Quasi-Zenith Satellite System
Performance Standard
(PS-QZSS-001)

(November 5, 2018)

Cabinet Office

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Revision History

Rev. No.	Date	Page	Revisions
001 Draft Edition	January 10,2017		Draft edition
	July 24,2017	23	Corrects description of DC-Report availability, Table 7.3.1-1 Definition of unhealthy conditions and 7.3.2 Service Availability by Each QZS.
	April 6,2018	19	Updates service area of CLAS, Figure 6.2-1.
	August 31, 2018	19	Adds description of service area on the altitude direction
		20	Adds remarks of CLAS positioning accuracy, Table 6.3-1
001	November 5, 2018	4	Updates 2.5. Abbreviations
		12	Adds remarks and figure 4.3-2 of 4.3.4 Almanac accuracy.
		18	Adds remarks and Table 5.5-1 Definition of unhealthy conditions
		20	Updates 6.1 Service Overview of CLAS
		22	Changes description of Table 6.4-1 Definition of unhealthy conditions
		22	Updates interruption conditions by adding Table 6.5-1 Definition of interruption conditions

"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

1. Scope

The Quasi-Zenith Satellite System (QZSS) provides the following services:

(1) Satellite Positioning, Navigation and Timing Service (PNT)
(2) Sub-meter Level Augmentation Service (SLAS)
(3) Centimeter Level Augmentation Service (CLAS)
(4) Satellite Report for Disaster and Crisis Management (DC Report)
(5) QZSS Safety Confirmation Service (Q-ANPI)
(6) Positioning Technology Verification Service (PTV)

This document contains a service overview and system overview of QZSS.

2. Relevant Documents and Terms and Definitions

2.1. Applicable Documents

The following documents constitute part of this document within the scope defined in this document. This document may be updated when these applicable documents are updated.

(1) Global Positioning Systems Directorate Systems Engineering & Integration Interface Specification IS-GPS-200, Navstar GPS Space Segment/Navigation User Interfaces, Revision H, 24-SEP-2013

(2) Global Positioning Systems Directorate Systems Engineering & Integration Interface Specification IS-GPS-705, Navstar GPS Space Segment/User Segment L5 Interfaces, Revision D, 24-SEP-2013

(3) Global Positioning Systems Directorate Systems Engineering & Integration Interface Specification IS-GPS-800, Navstar GPS Space Segment/User Segment L1C Interfaces, Revision D, 24-SEP-2013

(4) RTCM STANDARD 10403.2 DIFFRENTIAL GNSS (GLOBAL NAVIGATION SATELLITE SYSTEMS) SERVICE –VERSION3, RTCM SPECIAL COMMITTEE NO.104, 1-FEB-2013.

2.2. 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) Global Positioning System Standard Positioning Service Performance Standard, 4th Edition, September 2008

(2) IS-QZSS-PNT, Quasi-Zenith Satellite System Interface Specification - Satellite Positioning, Navigation and Timing Service

(3) IS-QZSS-L1S, Quasi-Zenith Satellite System Interface Specification - Sub-meter Level

Augmentation Service

(4) IS-QZSS-L6, Quasi-Zenith Satellite System Interface Specification - Centimeter Level Augmentation Service

(5) IS-QZSS-DCR, Quasi-Zenith Satellite System Interface Specification - Satellite Report for Disaster and Crisis Management

(6) IS-QZSS-ANPI, Quasi-Zenith Satellite System Interface Specification - QZSS Safety Confirmation Service

(7) IS-QZSS-TV, Quasi-Zenith Satellite System Interface Specification - Positioning Technology Verification Service

2.3. Document architecture

The document architecture for the QZSS Performance Standard (PS-QZSS) and the QZSS Interface Specification (IS-QZSS) is shown in Table 2.3-1.

PS-QZSS describe the scope, accuracy, availability, continuity and other performance characteristics of each service and IS describe signal specifications, message specifications, user algorithms and other user interface specifications.

Table 2.3-1 Document architecture

Quasi-Zenith Satellite System Performance Standard	Quasi-Zenith Satellite System Interface Specification
PS-QZSS Quasi-Zenith Satellite System Performance Standard	IS-QZSS-PNT Quasi-Zenith Satellite System Interface Specification Satellite Positioning, Navigation and Timing Service
	IS-QZSS-L1S Quasi-Zenith Satellite System Interface Specification Sub-meter Level Augmentation Service
	IS-QZSS-L6 Quasi-Zenith Satellite System Interface Specification Centimeter Level Augmentation Service
	IS-QZSS-DCR Quasi-Zenith Satellite System Interface Specification Satellite Report for Disaster and Crisis Management
	IS-QZSS-ANPI Quasi-Zenith Satellite System Interface Specification QZSS Safety Confirmation Service
	IS-QZSS-TV Quasi-Zenith Satellite System Interface Specification Positioning Technology Verification Service

2.4. Terms and Definitions

Terms	Definitions
almanac	Reduced-precision subset of the clock and ephemeris
availability	The time ratio of a healthy signal.
clock offset	Offset between the ground system clock and satellite clock
continuity	The probability that a healthy signal will continue to be healthy without unscheduled interruption over a specified time interval.
Earth Centered Earth Fixed (ECEF)	Geographic coordinate system that does not rotate with the earth as follows: origin: the mass center of the earth x-axis: the direction of the spring equinox y-axis: the direction of the right ascention 90 degrees z-axis: the direction of the celestial north pole
Earth Centered Inertial (ECI)	Geographic coordinate system that rotates with the earth as follows: origin: the mass center of the earth x-axis: the direction of the Greenwich meridian y-axis: the direction of longitude 90E degrees z-axis: the direction of the North Pole
ephemeris	Predicted orbital elements.
health	State of the satellite service
integrity	The time ratio of a service error without a timely alarm.
navigation message	Message transmitted by satellite for navigation
polar motion	Movement of the earth's rotational axis
Signal-In-Reference User Range Error (SIR-URE)	Range error due to the satellite system and the ground system,
time-of-week (TOW) count	The total seconds of a week at the beginning of the message

2.5. Abbreviations

-A-

-B-

-C-

CLAS	Centimeter Level Augmentation Service
CNAV	Civil NAVigation
CRC	Cyclic Redundancy Check

-D-

DC Report	Satellite Report for Disaster and Crisis Management

-E-

ECEF	Earth Centered Earth Fixed
ECI	Earth Centered Inertial
EOP	Earth Orientation Parameters

-F-

-G-

GEO	GEostationary Orbits
GGTO	Time Offset between GPST and GNSST
GNSS	Global Navigation Satellite System
GNSST	GNSS Time
GPS	Global Positioning System
GPST	GPS Time

-H-

-I-

ISF	Integrity Status Flag
IS-QZSS	QZSS Interface Specification

-J-

-K-

-L-

LNAV	Legacy NAVigation

-M-

MT	Message Type
mas	milliarcsecond

-N-

NICT	National Institute of Information and Communications Technology

-O-

-P-

PRN	Pseudorandom Noise
PS-QZSS	QZSS Performance Standard
PTV	Positioning Technology Verification Service

