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Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B)

Draft of Change 1

RTCA DO-260A, Change 1
MM DD, 2006
Modifies RTCA/DO-260A

Prepared by: SC-186

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Foreword

This document was prepared by Special Committee 186 (SC-186) and approved by the RTCA Program Management Committee (PMC) on MM DD, 2006.

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- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;
- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;
- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and
- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunications Union and other appropriate international organizations can be based.

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration technical Standard Orders.

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Executive Summary

The update to the *Minimum Operational Performance Standards (MOPS) for the 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B)* systems, published by RTCA on April 10, 2003 as RTCA/DO-260A, contained herein as RTCA/DO-260A Change 1, has been produced to reflect changes that have resulted in requirements for 1090ES ADS-B transmitting and receiving systems.

In the beginning, RTCA/DO-260 was developed in accordance with the *Minimum Aviation System Performance Standards (MASPS) for Automatic Dependent Surveillance – Broadcast (ADS-B)*, which was published by RTCA on February 19, 1998 as RTCA/DO-242. Even during the development of DO-260, it was always the intention of RTCA and the International community to update the initial 1090ES MOPS with the addition of enhanced reception techniques, as well as improved definitions of navigational accuracy and integrity measurements, and system integrity levels, among other things. However, prior to the updating of such information, it was necessary to update the ADS-B MASPS on which those standards were to be based. On June 25, 2002, RTCA published the updated ADS-B MASPS as RTCA/DO-242A, and the revision of the 1090ES MOPS, DO-260A was also begun. On April 10, 2003, RTCA published RTCA/DO-260A as the update to the 1090ES MOPS which was intended to totally replace RTCA/DO-260 and all of its requirements.

When RTCA/DO-260 was published in September 2000, the International community began to refine and adapt the requirements contained therein into ICAO Standards and Recommended Practices (SARPs) for all International States to use. The initial 1090ES SARPs were adapted and published by ICAO into Annex 10 with Amendment 77, which was effective on November 28, 2002.

With the publication of the 1090ES SARPs, a trial program was started by Australia for transmit-only 1090ES equipment for the purpose of evaluating ADS-B for supplying surveillance in areas of their country where no radar exists. As this program progressed, operational experience was gained and data was collected on the implementations of 1090ES equipment, which in turn shed light on some issues within the ADS-B MOPS documents that outlined the requirements. This initial Australian program relied solely on aircraft avionics that were based on the initial 1090ES MOPS, RTCA/DO-260.

One of the initial issues uncovered by the Australian trials were errors reported in the airborne/on-the-ground status of ADS-B equipped aircraft. It was found that there were errors in the determination of the “on-the-ground” condition of the aircraft. After an extensive analysis of the collected data and of the algorithms defined in RTCA/DO-260 (and by that time also in DO-260A), it was determined that there had been errors introduced in both documents which could lead an ADS-B system to indicate that an aircraft was on-the-ground, when in fact, it was still airborne. This problem had to be corrected in both DO-260 and DO-260A.

Another issue that was a concern for ground stations and other users of position data from RTCA/DO-260 transmitters, was that the Navigational Uncertainty Category (NUC) in DO-260-based systems could be based either on accuracy or integrity measurements. It was deemed necessary for the benefit of receivers of RTCA/DO-260 transmitted position information that the NUC be based on integrity, and not accuracy. To correct this problem, a statement in DO-260, §2.2.3.2.3.1.2 and §2.2.3.2.4.1.2, which indicated that "if the Horizontal Protection Limit (HPL) was not available from a navigation source, then the TYPE Code of the respective 1090ES ADS-B Airborne or Surface Position Message could be based on the 95% bound on the horizontal and vertical position error identified in Table 2-11," had to be changed in DO-260 to not allow NUC to be based on HFOM.

In order to correct these problems prior to the MOPS being updated for manufacturers that are building equipment, specifically for those systems that were being built for transmit-only compliance to RTCA/DO-260 in the Australian trials, corrections were written for the basic requirements, and for the test procedures which verify those requirements, for both RTCA/DO-260 and for RTCA/DO-260A, and attached as an Appendix to the first Technical Standard Order (TSO) that was written for 1090ES ADS-B systems, and published as TSO C166 by the Federal Aviation Administration (FAA) on September 20, 2004.

Additionally, with the development and publication of RTCA/DO-260A, it was recognized that in the United States, ground systems required the information transmitted in the Mode 3/A, or "4096" code. In DO-260A, the 1090ES ADS-B TEST Message (TYPE Code=23, SUBTYPE=7) was identified to contain this Mode 3/A Code. With the publication of TSO C166, and its attached Appendix, a change was also identified for DO-260-compliant transmit-only systems to optionally transmit this 1090ES ADS-B TEST Message. This transmission would assist with the identification of these aircraft if they enter the United States airspace.

Since no 1090ES equipment was submitted in the United States for certification for DO-260-compliant transmit-only systems under TSO C166, the FAA has determined that it is in the best interest of the aviation community to update TSO C166, and eliminate any reference to systems that only comply with DO-260. This update to TSO C166A resulted in the removal of the section of the Appendix that was included with TSO C166 which specifically identified those changes to DO-260 that were necessary for any State that wishes to implement a DO-260-compliant transmit-only ADS-B system. That set of changes to DO-260 are published as "Change 1 to DO-260."

With the publication of TSO C166 in September 2004, numerous other changes were identified in the Appendix to the TSO for DO-260A, including, but not limited to:

1. minor typographical errors;
2. the addition of the definition of a DF=18, CF=6 as the Rebroadcast of an ADS-B Message from an alternate data link using the same TYPE Codes and Message Formats as are defined for DF=17 ADS-B Messages;
3. hard wiring the Vertical and Horizontal Mode Indicators to ZERO because of inconsistencies with how onboard data sources represent the data associated with these parameters;
4. changes to the Aircraft/Vehicle Length and Width Code Encoding to correct problems identified during ICAO review of draft UAT SARPs, with identical changes also being made in ASA MASPS (DO-289) and UAT MOPS (DO-282A); and

5. addition of a new section §A.1.7.8 in Appendix A, entitled "Globally Unambiguous CPR Decoding of Surface Position."

With the publication of this document as "Change 1 to DO-260A" several other changes are being made to DO-260A that were identified as necessary since the publication of the Appendix to TSO C166. These changes include, but are not limited to:

1. guidance notes in all sections relating to the parameter SIL which explain that if a manufacturer sets the value of SIL statically, it should not be set to ZERO;
2. the addition of new sections §2.2.18 and §2.4.18 to define the requirements for the formats and test procedures for the ADS-B Messages that are to be Rebroadcast as a 1090ES ADS-B Message with data from a received Message from an alternate data link;
3. modification of several test procedures that were copied directly from DO-260 that related in DO-260 to the testing of NUC, and were not updated to relate to NIC when DO-260A was published;
4. corrections to test procedures for testing of the preambles in enhanced reception techniques;
5. the addition of guidance notes and new requirements for testing cases that have been identified during 1090ES implementations for problems related to longitude zone boundary conditions when calculating position using CPR techniques; and
6. other changes related to correcting additional typographical errors.

Since the publication of RTCA/DO-260A in March 2003, ICAO has also been in the process of updating the ICAO 1090ES SARPs to include those requirements identified in DO-260A. These updated SARPs are expected to become effective in November 2007. It has also been recognized by the International community that systems based solely on the requirements of DO-260 and the initial 1090ES SARPs published in Annex 10, Amendment 77, are not sufficient to provide robust receiver/decoder systems for reception of 1090ES ADS-B information. Therefore, the updated 1090ES SARPs recommend (and it is required by FAA TSO C166A) that 1090ES ADS-B receiver systems must be based on the requirements of the updated 1090ES SARPs, which are the same as RTCA/DO-260A, Change 1, contained herein. Therefore, the receiver/decoder requirements of DO-260 have not been updated in the "Change 1 to DO-260" since all receiver/decoder implementations will need to adhere to DO-260A, Change 1 and the latest version of TSO C166.

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Change 1 to RTCA/DO-260A

Extended Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Service - Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)

This Change prescribes the Minimum Performance Standards (MPS) for 1090 MHz Extended Squitter Transmitting and Receiving Subsystems, modified as described in this document. The applicable standards for those changes requested in this document is RTCA/DO-260A, "*Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B),*" issued April 10, 2003.

(1.1) In RTCA/DO-260A, section §2.1.12.2, in Table 2-6, the definitions of the "Operations" performed by ground based 1090ES receiving systems was incorrectly copied from a table in the original DO-260. In order to correct this problem, replace Table 2-6 with the following:

<u>Table 2-6:</u> ADS-B Class C Receiver Equipment To Report Coverage

Receiver Class	Minimum Trigger Threshold Level (MTL)	Operation	MASPS Requirement [RTCA DO-242A Table 3-3(b)]	Minimum Report Required
C1 (ATS En Route and Terminal)	Not Specified in these MOPS	Supports Cooperative ATC Surveillance Services	SV MS TS ARV TC+n	*ADS-B State Vector Report (§2.2.8.1)* *AND* *ADS-B Mode Status Report (§2.2.8.2)* *AND* *ADS-B Target State Report (§2.2.8.3)* *AND* *ADS-B ARV Report (§2.2.8.3.2)* *AND* *Reserved for ADS-B Trajectory Change Report(s)*
C2 (Approach and Surface)	Not Specified in these MOPS	Supports Cooperative ATC Surveillance Services	SV MS TS ARV TC+n	*ADS-B State Vector Report (§2.2.8.1)* *AND* *ADS-B Mode Status Report (2.2.8.2)* *AND* *ADS-B Target State Report (§2.2.8.3.1)* *AND* *ADS-B ARV Report (§2.2.8.3.2)* *AND* *Reserved for ADS-B Trajectory Change Report(s)*
C3 (Flight Following)	Not Specified in these MOPS	Supports Private User Operations Planning and Flight Following	SV MS	*ADS-B State Vector Report (§2.2.8.1)* *AND* *ADS-B Mode Status Report (§2.2.8.2)*

(1.2) In RTCA/DO-260A, section §2.2.2.1.1.4, replace the entire paragraph, and the *Note* that follows, it with the following paragraph:

The minimum RF peak output power for Class A3 ADS-B Transponder Based equipment **shall** be 23.0 dBW (200 W).

