Chinastandards.org

JJF

NATIONAL METROLOGY TECHNICAL SPECIFICATION OF THE

PEOPLE'S REPUBLIC OF CHINA

JJF 1957-2021

Calibration Specification for Rubidium Atomic Frequency Standards

铷原子频率标准校准规范

(English Translation)

Issued on: December 28, 2021 **Implemented on: June 28, 2022**

Issued by: State Administration for Market Regulation

Preview: page 1 of 4 shown, 21 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1957-2021

Chinastandards.org

Table of Contents

Introduction (II)
1 Scope(1)
2 References (1)
3 Overview(1)
4 Metrology Characteristics(2)
4.1 Output signal(2)
4.2 Harmonics and non-harmonics(2)
4.3 Relative frequency deviation(2)
4.4 Power-on characteristics(2)
4.5 Daily Frequency Drift Rate(2)
4.6 Frequency Stability(3)
4.7 Phase noise(3)
4.8 Frequency Reproducibility(3)
4.9 Frequency adjustment(3)
4.10 GNSS tames the relative frequency deviation of the rubidium frequency standard (3)
4.11 GNSS Tames Rubidium Frequency Standard Second Pulse Timing Deviation(3)
4.12 GNSS taming the rubidium frequency scale second pulse timing stability (3)
5 Calibration Conditions(3)
5.1 Environmental conditions (3)
5.2 Measurement standards and other equipment(4)
6 Calibration items and calibration methods (4)
6.1 Calibration items(4)
6.2 Calibration method(5)
7 Expression of calibration results (11)
8 Recalibration interval(11)
Appendix A Raw Record Format(12)
Appendix B Calibration Certificate (Inner Page) Format (15)
Appendix C Example of Uncertainty Evaluation of Main Calibration Items (17)

Preview: page 2 of 4 shown, 21 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1957-2021

8 Recalibration interval(11)

Appendix A Raw Record Format(12)

Appendix B Calibration Certificate (Inner Page) Format (15)

Appendix C Example of Uncertainty Evaluation of Main Calibration Items (17)

Introduction

This specification is based on JJF 1071-2010 "Rules for Compilation of National Metrology Calibration Specifications" and JJF 1059.1-2012 "Measurement Uncertainty Evaluation and Representation" written.

This specification is a revision of JJG292-2009 "Rubidium Atomic Frequency Standard". Compared with JJG292-2009, the technical revisions are as follows.

---According to JJG2007-2015 "Time and Frequency Measuring Instruments", the frequency accuracy is modified to the relative frequency deviation;

--- Corrected the formula for calculating Allen's standard deviation when deducting frequency drift;

--- Added calibration items for GNSS to tame rubidium atomic frequency standard second pulse timing deviation and timing stability;

--- Improve the frequency stability and relative frequency deviation measurement methods.

Previous releases of this specification.

---JJG292-2009;

---JJG292-1996.

Rubidium Atomic Frequency Standard Calibration Specification

1 Scope

System) to tame the calibration of rubidium atomic frequency standards.

2 Reference documents this specification references the following documents.

JJF 1001-2011 General Metrology Terms and Definitions JJF 1180 Terms and Definitions of Time and Frequency Measurement JJF 1403-2013 Global Navigation Satellite System (GNSS) Receiver (Time Measurement Type) Calibration Specification JJG2007-2015 Time and frequency measuring instruments for dated references, only the dated version applies to this specification; for undated references the latest version (including all amendments) applies to this specification.

3 Overview

Preview: page 3 of 4 shown, 21 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1957-2021

The rubidium atomic frequency standard (hereinafter referred to as the rubidium frequency standard) is a passive atomic frequency standard, and its working principle is shown in Figure 1.

The crystal oscillator generates a microwave excitation signal through frequency synthesis technology, and the rubidium isotope atoms are induced in the microwave excitation signal.

A transition occurs under the atomic transition signal, and the frequency of the atomic transition signal and the microwave signal is discriminated to generate an error signal, and the crystal is controlled by a frequency-locked loop.

The frequency of the oscillator is adjusted to lock the frequency of the microwave synthesized by the crystal oscillator to the transition frequency of the rubidium atom, and a highly stable signal is output.

Figure 1 Working principle of rubidium frequency standard

The working principle of GNSS taming rubidium frequency standard is shown in Figure 2.The time difference (or phase difference) measurement circuit is used to measure GNSS the time difference between the output 1PPS signal and the output 1PPS signal of the rubidium frequency standard to be tamed, the control unit changes according to the time difference or phase difference.

The chemical quantity continuously adjusts the output signal of the rubidium frequency standard to make it have a smaller frequency deviation.

Preview: page 4 of 4 shown, 21 in the full document. Complete English PDF, instant download:
https://chinastandards.org/standards/jjf-1957-2021