-Q-

QZO	Quasi-Zenith Orbits

QZS	Quasi-Zenith Satellite
QZSS	Quasi-Zenith Satellite System
QZSST	QZSS Time
Q-ANPI	QZSS Safety Confirmation Service
-R-	
RF	Radio Frequency
RMS	Root Mean Square
-S-	
SIR	Signal-In-Reference
SIR-URE	SIR User Range Error
SIS	Signal-In-Space
SIS-URE	SIS User Range Error
SIS-URRE	SIS User Range Rate Error
SLAS	Sub-meter Level Augmentation Service
PNT	Satellite Positioning, Navigation and Timing Service
-T-	
TOW	Time Of Week
TTA	Time To Alert
TTFF	Time To First Fix
-U-	
URA	User Range Accuracy
URE	User Range Error
UT1	Universal Time
UTC	Coordinated Universal Time
-V-	
-W-	
-X-	
-Y-	
-Z-	

3. QZSS Overview

3.1. System Overview

3.1.1. System Architecture

QZSS consists of the satellite system (four QZSs) and the ground system (master control stations, tracking stations and monitoring stations). The system architecture is shown in Figure 3.1-1.

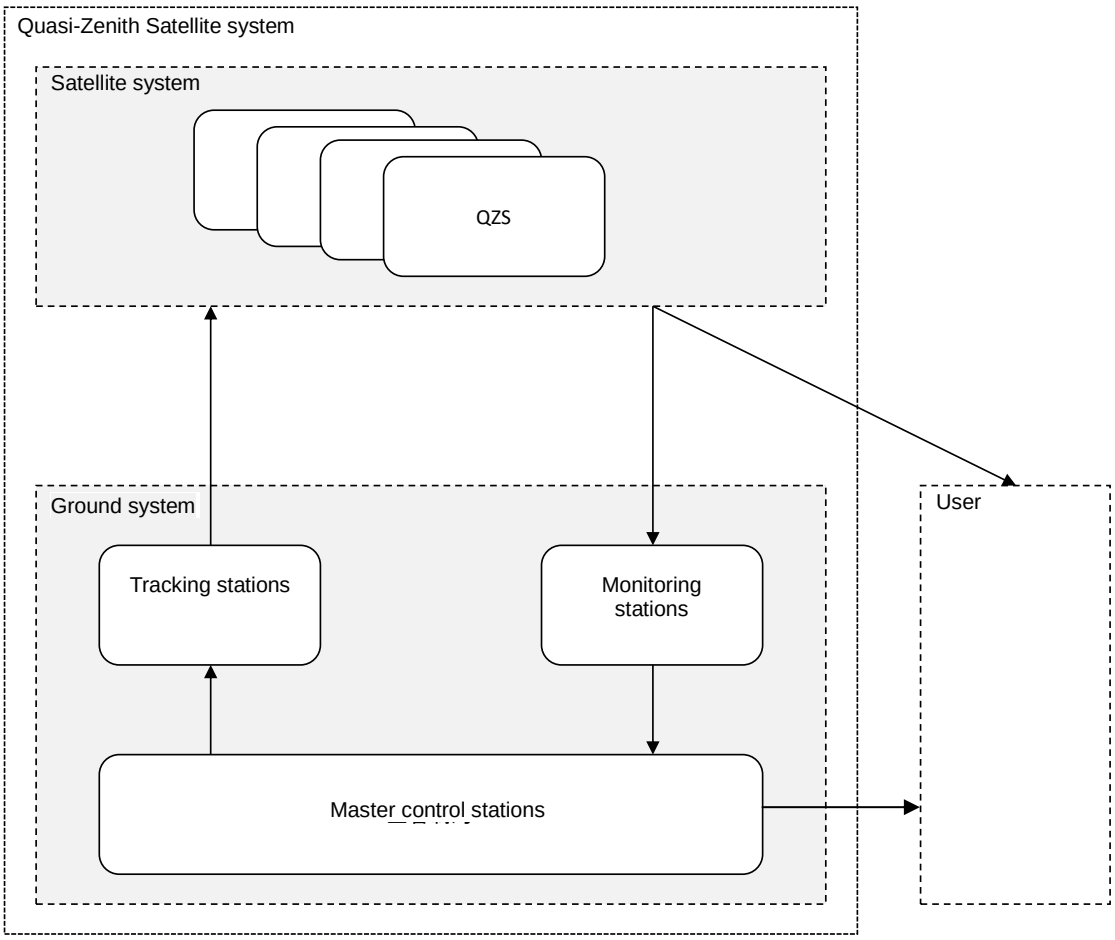

Figure 3.1-1 System architecture

3.1.1.1 Satellite System

The four QZSs making up the satellite system consist of three Quasi-Zenith Orbit (QZO) satellites and one geostationary orbit (GEO) satellite that transmit signals to provide the services.

The Block of QZS system is defined in the development generation and its orbit. The first QZS is referred to as Block I-Q, the other two QZO satellites as Block II-Q, and the GEO satellite as Block II-G.

The first QZS was already launched in 2010. There is also some signal differences among Block I-Q, Block II-Q and Block II-G. The signals are listed in Table 3.1-1.

Table 3.1-1 List of transmitted signals

Signal name	1st QZS	2nd to 4th QZSs		Delivered services	Center frequency
	Block I-Q	Block II-Q	Block II-G		
	QZO	QZO	GEO		
	1 sat	2 sats	1 sat		
L1C/A	Transmit	Transmit	Transmit	PNT	1575.42 MHz
L1C	Transmit	Transmit	Transmit	PNT	
L1S	Transmit	Transmit	Transmit	SLAS	
				DC Report	
L2C	Transmit	Transmit	Transmit	PNT	1227.60 MHz
L5	Transmit	Transmit	Transmit	PNT	1176.45 MHz
L5S	-	Transmit	Transmit	PTV	
L6	Transmit	Transmit	Transmit	CLAS	1278.75 MHz
S band	-	-	Transmit	Q-ANPI	2 GHz band

3.1.1.2 Ground System

The ground system consists of master control stations, tracking stations and monitoring stations.

The master control stations monitor and control the satellite system and the ground system, and make data for each service.

The tracking stations communicate the satellite system and uplink data.

The monitoring stations receive the positioning signals transmitted from QZS, GPS and other GNSS.

3.1.2. Satellite Orbits

QZO has each other different orbital planes that are highly inclined and elliptical. The orbital period of QZO is the same as GEO. The three QZO satellites have an orbital plane phase that has been adjusted so that they have almost the same ground track.

The parameters and operational ranges for QZO and GEO are shown in Table 3.1-2 and Table 3.1-3.

The ground track of QZO is shown in Figure 3.1-2.

The QZO satellites maintain orbit control once about every 6 months to keep the orbital position. The GEO satellites maintain orbit control once about every a month. During orbit control maintenance, Satellite Positioning, Navigation and Timing Service of the satellite is suspended.