(1.3) In RTCA/DO-260A, add the definition of DF=18 and CF=6 Message as an ADS-B Rebroadcast Message by ground equipment of an ADS-B Message from an alternate data link using the same TYPE Codes and Message formats as are defined for DF=17 ADS-B Messages, in Section §2.2.3.2, with the exception of bits modified as identified in Section §2.2.18, replace Figure 2-2 with the following:

<table>
<tr><th colspan="6">ADS-B and TIS-B Overall Message Format Structures</th></tr>
<tr><td>Bit # →</td><td>1 ------ 5</td><td>6 ------ 8</td><td>9 ------ 32</td><td>33 ------ 88</td><td>89 ------ 112</td></tr>
<tr><td>DF = 17 Field Names →</td><td>DF = 17
[5]</td><td>CA
[3]</td><td>AA
ICAO Address
[24]</td><td>ADS-B Message ME Field
[56]</td><td>PI
[24]</td></tr>
<tr><td rowspan="7">DF = 18 Field Names →</td><td rowspan="7">DF = 18
[5]</td><td>CF = 0
[3]</td><td>AA
ICAO Address
[24]</td><td rowspan="2">ADS-B Message ME Field
[56]</td><td rowspan="2">PI
[24]</td></tr>
<tr><td>CF = 1
[3]</td><td>AA
non-ICAO
Address
[24]</td></tr>
<tr><td>CF = 2 to 3
[3]</td><td>AA
[24]</td><td>TIS-B Message ME Field
[56]</td><td>PI
[24]</td></tr>
<tr><td>CF = 4
[3]</td><td colspan="2">Reserved for TIS-B Management Messages</td><td>PI
[24]</td></tr>
<tr><td>CF = 5
[3]</td><td>AA
non-ICAO
Address
[24]</td><td>TIS-B Message ME Field
[56]</td><td rowspan="3">PI
[24]</td></tr>
<tr><td>CF = 6
[3]</td><td colspan="2">Rebroadcast of an ADS-B Message from an alternate data link using the same TYPE Codes and Message Formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18.</td></tr>
<tr><td>CF = 7</td><td colspan="2">Reserved</td></tr>
<tr><td rowspan="2">DF = 19 Field Names→</td><td rowspan="2">DF = 19
[5]</td><td>AF = 0
[3]</td><td>AA
ICAO Address
[24]</td><td>ADS-B Message ME Field
[56]</td><td>PI
[24]</td></tr>
<tr><td>AF = 1 to 7
[3]</td><td colspan="3">Reserved for Military Applications</td></tr>
<tr><td></td><td>MSB LSB</td><td>MSB LSB</td><td>MSB LSB</td><td>MSB LSB</td><td>MSB LSB</td></tr>
</table>

<u>Figure 2-2:</u> ADS-B and TIS-B Message Baseline Format Structure

(1.4) In RTCA/DO-260A, replace the last paragraph of section §2.2.3.2 with the following:

TIS-B Messages **shall** use Extended Squitter formats in which DF = 18 and CF is in the range from 2 to 5. An ADS-B Message from an alternate data link that is being rebroadcast by ground equipment as a Message using 1090 MHz Extended Squitter **shall** use formats in which DF = 18 and CF = 6, and **shall** use the same TYPE Codes and Message formats as are defined for DF = 17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18. Receiving equipment **shall not** process as TIS-B Messages any Extended Squitter receptions in which DF is not equal to 18, or in which CF is not in the range from 2 to 5.

(1.5) In RTCA/DO-260A, replace section §2.2.3.2.1.2, subparagraph "c," including Table 2-9, with the following:

c. Air/Ground Determination

(1). If a transmitting ADS-B participant is not equipped with a means, such as a weight-on-wheels switch, to determine whether it is airborne or on the surface, and that participant's Emitter Category (§2.2.3.2.5.2) is one of the following, then it **shall** set its Air/Ground State to "Airborne," and broadcast the Airborne Position Message (§2.2.3.2.3):

- Unknown Emitter Category
- Light Aircraft
- Rotorcraft
- Glider or Sailplane
- Lighter Than Air
- Unmanned Aerial Vehicle
- Ultralight, Hang Glider or Paraglider
- Parachutist or Skydiver
- Point Obstacle
- Cluster Obstacle
- Line Obstacle

Notes:

1. *Because of the unique operating capabilities of "Lighter-Than-Air" vehicles, i.e., balloons, an operational "Lighter-Than-Air" vehicle will always report the "Airborne" State, unless the "ON-GROUND" State is specifically declared in compliance with subparagraph "(4)" below.*
2. *Because of the fact that it is important for Fixed Ground or Tethered Obstacles to report altitude, such objects will always report the "Airborne" state.*
3. *Because of the unique capabilities of Rotorcraft, i.e., hover, etc., an operational Rotorcraft will always report the "Airborne" state unless the "ON-GROUND" state is specifically declared in compliance with subparagraph "(4)" below.*
4. *An automatic means of determining air/ground status may include Weight-on-Wheels discrete, Airspeed, Ground Speed, Radio Altitude, or other appropriate data sources.*

(2). If a transmitting ADS-B participant's Emitter Category (§2.2.3.2.5.2) is one of the following, then that participant **shall** set its Air/Ground State to the "ON-GROUND" condition and broadcast the Surface Position Message (§2.2.3.2.4):

- Surface Vehicle – Emergency
- Surface Vehicle – Service

(3). If a transmitting ADS-B participant is not equipped with a means, such as a weight-on-wheels switch, to determine whether it is airborne or on the surface, and its ADS-B Emitter Category (§2.2.3.2.5.2) is not one of those listed under tests (1) or (2) above (i.e., the participant's Emitter Category is either: Small, Large, High Vortex Large, Heavy, Highly Maneuverable, or Space/Trans-Atmospheric), then the following tests will be performed to determine whether to broadcast the Airborne or Surface Position Messages.

a. If the participant's Radio Height (RH) parameter is available, and RH < 50 feet, and at least Ground Speed (GS) or Airspeed (AS) is available, and the available GS < 100 knots, or the available AS < 100 knots, then that participant **shall** broadcast the Surface Position Message (§2.2.3.2.4).

   If all three parameters are available, the decision to broadcast the Airborne or Surface Position Messages **shall** be determined by the logical "AND" of all three parameters.

b. Otherwise, if Radio Height (RH) is not available, and if the participant's Ground Speed (GS) and Airspeed (AS) are available, and GS < 50 knots and AS < 50 knots, then that participant **shall** broadcast the Surface Position Message (§2.2.3.2.4).

c. Otherwise, the participant **shall** broadcast the Airborne Position Message (§2.2.3.2.3).

(4). If a transmitting ADS-B participant is equipped with a means, such as a weight-on-wheels switch, to determine automatically whether it is airborne or on the surface, then such information **shall** be used to determine whether to broadcast the Airborne Position Message (§2.2.3.2.3), or the Surface Position Message (§2.2.3.2.4).

(1.6) In RTCA/DO-260A, to add the definition of DF=18 and CF=6 as an ADS-B Rebroadcast by ground equipment of an ADS-B Message from an alternate data link using the same TYPE Codes and Message formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18, in section §2.2.3.2.1.3, replace Table 2-11 and the paragraph that follows the table with the following:

<u>Table 2-11:</u> "CF" Field Code Definitions

Coding		Meaning	
(Binary)	(Decimal)		
000	0	ADS-B Message	AA field holds the transmitting ADS-B Participant's 24-bit ICAO address.
001	1		AA field holds another kind of address for the transmitting ADS-B Participant: a self-assigned "anonymous" address, a ground vehicle address, or a surface obstruction address.
010	2	TIS-B Message	Fine TIS-B Message using ICAO 24-bit address
011	3		Coarse TIS-B Airborne Position and Velocity Message.
100	4		Reserved for TIS-B Management Message.
101	5		Fine TIS-B Message using non-ICAO 24-bit address
110	6	Rebroadcast of an ADS-B Message from an alternate data link using the same TYPE Codes and Message Formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18.	
111	7	Reserved	

ADS-B Messages from ADS-B Transmitting Subsystems that are <u>not</u> based on Mode S transponders **shall** use CF = 0 or 1, according to the type of address conveyed in the AA field. TIS-B Messages **shall** use CF = 2, 3 or 5. An ADS-B Message from an alternate data link that is being rebroadcast by ground equipment as a Message using 1090 MHz Extended Squitter **shall** use formats in which DF = 18 and CF = 6, and **shall** use the same TYPE Codes and Message formats as are defined for DF = 17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18. CF code of 4 and 7 are reserved for future standardization and **shall not** be transmitted by equipment that conforms to these MOPS (RTCA DO-260A).

(1.7) In RTCA/DO-260A, to add the definition of DF=18 and CF=6 as a Rebroadcast by ground equipment of an ADS-B Message from an alternate data link using the same TYPE Codes and Message formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18, in section §2.2.3.2.1.5, replace Table 2-13 with the following:

Table 2-13: Determining The Type of Address in the AA Field

DF Field	CF or AF Field	IMF Subfield	AA Field Contents
17	N/A	N/A	24-bit ICAO address of the transmitting ADS-B Participant
18	CF = 0	N/A	24-bit ICAO address of the transmitting ADS-B Participant
	CF = 1		Anonymous address or ground vehicle address or fixed obstacle address of the transmitting ADS-B Participant
	CF = 2	0	TIS-B target's 24-bit ICAO address
		1	TIS-B target's 12-bit Mode A code and track file number
	CF = 3	0	TIS-B target's 24-bit ICAO address
		1	TIS-B target's 12-bit Mode A code and track file number
	CF = 4	N/A	Reserved for TIS-B Management Messages; AA field holds TIS-B Service Volume ID + other information
	CF = 5	0	TIS-B target's 24-bit non-ICAO address
		1	Reserved
	CF = 6	0	24-bit ICAO address of the transmitting ADS-B Participant
		1	Anonymous address or ground vehicle address or fixed obstacle address of the transmitting ADS-B Participant
	CF = 7	N/A	Reserved for future standardization; AA field does not necessarily exist in messages. For which DF = 18 and CF is equal to 7.
19	AF = 0	N/A	24-bit ICAO address of the transmitting ADS-B participant
	AF = 1 to 7		Reserved for military use; AA field does not necessarily exist in messages for which DF= 19 and AF is in the range from 1 to 7.

(1.8) In RTCA/DO-260A, to clarify the use of DF=18 and CF=6 as a Rebroadcast by ground equipment of an ADS-B Message from an alternate data link using the same TYPE Codes and Message formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18, in section §2.2.3.2.2, replace the third paragraph (just prior to Table 2-14) and the title of Table 2-14 as follows:

For ADS-B Messages (those for which DF=17, or DF=18 and CF=0, 1 or 6, or DF=19 and AF=0), the possible message Types are those listed in Table 2-14. An ADS-B Message from an alternate data link that is being rebroadcast by ground equipment as a TIS-B Message using 1090 MHz Extended Squitter uses formats in which DF = 18 and CF = 6, and uses the same TYPE Codes and Message formats as are defined for DF = 17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18. In Table 2-14, the word "***Reserved***" indicates ADS-B Message Types for which the message formats have not yet been defined, but which may be defined in future versions of these MOPS. The TYPE Code, together with the SUBTYPE Code (if present for a given TYPE Code value), identifies the TYPE of ADS-B Message being broadcast, in accordance with Table 2-14.

<u>Table 2-14:</u> Determining ADS-B Message Type
(DF=17 or DF=18 and CF=0, 1 or 6, or DF=19 and AF=0)
[change occurs in title only]

(1.9) In RTCA/DO-260A, in order to correct an error in the title of Table 2-15 and to rename the previous "TIS-B Airborne Velocity Message" to only the "TIS-B Velocity Message," in section §2.2.3.2.2, replace Table 2-15 with the following:

<u>Table 2-15:</u> Determining TIS-B Message Type (DF=18, CF=2 to 5)

CF Field Value	TYPE Code ("ME" bits 1-5)	SUBTYPE Code ("ME" bits 6-8)	TIS-B Message Type
2 or 5	0	Not Present	TIS-B Fine Airborne Position Message (§2.2.17.3.1), or TIS-B Fine Surface Position Message (§2.2.17.3.2)
	1 – 4	Not Present	TIS-B Identification and Type Message (§2.2.17.3.3)
	5 – 8	Not Present	TIS-B Fine Surface Position Message (§2.2.17.3.2)
	9 – 18	Not Present	TIS-B Fine Airborne Position Message (§2.2.17.3.1)
	19	0	Reserved
		1 – 4	TIS-B Velocity Message (§2.2.17.3.4)
		5 – 7	Reserved
	20 – 22	Not Present	TIS-B Fine Airborne Position Message (§2.2.17.3.1)
	23 – 31	Not Present	Reserved
3	Not Present	Not Present	TIS-B Coarse Airborne Position and Velocity Message (§2.2.17.3.5)
4	Not Present	Not Present	Reserved (for TIS-B Management Message)

(1.10) In RTCA/DO-260A, section §2.2.3.2.4.8.2.1, in the "COMMENTARY" section, the definition of the mathematical symbol Phi (ϕ) was stated incorrectly using longitude instead of correctly using latitude. Replace the definition for Phi as follows:

ϕ = approximate latitude (the latitude, ϕ_{fix} at the time of the fix may be used)

(1.11) In RTCA/DO-260A, section §2.2.3.2.4.8.3.1, in the "COMMENTARY" section, the definition of the mathematical symbol Phi (ϕ) was stated incorrectly using longitude instead of correctly using latitude. Replace the definition for Phi as follows:

ϕ = approximate latitude (the latitude, ϕ_{fix} at the time of the fix may be used)

(1.12) In RTCA/DO-260A, add the following onto the end of the paragraph in section §2.2.3.2.7.1.3.5 and prior to Table 2-50.

