Number：CTSO-2C604a
Date of approval：
Approved by：

China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

BeiDou Navigation Satellite System (BDS) Airborne Equipment for Aircraft tracking only

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is applicable to the manufacturer of the Project Approval for application of CTSO authorization (CTSOA) for Airborne Equipment of The BeiDou Navigation Satellite System (BDS) based on the BeiDou III for aircraft tracking only. This CTSO specifies the minimum performance standards that BeiDou Navigation Satellite System (BDS) airborne equipment used solely for aircraft tracking only must meet in order to be approved and identified using the applicable CTSO markings.

2. Applicability.

This CTSO affects new application submitted after its effective date.

a. From the effective date of this CTSO, applicants who wish to

obtain the CTSOA of BeiDou Navigation Satellite System (BDS) airborne equipment for aircraft tracking only should submit applications in accordance with this CTSO.

b. As of the effective date of this CTSO, equipment that has received CTSOA under the previous version of CTSO may continue to be manufactured in accordance with the provisions at the time of approval.

c. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21R4.

3. Requirements

BeiDou navigation satellite system (BDS) airborne equipment for aircraft tracking only manufactured on or after the effective date of this CTSO and intended to be marked with this CTSO mark for aircraft tracking only shall meet the minimum performance standards specified in Appendix A to Appendix D of this CTSO to meet the equipment type requirements listed in Table 1. The classification of CTSO equipment depends on the service scope provided by the system and the BeiDou public service signal that can be received by the Radio Navigation Satellite Service (RNSS). Class R is a regional BDS airborne device that only supports regional services; Class G is a global BDS airborne device that only supports global services; Class RG is a regional and global BDS airborne device that supports both regional services and global services

Serve. I is the BDS airborne equipment that the RNSS can only receive the BeiDou public service signal as the B1I frequency signal. C is the BDS airborne equipment that the RNSS can only receive the BeiDou public service signal as the B1C frequency signal. IC is a BDS airborne device that RNSS can receive both the BeiDou public service signal is B1I frequency signal and can receive B1C frequency signal. Table 1 provides details of device categories.

Table 1. Category of BDS Equipment

Class	Equipment	Type	Range of application	Minimum performance standard
R	Regional type	RI	Only regional services and B1I frequency points are supported	Appendix A1、Appendix B、Appendix C1、AppendixD1
		RC	Only regional services and B1C frequency points are supported	Appendix A2、Appendix B、Appendix C1、AppendixD1
		RIC	Only regional services are supported, and B1I and B1C frequency points can be supported	Appendix A3、Appendix B、Appendix C1、AppendixD1
G	Global type	GI	Only global services and B1I frequency points are supported	Appendix A1、Appendix B、Appendix C2、AppendixD2
		GC	Only global services and B1C frequency points are supported	Appendix A2、Appendix B、Appendix C2、AppendixD2
		GIC	Only global services are supported, and B1I and B1C frequency points can be supported	Appendix A3、Appendix B、Appendix C2、AppendixD2
RG	Regional type + Global type	RGI	Support regional and global services, only support B1I frequency	Appendix A1、Appendix B、Appendix C3、AppendixD3
		RGC	Support regional and global services, only support B1C frequency	Appendix A2、Appendix B、Appendix C3、AppendixD3
		RGIC	Support regional and	Appendix A3、Appendix B、

Class	Equipment	Type	Range of application	Minimum performance standard
			global services, can support B1I and B1C frequency points	Appendix C3、AppendixD3

Note 1：For RG equipment, RSMC service is preferred in the closed area of $75^{+0.1}_{0}$ to $135^{0}_{-0.1}$ east longitude and $10^{+0.1}_{0}$ to $55^{0}_{-0.1}$ north latitude, and GSMC service is used beyond this range.

a. Functionality.

This CTSO's standard is applicable to the BDS airborne equipment that is expected to locate the aircraft in real time based on the BeiDou positioning function, periodically send the obtained aircraft identification number, position, speed, time and other parameters to the ground platform using the short message function, and only realize the aircraft tracking function. Aircraft parameters based on the output of the equipment shall not be displayed to the crew. Under normal circumstances, it can not be used as the basis for air traffic controllers to implement air control decisions.

The equipment includes Radio Navigation Satellite Service (RNSS) positioning unit and antenna, and a Radio Determination Satellite Service (RDSS) communication unit and antenna.

(1) RNSS Positioning unit and Antenna

The positioning unit shall be able to receive B1I and / or B1C BeiDou public service signals and provide aircraft identification number, position information (longitude, latitude and altitude), ground speed

information based on BDCS coordinate system and time information based on coordinated universal time (UTC).

(2) RDSS Communication unit and Antenna

According to the RDSS service protocol, the BeiDou short message communication function is realized, and data such as the location of the RNSS positioning unit are received and sent. The information sent includes at least position information (latitude, longitude and altitude) based on the BDCS coordinate system, ground speed information, time information based on Coordinated Universal Time (UTC), aircraft identification number, etc. The service frequency and communication level are controlled by corresponding parameters in the user information. The interval for reporting user information should not exceed 15 minutes.

Note：If relevant information based on WGS-84 coordinate system is adopted, the conversion function from BDCS coordinate system to WGS-84 coordinate system is required.

b. Failure Condition Classifications.

(1) For the function defined in Section 3.a of this CTSO, the failure of error report and loss of notification is the failure condition without safety impact.

(2) The loss of function defined in Section 3 of this CTSO is a failure condition without safety impact.

(3) The Design Assurance Level of the equipment shall at least

correspond to this failure condition classification.

c. Functional Qualification.

For the RNSS positioning antenna, the minimum performance standard requirements in Appendix A shall be met.

For the RNSS positioning unit, the minimum performance standards in Appendix B shall be met.

For the RDSS communication unit, the minimum performance standards in Appendix C shall be met.

For RDSS communication antenna, the minimum performance standard requirements in Appendix D shall be met.

Note: the equipment with integrated design of RNSS and RDSS shall also meet the requirements of the above standards.

d. Environmental Qualification.

The standard environmental conditions and test procedures applicable to the equipment shall be adopted according to the test conditions in Appendix A to Appendix D of this CTSO to prove that the performance of the equipment meets the requirements. Besides RTCA / DO-160G (2010.12.8), the applicant can adopt other standard environmental conditions and test procedures applicable to Beidou satellite navigation system (BDS) airborne equipment for aircraft tracking only.

e. Software Qualification.

If the equipment contains software, the software shall be developed in accordance with the requirements of RTCA/DO-178B(1992.12.1) or RTCA/DO-178C(2011.12.13), including applicable supplementary references. The design assurance level of the software shall be consistent with the failure condition classification defined in Section 3.b of this CTSO.

f. Electronic Hardware Qualification.

If the equipment contains complex electronic hardware, it shall be developed in accordance with the requirements of RTCA/DO-254 (2000.4.19). The design assurance level of hardware shall be consistent with the failure state category specified in Section 3.b of this CTSO. For the airborne electronic hardware determined as simple, it can be handled according to the requirements of Section 1.6 in RTCA/DO-254.

g. Deviations.

For using alternative or equivalent means of compliance to the criteria in this CTSO, the applicant must show that the equipment maintains an equivalent level of safety. Apply for a deviation under the provision of 21.368(a) in CCAR-21R4.

Note：Some performance requirements in Appendix A to Appendix D do not need to be tested under all conditions contained in RTCA/ DO-160G. If judgment and experience can show that these specific performance parameters are not vulnerable to environmental conditions,

and the performance levels specified in Appendix A to Appendix D will not be significantly reduced due to exposure to such special environmental conditions, such tests can be ignored.

4. Marking.

a. Mark at least one major component permanently and legibly with all the information in 21.423(b) of CCAR-21R4. The marking must include the serial number.

b. Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the CTSO number:

(1) Each component that is easily removable (without hand tools); and,

(2) Each subassembly of the article that manufacturer determined may be interchangeable.

c. If the article includes software and/or airborne electronic hardware, then the article part numbering scheme must identify the software and airborne electronic hardware configuration. The part numbering scheme can use separate, unique part numbers for software, hardware, and airborne electronic hardware.

d. The applicant may use electronic part marking to identify software or airborne electronic hardware components by embedding the identification within the hardware component itself (using software)

rather than marking it on the equipment nameplate. If electronic marking is used, it must be readily accessible without the use of special tools or equipment.