Table 3.1-2 QZO parameters and operational ranges

Orbit parameter	Nominal value	Operational range
Semi-major axis (A)	42,165 km	-
Eccentricity (e)	0.075	0.075 ± 0.015
Angle of inclination (i)	41 degrees (Average of the service period (15 years))	-
Argument of perigee (ω)	270 degrees	270 ± 2.5 degrees
Right ascension of ascending node (Ω) (*)	Block I-Q: 117 degrees Block II-Q: 247 and 347degrees (Mid-point of the service period (15 years) (7.5 years from the start of service))	-
Center of longitude (λ)	139 degrees east (Average of orbit control interval (approx. 6 months))	-

(*) Epoch: September 2025

Table 3.1-3 GEO parameters and operational ranges

Orbit parameter	Nominal value	Operational range
Longitude	127 degrees east	127 ± 0.1 degrees east
Latitude	0 degrees	0 ± 0.1 degrees

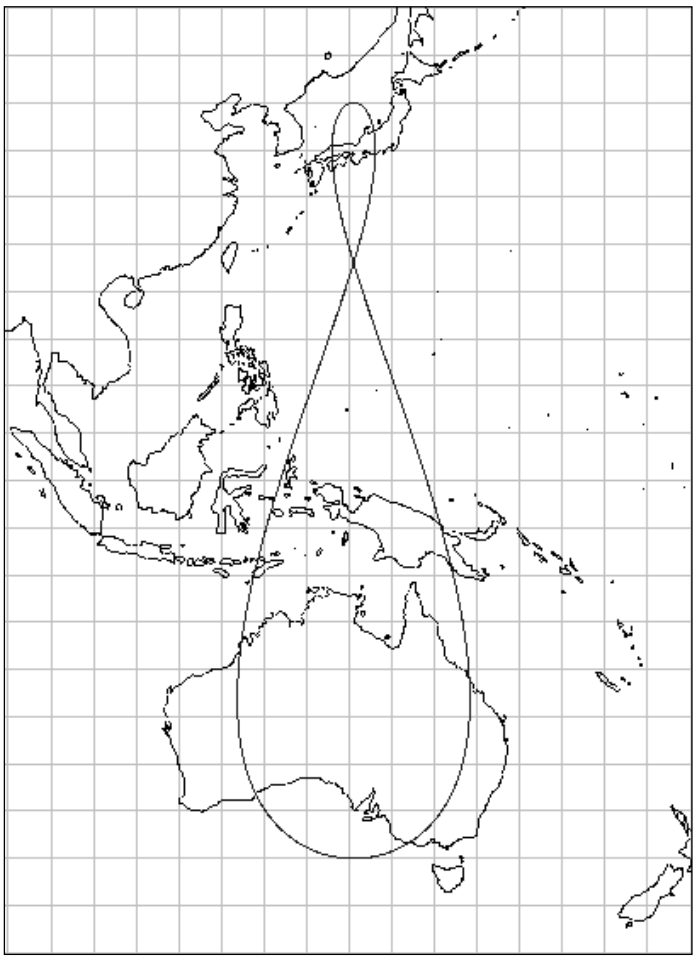

Figure 3.1-2 QZO Ground track (nominal)

4. PNT Specifications

4.1. Service Overview

Satellite Positioning, Navigation and Timing Service (PNT) provides positioning signals (L1C/A signals, L1C signals, L2C signals and L5 signals) that have compatibility and interoperability with the signals of GPS Block III.

The user interface specifications are described in "IS-QZSS Satellite Positioning, Navigation and Timing Service (IS-QZSS-PNT)."

4.2. Visible Area

Figure 4.2-1 shows areas where at least one QZS is visible, with lines representing the elevation angles. (The numbers shown in the figure represent elevation angles [deg].) On the inside of an elevation angle of 10 degrees line is the area where PNT signal can be received.

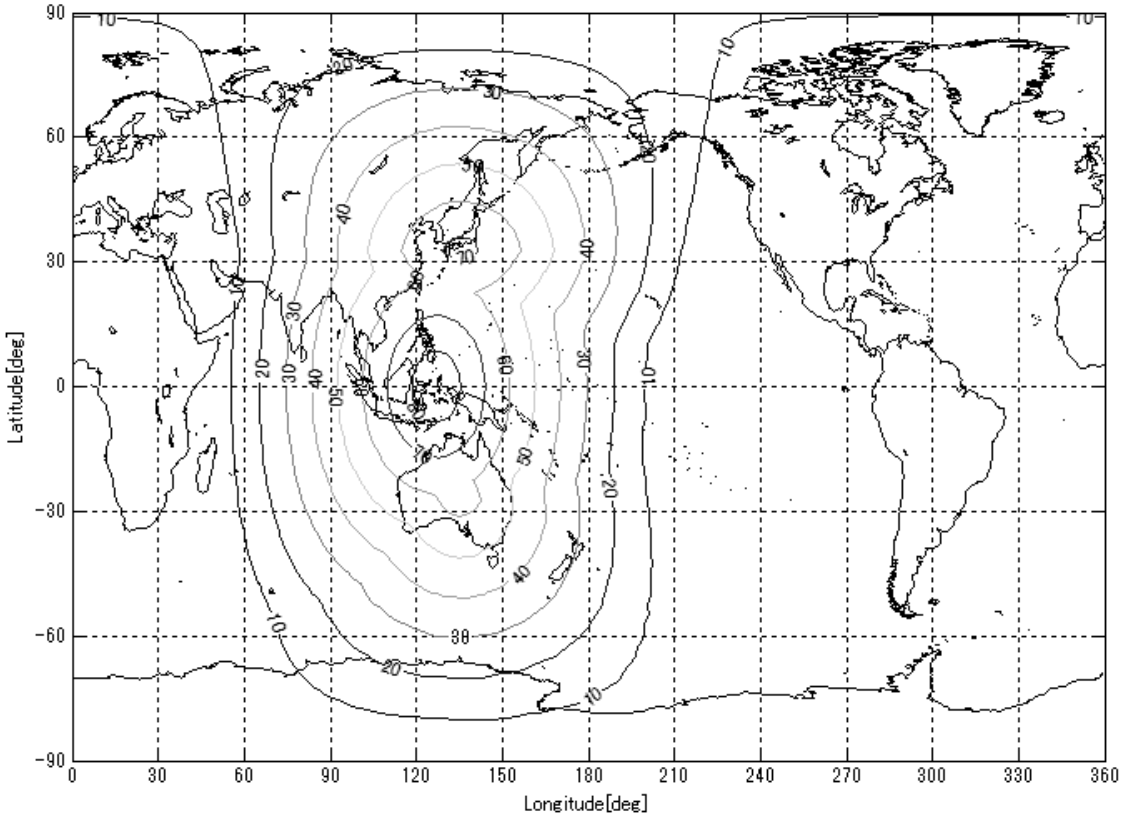

Figure 4.2-1 Area where at least one QZS is visible

4.3. Accuracy

4.3.1. SIS Accuracy

SIS-URE shall satisfy the following for all signals.

