Quasi-Zenith Satellite System

Correction Data on Centimeter Level Augmentation Service for Experiment

Data Format Specification

1st Edition
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Global Positioning Augmentation Service Corporation

Revision History

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1. Introduction

Global Positioning Augmentation Service Corporation (GPAS) provides a product (hereinafter referred to as "MADOCA Product") that is generated by MADOCA-SEAD, Multi-GNSS Advanced Demonstration tool for Orbit and Clock Analysis Supply of "MADOCA-PPP" - Enabled Advanced Demonstration System, as the centimeter level augmentation service for experiment of Quasi Zenith Satellite System (QZSS).

This document describes the data format of MADOCA Product provided by GPAS.

2. Scope

The specification in this document covers the format of DATA PART in L6E message that is defined by the interface specification of centimeter level augmentation service (IS-QZSS-L6-001).

For other specifications of L6E message, or the user interface specification, see IS-QZSS-L6-001.

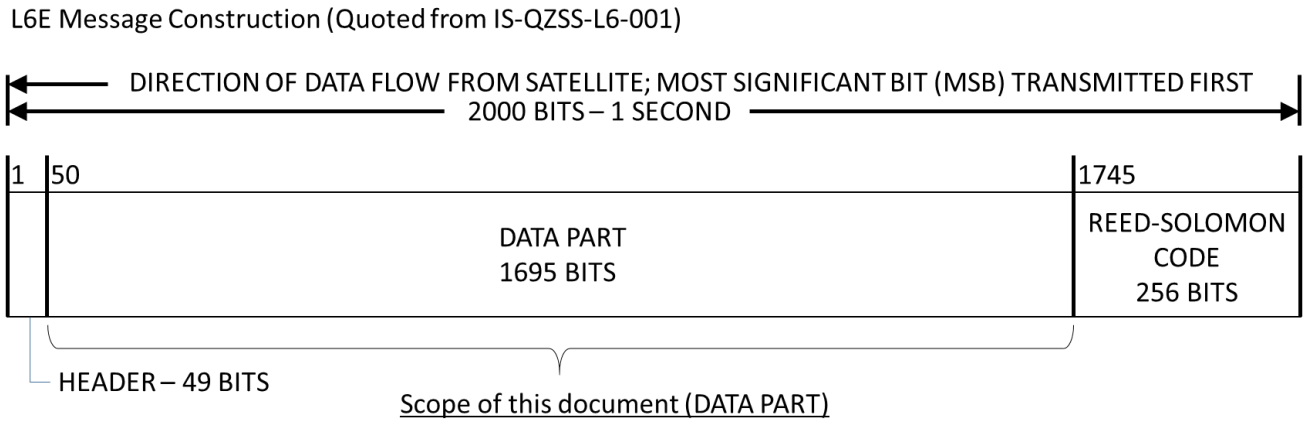

Figure 1 L6E message construction and the scope of this document

3. Reference

3.1 Applicable Documents

(1) The Cabinet Office, government of Japan: Quasi-Zenith Satellite System Interface Specification Centimeter Level Augmentation Service (IS-QZSS-L6-001), September, 2017.

(2) RTCM SPECIAL COMMITTEE NO. 104, RTCM Paper 228-2013-SC104-STD, RTCM STANDARD 10403.2 DIFFERENTIAL GNSS (GLOBAL NAVIGATION SATELLITE SYSTEMS) SERVICES - VERSION 3 with Amendment 2, Nov, 2013.

(3) RTCM SPECIAL COMMITTEE NO. 104, RTCM Paper 107-2014-SC104-818, Proposal of new RTCM SSR Messages SSR Stage 1: Galileo, QZSS, SBAS, BDS for RTCM STANDARD 10403.2, v.6, May, 2014.

3.2 Reference Documents

(1) Japan Aerospace Exploration Agency: MADOCA-SEAD Interface Specification Edition A, 2017

4. Data Structure

4.1 Overview

MADOCA Product is broadcasted by being stored in DATA PART (1695 bits) of L6E message (see applicable document (1) IS-QZSS-L6-001).

As shown on Figure 2, time of week (TOW) and GPS week number (WN) are stored at the top of DATA PART, and RTCM messages are stored in the subsequent space. RTCM messages are generated as to meet RTCM SSR (State Space Representation) standard format defined by RTCM10403.2 (see applicable document (2) (3)). The stored RTCM messages are message part ("Variable Length Data Message") only, excluding preamble, reserved bits, message length, and CRC.

Provided RTCM SSR message types of MADOCA Product are listed in Chapter 4.2, and those messages are broadcasted separately by multiple L6E messages according to the sequence shown in Chapter 4.4.

