ICS 19.040
CCS V 06

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 42242-2022

Space environment - Evaluation of radiation effects on Commercial-Off-The-Shelf (COTS) parts for use on low-orbit satellite

Issued on: December 30, 2022 **Implemented on: July 1, 2023**

Issued by: State Administration for Market Regulation, China National Standardization Administration

Table of Contents

foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part 1.Structure and Drafting Rules for Standardization Documents"

drafting.

This document is modified to adopt ISO 21980.2020 "Evaluation of radiation effects of commercial off-the-shelf (COTS) devices for low-orbit satellites in space systems".

estimate".

Compared with ISO 21980.2020, this document has more structural adjustments. Comparison list of structure number changes between two files

See Appendix A.

Compared with ISO 21980.2020, this document has many technical differences, and the clauses involved in these differences have been adopted in the outer margin

The white position is indicated by a vertical single line (?). Appendix B gives a list of corresponding technical differences and their reasons.

The following editorial changes have been made to this document.

--- Revised and supplemented 3.2, 3.7, 3.13 in "Terms and Definitions";

--- Refresh the references.

Please note that some contents of this document may refer to patents. The issuing agency of this document assumes no responsibility for identifying patents.

This document was proposed by the Chinese Academy of Sciences.

This document is under the jurisdiction of the National Aerospace Technology and Its Application Standardization Technical Committee (SAC/TC425).

Introduction

This document presents a methodology for the assessment of radiation effects from commercial off-the-shelf (COTS) devices used in low Earth orbit (LEO) satellites. many

Small satellites (< 180kg) and nano-satellites/micro-satellites (1kg~50kg) are launched to space radiation that exists but is less than high-orbit space radiation

LEO orbit. It is common for designers and manufacturers of such satellites to use COTS semiconductor devices for their satellite components and electronics.

sub circuit board. Using nanosatellites/microsatellites and cubesats [1.33kgx(1U~3U)] (volume 10cmx10cmx10cm is called

1U) industries or units include IT companies, mobile phone and Internet industries, universities and research institutions, etc.

Satellite manufacturers prioritizing investment efficiency are also aiming to extend mission lifetimes (up to 3, 5 and 10 years) more than with Nanosatellite

Educational and technical demonstrations of satellite/microsatellites have longer mission lifetimes of one year, as is common.

Compared with higher orbits, even if the space radiation conditions of LEO are relatively good, the long mission life of LEO is not good for small nano satellites.

COTS devices on satellites/microsatellites and cubesats constitute a key radiation environmental constraint.

While methods exist for evaluating the radiation susceptibility of space devices, methods for evaluating COTS devices for use in LEO satellites are

limitations, and these methods are usually based on the use of existing devices.

This document provides guidance for evaluating the radiation tolerance of COTS devices and can help increase confidence in long-term mission lifetimes.

Space Environment for commercial off-the-shelf LEO satellites

Radiation Effect Evaluation of (COTS) Devices

1 Scope

This document presents the results of ionizing total dose effects, single event effects, and displacement damage effects for commercial off-the-shelf (COTS) devices used in spacecraft.

assessment method.

This document applies to the assessment of radiation effects of COTS devices used in low-orbit (LEO) satellites. COTS devices for other orbiting spacecraft can be

Refer to use.

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, dated references

For documents, only the version corresponding to the date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to

this document.

GB/T 30114.2-2014 Terminology for Space Science and Its Applications Part 2.Space Physics

GB/T 32452 Terminology for space environment of spacecraft

GB/T 37834 Galactic cosmic ray model

3 Terms and Definitions

GB/T 30114.2-2014, GB/T 32452, GB/T 37834 and the following terms and definitions apply to this document.

3.1

galactic cosmic rays; GCR

galactic cosmic rays

Streams of energetic charged particles from the Milky Way.

3.2

Flux flux

The number of particles passing through a unit area per unit time.

Note. The unit is particle number.m-2.s-1.

3.3

fluence

The number of particles passing per unit area within a certain period of time.

Note 1.It is the time integral of the flux.

Note 2.The unit of integrated particle fluence is the number of particles m-2.The unit of energy integration fluence is particle number.m-2.MeV-1.If it indicates direction note

amount, then add another unit solid angle (sr-1), which is the number of particles.m-2.sr-1.MeV-1.

3.4

absorbed dose

The average radiation energy absorbed per unit mass of irradiated material.