5. Application Data Requirements.

The applicant must furnish the responsible certification personnel with the related data to support design and production approval. The application data include a statement of conformance as specified in section 21.353(a)(1) in CCAR-21R4 and one copy each of the following technical data:

a. A Manual(s) containing the following:

(1) Operating instructions and equipment limitations sufficient to describe the equipment's operational capability.

(2) Describe in detail any deviations.

(3) Installation procedures and restrictions. Ensure that the equipment complies with the requirements of this CTSO after being installed according to this installation procedure. Restrictions must identify any special installation requirements and must also include the following declarations in comments：

" This article meets the minimum performance and quality control standards required by a CTSO. Installation of this article requires separate approval."

(4) For each unique configuration of software and airborne

electronic hardware, reference the following:

(i) Software part number including revision and design assurance level;

(ii) Airborne electronic hardware part number including revision and design assurance level;

(iii) Functional description.

(5) A summary of the test conditions used for environmental qualifications for each component of the article. For example, a form as described in RTCA/DO-160G, Environmental Conditions and Test Procedures for Airborne Equipment, Appendix A.

(6) Schematic drawings, wiring diagrams, and any other documentation necessary for installation of equipment.

(7) List the main parts of the equipment (including replaceable parts) by part number, such as antenna, transceiver or duplexer conforming to this CTSO standard. Cross indexing of supplier part numbers shall also be included if applicable. If the equipment can only meet the requirements in Appendices A to D of this CTSO when using some special parts, the installation requirements of this part (through part number) shall be included. If the equipment is installed with standard components that are only applicable to some single operating environment, they shall be included in the installation requirements as a limitation in the installation manual.

b. Continuous Airworthiness document, including the requirements for periodic maintenance, calibration and repair of equipment, so as to ensure the Continuous Airworthiness of equipment. If applicable, the recommended inspection interval and service life shall be included.

c. If the equipment includes software: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary.

d. If the equipment contains simple or complex electronic hardware, it shall also provide: Hardware certification plan (PHAC), hardware verification plan, top-level drawings and hardware completion summary (or similar documents, if applicable).

e. A drawing depicting how the article will be marked with the information required by paragraph 4 of this CTSO.

f. Identify functionality or performance contained in the article not evaluated under paragraph 3 of this CTSO (that is, non-CTSO functions). Non-CTSO functions are accepted in parallel with the CTSO authorization. For those non-CTSO functions to be accepted, the applicant must declare these functions and include the following information with CTSO application:

(1) Description of the non-CTSO function(s), such as performance specifications, failure condition classifications, software, hardware, and environmental qualification levels. Include a statement confirming that

the non-CTSO function(s) don't interfere with the article's compliance with the requirements of paragraph 3.

(2) Installation procedures and limitations sufficient to ensure that the non-CTSO function(s) meets the declared functions and performance specification(s) described in paragraph 5.f.(1).

(3) Instructions for continued performance applicable to the non-CTSO function(s) described in paragraph 5.f.(1).

(4) Interface requirements and applicable installation test procedures to ensure compliance with the performance data defined in paragraph 5.f.(1).

(5) Test plans, analysis and results, as appropriate, to verify that performance of the hosting CTSO article is not affected by the non-CTSO function(s).

(6) Test plans, analysis and results, as appropriate, to verify the function and performance of the non-CTSO function(s) as described in paragraph 5.f.(1).

g. The quality system description required by section 21.358 of CCAR-21R4, including functional test specifications. The quality system should ensure that it will detect any change to the approved design that could adversely affect compliance with the CTSO MPS, and reject the article accordingly.

h. Provide a description of the organization as required by 21.355 of

CCAR-21-R4.

i. Material and process specifications list.

j. List of all drawings and processes (including revision level) that define the article's design.

k. Manufacturer's CTSO qualification report showing results of testing accomplished according to paragraph 3.c of this CTSO.

6. Manufacturer Data Requirements.

Besides the data given directly to the authorities, have the following technical data available for review by the authorities:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this CTSO.

b. Equipment calibration procedures.

c. Schematic drawings.

d. Wiring diagrams.

e. Material and process specifications.

f. The results of the environmental qualification tests conducted according to paragraph 3.d of this CTSO.

g. If the equipment contains software, provide relevant documents specified in RTCA/DO-178B or RTCA/DO-178C, including all materials supporting the applicable objectives in Annex A of RTCA/DO-178B or RTCA/DO-178C.

h. If the article includes complex custom airborne electronic

hardware, the appropriate hardware life cycle data in combination with design assurance level, as defined in RTCA/DO-254, Appendix A, Table A-l. For simple custom airborne electronic hardware, the following data: test cases or procedures, test results, test coverage analysis, tool assessment and qualification data, and configuration management records, including problem reports.

i. If the article contains non-CTSO function(s), the applicant must also make available items 6.a through 6.h as they pertain to the non-CTSO function(s).

7. Furnished Data Requirements.

a. If furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy or technical data and information specified in paragraphs 5.a and 5.b of this CTSO, as well as the data necessary for the correct installation, approval, use and Continuous Airworthiness of the equipment.

b. If the article contains declared non-CTSO function(s), include one copy of the data in paragraphs 5.f.(1) through 5.f.(4).

8. Availability of Referenced Documents.

a. Order RTCA documents from:

Radio Technical Commission for Aeronautics, Inc.

1150 18th Street NW, Suite 910, Washington D.C. 20036

b. Copies of the BD file can be downloaded at :

www.beidou.gov.cn.

Appendix A

Minimum Performance Standards for RNSS Positioning Antenna Units

A1 RNSS B1I Frequency Positioning Antenna Requirements

A1.1RNSS B1I Frequency Passive Positioning Antenna Requirements

B1I passive antennas for airborne satellite positioning shall meet the requirements of chapter 2 of RTCA/DO-228 “Minimum Operational Performance Standards For Global Navigation Satellite System (GNSS) Airborne Antenna Equipment” (excluding 2.2.2, 2.3 and 2.4.3) and the following modifications.

1. Modify 2.1.2 to “The antenna shall perform its intended function(s), as defined by the manufacturer, and its proper use shall not create a hazard to other airspace users”.

2. Modify 2.1.3 to “All equipment shall comply with the relevant requirements of the Radio Commission of China”.

3. Modify the Note in 2.1.4 to “Compliance can be demonstrated through CCAR-25-R4 Appendix F”.

4. Change “The antenna shall operate over the minimum frequency range of 1575.42 MHz±10 MHz” in 2.2.1.1 to “BDS B1I operating frequency 1561.098MHz±2.046MHz”.

5. Considering the integrated design of BeiDou RNSS antenna and RDSS antenna in this CTSO, antenna gain is reduced by 2dB on the basis of

section 2.2.1.4 of RTCA/DO 228, namely:

0° ~5° elevation angle, -2dBic≥Gain≥-9.5dBic

5° ~10° elevation angle, 7dBic≥Gain≥-6.5dBic

10° ~15° elevation angle, 7dBic≥Gain≥-5dBic

Above 15° elevation angle, 7dBic≥Gain≥-4dBic

6. Change the working frequency in 2.4.1.9 to：

B1I Upper Band-edge Test Frequencies：1561.098MHz＋2.046MHz；

B1I Mid-Band Test Frequencies：1561.098MHz；

B1I Lower Band-edge Test Frequencies：1561.098MHz-2.046MHz.

7. The test frequency used by antenna in 2.4.2.3~2.4.2.6 described in 2.4.2.1 should be consistent with item 6.

8. Deleted 2.4.2.2 Requirements for GLONASS frequency.

A1.2 RNSS B1I Frequency Active Positioning Antenna Requirements

For active antennas for airborne satellite positioning, the requirements shall meet the requirements of chapter 2 of RTCA/DO-301 “Minimum Operational Performance Standards (MOPS) for Global Navigation Satellite System (GNSS) Airborne Active Antenna Equipment for theL1 Frequency Band” (excluding Section 2.3) and the following modifications.

1. Modify 2.1.2 to “The antenna shall perform its intended function(s), as defined by the manufacturer, and its proper use shall not create a hazard

to other airspace users".

2. Modify 2.1.3 to "All equipment shall comply with the relevant requirements of the Radio Commission of China".

3. Modify the Note in 2.1.4 to "Compliance can be demonstrated through CCAR-25-R4 Appendix F".

4. Change "The antenna unit shall operate over the minimum frequency range of 1575.42 MHz ± 10.23 MHz" in 2.2.1 to "BDS B1I operating frequency range of 1561.098MHz±2.046MHz".