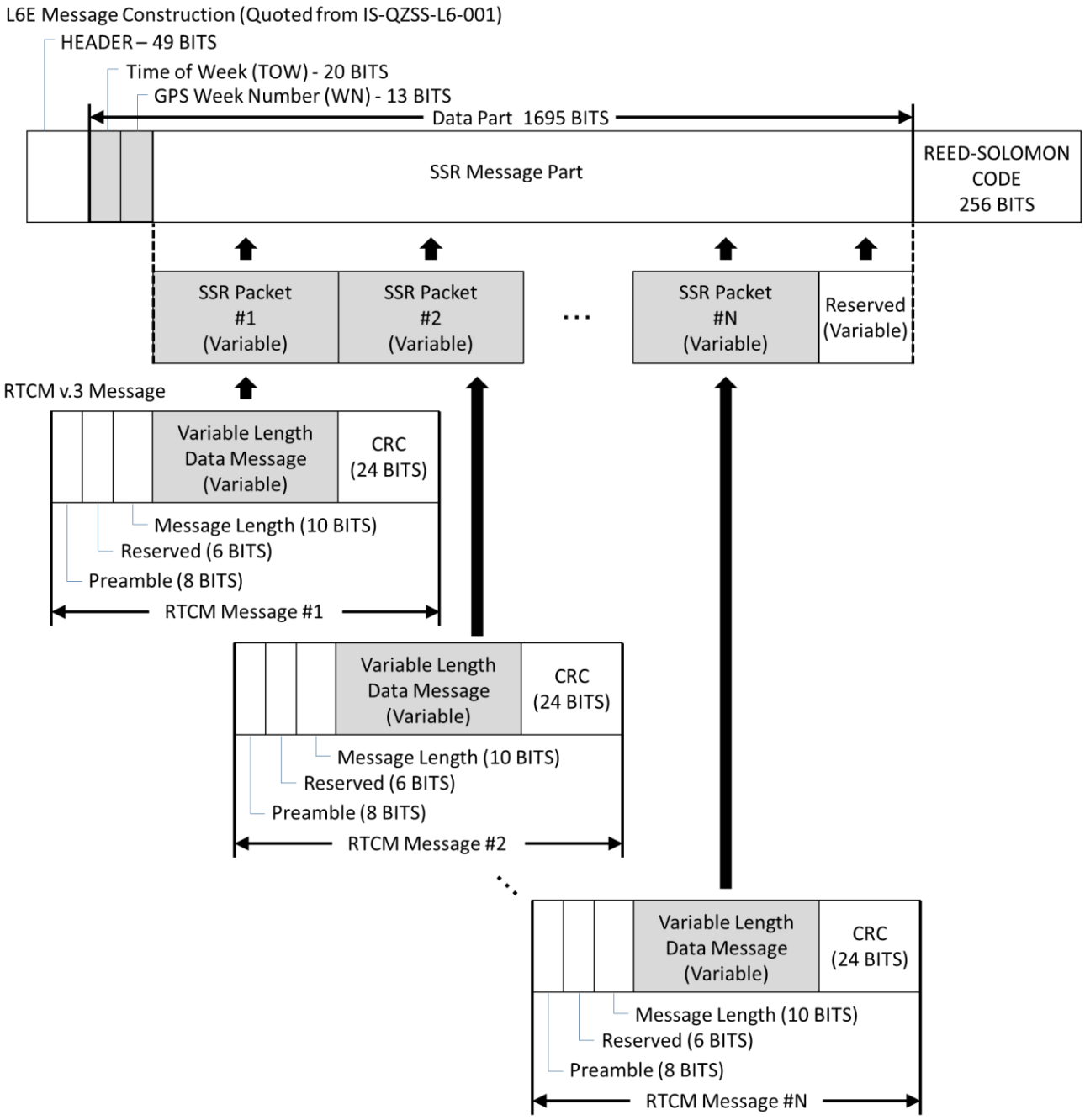

Figure 2 Data storage construction for 1695 bits part

4.2 RTCM SSR Message Types

Provided RTCM SSR message types as MADOCA Product are listed on Table 1.

