QZSS Early Warning System (EWS)

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The Worst Tsunami Disaster

The earthquake hit at just before 1am GMT on 26th December 2004. The magnitude 9.1 earthquake struck 30km below the surface around 160km off the western coast of northern Sumatra near Banda Aceh.

- Loss of over 230,000 lives
- The displacement of over 1.6 million people around the Indian Ocean
- Environmental Damage
- Psychological trauma
- estimated economic losses of $14 billion.

Source: BMKG

https://www.thailanddiscovery.info/thailand-boxing-day-tsunami-rememberance/

2011 Great East Japan Earthquake (311)

References from Japan Meteorological Agency (JMA)

https://www.data.jma.go.jp/svd/eqev/data/en/tsunami/LessonsLearned_Improvements_brochure.pdf

3/11 - The Tsunami: The First 3 Days | NHK WORLD-JAPAN On Demand
https://www3.nhk.or.jp/nhkworld/en/ondemand/video/3016087/

https://www.ibtimes.co.uk/2011-earthquake-tsunami-60-powerful-photos-disaster-that-hit-japan-five-years-ago-1548255

https://www3.nhk.or.jp/nhkworld/en/ondemand/video/2090024/

Problems of Early Warning System

- Difficulty in reaching the people at risk or reaching to the “the Last Mile”
  - How to send alerts to people in the risk zones?
- Shutdown of power and communication systems due to Earthquake, Tsunami etc.
  - Alerts can’t be sent effectively
    - Mobile phones, SMS, Internet, and Social Media may not work
  - Even if a mobile phone is working, due to bandwidth congestion, communications may not be established on time
    - Delayed arrival of alert message
- How to deliver the Warning Message to Millions of people in the affected area?

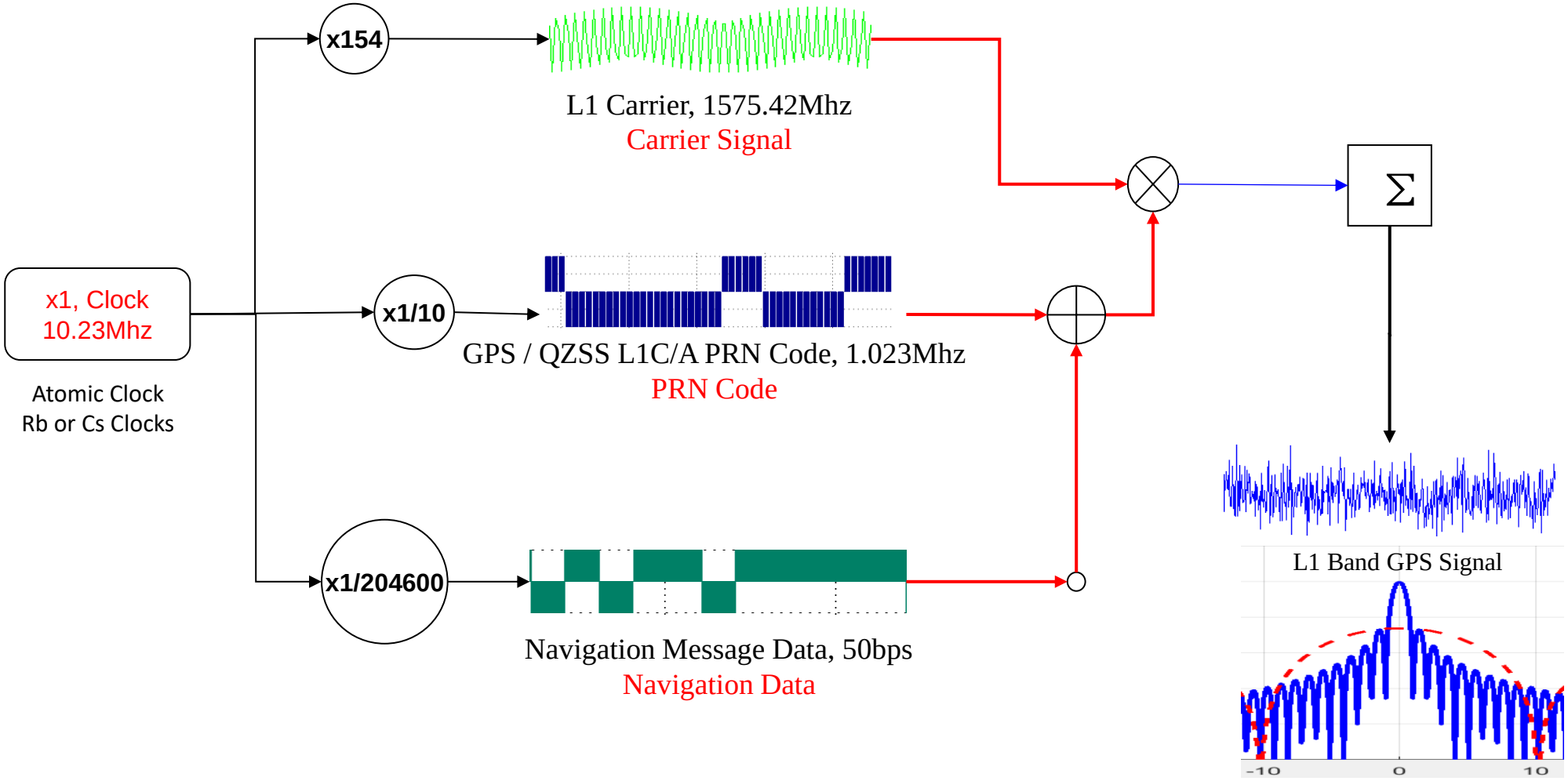
Why Satellite-based Message Broadcasting Useful?

- It can reach people in the affected area at the same time
- System can be designed to send messages to people only in the affected area
  - Geo-Boundary, Geo-Fence, Location Based Services
- No bandwidth limitation
  - Only one-way message from satellite to receiver, like radio
- During huge disasters like tsunamis and earthquakes, mobile phones may not work, power failure and damage to infrastructures are very likely
  - Telecom based systems like phone, internet, SMS, and SNS may not work
  - But, this will not affect satellite-based systems as long as the user device has power
    - It works even if a mobile phone does not work due to bandwidth congestion or power failure to the cell base-station.

How can it be implemented?

- Warning Message Generation
  - Format the current warning message to fit into the EWS message format
  - Standards are now being developed
  - Protocols will be defined
    - Such as CAP (Common Alerting Protocol)
  - Send the message to QZSS control system in Japan for broadcasting
- Warning Message Reception
  - It requires a GPS/QZSS receiver that is capable of receiving QZSS EWS message
    - At present few mobile phone devices has this capability
      - In the next few years, many mobile phones will be capable of receiving EWS message
    - GPS/QZSS receivers are getting cheaper
      - Low-cost devices are just a few tens of dollars
  - Requires Software applications to be developed
    - HW device makers are publishing SDKs to get EWS
- Use of Common Alerting Protocol (CAP)
  - Base system shall be maintained

GPS/QZSS L1C/A Signal Structure (Satellite Side)



SBAS / L1S Navigation Message Format

- SBAS and QZSS L1S signal structures are similar to GPS/QZSS L1C/A signal structure
- Only the Navigation Message Rate is different
  - GPS and QZSS L1C/A Signal Navigation Message Rate is 50bps
  - SBAS and QZSS L1S Signal Navigation Message rate is 250bps

Preamble 8 bits	Message Type 6 bits	SBAS Message 212 bits	CRC 24 bits

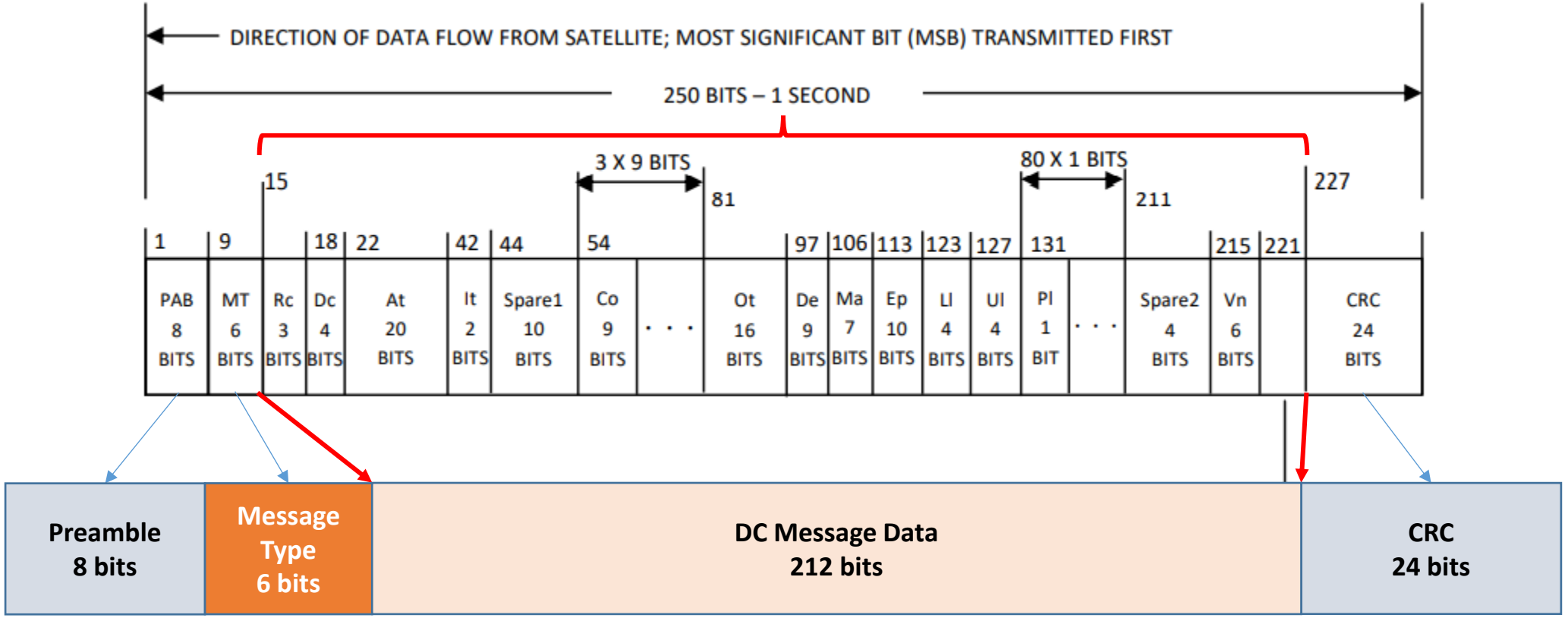
Preamble 8 bits	Message Type 6 bits	L1S Message (For Sub-meter Accuracy) 212 bits	CRC 24 bits

