ECSS-E-50 Part 2A
4 July 2005


# Space engineering

## Communications – Part 2: Document requirements definitions (DRDs)

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# Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance 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 must 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.

The formulation of this Standard takes into account the existing ISO 9000 family of documents.

This Standard is divided in two parts:

- Part 1 defines the principles and requirements applicable to communications engineering.
- Part 2 defines the content of the DRDs which are specifically referenced in Part 1.

This Standard has been prepared by the ECSS-E-50 Working Group, reviewed by the ECSS Engineering Panel and approved by the ECSS Steering Board.

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# Contents

## Tables

# 1

# Scope

This Part 2 of ECSS-E-50 defines the content of the document requirements definitions (DRDs) that are called up by other ECSS Standards and explicitly referenced in ECSS-E-50 Part 1.

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# 2

# Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revisions of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references the latest edition of the publication referred to applies.

| | |
|---|---|
| ECSS-P-001 | Glossary of terms |
| ECSS-E-50 Part 1A | Space engineering - Communications - Part 1: Principles and requirements |
| ECSS-M-50 | Space project management - Information/documentation management |

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# 3

# Terms, definitions and abbreviated terms

## 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ECSS-P-001 and ECSS-E-50 Part 1 apply.

## 3.2 Abbreviated terms

The following abbreviated terms are defined and used within this document:

| **Abbreviations** | **Meaning** |
|---|---|
| **CSAD** | communication system analysis document |
| **CSADD** | communication system architectural design document |
| **CSBD** | communication system baseline definition |
| **CSDDD** | communication system detailed design document |
| **CSOM** | communication system operations manual |
| **CSPD** | communication system profile document |
| **CSRD** | communication system requirements document |
| **CSVP** | communication system verification plan |
| **DRD** | document requirements definition |
| **LEOP** | launch and early operations phase |
| **RF** | radio frequency |

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# 4

# Document requirements definitions (DRD) list

ECSS Standards specify the production and use of project documents. Document requirements definitions are defined to control the content of the project documents.

Document requirements definitions serve to ensure:

a. completeness and consistency of information within documents,

b. that the information contained in a document conforms to its defined scope, and correctly implements its interfaces with other documents, and

c. that portions of a document can be generated or maintained by separate organizational groups and seamlessly integrated into a coherent whole.

Table 1 lists and summarizes the DRDs that are defined in the annexes of this Standard and called up in ECSS-E-50 Part 1.

## Table 1: ECSS-E-50 DRD list

| DRD ID | DRD Title | DRD summary content | Applicable to (phase) | Delivered | Remarks |
|---|---|---|---|---|---|
| ECSS-E-50 Part 2A Annex A | Communication system requirements document (CSRD) | Formally describes the requirements from the customer on the spacecraft communication system. Covers ground network, spacelink, and on-board network requirements, design, development, and operation. | Requirement engineering | SRR | |
| ECSS-E-50 Part 2A Annex B | Communication system baseline definition (CSBD) | Formal response to the CSRD that constitutes the technical baseline for the design and implementation of the spacecraft communication system. Includes a compliance matrix with the CSRD and any derived requirements. Documents any major assumptions and constraints and non-compliances. | Analysis | PDR | |
| ECSS-E-50 Part 2A Annex C | Communication system analysis document (CSAD) | Contains a full technical analysis of the communication system leading to the selection of frequencies, protocols, protocol options, redundancy strategy, and operational concept. | Analysis | PDR | |
| ECSS-E-50 Part 2A Annex D | Communication system verification plan (CSVP) | Describes the verification test plan for the spacecraft communication system. Plan covers tests carried out during verification phase and tests that may be used during operations. | Analysis, verification | PDR | |
| ECSS-E-50 Part 2A Annex E | Communication system architectural design document (CSADD) | Describes the architectural design of the spacecraft communication system and shows the relationships between the communication system and other mission systems. | Design and configuration | PDR | |
| ECSS-E-50 Part 2A Annex F | Communication system detailed design document (CSDDD) | Describes the detailed design of the spacecraft communication system. | Design and configuration | CDR | |