In this version of these MOPS (RTCA/DO-260A), the Vertical Mode Indicator **shall** be set to ZERO (binary 00).

Note: *Inconsistencies have been identified with how existing onboard data sources represent the data associated with the Vertical Mode Indicator parameter. Until these inconsistencies are resolved through a future update to these MOPS (RTCA/DO-260A), this parameter must be encoded as ALL ZEROs, indicating an Unknown Mode or that Information is Unavailable.*

(1.13) In RTCA/DO-260A, section §2.2.3.2.7.1.3.6, Table 2-51 has errors in the Binary and Decimal values for the Target Altitudes of ZERO (0) feet and +100 feet. Replace Table 2-51 with the following table. Changed values are highlighted in gray.

Table 2-51: "Target Altitude" Subfield Encoding

Coding		Meaning
(Binary)	(Decimal)	
00 0000 0000	0	Target Altitude = -1000 feet
00 0000 0001	1	Target Altitude = -900 feet
00 0000 0010	2	Target Altitude = -800 feet
***	***	***
00 0000 1010	10	Target Altitude = zero (0) feet
00 0000 1011	11	Target Altitude = 100 feet
***	***	***
11 1111 0010	1010	Target Altitude = 100,000 feet
11 1111 0011 through 11 1111 1111	1011 through 1023	Invalid (out of range)

(1.14) In RTCA/DO-260A, add the following onto the end of the paragraph in section §2.2.3.2.7.1.3.10 and prior to Table 2-55.

In this version of these MOPS (RTCA/DO-260A), the Horizontal Mode Indicator **shall** be set to ZERO (binary 00).

Note: *Inconsistencies have been identified with how existing onboard data sources represent the data associated with the Horizontal Mode Indicator parameter. Until these inconsistencies are resolved through a future update to these MOPS (RTCA DO-260A), this parameter must be encoded as ALL ZEROs, indicating an Unknown Mode or that Information is Unavailable.*

(1.15) In RTCA/DO-260A, section §2.2.3.2.7.2.3.1, the reference to "ME" bits and "Message bits" is reversed in the first sentence. Replace the text of the first paragraph with the following:

Within the CC Code subfield, a 4-bit ("ME" bits 9-10 and 13-14, Message bits 41-42, and 45-46) subfield **shall** be reserved for the "Service Level" of the ADS-B Transmitting Subsystem. ADS-B equipment conforming to this version (RTCA/DO-260A) of these MOPS **shall** set the Service Level code to ALL ZEROs.

(1.16) In RTCA/DO-260A, section §2.2.3.2.7.2.9, entitled "SIL Subfield in Aircraft Operational Status Messages," replace the entire section, including Table 2-72, with the following:

The Surveillance Integrity Level (SIL) is a two-bit subfield of "Subtype=0" ADS-B Aircraft Operational Status Messages ("ME" bits 51 and 52, Message bits 83 and 84) that **shall** announce the integrity level associated with the Containment Radius (R_C) being broadcast in the NIC parameter. Table 2-72 defines the meaning of each SIL value. For installations where the SIL value is being dynamically updated, if an update has not been received from an on-board data source for SIL within the past 5 seconds, then the SIL subfield **shall** be encoded as a value of ZERO (0), indicating "Unknown."

Table 2-72: "SIL" Subfield Encoding

SIL Coding		Meaning (Probability of Exceeding the Integrity Containment Radius Reported in the NIC Subfield Without Detection)
(Binary)	(Decimal)	
00	0	Unknown
01	1	$\leq 1 \times 10^{-3}$ per flight hour or per operation
10	2	$\leq 1 \times 10^{-5}$ per flight hour or per operation
11	3	$\leq 1 \times 10^{-7}$ per flight hour or per operation

Notes:

1. *The NIC parameter is broadcast partly in the TYPE subfield of Airborne Position and Surface Position Messages, and partly in the NIC Supplement subfield of Aircraft Operational Status Messages (§2.2.3.2.7.2.6).*

2. *The Surveillance Integrity Level (SIL) defines the probability of exceeding the integrity containment radius, R_C, used in the NIC parameter without being detected at the transmitting ADS-B participant. See §2.1.2.15 of the ADS-B MASPS, RTCA DO-242A, for a more complete description of SIL.*

3. *Since the SIL is intended to reflect the integrity of the navigation source of the position information broadcast, the SIL value transmitted should be indicative of the true integrity of the ADS-B position data. A problem for installations that include currently available GNSS receivers and FMS systems is that SIL is not output by these systems. With the lack of SIL information being provided by the navigation source, implementers should not arbitrarily set a SIL value of zero indicating unknown integrity. It is suggested, unless there is a tightly coupled navigation source where SIL can be unambiguously determined and set dynamically, that the ADS-B Transmitting Subsystem should provide for the static setting of SIL as part of the installation procedure. Most implementers are expected to determine SIL by off-line analysis of the installed configuration. This off-line analysis can be performed on the various primary and alternate means of determining the reported position. SIL is a static value for each of these configurations.*

(1.17) In RTCA/DO-260A, section §2.2.3.2.7.2.11, in order to eliminate an ambiguity in the Length and Width Code definitions, replace the last sentence of the first paragraph with the following:

Once the actual Length and Width of the A/V has been determined, each A/V **shall** be assigned the smallest A/V Length and Width Code from Table 2-74 for which the actual length is less than or equal to the upper bound length for that Length/Width Code, and for which the actual width is less than or equal to the upper bound width for that Length/Width Code.

(1.18) In RTCA/DO-260A, section §2.2.3.2.7.2.11, in order to eliminate an ambiguity in the Length and Width Code definitions, replace Table 2-74 with the following:

<u>Table 2-74:</u> "Aircraft/Vehicle Length and Width Code" Encoding

A/V - L/W Code (Decimal)	Length Code			Width Code	Upper-Bound Length and Width for Each Length/Width Code	
	ME Bit 49	ME Bit 50	ME Bit 51	ME Bit 52	Length (meters)	Width (meters)
0	0	0	0	0	15	11.5
1				1		23
2	0	0	1	0	25	28.5
3				1		34
4	0	1	0	0	35	33
5				1		38
6	0	1	1	0	45	39.5
7				1		45
8	1	0	0	0	55	45
9				1		52
10	1	0	1	0	65	59.5
11				1		67
12	1	1	0	0	75	72.5
13				1		80
14	1	1	1	0	85	80
15				1		90

If the Aircraft or Vehicle is longer than 85 meters, or wider than 90 meters, then decimal Aircraft/Vehicle Length/Width Code 15 **shall** be used.

(1.19) In RTCA/DO-260A, in section §2.2.8.4.1, in the third line of the first paragraph, change the phrase "from TYPE 9 or 10" **to** "from TYPE 9, 10, 20 or 21."

(1.20) In RTCA/DO-260A, in section §2.2.10.2, after subparagraph "f," and prior to the section heading for §2.2.10.3, place the following *Note*:

<u>Note:</u> *Upon the first receptions of airborne-format messages from a target that is already in the Track State as a surface participant, it is not necessary to enter the Initialization State or the Acquisition State. The target remains in the Track State, now as an airborne participant. Similarly, for the transition from airborne-format to surface-format messages, if the target is currently in the Track State, it remains in the Track State, now as a surface participant.*

(1.21) In RTCA/DO-260A, in section §2.2.10.3.1, after subparagraph "a," and prior to subparagraph "b," place the following *Note*:

Note: *If the Airborne Participant has already been in the Track State as a Surface Participant, then it is not necessary to perform the Globally Unambiguous CPR Decode.*

(1.22) In RTCA/DO-260A, in section §2.2.10.3.2, to correct an ambiguity condition encountered in operational testing, replace subparagraph "a" with the following:

a. Perform a successful Globally Unambiguous CPR Decode of the Participant Position in accordance with §A.1.7.8 of Appendix A.

(1.23) In RTCA/DO-260A, in section §2.2.10.3.2, after subparagraph "a," and prior to subparagraph "b," place the following *Note*:

Note: *If the Surface Participant has already been in the Track State as an Airborne Participant, then it is not necessary to perform the Globally Unambiguous CPR Decode.*

(1.24) In RTCA/DO-260A, in section §2.2.10.3.2, in subparagraph "f," and in the *Note* following subparagraph "f," change all references from "Local Unambiguous" **to** "Globally Unambiguous."

(1.25) In RTCA/DO-260A, to add the use of DF=18 and CF=6 as a Rebroadcast by ground equipment of an ADS-B Message from an alternate data link using the same TYPE Codes and Message formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18, replace Table 2-106 with the following:

Table 2-106: "CF" Field Code Definitions in DF=18 ADS-B and TIS-B Messages

CF Value	ICAO/Mode A Flag (IMF)	Meaning
0	N/A	ADS-B Message from a non-transponder device, AA field holds 24-bit ICAO aircraft address
1	N/A	Reserved for ADS-B Message in which the AA field holds anonymous address or ground vehicle address or fixed obstruction address
2	0	Fine TIS-B Message, AA field contains the 24-bit ICAO aircraft address
	1	Fine TIS-B Message, AA field contains the 12-bit Mode A code followed by a 12-bit track file number
3	0	Coarse TIS-B Airborne Position and Velocity Message, AA field contains the 24-bit ICAO aircraft address
	1	Coarse TIS-B Airborne Position and Velocity Message, AA field contains the 12-bit Mode A code followed by a 12-bit track file number.
4	N/A	Reserved for TIS-B Management Message AA field holds TIS-B Service Volume ID + other information (e.g., MSB of reference position for the service volume)
5	0	Fine TIS-B Message AA field contains a non-ICAO 24-bit address
	1	Reserved
6	0	Rebroadcast of ADS-B Message from an alternate data link. AA field holds 24-bit ICAO aircraft address
	1	Rebroadcast of ADS-B Message from an alternate data link. AA field holds anonymous address or ground vehicle address or fixed obstruction address
7	N/A	Reserved

(1.26) In RTCA/DO-260A, to add the use of DF=18 and CF=6 as a Rebroadcast by ground equipment of an ADS-B Message from an alternate data link using the same TYPE Codes and Message formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18, add the following text on to the end of the paragraph of section §2.2.17.2.2:

The ADS-B Receiving Subsystem shall accept and process DF=18, CF=6 Messages in the same manner as a DF=17 ADS-B Message, with the exception of bits modified as identified in Section §2.2.18.