5. Modify the output VSWR for antenna unit to "≤2.0" in 2.2.2.

6. Modify the antenna center frequency 1575.42MHz in relative radiation pattern of antenna unit in 2.2.3.1 to 1561.098MHz; Delete 0 degree index in the table "Relative Radiation Pattern versus Elevation Angle".

7. Change the passive device gain from 1575.42MHz to 1561.098MHz in 2.2.3.2, and for the gain above 5° elevation, decrease by 2 dBic on the basis of≥-5.5dBic, that is,≥-7.5dBic.

8. Increase the G/T value in 2.2.5: when the effective working frequency is 1561.098 MHz ± 2.046MHz, the G/T value in all directions of 5° elevation Angle is ≥-33.6dB/K.

9. 2.2.6.1 Minimum Boresight Total Transducer Gain. Modify the measurement frequency of gain to 1561.098MHz± 2.046MHz.

10. 2.2.6.2 Gain of active sub-assembly, modified gain frequency is 1561.098MHz±2.046MHz, ≥26.5dB in bandwidth.

11. 2.2.6.3 Boresight Transducer Gain Compression Point, change (-25dBm, 1557MHz~1593MHz) to (-25dBm, 1551MHz~1593MHz), and modify figure 2-2 accordingly. At this time, the signal frequency should be 1561.098MHz. Delete “between 1000 MHZ and 1315MHz, the minimum value should be +23dBm”.

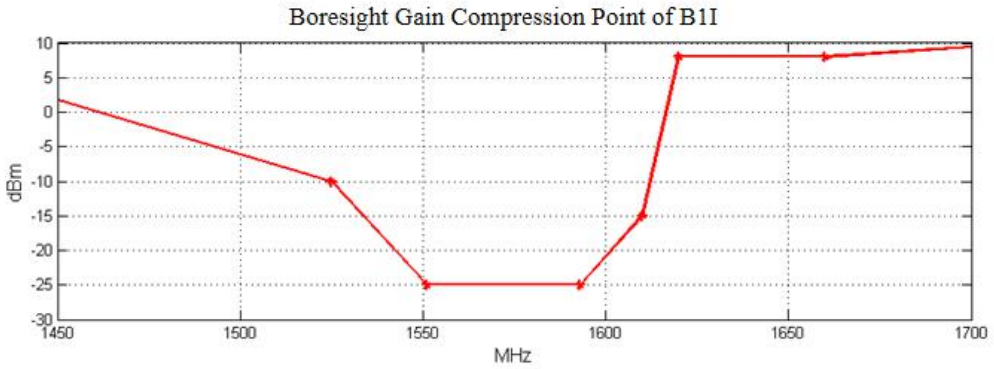

Figure 2-2 Minimum Input 1 dB Gain Compression Point vs. Frequency

12. 2.2.8 Boresight Relative Gain Frequency Response, “1575.42MHz± 7.5mhz” is changed to “1561.098 MHz±2.046MHz”.

13. 2.2.8.1 The response frequency related to -3dB should be increased to 1561.098MHz, that is, the low frequency should not be higher than 1559.052MHz, and the high frequency of the gain point of -3dB should not be lower than 1563.144MHz.

14. 2.2.8.2 Maximum Boresight Relative Frequency Response is modified as follows, and corresponding modifications are made to Figure 2-3：

Frequency (MHz)	Relative Response (dB)
1315≤f≤1504.42	-50dB

1504.42≤f≤1552.42	Linearly increasing from -50 dB to 0 dB
1552.42≤f≤1591.92	0dB
1591.92≤f≤1605.42	Linearly decreasing to -25.35 dB
1605.42≤f≤1625.42	inearly decreasing from -25.35 dB to -50 dB
1625.42≤f≤2000	-50dB

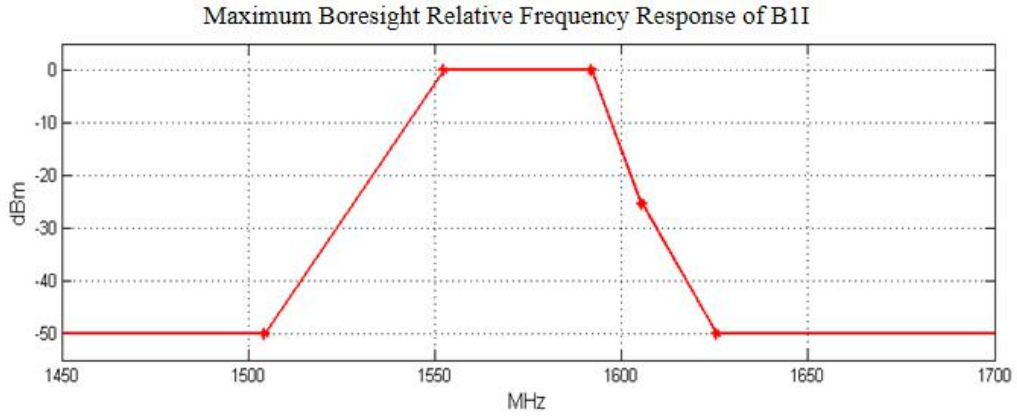

Figure 2-2 Maximum Boresight Relative Frequency Response

15. 2.2.11.1 The delay center frequency of t Boresight Differential Group Delay is modified as fc=1561.098MHz， $f_{c-2.046MHz} \leq f_1, f_2 \leq f_{c+2.046MHz}$。

16. Delete the Group Delay Versus Aspect Angle requirements in 2.2.11.2.

17. Deleted the requirements for DC power interface in 2.2.12.

18. Change "Perform at minimum 17 frequencies" to "Perform at minimum 5 frequencies" in 2.4.1.9;

The test frequency is modified as follows:

“The Lower Band-edge is 1557.098MHz

GPS Mid-Band is 1561.098MHz

Upper Band-edge is 1565.098MHz

...

All other measurements shall be performed within the minimum operating frequency range of 1561.098MHz±2.046MHz.”

19. Modify the frequency range of 1565.42MHz~1585.42MHz in 2.4.2.1 to the working frequency of 1561.09 MHz ± 2.046 MHz for BeiDou B1I.

20. Change “L1 center Frequency 1575.42MHz” in 2.4.2.2.1 to “B1I Center Frequency 1561.098MHz”.

21. Change “L1 center Frequency 1575.42MHz” in 2.4.2.2.2 to “B1I Center Frequency 1561.098MHz”.

22. Change 1575.42MHz±8MHz in 2.4.2.2.3 to 1561.098MHz± 2.046MHz.

23. Change 1575.42MHz±8MHz in 2.4.2.2.5 to 1561.098MHz± 2.046MHz.

24. Delete "2.2.11.2" from "Insert the delay values in the appropriate limit formula in Section 2.2.11 and verify that the requirements of Sub-sections 2.2.11.1 and 2.2.11.2 are met." in 2.4.2.2.6.

25. Change 1575.42MHz in 2.4.2.3 to 1561.098MHz.

26. Change DO-160E in 2.4.2.6 to DO-160G.

27. 2.4.2.6.1 Boresight Gain Compression Point and Test, delete Test 1 in Table 2-5. Change 1575.42MHz to 1561.098MHz.

28. 2.4.2.6.2 Pulse Saturation Recovery Time Test, change 1575.42MHz to 1561.098MHz.

29. Change 1559.42MHz~1591.42MHz in 2.4.3.1.1 to 1557.098MHz ~ 1565.098MHz.

30. Change 1575.42 MHz±16MHz in 2.4.3.1.2 to 1561.098 MHz±4MHz; Change 1567.42MHz~1583.42MHz in 2.4.3.1.2 to 1559.098MHz ~ 1563.098MHz.

31. Change 1575.42MHz±2MHz in 2.4.3.2.1 to 1561.098MHz± 2.046MHz. Removed relevant tests for the 1575.42mhz±8MHz frequency range.

32. Change 1575.42MHz±16MHz in 2.4.3.2.2 to 1561.098MHz± 4MHz.

33. Change 1575.42MHz in 2.4.3.3 to 1561.098MHz; Change 1565.42MHz in 2.4.3.3 to 1559.052MHz; Change 1585.42MHz in 2.4.3.3 to 1563.144MHz.

A2 RNSS B1C Frequency Positioning Antenna Requirements

A2.1 RNSS B1C Frequency Passive Positioning Antenna Requirements

B1C passive antennas for airborne satellite positioning shall meet the requirements of chapter 2 of RTCA/DO-228 “Minimum Operational Performance Standards For Global Navigation Satellite System (GNSS) Airborne Antenna Equipment” (excluding 2.2.2, 2.3 and 2.4.3) and the following modifications.

