TECHNICAL CONDITIONS FOR RADIO EQUIPMENT AT RADIONAVIGATION LAND STATIONS PROVIDING SATELLITE DETERMINATION ERROR CORRECTING INFORMATION

(Article 14 and Article 48.3 of the Ordinance Regulating Radio Equipment)

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The technical conditions for the radio equipment at radionavigation land stations that provide satellite determination error correcting information shall be stipulated pursuant to the provisions of Article 14 paragraph 3 and Article 48.3 item 3) of the Ordinance Regulating Radio Equipment (Radio Regulatory Commission Regulations No. 18 of 1950), as follows.

1 General conditions

 1) The radio equipment shall be capable of transmitting the following information.

 (1) The location of the position at which the determination error to be obtained by receiving emissions from the satellite of GPS (which refers to the overall global satellite positioning system; the same applies hereafter) is measured

 (2) Information about the state of the satellite of GPS

 (3) Null information of GPS (which refers to the state in which there is no information to be transmitted, or information to be transmitted when starting of information transmission is adjusted; the same applies hereafter)

 (4) Almanac data of radionavigation land stations (which refers to the data concerning the position, frequency, and state of neighboring radionavigation land stations; the same applies hereafter)

 (5) Information about the correction of the determination error to be obtained by receiving emissions from the satellite of GPS

 (6) Special information

 2) The category number of the satellite determination error correcting information shall be as indicated in the right-hand column in accordance with the category of the satellite determination error correcting information in the left-hand column.

Category	Category number
The location of the position at which the determination error to be obtained by receiving emissions from the satellite of GPS is measured	3
Information about the state of the satellite of GPS	5
Null information of GPS	6
Almanac data of radionavigation land stations	7
Information about the correction of the determination error to be obtained by receiving emissions from the satellite of GPS	9
Special information	16

3) The radio equipment shall be capable of transmitting the information for testing or adjusting it.

2 Electric Conditions
1) The composition of the transmitting signal shall be as shown in Fig. 1 to Fig. 6.
2) The upper limit of the permissible values for the antenna power shall be 10%, and the lower limit shall be 20%.

Fig. 1 Composition of the signal of the location at the position at which the determination error to be obtained by receiving emissions from the satellite of GPS is measured (the signal shall consist of a first signal and a second signal)
The first signal;

	MSB LSB	MSB LSB		
The first word	Pre-code 01100110	Category of satellite-determination error correcting information (Note 1)	Identification number of reference equipment (which refers to the receiving equipment that measures a determination error; the same applies hereafter) (Note 2)	Error detecting code
	← 1 to 8 →	← 9 to 14 →	← 15 to 24 →	←25 to 30 →
Bit number				

	MSB LSB	MSB LSB			
The second word	Modified Z count (Note 3)	Serial number (Note 4)	Number of words that are expected to be transmitted (Note 5)	State of reference equipment (Note 6)	Error detecting code
Bit number	← 1 to 13 →	← 14 to 16 →	← 17 to 21 →	← 22 to 24 →	← 25 to 30 →

"MSB": Most significant bit

"LSB": Least significant bit

Note 1　The category of satellite determination error correcting information shall be as shown in the table below.

Category number	Category	Bit indication
3	The location of the position at which the determination error to be obtained by receiving emissions from the satellite of GPS is measured	000011
5	Information about the state of the satellite of GPS	000101
6	Null information of GPS	000110
7	Almanac data of radionavigation land stations	000111
9	Information about the correction of the determination error to be obtained by receiving emissions from the satellite of GPS	001001
16	Special information	010000

Note 2　Identification numbers that are assigned by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) shall be used.

Note 3　The modified Z count shall indicate the reference time of satellite error correcting information. The modified Z count shall begin with 0 at the start of each GPS time calculation, the maximum value shall be 3,599.4 seconds, and the resolution shall be 0.6 second. The modified Z count shall be used to calculate the GPS time at a user's receiving equipment as in any other time calculation.

Note 4　The serial number shall increase by 1 each time satellite-determination error correcting information is transmitted, and shall be used for synchronization.

Note 5　The number of the words that are expected to be transmitted shall indicate that "N" words are transmitted in succession to the second word.

Note 6　"111" shall indicate that the reference equipment does not operate properly, and "110" shall indicate that the transmission of radionavigation land stations is not monitored.