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(1.27) In RTCA/DO-260A, in order to rename the previous “TIS-B Airborne Velocity Message” to only the “TIS-B Velocity Message,” in section §2.2.17.3.4, and to correct an incorrect specification of the use of the Vertical Rate Type in ME Bit #56, replace the title of section §2.2.17.3.4 and Figure 2-28 with the following:

2.2.17.3.4 TIS-B Velocity Message

<table>
<tr><th colspan="18">TIS-B Velocity Message – Subtypes “1” and “2”</th></tr>
<tr><td>MSG BIT #</td><td>33 - 37</td><td>38 - 40</td><td>41</td><td>42 - 45</td><td>46</td><td>47 - 56</td><td>57</td><td>58 - 67</td><td>68</td><td>69</td><td>70 - 78</td><td>79</td><td colspan="3">80 - 82</td><td>83 - 84</td><td>85 – 88</td></tr>
<tr><td>“ME” BIT #</td><td>1 - 5</td><td>6 - 8</td><td>9</td><td>10 - 13</td><td>14</td><td>15 - 24</td><td>25</td><td>26 - 35</td><td>36</td><td>37</td><td>38 - 46</td><td>47</td><td colspan="3">48 - 50</td><td>51 - 52</td><td>53 – 56</td></tr>
<tr><td rowspan="2">FIELD NAME</td><td rowspan="2">TYPE [5]</td><td rowspan="2">Subtype [3]</td><td rowspan="2">IMF [1]</td><td rowspan="2">NAC$_P$ [4]</td><td rowspan="2">E/W Direction Bit [1]</td><td rowspan="2">E/W Velocity [10]</td><td rowspan="2">N/S Direction Bit [1]</td><td rowspan="2">N/S Velocity [10]</td><td>GEO Flag =0 [1]</td><td rowspan="2">Vertical Rate Sign Bit [1]</td><td rowspan="2">Vert Rate [9]</td><td rowspan="2">NIC Supplement [1]</td><td colspan="3">NAC$_V$ [3]</td><td>SIL [2]</td><td>Reserved [4]</td></tr>
<tr><td>GEO Flag =1 [1]</td><td>Reserved [1]</td><td>Difference Sign Bit [1]</td><td colspan="3">Geometric Height Difference From Barometric [7]</td></tr>
<tr><td></td><td>MSB LSB</td><td>MSB LSB</td><td></td><td>MSB LSB</td><td></td><td>MSB LSB</td><td></td><td>MSB LSB</td><td></td><td></td><td>MSB LSB</td><td></td><td colspan="3">MSB LSB</td><td>MSB LSB</td><td>MSB LSB</td></tr>
</table>

Notes:

1. *“[#]” provided in the Field Name column indicates the number of bits in the respective field.*
2. *The “Vertical Rate” and “Geometric Height Difference From Barometric” fields for surface aircraft do not need to be processed by TIS-B receivers.*

<u>Figure 2-28:</u> TIS-B Velocity Message, Subtypes 1 and 2

(1.28) In RTCA/DO-260A, in order to rename the previous "TIS-B Airborne Velocity Message" to only the "TIS-B Velocity Message," in section §2.2.17.3.4, and to correct an incorrect specification of the use of the Vertical Rate Type in ME Bit #56, replace Figure 2-29 with the following:

<table>
<tr><th colspan="20">TIS-B Velocity Message – Subtypes "3" and "4"</th></tr>
<tr><td>MSG BIT #</td><td>33 - 37</td><td>38 - 40</td><td>41</td><td>42 - 45</td><td>46</td><td>47 - 56</td><td>57</td><td>58 - 67</td><td>68</td><td>69</td><td>70 - 78</td><td>79</td><td colspan="3">80 - 82</td><td>83 - 84</td><td colspan="3">85 – 88</td></tr>
<tr><td>"ME" BIT #</td><td>1 - 5</td><td>6 - 8</td><td>9</td><td>10 - 13</td><td>14</td><td>15 - 24</td><td>25</td><td>26 - 35</td><td>36</td><td>37</td><td>38 - 46</td><td>47</td><td colspan="3">48 - 50</td><td>51 - 52</td><td colspan="3">53 – 56</td></tr>
<tr><td rowspan="2">FIELD NAME</td><td rowspan="2">TYPE [5]</td><td rowspan="2">Subtype [3]</td><td rowspan="2">IMF [1]</td><td rowspan="2">NAC_P [4]</td><td rowspan="2">Heading Status Bit [1]</td><td rowspan="2">Heading [10]</td><td rowspan="2">Airspeed Type [1]</td><td rowspan="2">Airspeed [10]</td><td>GEO Flag =0 [1]</td><td rowspan="2">Vertical Rate Sign Bit [1]</td><td rowspan="2">Vert Rate [9]</td><td rowspan="2">NIC Supplement [1]</td><td colspan="3">NAC_V [3]</td><td>SIL [2]</td><td>Reserved [2]</td><td>True/Mag [1]</td><td>Reserved [1]</td></tr>
<tr><td>GEO Flag =1 [1]</td><td>Reserved [1]</td><td>Difference Sign Bit [1]</td><td colspan="5">Geometric Height Difference From Barometric [7]</td></tr>
<tr><td></td><td>MSB LSB</td><td>MSB LSB</td><td></td><td>MSB LSB</td><td></td><td>MSB LSB</td><td></td><td>MSB LSB</td><td></td><td></td><td>MSB LSB</td><td></td><td colspan="3">MSB LSB</td><td>MSB LSB</td><td colspan="3">MSB LSB</td></tr>
</table>

Notes:

1. *"[#]" provided in the Field Name column indicates the number of bits in the respective field.*
2. *The "Vertical Rate" and "Geometric Height Difference From Barometric" fields for surface aircraft do not need to be processed by TIS-B receivers.*

<u>Figure 2-29:</u> TIS-B Velocity Message, Subtypes 3 and 4

(1.29) In RTCA/DO-260A, in order to rename the previous "TIS-B Airborne Velocity Message" to only the "TIS-B Velocity Message," in section §2.2.17.3.4.1, delete the word "Airborne" from the first line of the paragraph.

(1.30) In RTCA/DO-260A, in section §2.2.17.4.6, replace the entire first paragraph with the following:

As TIS-B Messages are received, the information is reported to applications. All received information elements, other than position, **shall** be reported directly, including all reserved fields for the TIS-B fine format messages (§2.2.17.3.1 to §2.2.17.3.4) and the entire message content of any received TIS-B Management Message (Table 2-106, CF Value =4). The reporting format is not specified in detail, except that the information content reported **shall** be the same as the information content received. The report **shall** be issued within 0.5 seconds of the message reception.

(1.31) In RTCA/DO-260A, after the end of section §2.2.17.4.6, add the following as a new section §2.2.18:

2.2.18 ADS-B Rebroadcast Service – Formats and Coding

2.2.18.1 Introduction

Notes:

1. *This section defines the formats and coding for an ADS-B Rebroadcast (ADS-R) Service based on the same 112-bit 1090 MHz Extended Squitter signal transmission that is used for ADS-B Messages on 1090 MHz.*
2. *ADS-R complements the operation of ADS-B and TIS-B by providing ground-to-air rebroadcast of ADS-B data about aircraft that are not equipped for 1090 MHz Extended Squitter ADS-B, but are equipped with an alternate form of ADS-B (e.g., Universal Access Transceiver (UAT)). The basis for the ADS-R transmission is the ADS-B Report received at the Ground Station using a receiver compatible with the alternate ADS-B data link.*
3. *The ADS-R ground-to-air transmissions use the same signal formats as the 1090 MHz Extended Squitter ADS-B and can therefore be accepted by a 1090 MHz ADS-B Receiving Subsystem, with the exceptions identified in the following sections.*

2.2.18.2 ADS-B Rebroadcast Format Definition

ADS-B Rebroadcast information **shall** be transmitted using the 112-bit Mode S DF=18 format specified in Figure 2-2.

2.2.18.3 Control Field Allocation

The content of the DF=18 transmission is defined by the value of the Control Field (CF). As specified in Table 2-11, ADS-B Rebroadcast transmissions **shall** use CF=6.

2.2.18.4 ADS-B Rebroadcast Surveillance Message Definitions

The Rebroadcast of ADS-B information on the 1090 MHz Extended Squitter data link is accomplished by utilizing the same ADS-B Message formats defined in Figure A-1 through Figure A-10, with the exception of the need to transmit an indication to the 1090 MHz Receiving Subsystem as to the type of identity associated with the aircraft data being reported in the ADS-B Rebroadcast Message. This identification is performed using the ICAO/Mode A Flag (IMF), which was previously discussed in §2.2.17.3.1.2 for the TIS-B transmissions.

The insertion of this one bit into the ADS-B Messages identified in the subparagraphs below allows the ADS-B Receiving Subsystem to interpret the Address Field (AF) in the following manner:

IMF = 0 **shall** indicate that the ADS-B Rebroadcast data is identified by an ICAO 24-bit Address.

IMF = 1 **shall** indicate that the ADS-B Rebroadcast data is identified by an anonymous 24-bit address or ground vehicle address or fixed obstruction address.

2.2.18.4.1 Rebroadcast Airborne Position Message

The ME Field of the Rebroadcast Airborne Position Message **shall** be formatted as specified in Figure 2-3, except that ME bit 8 is redefined to be the ICAO/Mode A Flag (IMF).

2.2.18.4.2 Rebroadcast Surface Position Message

The ME Field of the Rebroadcast Surface Position Message **shall** be formatted as specified in Figure 2-5, except that ME bit 21 is redefined to be the ICAO/Mode A Flag (IMF).

2.2.18.4.3 Rebroadcast Aircraft Identification and Category Message

The ME Field of the Rebroadcast Aircraft Identification and Category Message **shall** be formatted exactly as specified in Figure 2-6.

Note: *Any Rebroadcast Aircraft Identification and Category Message does not contain the IMF bit since aircraft using an anonymous 24-bit address will not provide identity and category information.*

2.2.18.4.4 Rebroadcast Airborne Velocity Messages

The ME Field of the Rebroadcast Airborne Velocity Messages **shall** be formatted as specified in Figure 2-7 for Subtype 1 & 2 Messages, and in Figure 2-8 for Subtype 3 & 4 Messages, except that ME bit 9 is redefined to be the ICAO/Mode A Flag (IMF).

2.2.18.4.5 Rebroadcast Aircraft Emergency/Priority Status Message

The ME Field of the Rebroadcast Aircraft Emergency/Priority Status Message **shall** be formatted as specified in Figure 2-14, except that ME bit 56 is redefined to be the ICAO/Mode A Flag (IMF).

2.2.18.4.6 Rebroadcast Target State and Status Message

The ME Field of the Rebroadcast Target State and Status Message **shall** be formatted as specified in Figure 2-10, except that ME bit 51 is redefined to be the ICAO/Mode A Flag (IMF).

2.2.18.4.7 Rebroadcast Aircraft Operational Status Message

The ME Field of the Rebroadcast Aircraft Operational Status Message **shall** be formatted as specified in Figure 2-11, except that ME bit 56 is redefined to be the ICAO/Mode A Flag (IMF).

(1.32) In RTCA/DO-260A, replace section §2.4.3.2.1.2.1, Test Procedure Step 3, with the following.

For transponder based ADS-B transmitting systems that have automatic detection of on the ground status and have ground speed, airspeed or radio altitude available, the following procedure applies. For ADS-B Transmitting Systems for installations without automatic means of determining on the ground status, the following procedure shall verify that the "CA" field remains set to 6 throughout the procedure.

Set up the ADS-B transmitting system as in step 1 with on the ground status externally provided to the ADS-B transmitting system and additionally provide radio altitude input. Use a value greater than 50 feet. Vary the "Emitter Category" data input through the range of Emitter Category Sets that the system is capable. Verify that the ADS-B transmitting system correctly broadcasts each extended squitter message type with the “CA” field equal to 5 for all Emitter Category Set “A” codes 2 through 6 as specified in Table 2-10.

