INTERNATIONAL STANDARD

ISO 20930

First edition
2018-08

Space systems — Calibration requirements for satellite-based passive microwave sensors

Systèmes spatiaux — Exigences d'étalonnage des capteurs passifs d'hyperfréquences satellitaires

Reference number
ISO 20930:2018(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

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Introduction

Water is one of the key elements for survival of all creatures on earth. Water brings us the blessings of food thanks to agriculture, but water is also responsible for providing forest products and fish, which are essential for our lives. However, too much or too little water can lead to environmental disasters such as hurricanes, heavy rains, floods, droughts and wild fires.

Many satellite sensors are launched through international cooperation ventures with the aim of monitoring the behaviour of the water cycle and estimating some of the parameters related to it, e.g. soil moisture, vegetation biomass, snow cover, sea ice, and so on. A systematic and timely monitoring of land surface parameters that affect the hydrological cycle at local and global scales are of primary importance in obtaining a better understanding of geophysical processes and in order to manage environmental resources and mitigate for natural disasters.

At present, some applications to assist our human activities are provided, such as weather forecasts and predictions of climate change. Nowadays, the observation data acquired by passive microwave sensors are used for weather forecasts, fishery services, drought monitoring on a daily basis, and for predicting climate change in the future. However, errors due to bias, gain, and sensitivity among passive microwave sensors can degrade accuracy of applications and users could waste effort and time for compensation by on-orbit operation.

This document standardizes calibration methods (requirements and verification methods) to minimize errors of observation data among passive microwave sensors. It is expected that this document can improve the accuracy of weather forecasts, sea surface temperatures for fishery services, soil moisture monitoring to decrease water waste for farmers, snow cover and depth for water storage. Moreover, these observations can provide useful information for climate change prediction that is relevant to our daily lives.

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Space systems — Calibration requirements for satellite-based passive microwave sensors

1 Scope

This document defines the requirements and verification methods from design to on-orbit operation for Satellite Based Passive Microwave Sensors.

This document covers the requirements for, design, analysis, manufacturing, ground tests and on-orbit self-sensor calibration and validation. In addition, this document includes the conditions considered for on-orbit inter-comparison among sensors as preparation for cross-calibration. This document includes some examples on how to apply the development of passive microwave sensors as shown in Annex A through D.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10795:2011, *Space systems — Programme management and quality — Vocabulary*

ISO 14302, *Space systems — Electromagnetic compatibility requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10795:2011 and the following apply. ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
calibration
set of operations that establish, under specified conditions, the relationship between sets of values of quantities indicated by a measuring instrument or measuring system and the corresponding values realized by standards

3.2
validation
process of assessing by independent means the quality of the data products derived from the system outputs

3.3
level one processing
type of processing where the antenna brightness temperature of the sensor instrument is calculated and compensated radiometrically and geometrically based on evaluation results of ground test and on-orbit calibration

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