

INTERNATIONAL  
STANDARD

ISO  
21324

First edition  
2016-11-15

---

---

**Space data and information transfer  
systems — Space data link security  
protocol**

*Systèmes de transfert des données et informations spatiales —  
Protocole de sécurité de liaison de données spatiales*

**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

[ISO 21324:2016](#)

<https://standards.iteh.ai/catalog/standards/iso/ae736d47-5978-4bdd-ab2e-e15a1a2b9b8e/iso-21324-2016>



Reference number  
ISO 21324:2016(E)

© ISO 2016

**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

[ISO 21324:2016](#)

<https://standards.iteh.ai/catalog/standards/iso/ae736d47-5978-4bdd-ab2e-e15a1a2b9b8e/iso-21324-2016>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2016

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
copyright@iso.org  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

## 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. [www.iso.org/directives](http://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. [www.iso.org/patents](http://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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](http://www.iso.org/foreword-supplementary-information)

ISO 21324 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 355.0-B-1, 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*.

<http://standards.iso.org/iso/standard/21324/5978-4bdd-ab2e-e15a1a2b9b8e/iso-21324-2016>

## 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:

- o Whenever a member establishes a CCSDS-related **standard**, this **standard** will be in accord with the relevant **Recommended Standard**. Establishing such a **standard** does not preclude other provisions which a member may develop.
- o Whenever a member establishes a CCSDS-related **standard**, that member will provide other CCSDS members with the following information:
  - The **standard** itself.
  - The anticipated date of initial operational capability.
  - The anticipated duration of operational service.
- o Specific service arrangements shall be made via memoranda of agreement. Neither this **Recommended Standard** nor any ensuing **standard** is a substitute for a memorandum of agreement.

No later than five years from its date of issuance, this **Recommended Standard** will be reviewed by the CCSDS to determine whether it should: (1) remain in effect without change; (2) be changed to reflect the impact of new technologies, new requirements, or new directions; or (3) be retired or canceled.

In those instances when a new version of a **Recommended Standard** is issued, existing CCSDS-related member standards and implementations are not negated or deemed to be non-CCSDS compatible. It is the responsibility of each member to determine when such standards or implementations are to be modified. Each member is, however, strongly encouraged to direct planning for its new standards and implementations towards the later version of the Recommended Standard.

## FOREWORD

This document describes a protocol for applying security services to the CCSDS Space Data Link Protocols used by space missions over a space link.

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.

Through the process of normal evolution, it is expected that expansion, deletion, or modification of this document may occur. This Recommended Standard is therefore subject to CCSDS document management and change control procedures, which are defined in *Organization and Processes for the Consultative Committee for Space Data Systems* (CCSDS A02.1-Y-4). Current versions of CCSDS documents are maintained at the CCSDS Web site:

**iTeh Standards** <http://www.ccsds.org/>

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

## Document Preview

[ISO 21324:2016](#)

<https://standards.iteh.ai/catalog/standards/iso/ae736d47-5978-4bdd-ab2e-e15a1a2b9b8e/iso-21324-2016>

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

#### Member Agencies

- Agenzia Spaziale Italiana (ASI)/Italy.
- Canadian Space Agency (CSA)/Canada.
- Centre National d'Etudes Spatiales (CNES)/France.
- China National Space Administration (CNSA)/People's Republic of China.
- Deutsches Zentrum für Luft- und Raumfahrt (DLR)/Germany.
- European Space Agency (ESA)/Europe.
- Federal Space Agency (FSA)/Russian Federation.
- Instituto Nacional de Pesquisas Espaciais (INPE)/Brazil.
- Japan Aerospace Exploration Agency (JAXA)/Japan.
- National Aeronautics and Space Administration (NASA)/USA.
- UK Space Agency/United Kingdom.