1. Modify 2.1.2 to “The antenna shall perform its intended function(s), as defined by the manufacturer, and its proper use shall not create a hazard to other airspace users”.

2. Modify 2.1.3 to “All equipment shall comply with the relevant requirements of the Radio Commission of China”.

3. Modify the Note in 2.1.4 to “Compliance can be demonstrated through CCAR-25-R4 Appendix F”.

4. Considering the integrated design of BeiDou RNSS antenna and RDSS antenna in this CTSO, antenna gain is reduced by 2dB on the basis of section 2.2.1.4 of RTCA/DO 228, namely:

0° ~5° Elevation angle, -2dBic≥Gain≥-9.5dBic

5° ~10° elevation angle, 7dBic≥Gain≥-6.5dBic

10° ~15° elevation angle, 7dBic≥Gain≥-5dBic

Above 15° elevation angle, 7dBic≥Gain≥-4dBic

5. Delete the GLONASS frequency requirement in 2.4.2.2.

A2.2 RNSS B1C Frequency Active Positioning Antenna Requirements

B1C active antennas for airborne satellite positioning should meet the requirements of Chapter 2 of RTCA/DO-301 “Minimum Operational Performance Standards (MOPS) for Global Navigation Satellite System (GNSS) Airborne Active Antenna Equipment for theL1 Frequency Band” (excluding Section 2.3) and the following modifications.

1. Modify 2.1.2 to “The antenna shall perform its intended function(s), as defined by the manufacturer, and its proper use shall not create a hazard to other airspace users”.

2. Modify 2.1.3 to “All equipment shall comply with the relevant requirements of the Radio Commission of China”.

3. Modify the Note in 2.1.4 to “Compliance can be demonstrated through CCAR-25-R4 Appendix F”.

4. Modify the output VSWR for antenna unit to “≤2.0” in 2.2.2.

5. 2.2.3.1Antenna Unit Relative Radiation Pattern, Delete 0 degree index in the table “Relative Radiation Pattern versus Elevation Angle”.

6. 2.2.3.2 passive device gain, for the gain above 5° elevation, decrease by 2 dBic on the basis of≥-5.5dBic, that is,≥-7.5dBic.

7. 2.2.5 G/T Ratio, “The active antenna unit G/T ratio at 5 degrees elevation shall be not less than -32.6 dB/K” was changed to “The active

antenna unit G/T ratio at 5 degrees elevation shall be not less than -33.6 dB/K”; Delete “Over the frequency range 1575.42 ± 2 MHz, the 5 degree elevation G/T ratio shall not be less that -31.6 dB/K over all azimuth angles and over the full environmental temperature range”.

8. 2.2.6.1 Minimum Boresight Total Transducer Gain. Modify the measurement frequency of gain to 1575.42MHz±7.5MHz.

9. 2.2.6.2 Gain of active sub-assembly, modified gain frequency is 1575.42MHz±7.5MHz, ≥26.5dB in bandwidth.

10. 2.2.6.3 Boresight Transducer Gain Compression Point, Delete “between 1000 MHZ and 1315MHz, the minimum value should be +23dBm”.

11. Delete the Group Delay Versus Aspect Angle requirements in 2.2.11.2.

12. Deleted the requirements for DC power interface in 2.2.12.

13. Change "Perform at minimum 17 frequencies" to "Perform at minimum 9 frequencies" in 2.4.1.9.

14. Delete "2.2.11.2" from "Insert the delay values in the appropriate limit formula in Section 2.2.11 and verify that the requirements of Sub-sections 2.2.11.1 and 2.2.11.2 are met." in 2.4.2.2.6.

15. Change DO-160E in 2.4.2.6 to DO-160G.

16. 2.4.2.6.1 Boresight Gain Compression Point and Test, delete Test 1 in Table 2-5.

17. Change 1575.42MHz±2MHz in 2.4.3.2.1 to 1575.42MHz± 7.5MHz.

A3 RNSS B1I and B1C Frequency Positioning Antenna Requirements

A3.1 RNSS B1I and B1C Frequency Passive Positioning Antenna Requirements

B1I and B1C passive antennas for airborne satellite positioning function shall meet the requirements of B1I passive antenna (Appendix A1.1) and B1C passive antenna (Appendix A2.1) respectively.

A3.2 RNSS B1I and B1C Frequency Active Positioning Antenna Requirements

For airborne satellite positioning functions, B1I and B1C active antennas shall meet the requirements of B1I active antennas (Appendix A1.2) and B1C active antennas (Appendix A2.2) respectively, as well as the following modifications:

1. 2.2.6.3 Boresight Transducer Gain Compression Point shall meet the requirements of B1I (Appendix A1.2).
2. 2.2.8.2 Maximum Boresight Relative Frequency Response shall meet the requirements of B1I (Appendix A1.2).

Appendix B Minimum Performance Standard for RNSS Positioning Units

The positioning unit of the RNSS shall meet the relevant requirements in sections 4.1 to 4.4 and 5.1 to 5.6 of BD420011-2015 “General specification for BeiDou/Global Navigation Satellite Systems(GNSS) positioning devices” and the following changes. The "test method" in sections 5.1 to 5.6 is not the only method of compliance, and other alternative methods may be used for testing if the applicant can demonstrate an equivalent test method. At this point, Sections 5.1 to 5.6 will serve as the basis for assessing the acceptability of alternative methods.

1. Increased airworthiness requirements. The design and manufacture of the equipment does not affect the airworthiness of the aircraft.

2. Added expected functional requirements. Equipment shall perform the intended function as specified by this MOPS and the manufacturer.

3. Added requirement “Flame Retardant. All materials used shall be flame retardant, except for small parts that do not significantly contribute to the spread of fire (eg handles, fasteners, seals, gaskets, small electrical components, etc.)”

4. Add the requirement "design the interface with other aircraft equipment to ensure that the normal or abnormal operation of BDS airborne equipment will not have an adverse impact on the operation of other

equipment. On the contrary, the normal or abnormal operation of other equipment shall not have an adverse impact on BDS airborne equipment, unless expressly permitted.

Note： It is assumed that the equipment is installed correctly, and the equipment connected with it is fully designed and installed correctly."

5. Add requirement "Test Impact. Unless explicitly permitted in this MOPS, the equipment shall be designed so that the specified test procedures do not adversely affect the performance of the equipment."

6. Delete section 4.1.2.

7. Delete "b) Communication Unit" in Section 4.2.1.

8. Delete "words, graphics and signs" in 4.2.3 and "nameplate" in 4.2.4. Relevant contents shall meet the requirements of this CTSO.

9. Modify Section 4.3.1 and delete "the output format of positioning data shall comply with BD410004-2015".

10. Delete 4.3.2 Communication.

11. Delete 4.3.3 Data Store.

12. Delete 4.3.4 Output.

13. Delete sections 4.4.1 and 4.4.2.

14. Modify Section 4.4.6.1 by changing "-137dbm" to "-133dbm".

15. Modify section 4.4.6.2 by changing "-142dbm" to "-135dbm".

16. Modify section 4.4.6.3 by changing "-147dbm" to "-138dbm".

17. Modify 4.4.6.4, and change the dynamic performance requirement to

“Under the operation condition of 340m/s speed and 4g acceleration...” Added height range：-500m to 13000m.

18. Delete 5.1 Test Environment. Comply with RTCA DO-160G requirements.

19. Delete 5.4.2, 5.5.2, 5.5.3 and 5.5.4.

20. Delete 5.6.1, 5.6.2, 5.6.3, 5.6.4 and 5.6.5. Relevant content should meet the requirements of RTCA DO-160G.

21. Modify 5.6.6.2 and delete “the actual navigation satellite signal can also be used to test the dynamic positioning accuracy as required. See Appendix B for the specific test method.” Modify the carrier motion trajectory “a)...” and “b)...” in the original text as follows：

a) Run a fixed equipment under test in a straight line for 2min at a speed of 340m/s, and then reduce the speed to 0 at an acceleration of 4G along the same straight line.

b) Move a fixed equipment under test in a horizontal circular motion with a height of -480m±20m, a speed of 340m/s and a radius of 3000m for 5min.

c) Move a fixed equipment under test in a horizontal circular motion with a height of 12980m±20m, a speed of 340m/s and a radius of 3000m for 5min.