Preamble 8 bits	Message Type 6 bits	DC Report (Japan) EWSS Message based on CAMF (Outside Japan) 212 bits	CRC 24 bits

Data Rate : 250bps
Symbol Rate : 500sps (1/2 rate FEC)

EWSS Message: Early Warning Satellite System
CAMF: Common Alert Message Format
DC Report: Disaster Crisis Report, QZSS uses the term DC Report instead of EWS.

DC Message Format



https://qzss.go.jp/en/technical/ps-is-qzss/is_qzss_dcr_008_agree.html

https://qzss.go.jp/en/technical/ps-is-qzss/ps-is-qzss.html

Can be transmitted once every 3 seconds without impact on the L1S accuracy performance.

Earthquake Early Warning Message Format

Table 4.1.2-5 Parameter Definitions (Earthquake Early Warning) (1/2)

Parameter	Description	Effective Range	Number of Bits	LSB	Units
-	PAB and MT See Section 4.1.2.2.	-	-	-	-
Rc	Report Classification 1: Maximum priority 7: Training/Test	1,7	3	-	-
Dc	Disaster Category 1: 防災気象情報(緊急地震速報)	1	4	1	-
At AtMo	Report Time The UTC time when JMA issued the information.	1-12	4	1	month
At AtD		1-31	5	1	day
At AtH		0-23	5	1	hour
At AtMi		0-59	6	1	minute
It	Information Type 0: Issue: 発表 2: Cancellation: 取消	0, 2	2	-	-
Spare1	Spare1 Fix to "0" for spare.	-	10	-	-
Co_1	Notification on Disaster Prevention (Information 1) See Table 4.1.2-6.	0, 101-500	9	1	-
:					
Co_3	Notification on Disaster Prevention (Information 3) See.Table 4.1.2-6.	0, 101-500	9	1	-
Ot D_1	Occurrence Time of Earthquake The UTC time when the earthquake occurred.	1-31	5	1	day
Ot H_1		0-23	5	1	hour
Ot M_1		0-59	6	1	minute
De	Depth of Seismic Epicenter The depth kilometers of hypocenter. It is "501" if the depth is more than 500 km, and "511" if the depth is unknown. It is "10" if Ma is "10".	0-501, 511	9	1	km
Ma	Magnitude 0.1 unit of the magnitude. It is "101" if the magnitude is more than 10.0, and "127" if the magnitude is unknown. It is "10" if JMA issue Earthquake Early Warning by assumptive hypocenter.	1-101, 127	7	0.1	-
Ep	Seismic Epicenter See Table 4.1.2-7.	11-1000	10	-	-

Table 4.1.2-5 Parameter Definitions (Earthquake Early Warning) (2/2)

Parameter	Description	Effective Range	Number of Bits	LSB	Units
Ll	Seismic Intensity Lower Limit See Table 4.1.2-8.	1-15	4	-	-
Ul	Seismic Intensity Upper Limit See Table 4.1.2-9.	1-15	4	-	-
Pl_1	Forecast Region_Earthquake Early Warning (Region 1) See Table 4.1.2-10.	0-1	1	-	-
:					
Pl_80	Forecast Region_Earthquake Early Warning (Region 80) See Table 4.1.2-10.	0-1	1	-	-
Spare2	Spare2 Fix to "0" for spare.	-	4	-	-
Vn	Version Number "1" The version number of JMA-DC Report, which is used to judge whether JMA-DC Report can be used or not. JMA-DC Report can be used only if the receiver supports the version showed in this section. JMA-DC Report shall be transmitted in upward compatible. Set a transitional period if upward compatibility is not available.	0-63	6	1	-
Reserved	Reserved	-	6	1	-
-	CRC See Section 4.1.1.3.	-	-	-	-
Display example	防災気象情報(緊急地震速報) 緊急地震速報 Co 発表時刻：AtMo 月 AtD 日 AtH 時 AtMi 分 震央地名：Ep 地震発生時刻：D_1 日 H_1 時 M_1 分 深さ(km)：De マグニチュード：Ma 震度(下限)：Ll 震度(上限)：Ul Pl				

EWSS Related Documents

Quasi-Zenith Satellite System

Interface Specification

DC Report Service

(IS-QZSS-DCR-013)

(May 30, 2024)

Cabinet Office

IS-QZSS-DCX-002

Quasi-Zenith Satellite System

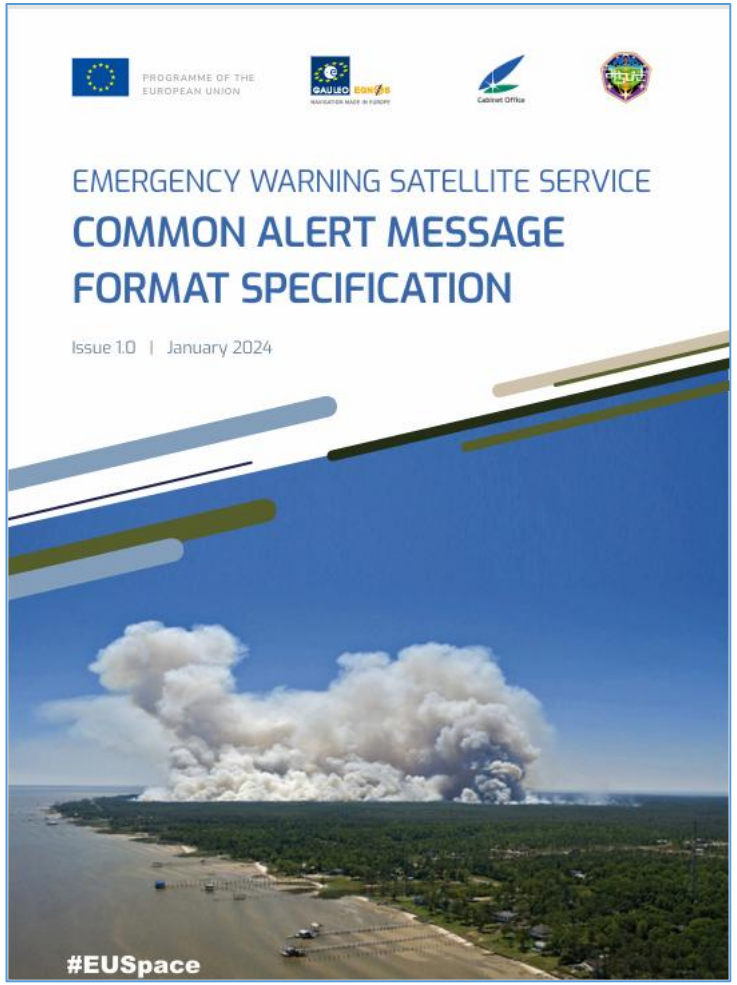
Interface Specification

DCX Service

(IS-QZSS-DCX-002)