#### Observer Agencies

- Austrian Space Agency (ASA)/Austria.
- Belgian Federal Science Policy Office (BFSPO)/Belgium.
- Central Research Institute of Machine Building (TsNIIMash)/Russian Federation.
- China Satellite Launch and Tracking Control General, Beijing Institute of Tracking and Telecommunications Technology (CLTC/BITTT)/China.
- Chinese Academy of Sciences (CAS)/China.
- Chinese Academy of Space Technology (CAST)/China.
- Commonwealth Scientific and Industrial Research Organization (CSIRO)/Australia.
- Danish National Space Center (DNSC)/Denmark.
- Departamento de Ciência e Tecnologia Aeroespacial (DCTA)/Brazil.
- Electronics and Telecommunications Research Institute (ETRI)/Korea.
- European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)/Europe.
- European Telecommunications Satellite Organization (EUTELSAT)/Europe.
- Geo-Informatics and Space Technology Development Agency (GISTDA)/Thailand.
- Hellenic National Space Committee (HNSC)/Greece.
- Indian Space Research Organization (ISRO)/India.
- Institute of Space Research (IKI)/Russian Federation.
- KFKI Research Institute for Particle & Nuclear Physics (KFKI)/Hungary.
- Korea Aerospace Research Institute (KARI)/Korea.
- Ministry of Communications (MOC)/Israel.
- National Institute of Information and Communications Technology (NICT)/Japan.
- National Oceanic and Atmospheric Administration (NOAA)/USA.
- National Space Agency of the Republic of Kazakhstan (NSARK)/Kazakhstan.
- National Space Organization (NSPO)/Chinese Taipei.
- Naval Center for Space Technology (NCST)/USA.
- Scientific and Technological Research Council of Turkey (TUBITAK)/Turkey.
- South African National Space Agency (SANSA)/Republic of South Africa.
- Space and Upper Atmosphere Research Commission (SUPARCO)/Pakistan.
- Swedish Space Corporation (SSC)/Sweden.
- Swiss Space Office (SSO)/Switzerland.
- United States Geological Survey (USGS)/USA.

**DOCUMENT CONTROL**

<b>Document</b>	<b>Title</b>	<b>Date</b>	<b>Status</b>
CCSDS 355.0-B-1	Space Data Link Security Protocol, Recommended Standard, Issue 1	September 2015	Original issue

**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

[ISO 21324:2016](#)

<https://standards.iteh.ai/catalog/standards/iso/ae736d47-5978-4bdd-ab2e-e15a1a2b9b8e/iso-21324-2016>

## CONTENTS

<u>Section</u>	<u>Page</u>
<b>1 INTRODUCTION.....</b>	<b>1-1</b>
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 DEFINITIONS.....	1-3
1.7 CONVENTIONS .....	1-3
1.8 REFERENCES .....	1-4
<b>2 OVERVIEW.....</b>	<b>2-1</b>
2.1 CONCEPT OF SECURITY PROTOCOL.....	2-1
2.2 FEATURES OF SECURITY PROTOCOL.....	2-2
2.3 SERVICE FUNCTIONS .....	2-6
<b>3 SERVICE DEFINITION.....</b>	<b>3-1</b>
3.1 OVERVIEW .....	3-1
3.2 FUNCTION AT THE SENDING END .....	3-1
3.3 FUNCTION AT THE RECEIVING END .....	3-4
3.4 SECURITY ASSOCIATION MANAGEMENT SERVICE.....	3-7
<b>4 PROTOCOL SPECIFICATION.....</b>	<b>4-1</b>
4.1 PROTOCOL DATA UNITS .....	4-1
4.2 SECURITY PROTOCOL PROCEDURES .....	4-3
<b>5 USE OF THE SERVICES WITH CCSDS PROTOCOLS .....</b>	<b>5-1</b>
5.1 TM PROTOCOL .....	5-1
5.2 TC PROTOCOL .....	5-1
5.3 AOS PROTOCOL .....	5-2
5.4 SUMMARY OF PROTOCOL SERVICES.....	5-3
<b>6 MANAGED PARAMETERS .....</b>	<b>6-1</b>
6.1 OVERVIEW .....	6-1
6.2 REQUIREMENTS.....	6-1
<b>7 CONFORMANCE REQUIREMENTS .....</b>	<b>7-1</b>

## CONTENTS (continued)

<u>Section</u>	<u>Page</u>
<b>ANNEX A PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) PROFORMA (NORMATIVE) .....</b>	<b>A-1</b>
<b>ANNEX B SECURITY, SANA, AND PATENT CONSIDERATIONS (INFORMATIVE) .....</b>	<b>B-1</b>
<b>ANNEX C ABBREVIATIONS AND ACRONYMS (INFORMATIVE).....</b>	<b>C-1</b>
<b>ANNEX D INFORMATIVE REFERENCES (INFORMATIVE) .....</b>	<b>D-1</b>
<b>ANNEX E BASELINE IMPLEMENTATION MODE (INFORMATIVE).....</b>	<b>E-1</b>

### Figure

2-1 Security Protocol within OSI Model .....	2-1
2-2 Security Protocol Interaction with Space Link Frames .....	2-2
2-3 Security Protocol Support for TM Services.....	2-3
2-4 Security Protocol Support for TC Services .....	2-4
2-5 Security Protocol Support for AOS Services.....	2-5
4-1 Security Header .....	4-1
4-2 Security Trailer .....	4-3
5-1 TM Transfer Frame Using the Security Protocol .....	5-1
5-2 TC Transfer Frame Using the Security Protocol .....	5-2
5-3 AOS Transfer Frame Using the Security Protocol .....	5-2
E-1 Security Header (TM Baseline) .....	E-1
E-2 Security Trailer (TM Baseline).....	E-2
E-3 Security Header (TC Baseline) .....	E-2
E-4 Security Trailer (TC Baseline).....	E-3
E-5 Security Header (AOS Baseline) .....	E-4
E-6 Security Trailer (AOS Baseline).....	E-4