22. Modify 5.6.6.3 by adding a row to Table 13, namely row 4：

Serial number	Maximum speed (m/s)	Maximum acceleration(m/s^2)

4	340	39.2

23. According to dynamic performance requirements, modify “Design GNSS simulator to simulate user track of linear motion with speed of 2m/s” in 5.6.7, 5.6.8 and 5.6.9, and change “linear motion of 2m/s” to “horizontal circular motion of 340m/s with radius of 3000m”.

24. 5.6.9 "Sensitivity" test shall be modified as follows according to the modification requirements in Clauses 7, 8 and 9 above.

5.6.9.1 Capture Sensitivity

Test with GNSS simulator, set the simulation speed of GNSS simulator to 340m/s and the horizontal circular motion user track with radius of 3000m. Set the signal level of each channel of each satellite output by GNSS simulator every time, starting from the state that the equipment cannot capture the signal, and increase in steps of 1dB. If the capture sensitivity value declared in the technical document of the tested equipment is lower than -133dBm, it can start from the level value 2dB lower than the declared sensitivity value.

Under each level value of GNSS simulator output signal, the tested equipment starts up in the cold start state. If it can capture the navigation signal within 300s and output the positioning data with three-dimensional positioning error less than 100m for 10 consecutive times at the update rate of 1Hz, record the level value, which shall not be higher than -133dBm.

5.6.9.2 Recapture Sensitivity

Test with GNSS simulator, set the simulation speed of GNSS simulator to 340m/s and the horizontal circular motion user track with radius of 3000m. Each time the signal level of each channel of each satellite output by GNSS simulator is set, it starts from the quantity value that the equipment cannot capture the signal. If the technical document of the tested equipment states that the quantity value of recapture sensitivity is lower than -135dBm, it can start from the level value 2dB lower than the declared sensitivity value. Under each set level value of the output signal of GNSS simulator, after the tested equipment is positioned normally (at this time, in order to enable the navigation to locate normally, the higher locatable level can be output first), control the GNSS simulator to interrupt the satellite signal for 30s and then restore to the set level value. If the tested equipment can capture the navigation signal within 300s after the signal is restored, And output the positioning data with three-dimensional positioning error less than 100m for 10 consecutive times at the update rate of 1Hz, and record the setting level value, which shall not be higher than -135dBm.

5.6.9.3 Tracking Sensitivity

Test with GNSS simulator, set the simulation speed of GNSS simulator to 340m/s and the horizontal circular motion user track with radius of 3000m. Under the condition of normal positioning of the

equipment, set the signal level of each channel of each satellite output by GNSS simulator to decrease in 1dB steps. Under each level value of GNSS simulator output signal, test whether the tested equipment can output positioning data with three-dimensional positioning error less than 100m for 10 times in 300s, and find out the lowest level value that can make the tested equipment meet the positioning requirements, which shall not be higher than -138dBm.

25. Delete 5.6.10 “dynamic performance test”, and the test of dynamic performance has been combined in 5.6.6.2 “dynamic positioning accuracy” and 5.6.6.3 “speed measurement accuracy”.

26. According to the dynamic performance requirements, the “design GNSS simulator to simulate the user track of linear motion with speed of 2.5m/s±0.5m/s” in 5.6.11 is modified, and the “linear motion of 2.5m/s±0.5m/s” is modified to “horizontal circular motion with speed of 340m/s and radius of 3000m”. 5.6.11 replace “shall meet the requirements of 4.4.8” with “shall meet the requirements of 4.4.7”.

27. In 5.6.12, “shall meet the requirements of 4.4.9” is changed to “shall meet the requirements of 4.4.8”.

Appendix C Minimum Performance Standard of RDSS Communication Unit

C1 Minimum Performance Standard for RSMC Service of RDSS Communication Unit

The RSMC service of RDSS communication unit shall meet the requirements in Chapters 4 and 5 of BD420007-2015 “Performance requirements and test methods for BDS RDSS unit” and the following changes. Chapter 5 “Test Methods” is not the only compliance method. If the applicant can show an equivalent test method, other alternative methods can be used for testing. At this time, the contents of Chapter 5 will be used as the basis for evaluating the acceptability of alternative methods.

1. Add airworthiness requirements. The design and manufacture of the equipment does not affect the airworthiness of the aircraft.

2. Add expected functional requirements. Equipment shall perform the intended function as specified by this MOPS and the manufacturer.

3. Add requirement “Flame Retardant. All materials used shall be flame retardant, except for small parts that do not significantly contribute to the spread of fire (eg handles, fasteners, seals, gaskets, small electrical components, etc.)”

4. Add the requirement "design the interface with other aircraft equipment to ensure that the normal or abnormal operation of BDS airborne

equipment will not have an adverse impact on the operation of other equipment. On the contrary, the normal or abnormal operation of other equipment shall not have an adverse impact on BDS airborne equipment, unless expressly permitted.

Note： It is assumed that the equipment is installed correctly, and the equipment connected with it is fully designed and installed correctly."

5. Add requirement "Test Impact. Unless explicitly permitted in this MOPS, the equipment shall be designed so that the specified test procedures do not adversely affect the performance of the equipment."

6. The text of "RDSS unit structure of BeiDou" in Figure 1 in 4.1 is incorrect and modified to "receiving and transmitting channel".

7. Add the requirement of "Identification. RDSS unit of BeiDou needs to use physical identification method to correctly identify the serial number of BeiDou Ⅲ short message user terminal."

8. Modify 4.2.4 "a) Beidou RDSS unit shall have at least one input / output data interface, and the input / output format shall comply with the provisions of positioning unit", and delete the content of "d)".

9. Delete 4.2.5 and the relevant contents shall comply with the requirements of RTCA DO-160G.

10. 4.3.1 Self-test and initialization function, revise "b) after BeiDou RDSS unit starts up or re captures satellite signals, automatically or manually (set by the user) send a query application in a specific format as

required to query unreceived information" to "b) after BeiDou RDSS unit starts up or satellite signals are recovered, it can track satellite signals".

11. Delete "inhibit state" in 4.3.2 state detection function.

12. Modify 4.3.3 to "BeiDou RDSS unit registered for network access can provide short message communication function".

13. Delete 4.3.4 "Permanently close the response function", 4.3.5 "Suppress the response function", 4.3.6 "Service frequency control function", 4.3.7 "Communication level control function", 4.3.8 "System RDSS integrity information receiving and processing functions", 4.3.9 "User terminal two-way equipment delay correction function".

14. Revise 4.4.1 as "receiving sensitivity (azimuth 0°~360°, elevation 60°~90°, bit error rate no more than 1×10^{-5}) 24kbps of special section shall not be greater than -153.8dBw."

15. Revise 4.4.2 to "the number of receiving channels of BeiDou RDSS unit shall not be less than 8".

16. Delete 4.4.3 "First capture time", Delete 4.4.4 "recapture time", 4.4.5 "any two channel TDOA measurement error", 4.4.6 "timing accuracy", 4.4.7 "time synchronization error of transmitted signal", 4.4.8 "output power of power amplifier" and 4.4.9 "carrier phase modulation deviation of transmitted signal".

17. Modify 4.4.12 power consumption to "the power consumption performance index of RDSS unit shall meet the installation requirements,

and the specific value shall be specified in the product specification".

18. Delete 4.5 "security".

19. Delete 5.1 test conditions. It shall comply with relevant requirements of RTCA/DO-160G.

20. Modify 5.3.3 to "b) check whether BeiDou RDSS unit normally completes the function of short message communication in the actual environment", and delete the requirement of "c)".

21. Delete 5.3.4 "power test".

22. 5.4.1 self test and initialization function test , "b) under the actual satellite signal, the data port of BeiDou RDSS unit is connected with the computer, set it to the shutdown state, set another terminal device to send message communication to it, and check whether the message communication sent by the terminal is received after startup" is changed to "b) connect the data port of BeiDou RDSS unit with the computer, confirm that the satellite signal broadcasting is normal, and check that BeiDou RDSS unit can track the satellite signal after power on".

23. 5.4.3 RDSS service function test is changed to "under the actual satellite signal, the data port of Beidou RDSS unit is connected with the computer, and RDSS service application is made according to the requirements of 4.3.3. Class R equipment is only completed through GEO satellite to check whether all functions are normal".

24. Delete 5.4.4 "permanent shutdown response function test", 5.4.5

“suppression response function test”, 5.4.6 “service frequency control function test”, 5.4.7 “communication level control function test”, 5.4.8 “system RDSS integrity information receiving and processing function test”, 5.4.9 “user terminal two-way equipment delay correction function test”.