- ≤ 2.6 m (95%) (Error(RMS) = 1.3 m)

4.3.2. Ionosphere Parameter Accuracy

There are two types of ionosphere parameters transmitted from QZS: wide area and Japan area. These are as shown in Figure 4.3-1 and Table 4.3-1. Each ionosphere parameter shall be able to be used only in the each area. The both average ionosphere URE shall satisfy the following in their areas.

- ≤ 7.0 m (95%) (Error(RMS) = 3.5 m)

The parameter for Japan area is customized for the area surrounding Japan. In Japan area, more accurate ionosphere correction values than those of the wide area type can be obtained.

Outside of the wide area, the ionosphere parameter transmitted from QZS shall not be used, but the ionosphere parameter transmitted from GPS described in the applicable documents (6), (7) and (8) shall be used.

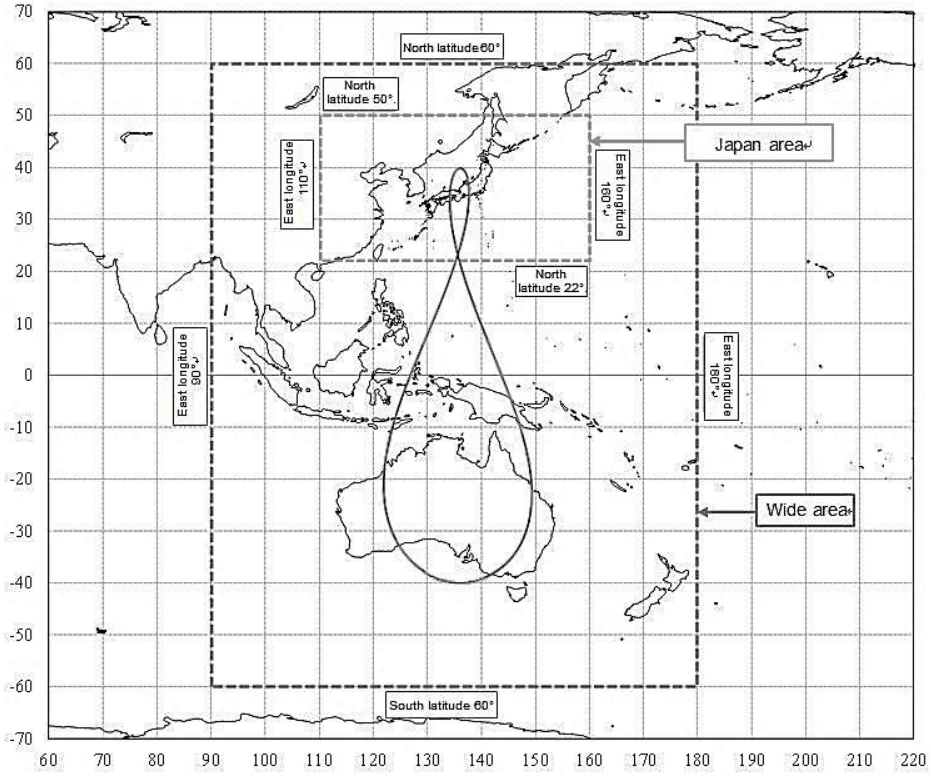

Figure 4.3-1 Target areas of ionosphere parameters

Table 4.3-1 Longitude and latitude lines that form target areas of ionosphere parameter

Direction	Target area of ionosphere parameter for wide area	Target area of ionosphere parameter for Japan area
North	North latitude 60°	North latitude 50°
South	South latitude 60°	North latitude 22°
West	East longitude 90°	East longitude 110°
East	East longitude 180°	East longitude 160°

4.3.3. UTC Accuracy

QZS shall transmit the time offset between QZSS time (QZSST) and UTC(NICT). The accuracy of the time offset modulo one second shall satisfy the following condition:

- ≤ 40 ns (95%) (Error(RMS) = 20 ns)

4.3.4. Almanac Accuracy

QZS shall transmit the approximate orbit information of each QZS as almanac. That shall satisfy the following condition(*):

(1) Almanac (LNAV (L1C/A))

- Positioning Accuracy: ≤ 10 km (3D-1σ)
- Clock offset Accuracy: ≤ 135 m (1σ)
- Clock drift Accuracy: ≤ 50 m/day (1σ)
- SIS-URE: ≤ 3.0 km (1σ)
- SIS-URRE: ≤ 0.3 m/s (1σ) (The orbit control period isn't included.)
- SIS-URRE (maximum): 30 m/s (The orbit control period is included.)

(2) Midi almanac (CNAV2 (L1C), CNAV (L2C, L5))

- Positioning Accuracy: ≤ 10 km (3D-1σ)
- SIS-URE: ≤ 3.0 km (1σ)
- SIS-URRE: ≤ 0.3 m/s (1σ) (The orbit control period isn't included.)
- SIS-URRE (maximum): 30 m/s (The orbit control period is included.)

(3) Reduced almanac (CNAV2 (L1C), CNAV (L2C, L5))

Reduced almanac accuracy isn't defined.

(*) After the alert flag is "1" in almanac valid period, the almanac may not provide the specified time accuracy or URE/URRE component as shown in Figure 4.3-2.

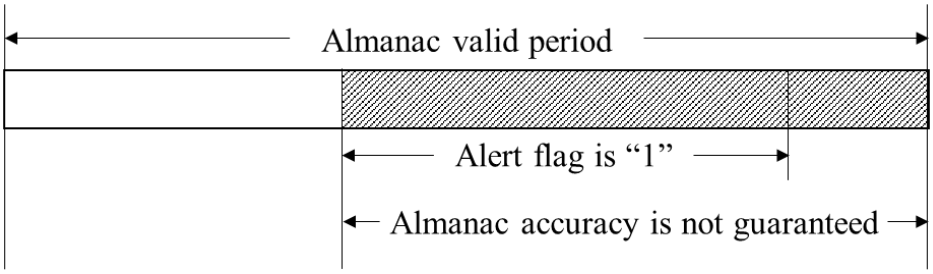

Figure 4.3-2 Almanac accuracy when the alert flag is "1"

4.3.5. EOP Accuracy

QZS shall transmit the polar motion parameter and the UT1-UTC parameter that are required for coordinate transformation between the Earth Centered Inertial (ECI) and the Earth Centered Earth Fixed (ECEF) as an earth orientation parameter (EOP) that shall satisfy the following condition:

Polar motion accuracy along X and Y axes:
≤ 1.0 mas (*) (95%) (≈ 20 cm at QZS altitude) (Error(RMS) = 0.5 mas)
UT1-UTC: ≤ 2.0 ms (95%) (≈ 666 cm at QZS altitude) (Error(RMS) = 1.0 ms)

((*) mas: milliarcsecond))

4.3.6. GGTO Accuracy

QZS shall transmit the time offset between QZSST and another GNSS time.
The accuracy the time offset modulo one second shall satisfy the following condition:

- 2.0 ns (95%) (Error(RMS) = 1.0 ns)

4.4. Availability

4.4.1. Constellation Service Availability

Constellation availability is a time ratio of the simultaneous transmission of healthy signals from at least three of four QZSs. It shall satisfy the following condition:

- ≥ 0.99

The unhealthy conditions of PNT signal (L1C/A, L1C, L2C or L5) are defined as unhealthy in Table 4.4-1.

