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Interface specification for the signal in space of the BeiDou Satellite-Based Augmentation System - Part 2: Dual-frequency augmentation service signal BDSBAS-B2a

北斗星基增强系统空间信号接口规范 第2部分：双频增强服务信号BDSBAS-B2a

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2 Dual-Frequency Enhanced Service Signal BDSBAS-B2a Published on 2026-04-

30 Implemented on August 1, 2026 State Administration for Market Regulation The State Administration for Standardization issued a statement.

1.Scope This document specifies the signal radio frequency characteristics, electrical characteristics, and other specifications of the dual-frequency augmentation service signal BDSBAS-B2a of the BeiDou Satellite-Based Augmentation System (BDSBAS). Message structure, message content, message parameter calculation, etc. This document applies to the operation and maintenance of BDSBAS system services and the design and development of enhanced receivers using BDSBAS-B2a signals. Production, testing and application.

4 Zodiac Signs and Time-Space Benchmarks

4.1 Spatial Constellations The BDSBAS space constellation consists of three BDSGEO

satellites that broadcast enhanced service signals, positioned at 80°E and 110.5°E, respectively. And 140°.

4.2 Coordinate System The coordinate datum for BDSBAS is BDCS, and the deviation between this coordinate system and ITRF is no greater than 3 cm (95%). WGS-84 is implemented based on the ITRF framework.

Note. Differences between the two are negligible for aviation applications.

4.3 Time System When using a dual-frequency multi-constellation satellite-based augmentation system network (SNTDFMC).

5 Signal RF Characteristics

5.1 Carrier Frequency The carrier frequency of the BDSBAS-B2a signal is 1176.45MHz.

5.2 Signal Spurious Signals The spurious power of the BDSBAS-B2a signal should be at least 40 dB lower than the unmodulated carrier power on the channel.

5.3 Carrier Phase Noise The carrier phase noise spectral density of the unmodulated BDSBAS-B2a signal should be such that the tracking accuracy of a 10Hz single-sided noise bandwidth phase-locked loop is achieved. (1sigma) is better than

0.1 rad.

5.4 Signal Spectrum At least 95% of the BDSBAS-B2a broadcast power should be contained in a frequency band centered at 1176.45MHz and with a bandwidth of 20MHz to 24MHz. Within the frequency band between.

5.5 Doppler frequency shift Relative to any fixed reference point within the coverage area of the BDSGEO satellite, the Doppler frequency shift of the BDSGEO satellite is less than or equal to 40m/s (not greater than 156Hz at the 1176.45MHz frequency point).

5.6 Carrier frequency stability At the output of the satellite transmission antenna, the short-term stability (square root of the Allan variance) of the BDSBAS-B2a carrier frequency within 10 seconds is not large. At 6.7x10-11.

5.7 Polarization Mode The BDSBAS-B2a signal is right-hand circularly polarized (RHCP), and the ellipticity is small within a ±9.1° axial angle range of the satellite antenna. At 2dB.

5.8 Code/Carrier Frequency Consistency At the BDSBAS-B2a frequency point, the rate of change of the code difference with the carrier is less than

0.5 m/s.

5.9 Signal power at ground level Each BDSGEO satellite should broadcast the BDSBAS-B2a signal with sufficient power, and be positioned on an unobstructed ground surface at an observation elevation angle of 5° or higher. In the region where the antenna is orthogonal to the propagation direction of the BDSBAS-B2a signal, the signal power output

by the 3dBi linearly polarized antenna is not less than [a certain value]. The signal power output of a -158dBW, 0dBic right-hand circularly polarized (RHCP) antenna should not exceed -150.5dBW. The antenna output signal... Power needs to be measured within a ±10MHz frequency band centered on the BDSBAS-B2a frequency.

5.10 Modulation Loss The correlation loss caused by modulation and filtering of the BDSGEO satellite payload is no greater than 1 dB.

5.11 Maximum code phase deviation Compared to SNTDFMC, the maximum code phase deviation of the BDSBAS-B2a signal is within the range of [-2-10s, 2-10s].

