SLOVENSKI STANDARD
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Vesoljska tehnika - Električna in elektronska

Space engineering - Electrical and electronic

Raumfahrttechnik - Elektrik und Elektronik

Ingénierie spatiale - Électrique et électronique

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Space engineering - Electrical and electronic

Ingénierie spatiale - Électrique et électronique

Raumfahrttechnik - Elektrik und Elektronik

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CEN-CENELEC Management Centre:
Rue de la Science 23, B-1040 Brussels

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European Foreword

This document (EN 16603-20:2020) has been prepared by Technical Committee CEN-CENELEC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16603-20:2020) originates from ECSS-E-ST-20C Rev.1.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2021, and conflicting national standards shall be withdrawn at the latest by March 2021.

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 supersedes EN 16603-20:2014.

The main changes with respect to EN 16603-20:2014 are listed below:

- Addition of Pre-Tailoring per “Space product types” and Feature types” in clause 8

- Implementation of Change Requests
- Several definitions and abbreviated terms updated (see clause 3)

This document has been prepared under a standardization request 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 EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1
Scope

This Standard establishes the basic rules and general principles applicable to the electrical, electronic, electromagnetic, microwave and engineering processes. It specifies the tasks of these engineering processes and the basic performance and design requirements in each discipline.

It defines the terminology for the activities within these areas.

It defines the specific requirements for electrical subsystems and payloads, deriving from the system engineering requirements laid out in ECSS-E-ST-10 “Space engineering – System engineering general requirements”.

This standard may be tailored for the specific characteristic and constrains of a space project in conformance with ECSS-S-ST-00.

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 revision 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 more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system – Glossary of terms
EN 16603-10	ECSS-E-ST-10	Space engineering – System engineering general requirements
EN 16603-20-06	ECSS-E-ST-20-06	Space engineering – Spacecraft charging
EN 16603-20-07	ECSS-E-ST-20-07	Space engineering – Electromagnetic compatibility
EN 16603-20-08	ECSS-E-ST-20-08	Space engineering - Photovoltaic assemblies and components
EN 16603-20-20	ECSS-E-ST-20-20	Space engineering - Electrical design and interface requirements for power supply
EN 16603-33-11	ECSS-E-ST-33-11	Space engineering – Explosive systems and devices
EN 16603-50-05	ECSS-E-ST-50-05	Space engineering – Radio frequency and modulation
EN 16603-50-14	ECSS-E-ST-50-14	Space engineering – Spacecraft discrete interfaces
EN 16602-30-11	ECSS-Q-ST-30-11	Space product assurance – Derating – EEE components
EN 16602-40	ECSS-Q-ST-40	Space product assurance – Safety
	IEEE 145-1993	Antenna terms
	Impedance Specifications for Stable DC Distributed Power Systems, EEE transactions on power electronics, Vol. 17, no. 2, March 2002	Impedance Specifications for Stable DC Distributed Power Systems, X. Feng, J. Liu, F.C. Lee, IEEE Transactions on power electronics, Vol. 17, no. 2, March 2002

3 Terms, definitions and abbreviated terms

3.1 Terms from other standards

a. For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply.

b. For the purpose of this Standard, the following terms and definitions from ECSS-E-ST-20-20 apply:

1. latching current limiter (LCL)
2. retriggerable latching current limiter (RLCL)

3.2 Terms specific to the present standard

3.2.1 antenna farm

ensemble of all antennas accommodated on the spacecraft and provides for all the transmission and reception of RF signals

3.2.2 antenna port

abstraction of the physical connection among the antenna and its feeding lines, realised by means of connectors or waveguide flanges

3.2.3 antenna RF chain

sequence of microwave components inserted between an antenna input port or a BFN output port and a corresponding individual radiating element

NOTE Examples of microwave components are: ortho-mode transducers, polarisers, transformers as well as filters.

3.2.4 antenna support structure

part of an antenna having no electrical function, which can however impact its electrical performances, either directly due to scattering or indirectly

NOTE Example of indirect effect is induced thermo-elastic deformations.

3.2.5 array antenna

antenna composed by a number of, possibly different, elements that radiate RF signals directly into free space operating in combination, such that all or a part of them radiate the same signals

3.2.6 array-fed reflector antenna

antenna composed by a feed array, which can include or not a beam forming network, and one or more optical elements like reflectors and lenses

3.2.7 battery bus

primary power bus directly connected to the battery

NOTE Battery bus is sometimes called unregulated bus (although the battery charge is regulated).

3.2.8 beam forming network (BFN)

wave-guiding structure composed a chain of microwave components and devices aimed at distributing the RF power injected at the input ports to a number of output ports; in a transmitting antenna the RF power injected from the transmitter is routed to the radiating elements, in a receiving antenna the RF power coming from the radiating elements is routed to the antenna ports connected to the receiver

NOTE Examples of microwave components and devices are lines, phase shifters, couplers, loads.