Table 1　Provided RTCM SSR message as MADOCA Product

Message Type #	Message Name	Size [BITS]
1057	SSR GPS Orbit Correction	68 + 135 × NS※2
1059	SSR GPS Code Bias	67 + 11 × NS※2 + 19 × ΣNCB※3
1061	SSR GPS URA	67 + 12 × NS※2
1062	SSR GPS High Rate Clock Correction	67 + 28 × NS※2
1063	SSR GLONASS Orbit Correction	65 + 134 × NS※2
1065	SSR GLONASS Code Bias	64 + 10 × NS※2 + 19 × ΣNCB※3
1067	SSR GLONASS URA	64 + 11 × NS※2
1068	SSR GLONASS High Rate Clock Correction	64 + 27 × NS※2
1246※1	SSR QZSS Orbit Correction	66※4 + 133 × NS※2
1248※1	SSR QZSS Code Bias	65※4 + 9 × NS※2 + 19 × ΣNCB※3
1250※1	SSR QZSS URA	65※4 + 10 × NS※2
1251※1	SSR QZSS High Rate Clock Correction	65※4 + 26 × NS※2

※1　Based on RTCM Draft Edition (see applicable document (3))

※2　NS : Number of Satellites

※3　NCB : Number of Code Biases per individual Satellite

※4　The size of data field which specifies the number of satellites in QZSS RTCM SSR is allocated "4 bits". In order to meet the enacted RTCM standard, this size will be changed to "6 bits" in future.

4.3 Update Interval

The update interval of provided RTCM SSR message types as MADOCA Product is shown on Table 2.

Table 2　Message update interval

Message Type #			Contents	Update Interval [sec]
GPS	GLONASS	QZSS		
1057	1063	1246※1	Orbit Correction	30
1059	1065	1248※1	Code Bias	10800 (3 hours)
1061	1067	1250※1	URA	30
1062	1068	1251※1	High Rate Clock Correction	2

※1　Based on RTCM Draft Edition (see applicable document (3))

4.4 RTCM broadcasting sequence

The sequence of RTCM SSR message types is shown on Table 3. Each packet of L6E message is transmitted every one second, and multiple message types are stored in each packet. One cycle of sequence is consisted of 30 packets (30 seconds), and broadcasted repeatedly.

In case of no applicable correction data, no message is stored and the following messages are moved up within a packet. Any message doesn't move to different packet.

Table 3 Sequence of RTCM SSR message types

Packet #	RTCM Message Type # (maximum number of satellites)	Notes
1	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
2	1068 (6), 1057 (8), 1061 (8)	1068: Correction for 19th - 24th satellite 1057, 1061: Correction for 1st - 8th satellite
3	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
4	1068 (6), 1057 (8), 1061 (8)	1068: Correction for 19th - 24th satellite 1057, 1061: Correction for 9th - 16th satellite
5	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
6	1068 (6), 1057 (8), 1061 (8)	1068: Correction for 19th - 24th satellite 1057, 1061: Correction for 17th - 24th satellite
7	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
8	1068 (6), 1057 (8), 1061 (8)	1068: Correction for 19th - 24th satellite 1057, 1061: Correction for 25th - 32nd satellite
9	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
10	1068 (6), 1063 (8), 1067 (8)	1068: Correction for 19th - 24th satellite 1063, 1067: Correction for 1st - 8th satellite
11	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
12	1068 (6), 1063 (8), 1067 (8)	1068: Correction for 19th - 24th satellite 1063, 1067: Correction for 9th - 16th satellite
13	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite

14	1068 (6), 1063 (8), 1067 (8)	1068: Correction for 19th - 24th satellite 1063, 1067: Correction for 17th - 24th satellite
15	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
16	1068 (6), 1246 (1), 1250 (1)	1068: Correction for 19th - 24th satellite 1246, 1250: Correction for 1st satellite
17	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
18	1068 (6), 1059 (24)	1068: Correction for 19th - 24th satellite 1059: Correction for 1st - 24th satellite
19	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
20	1068 (6), 1059 (8)	1068: Correction for 19th - 24th satellite 1059: Correction for 25th - 32nd satellite
21	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
22	1068 (6), 1065 (24)	1068: Correction for 19th - 24th satellite
23	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
24	1068 (6)	1068: Correction for 19th - 24th satellite
25	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
26	1068 (6)	1068: Correction for 19th - 24th satellite
27	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
28	1068 (6)	1068: Correction for 19th - 24th satellite
29	1251 (1), 1062 (32), 1068 (18)	1068: Correction for 1st - 18th satellite
30	1068 (6)	1068: Correction for 19th - 24th satellite

4.5 Points of Consideration for Positioning

4.5.1 SSR IOD number

Orbit and clock correction of RTCM SSR format are delta value from reference ephemeris. IODE number of reference ephemeris is stored in SSR Orbit Correction message, and other SSR messages are associated by IOD number in each data. Users of MADOCA Product need to combine the messages that have the same IOD number. For details, see applicable document (2) and (3).

4.5.2 Clock Correction

In order to reduce the size of clock correction that requires high-frequency updates, RTCM10403.2 (see applicable document (2)) defines the clock correction as the sum of "Clock Correction" (MT=1058 etc.) that shows difference from reference ephemeris and "High Rate Clock Correction (HRCC)" (MT=1062 etc.) that shows difference from the original Clock Correction. Image of these messages is shown on Figure 3.