The second signal;

MSB

The third word	ECEF (Note) X- coordinates	Error detecting code
Bit number	← 1 to 24 →	← 25 to 30 →

LSB MSB

The fourth word	ECEF X- coordinates (continued)	ECEF Y- coordinates	Error detecting code
Bit number	← 1 to 8 →	← 9 to 24 →	← 25 to 30 →

LSB MSB

The fifth word	ECEF Y- coordinates (continued)	ECEF Z- coordinates	Error detecting code
Bit number	← 1 to 16 →	← 17 to 24 →	← 25 to 30 →

LSB

The sixth word	ECEF Z- coordinates (continued)	Error detecting code
Bit number	← 1 to 24 →	← 25 to 30 →

Note: "ECEF" shall indicate the earth center/earth fixed orthogonal axial system in the WGS-84 coordinate system.

Fig. 2　Composition of the signal of the information about the state of the satellite of GPS (the signal shall consist of a first signal and a second signal)

The first signal;

The first signal shall be the same as the first signal shown in Fig. 1.

The second signal;

The second signal shall consist of one word for each satellite, as follows (the conditions for each signal shall be as shown in the Table below).

Data issue number linked   Compulsorily handled as a normal satellite   Warning of a predicted abnormal state

(Note) The N₁th+ two words	Preliminary	Satellite identification number		State data	C/N₀		Acquisition of new navigation data		Time to an abnormal state	Pending	Error detecting code
Bit number	1	2 to 6	7	8 to 10	11 to 15	16	17	18	19 to 22	23 and 24	25 to 30

Note: N_1 shall indicate the number of satellites.

Table   Conditions for each signal

Signal	Bit number	Condition
Preliminary	1	The preliminary signal shall be used when the number of satellites exceeds 32 in the future.
Satellite identification number	2 to 6	The satellite identification number shall indicate 1 to 32 (32 shall be "0" for all the bits) in the standard form.
Data issue number linked	7	When the bit indication is "0," the data issue number linked signal shall indicate that the navigation data in the issue number of the ephemeris data (which refers to the data of orbit information, etc. of each satellite; the same applies hereafter) of the signal shown in Fig. 5 must be referred to.
State data	8 to 10	The state data shall indicate the state of the navigation data of satellites. When the bit indication is "000," the state data shall indicate that all the data are normal, and that when any of the bit indications is "1," all or part of the state of the navigation data of satellites is abnormal.
C/N₀	11 to 15	C/N_0 shall be the signal to noise ratio of a satellite signal measured with the reference equipment. The unit shall be 1 [dB – Hz], and shall indicate the range of 25 to 55 [dB – Hz]. The bit indication "00000" shall indicate that a satellite signal has not been captured, "00001" shall indicate the lowest value of 25 [dB – Hz], and "11111" shall indicate the highest value of 55 [dB – Hz].

Compulsorily handled as a normal satellite	16	The signal compulsorily handled as a normal satellite shall indicate that even if the navigation data of a satellite indicates an abnormal value when the bit indication is "1," the equipment that uses DGPS neglects the abnormal navigation data and considers it to be normal.
Acquisition of new navigation data	17	The acquisition of new navigation data shall indicate that when the bit indication is "1," the reference equipment acquires new navigation data of a satellite and is in the process of producing a dummy distance correcting value. It shall indicate that the serial number of the signal shown in Fig. 5 is expected to be updated.
Warning of a predicted abnormal state	18	The warning of a predicted abnormal state shall indicate that when the bit indication is "1," the state of the navigation data of a satellite is expected to become abnormal. The outline of the time during which the state of the navigation data is normal shall be indicated in 4 bits from the next digit.
Time to an abnormal state	19 to 22	Refer to bit number 18. The time to an abnormal state shall indicate the time range from 0 to 75 minutes (the unit is in five minutes). "0000" shall indicate that the state of the navigation data of a satellite becomes abnormal immediately, and "1111" shall indicate that it will become abnormal 75 minutes later.

Fig. 3   Composition of the signal of the null information of GPS (the signal shall consist of a first signal and a second signal)

The first signal;

The first signal shall be the same as the first signal shown in Fig. 1.

The second signal;

This signal shall not include any parameter, shall continue transmission whenever necessary, and shall be used for the maintenance of the circuit. The purpose of transmitting this signal is to use it when the information that a radionavigation land station transmits has not been prepared yet, or when the time for starting the transmission of information should be adjusted.

This signal shall include first two words with N = "0" or N = "1" as the number of words that are expected to be transmitted by making the number of words to be transmitted either odd-numbered or

even-numbered, as in the composition of other transmission signals. When N = "1," the 24-digit data bit in the word following the first two words shall be data with "1" and "0" one after the other. The error detecting signal shall properly operate as in the composition of other transmission signals.

Fig. 4 Composition of the signal of almanac data of radionavigation land stations (the signal shall consist of a first signal and a second signal)

The first signal;

The first signal shall be the same as the first signal shown in Fig. 1.