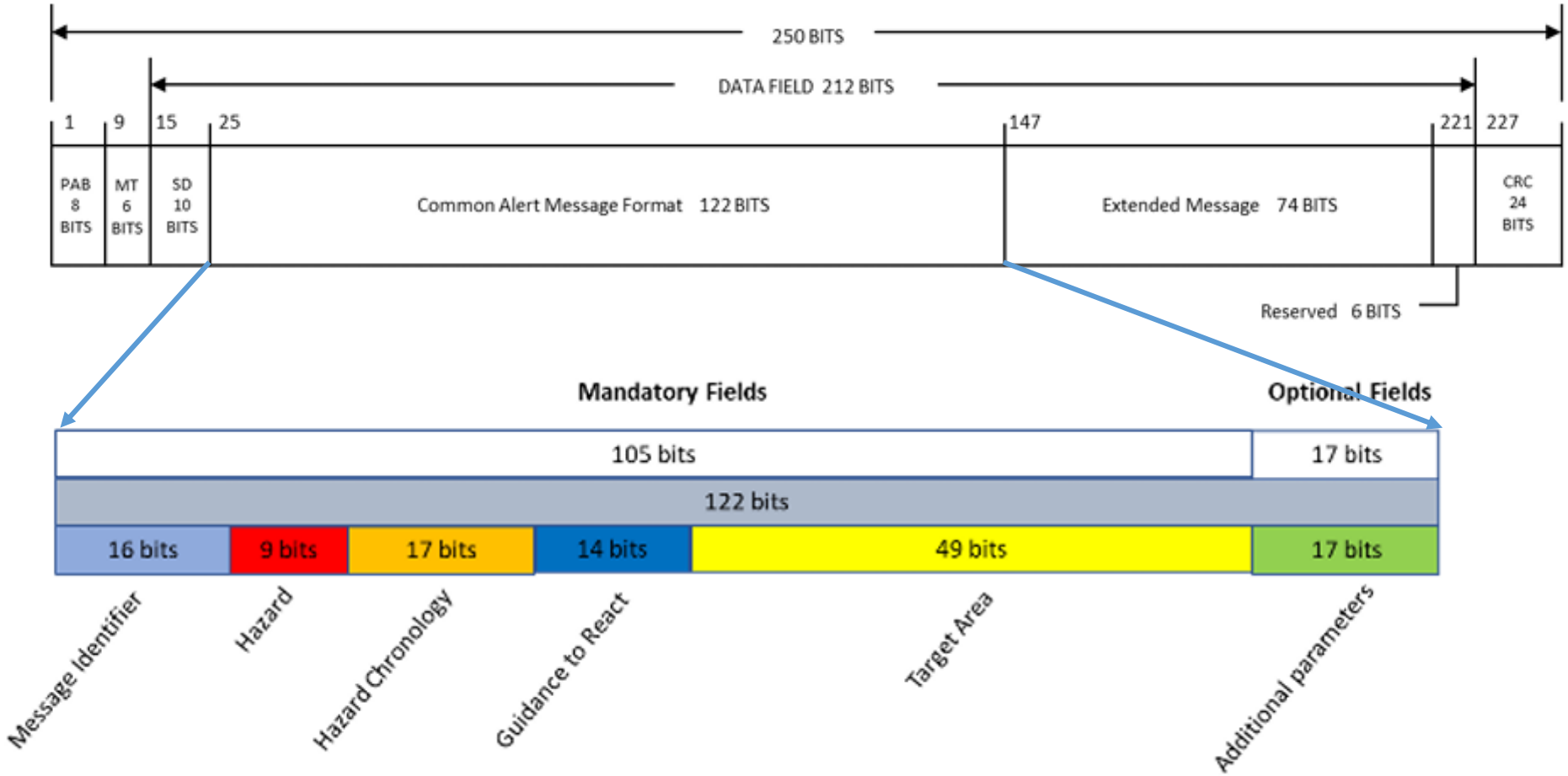
October, 2024

Cabinet Office

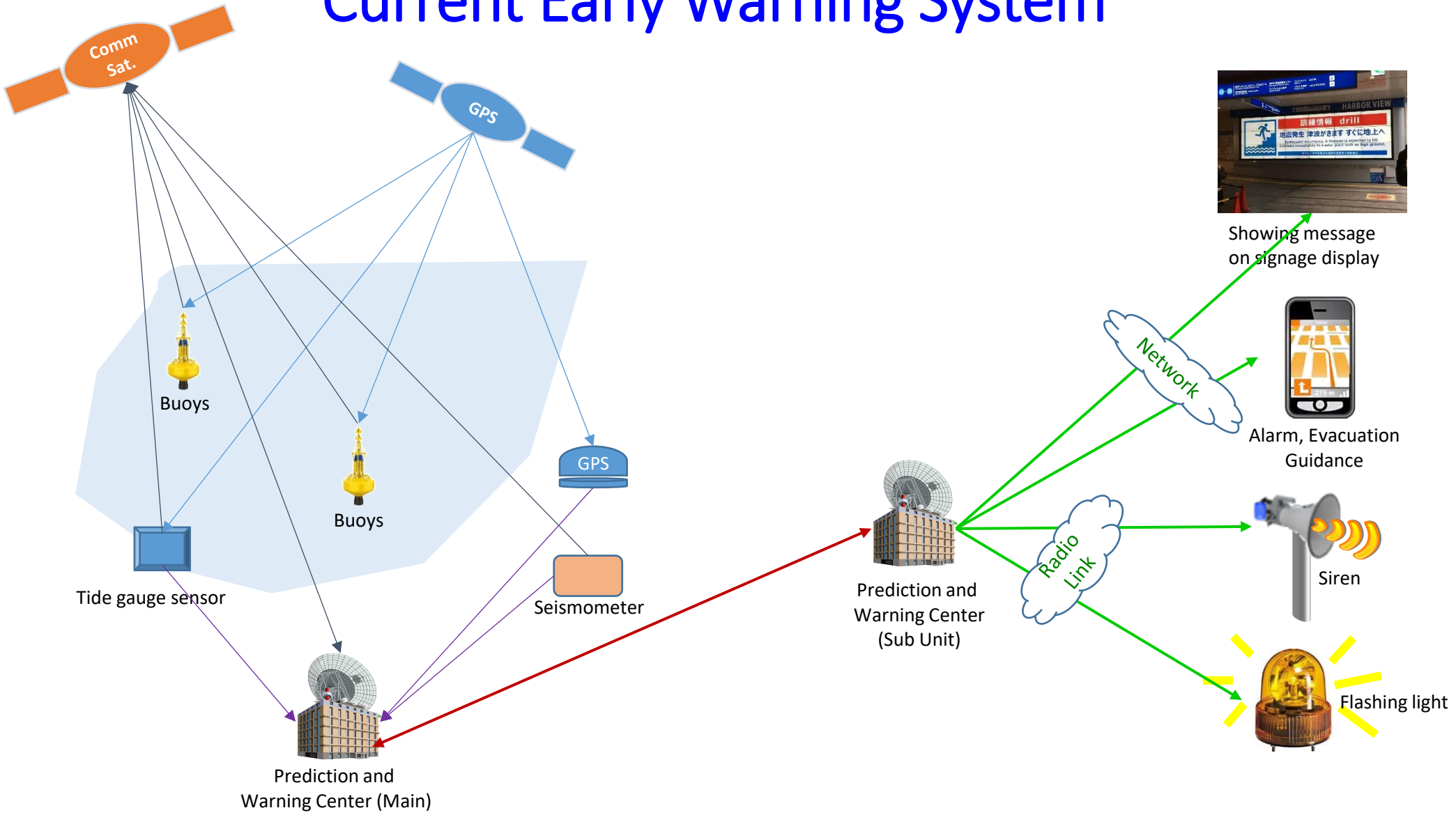


QZSS DCX and CAMF

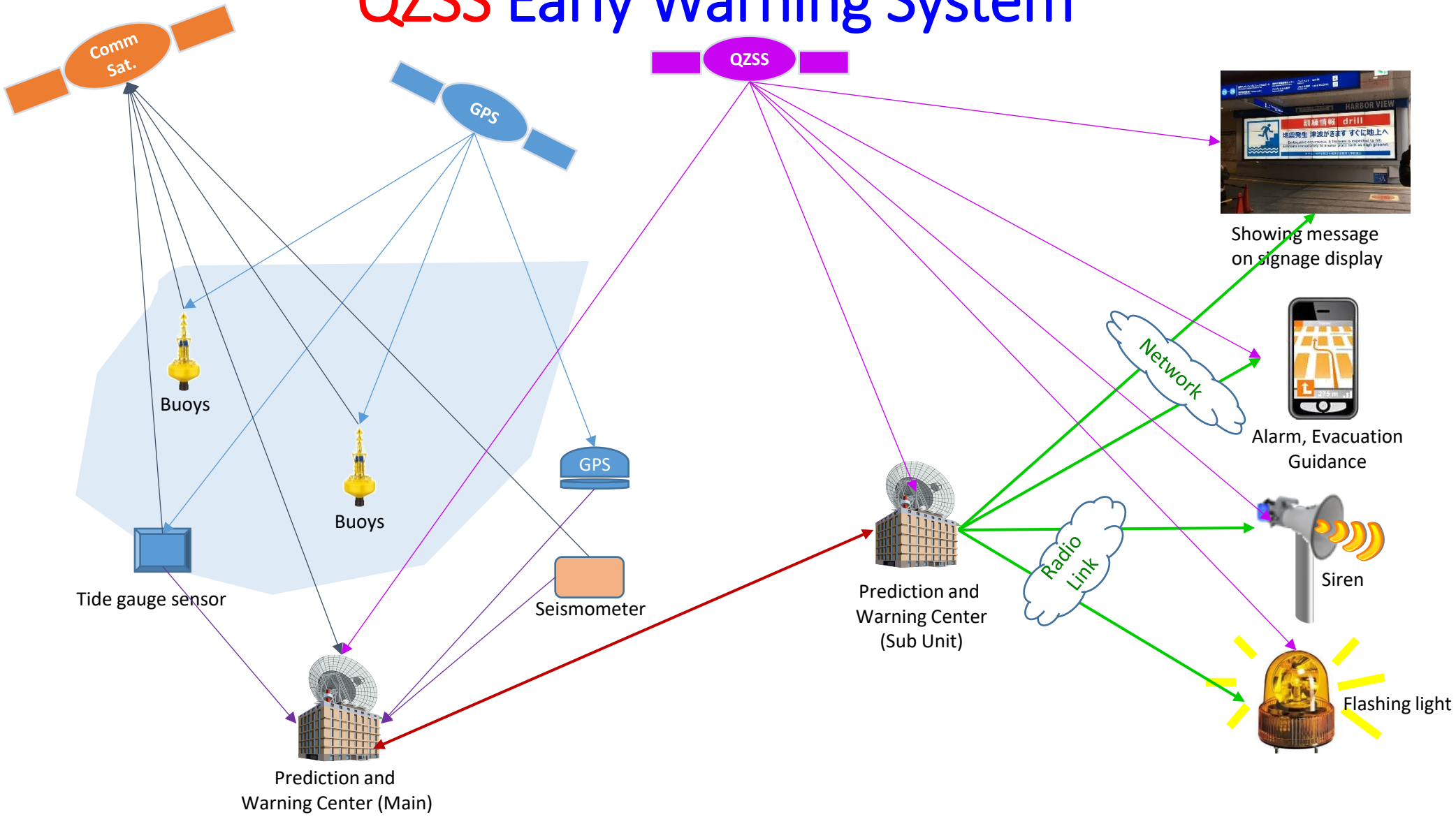
In the format of MT44, the 10-bit Satellite Designation (SD), 122-bit Common Alert Message Format (CAMF), and 74-bit Extended Message fields follow the MT field.