25. The content in 5.5.1 Receiving Sensitivity Test is changed to “Connect the BeiDou RDSS unit with the analog signal source, and the analog signal source broadcasts the satellite analog signal of s-frequency point (the signal power to the antenna interface meets the requirements of 4.4.1). The rate of the special section is 24kbps, and the test times are 4 times according to the elevation angles of 60°,70°,80°and 90°. The prototype receives test signals at different elevation angles. The sum of messages collected in a single test is 106. Compare the outbound information received by BeiDou RDSS unit with the original information broadcast by the signal source to count the bit error rate, which shall meet the requirements of 4.4.1. S carrier level shall be set to -153.8dBw”.

26. 5.5.2 for the test of the number of receiving channels, change "the test system sends positioning and communication data to the unit under test through 10 beams, the power of the test signal reaching the antenna port surface of the prototype is - 127dbm, and the antenna elevation angle is 50 °" to "the test system broadcasts 8 beam signals, the power of the test signal reaching the antenna port surface of the unit under test is -

153.8dbw, and the antenna elevation angle is 60° "

27.Delete 5.5.3 “first acquisition time test”, 5.5.4 “recapture time test”, 5.5.5 “Any two-channel time difference measurement error test”, 5.5.6 “timing accuracy”, 5.5.7 “transmission signal time synchronization error test”, 5.5.8 “power amplifier output power test”, 5.5.9 “transmission signal carrier phase modulation deviation test”, 5.5.10 “frequency accuracy test of transmitted signal”.

28. Delete 5.6 "Security Testing".

C2 Minimum Performance Standard for GSMC Service of RDSS Communication Unit

The GSMC service of RDSS communication unit shall meet the requirements in Chapters 4 and 5 of BD420007-2015 “Performance requirements and test methods for BDS RDSS unit” and the following changes. Chapter 5 “Test Methods” is not the only compliance method. If the applicant can show an equivalent test method, other alternative methods can be used for testing. At this time, the contents of Chapter 5 will be used as the basis for evaluating the acceptability of alternative methods.

1. Add airworthiness requirements. The design and manufacture of the equipment does not affect the airworthiness of the aircraft.

2. Add expected functional requirements. Equipment shall perform the intended function as specified by this MOPS and the manufacturer.

3. Add requirement “Flame Retardant. All materials used shall be flame retardant, except for small parts that do not significantly contribute to the spread of fire (eg handles, fasteners, seals, gaskets, small electrical components, etc.)”

4. Add the requirement "design the interface with other aircraft equipment to ensure that the normal or abnormal operation of BDS airborne equipment will not have an adverse impact on the operation of other equipment. On the contrary, the normal or abnormal operation of other

equipment shall not have an adverse impact on BDS airborne equipment, unless expressly permitted.

Note： It is assumed that the equipment is installed correctly, and the equipment connected with it is fully designed and installed correctly."

5. Add requirement "Test Impact. Unless explicitly permitted in this MOPS, the equipment shall be designed so that the specified test procedures do not adversely affect the performance of the equipment."

6. In 4.1, the text of the BeiDou RDSS unit structure diagram in Figure 1 is changed to "Receive and Transmit Channel".

7. Add the requirement of "Identification. BeiDou RDSS unit needs to use physical identification method to correctly identify the serial number of BeiDou Ⅲ short message user terminal."

8. Modify 4.2.4 "a) Beidou RDSS unit shall have at least one input / output data interface, and the input / output format shall comply with the provisions of positioning unit", and delete the content of "d)".

9. Delete 4.2.5 and the relevant contents shall comply with the requirements of RTCA DO-160G.

10. 4.3.1 Self-test and initialization function, revise "b) after BeiDou RDSS unit starts up or re captures satellite signals, automatically or manually (set by the user) send a query application in a specific format as required to query unreceived information" to "b) after BeiDou RDSS unit starts up or satellite signals are recovered, it can track satellite signals".

11. Delete “inhibit state” in 4.3.2 state detection function.

12. Modify 4.3.3 to “BeiDou RDSS unit registered for network access can provide short message communication function”.

13. Delete 4.3.4 “Permanently close the response function”, 4.3.5 “Suppress the response function”, 4.3.6 “Service frequency control function”, 4.3.7 “Communication level control function”, 4.3.8 “System RDSS integrity information receiving and processing functions”, 4.3.9 “User terminal two-way equipment delay correction function”.

14. Revise 4.4.1 as “receiving sensitivity (azimuth 0°~360°, elevation 60°~90°, bit error rate no more than 1×10^{-5}) shall not be greater than -159.8dBw.”

15. Revise 4.4.2 to “the number of receiving channels of BeiDou RDSS unit shall not be less than 12”.

16. Delete 4.4.3 “First capture time”, Delete 4.4.4 “recapture time”, 4.4.5 “any two channel TDOA measurement error”, 4.4.6 “timing accuracy”, 4.4.7 “time synchronization error of transmitted signal”, 4.4.8 “output power of power amplifier” and 4.4.9 “carrier phase modulation deviation of transmitted signal”, 4.4.10 “Transmitted Signal Frequency Accuracy”.

17. Modify 4.4.12 power consumption to “the power consumption performance index of RDSS unit shall meet the installation requirements, and the specific value shall be specified in the product specification”.

18. Delete 4.5 “security”.

19. Delete 5.1 test conditions. It shall comply with relevant requirements of RTCA/DO-160G.

20. Modify 5.3.3 to “b) check whether BeiDou RDSS unit normally completes the function of short message communication in the actual environment”, and delete the requirement of “c)”.

21. Delete 5.3.4 “power test”.

22. 5.4.1 self test and initialization function test , “b) under the actual satellite signal, the data port of BeiDou RDSS unit is connected with the computer, set it to the shutdown state, set another terminal device to send message communication to it, and check whether the message communication sent by the terminal is received after startup” is changed to “b) connect the data port of BeiDou RDSS unit with the computer, confirm that the satellite signal broadcasting is normal, and check that BeiDou RDSS unit can track the satellite signal after power on”.

23. 5.4.3 RDSS service function test is changed to “under the actual satellite signal, the data port of Beidou RDSS unit is connected with the computer, and RDSS service application is made according to the requirements of 4.3.3. Class G equipment is only completed through GEO satellite to check whether all functions are normal”.

24. Delete 5.4.4 “permanent shutdown response function test”, 5.4.5 “suppression response function test”, 5.4.6 “service frequency control function test”, 5.4.7 “communication level control function test”, 5.4.8

“system RDSS integrity information receiving and processing function test”, 5.4.9 “user terminal two-way equipment delay correction function test”.

25. The content in 5.5.1 Receiving Sensitivity Test is changed to “Connect the BeiDou RDSS unit with the analog signal source, and the analog signal source broadcasts the B2b frequency point satellite analog signal (the signal power to the entrance of the antenna active component meets the requirements of C.4.4.1), and the test elevation is 90 °. The sum of messages collected in a single test is 10^6. Compare the outbound information received by BeiDou RDSS unit with the original information broadcast by the signal source to count the bit error rate, which shall meet the requirements of C.4.4.1. B2b carrier level shall be set to -159.8dBw”.

26. 5.5.2 Receive channel number test, change “The test system sends positioning and communication data to the unit under test through 10 beams. The test signal reaches the prototype antenna with a surface power of -127dBm and an antenna elevation angle of 50°” to “The test system sends positioning and communication data to the unit under test through 12 beams. The test signal reaches the prototype antenna with a surface power of -129.8dBm and an antenna elevation angle of 90°”.

27. Delete 5.5.3 “first acquisition time test”, 5.5.4 “recapture time test”, 5.5.5 “Any two-channel time difference measurement error test”, 5.5.6 “timing accuracy”, 5.5.7 “transmission signal time synchronization error

test”, 5.5.8 “power amplifier output power test”, 5.5.9 “transmission signal carrier phase modulation deviation test”, 5.5.10 “frequency accuracy test of transmitted signal”.

28. Delete 5.6 "Security Testing".

C3 RDSS Communication Unit RSMC and GSMC Service Minimum Performance Standards

In the closed area of $75_{0}^{+0.1}$ to $135_{-0.1}^{0}$ east longitude and $10_{0}^{+0.1}$ to $55_{-0.1}^{0}$ north latitude, the RSMC service is preferentially used, and the requirements of Appendix C1 must be met. The use of GMSC services beyond the scope of this area must meet the requirements of Appendix C2.