The second signal;

(Note 5) 3rd N_b word	Latitude (Note 1)	Longitude (higher-rank byte) (Note 1)	Error detecting code
Bit number	1 to 16	17 to 24	25 to 30

3rd N_b + one word	Longitude (lower-rank byte) (Note 1)	Usage range of a radionavigation land station	Frequency (higher-rank 6 bits) (Note 2)	Error detecting code
Bit number	1 to 8	9 to 18	19 to 24	25 to 30

Transmission coding (the data bit shall be "0")

Synchronization identification (the data bit shall be "1")

State of a radionavigation land station   Modulation method (the data bit shall be "0")

3rd N_b + two words	Frequency (lower-rank 6 bits) (Note 2)		Identification number of a radionavigation land station that transmits information (Note 4)	Transmission rate (Note 5)				Error detecting code
Bit number	1 to 6	7 and 8	9 to 18	19 to 21	22	23	24	25 to 30

Note 1   The "+" value shall indicate the north latitude in the case of latitude, and the east longitude in the case of longitude.

Note 2   The unit shall be 100 Hz.

Note 3   The state of a radionavigation land station shall be as follows.

Bit indication	Number	State
"00"	(0)	It is in normal operation.
"01"	(1)	It is operated under non-perfect surveillance.
"10"	(2)	There is no information provided about it.
"11"	(3)	It cannot be used.

Note 4　The identification numbers that are assigned by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) shall be used.

Note 5　The transmission rate shall be as shown in the table below.

Bit indication	Number	Transmission rate
"001"	(1)	50 bits/s
"010"	(2)	100 bits/s
"101"	(5)	200 bits/s

Note 6　N_b shall indicate the number of radionavigation land stations that are included in almanac data.

Fig. 5　Composition of the signal of the information about the correction of the determination error obtained by receiving emissions from the satellite of GPS (the signal shall consist of a first signal through a third signal);

The first signal

　　The first signal shall be the same as the first signal shown in Fig. 1.

The second signal;

3rd, 8th, 13th, or 18th word	Designation of unit	User distance error	Satellite identification number	Dummy distance correcting value (Note 1)	Error detecting code
Bit number	1	2 and 3	4 to 8	9 to 24	25 to 30

4th, 9th, 14th, or 19th word	Dummy distance variation ratio (Note 2)	Issue number of ephemeris data	Designation of unit	User distance error	Satellite identification number	Error detecting code
Bit number	1 to 8	9 to 10	17	18 and 19	20 to 24	25 to 30

5th, 10th, 15th, or 20th word	Dummy distance correcting value	Dummy distance variation ratio	Error detecting code
Bit number	1 to 16	17 to 24	25 to 30

6th, 11th, 16th, or 21st word	Issue number of ephemeris data	Designation of unit	User distance error	Satellite identification number	Dummy distance correcting value (higher-rank bits)	Error detecting code
Bit number	1 to 8	9	10 and 11	12 to 16	17 to 24	25 to 30

7th, 12th, 17th, or 22nd word	Dummy distance correcting value (lower-rank bits)	Dummy distance variation ratio	Issue number of ephemeris data	Error detecting code
Bit number	1 to 8	9 to 16	17 to 24	25 to 30

Note 1   The bit indication of "1000000000000000" shall indicate that a problem is occurring.

Note 2   The bit indication of "10000000" shall indicate that a problem is occurring.

The third signal;

When the number of satellites, N_1, cannot be divided by 3, it shall be compensated for by either word out of the following two words in order to complete the information about the correction of a satellite error.

Nth + two words When N_1 = 1, 4, 7, or 10	Dummy distance variation ratio	Issue number of ephemeris data	Dummy bits	Error detecting code
Bit number	1 to 8	9 to 16	17 to 24	25 to 30

Nth + two words When N_1 = 2, 5, 8, or 11	Issue number of ephemeris data	Dummy bits	Dummy bits	Error detecting code
Bit number	1 to 8	9 to 16	17 to 24	25 to 30

Fig. 6   Composition of special information of GPS (the information shall consist of a first signal and a
        second signal)

The first signal;

   The first signal shall be the same as the first signal shown in Fig. 1.

The second signal;

	MSB LSB	MSB LSB	MSB LSB	
(Note 1) N + two words	Alphanumeric (Note 2)	Alphanumeric	Alphanumeric	Error detecting code
Bit number	1 to 8	9 to 16	17 to 24	25 to 30

Note 1   N shall be a bit number from 1 to 28.

Note 2   The alphanumeric shall be based on the ASCII code.

Reference: Article 48.3 of the Ordinance Regulating Radio Equipment shall be brought down to Article 49
        pursuant to the MPHPT Ordinance of 2001.