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European Foreword

This document (EN 16603-20-01:2020) has been prepared by Technical Committee CEN-CENELEC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16603-20-01:2020) originates from ECSS-E-ST-20-01C.

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of an identical text or by endorsement, at the latest by March 2021, and conflicting national standards shall be withdrawn at the latest by March 2021.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 14777:2004.

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.

Introduction

In the context of increased RF power and equipment or component miniaturization, more and more attention shall be paid to multipactor which is critical for space missions based on satellite telecommunication or navigation payloads, or active microwave instruments for Earth Observation or Science. The multipactor phenomenon is an electron avalanche discharge occurring in high vacuum initiated by primary electrons inside a RF component in presence of a high local RF voltage or electric field.

In order to verify by analysis that a RF equipment or component is multipactor free, accurate EM modelling tools are required. These tools need more and more computation resources to cope with RF equipment or components with complex geometries, advanced manufacturing techniques, new materials and processes, and complex RF signals. The verification by test also requires some up-to-date test facilities, that provide high power amplification, electron seeding techniques, multiple and accurate detection methods, ability to generate complex signals, and the ability to reproduce the space representative environment conditions.

This standard is an update of previous version of ECSS-E-20-01A Rev.1, that includes the state-of-art of new verification approaches, and associated margins.

1
Scope

This standard defines the requirements and recommendations for the design and test of RF components and equipment to achieve acceptable performance with respect to multipactor-free operation in service in space. The standard includes:

- verification planning requirements,
- definition of a route to conform to the requirements,
- design and test margin requirements,
- design and test requirements, and
- informative annexes that provide guidelines on the design and test processes.

This standard is intended to result in the effective design and verification of the multipactor performance of the equipment and consequently in a high confidence in achieving successful product operation.

This standard covers multipactor events occurring in all classes of RF satellite components and equipment at all frequency bands of interest in high vacuum conditions (pressure lower than 10^{-5} hPa). Operation in single carrier CW and pulse modulated mode are included, as well as unmodulated multi-carrier operations. A detailed clause on secondary emission yield is also included.

This standard does not include breakdown processes caused by collisional processes, such as plasma formation.

This standard is applicable to all space missions.

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	ECSS-S-ST-00-01	ECSS – Glossary of terms
EN 16603-10-02	ECSS-E-ST-10-02	Space engineering –Verification
EN 16603-10-03	ECSS-E-ST-10-03	Space engineering - Testing
EN 16602-20	ECSS-Q-ST-20	Space product assurance – Quality assurance
EN 16602-20-08	ECSS-Q-ST-20-08	Space product assurance – Storage, handling and transportation of spacecraft hardware
EN 16602-70-01	ECSS-Q-ST-70-01	Space product assurance – Cleanliness and contamination control
EN 16602-70-02	ECSS-Q-ST-70-02	Space product assurance – Thermal vacuum outgassing test for the screening of space materials
	ESCC-20600	Preservation, packaging and despatch of ESCC component
	ISO 14644–1:2015	Cleanrooms and associated controlled environments – Part 1: Classification of air cleanliness by particle concentration