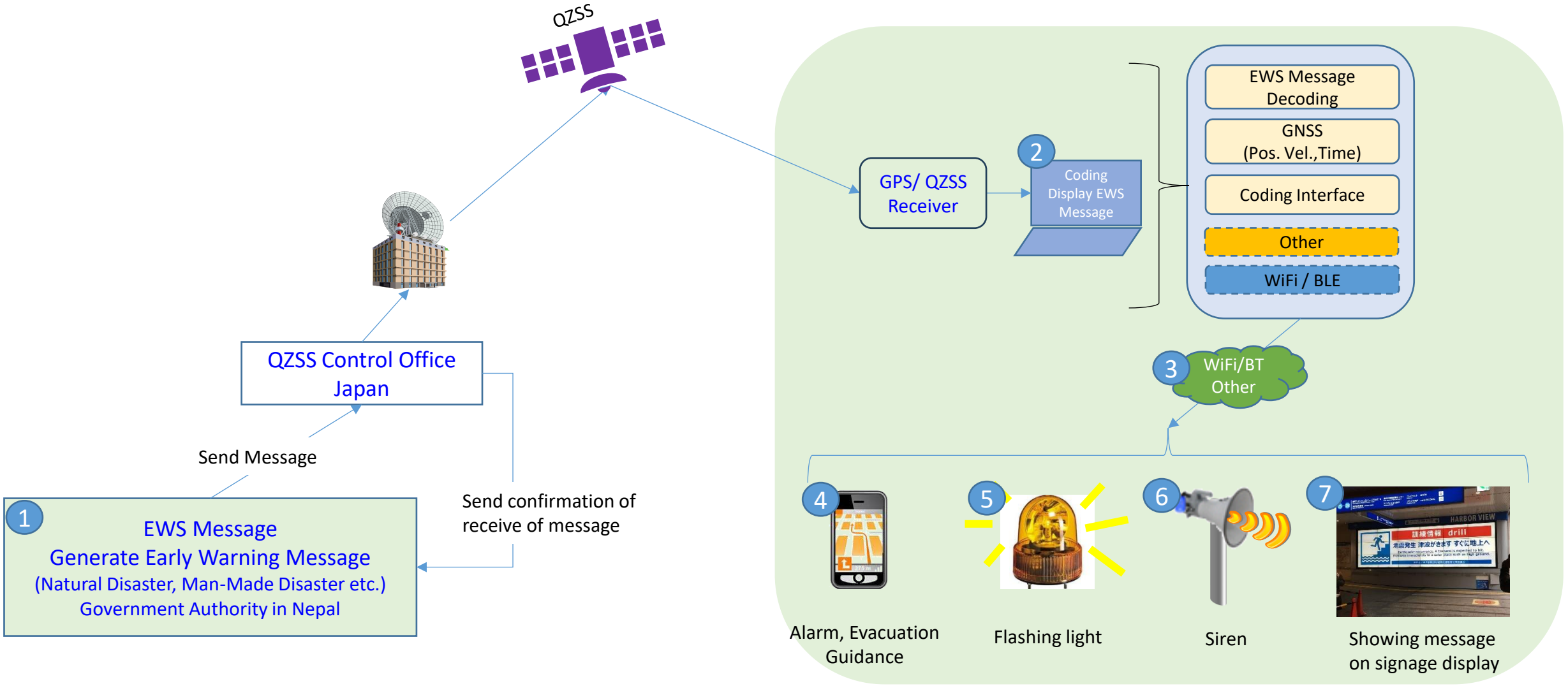
Current Early Warning System



QZSS Early Warning System



QZSS EWSS Demo: System Architecture



DC Report message output from a receiver

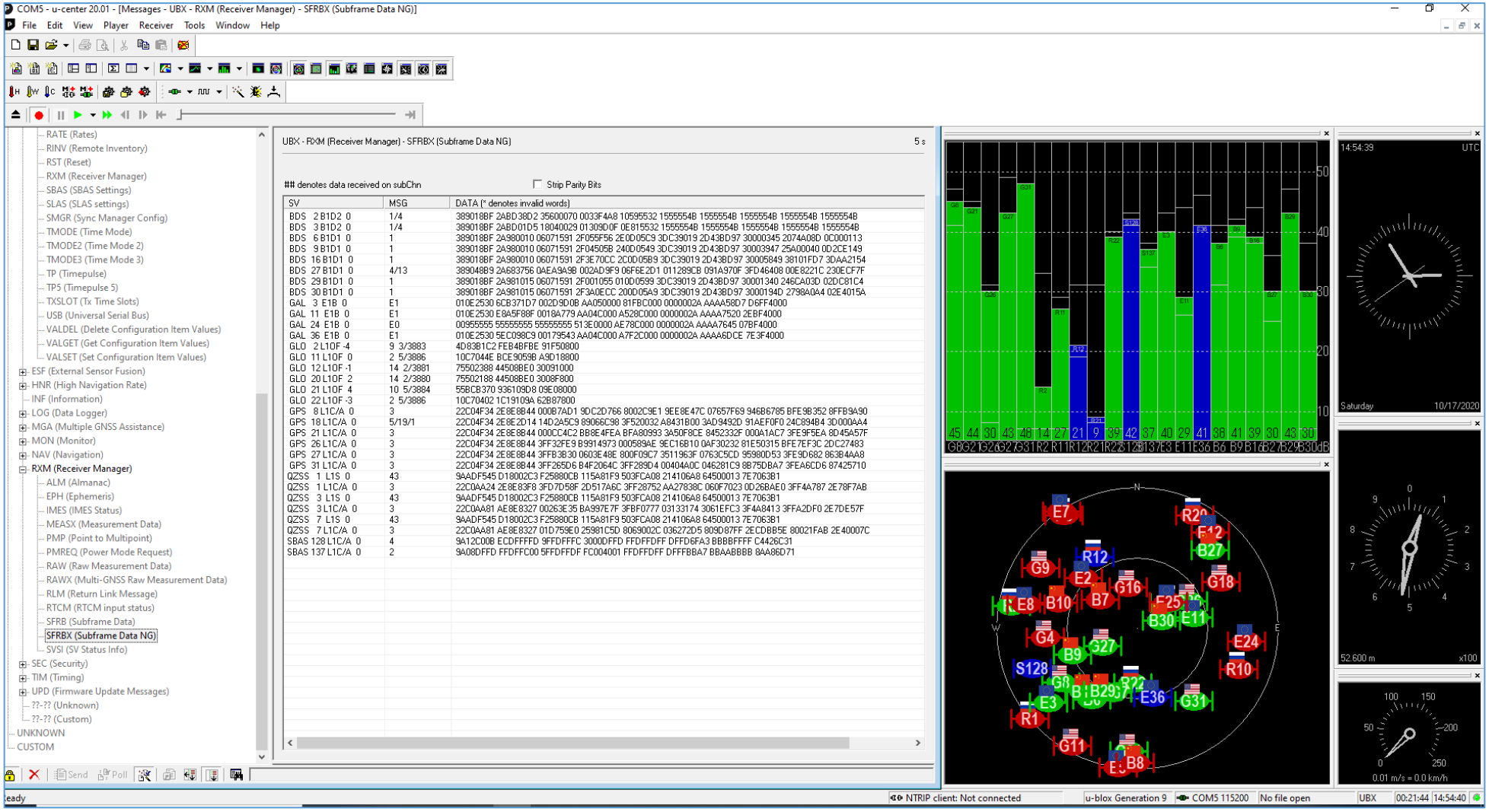
- DC (Disaster Crisis) Report Message Format
  - QZSS uses the term “DC” instead of EWS.
  - All output data shall be interpreted as ASCII characters
  - The beginning of the sentence is identified by message header "$QZQSM“
  - Satellite ID is 6 LSB of the 8 bit which represents PRN ID of the L1S signal
    - PRN 183 ➔0xB7➔ 10110111_b ➔ 110111_b (Take 6LSBs) ➔ 55_{10}
    - PRN 183 corresponds to 55
  - Two binary data "00" are added to 250bit DC Report Message at end of a message to make DC Report 252bit data
  - A carriage return code (CR) and a linefeed code (LF) are added at the end of the sentence