Repeat the procedure given in the previous paragraph, except change the radio altitude data to a value less than 50 feet. Verify for each extended squitter type that the reported “CA” field equals 4.

Maintain the radio altitude data at a value less than 50 feet and if the system is capable of accepting ground speed data input, provide ground speed data greater than 100 knots to the ADS-B transmitting system. Verify for each extended squitter type that the reported “CA” field equals 5 for Emitter Category Set “A,” codes 2 through 6.

Maintain the radio altitude data at a value less than 50 feet and set the ground speed to a value less than or equal to 100 knots. Verify for each extended squitter type that the reported “CA” field equals 4.

Maintain the radio altitude data at a value less than 50 feet and the ground speed at 100 knots or less. If the system is capable of accepting airspeed data input, provide airspeed data greater than 100 knots to the ADS-B transmitting system. Verify for each extended squitter type that the reported “CA” field equals 5 for Emitter Category Set “A,” codes 2 through 6.

Maintain the radio altitude data at a value less than 50 feet and the ground speed at a value less than or equal to 100 knots. Set the airspeed to a value less than or equal to 100 knots. Verify for each extended squitter type that the reported “CA” field equals 4.

(1.33) In RTCA/DO-260A, replace section §2.4.3.2.1.2.1, Test Procedure Step 4, with the following:

The following procedure verifies that ADS-B Transmitting Systems without automatic detection of “On-The-Ground” status and capable of inputting radio altitude, ground speed, or airspeed, correctly reports “CA” Field equal to SIX (6), even when Surface Position Message broadcast is determined according to the requirements of section 2.2.3.2.1.2.1 (c). Set up the ADS-B Transmitting System as in Step 1 above. For ADS-B Transmitting Systems with automatic means of determining “On-The-Ground” status, and capable of inputting radio altitude, ground speed or airspeed, provide external input to set the system to “Airborne” status and verify that the “CA” Field remains equal to FIVE (5) throughout this procedure.

For ADS-B Transmitting Systems capable of accepting radio altitude input, ground speed or airspeed, provide radio altitude data, ground speed and airspeed data to the ADS-B transmitting system according to the values defined in Table 2-124 or in the case of no data, stop providing the data as indicated. Verify that the system broadcasts extended squitters with the “CA” Field equal to SIX (6) for each test condition in Table 2-124.

(1.34) In RTCA/DO-260A, in section §2.4.3.2.1.2.2, Test Procedure Step 3, rename the test Step to "Air/Ground Status Determination – Input Data Variation" and replace Table 2-124 with the following:

Table 2-124: Vertical Status Determination

Vertical Status Determination					
Test	**Emitter Category / Coding**	**Ground Speed (knots)**	**Airspeed (knots)**	**Radio Altitude (feet)**	**Resulting Vertical Status**
1	A/2 – 6, B/7	100	100	50	AIRBORNE
2	A/2 – 6, B/7	100	50	25	AIRBORNE
3	A/2 – 6, B/7	50	100	25	AIRBORNE
4	A/2 – 6, B/7	50	50	50	AIRBORNE
5	A/2 – 6, B/7	99	99	49	ON-GROUND
6	A/2 – 6, B/7	50	25	No Data	AIRBORNE
7	A/2 – 6, B/7	25	50	No Data	AIRBORNE
8	A/2 – 6, B/7	49	49	No Data	ON-GROUND
9	A/2 – 6, B/7	No Data	25	No Data	AIRBORNE
10	A/2 – 6, B/7	25	No Data	No Data	AIRBORNE
11	A/2 – 6, B/7	100	No Data	25	AIRBORNE
12	A/2 – 6, B/7	No Data	100	25	AIRBORNE
13	A/2 – 6, B/7	99	No Data	49	ON-GROUND
14	A/2 – 6, B/7	No Data	99	49	ON-GROUND
15	A/2 – 6, B/7	25	No Data	50	AIRBORNE
16	A/2 – 6, B/7	No Data	25	50	AIRBORNE
17	A/2 – 6, B/7	No Data	No Data	25	AIRBORNE
18	A/2 – 6, B/7	No Data	No Data	No Data	AIRBORNE

(1.35) In RTCA/DO-260A, in section §2.4.3.2.1.2.2, Test Procedure Step 4, rename the test step to "Air/Ground Status Validation – ON-GROUND Override." In the last sentence of the paragraph of Step 4, change the reference from Table 2-124 **to** Table 2-125, and replace Table 2-125 with the following:

Table 2-125: On-Ground Override

ON-GROUND Override					
Test	**Emitter Category / Coding**	**Ground Speed (knots)**	**Speed (knots)**	**Radio Altitude (feet)**	**Resulting Vertical Status**
1	A/2 – 6, B/7	100	100	50	ON-GROUND
2	A/2 – 6, B/7	100	100	51	AIRBORNE
3	A/2 – 6, B/7	100	101	50	AIRBORNE
4	A/2 – 6, B/7	101	100	50	AIRBORNE
5	A/2 – 6, B/7	No Data	100	50	ON-GROUND
6	A/2 – 6, B/7	No Data	100	51	AIRBORNE
7	A/2 – 6, B/7	No Data	101	50	AIRBORNE
8	A/2 – 6, B/7	No Data	No Data	50	ON-GROUND
9	A/2 – 6, B/7	No Data	No Data	51	AIRBORNE
10	A/2 – 6, B/7	100	No Data	50	ON-GROUND
11	A/2 – 6, B/7	101	No Data	50	AIRBORNE
12	A/2 – 6, B/7	100	No Data	51	AIRBORNE
13	A/2 – 6, B/7	100	No Data	No Data	ON-GROUND
14	A/2 – 6, B/7	101	No Data	No Data	AIRBORNE
15	A/2 – 6, B/7	No Data	100	No Data	ON-GROUND
16	A/2 – 6, B/7	No Data	101	No Data	AIRBORNE
17	A/2 – 6, B/7	100	101	No Data	AIRBORNE
18	A/2 – 6, B/7	101	100	No Data	AIRBORNE
19	A/2 – 6, B/7	100	100	No Data	ON-GROUND
20	A/2 – 6, B/7	No Data	No Data	No Data	ON-GROUND

(1.36) In RTCA/DO-260A, replace the entire section §2.4.3.2.3.1 with the following:

Purpose/Introduction:

This test procedure verifies that the ADS-B Transmitting Subsystem correctly outputs Airborne Position Messages with the correct TYPE Code subfield data content in Message Bits 33 through 37 in DF=17 Messages for Transponder Based Systems and DF=18 Messages for Non-Transponder Based Systems. The ME field of the ADS-B Airborne Position Message contains the TYPE Code subfield in bits 1 through 5 which, along with the Navigation Integrity Category Supplement in the Aircraft Operational Status Message, indicates the navigational integrity of the position information. The ADS-B Transmitting Subsystem determines and outputs the TYPE Code subfield based upon the input it receives from the possible Navigational sources that may interface to the system. The ADS-B Transmitting Subsystem may receive the TYPE Code subfield directly through an external interface instead of dynamically determining the TYPE Code subfield. Whatever the implementation, the test cases must exercise all of the resulting TYPE Code possibilities. If an ADS-B Transmitting Subsystem can only generate a subset of the possible ADS-B Airborne Position Message TYPE Codes, then only those test cases required to produce the possible TYPE Codes **shall** be tested. The test configuration is based on the type(s) of Navigational System(s) that may interface to the ADS-B Transmitting Subsystem and the data it provides.

Measurement Procedure:

Step 1: Verification of TYPE Codes 9 through 18 and 20 through 22 with GNSS/Baro Altitude

Configure the ADS-B Transmitting Subsystem to transmit ADS-B Airborne Position Messages by providing position information at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to "Airborne" status. Provide valid non-zero barometric pressure altitude data and GNSS altitude data to the ADS-B System. For each Navigation Integrity Category (NIC) supported, verify that the TYPE Code subfield in the ADS-B Airborne Position Message correctly matches the TYPE Code subfield value from the Radius of Containment (R_C) depicted in Table 2-16. Additionally, verify that the NIC Supplement contained in the Aircraft Operational Status Message along with the TYPE Code in the Airborne Position Message reflects the proper NIC value contained in Table 2-16 (see §2.4.3.2.7.2.6). The NIC may be derived by the Horizontal Radius of Containment depicted in Table 2-16, or the Horizontal Integrity Limit (HIL), or another means which establishes an appropriate Radius of Containment. To test all of the possible resulting TYPE Codes that could be produced from the Navigational source, degradation of the position data from the Navigation source may require an alarm or alert condition that must be sensed by the ADS-B Transmitting Subsystem. The TYPE Code subfield **shall** contain values in the range from 9 through 18. In the cases where R_C meets the criteria for NIC values of 9, 10 and 11, verify that the proper TYPE Code and NIC Supplement are assigned according to the VPL criteria for each of these NIC values.

Verify that TYPE codes 9 and 10 cannot be set if the unit under test is not provided with either a GNSS Time Mark (see §2.2.5.1.6) or UTC data unless the Non-Coupled Case of position estimation (see §2.2.3.2.3.7.2.2 for Latitude, and §2.2.3.2.3.8.2.2 for Longitude) is implemented.

Note: *UTC data is not acceptable to be used in place of GNSS Time Mark (see §2.2.5.1.6) due to the fact that UTC data may not be available for any possible time up to 200 milliseconds after the leading edge of the GNSS Time Mark. Therefore, UTC data may not be used to establish TYPE codes 9 and 10.*

Stop providing input of barometric altitude to the ADS-B Transmitting Subsystem and continue providing GNSS Altitude data. If the ADS-B Transmitting Subsystem supports broadcasting TYPE Codes 20 and 21, then verify that the TYPE Code subfield in the ADS-B Airborne Position Message correctly matches the TYPE Code subfield value from the Radius of Containment and Vertical Protection Limit (VPL) values depicted in Table 2-16 for TYPE codes 20 and 21. If GNSS Altitude data is provided, but it is not possible to determine the R_C or VPL values, then verify that the TYPE Code subfield is set to 22.

Verify that TYPE Codes 20 and 21 cannot be set if the unit under test is not provided with either a GNSS Time Mark (see §2.2.5.1.6) or UTC data, unless the Non-Coupled Case of position estimation (see §2.2.3.2.3.7.2.2 for Latitude, and §2.2.3.2.3.8.2.2 for Longitude) is implemented.

Note: *UTC data is not acceptable to be used in place of GNSS Time Mark (see §2.2.5.1.6) due to the fact that UTC data may not be available for any possible time up to 200 milliseconds after the leading edge of the GNSS Time Mark. Therefore, UTC data may not be used to establish TYPE codes 20 and 21.*

Stop providing inputs of barometric altitude and GNSS altitude to the ADS-B Transmitting Subsystem, and provide position data for each of the R_C values that correspond to the horizontal containment limits for NIC values 0 to 11 (TYPE Codes 9 through 18). Verify that the TYPE Code subfield is 11 and NIC Supplement is ZERO when R_C meets the horizontal containment limits for NIC of 9, 10 and 11. For all other cases, verify that the TYPE Code and the NIC Supplement contain values that correspond to the R_C value depicted in Table 2-16, with the Altitude Subfield set to ALL ZEROs.

