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**Information interface for BDS-3 regional short message
communication user terminal - Part 2: General data interface**

北斗三号区域短报文通信用户终端信息接口 第2部分:通用数据接口

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3 Terms, definitions and abbreviations

The terms defined in GB/T 2312-1980 and GB/T 39267 apply together with seven terms given here. An address (3.1.1) is the unique number that identifies an interacting party in the BDS-3 short message service, a note dividing addresses into intranet and extranet addresses. An intranet address (3.1.2) is the unique number that identifies a party inside the BDS-3 system, also called the user ID and covering the point cast, broadcast and multicast IDs. An extranet address (3.1.3) is the unique number that identifies an external user interacting with the BDS-3 system by point cast communication, a note listing mobile phone numbers, WeChat user numbers and Weibo numbers.

The GB code (3.1.4) is the first Chinese character encoding standard issued by China in 1980, a note giving its full name, its short name GB 2312, its 6 763 common characters and symbols, and its representation of each character by two bytes whose most significant bits are both zero. The zone-location code (3.1.5) is a four digit decimal number used to address a Chinese character library, the high two digits being the zone code and the low two the location code, each running from 01 to 94 and together forming a 94 by 94 matrix.

The compressed zone-location code (3.1.6) is the representation of the zone-location code by 14 bits in the space interface format of the BeiDou short message inbound and outbound service, the first 7 bits being the zone number and the last 7 the location number. The machine code (3.1.7) is the code of zeros and ones used inside a computer to store, process and transmit Chinese characters. The abbreviations of 3.2 are BDCS for the BeiDou coordinate system, RNSS for the radio navigation satellite service and UTC.

Clause 4 fixes the transmission protocol. The physical interface of the user terminal is the RS-232C standard interface, its electrical signal characteristics meeting Clause 2 of GB/T 6107-2000 and its serial data transmission standard meeting Clause 4 of GB/T 11014-1989; the user may choose the form of the physical connector, DB9, DB25 or another standard communication connector, according to the needs of the application. Data is sent serially and asynchronously, the first bit being the start bit, followed by the data bits and finally the stop bit, and the least significant bit is sent first. The parameters are a baud rate of 4 800 bit/s, 9 600 bit/s, 19 200 bit/s or 115 200 bit/s, settable as needed with 115 200 bit/s as the default; one start bit; eight data bits; one stop bit; and no parity.

5 Information format

5.1.1 The reserved character set is made up of the ASCII characters of Table 1, which has four columns and seven rows and gives the symbol, its hexadecimal value, its decimal value and its function: carriage return, hexadecimal 0D and decimal 13, the end of the sentence delimiter; line feed, 0A and 10; the dollar sign, 24 and 36, the start of the parameter sentence delimiter; the asterisk, 2A and 42, the checksum field delimiter; the comma, 2C and 44, the field delimiter; the backslash, 5C and 92, reserved; the tilde, 7E and 126, reserved; and the delete character, 7F and 127, reserved.

5.1.2 The valid character set comprises the ASCII characters from 0x20 to 0x7F; the upper bound of that range is the delete character, which Table 1 lists among the reserved characters, and both statements are translated here as printed. 5.1.3 ASCII characters defined neither as reserved nor as valid shall not be used at any time in any field other than the user data field. 5.1.4 Where individual characters are used to define units of measurement, to state the type of a data field or to state the type of a sentence, they shall be interpreted according to the notes in the sentence concerned.

5.2.1 A field is a string of valid characters between two appropriate delimiting characters.

5.2.2 Data fields are of character type and of numeric type. A data field in a sentence follows the delimiter comma, and its position in the sentence is determined by watching the field delimiter; at the receiving end the position is determined by counting the delimiters. A data field in a proprietary sentence contains only valid characters and the delimiter comma. Data fields may be of fixed length, of variable length, or fixed plus variable; a variable length field may be of character or of numeric type and contains one decimal point, and several zeros may stand at its beginning and at its end. In a fixed length data field, where the valid

data is not long enough, enough ASCII zero characters are added in front.

5.2.3 A checksum field shall be transmitted in every sentence. It is the last field of the sentence and follows the checksum delimiter asterisk. The checksum is the result of an exclusive OR over the eight bits of every character of the sentence, excluding the start and stop bits, all the characters meaning those between the delimiters dollar sign and asterisk but not those delimiters themselves, and including the commas. On transmission the high four bits and the low four bits of the hexadecimal value are converted into two ASCII characters from 0 to 9 and A to F, the most significant being sent first. An example is given of a sentence that sends a short message to a mobile number using the Lf2 frequency, once only, with inbound acknowledgement required, with the Chinese character encoding class and a communication length of 140 bits, the hexadecimal value 1A being the checksum computed over the characters between the two delimiters.