Table 4.4-1 Definition of unhealthy conditions

<table>
<tr><td rowspan="6">Unhealthy</td><td>System maintenance</td><td colspan="2">When the service is outage in scheduled system interruption such as orbit control or unloading. The health bit is "1" in this case.</td></tr>
<tr><td rowspan="5">System error</td><td colspan="2">When a PNT signal is transmitted by non-standard PRN code.
When a PNT signal cannot be continuously tracked for 1 second or longer (including the case where the signal power has decreased by 20 dB or more).

When the preamble or inspection bit (parity, CRC) is error.
When the default message is transmitted.
When the ground system detects that any of the following parameters can't be generated properly.
- Ionosphere parameter
- QZS almanac
- UTC parameter
- EOP parameter
- GGTO parameter
When the alert flag or the health bit is "1" in such a case that a service error as follows has occurred.
When no alarm has been activated even when a service error as follows has occurred.</td></tr>
<tr><td rowspan="4">Service error</td><td>RF error
Decrease in signal power
Decrease in power of transmitted signal by 20 dB or more</td></tr>
<tr><td>TOW error
Discontinuity of the TOW count</td></tr>
<tr><td>SIS-URE error
SIS-URE exceeds 4.42 times (when ISF = 0) or 5.73 times (when ISF = 1) the URA, or SIS-URE exceeds 9.65 m</td></tr>
<tr><td>(1) UTC error
The UTC time offset based on the UTC parameter exceeds 120 ns</td></tr>
<tr><td>Accuracy degradation</td><td colspan="2">When the transmitted URA exceeds 9.65 m.</td></tr>
</table>

4.4.2. Service Availability by Each QZS

PNT availability by each QZS is a time ratio when the signal is not unhealthy defined in Section 4.4.1 and shall satisfy the following condition. The following values shall be applied to each signal (L1C/A, L1C, L2C and L5).

- QZO satellite: ≥ 0.95
- GEO satellite: ≥ 0.80

4.5. Continuity

The continuity of PNT signals shall satisfy the following condition. The following values shall be applied to each signal (L1C/A, L1C, L2C, and L5) and each QZS in any one hour.

- ≥ 1-2×10-4[/hour]

When a system maintenance defined in Section 4.4.1 is predicted and the notification has been announced to users at least 48 hours before the outage, that period shall be excluded in the continuity.

4.6. Integrity

The integrity of PNT is a time ratio of a service error defined in Section 4.4.1 without a timely alarm. It shall satisfy the following conditions, which shall be applied to each signal (L1C/A, L1C, L2C and L5) and each satellite in any one hour.

- ≤ 1×10-5[/hour] (when integrity status flag (ISF) is "0")
- ≤ 1×10-8[/hour] (when ISF is "1")

The timely alarm is a time period between an occurrence of a service error and the time it reaches a user receiver. It shall be shown in

Table 4.6-1.

Table 4.6-1 Alarm notification and Time-to-Alert (TTA)

Service error item	Alarm notification	Time-to-Alert (TTA)
RF error	Non-standard PRN code	8.0 seconds
TOW error	Non-standard PRN code	8.0 seconds
SIS-URE error	Non-standard PRN code	5.2 seconds
UTC error	Alert flag	30 seconds

5. SLAS Specifications

5.1. Service Overview

Sub-meter Level Augmentation Service (SLAS) provides sub-meter level augmentation information as L1S signals.

The user interface specifications are described in "IS-QZSS Sub-meter Level Augmentation Service (IS-QZSS-L1S)."

SLAS augments the following signals.

- QZSS : L1C/A
- GPS : L1C/A

5.2. Service Area

SLAS will be available in the area depicted in Figure 5.2-1.

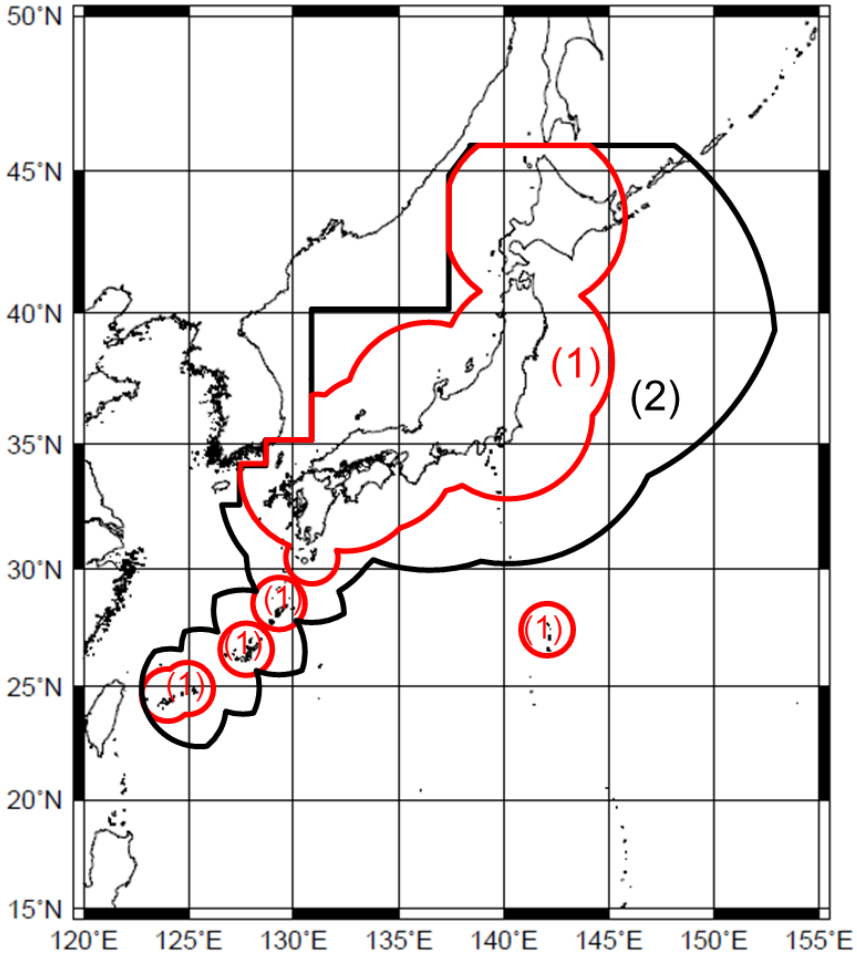

Figure 5.2-1 Service Area of the Sub-meter Level Augmentation Service (SLAS)

5.3. Accuracy

5.3.1. Positioning Accuracy

SLAS positioning accuracy is shown in Table 5.3.1-1.