### Table

5-1 Summary of Protocol and Services Support .....	5-3
6-1 Managed Parameters for Security Protocol .....	6-1

## 1 INTRODUCTION

### 1.1 PURPOSE

The purpose of this Recommended Standard is to specify the Space Data Link Security Protocol (hereafter referred as the Security Protocol) for CCSDS data links. This protocol provides a security header and trailer along with associated procedures that may be used with the CCSDS Telemetry, Telecommand, and Advanced Orbiting Systems Space Data Link Protocols (references [1]-[3]) to provide a structured method for applying data authentication and/or data confidentiality at the Data Link Layer.

### 1.2 SCOPE

This Recommended Standard defines the Security Protocol in terms of:

- a) the protocol data units employed by the service provider; and
- b) the procedures performed by the service provider.

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 service.

This Recommended Standard does not mandate the use of any particular cryptographic algorithm with the Security Protocol. Reference [4] provides a listing of algorithms recommended by CCSDS; any organization should conduct a risk assessment before choosing to substitute other algorithms. Annex E (non-normative) defines baseline implementations suitable for a large range of space missions.

### 1.3 APPLICABILITY

This Recommended Standard applies to the creation of Agency standards and for secure data communications over space links between CCSDS Agencies in cross-support situations. The Recommended Standard includes comprehensive specification of the service 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 interoperability and 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 interoperability and 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 goals of this Recommended Standard are to:

- a) provide a standard method of applying security at the Data Link Layer, independent of the underlying cryptographic algorithms employed by any particular space mission;
- b) preserve compatibility with existing CCSDS Space Data Link Protocol Transfer Frame Header and Trailer formats and frame processing implementations so that, where appropriate, legacy frame processing infrastructure may continue to be used without modification;
- c) preserve compatibility with the CCSDS Space Link Extension (SLE) forward and return services; and
- d) facilitate the development of common commercial implementations to improve interoperability across agencies.

More discussion of the Security Protocol's goals and design choices, including its interaction with other CCSDS services, may be found in reference [D3].

<https://standards.iteh.ai/catalog/standards/iso/ae736d47-5978-4bdd-ab2e-e15a1a2b9b8e/iso-21324-2016>

## 1.5 DOCUMENT STRUCTURE

This document is organized as follows:

Section 1 presents the purpose, scope, applicability, and rationale of this Recommended Standard and lists the conventions, definitions, and references used throughout the document.

Section 2 (informative) provides an overview of the Security Protocol.

Section 3 (normative) defines the services provided by the protocol entity.

Section 4 (normative) specifies the protocol data units provided for these services and the procedures employed by the service provider.

Section 5 (normative) specifies the constraints associated with these services for each of the supported Space Data Link Protocols.

Section 6 (normative) lists the managed parameters associated with these services.

Section 7 (normative) specifies how to verify an implementation's conformance with the Security Protocol.

Annex A (normative) provides a Protocol Implementation Conformance Statement (PICS) proforma for the Security Protocol.

Annex B (informative) provides an overview of security, SANA registry, and patent considerations related to this Recommended Standard.

Annex C (informative) provides a glossary of abbreviations and acronyms that appear in the document.

Annex D (informative) provides a list of informative references.

Annex E (informative) defines baseline implementations suitable for a large range of space missions.

## 1.6 DEFINITIONS

For the purposes of this document, the following definitions apply.

NOTE – Generic definitions for the security terminology applicable to this and other CCSDS documents are provided in reference [D5].<sup>7</sup>

**Payload:** Data input to be processed by a Security Protocol function.

<https://standards.iteh.ai/ISO 21324-2016>

**ProcessSecurity Payload:** Payload to the ProcessSecurity function.

**Authentication Payload:** Part of the Transfer Frame to be authenticated.

## 1.7 CONVENTIONS

### 1.7.1 NOMENCLATURE

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.