**Table 1: ECSS-E-50 DRD list** *(continued)*

| DRD ID | DRD Title | DRD summary content | Applicable to (phase) | Delivered | Remarks |
|---|---|---|---|---|---|
| ECSS-E-50 Part 2A Annex G | Communication system profile document (CSPD) | Documents the communication system profile, including frequency assignments, protocol selection, protocol options, address assignments, channel assignments, spacecraft identifier assignments, spacelink bandwidth allocations, and onboard bus bandwidth allocations for TM and TC. | Design and configuration | CDR | 1. The CSPD constitutes the formal statement of compliance to ECSS-E-50.<br>2. ECSS Level 3 standards applied to the communication system have their own profile documents. |
| ECSS-E-50 Part 2A Annex H | Communication system operations manual (CSOM) | Formally describes all procedures for the operation of the spacecraft communication system. Covers normal and contingency operations. Normal operations include procedures such as spacecraft signal acquisition, loss of signal, and hand-over, as well as communication system management activities such as address initialization and router configuration and maintenance. Contingency operations cover uni-directional communications (uplink only, downlink only) and unexpected loss and discontinuous signal. | Analysis | PDR | |

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# Annex A (normative)

# Communication system requirements document (CSRD) DRD

## A.1 DRD identification

### A.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirement 5.2.1.3.

### A.1.2 Purpose and objective

The communication system requirements document (CSRD) contains the top level assumptions, constraints and communication system requirements for a given mission to enable the supplier of the communication system to elaborate a design for the communication system.

The CSRD is written by the space project customer and is the highest level requirements document defining the requirements on the space communication system. The supplier of the space communication system formally responds to the CSRD with the communication system baseline definition (CSBD, see Annex B) where all the requirements in the CSRD can be traced to a proposed implementation.

## A.2 Expected response

### A.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSRD.

### A.2.2 Scope and contents

The CSRD shall provide the information presented in the following sections:

### <1> Introduction

The CSRD shall contain a description of the purpose, objective, content and the reason prompting its preparation.

### <2> Applicable and reference documents

The CSRD shall list the applicable and reference documents in support to the generation of the document.

### <3> Mission overview

The CSRD shall briefly describe:

(a) the main objectives and characteristics of the space mission;

(b) the spacecraft;

(c) the instruments on-board the spacecraft;

(d) the ground segment for the control and operations of the spacecraft, the instruments, and the ground segment itself;

(e) the operations to achieve the goal of the space project.

### <4> Project responsibilities

The CSRD shall briefly describe the distribution of responsibilities within the space project, including the responsibilities of the space project customer and those of the communication system supplier.

### <5> Major project milestones

The CSRD shall summarize:

(a) the major project milestones relating to the space segment;

(b) the major project milestones relating to the ground segment;

(c) major project milestones relating to the communication system.

### <6> Mission constraints

The CSRD shall describe:

(a) Launch

(1) The launch vehicle, the launch site location and the ascent trajectory.

(2) For orbital vehicles, the orbit injection characteristics.

(b) Trajectory

(1) The trajectory of the spacecraft.

(2) Any significant constraints or parameters associated with each part of the trajectory.

(3) Any notable periods arising from the trajectory during which communications with the spacecraft are difficult or impossible.

(4) For orbital vehicles, the intended orbital period and visibility periods and characteristics during which communication can be performed.

(c) Operational phases

(1) Each distinct operational phase of the space mission.

(2) Any constraints on, and expected characteristics of the communication system for each phase.

NOTE Mission phases usually include LEOP, commissioning, routine operations, and disposal. Other phases that can be included are contingency operations, critical manoeuvres, and hibernation.

(d) Spacecraft

Any constraints imposed on the communication system by the spacecraft, such as for example power limitations, antenna pointing constraints, and prohibited frequencies.

(e) Additional constraints

Any other constraints not covered in the preceding categories, and other essential mission information that impacts on the design of the communication system.

### <7> Communication system requirements

(a) General

(1) The CSRD shall list the high level requirements on the space communication system, at a level appropriate to enable all significant aspects of the communication system technical baseline to be elaborated.

