

Quasi-Zenith Satellite System  
Service Level Information for  
Multi-GNSS Advanced Orbit and Clock Augmentation  
– Precise Point Positioning  
Technology Demonstration (Ionospheric Correction)  
(SLI-MDC-ION, Draft)

(February 2022)

Cabinet Office

**Disclaimer of Liability**

The Cabinet Office, Government of Japan, Quasi-Zenith Satellite System Services Inc. and other service providers of Quasi-Zenith Satellite System make the Service Level Information (SLI) (“Document”) available to the public to promote the services using Quasi-Zenith Satellite System (“QZSS”) by development of receivers, applications and so on, and also are aiming for high accuracy and convenience with respect to satellite positioning services and message services of QZSS (collectively “Services”). The Services are freely available to any user. However, the receivers and/or applications developed based on this Document may not receive signals or may receive incorrect signals due to no warranty of the Services. You are therefore highly recommended to ensure appropriate measures to avoid accidents such as redundancy, backup and fail-safe, if you develop receivers and/or applications using the Services for the purpose that will possibly give an impact to human life, body and properties. The Services may be suspended or changed without prior notice in accordance with the decision by Government of Japan. This Document and the Services are available subject to the following terms and conditions. You may use this Document only if you agree to such terms and conditions. You shall be deemed to agree such terms and conditions by using this Document.

(1) With respect to this Document and the information included in this Document, the Cabinet Office, Government of Japan (“CAO”), Quasi-Zenith Satellite System Services Inc. (“QSS”) and other service providers of Quasi-Zenith Satellite System (“Parties”) disclaim all warranties of any kind, express or implied, including but not limited to, the followings:

- i) warranty of accuracy, completeness, usefulness, and fitness for a particular request or purpose;
- ii) warranty that this Document and the information included in this Document will not be changed in to the future; and
- iii) warranty that this Document and the information included in this Document do not infringe any third party’s intellectual property rights.

(2) With respect to satellite positioning services and message services (collectively “Services”), CAO, QSS and Parties disclaim all warranties of any kind, express or implied, from any cause whether it is related to Quasi-Zenith Satellite System, other outside systems or not, including but not limited to, the followings:

- i) warranty as to service area, accuracy, availability, continuity, and integrity described in this Document;
- ii) warranty of usefulness, and fitness for a particular request or purpose; and
- iii) warranty that the use of Services does not infringe any third party’s intellectual property rights.

(3) To the extent permitted by applicable laws, CAO, QSS and Parties shall not be responsible and liable for any damages and losses, including but not limited to, direct, indirect, incidental, special or consequential damages, whether under contractual liability, product liability, strict liability, tort liability or otherwise (including intent or negligence), caused by the use of this Document, the information included in this Document and the Services, the inability to use the Services, or the change of this Document and the information included in this Document.

### Revision History

Rev. No.	Date	Page	Revisions
Draft Edition	February 2022		Draft edition

"TBD" in this document is an abbreviation of "To be determined." The items marked "TBD" have not been determined yet but will be determined in the future.

## Table of Contents

<b>1. Scope .....</b>	<b>1</b>
<b>2. Relevant Documents .....</b>	<b>1</b>
2.1. Reference Documents .....	1
<b>3. MADOCA-PPP Technology Demonstration (Ionospheric Correction).....</b>	<b>2</b>
3.1. Demonstration Overview .....	2
3.2. Demonstartion Schedule.....	2
3.3. Demonstartion Area.....	2
3.4. Convergence Time .....	2

## 1. Scope

This document provides general descriptions of the service level with regard to the following demonstration of the Quasi-Zenith Satellite System (QZSS) as users' reference.

- (1) Multi-GNSS Advanced Orbit and Clock Augmentation – Precise Point Positioning (MADOCA-PPP), Technology Demonstration (Ionospheric Correction).

## 2. Relevant Documents

### 2.1. Reference Documents

The following documents were used as references when this document was prepared. This document may be updated when these reference documents are updated.

- (1) PS-QZSS, Quasi-Zenith Satellite System Performance Standard.
- (2) IS-QZSS-L6, Quasi-Zenith Satellite System Interface Specification - Centimeter Level Augmentation Service.
- (3) IS-QZSS-MDC, Quasi-Zenith Satellite System Interface Specification - Multi-GNSS Advanced Orbit and Clock Augmentation – Precise Point Positioning.

### 3. MADOCA-PPP Technology Demonstration (Ionospheric Correction)

#### 3.1. Demonstration Overview

Multi-GNSS Advanced Orbit and Clock Augmentation – Precise Point Positioning (MADOCA-PPP) provides correction data for Precise Point Positioning (PPP) users by using L6 signal. For applying PPP method and/or PPP-Ambiguity Resolution (AR) method, the globally applicable error corrections on satellite orbit, clock offset and code/phase biases are broadcasted.

As a demonstration, the wide-range ionospheric correction for the Asia and Oceania regions is additionally transmitted by the L6D messages to shorten the TTFF (Time To First Fix) of MADOCA-PPP.

This Technology Demonstration (ionospheric correction) augments the following GNSSs:

- QZSS
- GPS
- GLONASS
- Galileo

#### 3.2. Demonstartion Schedule

The demonstrations using the QZS-5, 6 and 7 will be performed in 2024 to 2026.

#### 3.3. Demonstartion Area

The demonstrations will be performed in several areas of the Asia-Oceania region. The valid ionospheric correction data will be available in the area where the monitoring stations of the demonstration participant organizations are located.

#### 3.4. Convergence Time

The convergence time is the time from the reception of the augmentation messages via the L6(MADOCA-PPP) signal at a receiver until the PPP computation result which satisfies the following accuracy is obtained :

- Horizontal Accuracy  $\leq 30$  [cm] (95%)
- Vertical Accuracy  $\leq 50$  [cm] (95%)

The convergence time shall satisfy the following condition(\*):

- Convergence Time  $\leq 600$  [sec]

(\*) Assumptions:

- Environment: Open-sky
- Antenna and Receiver: Dual-frequency, for surveying