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Space engineering - Communication guidelines

Táto technická normalizačná informácia obsahuje anglickú verziu CEN/TR 17603-50:2022.
This Technical standard information includes the English version of CEN/TR 17603-50:2022.

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European Foreword

This document (CEN/TR 17603-50:2022) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

It is highlighted that this technical report does not contain any requirement but only collection of data or descriptions and guidelines about how to organize and perform the work in support of EN 16603-50.

This Technical report (CEN/TR 17603-50:2022) originates from ECSS-E-HB-50A.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any TR covering the same scope but with a wider domain of applicability (e.g.: aerospace).

1 Introduction

1.1 Purpose

This ECSS handbook is intended to help implementers and users of data handling systems who are adhering to the ECSS E-50 series of standards. The handbook provides an overview of the E-50 standards and related CCSDS Recommended Standards and describes how the individual standards may be used together to form a coherent set of communications protocols. It also evaluates issues which could not be discussed in the Standards documents themselves, and provides guidance on option selection and implementation choices.

1.2 Scope

This handbook provides guidance to the ECSS E-50 series of standards including related CCSDS Recommendations. The information provided is informative and intended to be used as best practice; it is not binding on implementers.

The information contained in this handbook is not part of the ECSS Standards. In the event of any conflict between the ECSS Standards and the material presented in this handbook, the ECSS Standards prevail.

1.3 Document structure

This document is divided into sections and annexes as follows:

- Section 1 (this section) provides intentional and administrative information.
- Section 2 provides the definition and abbreviations of the terms used in the present document.
- Section 3 gives a list of the E-50 series of standards and describes their relationship to CCSDS and other standards bodies. It also provides an overall architectural framework.
- Section 4 provides detailed information on each of the individual ECSS and CCSDS standards covered by the handbook.
- Section 5 addresses individual technical topics related to the ECSS E-50 standards.

- Section 6 provides guidance on selecting appropriate ECSS and CCSDS standards for coherent mission and infrastructure scenarios.
- Section 7 provides a summary of supporting components and products.
- Annex A to Annex F contain draft proforma of the Protocol Implementation Conformance Statement (PICS) for three of the E-50 standards.
- Annex G provides additional performance data for one of the telemetry channel coding options.

2 Terms, definitions and abbreviations

2.1 Terms and definitions from other documents

For the purpose of this document, the terms and definitions from ECSS-S-ST-00-01 and ECSS-E-ST-50 apply.

2.2 Terms specific to the present document

3.2.1 delimited

<data unit> with a known and finite length.

3.2.2 mission phase

period of a mission during which specified communications characteristics are fixed

NOTE The transition between two consecutive mission phases can cause an interruption of the communications services.

3.2.3 octet

group of eight bits

NOTE The numbering for octets within a data structure starts with 0.

3.2.4 physical channel

stream of bits transferred over a space link in a single direction

2.3 Conventions

2.3.1 Bit numbering and most significant bit

To identify each bit in an N-bit field, the first bit in the field to be transferred (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 an N-bit field is used to express a binary value (such as a counter), the most significant bit (MSB) is the first bit of the field, i.e. bit 0 (see Figure 2-1).