NOTE This in turn enables:

- informed decision making concerning the development and procurement of the communication system components, and
- the communication system design drivers to be established.

(2) The list specified in (1) above shall include the communication system requirements that address the following major system elements:

- functional;
- performance;
- reliability;
- availability;
- interface;
- design (implementation);
- maintainability;
- security.

(3) Where the requirements for a particular system element differ for different operational or mission phases, the requirements shall first be listed for the normal operational phases and then those that are different for other mission phases.

(b) Organization of the communication system requirements

The CSRD shall list:

(1) The overall system requirements on the communication system including requirements related to:

- overall system availability and reliability,
- end-to-end performance,
- communication system lifetime,
- design and implementation,
- interfaces to existing external entities, and
- compatibility with specific communications protocols.

(2) The security requirements for the communication system.

NOTE As specified in ECSS-E-50 Part 1, this is based on a threat analysis of the mission.

(3) The communication system requirements for the space network, which comprises all of the nodes of the flight segment of the mission.

(4) For missions that involve multiple space segment elements, such as cluster missions, orbiter-lander combinations, lander-rover combinations, and missions with deployable probes, the requirements on the communications between those elements.

(5) The requirements for the link between the ground station and the spacecraft including requirements regarding:

- uplink and downlink performance,
- RF frequencies,
- contact periods and outages,
- link acquisition, and
- link failure modes.

(6) The communication system requirements for the ground network, which comprises all of the ground communication facilities used in the mission, including requirements for redundancy, availability, and accessibility.

# Annex B (normative)

# Communication system baseline definition (CSBD) DRD

## B.1 DRD identification

### B.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirement 5.2.3.3.

### B.1.2 Purpose and objective

The communication system baseline definition (CSBD) is the top level design document produced by the communication system supplier to define the communication system to be developed for the mission. The CSBD forms the basis for all other specification and design activities undertaken by the communication system supplier, as well as constituting the baseline for generating cost and schedule information.

The CSBD constitutes the formal response to the CSRD (see Annex A). All requirements in the CSRD are traced in the CSBD and appropriately apportioned into specific CSBD clauses. Furthermore, any additional requirements can be derived in the CSBD to ensure common understanding and unambiguous interpretation of the CSRD requirements.

## B.2 Expected response

### B.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSBD.

### B.2.2 Scope and contents

The CSBD shall provide the information presented in the following sections:

### <1> Introduction

The CSBD shall contain a description of the purpose, objective, content and the reason prompting its preparation.

### <2> Applicable and reference documents

The CSBD shall list the applicable and reference documents in support to the generation of the document.

### <3> Mission description and communication system overview

The CSBD shall briefly describe:

(a) the main objectives and characteristics of the space mission;

(b) the communication system, including:

(1) the intended communication system implementation,

(2) the main concepts of the proposed communication system,

(3) the system components of the communication system, indicating where they are located and how they interrelate, and

(4) the proposed protocols and communication frequencies to be used within the intended communication system.

### <4> Mission constraints and implementation assumptions

The CSBD shall describe:

(a) All mission constraints that affect the communication system.

NOTE These can include trajectory induced constraints such as out of contact, or hibernation mode, attitude induced constraints such as tumbling mode or antenna pointing limitations, and ground induced constraints such as ground station availability.

(b) All of the assumptions made in establishing the communication system baseline definition.

### <5> Communication system interfaces

The CSBD shall summarize:

(a) interfaces between the space network elements of the communication system and other entities onboard the spacecraft including:

(1) the control interfaces for the onboard elements of the communication system, indicating how the onboard data handling system manages space link communication;

(2) the data interfaces that enable onboard entities to send data to and receive data from the ground;

(b) for missions that have multiple space segment elements:

(1) how the communication links between those elements are controlled, and

(2) how data is transferred across them;

(c) the interfaces between the ground network elements of the communication system and other ground entities, including:

(1) the control interfaces for the ground elements of the communication system, indicating how the ground system manages space link communication;

(2) the data interfaces that enable ground entities to send data to and receive data from the spacecraft.