### 1.7.2 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.

### 1.8 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.

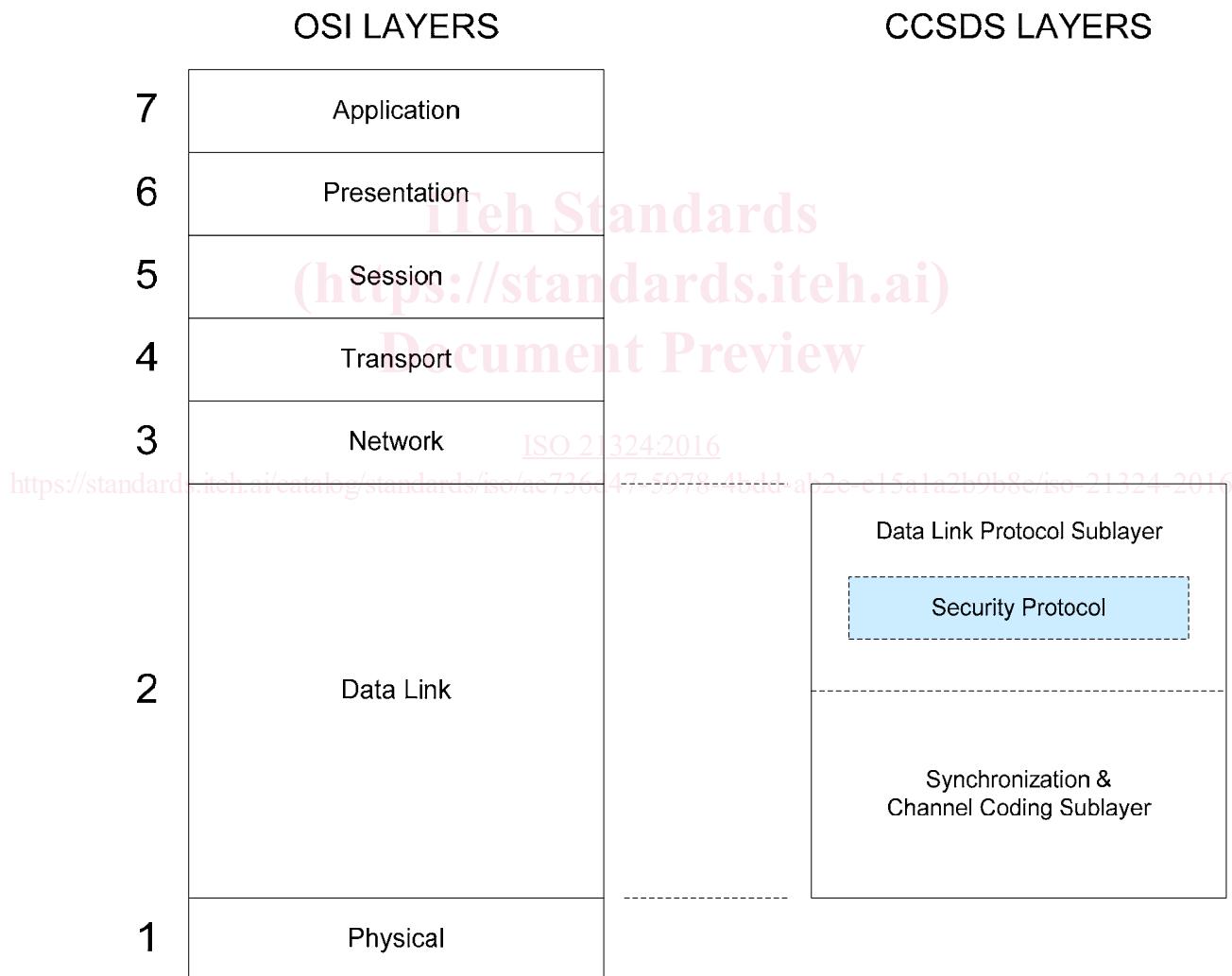
- [1] *TM Space Data Link Protocol*. Issue 2. Recommendation for Space Data System Standards (Blue Book), CCSDS e132.0-B-2. Washington, D.C.: CCSDS, September 2015.
- [2] *TC Space Data Link Protocol*. Issue 3. Recommendation for Space Data System Standards (Blue Book), CCSDS 232.0-B-3. Washington, D.C.: CCSDS, September 2015.
- [3] *AOS Space Data Link Protocol*. Issue 3. Recommendation for Space Data System Standards (Blue Book), CCSDS 732.0-B-3. Washington, D.C.: CCSDS, September 2015.
- [4] *CCSDS Cryptographic Algorithms*. Issue 1. Recommendation for Space Data System Standards (Blue Book), CCSDS 352.0-B-1. Washington, D.C.: CCSDS, November 2012.

NOTE – Informative references are listed in annex D.

## 2 OVERVIEW

### 2.1 CONCEPT OF SECURITY PROTOCOL

The Space Data Link Security Protocol is a data processing method for space missions that need to apply authentication and/or confidentiality to the contents of Transfer Frames used by Space Data Link Protocols over a space link. The Security Protocol is provided only at the Data Link Layer (Layer 2) of the OSI Basic Reference Model (reference [D1]), as illustrated in figure 2-1. It is an extra service of the Space Data Link Protocols defined in references [1]–[3], and therefore is to be used together with one of these references. (The Security Protocol is *not* applicable for use with the Proximity-1 Space Data Link Protocol.)



**Figure 2-1: Security Protocol within OSI Model**