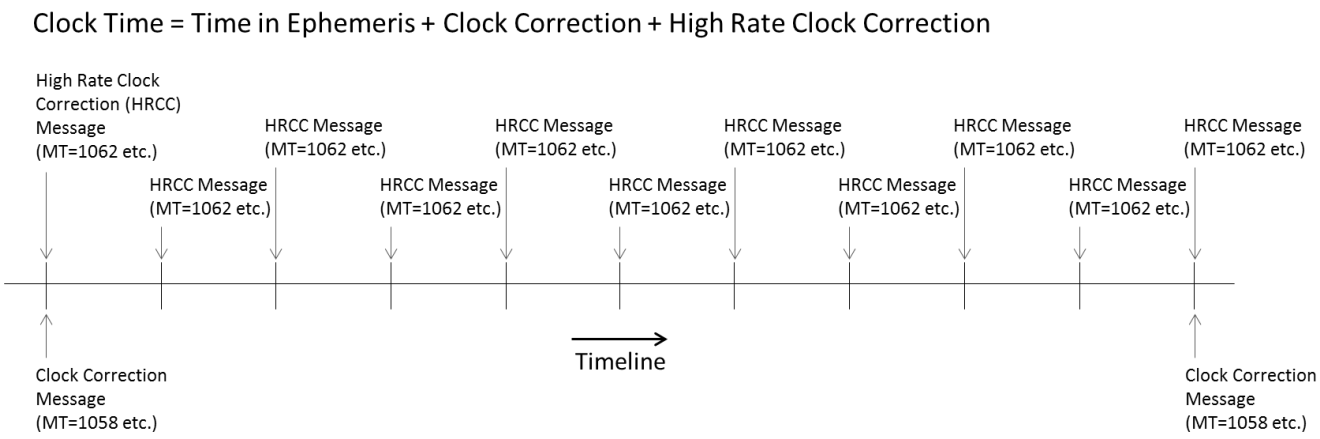

Figure 3 Image of Clock Correction and High Rate Clock Correction

On the other hand, MADOCA Product defines "HRCC" as the difference from reference ephemeris.

As described above, RTCM10403.2 defines "HRCC" as the difference from "Clock Correction", therefore, applications based on RTCM may not be able to apply HRCC of MADOCA Product due to the lack of difference information from reference ephemeris. For dealing with HRCC correctly, two example approaches are shown below.

Approach 1:

Based on "HRCC" of MADOCA Product, "Clock Correction" or "Combined Orbit and Clock Corrections" can be generated on the user's side. Figure 4 shows the dealing example of this approach in case of GPS.

1. Generate the header of "Clock Correction" message by diverting that of "HRCC". Since both header constructions are the same, it can be generated easily.
2. Copy the correction value (DF=390) in "HRCC" to δC0 (DF=376) in "Clock Correction" message.
3. Set zero as δC1 (DF=377) and δC2 (DF=378) in "Clock Correction" message.

* "DF" means "Data Field" of RTCM10403.2

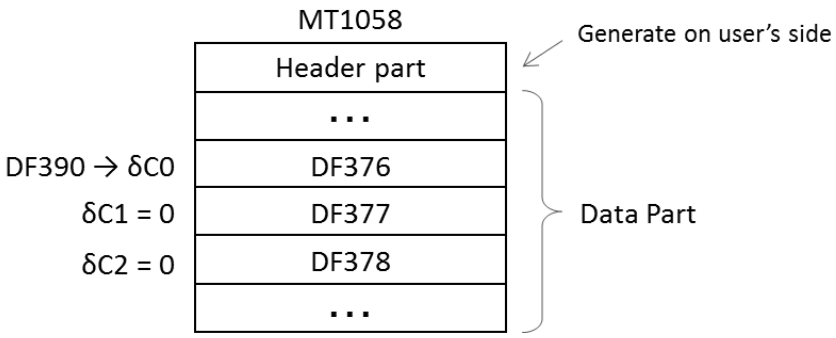

Figure 4 Approach 1, in case of GPS

Approach 2:

Generate dummy message of "Clock Correction". Figure 5 shows the dealing example of this approach in case of GPS.

1. Generate the header of "Clock Correction" message by diverting that of "HRCC". Since both header constructions are the same, it can be generated easily.
2. Set all zero as δC0 (DF=376), δC1 (DF=377), and δC2 (DF=378) so that dummy "Clock Correction" message is generated.