GNSS Navigation Data Bits (QZSS L1S Bits Highlighted)

denotes data received on subChn ☐ Strip Parity Bits

SV	MSG	DATA (* denotes invalid words)
BDS 2 B1D2 0	1/4	389018BF 2ABD38D2 35600070 0033F4A8 10595532 1555554B 1555554B 1555554B 1555554B 1555554B
BDS 3 B1D2 0	1/4	389018BF 2ABD01D5 18040029 01309D0F 0E815532 1555554B 1555554B 1555554B 1555554B 1555554B
BDS 6 B1D1 0	1	389018BF 2A980010 06071591 2F055F56 2E0D05C9 3DC39019 2D43BD97 30000345 2074A08D 0C000113
BDS 9 B1D1 0	1	389018BF 2A980010 06071591 2F04505B 240D0549 3DC39019 2D43BD97 30003947 25A00040 0D2CE149
BDS 16 B1D1 0	1	389018BF 2A980010 06071591 2F3E70CC 2C0D05B9 3DC39019 2D43BD97 30005849 38101FD7 3DAA2154
BDS 27 B1D1 0	4/13	389048B9 2A683756 0AEA9A9B 002AD9F9 06F6E2D1 011289CB 091A970F 3FD46408 00E8221C 230ECF7F
BDS 29 B1D1 0	1	389018BF 2A981015 06071591 2F001055 010D0599 3DC39019 2D43BD97 30001340 246CA03D 02DC81C4
BDS 30 B1D1 0	1	389018BF 2A981015 06071591 2F3A0ECC 200D05A9 3DC39019 2D43BD97 3000194D 2798A0A4 02E4015A
GAL 3 E1B 0	E1	010E2530 6CB371D7 002D9D0B AA050000 81FBC000 0000002A AAAA58D7 D6FF4000
GAL 11 E1B 0	E1	010E2530 E8A5F88F 0018A779 AA04C000 A528C000 0000002A AAAA7520 2EBF4000
GAL 24 E1B 0	E0	00955555 55555555 55555555 513E0000 AE78C000 0000002A AAAA7645 07BF4000
GAL 36 E1B 0	E1	010E2530 5EC098C9 00179543 AA04C000 A7F2C000 0000002A AAAA6DCE 7E3F4000
GLO 2 L1OF -4	9 3/3883	4D83B1C2 FEB4BFBE 91F50800
GLO 11 L1OF 0	2 5/3886	10C7044E BCE9059B A9D18800
GLO 12 L1OF -1	14 2/3881	75502388 44508BE0 30091000
GLO 20 L1OF 2	14 2/3880	75502188 44508BE0 3008F800
GLO 21 L1OF 4	10 5/3884	55BCB370 936109D8 09E08000
GLO 22 L1OF -3	2 5/3886	10C70402 1C19109A 62B87800
GPS 8 L1C/A 0	3	22C04F34 2E8E8B44 000B7AD1 9DC2D766 8002C9E1 9EE8E47C 07657F69 946B6785 BFE9B352 8FFB9A90
GPS 18 L1C/A 0	5/19/1	22C04F34 2E8E2D14 14D2A5C9 89066C98 3F520032 A8431B00 3AD9492D 91AEF0F0 24C894B4 3D000AA4
GPS 21 L1C/A 0	3	22C04F34 2E8E8B44 000CC4C2 BB8E4FEA BFA80993 3A50F8CE 8452332F 000A1AC7 3FE9F5EA 8D45A57F
GPS 26 L1C/A 0	3	22C04F34 2E8E8B44 3FF32FE9 B9914973 000589AE 9EC16B10 0AF30232 81E50315 BFE7EF3C 2DC27483
GPS 27 L1C/A 0	3	22C04F34 2E8E8B44 3FFB3B30 0603E48E 800F09C7 3511963F 0763C5CD 95980D53 3FE9D682 863B4AA8
GPS 31 L1C/A 0	3	22C04F34 2E8E8B44 3FF265D6 B4F2064C 3FF289D4 00404A0C 046281C9 8B75DBA7 3FEA6CD6 87425710
QZSS 1 L1S 0	43	9AADF545 D18002C3 F25880CB 115A81F9 503FCA08 214106A8 64500013 7E7063B1
QZSS 1 L1C/A 0	3	22C0AA24 2E8E83F8 3FD7D58F 2D517A6C 3FF28752 AA27838C 060F7023 0D26BAE0 3FF4A787 2E78F7AB
QZSS 3 L1S 0	43	9AADF545 D18002C3 F25880CB 115A81F9 503FCA08 214106A8 64500013 7E7063B1
QZSS 3 L1C/A 0	3	22C0AA81 AE8E8327 00263E35 BA997E7F 3FBF0777 03133174 3061EFC3 3F4A8413 3FFA2DF0 2E7DE57F
QZSS 7 L1S 0	43	9AADF545 D18002C3 F25880CB 115A81F9 503FCA08 214106A8 64500013 7E7063B1
QZSS 7 L1C/A 0	3	22C0AA81 AE8E8327 01D759E0 25981C5D 8069002C 036272D5 809D87FF 2ECDBB5E 80021FAB 2E40007C
SBAS 128 L1C/A 0	4	9A12C00B ECDFFFFD 9FFDFFFC 3000DFFD FFDFFDFF DFFD6FA3 BBBBFFFF C4426C31
SBAS 137 L1C/A 0	2	9A08DFFD FFDFFC00 5FFDFFDF FC004001 FFDFFDFF DFFFBBA7 BBAABBBB 8AA86D71

U-blox Screen Shot



QZSS Navigation Message Data Bits

SV	MSG		DATA (* denotes invalid words)	
QZSS 1	L1S	0	43	9AADF545 D18002C3 F25880CB 115A81F9 503FCA08 214106A8 64500013 7E7063B1
QZSS 1	L1C/A	0	3	22C0AA24 2E8E83F8 3FD7D58F 2D517A6C 3FF28752 AA27838C 060F7023 0D26BAE0 3FF4A787 2E78F7AB
QZSS 3	L1S	0	43	9AADF545 D18002C3 F25880CB 115A81F9 503FCA08 214106A8 64500013 7E7063B1
QZSS 3	L1C/A	0	3	22C0AA81 AE8E8327 00263E35 BA997E7F 3FBF0777 03133174 3061EFC3 3F4A8413 3FFA2DF0 2E7DE57F
QZSS 7	L1S	0	43	9AADF545 D18002C3 F25880CB 115A81F9 503FCA08 214106A8 64500013 7E7063B1
QZSS 7	L1C/A	0	3	22C0AA81 AE8E8327 01D759E0 25981C5D 8069002C 036272D5 809D87FF 2ECDBB5E 80021FAB 2E40007C

DC Report Output from a Receiver

DC report output from Spresense receiver (Sony)

Table 4.3.1-1 Sentence format

Field	Value	Number of character
Message header	$QZQSM	6
Field delimiter	,	1
Satellite ID	55,56,57,61(PRN183,184,185,189)	2
Field delimiter	,	1
DC Report Message		63
Field delimiter	*	1
Checksum		2

