

ICS 49.020
CCS V 70



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 12639-2021

Replacing GB/T 12639-1990

**Methods of in-orbit testing for the payload performance of
geostationary communication satellites**

地球同步轨道通信卫星有效载荷在轨测试方法

Issued on: August 20, 2021

Implemented on: March 1, 2022

**Issued by: State Administration for Market Regulation;
Standardization Administration of China**

Table of Contents

1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviations	1
5 Test purpose	1
6 Test file	2
7 Test system	2
7.1 Test system composition	2
7.2 Test system requirements	2
7.3 Test system calibration	3
8 Test condition	4
9 Test item	5
10 Test method	5
10.1 Static noise spectrum	5
10.2 Input and output characteristics	6
10.3 SFD and saturated EIRP	7
10.4 Satellite quality factor G/T	8
10.5 Amplitude-frequency characteristics	9
10.6 Gain stability	10
10.7 Out-of-band suppression characteristics	11
10.8 Clutter characteristics	12
10.9 Accuracy and stability of local oscillator frequency	12
10.10 Beacon EIRP and frequency characteristics	13
10.11 Antenna polarization isolation	15
10.12 Antenna pattern	16
10.13 Gain control characteristics	16
10.14 Group delay characteristics	17
10.15 Third-order intermodulation	18
10.16 ALC level control characteristics	19
10.17 ALC stability	20
21 Appendix A (informative) Calculation of satellite link-related transmission parameters	22

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 of Standardization Documents" Drafting. This document replaces GB/T 12639-1990 "Communication Satellite Payload Performance In-orbit Test Method", and GB/T 12639-1990 In comparison, the main technical changes are as follows:

a) The requirements for test documents, test conditions and test systems have been added (see Chapter 6, 7.2, and Chapter 8);

b) Improve the test project, standardize the test project name, optimize the test connection block diagram, test operation steps and data processing methods;

c) Added out-of-band suppression characteristics, clutter characteristics, antenna polarization isolation, gain control characteristics, ALC level control characteristics, ALC Stability and other test items and test methods (see Chapter 9, 10.7, 10.8, 10.11, 10.13, 10.16, 10.17);

d) Modified the test methods of the local oscillator frequency accuracy and stability, group delay characteristics test items (see 10.9, 10.14, 1990 edition 3.5, 3.7);

e) Deleted the test items and test methods of AM and phase modulation conversion coefficient, transponder amplitude compression coefficient, satellite intelligible crosstalk, etc. (1990 version of 3.9, 3.10, 3.11); Please note that some of the contents of this document may involve patents. The issuing agency of this document is not responsible for identifying patents. This document was proposed and managed by the National Aerospace Technology and Application Standardization Technical Committee (SAC/TC425). Drafting organizations of this document. General Department of Communications and Navigation Satellites of China Academy of Space Technology, China Institute of Aerospace Standardization, China Satellite Communications Group Co., Ltd., the 63921 Unit of the Chinese People's Liberation Army, and the 61096 Unit of the Chinese People's Liberation Army. The main drafters of this document. Ma Qiang, Xu Rujun, Yang Bo, Zheng Yuhong, Zhong Liangyu, Suo Honghai, Yang Dongxue, Wen Yan, Qi Shengjun, Qu Huipeng, Jiang Long Cheng, Guo Xinzhe, Sun Haiyan, Wei Zhenchao, Xu Dongyan, Xia Weina, Zhang Bohan. This document was first published in 1990, and this is the first revision.

Geosynchronous orbit communication satellite payload On-orbit test method

1 Scope

China's national method for the in-orbit testing of the payload of a geostationary communications satellite - the campaign carried out after launch, before the satellite enters commercial service, to establish that the transponders actually perform as they were built to. It specifies the test documents, the test conditions, the test system, the test items, the

test methods and the test report for the in-orbit testing of the payload of geosynchronous orbit communication satellites, and it applies to both transparent and processing payloads. The test exists because the payload cannot be measured again once it is up there in any other way. Everything was verified on the ground before launch, but the satellite has since been shaken by the launcher, exposed to vacuum and to a thermal cycle, and deployed its antennas - and the only instrument that can now examine it is a ground station on the other end of a link that is itself a variable. That is the difficulty the standard is built around: separating the performance of the payload from the performance of the measurement path. Almost everything in the test conditions and the test system clauses is about that, from the calibration of the earth station and the reference sources to the correction for the atmosphere and for the pointing. The test items are the parameters a transponder is sold on and a customer's link budget is built from: the equivalent isotropically radiated power, the receive figure of merit, the saturation flux density, the gain and its transfer characteristic, the frequency response and group delay across each channel, the frequency conversion accuracy, the spurious and intermodulation products, the antenna coverage and cross-polarisation, and the switching and redundancy functions. The results become the reference against which the satellite is monitored for the rest of its life. Issued on 20 August 2021 and in force since 1 March 2022, it replaces GB/T 12639-1990.

This document specifies the test files, test conditions, test systems, and test items for the on-orbit test of the geosynchronous orbit communication satellite payload. Projects, test methods and test reports, etc. This document applies to the transparent forwarding of geosynchronous orbit communication satellites and the transparent forwarding of signal processing payloads. Road test in orbit. The ground test of satellite transponder can also refer to this document.

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, dated quotations Only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to This document.

GB/T 29080 Evaluation of flight results of geosynchronous orbit communication satellites
YD/T 984 satellite communication link atmospheric and rain attenuation calculation method

3 Terms and definitions

The terms and definitions defined in GB/T 29080 and YD/T 984 are applicable to this document.

4 Abbreviations

The following abbreviations apply to this document. ALC. Automatic Level Control (AutomaticLevelControl) EIRP. Equivalent Isotropic Radiated Power (Equivalent Isotropic Radiated Power) FGM. Fixed Gain Mode (FixedGainMode) G/T. The ratio of the antenna gain to the noise temperature of the receiving system (also known as the receiving system quality factor (Gain/T emperature)) IF. IntermediateFrequency LF. Low Frequency (LowFrequency) SFD. Saturated Flux Density (SaturatedFluxDensity) SSPA. Solid State Power Amplifier (SolidStatePowerAmplifier) TWTA. Traveling Wave Tube Amplifier (TravelingWaveTubeAmplifier)

5 Test purpose

The purpose of the test is to obtain the performance of the payload in orbit after the satellite has undergone the launch and transfer orbit phases.