BeiDou
Navigation Satellite System

BDS SSV Characteristics Update

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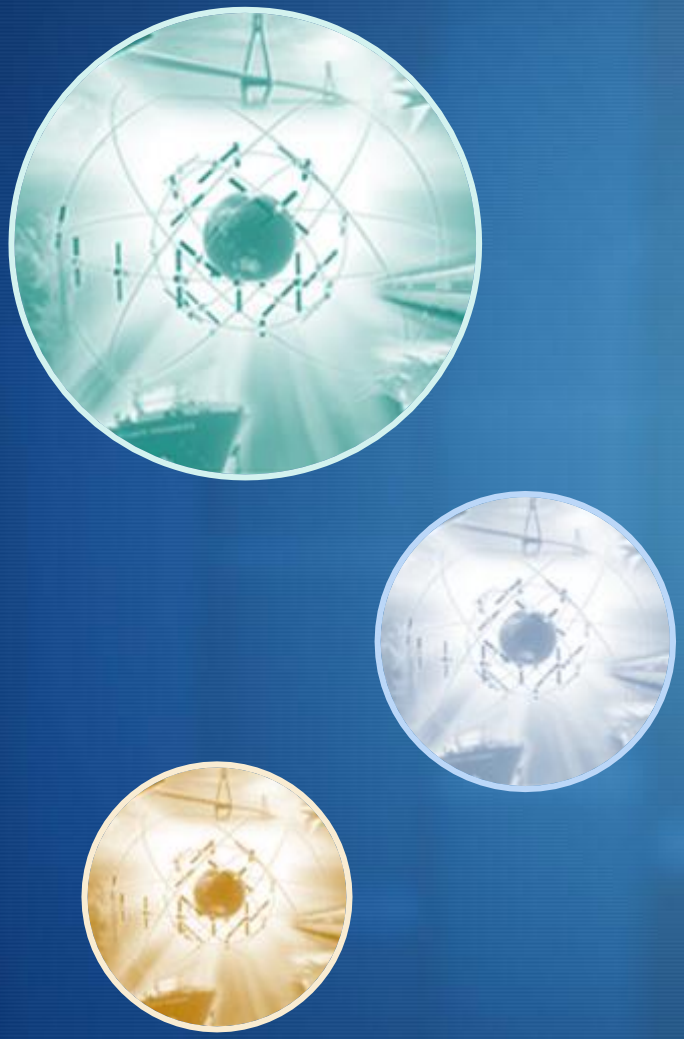

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Background

- Since ICG-10 a good working mechanism was formed on SSV in WG-B.It was based on solid and synergistic work in the SSV action group in the past 3 years and valuable input of SSV characteristics from all service providers.
- The interoperable GNSS SSV booklet is released in ICG-13.SSV performance presented in the booklet is assessed through simulation with configurations including GNSS constellations, reference off-boresite angles, transmitted signal power,etc.
- With the construction of BDS, some modifications were made to the configuration of GEO satellites and open service signals. These leads to updates on BDS SSV characteristics.
- Considering the booklet v1.0 is now published, in this presentation will provide the updated BDS SSV characteristics as references.

BDS Constellation

- The basic space constellation of BDS-2 (regional) consists of

5 GEO + 5 IGSO + 4 MEO

- The equatorial projections of the 5 GEO satellites are at 58.75° E, 80° E, 110.5° E, 140° E and 160° E
- The crossing longitudes of the 3 IGSO satellites locate at 118° E, and the other 2 locate at 95° E
- The 4 MEO satellites are in the 7th and 8th phases of the 1st orbital plane, and in the 3rd and 4th phases of the 2nd orbital plane (Walker 24/3/1)

- The basic space constellation of BDS-3 (global) consists of

3 GEO +3 IGSO +24MEO

- The equatorial projections of the 5 GEO satellites are at 80° E, 110.5° E, 140° E
- The crossing longitudes of the 3 IGSO satellites locate at 118° E
- 24 MEO satellites shape up into Walker 24/3/1
- According to actual situation, spare satellites may be deployed in orbit

BDS Open Service (OS) Signals

- BDS satellites transmit 5 types of OS signals:B1I, B1C,B2I, B2a and B3I.

ICD	Release Date
BDS SIS ICD OSS B1C V1.0	03/06/2018
BDS SIS ICD OSS B3I V1.0	09/02/2018
BDS SIS ICD OSS B2a V1.0	27/12/2017
BDS SIS ICD OSS (B1I & B2I) V2.1	07/12/2016

http://en.beidou.gov.cn/SYSTEMS/ICD/

- These 5 types of signals are not transmitted by all satellites of BDS for providing open services . The configuration shows as follows.