**<6> Communication system analysis**

(a) The CSBD shall describe:

(1) all of the communication system analysis and system studies to design a communication system that meets the objectives of the space mission, and

(2) the justification of the analysis and studies referred to in (1) above.

(b) The CSBD should:

(1) list all communication system issues to be resolved by modelling or simulation, and

(2) describe the modelling or simulation technique to be applied.

(c) The CSBD shall list the expected performances that can be achieved by the proposed communication system and indicate whether these fully meet the mission needs.

**<7> Communication system design and implementation**

The CSBD shall describe the technical approach to the design and implementation of the overall communication system and each of its components.

**<8> Communication system integration and technical verification and validation**

The CSBD shall describe the technical approach to the integration and testing of the communication system elements, and the technical verification and validation of the communication system as a whole.

**<9> Communication system operations**

The CSBD shall describe:

(a) All of the operational procedures relating to the communication system for normal operations.

(b) All of the operational procedures relating to the maintenance of the communication system.

(c) Special operational procedures to be used for contingency operation of the communication system, i.e. in case of degradation of its normal performance.

NOTE These operational procedures can include unidirectional operation of the communication system, e.g. command-in-the-blind and telemetry-in-the-blind, and operation at reduced signalling rates.

(d) The technical approach to monitoring the health and performance of the communication system.

(e) Any communication system specific operations not covered in items (a) to (d) above.

NOTE For example, these can include procedures to support in-flight communications experiments, reconfiguration of the communication system to support new mission parameters such as the addition of new flight elements, and procedures to adapt the communication system for use on other missions.

**<10> Special project facilities**

The CSBD shall describe any special project facilities for the development and implementation of the communication system (e.g. the modification of existing ground facilities, or the adaptation of reused flight software).

**<11> Support to other disciplines**

The CSBD shall describe the support to be provided to other spacecraft disciplines by the communication system supplier.

NOTE This can include the provision of simulation models of communication system components, and test harnesses.

**<12> Required input and output items and services**

The CSBD shall list:

(a) all of the deliverable items and services to be provided by the communication system supplier to support the mission;

(b) all of the items and services to be provided by the communication system customer in order to support the development of the communication system.

NOTE These can include:

- space segment design documents and information;
- ground segment design documents and information;
- access to testbeds, prototypes, and engineering models for integration and testing;
- simulation models of the ground and space segments.

**<13> CSRD vs. CSBD traceability matrix**

The CSBD shall provide a CSRD versus CSBD traceability matrix, summarized in a table, providing the following information for each entry:

— requirements – containing a list of all requirements in the CSRD;

— reference – providing a cross reference indicating one or more CSBD paragraphs where the requirement is fulfilled;

— compliance – indicating the level of the suppliers' compliance of the CSBD to the CSRD with one of the following values:

  * COMPLIANT,
  * PARTIALLY COMPLIANT, or
  * NON-COMPLIANT;

— notes – briefly describing the justification in those cases where column three indicates partial or non-compliance.

**<14> To-be-resolved items**

The CSBD shall list all of the items for which a clear resolution has not yet been found.

**<15> To-be-determined and to-be-confirmed items**

The CSBD shall list all of the items for which a specific communication system implementation cannot be committed without further information.

# Annex C (normative)

# Communication system analysis document (CSAD) DRD

## C.1 DRD identification

### C.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirement 5.2.2.3.

### C.1.2 Purpose and objective

The communication system analysis document (CSAD) is produced by the communication system supplier to capture the results of analysis and testing of the communication system. The first issue of the CSAD is produced for the PDR, but it is updated throughout the project as further communication system analysis and testing is carried out and, as specified in ECSS-E-50 Part 1, is reviewed at each major project milestone following the PDR.

The results of all analysis and testing carried out on the communication system are reported in the CSAD. This document is therefore critical for tracking the development of the communication system throughout the project, ensuring that the communication system continues to meet the functional and performance requirements as the design and implementation are elaborated. The CSAD is used as a reference for the identification and resolution of any design issues throughout the development of the communication system.