Appendix D Minimum Performance Standard for RDSS Communication Antennas

D1 RSMC Service Minimum Performance Standard for RDSS Communication Antennas

D1.1 S-Frequency Receiving Antenna

D1.1.1 S-Frequency passive receiving antenna

The passive receiving antenna of S-Frequency shall meet the following minimum performance standards. Refer to sections 5.6 and 5.7 of BD420004-2015 “Performance requirements and test methods for BDS RDSS unit” for test methods. However, the test method is not the only compliance method. If the applicant can show an equivalent test method, other alternative methods can be used for testing. At this time, the contents of sections 5.6 and 5.7 will be used as the basis for evaluating the acceptability of alternative methods.

1. Airworthiness. The design and manufacture of the antenna will not affect the airworthiness of the aircraft.

2. Expected function. The antenna shall perform the expected functions specified by this MOPS and the manufacturer, and its reasonable use shall not cause harm to other airspace users.

3. Flame retardancy. Except for small parts that will not significantly contribute to the spread of fire (such as handles, fasteners, seals, gaskets,

small electrical components, etc.), all materials used shall be flame retardant materials.

4. Test the impact. Unless explicitly permitted in this MOPS, the antenna shall be designed so that the specified test procedures will not adversely affect the performance of the equipment.

5. All equipment shall comply with the relevant requirements of China Radio Commission.

6. VSWR. Within the working frequency band, the standing wave ratio of antenna output voltage shall not be greater than 2.0, and the nominal characteristic impedance shall be 50 Ω.

7. Polarization characteristics and normal axis ratio. The polarization direction of the antenna shall be right-handed circular polarization. Within the working frequency band, the normal axis ratio of the antenna shall not be greater than 3dB.

8. Normal polarization gain. The normal polarization gain shall not be less than 3dBic.

9. 10° elevation polarization gain out of roundness. The out of roundness of 10° elevation polarization gain shall not be greater than 4.0dB.

10. Average polarization gain at 10° elevation. The average polarization gain at 10° elevation shall not be less than -9.0dBic.

11. Operating frequency. The operating frequency of S-Frequency receiving antenna is 2491.75MHz ± 8.16MHz.

D1.1.2 S-Frequency Active Receiving Antenna

1. Summary. The performance index of the passive antenna used by the active antenna shall meet the requirements of “S-Frequency passive receiving antenna”.

2. Voltage standing wave ratio. Within the working frequency band, the VSWR of the antenna output port shall not be greater than 2.0, and the nominal characteristic impedance shall be 50 Ω.

3. Noise figure. Within the working frequency band, the noise coefficient value of the low noise amplifier shall not be greater than 2.5dB, and the specific value shall be clearly listed in the product manual or technical specification.

D1.2 LF1, LF2 Frequency Transmitting Antenna

LF1 and LF2 frequency transmitting antennas shall meet the following minimum performance standards. For test methods, refer to sections 5.6-5.7 in BD420004 “Performance requirements and test methods for BDS RDSS unit” and the following supplements. However, this test method is not the only compliance method. If the applicant can show an equivalent test method, other alternative methods can be used for testing. At this time, the content of the test method will be used as the basis for evaluating the acceptability of alternative methods.

1. Airworthiness. The design and manufacture of the antenna will not affect the airworthiness of the aircraft.

2. Expected function. The antenna shall perform the expected functions specified by this MOPS and the manufacturer, and its reasonable use shall not cause harm to other airspace users.

3. Flame retardancy. Except for small parts that will not significantly contribute to the spread of fire (such as handles, fasteners, seals, gaskets, small electrical components, etc.), all materials used shall be flame retardant materials.

4. Test the impact. Unless explicitly permitted in this MOPS, the antenna shall be designed so that the specified test procedures will not adversely affect the performance of the equipment.

5. All equipment shall comply with the relevant requirements of China Radio Commission.

6. Operating frequency. The working frequency of L-frequency point transmitting antenna is LF1: 1614.26 ± 4.08MHz; Lf2： 1618.34 ± 4.08MHz。

7. Polarization mode and normal axial ratio. The antenna adopts left-handed circular polarization mode, and the maximum axial ratio within the coverage shall not exceed 3dB.

8. VSWR. Within the working frequency band, the standing wave ratio of antenna output voltage shall not be greater than 2.0, and the nominal characteristic impedance shall be 50 Ω.

9. Normal polarization gain. The normal polarization gain shall not be less than 2dBic.

10. 10° elevation polarization gain out of roundness. The out of roundness of 10° elevation polarization gain shall not be greater than 4.0dB.

11. Average polarization gain at 10° elevation. The average polarization gain at 10° elevation shall not be less than -9.0dBic.

12. Transmit EIRP. The equivalent omnidirectional radiation power (EIRP) of the antenna shall not be greater than 15dBw (azimuth 0°~360°, elevation 10°~70°).

13. The test methods to supplement the requirements related to

transmitting EIRP are as follows:

Transmit EIRP = power amplifier power + antenna gain. Its value can be set up in the test environment as shown in the figure below. The RDSS integrated test platform controls the RDSS transceiver test terminal 1 to output with the maximum transmit power. At the same time, it controls the antenna attitude control unit, sets the azimuth and pitch angle to meet the test requirements, and measures the signal level at the calibrated RDSS receiving antenna, Transmit EIRP = power at the feed port of RDSS receiving antenna - gain of RDSS receiving antenna + spatial attenuation. Test the EIRP of transmitting antenna. If it is no more than 15dbw, it meets the requirements.

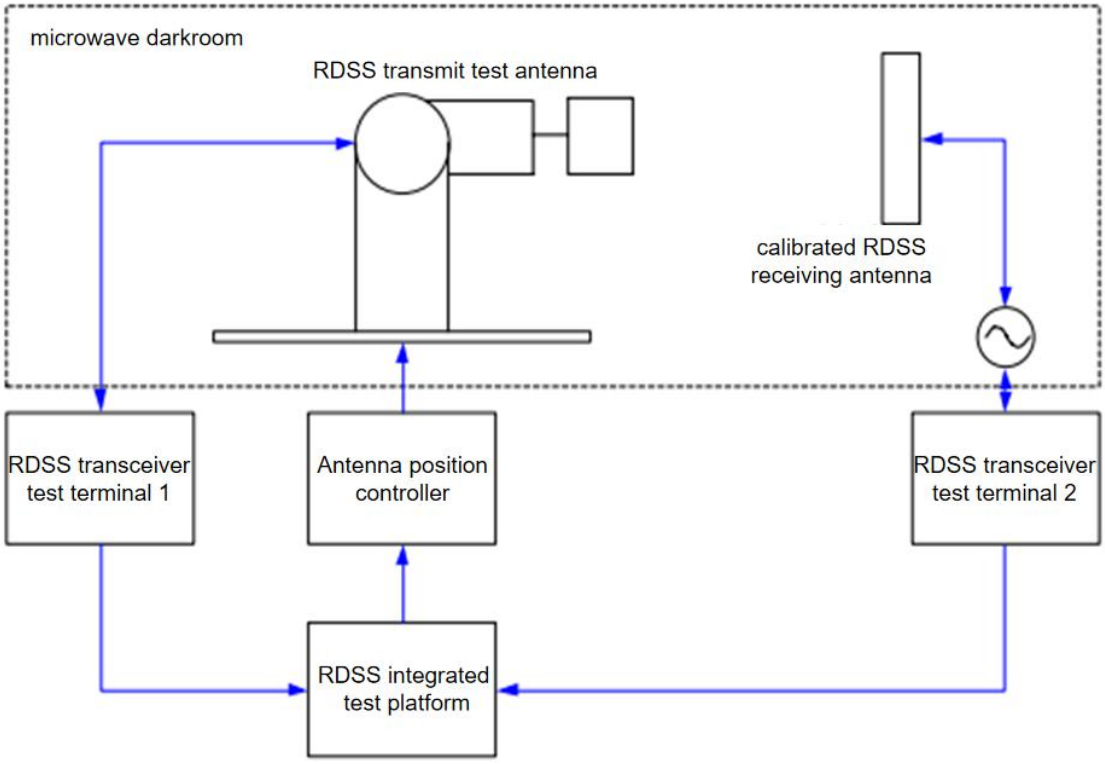

Figure 1 Construction of the transmit EIRP test environment

D2 GSMC Service Minimum Performance Standard for RDSS Communication Antennas

D2.1 B2b Frequency Receiving Antenna

D2.1.1 B2b Frequency Passive Receiving Antenna

B2b frequency point passive receiving antenna shall meet the following minimum performance standards. The test method can refer to the relevant contents in sections 5.6 and 5.7 of BD420004-2015 “Performance requirements and test methods for BDS RDSS unit”. However, the test method is not the only compliance method. If the applicant can show the equivalent test method, other alternative methods can be used for testing. At this time, the contents in sections 5.6 and 5.7 will be used as the basis for evaluating the acceptability of alternative methods.