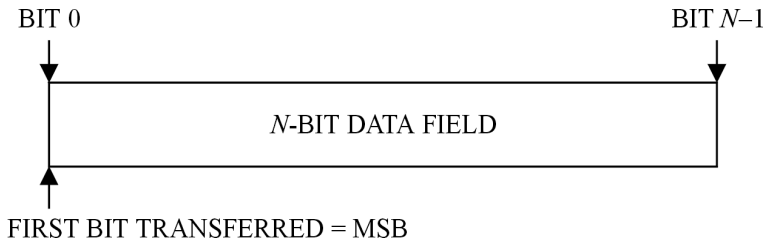

Figure 2-1: Bit numbering convention

2.4 Abbreviated terms

Abbreviation	Meaning
8PSK	phase shift keying of 8 states
AD	acceptance-check and data
AOS	advanced orbiting systems
API	application programming interface
APID	application process identifier
APP	*a posteriori* probability
ARP	address resolution protocol
ARQ	automatic repeat request
ASIC	application-specific integrated circuit
ASM	analogue signal monitor
ASM	attached sync marker
AWGN	additive white Gaussian noise
BC	bypass (of acceptance check) and control
BCH	Bose-Chaudhuri-Hocquenghem
BD	bypass (of acceptance check) and data
BDM	bi-level discrete monitor
BER	bit error rate
BPSK	binary phase shift keying
BSD	bi-directional serial digital
BSM	bi-level switch monitor
CADU	channel access data unit
CAN	controller area network
CCSDS	Consultative Committee for Space Data Systems
CFDP	CCSDS file delivery protocol
CLCW	communications link control word
CLTU	communications link transmission unit
COP	communications operation procedure

Abbreviation	Meaning
CPDU	command pulse distribution unit
CRC	cyclic redundancy code
dB	decibel
DHCP	dynamic host configuration protocol
DHS	data handling system
DML	data management library
DNS	domain name service
DRD	document requirements definition
DTN	delay tolerant networking
DWT	discrete wavelet transform
EDAC	error detection and correction
EMC	electromagnetic compatibility
EOF	end of file
ESA	European Space Agency
ESOC	European Space Operations Centre
FARM	frame acceptance and reporting mechanism
FDU	frame data unit
FER	frame error rate
FOP	frame operation procedure
FPGA	field-programmable gate array
FQPSK	Feher quadrature phase shift keying
GMSK	Gaussian minimum shift keying
GSTVi	ground systems test and validation infrastructure
HPC	high power command
HSRP	hot standby redundancy protocol
ID	identifier
IDC	image data compression
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISD	input serial digital
ISO	International Organization for Standardization
ISS	international space station
ITU	International Telecommunication Union
JAXA	Japan Aerospace Exploration Agency

Abbreviation	Meaning
JPEG	Joint Photographic Experts Group
LOS	loss of signal, or, line of sight
LPC	low power command
LVDS	low voltage data signalling
MAP	multiplexer access point
MER	Mars exploration rover
MCID	master channel identifier
MIL	military standard
MPE	multiprotocol encapsulation
MSB	most significant bit
NASA	National Aeronautics and Space Administration
OCF	operational control field
OID	only idle data
OQPSK	offset quadrature phase shift keying
OSD	output serial digital
OSI	open systems interconnection
OSPF	open shortest path first
PAC	packet assembly controller
PCM	pulse code modulation
PDU	protocol data unit
PEP	performance enhancing proxy
PICS	protocol implementation conformance statement
PLOP	physical layer operation procedure
PRL	PICS requirements list
PSNR	peak signal-to-noise ratio
PSS	procedures, specifications and standards
PUS	packet utilization standard
PVN	packet version number
QPSK	quadrature phase shift keying
RAF	return all frames
RCF	return channel frames
RIP	routing information protocol
RMAP	remote memory access protocol
RF	radio frequency
RFC	request for comments
R-S	Reed-Solomon

Abbreviation	Meaning
RTEMS	real-time executive for multiprocessor systems
SAR	synthetic aperture radar
SCID	spacecraft identifier *or* spacecraft identification
SCOS	spacecraft operating system
SCPS	space communications protocol specification
SEC	single error correction
SFO	store-and-forward overlay
SLE	space link extension
SOIS	spacecraft onboard interface services
SRD	system requirements document
SRRC	square root raised cosine
TC	telecommand
TCM	trellis-coded modulation
TCP	transmission control protocol
TDM	time division multiplexing
TED	triple error detection
TFVN	transfer frame version number
TM	telemetry
TP	transport protocol
TRL	technology readiness level
TSM	temperature sensors monitor
TT&C	telemetry, tracking and command
UDP	user datagram protocol
VCID	virtual channel identifier
VRRP	virtual router redundancy protocol