Example : $QZQSM, 55, 53AC12345 · · · · · · · 9ABCDEFC*1F

Spresense Output in NMEA Format

GPS Position Output

QZSS Satellite Visibility

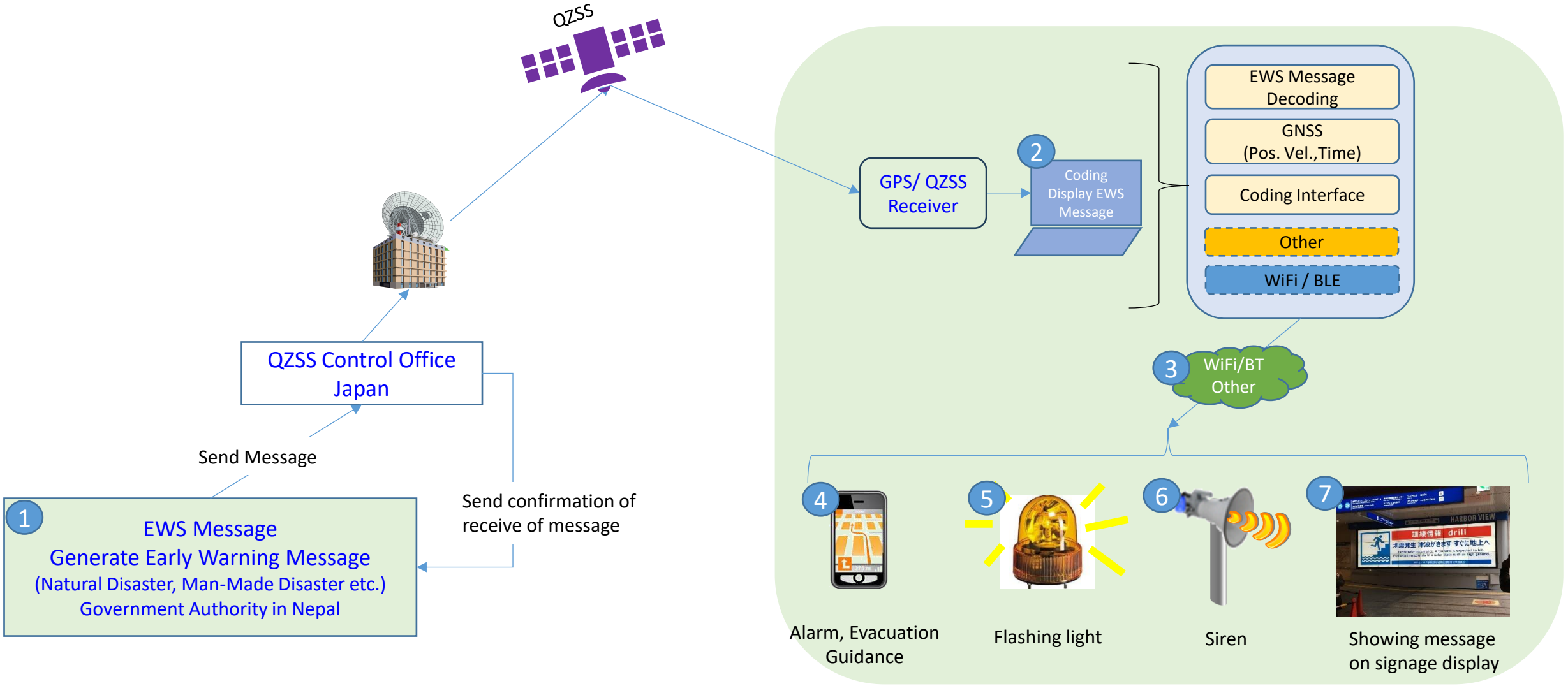
QZSS L1S Message
Includes EWS Message

Input Stream Monitor

ASCII | Close

```
$GNVTG,310.2,T,,M,0.0,N,0.0,K,D*16
$QZQSM,56,9AB3F8036D82261F8D809A73CB1CAC00480000012306000000000003664AC430*7D
$QZDCM,Message Type,15
$GPGGA,023825.00,3554.1825,N,13956.3582,E,2,08,1.5,54.1,M,39.3,M,,*59
$GPGSV,3,1,11,03,07,280,37,04,14,319,39,16,32,257,43,18,10,124,38,0*68
$GPGSV,3,2,11,25,14,060,36,26,57,286,48,27,07,204,,28,70,067,45,0*6A
$GPGSV,3,3,11,29,44,058,46,31,66,341,47,32,30,174,47,,,,,0*55
$GQGSV,2,1,05,56,87,205,48,02,87,205,46,03,18,168,41,04,32,207,43,0*6A
$GQGSV,2,2,05,07,46,201,38,,,,,,,,,,,,0*5C
$GNRMC,023825.00,A,3554.1825,N,13956.3582,E,0.0,310.2,300124,,,D,V*38
$GNVTG,310.2,T,,M,0.0,N,0.0,K,D*16
$GPGGA,023826.00,3554.1825,N,13956.3582,E,2,08,1.5,54.1,M,39.3,M,,*5A
$GPGSV,3,1,11,03,07,280,37,04,14,319,38,16,32,257,43,18,10,124,37,0*66
$GPGSV,3,2,11,25,14,060,36,26,57,286,48,27,07,204,,28,70,067,45,0*6A
$GPGSV,3,3,11,29,44,058,46,31,66,341,47,32,30,174,47,,,,,0*55
$GQGSV,2,1,05,56,87,205,48,02,87,205,47,03,18,168,41,04,32,207,43,0*6B
$GQGSV,2,2,05,07,46,201,39,,,,,,,,,,,,0*5D
$GNRMC,023826.00,A,3554.1825,N,13956.3582,E,0.0,310.2,300124,,,D,V*3B
$GNVTG,310.2,T,,M,0.0,N,0.0,K,D*16
$QZQSM,56,53B0600DE0000000000000000000000000000000000000000000000800CAC*7D
$QZDCM,Message Type,12
$GPGGA,023827.00,3554.1825,N,13956.3582,E,2,08,1.5,54.1,M,39.3,M,,*5B
$GPGSV,3,1,11,03,07,280,36,04,14,319,39,16,32,257,43,18,10,124,37,0*66
$GPGSV,3,2,11,25,14,060,36,26,57,286,48,27,08,204,,28,70,067,45,0*65
$GPGSV,3,3,11,29,44,058,47,31,66,341,47,32,30,174,47,,,,,0*54
$GQGSV,2,1,05,56,87,205,48,02,87,205,47,03,18,168,42,04,32,207,43,0*68
$GQGSV,2,2,05,07,46,201,40,,,,,,,,,,,,0*53
$GNRMC,023827.00,A,3554.1825,N,13956.3582,E,0.0,310.2,300124,,,D,V*3A
$GNVTG,310.2,T,,M,0.0,N,0.0,K,D*16
$GPGGA,023828.00,3554.1825,N,13956.3582,E,2,08,1.5,54.1,M,39.3,M,,*54
$GPGSV,3,1,11,03,07,280,36,04,14,319,39,16,32,257,43,18,10,124,38,0*69
$GPGSV,3,2,11,25,14,060,36,26,57,286,48,27,08,204,,28,70,067,45,0*65
$GPGSV,3,3,11,29,44,058,47,31,66,341,47,32,30,174,47,,,,,0*54
$GQGSV,2,1,05,56,87,205,48,02,87,205,47,03,18,168,42,04,32,207,43,0*68
$GQGSV,2,2,05,07,46,201,40,,,,,,,,,,,,0*53
$GNRMC,023828.00,A,3554.1825,N,13956.3582,E,0.0,310.2,300124,,,D,V*35
$GNVTG,310.2,T,,M,0.0,N,0.0,K,D*16
$QZQSM,56,C6ADF0F84F0005045600000000000000000000000000000000000138BD92A4*0D
$QZDCM,Message Type,14
$GPGGA,023829.00,3554.1825,N,13956.3582,E,2,08,1.5,54.1,M,39.3,M,,*55
$GPGSV,3,1,11,03,07,280,36,04,14,319,39,16,32,257,43,18,10,124,38,0*69
```

QZSS EWSS Demo: System Architecture



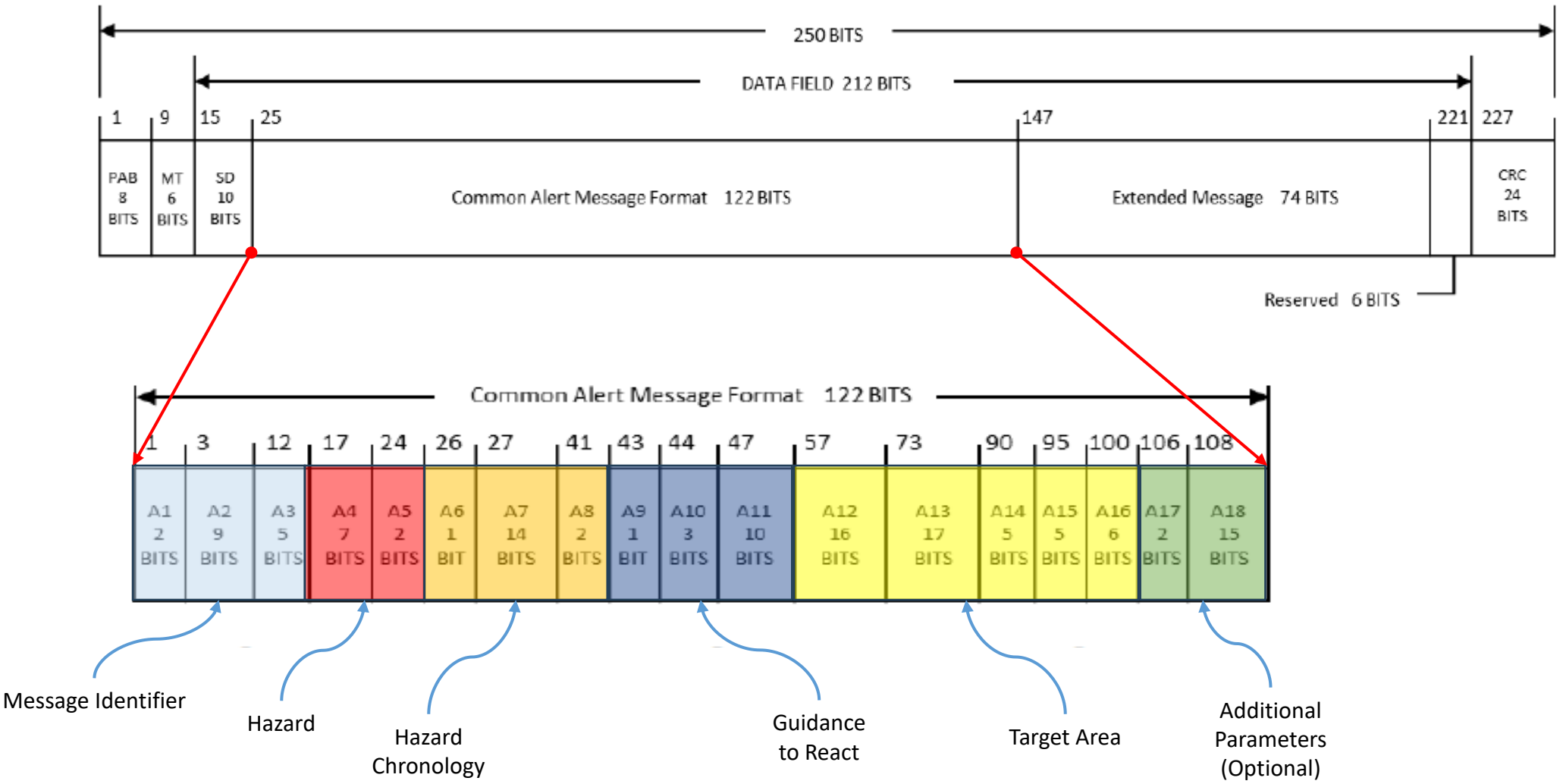
QZSS EWSS Demo Schedule

	Broadcast Type	Purpose	Date	Time (JST)	Remarks
1	System Test Broadcast	Demo System Test	21 January	13:00 – 17:00 (JST) 09:45 – 16:45 (NST)	Use sample message Test GPS/QZSS Receiver Test other receivers
2	Demo Broadcast	Real-Time System Demo	27 January	13:00 – 17:00 (JST) 09:45 – 16:45 (NST)	Use sample message Real-Time demo using GPS/QZSS Receiver