Table 5.3.1-1 Positioning Accuracy

Zone	Positioning Error		Remark
	Horizontal	Vertical	
Zone (1)	≤ 1.0m(95%) (0.58m(RMS))	≤ 2.0m(95%) (1.02m(RMS))	(*)
Zone (2)	≤ 2.0m(95%) (1.16m(RMS))	≤ 3.0m(95%) (1.53m(RMS))	(*)

(*)The condition is below.

・Elevation mask angle：10°

・User range error that caused user's receivers and user's situation：
≤0.87m(95%)

5.4. Availability

5.4.1. Constellation Service Availability

Constellation availability is a time ratio of the simultaneous transmission of healthy SLAS informations from at least three of four QZSs. It shall satisfy the following condition:

- ≥ 0. 9997

The unhealthy conditions of L1S signal are defined as unhealthy in Table 5.4.1-1

Table 5.4.1-1 Definition of unhealthy conditions

Unhealthy	System maintenance	When the service is outage in scheduled system interruption.	
	System error	When an L1S signal is transmitted with CRC error. When an L1S signal is suspended for 4 seconds or longer.	
		Service error	URE (User Range Error) of more than ±12.96m. The alert flag is "1" in this case.

5.4.2. Service Availability by Each QZS

L1S availability by each QZS is a time ratio when L1S signal is not unhealthy defined in Section 5.4.1 and shall satisfy the following condition:

- ≥ 0. 9799

5.4.3. Constellation Service Availability at High Elevation Angles

The constellation service availability at high elevation angles is a time ratio that indicates that the signal is not unlhealthy defined in Section 5.4.1 from any QZS at an elevation angle of 60 degrees or more. The ratio shall satisfy the following condition:

- ≥ 0.92

5.5. Continuity

The continuity of L1S signal shall satisfy the following conditions. The following values shall be applied to L1S signal and each QZS in any one hour.

- $\geq 1\text{-}0.875\times10^{-3}$ [/hour] (Block I)
- $\geq 1\text{-}2 \times 10^{-4}$ [/hour] (Block II)

Table 5.5-1 Definition of unhealthy conditions

Unhealthy	System maintenance	When the service is outage in scheduled system interruption.	
	System error	When any of MT 48,49,or 50 in an L1S signal is not transmitted more than twice continuously.*	
		Service error	URE (User Range Error) of more than ±12.96m. The alert flag is "1" in this case.

*This means that an L1S signal is not transmitted for more than 31 seconds.

When a system maintenance defined in Table 5.5-1 is predicted and the notification has been announced to users at least 48 hours before the outage, that period shall be excluded in the continuity.

5.6. Integrity

The integrity of SLAS is a time ratio of a service error defined in Section 5.4.1 without a timely alarm. It shall satisfy the following conditions, which shall be applied to each satellite in any one hour.

- $\leq 1.0 \times 10^{-5}$ [/hour]

The timely alarm is a time period between an occurrence of a service error and the time it reaches a user receiver. It shall satisfy the following condition:

- $\leq$ 24sec (Block I)
- $\leq$ 10sec (Block II)

5.7. Time to First Fix (TTFF)

TTFF is the time from the reception of L1S signals to the completion of positioning by SLAS. It shall

satisfy the following condition:

- ≤ 30[sec] (95%)

6. CLAS Specifications

6.1. Service Overview

Centimeter Level Augmentation Service (CLAS) provides centimeter level augmentation information as L6 signals.

The user interface specifications are described in "IS-QZSS Centimeter Level Augmentation Service (IS-QZSS-L6)."

CLAS adopts Real-Time Kinematic (RTK) Precise Point Positioning (PPP) method defined in RTCM STANDARD 10403.2 Section 3.5.12 “State Space Messages” in the applicable documents (4).

CLAS augments the following signals. Augmentation for GLONASS is a future service.

- QZSS : L1C/A, L1C, L2C, L5
- GPS : L1C/A, L1C, L2P, L2C, L5
- GLONASS : L1(CDMA), L2(CDMA)
- Galileo : E1B, E5a

6.2. Service Area

CLAS will be available in the area depicted in Figure 6.2-1.

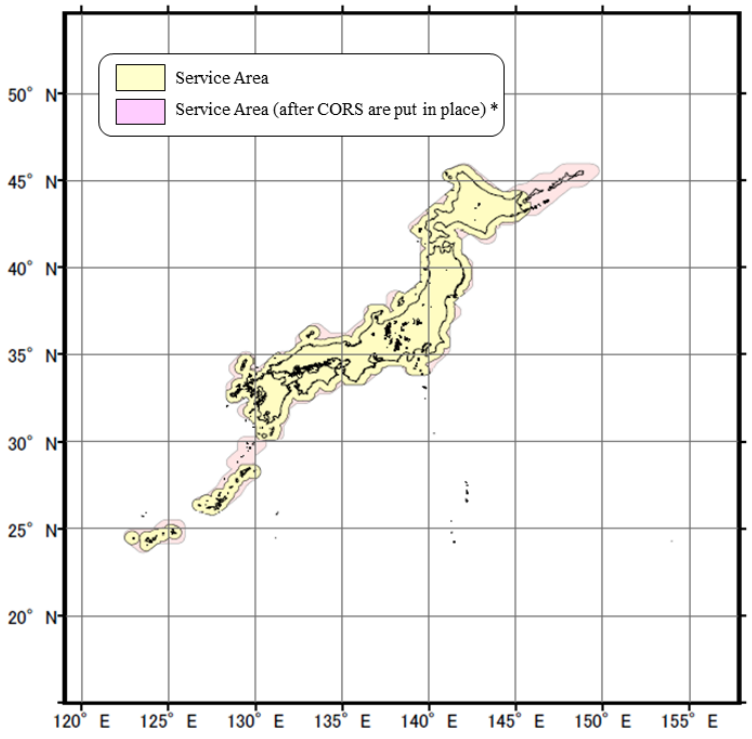

Fig. 6.2-1 Service Area of the Centimeter Level Augmentation Service (CLAS)

*Around islands such as Northern Territories and Tokara Islands, and regions with an altitude of 2000 meters or more

6.3. Accuracy

CLAS Positioning accuracy is shown in Table. 6.3-1.

Table. 6.3-1 Positioning Accuracy

Positioning Type	Positioning Error		Remark
	Horizontal	Vertical	
Static	≤ 6cm(95%) (3.47cm(RMS))	≤ 12cm(95%) (6.13cm(RMS))	(*)(**)
Kinematic	≤ 12cm(95%) (6.94cm(RMS))	≤ 24cm(95%) (12.25cm(RMS))	(*)(**)

(*) The augmentation information shall satisfy the following condition.

・SIR-URE ≤ 0.08m (95%)

(**) Usage assumptions to achieve the accuracy are as follows :

・All the augmented satellites (GNSSs) are used in the PPP-RTK positioning.

