important to document the rationale underlying the recommendations chosen, so that future evaluations of proposed changes or improvements will not lose sight of previous decisions.

1.5 DOCUMENT STRUCTURE

This document is divided into six numbered sections and three annexes:

- a) section 1 presents the purpose, scope, applicability and rationale of this Recommended Standard and lists the conventions, definitions, and normative references used throughout the Recommended Standard;
- b) section 2 provides an overview of the TC Space Data Link Protocol;
- c) section 3 defines the services provided by the protocol entity;
- d) section 4 specifies the protocol data units and procedures employed by the protocol entity;
- e) section 5 specifies the managed parameters used by the protocol entity;
- f) section 6 specifies the protocol entity with support for the Space Data Link Security protocol;
- g) annex A lists all acronyms used within this document;
- h) annex B provides a list of informative references.

1.6 CONVENTIONS AND DEFINITIONS

1.6.1 DEFINITIONS

1.6.1.1 Definitions from the Open Systems Interconnection (OSI) Basic Reference Model

This Recommended Standard makes use of a number of terms defined in reference [1]. The use of those terms in this Recommended Standard is to be understood in a generic sense, i.e., in the sense that those terms are generally applicable to any of a variety of technologies that provide for the exchange of information between real systems. Those terms are:

- a) blocking;
- b) connection;
- c) Data Link Layer;
- d) entity;

- e) flow control;
- f) Network Layer;
- g) peer entities;
- h) Physical Layer;
- i) protocol control information;
- j) protocol data unit;
- k) real system;
- l) segmenting;
- m) service;
- n) Service Access Point (SAP);
- o) SAP address;
- p) service data unit.

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1.6.1.2 Definitions from OSI Service Definition Conventions

This Recommended Standard makes use of a number of terms defined in reference [2]. The use of those terms in this Recommended Standard is to be understood in a generic sense, i.e., in the sense that those terms are generally applicable to any of a variety of technologies that provide for the exchange of information between real systems. Those terms are:

- a) confirmation;
- b) indication;
- c) primitive;
- d) request;
- e) response;
- f) service provider;
- g) service user.

1.6.1.3 Terms Defined in this Recommended Standard

For the purposes of this Recommended Standard, the following definitions also apply. Many other terms that pertain to specific items are defined in the appropriate sections.

asynchronous: not *synchronous* (see below).

delimited: having a known (and finite) length; applies to data in the context of data handling.

Mission Phase: a period of a mission during which specified communications characteristics are fixed. The transition between two consecutive Mission Phases may cause an interruption of the communications services.

Physical Channel: a stream of bits transferred over a space link in a single direction.

space link: a communications link between a spacecraft and its associated ground system, or between two spacecraft. A space link consists of one or more Physical Channels in one or both directions.

synchronous: of or pertaining to a sequence of events occurring in a fixed time relationship (within specified tolerance) to another sequence of events.

(TC) Transfer Frame: The protocol data unit of the Telecommand (TC) Space Data Link Protocol.

1.6.2 NOMENCLATURE

1.6.2.1 Normative Text

The following conventions apply for the normative specifications in this Recommended Standard:

- a) the words 'shall' and 'must' imply a binding and verifiable specification;
- b) the word 'should' implies an optional, but desirable, specification;
- c) the word 'may' implies an optional specification;
- d) the words 'is', 'are', and 'will' imply statements of fact.

NOTE – These conventions do not imply constraints on diction in text that is clearly informative in nature.

1.6.2.2 Informative Text

In the normative sections of this document, informative text is set off from the normative specifications either in notes or under one of the following subsection headings:

- Overview;
- Background;
- Rationale;
- Discussion.

1.6.3 CONVENTIONS

In this document, the following convention is used to identify each bit in an N -bit field. The first bit in the field to be transmitted (i.e., the most left justified when drawing a figure) is defined to be ‘Bit 0’; the following bit is defined to be ‘Bit 1’ and so on up to ‘Bit $N-1$ ’. When the field is used to express a binary value (such as a counter), the Most Significant Bit (MSB) shall be the first transmitted bit of the field, i.e., ‘Bit 0’ (see figure 1-1).

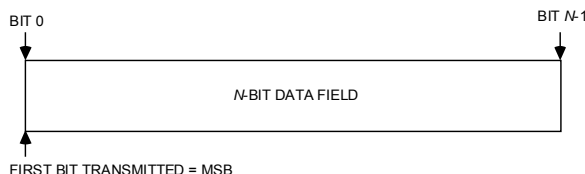


Figure 1-1: Bit Numbering Convention

In accordance with standard data-communications practice, data fields are often grouped into eight-bit ‘words’ which conform to the above convention. Throughout this Recommended Standard, such an eight-bit word is called an ‘octet’.

The numbering for octets within a data structure starts with zero.

By CCSDS convention, all ‘spare’ bits shall be permanently set to ‘0’.

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1.7 REFERENCES

The following publications contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All publications are subject to revision, and users of this document are encouraged to investigate the possibility of applying the most recent editions of the publications indicated below. The CCSDS Secretariat maintains a register of currently valid CCSDS publications.

- [1] *Information Technology—Open Systems Interconnection—Basic Reference Model: The Basic Model*. 2nd ed. International Standard, ISO/IEC 7498-1:1994. Geneva: ISO, 1994.
- [2] *Information Technology—Open Systems Interconnection—Basic Reference Model—Conventions for the Definition of OSI Services*. International Standard, ISO/IEC 10731:1994. Geneva: ISO, 1994.
- [3] *TC Synchronization and Channel Coding*. Issue 2. Recommendation for Space Data System Standards (Blue Book), CCSDS 231.0-B-2. Washington, D.C.: CCSDS, September 2010.