INTERNATIONAL STANDARD

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Second edition
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Space data and information transfer systems — Proximity-1 space link protocol — Coding and synchronization sublayer

Systèmes de transfert des informations et données spatiales — Protocole pour liaisons spatiales de proximité 1 — Sous-couche de codage et synchronisation

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 21459 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 211.2-B-2, December 2013) 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 second edition of ISO 21459:2015 cancels and replaces the first edition (ISO 21459:2006), which has been technically revised.

The Consultative Committee for Space Data Systems

Recommendation for Space Data System Standards

PROXIMITY-1 SPACE LINK PROTOCOL—CODING AND SYNCHRONIZATION SUBLAYER

RECOMMENDED STANDARD

CCSDS 211.2-B-2

BLUE BOOK

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This document has been approved for publication by the Management Council of the Consultative Committee for Space Data Systems (CCSDS) and represents the consensus technical agreement of the participating CCSDS Member Agencies. The procedure for review and authorization of CCSDS documents is detailed in *Organization and Processes for the Consultative Committee for Space Data Systems* (CCSDS A02.1-Y-3), and the record of Agency participation in the authorization of this document can be obtained from the CCSDS Secretariat at the address below.

This document is published and maintained by:

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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 anticipated date of initial operational capability.

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FOREWORD

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CCSDS shall not be held responsible for identifying any or all such patent rights.

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Questions relating to the contents or status of this document should be addressed to the CCSDS Secretariat at the address indicated on page i.

At time of publication, the active Member and Observer Agencies of the CCSDS were:

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– Agenzia Spaziale Italiana (ASI)/Italy.
– Canadian Space Agency (CSA)/Canada.
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– Austrian Space Agency (ASA)/Austria.
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– Swedish Space Corporation (SSC)/Sweden.
– Swiss Space Office (SSO)/Switzerland.
– United States Geological Survey (USGS)/USA.

DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 211.0-B-1	Proximity-1 Space Link Protocol	October 2002	Original issue, superseded
CCSDS 211.2-B-1	Proximity-1 Space Link Protocol—Coding and Synchronization Sublayer	April 2003	Superseded
CCSDS 211.2-B-2	Proximity-1 Space Link Protocol—Coding and Synchronization Sublayer, Recommended Standard, Issue 2	December 2013	Current issue: This update includes several improvements and clarifications—accomplishing better alignment and consistency with the other Proximity-1 Blue Books—and the addition of an option for Low-Density Parity-Check (LDPC) codes.

NOTE – Changes from the previous issue are too extensive to permit markup.

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1 INTRODUCTION

1.1 PURPOSE

The purpose of this Recommended Standard is to specify synchronization and channel coding schemes used with the Proximity-1 Data Link Protocol (reference [3]) and Physical Layer (reference [4]). Proximity space links are defined to be short-range, bi-directional, fixed or mobile radio links, generally used to communicate among probes, landers, rovers, orbiting constellations, and orbiting relays. These links are characterized by short time delays, moderate (not weak) signals, and short, independent sessions.

1.2 SCOPE

This Recommended Standard defines synchronization and channel coding schemes for Proximity-1 links in terms of:

a) the services provided to the users of this specification;

b) data formats; and

c) the procedures performed to generate and process the data formats.

It does not specify:

a) individual implementations or products;

b) the methods or technologies required to perform the procedures; or

c) the management activities required to configure and control the protocol.

The Coding and Synchronization Sublayer is part of the Data Link Layer. The rest of the Data Link Layer is defined in the separate CCSDS Recommended Standard entitled, *Proximity-1 Space Link Protocol—Data Link Layer* (reference [3]). The Physical Layer is defined in the separate CCSDS Recommended Standard entitled, *Proximity-1 Space Link Protocol—Physical Layer* (reference [4]).

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. It applies also to internal Agency links where no cross-support is required. It includes specification of the services and protocols for inter-Agency cross support. It is neither a specification of, nor a design for, 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. Concept and rationale behind the decisions that formed the basis for Proximity-1 is documented in the CCSDS Proximity-1 Space Link Green Book (reference [E1]).

1.5 DOCUMENT STRUCTURE

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

a) section 1 presents the purpose, scope, applicability and rationale of this Recommended Standard and lists the conventions, definitions, and references used throughout the document;

b) section 2 provides an overview of Proximity-1 synchronization and channel coding;

c) section 3 specifies convolutional coding;

d) annex A contains the Protocol Implementation Conformance Statement (PICS) proforma for this specification;

e) annex B defines the service provided to the users;

f) annex C defines CRC-32 Coding Procedure;

g) annex D discusses security, SANA, and patent considerations;

h) annex E contains informative references;

i) annex F contains a list of abbreviations and acronyms.

1.6 CONVENTIONS AND DEFINITIONS

1.6.1 DEFINITIONS

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

This Recommended Standard makes use of a number of terms defined in reference [1]. In this Recommended Standard those terms are used 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 as follows:

a) Data Link Layer;

b) Physical Layer;

c) protocol data unit;

d) real system;

e) service;

f) service data unit.

1.6.1.2 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.

forward link: That portion of a Proximity space link in which the caller transmits and the responder receives (typically a command link).

physical channel: The RF channel upon which the stream of channel symbols is transferred over a space link in a single direction.

PLTU: Proximity Link Transmission Unit, the data unit composed of the Attached Synchronization Marker, the Version-3 Transfer Frame, and the attached Cyclic Redundancy Check (CRC)-32.

Proximity link: A full-duplex, half-duplex or simplex link for the transfer of data between Proximity-1 entities in a session.

return link: That portion of a Proximity space link in which the responder transmits and the caller receives (typically a telemetry link).

space link: A communications link between transmitting and receiving entities, at least one of which is in space.