Disaster Location and Type

	Warning Area	Hazard Target Coordinates	Scenario Type
1	Lobuche Everest Basecamp Area	LAT = 27.957924; LON = 86.813181; ALT = 5050;	GLOF (Glacier Lake Outburst Flood) Broadcast Early Warning Message for GLOF in Lobuche Once every 2 minute
2	Kathmandu	LAT = 27.707804; LON = 85.315372; ALT= 1220;	Earthquake Broadcast Early Warning Message for Earthquake in Kathmandu Once every 2 minute

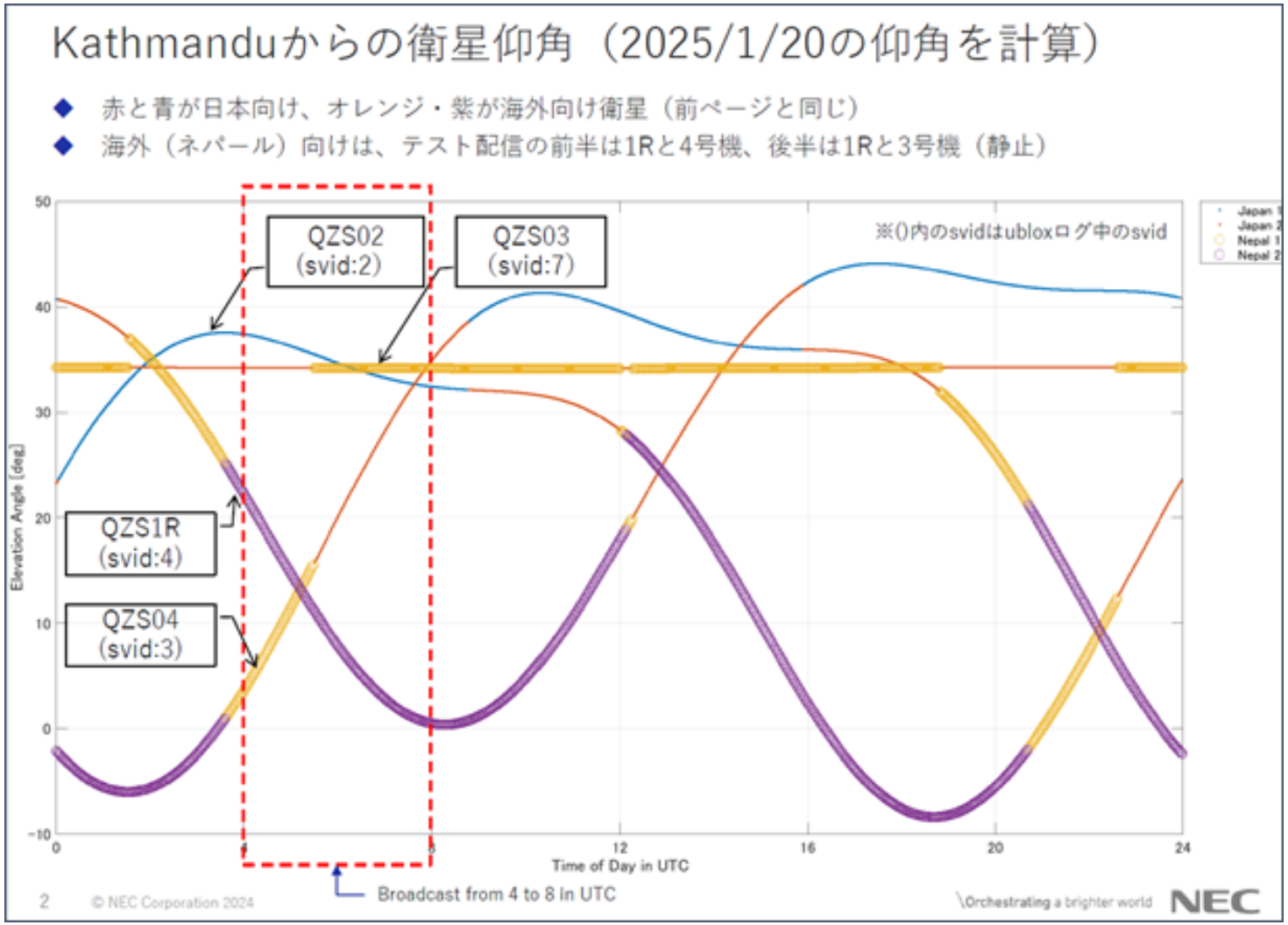
EWSS Message Format



EWSS Message for Demo

入力日時（JST）	配信期限（JST）	MT44（64文字HEX表現）
2025/1/27 13:00:00	2025/1/27 13:05:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 13:05:00	2025/1/27 13:10:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 13:10:00	2025/1/27 13:15:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 13:15:00	2025/1/27 13:20:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 13:20:00	2025/1/27 13:25:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 13:25:00	2025/1/27 13:30:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 13:30:00	2025/1/27 13:35:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 13:35:00	2025/1/27 13:40:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 13:40:00	2025/1/27 13:45:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 13:45:00	2025/1/27 13:50:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 13:50:00	2025/1/27 13:55:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 13:55:00	2025/1/27 14:00:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 14:00:00	2025/1/27 14:05:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 14:05:00	2025/1/27 14:10:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 14:10:00	2025/1/27 14:15:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 14:15:00	2025/1/27 14:20:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 14:20:00	2025/1/27 14:25:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 14:25:00	2025/1/27 14:30:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000
2025/1/27 14:30:00	2025/1/27 14:35:00	00B00012A1E2800C2001A7C3BDBB98B800000000000000000000000000000000
2025/1/27 14:35:00	2025/1/27 14:40:00	00B00012A1E2800C2001A767BCAB318000000000000000000000000000000000

QZSS Satellite Visibility Map: Kathmandu (as of 2025/1/20)



QZSS_EWS

Field	Value
Message Type	0
Country ID	149
Provider ID	1
Event Category	113
Severity	1
WeekNumber	0
Time Of Week	12
Duration	0
Library ID	1
Library Version	0
Guidance To React	1
Latitude	27.959258
Longitude	86.813254
SemiMajorAxis	1322.084
SemiMinorAxis	977.669
SemiMajorAzimuth	-73.125

Satellite-based Early Warning Messaging System

(Common Alert Message Format)

Disaster Type: Glacial Lake Outburst Flood (GLOF)
Severity: Strong
Guidance: Go to a safe place
Country: Nepal
Location: LAT: 27.959258 LON: 86.813254
Date: 27 January 2025 **Time:** 09:12 AM
Satellite: QZSS **SAT ID:** 3

```
$GBGSV,4,2,16,05,46,227,,13,02,184,,24,11,271,,26,49,308,,0*7B
$GBGSV,4,3,16,29,26,082,,35,25,147,,36,05,070,,42,37,298,,0*77
C6C9886B 7400FD6F E403CFF7 041FA806 AFB90070 00000000 00000000 089D6480 00000000
$GBGSV,4,4,16,59,22,110,,60,55,191,,61,46,136,,62,06,096,,0*7F
$GQGSV,1,1,04,02,36,060,41,03,10,110,34,04,16,146,37,07,34,118,35,1*6A
$GQGSV,1,1,04,02,36,060,43,03,10,110,40,04,16,146,41,07,34,118,43,6*6C
$GNGLL,2741.5557235,N,08520.3619364,E,042030.00,A,D*72
$GNGST,042030.00,11,1.1,0.91,33,0.44,0.40,0.99*40
C6C9886B 7400FD6F E403CFF7 041FA806 AFB90070 00000000 00000000 089D6480 00000000
C6C9886B 7400FD6F E403CFF7 041FA806 AFB90070 00000000 00000000 089D6480 00000000
C6C9886B 7400FD6F E403CFF7 041FA806 AFB90070 00000000 00000000 089D6480 00000000
```

QZSS_EWS

Field	Value
Message Type	0
Country ID	149
Provider ID	1
Event Category	113
Severity	1
WeekNumber	0
Time Of Week	12
Duration	0
Library ID	1
Library Version	0
Guidance To React	1
Latitude	27.959258
Longitude	86.813254
SemiMajorAxis	1322.084
SemiMinorAxis	977.669
SemiMajorAzimuth	-73.125

Satellite-based Early Warning Messaging System

(Common Alert Message Format)