6.1 Message Arrangement

6.1.1 Telegram Format The BDSBAS-B2a message frame is 250 bits long and is broadcast in 1 second. The highest 4 bits are guidance information, and 6 bits are the message type. The message format is as follows: the lowest 24 bits are the Cyclic Redundancy Check (CRC) bits, and the remaining 216 bits are the data field. See the BDSBAS-B2a message format. Figure 1.

6.1.2 Guidance Information The guidance information is distributed across six consecutive enhanced messages, each containing 4 bits, for a total of 24 bits. These six consecutive 4-bit guidance messages... The sequence of information is 0101, 1100, 0110, 1001, 0011, 1010.The 24-bit guidance information is maintained at a time exactly 6 seconds after the SNTDFMC time. synchronous.

6.1.3 Message Types The message types for BDSBAS-B2a are shown in Table 1.

6.1.4 Cyclic Redundancy Check Bit Under the condition that the bit error rate of all channels is no greater than 0.5, 24-bit CRC information can detect burst and random bit errors. Its false negative probability is no greater than 2^-24 ~ 5.96 x 10^-

8.The 24-bit CRC information (p1, p2,..., p24) utilizes the first bit of the message...

6.2 Message Coding and Modulation

6.2.1 Encoding and Modulation Process The 250-bit message sequence, after convolutional coding, is Manchester encoded at a rate of 500 symbols per second, and then... Modulated modulo-2 onto a 10230-bit PRN code, and finally processed using binary phase-shift keying (BPSK) at a rate of

10.23 megachips per second. The rate of (Mcps) is modulated onto the carrier. The BDSBAS-B2a message coding and modulation process is shown in Figure 3.

6.2.2 Convolutional Coding The original message data was broadcast at a rate of 250 bps, and 500 symbols were generated by a convolutional encoder with a constraint length of 7 and a code rate of 1/2. The convolutional code per second (sps) has the code generator polynomials G3 = "1111001" and G4 = "1011011", as shown in Figure 4.

6.2.3 Manchester Encoding The 500sps convolutional code, after Manchester encoding, generates "0" character pairs from the original "0" character and "1" character pairs from the "1" character, forming... The 500sps Manchester code, the encoding principle is shown in Figure 5.

6.2.4 PRN Code Generation The PRN codes for the three BDSBAS GEO satellites are 130, 143, and 144, respectively. The PRN code rate is

10.23 Mbps. The Gold code, with a code length of 10230 bits, is generated by modulo-2 summing of the XA and XB codes generated by two 13-stage linear feedback shift registers. The result is obtained through expansion.

6.2.5 Spread Spectrum Modulation The baseband signal representation of the BDSBAS-B2a enhancement signal before carrier modulation is shown in formula (5).

6.3.4 Message Type 34

6.3.4.1 Data Field Format Message type 34 is used to broadcast satellite DFRECI and DFREI information. The format of the 216-bit data field is shown in Table 6.

6.3.6 Message Type 36

6.3.6.1 Data Field Format Message type 36 is used to broadcast DFREI information; the format of the 216-bit data field is shown in Table 9.

6.3.6.2 Data Field Description Message type 36 can broadcast DFREI information from up to 39 satellites using 156 bits in the data field. 39 satellites constitute the message type. The satellites with a mask information of 1 in Type 31 correspond to the 54th to 92nd satellites.

6.3.7 Message Type 37

6.3.7.1 Data Field Format Message type 37 is used to broadcast the degradation parameters (OBAD) and DFREE mapping tables of various GNSS systems, in a 216-bit data field format. See Table 10.

6.3.8.2 Data Field Description The effective range of the SBAS satellite mask is 1 to

39.After adding an offset of 119, it corresponds to the SBAS satellite mask in message type 31. Both message type 39 and message type 40 contain a 2-bit IODG identifier, which is used for pairing message types 39 and 40. This ensures that message type 39 and message type 40 contain information from the same satellite at the same reference time, and that the IODG is updated each time. Add 1 (modulo 4). If the SBAS satellite correction information is broadcast via message type 32, then the IODN in message type 32 needs to be consistent with... IODG matching.