## C.2 Expected response

### C.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSAD.

### C.2.2 Scope and contents

The CSAD shall provide the information presented in the following sections:

### <1> Introduction

The CSAD shall contain a description of the purpose, objective, content and the reason prompting its preparation.

### <2> Applicable and reference documents

The CSAD shall list the applicable and reference documents in support to the generation of the document.

### <3> Mission description and communication system overview

The CSAD shall briefly describe:

(a) the main objectives and characteristics of the space mission, and

(b) the intended communication system implementation.

### <4> Overview of analysis approach

The CSAD:

(a) shall provide an overview of the analysis approach applied to the communication system;

(b) shall describe the goals and objectives of the analyses;

(c) shall describe the different analysis techniques used on the communication system;

(d) should contain a list of the communication system issues to be resolved by analysis.

### <5> Description and results of analysis

(a) The CSAD shall describe each of the analysis techniques applied to the communication system together with the results of that analysis.

(b) For each technique referred to in (a) above, the CSAD shall include at least the following:

(1) the objective of the analysis,

(2) a detailed description of the analysis technique,

(3) a description of any tools used to carry out the analysis,

(4) a list of any assumptions made concerning the communication system or its environment during the analysis,

(5) a list of starting conditions for the analysis,

(6) copies of all inputs to the analysis,

(7) the results of the analysis,

(8) an appraisal of the analysis drawing conclusions and inferences with respect to the communication system, and

(9) recommendations for the communication system based on the analysis.

NOTE The objective is that the analysis results can be reviewed offline, and the analyses can be repeated.

(c) The conclusions referred to in (b) (8) above should indicate whether the communication system meets its functional and performance requirements.

(d) The recommendations referred to in (b) (9) above should include recommendations on design changes.

# Annex D (normative)

# Communication system verification plan (CSVP) DRD

## D.1 DRD identification

### D.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirements 5.2.2.3, 5.2.3.3 and 5.2.4.3.

### D.1.2 Purpose and objective

The communication system verification plan (CSVP) is produced by the communication system supplier to describe the verification strategy and specific verification tests used to ensure that the communication system complies with the requirements established in the CSRD and CSBD. The first issue of the CSVP is produced for the PDR but, as specified in ECSS-E-50 Part 1, is updated throughout the project as more detailed tests are defined and critical issues are identified, and is reviewed at each major project milestone following the PDR.

The communication system verification plan defines the tests to be conducted on the communication system to verify conformity to CSRD (see Annex A) and CSBD (see Annex B) requirements and therefore derives from these two documents. The results of the verification tests and any analysis to be conducted as a part of the verification process are reported in the CSAD (see Annex C).

## D.2 Expected response

### D.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSVP.

### D.2.2 Scope and contents

The CSVP shall provide the information presented in the following sections:

**<1> Introduction**

The CSVP shall contain a description of the purpose, objective, content and the reason prompting its preparation.

**<2> Applicable and reference documents**

The CSVP shall list the applicable and reference documents in support to the generation of the document.

**<3> Mission description and communication system overview**

The CSVP shall briefly describe:

(a) the main objectives and characteristics of the space mission, and

(b) the intended communication system implementation.

**<4> Verification approach**

The CSVP shall:

(a) describe the approach to the communication system verification,

(b) describe the techniques to be used for the verification, and

(c) list any special tools or facilities to be used.

**<5> Verification schedule**

The CSVP shall:

(a) describe the communication system verification schedule explaining how the communication system verification schedule matches the development schedules for both the ground segment and flight segment of the space mission;

(b) include a list of all tools and equipment to be used for the communication system verification activities, identifying for each tool

(1) who is responsible for supplying it,

(2) where it is provided,

(3) the equipment configuration to use, and

(4) the duration for which it is used.

**<6> Support to other verification activities**

The CSVP shall describe:

(a) the tools, equipment, and facilities associated with the communication system that can be made available to support other verification activities, such as the ground system or flight system verification;

(b) the nature of the tool, equipment, or facility;

(c) the capability of each tool;

(d) when and where each tool can be made available.