・A minimum number of satellites with no cycle slips : ≥ 5

・Elevation mask angle : 15°

・Average Dilution of Precision (DOP) by augmented satellites :

≤ 1.1 for Horizontal

≤ 1.8 for Vertical

・Multipath :

≤ 0.34m (RMS) for pseudorange per augmented satellite

≤ 0.75cm (RMS) for carrier phase per augmented satellite

・Receiver noise :

≤ 0.30cm (RMS) for carrier phase per augmented satellite

・Antenna phase center variation (PCV) error :

≤ 0.30cm (RMS) for each frequency

6.4. Availability

6.4.1. Constellation Service Availability

Constellation availability is a time ratio of the simultaneous transmission of healthy L6 signals from at least three of four QZSs. It shall satisfy the following condition:

- ≥ 0. 99

The unhealthy conditions of L6 signal are defined as unhealthy in Table 6.4-1.

Table 6.4-1 Definition of unhealthy conditions

Unhealthy	System maintenance	(1) When the service is outage in scheduled system interruption. (2) The alert flag is "1" in this case.	
	System error	(3) When an L6 signal is transmitted by a non-standard PRN code. (4) When the null message is transmitted for 3 seconds or longer.	
		Service error	SIR-URE(Signal In Reference User Range Error) of more than ±0.468m at 3 or more augmented satellites among at least 2 GNSS. When the number of augmented satellites is less than 5 at all locations in the service area. The alert flag is "1" in these case.

6.4.2. Service Availability by Each QZS

L6 availability by each QZS is a time ratio when L6 signal is not unhealthy defined in Section 6.4.1 and shall satisfy the following condition:

- ≥ 0.97

6.4.3. Constellation Service Availability at High Elevation Angles

The constellation service availability at high elevation angles is a time ratio that indicates that the signal is not unhealthy defined in Section 6.4.1 from any QZS at an elevation angle of 60 degrees or more. The ratio shall satisfy the following condition:

- ≥ 0.92

6.5. Continuity

The continuity of L6 signals shall satisfy the following conditions. The following values shall be applied to L6 signal and each QZS in any one hour.

- $\geq 1-0.875\times10^{-3}$ [/hour] (Block I)
- $\geq 1-2 \times 10^{-4}$ [/hour] (Block II)

The interruption conditions of L6 signal are defined as interruptionin in Table 6.5-1.

Table 6.5-1 Definition of interruption conditions

Interruption	System maintenance	(1) When the service is outage in scheduled system interruption. (2) The alert flag is "1" in this case.	
	System error	(3) When an L6 signal is transmitted by a non-standard PRN code. (4) When MT4073,3 in an L6 signal is not transmitted more than twice continuously.* (5) When any of MT4073,2 or MT4073,4～6 or MT4073,8～9, or MT4073,11 in an L6 signal is not transmitted more than twice continuously.**	
		Service error	SIR-URE(Signal In Reference User Range Error) of more than ±0.468m at 3 or more augmented satellites among at least 2 GNSS. When the number of augmented satellites is less than 5 at all locations in the service area. The alert flag is "1" in these case.

* This means that an L6 signal is not transmitted for more than 6 seconds.

** This means that an L6 signal is not transmitted for more than 31 seconds.

When a system maintenance defined in Table 6.5-1 is predicted and the notification has been announced to users at least 48 hours before the outage, that period shall be excluded in the continuity.

6.6. Integrity

The integrity of CLAS is a time ratio of a service error defined in Section 6.4.1 without a timely alarm. It shall satisfy the following conditions, which shall be applied to each satellite in any one hour.

- $\leq 1.0 \times 10^{-5}$ [/hour]

The timely alarm is a time period between an occurrence of a service error and the time it reaches a user reciever. It shall satisfy the following condition:

- ≤ 10.2sec (Block I)
- ≤ 9.2sec (Block II)

6.7. Time to First Fix (TTFF)

TTFF is the time from the reception of L6 signals to the resolution of the corrected carrier phase integer ambiguities. It shall satisfy the following condition:

- ≤ 60[sec] (95%)

7. DC Report Specifications

7.1. Service Overview

Satellite Report for Disaster and Crisis Management (DC Report) provides disaster, evacuation and other information as a message of L1S signals.

The user interface specifications are described in "IS-QZSS DC Report (IS-QZSS-DCR)."

7.2. Coverage Area

DC report will be available in the area depicted in Figure 7.2-1 where at least one QZS is visible at an elevation angle of 10 degrees or more. On the inside of line is the area where L1S signal can be received.

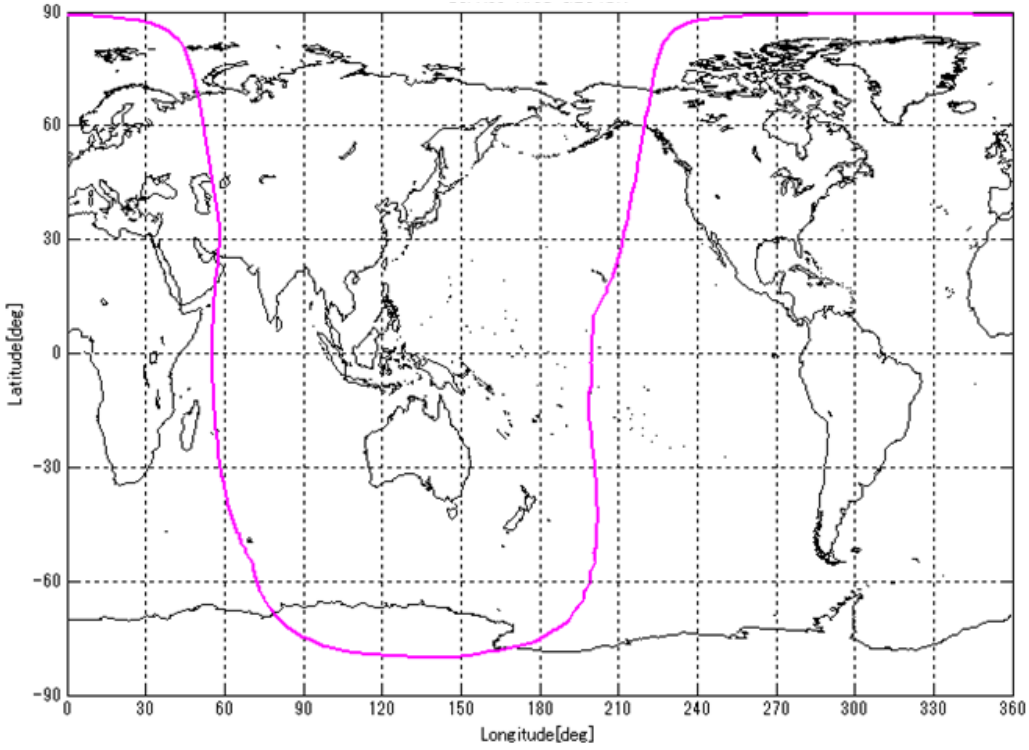

Figure 7.2-1 Coverage Area of the DC Report

7.3. Availability

7.3.1. Constellation Service Availability

Constellation availability is a time ratio of the simultaneous transmission of DC Report from at least three of four QZSs. It shall satisfy the following condition:

- ≥ 0.999

The unhealthy conditions of L1S (DC Report) signal are defined as unhealthy in Table 7.3.1-1

Table 7.3.1-1 Definition of unhealthy conditions

Unhealthy	System maintenance	When the service is outage in scheduled system interruption.
	System error	When an L1S (DC Report) signal can not normally be used.