* "DF" means "Data Field" of RTCM10403.2

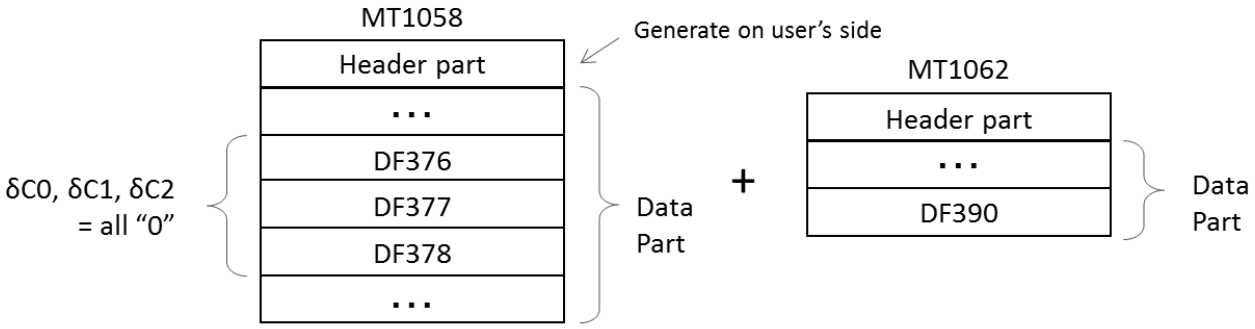

Figure 5 Approach 2, in case of GPS

5. Message Format

5.1 Orbit Correction

Below table shows the contents of Orbit Correction message for GPS, QZSS, and GLONASS. This definition is based on RTCM10403.2 (applicable document (2) and (3)). "DF" in Notes column means the Data Field of corresponding RTCM10403.2 definition.

(1) GPS Orbit Correction

Contents of SSR GPS Orbit Correction is shown on Table 4.

Table 4　SSR GPS Orbit Correction (Message Type: 1057)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1057)	DF002
2	GPS Epoch Time 1s	uint20	20	0 - 604799 [s]	GPS Reference Time (Time of GPS Week)	DF385
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 5) = 30 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	Satellite Reference Datum	bit(1)	1	0 or 1	Satellite Reference Datum 0- ITRF　1- Regional	DF375
6	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
7	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
8	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
9	No. of Satellites	uint6	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #9)		68			
#10 - #17 are repeated for the number of Satellites (NS)						
10	GPS Satellite ID	uint6	6	1 - 32	GPS Satellite ID	DF068
11	GPS IODE	uint8	8	0 - 255	IODE Number of reference ephemeris	DF071
12	Delta Radial	int22	22	±209.7151 [m]	Radial orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.1 [mm] DF365

13	Delta Along Track	int20	20	±209.7148 [m]	Along-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.4 [mm] DF366
14	Delta Cross-Track	int20	20	±209.7148 [m]	Cross-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.4 [mm] DF367
15	Dot Delta Radial	int21	21	±1.048575 [m/s]	Velocity of Radial orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.001 [mm/s] DF368
16	Dot Delta Along-Track	int19	19	±1.048572 [m/s]	Velocity of Along-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.004 [mm/s] DF369
17	Dot Delta Cross-Track	int19	19	±1.048572 [m/s]	Velocity of Cross-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.004 [mm/s] DF370
	Subtotal (#10 - #17)	135				
	Total	68 + 135 × NS				

(2) QZSS Orbit Correction

Contents of SSR QZSS Orbit Correction is shown on Table 5.

Table 5 SSR QZSS Orbit Correction (Message Type: 1246)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1246)	DF002
2	QZSS Epoch Time 1s	uint20	20	0 - 604799 [s]	QZSS Reference Time (Time of QZSS Week)	DF460※1
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 5) = 30 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	Satellite Reference Datum	bit(1)	1	0 or 1	Satellite Reference Datum 0- ITRF 1- Regional	DF375
6	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
7	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
8	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
9	No. of Satellites	uint4	4	0 - 15	Number of Corrected Satellites	No definition
	Subtotal (#1 - #9)		66			
#10 - #17 are repeated for the number of Satellites (NS)						
10	QZSS Satellite ID	uint4	4	1 - 10	QZSS Satellite ID※2	DF429
11	QZSS IODE	uint8	8	0 - 255	IODE Number of reference ephemeris	DF071
12	Delta Radial	int22	22	±209.7151 [m]	Radial orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.1 [mm] DF365
13	Delta Along Track	int20	20	±209.7148 [m]	Along-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution 0.4 [mm] DF366
14	Delta Cross-Track	int20	20	±209.7148 [m]	Cross-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.4 [mm] DF367

15	Dot Delta Radial	int21	21	±1.048575 [m/s]	Velocity of Radial orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.001 [mm/s] DF368
16	Dot Delta Along-Track	int19	19	±1.048572 [m/s]	Velocity of Along-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.004 [mm/s] DF369
17	Dot Delta Cross-Track	int19	19	±1.048572 [m/s]	Velocity of Cross-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.004 [mm/s] DF370
	Subtotal (#10 - #17)	133				
	Total	66 + 133 × NS				

※1 Based on RTCM Draft Edition (see applicable document (3))

※2 QZSS Satellite ID is defined as below table.