5.3.1 A sentence starts with the sentence start delimiter dollar sign and ends with carriage return and line feed. The first field is the address field, which holds the identifier of the sending end and the sentence format character; that format character fixes the number of data fields in the sentence, the type of data they hold and the order in which the data segments are sent. The rest of the sentence may be zero or more data segments. 5.3.2 A sentence that meets the format requirements is a valid sentence; a sentence of any other form is invalid and shall not be transmitted. Every interface sentence is made up of the dollar sign, a type identifier, a series of data fields separated by commas, the asterisk, the checksum, and carriage return and line feed.

Table 2 explains the standard sentence format in two columns and seven rows. The dollar sign, ASCII 0x24, is the start marker of the sentence. The type identifier distinguishes the kind and the function of the sentence and is a fixed width of five English characters, capitals being recommended, the first two forming a common header and the last three the type. The comma, ASCII 0x2C, separates the several fields of the sentence. Each sentence may hold several data fields separated by commas, and unless otherwise stated a data field may use only printable ASCII characters other than the reserved characters of Table 1; the position of a data field in a sentence is determined only through the comma delimiters, by counting them, and never by counting the total number of characters received from the start of the sentence. The asterisk is the checksum delimiter separating the data content from the checksum field. The checksum is the byte-wise exclusive OR of all the characters between the dollar sign and the asterisk, not counting those two symbols, its high four bits and low four bits being expressed as hexadecimal digits in ASCII from 0 to 9 and A to F with the high part first. Carriage return and line feed, ASCII 0x0D and 0x0A, mark the end of the sentence.

The common header of the type identifier shows the path characteristic of the sentence: CC means that the user is using a sentence of this data interface to make the terminal carry out an operation or a setting, and BD means that the BeiDou equipment is putting out over the

serial port the information it has received from the satellites, or its own status or attribute information. Data fields are of three basic types, fixed length, variable length and fixed plus variable length, and in a fixed length numeric field enough ASCII zero characters are added in front where the valid data is not long enough. Table 3 gives the data field types commonly used in the interface sentence definitions, and types not covered there are described where the sentence is described.

Table 3 has three columns and eleven rows, giving the data type, its symbol and its definition. The variable length number has both its integer and its fractional part of variable length, the decimal point and the fractional part being optional, and the field may express an integer. The fixed length number has a length equal to the number of symbol characters; where the value is negative the first character of the field is the sign, ASCII 0x2D, and the field grows by one character, while a positive value carries no sign and keeps its length. The variable length character field and the fixed length character field follow, the latter distinguishing capitals from lower case. The fixed length hexadecimal field and the variable length hexadecimal field are both written big endian. Latitude is a fixed plus variable field of degrees, minutes and a decimal fraction, the part left of the point being fixed at four digits of which the first two are degrees and the last two minutes, the digits after the point being minutes and of variable length, with leading zeros where the degrees or minutes are short and the point and fraction omitted where the value is whole; a navigation type terminal keeps four decimal places and a survey type terminal eight. Longitude follows the same scheme with five digits left of the point, three of degrees and two of minutes. Time appears in two forms, a fixed year, month and day field with leading zeros, and a fixed plus variable field of hours, minutes and seconds with six digits left of the point and a variable fraction of seconds. The status field is one character, A for affirmative, present or correct and V for negative, absent or wrong. The unit field is one capital letter, the common correspondences being M for metre, M for metre per second, K for kilometre and K for kilometre per hour, the same letters serving two units each as printed.

5.3.3 The interval between service input sentences shall meet the frequency limit set when the user registered; the time to send one complete sentence shall be not more than 1 s, and the serial communication rate should be set with the message length in mind. 5.4 The terminal shall be able to detect errors in the data transfer, namely checksum errors, invalid characters, an incorrect sending end identifier length, sentence format character or data field, and sentence transmission timeout; the terminal uses only correct sentences conforming to this document and discards erroneous ones.

6.1 List of sentences

The document defines sixteen sentences for emergency search and rescue, position reporting and message communication. By direction of the data flow the terminal data interface is divided into input and output sentences, listed in Table 4, which has four