Warning Message: FLOOD

Disaster Type: Glacial Lake Outburst Flood (GLOF)
Severity: Strong
Guidance: Go to a safe place
Country: Nepal
Location: LAT: 27.959258 LON: 86.813254
Date: 27 January 2025 **Time:** 09:12 AM
Satellite: QZSS **SAT ID:** 3

```
$GBGSV,5,3,17,29,27,076,,33,00,327,,35,30,143,,36,02,074,,0*79
$GBGSV,5,4,17,42,39,291,,59,22,110,,60,55,191,,61,46,136,,0*74
$GBGSV,5,5,17,62,06,096,,0*4C
$GQGSV,1,1,04,02,36,060,42,03,12,108,35,04,15,146,34,07,34,118,35,1*63
$GQGSV,1,1,04,02,36,060,43,03,12,108,39,04,15,146,41,07,34,118,43,6*6A
$GNGLL,2741.5554081,N,08520.3621319,E,043425.00,A,D*7C
$GNGST,043425.00,11,1.2,0.96,21,0.46,0.40,1.1*74
53B0600D E0000000 00000000 00000000 00000000 00000000 00000003 A62C7F80 00000000
53B0600D E0000000 00000000 00000000 00000000 00000000 00000003 A62C7F80 00000000
53B0600D E0000000 00000000 00000000 00000000 00000000 00000003 A62C7F80 00000000
53B0600D E0000000 00000000 00000000 00000000 00000000 00000003 A62C7F80 00000000
```

QZSS_EWS

Field	Value
Message Type	0
Country ID	149
Provider ID	1
Event Category	113
Severity	1
WeekNumber	0
Time Of Week	12
Duration	0
Library ID	1
Library Version	0
Guidance To React	1
Latitude	27.706569
Longitude	85.316355
SemiMajorAxis	8084.674
SemiMinorAxis	8084.674
SemiMajorAzimuth	-56.250

Satellite-based Early Warning Messaging System

(Common Alert Message Format)

Warning Message: EARTHQUAKE

Disaster Type: Earthquake
Severity: Strong
Guidance: Go to the nearest Evacuation Place
Country: Nepal
Location: LAT: 27.706569 LON: 85.316355
Date: 27 January 2025 **Time:** 09:12 AM
Satellite: QZSS **SAT ID:** 3

```
$GBGSV,4,1,16,01,18,107,,02,57,183,,03,46,136,,04,04,099,,0*74
$GBGSV,4,2,16,05,46,227,,13,02,184,,24,11,271,,26,49,308,,0*7B
$GBGSV,4,3,16,29,26,082,,35,25,147,,36,05,070,,42,37,298,,0*77
$GBGSV,4,4,16,59,22,110,,60,55,191,,61,46,136,,62,06,096,,0*7F
$GQGSV,1,1,04,02,36,060,41,03,10,110,35,04,16,146,37,07,34,118,35,1*6B
$GQGSV,1,1,04,02,36,060,43,03,10,110,39,04,16,146,42,07,34,118,43,6*61
$GNGLL,2741.5557160,N,08520.3619250,E,042120.00,A,D*77
$GNGST,042120.00,11,1.1,0.91,32,0.44,0.40,0.99*41
9AC9817F 7400FAEF C2F8E057 FE603304 FFDE07AF DD00D000 00000000 2616C780 00000000
9AC9817F 7400FAEF C2F8E057 FE603304 FFDE07AF DD00D000 00000000 2616C780 00000000
9AC9817F 7400FAEF C2F8E057 FE603304 FFDE07AF DD00D000 00000000 2616C780 00000000
```

QZSS_EWS

Satellite-based Early Warning Messaging System

(Common Alert Message Format)

Field	Value
Message Type	0
Country ID	149
Provider ID	1
Event Category	113
Severity	1
WeekNumber	0
Time Of Week	12
Duration	0
Library ID	1
Library Version	0
Guidance To React	1
Latitude	27.706569
Longitude	85.316355
SemiMajorAxis	8084.674
SemiMinorAxis	8084.674
SemiMajorAzimuth	-56.250

Disaster Type: Earthquake
Severity: Strong
Guidance: Go to the nearest Evacuation Place
Country: Nepal
Location: LAT: 27.706569 LON: 85.316355
Date: 27 January 2025 **Time:** 09:12 AM
Satellite: QZSS **SAT ID:** 3

```
$GBGSV,5,3,17,29,27,076,,33,00,327,,35,30,143,,36,02,074,,0*79
$GBGSV,5,4,17,42,39,291,,59,22,110,,60,55,191,,61,46,136,,0*74
$GBGSV,5,5,17,62,06,096,,0*4C
$GQGSV,1,1,04,02,36,060,41,03,12,108,35,04,15,146,34,07,34,118,35,1*60
$GQGSV,1,1,04,02,36,060,43,03,12,108,38,04,15,146,41,07,34,118,43,6*6B
$GNGLL,2741.5554387,N,08520.3621207,E,043317.00,A,D*71
$GNGST,043317.00,11,1.2,0.95,22,0.47,0.40,1.1*73
9AB0600D E0000000 00000000 00000000 00000000 00000000 00000003 BB2B3E00 00000000
9AB0600D E0000000 00000000 00000000 00000000 00000000 00000003 BB2B3E00 00000000
9AB0600D E0000000 00000000 00000000 00000000 00000000 00000003 BB2B3E00 00000000
9AB0600D E0000000 00000000 00000000 00000000 00000000 00000003 BB2B3E00 00000000
```

Bit Masking in Spresense to Select NMEA Sentence Output

NMEA Sentence Type

NMEA Output Description		QZQSM							ZDA	VTG	RMC	GNS	GSV	GSA	GLL	GGA	HEX Value
	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	
Output Only QZQSM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0x4000
Output QZQSM and All NMEA	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0x40FF
Output QZQSM, GGA, ZDA	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0x4081
Output QZQSM, GGA, GSV, VTG, ZDA																	

Sample NMEA Output Data from Spresense Device

$QZQSM,56,53ADF6105400050FB4A1F7D4403A880C51022A2711450028A2D00010E28E564*05
$QZDCM,Message Type,14
$GPGGA,072433.00,3554.1824,N,13956.3583,E,2,09,1.2,54.3,M,39.3,M,,*52
$GPGSV,3,1,09,03,09,310,38,12,05,050,37,16,07,235,36,22,11,288,,0*69
$GPGSV,3,2,09,25,37,046,44,26,42,252,45,29,48,089,46,31,59,329,47,0*6B
$GPGSV,3,3,09,32,63,180,51,,,,,,,,,,,,0*55
$GQGSV,2,1,05,56,86,275,48,01,45,189,44,02,86,275,47,03,22,167,40,0*6B
$GQGSV,2,2,05,07,46,201,39,,,,,,,,,,,,0*5D
$GNRMC,072433.00,A,3554.1824,N,13956.3583,E,0.0,22.2,041221,,,D,V*05
$GNVTG,22.2,T,,M,0.0,N,0.0,K,D*24
$GPGGA,072434.00,3554.1824,N,13956.3583,E,2,09,1.2,54.3,M,39.3,M,,*55
$GPGSV,3,1,09,03,09,310,38,12,05,050,37,16,07,235,36,22,11,288,,0*69
$GPGSV,3,2,09,25,37,046,44,26,42,252,45,29,48,089,45,31,59,329,47,0*68
$GPGSV,3,3,09,32,63,180,51,,,,,,,,,,,,0*55
$GQGSV,2,1,05,56,86,275,48,01,45,189,44,02,86,275,46,03,22,167,39,0*64
$GQGSV,2,2,05,07,46,201,38,,,,,,,,,,,,0*5C
$GNRMC,072434.00,A,3554.1824,N,13956.3583,E,0.0,22.2,041221,,,D,V*02
$GNVTG,22.2,T,,M,0.0,N,0.0,K,D*24

Sample NMEA Output Data from Spresense Device

$GPGGA,072436.00,3554.1824,N,13956.3583,E,2,09,1.2,54.3,M,39.3,M,,*57
$GPGSV,3,1,09,03,09,310,38,12,05,050,36,16,07,235,37,22,11,288,,0*69
$GPGSV,3,2,09,25,37,046,43,26,42,252,46,29,48,089,45,31,59,329,46,0*6D
$GPGSV,3,3,09,32,63,180,51,,,,,,,,,,,,0*55
$GQGSV,2,1,05,56,86,275,48,01,45,189,44,02,86,275,46,03,22,167,41,0*6B
$GQGSV,2,2,05,07,46,201,38,,,,,,,,,,,,0*5C
$GNRMC,072436.00,A,3554.1824,N,13956.3583,E,0.0,22.2,041221,,,D,V*00
$GNVTG,22.2,T,,M,0.0,N,0.0,K,D*24
$QZQSM,56,9AADF6104F000283F2507F8A106961F92C406588AD40FF282080000111573F9C*74
$QZDCM,Message Type,14
$GPGGA,072437.00,3554.1824,N,13956.3583,E,2,09,1.2,54.3,M,39.3,M,,*56

Demo of EWS Message from UTokyo Spresense Receiver

Contact and Additional Information

- Homepage
  - Main Page : https://home.csis.u-tokyo.ac.jp/~dinesh/
  - Facebook : https://www.facebook.com/gnss.lab/
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  - Skype : mobilemap