OS Signal	Center Frequency	Transmitted by
B1I	1561.098MHz	All satellites of BDS-2 & BDS-3
B1C	1575.42 MHz	MEO & IGSO satellites of BDS-3
B2I	1207.14MHz	All satellites of BDS-2 (will be gradually replaced)
B2a	1176.45 MHz	MEO & IGSO satellites of BDS-3
B3I	1268.52 MHz	All satellites of BDS-2 & BDS-3

BDS Antenna Parameters

- The antenna parameters provided in booklet v1.0 are characterized data from pre-flight ground test of BDS satellites.
- For MEO satellites launched after 2017, the reference off-boresite angles for SSV characterization are specified in system specifications.

SV	Launch Date
24th & 25th BDS Satellite	2017.11.5
26th & 27th BDS Satellite	2018.1.12
28th & 29th BDS Satellite	2018.2.12
30th & 31th BDS Satellite	2018.3.30
33th & 34th BDS Satellite	2018.7.29
35th & 36th BDS Satellite	2018.8.25
37th & 38th BDS Satellite	2018.9.19
39th & 40th BDS Satellite	2018.10.15

OS Signal	Reference Off-boresite Angle		
	MEO	GEO/IGSO	MEO Spec.
B1	25°	19°	23.5°
B2	28°	22°	23.5°
B3	28°	22°	23.5°

BDS SSV Characteristics

Parameters	Value			
User Range Error	0.5 meters			
Signal Center Frequency				
B1I(MEO/IGSO/GEO)	1561.098MHz			
B1C(MEO/IGSO)	1575.42 MHz			
B2a(MEO/IGSO)	1176.45MHZ			
B3I(MEO/IGSO/GEO)	1268.52MHZ			
Minimum Received Civilian Signal Power	0 dBi RCP antenna at GEO		Reference Off-Boresight Angle	
			Char.	Spec.
B1I, B1C (MEO)	-184.2 dBW		25 deg	23.5 deg
B1I (GEO/IGSO)	-185.9 dBW		19 deg	/
B2a (MEO)	-182.8 dBW		28 deg	23.5 deg
B3I (MEO)	-182.8 dBW		28 deg	23.5 deg
B3I (GEO/IGSO)	-184.4 dBW		22 deg	/
Signal Availability[1]				
Lower Space Service Volume (MEO) [2]	At least 1 signal		4 or more signals	
B1I	100%	100%	100%	100%
B1C	100%	100%	100%	100%
B2a	100%	100%	100%	100%
B3I	100%	100%	100%	100%
Upper Space Service Volume (GEO/HEO) [3]	At least 1 signal		4 or more signals	
B1I	97.2% [4]	93.5% [10]	19.6% [5]	14.8% [5]
B1C	96.1% [9]	90.9% [6]	5.2% [5]	2.4% [5]
B2a	99.9% [7]	90.9% [6]	19.0% [8]	2.4% [5]
B3I	99.9% [11]	94.1% [13]	40.7% [12]	19.8% [5]

Note 1: Signal Availability is evaluated by averaging of performance over the 8000km sphere for Lower Space Service Volume (MEO) and 36000km for Upper Space Service Volume (GEO/HEO)。

Note 2: The antenna for a user in the Lower Space Service Volume (MEO) is considered to be omni-directional.

Note 3: The antenna for a user in the Upper Space Service Volume (GEO/HEO) is considered to be NADIR pointing.

Note 4: Assumes less than 45 minutes of continuous outage time

Note 5: Partial region will be not visible for 4 signals

Note 6: Assumes less than 57 minutes of continuous outage time

Note 7: Assumes less than 7 minutes of continuous outage time

Note 8: Assumes less than 644 minutes of continuous outage time

Note 9: Assumes less than 45 minutes of continuous outage time

Note 10: Assumes less than 57 minutes of continuous outage time

Note 11: Assumes less than 7 minutes of continuous outage time

Note 12: Assumes less than 644 minutes of continuous outage time

Note 13: Assumes less than 57 minutes of continuous outage time

Summary

- The basic space constellation of BDS-3 (Global) consists of 24 MEO,3 IGSO and 3 GEO satellites.
- BDS-3 GEO satellites will not transmit B1C and B2a signals for open services.
- B1I and B3I signals will be transmitted by all BDS satellites.
- For the 24th and follow-up BDS MEO Satellites (a total of 16 SVs till Oct.2018), the reference off-boresite angles for SSV characterization are specified.
- BDS SSV characteristics are updated and the results are calculated by the same simulation method with SSV action group.
- BDS will keep on sharing updated information relating to SSV characteristics in ICG and also hope to see updates from other GNSSs.

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Thank you for your attention!

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