QZSS Satellite ID

ID	QZSS Satellite PRN
1	193
2	194
3	195
4	196
5	197
6	198
7	199
8	200
9	201
10	202

(3) GLONASS Orbit Correction

Contents of SSR GLONASS Orbit Correction is shown on Table 6.

Table 6 SSR GLONASS Orbit Correction (Message Type: 1063)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1063)	DF002
2	GLONASS Epoch Time 1s	uint17	17	0 - 86399 [s]	GLONASS Reference Time (Time of GLONASS day)	DF386
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 5) = 30 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	Satellite Reference Datum	bit(1)	1	0 or 1	Satellite Reference Datum 0- ITRF 1- Regional	DF375
6	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
7	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
8	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
9	No. of Satellites	uint6	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #9)		65			
#10 - #17 are repeated for the number of Satellites (NS)						
10	GLONASS Satellite ID	uint5	5	1 - 24	GLONASS Satellite ID	DF384
11	GLONASS IOD	uint8	8	0 - 255	IODE Number of reference ephemeris	DF392
12	Delta Radial	int22	22	±209.7151 [m]	Radial orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.1 [mm] DF365
13	Delta Along Track	int20	20	±209.7148 [m]	Along-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.4 [mm] DF366
14	Delta Cross-Track	int20	20	±209.7148 [m]	Cross-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.4 [mm] DF367

15	Dot Delta Radial	int21	21	±1.048575 [m/s]	Velocity of Radial orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.001 [mm/s] DF368
16	Dot Delta Along-Track	int19	19	±1.048572 [m/s]	Velocity of Along-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.004 [mm/s] DF369
17	Dot Delta Cross-Track	int19	19	±1.048572 [m/s]	Velocity of Cross-Track orbit correction for reference ephemeris with IODE specified by #11	Resolution: 0.004 [mm/s] DF370
	Subtotal (#10 - #17)	134				
	Total	65 + 134 × NS				

5.2 Code Bias

Below table shows the contents of Code Bias message for GPS, QZSS, and GLONASS. This definition is based on RTCM10403.2 (applicable document (2) and (3)). "DF" in Notes column means the Data Field of corresponding RTCM10403.2 definition.

(1) GPS Code Bias

Contents of SSR GPS Code Bias Correction is shown on Table 7.

Table 7 SSR GPS Code Bias Correction (Message Type: 1059)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1059)	DF002
2	GPS Epoch Time 1s	uint20	20	0 - 604799 [s]	GPS Reference Time (Time of GPS Week)	DF385
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 15) = 3 hours	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint6	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #8)		67			
#9 - #12 are repeated for the number of Satellites (NS)						
9	GPS Satellite ID	uint6	6	1 - 32	GPS Satellite ID	DF068
10	No. of Code Biases Processed	uint5	5	0 - 31	Number of processed Code Biases for GPS Satellite ID specified by #9	DF379
	Subtotal (#9 - #10)		11			
	#11 and #12 are repeated for the number of Code Biases Processed (NCB) specified by #10					
11	GPS Signal and Tracking Mode Indicator	uint5	5	0 - 31	Indicator to specify the GPS signal and tracking mode.	DF380

12	Code Bias	int14	14	±81.91 [m]	Code Bias for signal specified by #11	Resolution: 0.01 [m] DF383
	Subtotal (#11 - #12)	19				
	Total	67 + 11 × NS + 19 × ΣNCB				

(2) QZSS Code Bias

Contents of SSR QZSS Code Bias Correction is shown on Table 8.