Step 2: Verification of TYPE Codes 20 through 22 with GNSS Altitude

This step **shall** be performed for all ADS-B Transmitting Subsystems capable of broadcasting GNSS Altitude data. Configure the ADS-B Transmitting Subsystem to transmit Airborne Position Messages. Provide both barometric altitude and GNSS altitude data to the ADS-B Transmitting Subsystem. Disconnect the barometric altitude source to the ADS-B Transmitting Subsystem so that only GNSS altitude data is available. For each NIC value supported, verify that the TYPE Code subfield in the ADS-B Airborne Position Message correctly matches the TYPE Code subfield value from the R_C range of values depicted in Table 2-16 for TYPE Codes 20 through 22. The TYPE Code may be derived by the R_C depicted in Table 2-16, or the HIL, or another means which establishes an appropriate integrity containment. To test all of the possible resulting TYPE Codes that could be produced from the Navigational source, degradation of the position data from the Navigation source may require an alarm or alert condition that must be sensed by the ADS-B Transmitting Subsystem. If the VPL and R_C values vary independently, test all possible resultant TYPE Codes from the variations and verify that the least capable VPL or R_C value of each test case is used to determine the TYPE Code.

Step 3: Verification of TYPE Code if the Radius of Containment is Unavailable

Configure the ADS-B Transmitting Subsystem to “Airborne” status as in Step 1, and provide navigation data from a source that does not provide a valid R_C. Horizontal Containment Radius is valid from a navigation source that provides HPL, HIL, or HPL that can be derived from a RAIM protection threshold. Input both valid barometric altitude and GNSS altitude data. Verify that in the absence of a valid R_C value, the ADS-B Transmitting Subsystem transmits ADS-B Airborne Position Messages with a TYPE Code subfield set to 18.

Stop providing input of valid barometric altitude data to the ADS-B Transmitting Subsystem and continue to provide GNSS altitude data. Verify that the ADS-B Transmitting Subsystem transmits ADS-B Airborne Position Messages with the TYPE Code subfield set to 22.

Stop providing input of valid GNSS altitude data to the ADS-B Transmitting Subsystem. Verify that the ADS-B Transmitting Subsystem transmits ADS-B Airborne Position Messages with the TYPE Code subfield set to ZERO.

(1.37) In RTCA/DO-260A, replace the entire section §2.4.3.2.4.1 with the following:

Purpose/Introduction:

This test procedure verifies that the ADS-B Transmitting Subsystem correctly outputs ADS-B Surface Position Messages with the correct TYPE Code subfield data content in

Message Bits 33 through 37 in DF=17 Messages for Transponder Based Systems and DF=18 Messages for Non-Transponder Based Systems. The ME field of the ADS-B Surface Position Message contains the TYPE Code subfield in bits 1 through 5 which, along with the Navigation Integrity Category Supplement in the Aircraft Operational Status Message, indicates the navigational integrity of the position information. The ADS-B Transmitting Subsystem determines and outputs the TYPE Code subfield based upon the input it receives from the possible Navigational sources that may interface to the system. The ADS-B Transmitting Subsystem may receive the TYPE Code subfield directly through an external interface instead of dynamically determining the TYPE Code subfield. Whatever the implementation, the test cases must exercise all of the resulting TYPE Code possibilities. If an ADS-B Transmitting Subsystem can only generate a subset of the possible ADS-B Surface Position Message TYPE Codes, then only those test cases required to produce the possible TYPE Codes **shall** be tested. The test configuration is based on the type(s) of Navigational System(s) that may interface to the ADS-B Transmitting Subsystem and the data it provides.

Measurement Procedure:

Step 1: Verification of TYPE Codes 5 through 8

Configure the ADS-B Transmitting Subsystem to transmit ADS-B Surface Position Messages by providing position information at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to the "On-Ground" status. Provide appropriate Ground Speed information to the ADS-B System in order to establish the high rate of transmission for the ADS-B Surface Position Messages. For each Navigation Integrity Category (NIC) supported, verify that the TYPE Code subfield in the ADS-B Surface Position Message correctly matches the TYPE Code subfield value from the Radius of Containment (R_C) depicted in Table 2-16. Additionally, verify that the NIC Supplement contained in the Aircraft Operational Status Message, along with the TYPE Code, reflects the proper NIC value contained in Table 2-16 (see §2.4.3.2.7.2.6). The TYPE Code may be derived by the Horizontal Radius of Containment depicted in Table 2-16, or the Horizontal Integrity Limit (HIL), or another means which establishes an appropriate Radius of Containment. To test all of the possible resulting TYPE Codes that could be produced from the Navigational source, degradation of the position data from the Navigation source may require an alarm or alert condition that must be sensed by the ADS-B Transmitting Subsystem. The TYPE Code subfield **shall** contain values in the range from 5 through 8.

Verify that TYPE codes 5 and 6 cannot be set if the unit under test is not provided with either a GNSS Time Mark (see §2.2.5.1.6) or UTC data unless the Non-Coupled Case of position estimation (see §2.2.3.2.4.7.2.2 for Latitude, and §2.2.3.2.4.8.2.2 for Longitude) is implemented.

Note: *UTC data is not acceptable to be used in place of GNSS Time Mark (see §2.2.5.1.6) because of the fact that UTC data may not be available for any possible time up to 200 milliseconds after the leading edge of the GNSS Time Mark. Therefore, UTC data may not be used to establish TYPE codes 5 and 6.*

Step 2: Verification of TYPE Codes if the Radius of Containment is Unavailable

Configure the ADS-B Transmitting Subsystem to the "On-Ground" status as in Step 1, and provide navigation data from a source that does not provide a valid RC value. Horizontal Containment Radius is valid from a navigation source that provides HPL, HIL, or HPL that can be derived from a RAIM protection threshold. Verify that in the absence of a valid R_C value, the ADS-B Transmitting Subsystem transmits ADS-B Surface Position Messages with a TYPE Code subfield set to 8.

(1.38) In RTCA/DO-260A, replace the entire section §2.4.3.2.4.1.1 with the following:

Appropriate test procedures are provided in §2.4.3.2.4.1.

(1.39) In RTCA/DO-260A, in section §2.4.3.2.7.1.3.5, replace the sentence after the "Purpose/Introduction" with the following:

In this version of these MOPS (RTCA/DO-260A), the Vertical Mode Indicator **shall** be set to ZERO (binary 00).

(1.40) In RTCA/DO-260A, in section §2.4.3.2.7.1.3.5, replace the last sentence in each of the Test Procedure Steps 2 and 3 with the following:

"Verify that ME bits 14 and 15 are set to a value of ZERO (binary 00)."

(1.41) In RTCA/DO-260A, in section §2.4.3.2.7.1.3.10, replace the sentence after the "Purpose/Introduction" with the following:

In this version of these MOPS (RTCA/DO-260A), the Horizontal Mode Indicator **shall** be set to ZERO (binary 00).

(1.42) In RTCA/DO-260A, in section §2.4.3.2.7.1.3.10, replace the last sentence in each of the Test Procedure Steps 2 and 3 with the following:

"Verify that ME bits 38 and 39 are set to a value of ZERO (binary 00)."

(1.43) In RTCA/DO-260A, in section §2.4.3.2.7.2.3.1, in the "Purpose / Introduction" the references to "ME bits" and "Message bits" are reversed. Replace the text of the "Purpose/Introduction" with the following:

Within the CC Code subfield, a 4-bit subfield ("ME" bits 9-10 and 13-14, Message bits 41-42, and 45-46) that **shall** be reserved for the "Service Level" of the ADS-B Transmitting Subsystem. ADS-B equipment conforming to Version 1 (RTCA DO-260A) of these MOPS **shall** set the Service Level code to ALL ZEROs.

(1.44) In RTCA/DO-260A, in section §2.4.3.2.7.2.3.1, in the "Measurement Procedure" the references to "ME bits" and "Message bits" were exchanged. Replace the last sentence of the "Measurement Procedure" with the following:

Verify that the ME bits 9 and 10 and ME bits 13 and 14 are set to ALL ZEROs.

(1.45) In RTCA/DO-260A, section §2.4.3.2.7.2.9, replace the "Purpose/Introduction," with the following:

The Surveillance Integrity Level (SIL) is a two-bit subfield of "Subtype=0" ADS-B Aircraft Operational Status Messages ("ME" bits 51 and 52, Message bits 83 and 84) that **shall** announce the integrity level associated with the Containment Radius (R_C) being broadcast in the NIC parameter. Table 2-72 defines the meaning of each SIL value. For installations where the SIL value is being dynamically updated, if an update has not been received from an on-board data source for SIL within the past 5 seconds, then the SIL subfield **shall** be encoded as a value of ZERO (0), indicating "Unknown."

(1.46) In RTCA/DO-260A, section §2.4.3.3.1.4.2, replace test procedure Step 4 through Step 6c with the following:

Step 4: ADS-B Message Broadcasts in the "On-Ground" State – Repeat Tests With ADS-B Target State and Status and Operational Status Messages

Repeat the Step 1 set up, except replace the ADS-B Aircraft Operational Status Messages (TYPE=31, SUBTYPE=ZERO) with ADS-B Aircraft Operational Status Messages (TYPE=31, SUBTYPE=ONE), indicating an "On-Ground" status, and then verify that the ADS-B Transmitting Subsystem is **not** broadcasting ADS-B Target State and Status Messages, and is broadcasting ADS-B Aircraft Operational Status Messages with SUBTYPE=ONE at a spacing uniformly distributed over the range of 4.8 to 5.2 seconds.

Step 5: ADS-B Message Broadcasts in the "On-Ground" State – With Changes (§2.2.3.3.1.4.2)

Separately initiate each of the two (2) changes described in §2.2.3.3.1.4.2, Condition 2 "c" and "d," and for each separate case, verify that the ADS-B Transmitting Subsystem continues broadcasting ADS-B Operational Status Messages with SUBTYPE=ONE, at a spacing uniformly distributed over the range of 4.8 to 5.2 seconds.

(1.47) In RTCA/DO-260A, in sections §2.4.4.4.2.2 and §2.4.4.4.2.3, replace both of the entire test procedure sections with the following:

2.4.4.4.2.2 Four-Pulse Preamble Detection Tests

Purpose/Introduction:

These tests verify that the ADS-B reply processor correctly detects the presence of a valid ADS-B preamble whose pulse characteristics are within the allowable limits and rejects preambles having pulse spacing and position characteristics that are outside the allowable limits.