7.3.2. Service Availability by Each QZS

Service availability by each QZS is a time ratio when L1S (DC Report) signal is not unhealthy defined in Section 7.3.1 and shall satisfy the following condition:

- ≥ 0. 97

7.3.3. Constellation Service Availability at High Elevation Angles

The constellation service availability at high elevation angles is a time ratio that indicates that L1S (DC Report) signal is not unlhealthy defined in Section 7.3.1 from any QZS at an elevation angle of 60 degrees or more. The ratio shall satisfy the following condition:

- ≥ 0.92

8. Q-ANPI Specifications

8.1. Service Overview

QZSS Safety Confirmation Service (Q-ANPI) provides emergency shelter information service using S-band mobile satellite communication of the QZSS.

In emergency shelter, when disasters occur, emergency shelter administrators collect safety status of evacuees and emergency shelter management information, then send them from the transmitting terminal to the Cabinet Office using QZS (GEO). The Cabinet Office collects information and provides it to disaster prevention agencies.

The user interface specifications are described in "IS-QZSS Safety Confirmation Service (IS-QZSS-ANPI)."

8.2. Service Area

Q-ANPI will be available in Japan shown in Figure 8.2-1-1.

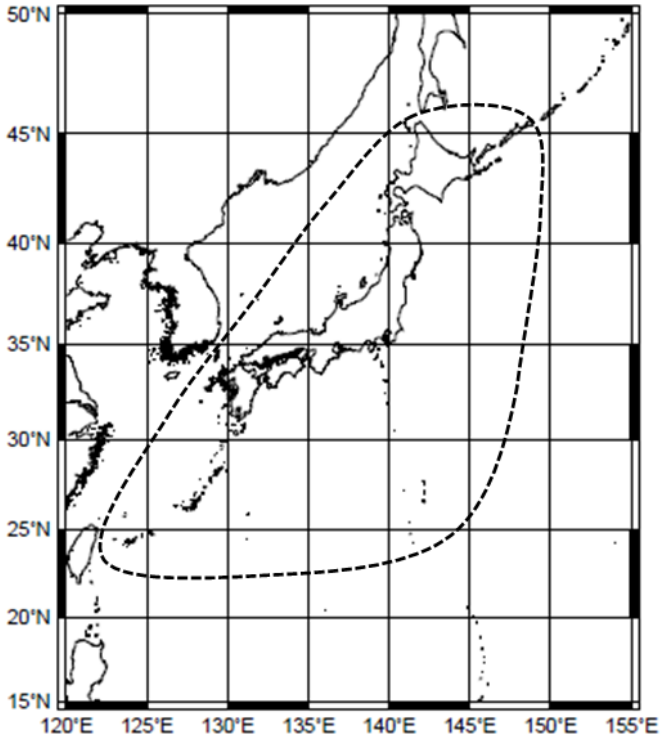

Figure 8.2-1 Service Area of the Q-ANPI

8.3. Availability

Service availability is a time ratio of the transmission of normal signals from single QZS (GEO). It shall satisfy the following condition:

- ≥ 0.97

9. PTV Specifications

9.1. Service Overview

The positioning technology verification service (PTV) provides an environment for verifying positioning information with new technology as L5S signals.

The user interface specifications are described in "IS-QZSS Positioning Technology Verification Service (IS-QZSS-TV)."

9.2. Service Area

PTV will be available in the area depicted in Figure 9.2-1 where at least one QZS is visible at an elevation angle of 10 degrees or more. On the inside of line is the area where L5S signal can be received.

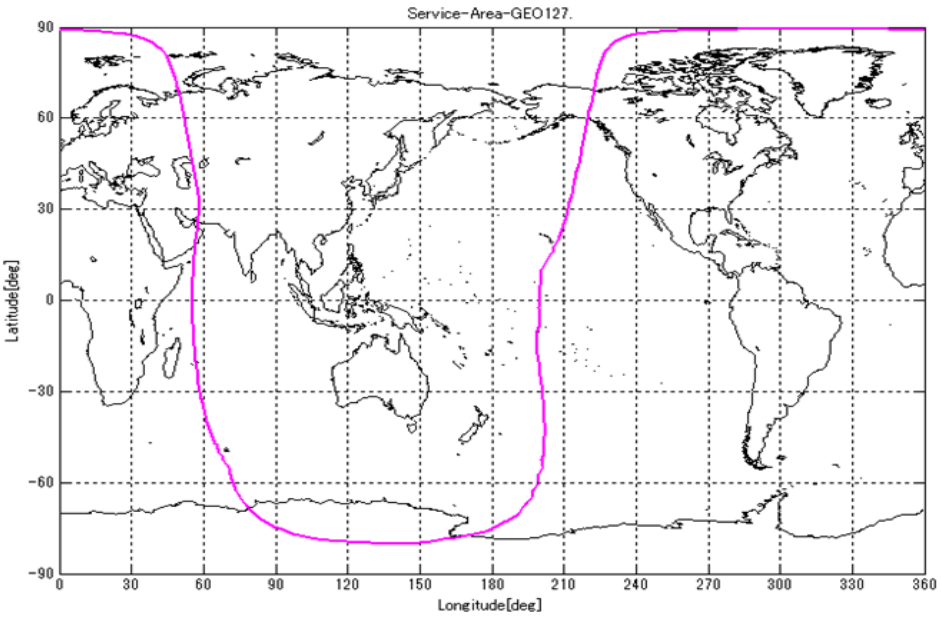

Figure 9.2-1 Service Area of the PTV

9.3. Accuracy

Since the signals are used for verification, the accuracy is not specified.

9.4. Availability

9.4.1. Constellation Service Availability

Constellation availability is not specified since the signals are used for verification

9.4.2. Service Availability by Each QZS

PTV availability by each QZS is a time ratio when L5S signals is not unhealthy defind in Table 9.4-1 and shall satisfy the following condition:

- ≥0.97 (target value)

Table 9.4-1 Definition of unhealthy conditions

Unhealthy	System maintenance	When the service is outage in scheduled system interruption.
	System error	When an L5S signal is transmitted with CRC error. When an L5S signal is suspended for 4 seconds or longer.

9.4.3. Constellation Service Availability at High Elevation Angles

The constellation service availability at high elevation angles is not specified since the signals are used for verification

9.5. Continuity

The continuity of L5S signal shall satisfy the following condition. The following values shall be applied to L5S signal and each QZS in any one hour.

- $\geq 1\text{-}2 \times 10^{-4}$ [/hour]

When a system maintenance defined in Section 9.4.2 is predicted and the notification has been announced to users at least 48 hours before the outage, that period shall be excluded in the continuity.