Table 8 SSR QZSS Code Bias Correction (Message Type: 1248)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1248)	DF002
2	QZSS Epoch Time 1s	uint20	20	0 - 604799 [s]	QZSS Reference Time (Time of QZSS Week)	DF460※1
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 15) = 3 hours	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint4	4	0 - 15	Number of Corrected Satellites	No Definition
	Subtotal (#1 - #8)		65			
#9 - #12 are repeated for the number of Satellites (NS)						
9	QZSS Satellite ID	uint4	4	1 - 10	QZSS Satellite ID※2	DF429
10	No. of Code Biases Processed	uint5	5	0 - 31	Number of processed Code Biases for QZSS Satellite ID specified by #9	DF379
	Subtotal (#9 - #10)		9			
	#11 and #12 are repeated for the number of Code Biases Processed (NCB) specified by #10					
11	QZSS Signal and Tracking Mode Indicator	uint5	5	0 - 31	Indicator to specify the QZSS signal and tracking mode.※3	DF461※1
12	Code Bias	int14	14	±81.91 [m]	Code Bias for signal specified by #11	Resolution: 0.01 [m] DF383
	Subtotal (#11 - #12)		19			
	Total	65 + 9 × NS + 19 × ΣNCB				

※1　Based on RTCM Draft Edition (see applicable document (3))

※2　QZSS Satellite ID is defined at the comment under Table 5.

※3　QZSS signal and tracking mode is defined as below table.

QZSS Signal and Tracking mode

ID	QZSS Signal and Tracking mode
0	L1 C/A
1	L1 L1C (D)
2	L1 L1C (P)
3	L2 L2C (M)
4	L2 L2C (L)
5	L2 L2C (M+L)
6	L5 I
7	L5 Q
8	L5 I+Q
9～	Reserved

(3) GLONASS Code Bias

Contents of SSR GLONASS Code Bias Correction is shown on Table 9.

Table 9 SSR GLONASS Code Bias Correction (Message Type: 1065)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1065)	DF002
2	GLONASS Epoch Time 1s	uint17	17	0 - 86399 [s]	GLONASS Reference Time (Time of GLONASS day)	DF386
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 15) = 3 hours	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint4	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #8)	64				
#9 - #12 are repeated for the number of Satellites (NS)						
9	GLONASS Satellite ID	uint5	5	1 - 24	GLONASS Satellite ID	DF384
10	No. of Code Biases Processed	uint5	5	0 - 31	Number of processed Code Biases for GLONASS Satellite ID specified by #9	DF379
	Subtotal (#9 - #10)	10				
	#11 and #12 are repeated for the number of Code Biases Processed (NCB) specified by #10					
11	GLONASS Signal and Tracking Mode Indicator	uint5	5	0 - 31	Indicator to specify the GLONASS signal and tracking mode.	DF381
12	Code Bias	int14	14	±81.91 [m]	Code Bias for signal specified by #11	Resolution: 0.01 [m] DF383
	Subtotal (#11 - #12)	19				
	Total	64 + 10 × NS + 19 × ΣNCB				

5.3 URA

Below table shows the contents of URA message for GPS, QZSS, and GLONASS. This definition is based on RTCM10403.2 (applicable document (2) and (3)). "DF" in Notes column means the Data Field of corresponding RTCM10403.2 definition.

(1) GPS URA

Contents of SSR GPS URA is shown on Table 10.

Table 10 SSR GPS URA (Message Type: 1061)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1061)	DF002
2	GPS Epoch Time 1s	uint20	20	0 - 604799 [s]	GPS Reference Time (Time of GPS Week)	DF385
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 5) = 30 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint6	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #8)	67				
#9 - #10 are repeated for the number of Satellites (NS)						
9	GPS Satellite ID	uint6	6	1 - 32	GPS Satellite ID	DF068
10	SSR URA	bit(6)	6	bits5-3: 0 - 7 bits2-0: 0 - 7	SSR User Range Accuracy (1 sigma) represented by a combination of URA_CLASS (bit5-3) and URA_VALUE (bit2-0)	DF389
	Subtotal (#9 - #10)	12				
	Total	67 + 12 × NS				

(2) QZSS URA

Contents of SSR QZSS URA is shown on Table 11.

Table 11 SSR QZSS URA (Message Type: 1250)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1250)	DF002
2	QZSS Epoch Time 1s	uint20	20	0 - 604799 [s]	QZSS Reference Time (Time of QZSS Week)	DF460※1
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 5) = 30 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint4	4	0 - 15	Number of Corrected Satellites	No Definition
	Subtotal (#1 - #8)	67				
#9 - #10 are repeated for the number of Satellites (NS)						
9	QZSS Satellite ID	uint4	4	1 - 10	QZSS Satellite ID※2	DF429
10	SSR URA	bit(6)	6	bits5-3: 0 - 7 bits2-0: 0 - 7	SSR User Range Accuracy (1 sigma) represented by a combination of URA_CLASS (bit5-3) and URA_VALUE (bit2-0)	DF389
	Subtotal (#9 - #10)	10				
	Total	65 + 10 × NS				

※1 Based on RTCM Draft Edition (see applicable document (3))

※2 QZSS Satellite ID is defined at the comment under Table 5.

(3) GLONASS URA

Contents of SSR GLONASS URA is shown on Table 12.