Reference Input:

Provide a method of supplying the UUT with:

Any Valid ADS-B Message having:

"DF"	=	17
"CA"	=	0
"AA"	=	Any discrete address
Message Rate	=	50 Hz
Frequency	=	1090 MHz
Power	=	-23 dBm (for the first preamble pulse level)

Input A:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-150: Input A: Preamble Pulse Characteristics

Input A: Preamble Pulse Characteristics					
Pulse	**Rise time** (µsec)	**Fall time** (µsec)	**Δ Width** (µsec)	**Δ Position** (µsec)	**Δ Amplitude** (dB)
1	0.05 - 0.1	0.05 - 0.2	+0.05	—	—
2	0.05 - 0.1	0.05 - 0.2	-0.05	+0.100	+2
3	0.05 - 0.1	0.05 - 0.2	+0.05	+0.100	+2
4	0.05 - 0.1	0.05 - 0.2	-0.05	+0.100	0

Input B:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-151: Input B: Preamble Pulse Characteristics

Input B: Preamble Pulse Characteristics					
Pulse	**Rise time** (µsec)	**Fall time** (µsec)	**Δ Width** (µsec)	**Δ Position** (µsec)	**Δ Amplitude** (dB)
1	0.05 - 0.1	0.05 - 0.2	+0.05	—	—
2	0.05 - 0.1	0.05 - 0.2	-0.05	-0.100	+2
3	0.05 - 0.1	0.05 - 0.2	+0.05	-0.100	+2
4	0.05 - 0.1	0.05 - 0.2	-0.05	-0.100	0

Input C:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-152: Input C: Preamble Pulse Characteristics

Input C: Preamble Pulse Characteristics					
Pulse	**Rise time** (µsec)	**Fall time** (µsec)	**Δ Width** (µsec)	**Δ Position** (µsec)	**Δ Amplitude** (dB)
1	0.05 - 0.1	0.05 - 0.2	0	—	—
2	0.05 - 0.1	0.05 - 0.2	+3.5	0	0
3	Pulse Not Present				
4	Pulse Not Present				

Note: *Input C sets up a preamble where only P1 and P2 have actual leading edges, while P3 and P4 have pulse positions provided by the extended P2 pulse. All pulse positions and leading edges are at nominal positions. This test input verifies that the UUT accepts a preamble with the minimum 2 actual leading edges using P1 and P2. The test procedure requires that the UUT accepts this input at a rate of at least 90%.*

Input D:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-153: Input D: Preamble Pulse Characteristics

Input D: Preamble Pulse Characteristics					
Pulse	**Rise time** (µsec)	**Fall time** (µsec)	**Δ Width** (µsec)	**Δ Position** (µsec)	**Δ Amplitude** (dB)
1	0.05 - 0.1	0.05 - 0.2	+1.0	—	—
2	Pulse Not Present				
3	0.05 - 0.1	0.05 - 0.2	+1.0	0	0
4	Pulse Not Present				

Note: *Input D sets up a preamble where only P1 and P3 have actual leading edges, while P2 and P4 have pulse positions provided by the extended P1 and P3 pulses. All pulse positions and leading edges are at nominal positions. This test input verifies that the UUT accepts a preamble with the minimum 2 actual leading edges using P1 and P3. The test procedure requires that the UUT accepts this input at a rate of at least 90%.*

Input E:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-154: Input E: Preamble Pulse Characteristics

Input E: Preamble Pulse Characteristics					
Pulse	**Rise time** (µsec)	**Fall time** (µsec)	**Δ Width** (µsec)	**Δ Position** (µsec)	**Δ Amplitude** (dB)
1	0.05 - 0.1	0.05 - 0.2	+3.5	—	—
2	Pulse Not Present				
3	Pulse Not Present				
4	0.05 - 0.1	0.05 - 0.2	0	0	0

Note: *Input E sets up a preamble where only P1 and P4 have actual leading edges, while P2 and P3 have pulse positions provided by the extended P1 pulse. All pulse positions and leading edges are at nominal positions. This test input verifies that the UUT accepts a preamble with the minimum 2 actual leading edges using P1 and P4. The test procedure requires that the UUT accepts this input at a rate of at least 90%.*

Input F:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-155: Input F: Preamble Pulse Characteristics

Input F: Preamble Pulse Characteristics					
Pulse	**Rise time** (μsec)	**Fall time** (μsec)	**Δ Width** (μsec)	**Δ Position** (μsec)	**Δ Amplitude** (dB)
1	0.05 - 0.1	0.05 - 0.2	+1.3	-0.3	—
2	Pulse Not Present				
3	0.05 - 0.1	0.05 - 0.2	0	0	0
4	0.05 - 0.1	0.05 - 0.2	0	0	0

Note: *Input F sets up a preamble where only P3 and P4 provide actual leading edges within the allowable position limits, while P1 and P2 have pulse positions provided by the extended P1 pulse. Pulse positions and leading edges are located at nominal positions. This test input verifies that the UUT accepts a preamble with the minimum 2 actual leading edges using P3 and P4. The test procedure requires that the UUT accepts this input at a rate of at least 90%.*

Inputs G through W:

The Inputs for G through W are the same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-156: Inputs G thru W: Preamble Pulse Characteristics

Input Set	Pulse	**Rise time** (μsec)	**Fall time** (μsec)	**Δ Width** (μsec)	**Δ Position** (μsec)	**Δ Amplitude (dB)**
Input G	1	0.05 - 0.1	0.05 - 0.2	+0.3	-0.3	—
	2	0.05 - 0.1	0.05 - 0.2	0	0	0
	3	0.05 - 0.1	0.05 - 0.2	+0.3	-0.3	0
	4	0.05- 0.1	0.05 - 0.2	0	0	0
Input H	1	0.05 - 0.1	0.05 - 0.2	+0.3	-0.3	—
	2	0.05 - 0.1	0.05 - 0.2	0	0	0
	3	0.05 - 0.1	0.05 - 0.2	+1.0	0	0
	4	Pulse Not Present				
Input I	1	0.05 - 0.1	0.05 - 0.2	-0.3	—	—
	2	0.05 - 0.1	0.05 - 0.2	-0.3	0	0
	3	0.05 - 0.1	0.05 - 0.2	-0.3	0	0
	4	0.05 - 0.1	0.05 - 0.2	-0.3	0	0
Input J	1	0.05 - 0.1	0.05 - 0.2	+4.5	—	—
	2	Pulse Not Present				
	3	Pulse Not Present				
	4	Pulse Not Present				
Input K	1	0.05 - 0.1	0.05 – 0.2	0	—	—
	2	0.05 - 0.1	0.05 – 0.2	+3.5	-0.2	0
	3	Pulse Not Present				
	4	Pulse Not Present				
Input L	1	0.05 - 0.1	0.05 – 0.2	0	—	—
	2	0.05 - 0.1	0.05 – 0.2	+3.5	+0.2	0

Input Set	Pulse	**Rise time** (µsec)	**Fall time** (µsec)	**Δ Width** (µsec)	**Δ Position** (µsec)	**Δ Amplitude (dB)**
	3	Pulse Not Present				
	4	Pulse Not Present				
Input M	1	0.05 - 0.1	0.05 - 0.2	+1.0	—	—
	2	Pulse Not Present				
	3	0.05 - 0.1	0.05 - 0.2	+1.0	-0.2	0
	4	Pulse Not Present				
Input N	1	0.05 - 0.1	0.05 - 0.2	+1.0	—	—
	2	Pulse Not Present				
	3	0.05 - 0.1	0.05 - 0.2	+1.0	+0.2	0
	4	Pulse Not Present				
Input O	1	0.05 - 0.1	0.05 - 0.2	+3.5	—	—
	2	Pulse Not Present				
	3	Pulse Not Present				
	4	0.05 - 0.1	0.05 - 0.2	0	-0.2	0
Input P	1	0.05 - 0.1	0.05 - 0.2	+3.5	—	—
	2	Pulse Not Present				
	3	Pulse Not Present				
	4	0.05 - 0.1	0.05 - 0.2	0	+0.2	0
Input Q	1	0.05 - 0.1	0.05 - 0.2	+1.3	-0.3	—
	2	Pulse Not Present				
	3	0.05 - 0.1	0.05 - 0.2	0	-0.125	0
	4	0.05 - 0.1	0.05 - 0.2	0	+0.125	0
Input R	1	0.05 - 0.1	0.05 - 0.2	+1.3	-0.3	—
	2	Pulse Not Present				
	3	0.05 - 0.1	0.05 - 0.2	0	+0.125	0
	4	0.05 - 0.1	0.05 - 0.2	0	-0.125	0
Input S	1	0.05 – 0.1	0.05 - 0.2	+0.3	-0.3	—
	2	0.05 – 0.1	0.05 - 0.2	0	-0.125	0
	3	0.05 – 0.1	0.05 - 0.2	+0.3	-0.3	0
	4	0.05 – 0.1	0.05 - 0.2	0	+0.125	0
Input T	1	0.05 – 0.1	0.05 - 0.2	+0.3	-0.3	—
	2	0.05 - 0.1	0.05 - 0.2	0	+0.125	0
	3	0.05 - 0.1	0.05 - 0.2	+0.3	-0.3	0
	4	0.05 - 0.1	0.05 - 0.2	0	-0.125	0
Input U	1	0.05 - 0.1	0.05 - 0.2	+0.3	-0.3	—
	2	0.05 - 0.1	0.05 - 0.2	0	-0.125	0
	3	0.05 - 0.1	0.05 - 0.2	+1.0	+.125	0
	4	Pulse Not Present				
Input V	1	0.05 - 0.1	0.05 - 0.2	+0.3	-0.3	—
	2	0.05 - 0.1	0.05 - 0.2	0	+0.125	0
	3	0.05 - 0.1	0.05 - 0.2	+1.0	-.125	0
	4	Pulse Not Present				
Input W	1	Pulse Not Present				
	2	0.05 - 0.1	0.05 – 0.2	0	0	0
	3	0.05 - 0.1	0.05 – 0.2	0	0	0
	4	0.05 - 0.1	0.05 – 0.2	0	0	0

Notes:

1. *Input G sets up a preamble where only P2 and P4 provide actual leading edges within the allowable position limits, while P1 and P3 have pulse positions. Pulse positions and leading edges are located at nominal positions. This test input verifies that the UUT accepts a preamble with the minimum 2 actual leading edges using P2 and P4. The test procedure requires that the UUT accepts this input at a rate of at least 90%.*

2. *Input H sets up a preamble where only P2 and P3 provide actual leading edges within the allowable position limits, while P1 and P4 have pulse positions provided by the extended P1 and P3 pulses. Pulse positions and leading edges are located at nominal positions. This test input verifies that the UUT accepts a preamble with the minimum 2 actual leading edges using P2 and P3. The test procedure requires that the UUT accepts this input at a rate of at least 90%.*

3. *Input K sets up a preamble where only P1 and P2 have actual leading edges, while P3 and P4 will have pulse positions provided by the extended P2 pulse. The P2 leading edge position is offset by -0.2 microseconds. This test input step verifies that the UUT uses a maximum ± 0.1 sample pulse leading edge position tolerance using P1 and P2. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

4. *Input L sets up a preamble where only P1 and P2 have actual leading edges, while P3 and P4 will have pulse positions provided by the extended P2 pulse. The P2 leading edge position is offset by +0.2 microseconds. This test input step verifies that the UUT uses a maximum ± 0.1 sample pulse leading edge position tolerance using P1 and P2. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

5. *Input M sets up a preamble where only P1 and P3 have actual leading edges, while P2 and P4 will have pulse positions provided by the extended P1 and P3 pulses. The P3 leading edge position is offset by -0.2 microseconds. This test input step verifies that the UUT uses a maximum ± 1 sample pulse leading edge position tolerance using P1 and P3. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

6. *Input N sets up a preamble where only P1 and P3 have actual leading edges, while P2 and P4 will have pulse positions provided by the extended P1 and P3 pulses. The P3 leading edge position is offset by +0.2 microseconds. This test input step verifies that the UUT uses a maximum ± 1 sample pulse leading edge position tolerance using P1 and P3. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

7. *Input O sets up a preamble where only P1 and P4 have actual leading edges, while P2 and P3 will have pulse positions provided by the extended P1 pulse. The P4 leading edge position is offset by -0.2 microseconds. This test input step verifies that the UUT uses a maximum ± 1 sample pulse leading edge position tolerance using P1 and P4. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

8. *Input P sets up a preamble where only P1 and P4 have actual leading edges, while P2 and P3 will have pulse positions provided by the extended P1 pulse. The P4 leading edge position is offset by +0.2 microseconds. This test input step verifies that the UUT uses a maximum ± 1 sample pulse leading edge position tolerance using P1 and P4. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

9. *The purpose of Input Q is to test that the UUT does not simultaneously apply both a + and – sample tolerance. Input Q sets up a preamble with no actual preamble pulse leading edges in their nominal positions. The P1 position is offset by -0.3 microseconds and width is offset by +1.3 microseconds to replace the missing P2 pulse. This places the P1 and P2 actual leading*

edges out of detection range but provides pulse positions at nominal positions. This focuses the actual leading edge detection on P3 and P4 whose leading edges are offset by -0.125 microseconds and +0.125 microseconds respectively. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.