3.2.9 conducted emission (CE)

desired or undesired electromagnetic energy that is propagated along a conductor

3.2.10 critical pressure

pressure at which corona or partial discharge can occur in an equipment

3.2.11 diffusivity

ability of a body to generate incoherent diffuse scattering due to local roughness, inhomogeneity or anysotropy when illuminated by RF waves

3.2.12 depth of discharge (DOD)

ampere–hour removed from a battery expressed as a percentage of the nameplate capacity

3.2.13 double insulation

barrier between conductors or elements of an electronic circuit such that after any credible single failure, conductors or elements of an electronic circuit are still insulated from each other

3.2.14 electrical bonding

process of connecting conductive parts to each other so that a low impedance path is established for grounding and shielding purposes

3.2.15 electromagnetic compatibility (EMC)

ability of equipment or an element to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

3.2.16 electromagnetic compatibility control

set of techniques to effectively regulate the electromagnetic interference environment or susceptibility of individual space system components or both

NOTE They include, among others, the design, placement of components, shielding, and employment of rejection filters.

3.2.17 electromagnetic interference (EMI)

undesired electrical phenomenon that is created by, or adversely affects any device whose normal functioning is predicated upon the utilization of electrical phenomena

NOTE It is characterized by the manifestation of degradation of the performance of an equipment, transmission channel, or element caused by an electromagnetic disturbance.

3.2.18 electromagnetic interference safety margin (EMISM)

ratio between the susceptibility threshold and the interference present on a test point

3.2.19 emission

electromagnetic energy propagated by radiation or conduction

3.2.20 energy balance

situation in which the spacecraft energy budget is positive when elaborated over a considered period of time

NOTE 1 Energy budget is generation minus consumption and losses.

NOTE 2 The considered period of time can be one orbit, several orbits or any relevant mission period.

3.2.21 energy reserve

energy that remains available from the energy storage assembly at the worst-case, most depleted, point of nominal operations

NOTE It is important that the energy reserve is sufficient to permit reaching a safe operating mode upon occurrence of an anomaly

3.2.22 essential function

function without which the spacecraft cannot be recovered following any conceivable on-board or ground-based failure

NOTE Examples of unrecoverable spacecraft is when spacecraft cannot be commanded, or permanently losses attitude and control, or the energy balance is no longer ensured, or the spacecraft consumables (e.g. hydrazine or Xenon) are depleted to such an extent that more than 10% of its lifetime is affected, or the safety of the crew is threatened.

3.2.23 faulty signal

signal generated by a circuit, appearing at its interface to another circuit, going out of its nominal range because of a failure

3.2.24 foldback current limiter (FCL)

non latching current-limiting function where the current limit decreases with the output voltage

NOTE This function is used for power distribution and protection typically for essential loads.

3.2.25 fully regulated bus

bus providing power during sunlight and eclipse periods with a regulated voltage

3.2.26 grounding

process of establishing intentional electrical conductive paths between an electrical circuit reference or a conductive part and equipment chassis or space vehicle structure

NOTE grounding is typically performed for safety, functionality, signal integrity, EMI control or charge bleeding purpose.

3.2.27 high Priority telecommand (HPC)

command originated from ground and issued by the telecommand decoder for essential spacecraft functions without main on board software intervention

3.2.28 high voltage

AC or DC voltage at which partial discharges, corona, arcing or high electrical fields can occur

3.2.29 lens antenna

antenna composed by a number of RF lenses and reflecting surfaces illuminated by a primary source, the feed

3.2.30 lightning indirect effects

electrical transients induced by lightning in electrical circuits due to coupling of electromagnetic fields

3.2.31 major reconfiguration function

function used to recover from system failures of criticality 1, 2 or 3

NOTE Criticality categories are defined in ECSS-Q-ST-30 and ECSS-Q-ST-40.

3.2.32 nameplate capacity

capacity stated by the manufacturer of an energy storage cell or battery

NOTE It is given in ampere-hours. It is not necessarily equal to any measurable capacity.

3.2.33 non essential loads

loads related to units which do not implement essential functions for the spacecraft

3.2.34 passive intermodulation products (PIM)

spurious signals generated by non-linear current-voltage characteristics in materials and junctions exposed to sufficiently RF high power carried by guided or radiated fields and currents, possibly triggered by microscopic mechanical movement

3.2.35 photovoltaic assembly (PVA)

power generating network comprising the interconnected solar cell assemblies, the shunt and blocking diodes, the busbars and wiring collection panels, the string, section and panel wiring, the wing transfer harness, connectors, bleed resistors and thermistors

3.2.36 primary cell or battery

battery or cell that is designed to be discharged once and never to be recharged

3.2.37 primary power bus

spacecraft electrical node closest to the power sources where power is controlled and made available to the user equipment

3.2.38 radiofrequency (RF)

frequency band used for electromagnetic waves transmission

3.2.39 radiated emission (RE)

radiation and induction field components in space

3.2.40 recharge ratio (k)

ampere–hours charged divided by the ampere–hours previously discharged, starting and finishing at the same state of charge

NOTE It is also known as the k factor.

3.2.41 reflector antenna

antenna composed by a number of reflecting surfaces, RF reflectors, illuminated by a primary source, the feed