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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/Z 42244-2022

Space environment - Procedure for obtaining the worst case and confidence level of Earth radiation belt fluence using a quasi-dynamic model

空间环境 利用准动态模型获得地球辐射带注量的最劣情况和置信水平的程序

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

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Standardization Administration of the PRC**

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Foreword

This document was issued on 30 December 2022 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 July 2023.

It is a GB/Z guiding technical document: it does not oblige, it guides.

It is classified under ICS 49.140, Chinese classification V06.

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 equivalent to ISO /T S21979.2018 "Space Environment (Natural and Artificial) Obtaining the Earth's Radiation Belts Using a Quasi-Dynamic Model"

Worst-Case and Confidence Level Procedures for Shots.

The following minimal editorial changes have been made to this document.

---In order to coordinate with the existing document, the name of the document is changed to "Using the quasi-dynamic model of the space environment to obtain the most

Procedures for Adverse Situations and Confidence Levels;

--- "3.5" in "Terms and Definitions" has been modified. The definition in the original text is the purpose of F10.7, and the notes in the original text are true

positive definition;

--- Modify ISO 12208.2015 in "5.1 Flux" and "5.2 Confidence level" to GB/T 41457-2022.

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).

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Introduction

Due to solar activities, magnetic storms, etc., the space environment has undergone tremendous changes. Therefore, the radiation fluence environment received by the satellite depends on its launch date

Period, orbit and cycle of operation vary.

For satellite design, the most important thing is the worst case and confidence level of radiation fluence. By understanding these conditions, it is possible to optimize

design. Although radiation belt models to date can distinguish solar maxima from minima, they have difficulty dealing with short-term and long-term waves.

move. Procedures for obtaining worst-case and confidence levels for radiation fluences are defined using quasi-dynamic models of the Earth's radiation belts.

The space environment uses a quasi-kinetic model to obtain Earth

Worst case and confidence level procedures for radiation fluences

1 Scope

GB/Z 42244-2022 covers how to arrive at the worst case and the confidence level of the particle fluence a spacecraft collects in the Earth's radiation belts over a stated orbit and design life, using a model that describes the belts as they fluctuate rather than as a long-term average. It presents the radiation belt model, then the fundamentals behind it: the fluence accumulated along the orbit, the confidence level attached to that figure, the quasi-dynamic Earth radiation belt model that drives its variation from input indices picked because they are readily available and track the belts closely, and instructions for use. Three informative appendices carry the calculation method and its process, the CRRESELE model, and the MDS-1 radiation belt model. The problem behind the document is that the belts swell and decay with solar activity and magnetic storms, so a satellite launched at one point in the cycle meets an environment quite unlike one launched a few years later; a designer working from an averaged number either under-shields and loses electronics before the mission ends, or over-shields and pays for the mass on every launch. Issued as a guiding technical document, equivalent to ISO/TS 21979:2018. Written for satellite and payload designers, radiation effects analysts, and mission assurance engineers.

This paper presents the particle injection (in terms of orbit and design lifetime) exposure to a spacecraft using a model that describes the dynamic fluctuations of the radiation belts.

Quantity calculation method. The quasi-dynamic Earth radiation belt model determines dynamic changes according to input parameters (various indices), and the input parameters are selected as

Parameters that are readily available and highly correlated with dynamic changes in the Earth's radiation belts.

This document applies to areas such as spacecraft design.

2 Normative references

This document has no normative references.

3 Terms and Definitions

The following terms and definitions apply to this document.

The terminology databases used by ISO and IEC for standardization are as follows.

3.1

L value

The distance between the center of the earth and the point where the lines of force intersect with the magnetic equator, in units of Re (radius of the earth).

3.2

B/B0

The value normalized by the minimum value of magnetic induction intensity at the position of the magnetic equator.

3.3

Kp and ap

Global geomagnetic activity levels based on 3h measurements from 13 ground stations.

Note. The range of ap value is 0~400, the unit is 2nT. Kp is basically the logarithm of ap, with a scale from 0 to 9 expressed in 1/3 of the unit (e.g., 5-=

,50=5,5=5

). The daily index (Ap) is obtained by averaging 8 ap values per day, and the index Ap can have the same value as the ap

considerable value.

3.4

Solar wind speed solarwindspeed

SWS

The speed at which the sun emits particle streams is usually used as an input parameter for the external source field model.

Note. The solar wind speed is usually about 350km/s.