**<7> Verification tests**

The CSVP shall describe each verification test to be performed, including the following information for each one:

(a) a statement of the purpose of the verification test;

(b) a detailed description of the test;

(c) a list of the tools, equipment, or facilities to perform the test;

(d) a definition of the configuration of the test environment and the unit under test at the start of the test (i.e. pre-conditions);

(e) a description of the expected result (i.e. post-conditions);

(f) pass and fail criteria for the test.

NOTE The purpose of these test description is to ensure that the verification tests can be repeated.

# Annex E (normative)

# Communication system architectural design document (CSADD) DRD

## E.1 DRD identification

### E.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirements 5.2.3.3 and 5.2.4.3.

### E.1.2 Purpose and objective

The communication system architectural design document (CSADD) describes the architectural design of the communication system defined in the CSBD (see Annex B).

The CSADD describes the design to the level where its functionality and operation can be understood for the purposes of the PDR. Furthermore, the CSADD enables the requirements for the individual system components, and the interfaces to those components, to be elaborated so that detailed design of the components can proceed.

The CSADD is produced by the communication system supplier to describe the architectural design of the communication system.

The CSADD is produced for the PDR, and its acceptance at the PDR by the communication system customer implies a commitment to proceed with the detailed design consistent with the architecture described. As specified in ECSS-E-50 Part 1, the CSADD is frozen after acceptance at the PDR.

The communication system architectural design document describes the high level architecture of the communication system and is therefore derived from the CSBD. In turn, the communication system detailed design document (CSDDD) is derived from the CSADD.

The interfaces identified within the CSADD, both between the communication system components, and to other external entities, are subject to tests defined in the CSVP. The functionality and performance of the communication system components identified in the CSADD can be the subject of specific analysis activities in the CSAD.

## E.2 Expected response

### E.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSADD.

### E.2.2 Scope and contents

The CSADD shall provide the information presented in the following sections:

**<1> Introduction**

The CSADD shall contain a description of the purpose, objective, content and the reason prompting its preparation.

**<2> Applicable and reference documents**

The CSADD shall list the applicable and reference documents in support to the generation of the document.

**<3> Mission description and communication system overview**

The CSADD shall briefly describe:

(a) the main objectives and characteristics of the space mission, and

(b) the intended communication system baseline as defined in the CSBD.

**<4> Communication system architectural design**

(a) The CSADD shall contain a description of the architectural design of the communication system in a human readable format, and include the justification of all critical architectural design decisions.

(b) Although this DRD imposes no constraints on the tools used to elaborate the architectural design, the architectural design shall be viewable without the use of the design tool.

(c) As a minimum, the architectural design of the communication system shall:

(1) list each major component of the communication system,

(2) describe the function and performance of each major component in terms of top level requirements,

(3) list and broadly describe all of the internal interfaces (i.e. interfaces between components of the communication system), and

(4) list and broadly describe all of the external interfaces (i.e. interfaces between external entities and components of the communication system).

**<5> Requirement applicability matrix**

This CSADD shall provide a requirement applicability matrix, including the following information:

— requirements - containing a list of all requirements in the CSRD plus any derived requirements contained in the CSBD;

— applicability - indicating the applicability of each requirement to each major communication system component. Usually, this column can be subdivided into a series of columns, one for each major system component, and completed check-box style;

— notes – providing any special information associated with a given requirement in respect of its allocation to a communication system component.

# Annex F (normative)

# Communication system detailed design document (CSDDD) DRD

## F.1 DRD identification

### F.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirements 5.2.3.3 and 5.2.4.3.

### F.1.2 Purpose and objective

The communication system detailed design document (CSDDD) describes the detailed design of the communication system, further elaborating the architectural design described in the CSADD (see Annex E). The CSDDD described the detailed design of each of the communication system components identified in the CSADD.

The CSDDD is produced by the communication system supplier to describe the detailed design of the communication system consistent with the architecture described in the CSADD. It describes the detailed design of each of the major communication system components identified in the CSADD.