1. Airworthiness. The design and manufacture of the antenna will not affect the airworthiness of the aircraft.

2. Expected function. The antenna shall perform the expected functions specified by this MOPS and the manufacturer, and its reasonable use shall not cause harm to other airspace users.

3. Flame retardancy. Except for small parts that will not significantly contribute to the spread of fire (such as handles, fasteners, seals, gaskets, small electrical components, etc.), all materials used shall be flame

retardant materials.

4. Test the impact. Unless explicitly permitted in this MOPS, the antenna shall be designed so that the specified test procedures will not adversely affect the performance of the equipment.

5. All equipment shall comply with the relevant requirements of China Radio Commission.

6. VSWR. Within the working frequency band, the standing wave ratio of antenna output voltage shall not be greater than 2.0, and the nominal characteristic impedance shall be 50 Ω.

7. Polarization characteristics and normal axis ratio. The polarization direction of the antenna shall be right-handed circular polarization. Within the working frequency band, the normal axis ratio of the antenna shall not be greater than 3dB.

8. Normal polarization gain. The normal polarization gain shall not be less than 2dBic.

9. 10° elevation polarization gain out of roundness. The out of roundness of 10° elevation polarization gain shall not be greater than 4.0dB.

10. Average polarization gain at 10° elevation. The average polarization gain at 10° elevation shall not be less than -9.0dBic.

11. Operating frequency. The working frequency of B2b frequency point receiving antenna is 1207.14MHz±10.23MHz.

D2.1.2 B2B Frequency Active Receiving Antenna

1. Summary. The performance index of the passive antenna used by the active antenna shall meet the requirements of “B1b Frequency passive receiving antenna”.

2. Voltage standing wave ratio. Within the working frequency band, the VSWR of the antenna output port shall not be greater than 2.0, and the nominal characteristic impedance shall be 50 Ω.

3. Noise figure. Within the working frequency band, the noise coefficient value of the low noise amplifier shall not be greater than 2.5dB, and the specific value shall be clearly listed in the product manual or technical specification.

D2.2 Lf4 Frequency Transmitting Antenna

Lf4 frequency transmitting antenna shall meet the following minimum performance standards. For test methods, refer to sections 5.6-5.7 in BD420004 “Performance requirements and test methods for BDS RDSS unit” and the following supplements. However, this test method is not the only compliance method. If the applicant can show an equivalent test method, other alternative methods can be used for testing. At this time, the content of the test method will be used as the basis for evaluating the acceptability of alternative methods.

1. Airworthiness. The design and manufacture of the antenna will not affect the airworthiness of the aircraft.

2. Expected function. The antenna shall perform the expected functions specified by this MOPS and the manufacturer, and its reasonable use shall not cause harm to other airspace users.

3. Flame retardancy. Except for small parts that will not significantly contribute to the spread of fire (such as handles, fasteners, seals, gaskets, small electrical components, etc.), all materials used shall be flame retardant materials.

4. Test the impact. Unless explicitly permitted in this MOPS, the antenna shall be designed so that the specified test procedures will not adversely affect the performance of the equipment.

5. All equipment shall comply with the relevant requirements of China Radio Commission.

6. Operating frequency. The working frequency of L-frequency point transmitting antenna is LF4: 1624.524±1.6376mhz.

7. Polarization mode and normal axial ratio. The antenna adopts left-handed circular polarization mode, and the maximum axial ratio within the coverage shall not exceed 3dB.

8. VSWR. Within the working frequency band, the standing wave ratio of antenna output voltage shall not be greater than 2.0, and the nominal characteristic impedance shall be 50 Ω.

9. Normal polarization gain. The normal polarization gain shall not be less than 2dBic.

10. 10° elevation polarization gain out of roundness. The out of roundness of 10° elevation polarization gain shall not be greater than 4.0dB.

11. Average polarization gain at 10° elevation. The average polarization gain at 10° elevation shall not be less than -9.0dBic.

12. Transmit EIRP. The equivalent omnidirectional radiation power (EIRP) of the antenna shall not be greater than 15dBw (azimuth 0°~360°, elevation 10°~70°).

13. The test methods to supplement the requirements related to transmitting EIRP are as follows:

Transmit EIRP = power amplifier power + antenna gain. Its value can be set up in the test environment as shown in the figure below. The RDSS integrated test platform controls the RDSS transceiver test terminal 1 to output with the maximum transmit power. At the same time, it controls the antenna attitude control unit, sets the azimuth and pitch angle to meet the test requirements, and measures the signal level at the calibrated RDSS receiving antenna, Transmit EIRP = power at the feed port of RDSS receiving antenna - gain of RDSS receiving antenna + spatial attenuation. Test the EIRP of transmitting antenna. If it is no more than 15dbw, it meets the requirements.

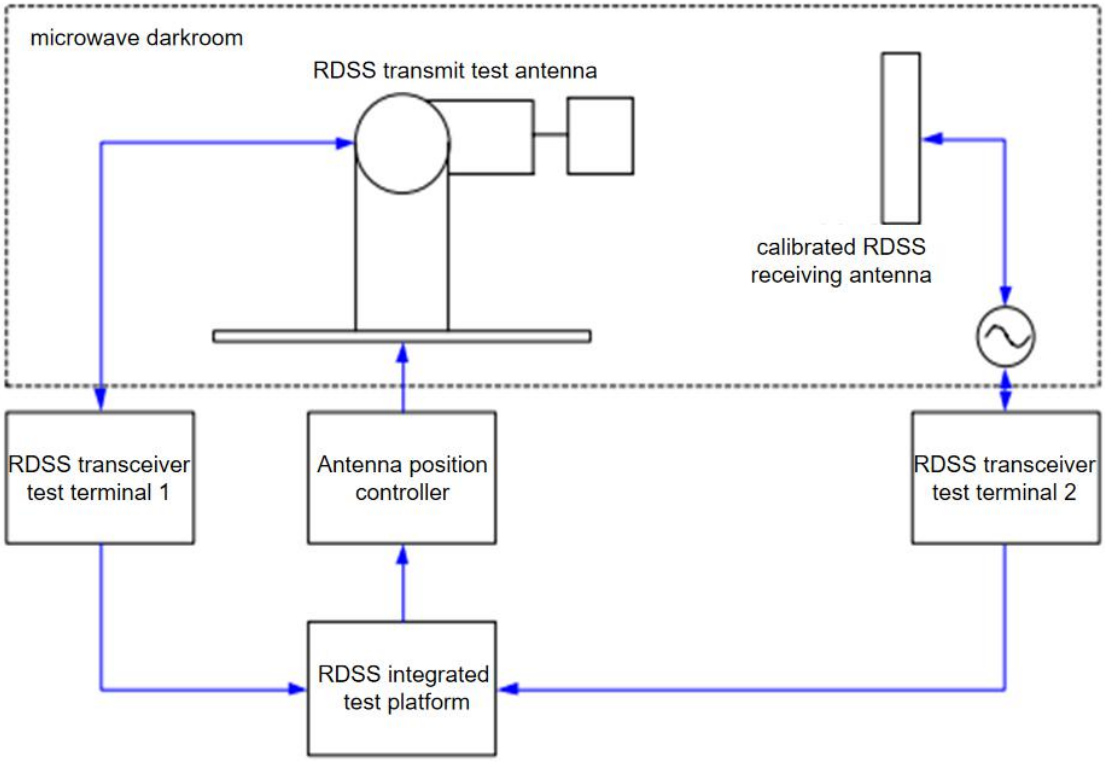

Figure 2 Construction of the transmit EIRP test environment

D3 Minimum Performance Standards for RSMC Service and GSMC Service of RDSS Communication Antenna

In the closed area of $75_{0}^{+0.1}$ degree to $135_{-0.1}^{0}$ degrees east longitude and $10_{0}^{+0.1}$ degrees to $55_{-0.1}^{0}$ degrees north latitude, the RSMC service is preferentially used, which must meet the requirements of Appendix D1; The use of GSMC service beyond this area must meet the requirements of Appendix D2.

(The English version is for reference only. In case of any discrepancy or ambiguity of meaning between this English translation and the Chinese version, the latter shall prevail.)