Table 12 SSR GLONASS URA (Message Type: 1067)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1067)	DF002
2	GLONASS Epoch Time 1s	uint17	17	0 - 86399 [s]	GLONASS Reference Time (Time of GLONASS day)	DF386
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 5) = 30 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint6	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #8)		64			
#9 - #10 are repeated for the number of Satellites (NS)						
9	GLONASS Satellite ID	uint5	5	1 - 24	GLONASS Satellite ID	DF384
10	SSR URA	bit(6)	6	bits5-3: 0 - 7 bits2-0: 0 - 7	SSR User Range Accuracy (1 sigma) represented by a combination of URA_CLASS (bit5-3) and URA_VALUE (bit2-0)	DF389
	Subtotal (#9 - #10)		11			
	Total	64 + 11 × NS				

5.4 High Rate Clock Correction

Below table shows the contents of URA message for GPS, QZSS, and GLONASS. For the purpose of downsizing, not all definitions meet RTCM10403.2 (see applicable document (2) (3)). See Section 4.5.2 for the difference between MADOCA Product and RTCM10403.2. "DF" in Notes column means the Data Field of corresponding RTCM10403.2 definition.

(1) GPS High Rate Clock Correction

Contents of SSR GPS High Rate Clock Correction is shown on Table 13.

Table 13 SSR GPS High Rate Clock Correction (Message Type: 1062)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1062)	DF002
2	GPS Epoch Time 1s	uint20	20	0 - 604799 [s]	GPS Reference Time (Time of GPS week)	DF385
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 1) = 2 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint6	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #8)	67				
#9 - #10 are repeated for the number of Satellites (NS)						
9	GPS Satellite ID	uint6	6	1 - 32	GPS Satellite ID	DF068
10	High Rate Clock Correction	int22	22	±209.7151 [m]	Clock Correction for reference ephemeris with the same IOD specified by #5.	DF390
	Subtotal (#9 - #10)	28				
	Total	67 + 28 × NS				

(2) QZSS High Rate Clock Correction

Contents of SSR QZSS High Rate Clock Correction is shown on Table 14.

Table 14 SSR QZSS High Rate Clock Correction (Message Type: 1251)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1251)	DF002
2	QZSS Epoch Time 1s	uint20	20	0 - 604799 [s]	QZSS Reference Time (Time of QZSS week)	DF460※1
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 1) = 2 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint4	4	0 - 15	Number of Corrected Satellites	No Definition
	Subtotal (#1 - #8)	65				
#9 - #10 are repeated for the number of Satellites (NS)						
9	QZSS Satellite ID	uint4	4	1 - 10	QZSS Satellite ID※2	DF429
10	High Rate Clock Correction	int22	22	±209.7151 [m]	Clock Correction for reference ephemeris with the same IOD specified by #5.	DF390
	Subtotal (#9 - #10)	26				
	Total	65 + 26 × NS				

※1 Based on RTCM Draft Edition (see applicable document (3))

※2 QZSS Satellite ID is defined at the comment under Table 5.

(3) GLONASS High Rate Clock Correction

Contents of SSR QZSS High Rate Clock Correction is shown on Table 15.

Table 15 SSR GLONASS High Rate Clock Correction (Message Type: 1068)

#	Data Field Name	Data Type	Size [bits]	Range	Data Field Notes	Notes
1	Message Number	uint12	12	0 - 4095	RTCM Message Type Number (Value: 1068)	DF002
2	GLONASS Epoch Time 1s	uint17	17	0 - 86399 [s]	GLONASS Reference Time (Time of GLONASS day)	DF386
3	SSR Update Interval	bit(4)	4	0 - 15	Update Interval of this data (Value: 1) = 2 seconds	DF391
4	Multiple Message Indicator	bit(1)	1	0 or 1	Indicator for transmitting messages with the same Message Number and Epoch Time (1- multiple message transmitted)	DF388
5	IOD SSR	uint4	4	0 - 15	Associating number with messages using the same reference	DF413
6	SSR Provider ID	uint16	16	0 - 65535	SSR Provider Number	DF414
7	SSR Solution ID	uint4	4	0 - 15	SSR Service Number	DF415
8	No. of Satellites	uint6	6	0 - 63	Number of Corrected Satellites	DF387
	Subtotal (#1 - #8)		64			
#9 - #10 are repeated for the number of Satellites (NS)						
9	GLONASS Satellite ID	uint5	5	1 - 24	GLONASS Satellite ID	DF384
10	High Rate Clock Correction	int22	22	±209.7151 [m]	Clock Correction for reference ephemeris with the same IOD specified by #5.	DF390
	Subtotal (#9 - #10)		27			
	Total	64 + 27 × NS				