The CSDDD is produced for the CDR, and its acceptance at the CDR by the communication system customer implies a commitment to proceed with the implementation of the system according to that detailed design.

As specified in ECSS-E-50 Part 1, the CSDDD is frozen after acceptance at the CDR.

The communication system detailed design document describes the detailed design of the communication system, and derives from the CSBD (see Annex B) and CSADD (see Annex E). Specific detailed tests for the components described in the communication system detailed design document are further described in the CSVP (see Annex D). Any specific analysis activities to justify the detailed design are contained in the CSAD (see Annex C).

As specified in ECSS-E-50 Part 1, the implementation or procurement of all of the communication system components is based on the communication system detailed design document.

## F.2 Expected response

### F.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSDDD.

### F.2.2 Scope and contents

The CSDDD shall provide the information presented in the following sections:

**<1> Introduction**

The CSDDD shall contain a description of the purpose, objective, content and the reason prompting its preparation.

**<2> Applicable and reference documents**

The CSDDD shall list the applicable and reference documents in support to the generation of the document.

**<3> Mission description and communication system overview**

The CSDDD shall briefly describe:

(a) the main objectives and characteristics of the space mission, and

(b) the architectural design contained in the CSADD.

**<4> Communication system detailed design**

(a) The CSDDD shall contain the detailed design of the communication system, with all critical detailed design decision justifications, including:

(1) the requirements applicable to each of the major components of the communication system identified in the CSADD,

(2) the detailed design of each major component of the communication system,

(3) a justification of all design decisions relating to the detailed design of each component, and

(4) a complete description of all of the interfaces to each component.

(b) This DRD imposes no constraints on the tools used to elaborate the detailed design, and some elements of the detailed design, that can only be viewed with the aid of the tools used in the elaboration of the design, may be accepted.

**<5> ICDs of the major components**

The CSDDD shall include the ICDs for each of the major components of the communication system.

# Annex G (normative)

# Communication system profile document (CSPD) DRD

## G.1 DRD identification

### G.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirements 5.2.3.3 and 5.2.5.3.

### G.1.2 Purpose and objective

The communication system profile document (CSPD) defines the frequencies, protocols and protocol options, address assignments, channel assignments, spacecraft identifier assignments, space link bandwidth allocations, and onboard bus bandwidth allocations used in the communication system, and constitutes a formal statement of compliance of the communication system to ECSS-E-50.

The CSPD is produced by the communication system supplier as a formal statement of the compliance of the communication system to the ECSS-E-50 requirements. The communication system profile document describes the frequencies, protocols and protocol options, address assignments, channel assignments, spacecraft identifier assignments, space link bandwidth allocations, and onboard bus bandwidth allocations used in the communication system.

As specified in ECSS-E-50 Part 1, the final version of the communication system profile document is available at FRR. Earlier versions can be produced for other reviews.

The communication system profile document describes the frequencies, protocols and protocol options, address assignments, channel assignments, spacecraft identifier assignments, spacelink bandwidth allocations, and onboard bus bandwidth allocations used in the communication system. This is a formal statement of compliance of the communication system to ECSS-E-50 and can be used for the establishment of interoperability agreements involving the communication system.

## G.2 Expected response

### G.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSPD.

### G.2.2 Scope and contents

The CSPD shall provide the information presented in the following sections:

**<1> Introduction**

The CSPD shall contain a description of the purpose, objective, content and the reason prompting its preparation.

**<2> Applicable and reference documents**

The CSPD shall list the applicable and reference documents in support to the generation of the document.

**<3> Mission description and communication system overview**

This CSPD shall briefly describe:

(a) the main objectives and characteristics of the space mission, and

(b) the communication system to which this profile document relates.

**<4> Communication system profile**

This CSPD shall consist of all tables, matrices, compliance statements, and compliance pro-formas to fully describe the characteristics of the communication system.

NOTE This DRD imposes no constraints on the way in which this information is presented. Generally, any standard protocols that are used can be defined by the compliance pro-forma associated with that protocol. For other, mission specific characteristics such as the spacecraft identifier values, spacelink frequencies, channel allocations, and address assignments, it is good practice that an appropriate mission pro-forma is defined early in the programme and populated as the values become known.

# Annex H (normative)

# Communication system operations manual (CSOM) DRD

## H.1 DRD identification

### H.1.1 Requirement identification and source document

ECSS-E-50 Part 1A, requirement 5.2.3.3.

### H.1.2 Purpose and objective

The communication system operations manual (CSOM) formally describes all procedures for the operation of the communication system. The operational procedures include normal and contingency operations. Normal operations include procedures for spacecraft signal acquisition, loss of signal, and hand-over, as well as communication system management activities such as address initialization and router configuration and maintenance. Contingency operations cover uni-directional space link (uplink only, downlink only), unexpected loss of signal, and discontinuos signal.

The CSOM is produced by the communication system supplier to describe the operations procedures for normal and contingency operation of the communication system.

As specified in ECSS-E-50 Part 1, the final version of the communication system operations manual is available for FRR. Earlier versions can be prepared for other reviews.

The communication system operations manual constitutes the user manual for the communication system. It is used in the development of the overall space mission operations procedures, and can be relevant to the definition of the onboard software.

## H.2 Expected response

### H.2.1 Response identification

The requirements for document identification contained in ECSS-M-50 shall be applied to the CSOM.

### H.2.2 Scope and contents

The CSOM shall provide the information presented in the following sections:

**<1> Introduction**

The CSOM shall contain a description of the purpose, objective, content and the reason prompting its preparation.

**<2> Applicable and reference documents**

The CSOM shall list the applicable and reference documents in support to the generation of the document.

**<3> Mission description and communication system overview**

The CSOM shall briefly describe:

(a) the main objectives and characteristics of the space mission, and

(b) the communication system implementation.

**<4> Communication systems operations**

The CSOM:

(a) shall describe the procedures used to commission the communication system during the early phases of the mission;

(b) shall describe the communication system test procedures used to verify the correct operation of the communication system during the mission;

(c) shall describe all of the routine operations procedures that are used during the mission, i.e. once the communication system is commissioned and operating normally;

(d) should include any procedure for the communication system reconfiguration that can be expected during the mission, such as the switch-over to a redundant communication chain, or the update of onboard routing tables;

(e) shall describe the contingency operations procedures to be used during abnormal operating conditions, e.g. when failures occur in the communication system.

**<5> Decommissioning procedure**

This CSOM shall describe the procedures used to decommission the communication system at the end of the mission.

**<6> Additional operating procedures**

The CSOM shall describe any operating procedures applicable to the communication system not described in items <4> and <5> above.

NOTE For example, these can include procedures to extend the capability of the communication system during the mission, e.g. by adding spacecraft to an existing constellation.

# ECSS Change Request / Document Improvement Proposal

A Change Request / Document Improvement Proposal for an ECSS Standard may be submitted to the ECSS Secretariat at any time after the standard's publication using the form presented below.

This form can be downloaded in MS Word format from the ECSS Website (www.ecss.nl, in the menus: Standards - ECSS forms).

## ECSS Change Request / Document Improvement Proposal

| 1. Originator's name:<br>Organization:<br>e-mail: | | | | 2. ECSS Document number:<br>3. Date: | |
|---|---|---|---|---|---|
| 4. Number. | 5. Location of deficiency<br>clause (e.g. 3.1) | page (e.g. 14) | 6. Changes | 7. Justification | 8. Disposition |
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**Filling instructions:**

1. **Originator's name -** Insert the originator's name and address
2. **ECSS document number -** Insert the complete ECSS reference number (e.g. ECSS-M-00B)
3. **Date -** Insert current date
4. **Number -** Insert originator's numbering of CR/DIP (*optional*)
5. **Location -** Insert clause, table or figure number and page number where deficiency has been identified
6. **Changes -** Identify any improvement proposed, giving as much detail as possible
7. **Justification -** Describe the purpose, reasons and benefits of the proposed change
8. **Disposition -** not to be filled in (*entered by relevant ECSS Panel*)

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