10. *The purpose of Input R is to test that the UUT does not simultaneously apply both a + and – sample tolerance. Input R sets up a preamble with no actual preamble pulse leading edges in their nominal positions. The P1 position is offset by -0.3 microseconds and width is offset by +1.3 microseconds to replace the missing P2 pulse. This places the P1 and P2 actual leading edges out of detection range but provides pulse positions at nominal positions. This focuses the actual leading edge detection on P3 and P4 whose leading edges are offset by +0.125 microseconds and -0.125 microseconds respectively. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

11. *The purpose of Input S is to test that the UUT does not simultaneously apply both a + and – sample tolerance. Input S sets up a preamble with no actual preamble pulse leading edges in their nominal positions. The P1 and P3 positions are offset by -0.3 microseconds and widths are offset by +0.3 microseconds. This places the P1 and P3 actual leading edges out of detection range but provides pulse positions at nominal positions. This focuses the actual leading edge detection on P2 and P4 whose leading edges are offset by -0.125 microseconds and +0.125 microseconds respectively. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

12. *The purpose of Input T is to test that the UUT does not simultaneously apply both a + and – sample tolerance. Input T sets up a preamble with no actual preamble pulse leading edges in their nominal positions. The P1 and P3 positions are offset by -0.3 microseconds and widths are offset by +0.3 microseconds. This places the P1 and P3 actual leading edges out of detection range but provides pulse positions at nominal positions. This focuses the actual leading edge detection on P2 and P4 whose leading edges are offset by +0.125 microseconds and -0.125 microseconds respectively. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

13. *The purpose of Input U is to test that the UUT does not simultaneously apply both a + and – sample tolerance. Input U sets up a preamble with no actual preamble pulse leading edges in their nominal positions. The P1 position is offset by -0.3 microseconds and width is offset by +0.3 microseconds. The P3 width is offset by +1.0 microsecond to replace the missing P4 pulse. This places the P1 and P4 actual leading edges out of detection range but provides pulse positions at nominal positions. This focuses the actual leading edge detection on P2 and P3 whose leading edges are offset by -0.125 microseconds and +0.125 microseconds respectively. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

14. *The purpose of Input V is to test that the UUT does not simultaneously apply both a + and – sample tolerance. Input V sets up a preamble with no actual preamble pulse leading edges in their nominal positions. The P1 position is offset by -0.3 microseconds and width is offset by +0.3 microseconds. The P3 width is offset by +1.0 microsecond to replace the missing P4 pulse. This places the P1 and P4 actual leading edges out of detection range but provides pulse positions at nominal positions. This focuses the actual leading edge detection on P2 and P3 whose leading edges are offset by +0.125 microseconds and -0.125 microseconds respectively. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

15. *Input W verifies that the UUT requires all 4 preamble pulses to be present. This test step will be repeated 3 times with each preamble pulse taking a turn as the missing pulse. This is a negative test procedure and requires that the UUT accepts this input at a rate of 10% or less.*

Measurement Procedure:

The ADS-B receiver power levels specified in this procedure are relative to the loss at the RF message source end of the transmission line used to interface the RF message source to the UUT receiver input port. For each ADS-B equipage class, the specified power level is adjusted to compensate for the maximum line loss for which the UUT receiver has been designed. For example, if the line loss is 3 dB, then each of the RF message power levels specified in the test procedures is lowered by 3 dB.

Step 1: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 1

Apply **Input A** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 2: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 2

Repeat Step 1 with the signal power level at -65 dBm.

Step 3: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 3

Apply **Input B** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 4: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 4

Repeat Step 3 with the signal power level at -65 dBm.

Step 5: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 5

Apply **Input C** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 6: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 6

Repeat Step 5 with the signal power level at -65 dBm.

Step 7: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 7

Apply **Input D** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 8: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 8

Repeat Step 7 with the signal power level at -65 dBm.

Step 9: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 9

Apply **Input E** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 10: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 10

Repeat Step 9 with the signal power level at -65 dBm.

Step 11: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 11

Apply **Input F** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 12: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 12

Repeat Step 11 with the signal power level at -65 dBm.

Step 13: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 13

Apply **Input G** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 14: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 14

Repeat Step 13 with the signal power level at -65 dBm.

Step 15: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 15

Apply **Input H** at the receiver input and verify that at least 90 percent of the ADS-B Messages are correctly decoded.

Step 16: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 16

Repeat Step 15 with the signal power level at -65 dBm.

Step 17: Preamble Pulse Widths set to Out-of-Tolerance Values - Part 1

Apply **Input I** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 18: Preamble Pulse Widths set to Out-of-Tolerance Values - Part 2

Repeat Step 17 with the signal power level at -65 dBm.

Step 19: Preamble Single Pulse - Part 1

Apply **Input J** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 20: Preamble Single Pulse - Part 2

Repeat Step 19 with the signal power level at -65 dBm.

Step 21: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 1

Apply **Input K** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 22: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 2

Repeat Step 21 with the signal power level at -65 dBm.

Step 23: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 3

Apply **Input L** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 24: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 4

Repeat Step 23 with the signal power level at -65 dBm.

Step 25: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 5

Apply **Input M** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 26: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 6

Repeat Step 25 with the signal power level at -65 dBm.

Step 27: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 7

Apply **Input N** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 28: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 8

Repeat Step 27 with the signal power level at -65 dBm.

Step 29: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 9

Apply **Input O** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 30: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 10

Repeat Step 29 with the signal power level at -65 dBm.

Step 31: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 11

Apply **Input P** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 32: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 12

Repeat Step 31 with the signal power level at -65 dBm.

Step 33: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 13

Apply **Input Q** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 34: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 14

Repeat Step 33 with the signal power level at -65 dBm.

Step 35: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 15

Apply **Input R** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 36: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 16

Repeat Step 35 with the signal power level at -65 dBm.

Step 37: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 17

Apply **Input S** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 38: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 18

Repeat Step 37 with the signal power level at -65 dBm.

Step 39: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 19

Apply **Input T** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 40: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 20

Repeat Step 39 with the signal power level at -65 dBm.

Step 41: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 21

Apply **Input U** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 42: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 22

Repeat Step 41 with the signal power level at -65 dBm.

Step 43: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 23

Apply **Input V** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 44: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 24

Repeat Step 43 with the signal power level at -65 dBm.

Step 45: Missing Preamble Pulse - Part 1

Apply **Input W** at the receiver input and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 46: Missing Preamble Pulse - Part 2

Repeat Step 45 with the signal power level at -65 dBm.

Step 47: Missing Preamble Pulse - Part 3

Apply **Input W** at the receiver input except restore the P1 pulse and remove the P2 pulse and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 48: Missing Preamble Pulse - Part 4

Repeat Step 47 with the signal power level at -65 dBm.

Step 49: Missing Preamble Pulse - Part 5

Apply **Input W** at the receiver input except restore the P1 pulse and remove the P3 pulse and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 50: Missing Preamble Pulse - Part 6

Repeat Step 49 with the signal power level at -65 dBm.

Step 51: Missing Preamble Pulse - Part 7

Apply **Input W** at the receiver input except restore the P1 pulse and remove the P4 pulse and verify that no more than 10 percent of the ADS-B Messages are correctly decoded.

Step 52: Missing Preamble Pulse - Part 8

Repeat Step 51 with the signal power level at -65 dBm.

2.4.4.4.2.3 Preamble Validation Tests

Purpose/Introduction:

These tests verify that the ADS-B reply processor correctly validates the ADS-B preamble. It is verified that when energy with an amplitude within 6 dB of the preamble reference level is contained in at least one chip of the first five data bits the preamble is accepted and the preamble is rejected if one or more of the first five data bits has insufficient energy in either chip.

Reference Input:

Provide a method of supplying the UUT with:

Any Valid ADS-B Message having:

"DF"	=	17 (or 18 as indicated in the test procedures)
"CA"	=	0
"AA"	=	Any discrete address
Message Rate	=	50 Hz
Frequency	=	1090 MHz
Power	=	-23 dBm

The transmitted power in the first six data bits is controlled in such a way that the amplitude of a data pulse can be set independently of the others.

Measurement Procedure:

The ADS-B receiver power levels specified in this procedure are relative to the loss at the RF message source end of the transmission line used to interface the RF message source to the UUT receiver input port. For each ADS-B equipage class, the specified power level is adjusted to compensate for the maximum line loss for which the UUT receiver has been designed. For example, if the line loss is 3 dB, then each of the RF message power levels specified in the test procedures is lowered by 3 dB.

For this test to be valid the receiver must perform error correction.

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Step 1: Preamble Validation – Missing First Data Bit - Part 1

Input the **Reference Input** DF=17 messages with the amplitude of the first data bit set to –30 dB into the receiver and verify that less than 10 percent of the ADS-B Messages are correctly decoded.

Step 2: Preamble Validation – Missing First Data Bit - Part 2

Repeat Step 1 with the signal power level at -65 dBm and the first bit at –72 dBm.

Step 3: Preamble Validation – Missing Second Data Bit - Part 1

Input the **Reference Input** DF=17 messages with the amplitude of the second data bit set to –30 dBm into the receiver and verify that less than 10 percent of the ADS-B Messages are correctly decoded.

Step 4: Preamble Validation – Missing Second Data Bit - Part 2

Repeat Step 3 with the signal power level at -65 dBm and the second bit at –72 dBm.

Step 5: Preamble Validation – Missing Third Data Bit - Part 1

Input the **Reference Input** DF=17 messages with the amplitude of the third data bit set to –30 dBm into the receiver and verify that less than 10 percent of the ADS-B Messages are correctly decoded.

Step 6: Preamble Validation – Missing Third Data Bit - Part 2

Repeat Step 5 with the signal power level at -65 dBm and the third bit at –72 dBm.

Step 7: Preamble Validation – Missing Third and Fourth Data Bits - Part 1

Input the **Reference Input** DF=18 messages with the amplitude of the third data pulse (that comprises the third and fourth data bits) set to –30 dBm into the receiver and verify that less than 10 percent of the ADS-B Messages are correctly decoded.

Step 8: Preamble Validation – Missing Third and Fourth Data Bits - Part 2

Repeat Step 7 with the signal power level at -65 dBm and the third data pulse at –72 dBm.

Step 9: Preamble Validation – Missing Fourth and Fifth Data Bits - Part 1

Input the **Reference Input** DF=17 messages with the amplitude of the fourth data pulse (that comprises the fourth and fifth data bits) set to –30 dBm into the receiver and verify that less than 10 percent of the ADS-B Messages are correctly decoded.

Step 10: Preamble Validation – Missing Fourth and Fifth Data Bits - Part 2

Repeat Step 9 with the signal power level at -65 dBm and the fourth data pulse at –72 dBm.

Step 11: Preamble Validation – Missing Sixth Data Bit - Part 1

Input the **Reference Input** DF=17 messages with no energy in either chip of the sixth data bit into the receiver and verify that greater than 90 percent of the ADS-B Messages are correctly decoded.

Step 12: Preamble Validation – Missing Sixth Data Bit - Part 2

Repeat Step 11 with the signal power level at -65 dBm.

(1.48) In RTCA/DO-260A, in section §2.4.5.1.5.2, in the second line of the paragraph, change the reference from §2.2.3.2.7.3.2 **to** §2.4.3.2.7.3.2.

(1.49) In RTCA/DO-260A, in section §2.4.8.1.16, Table 2-188, the value of NAC when NUC_P=2 should be 1, but for an HFOM < 10.0 NM. Replace Table 2-188 with the following table. Modified items are highlighted in gray.

__Table 2-188:__ Interpretation of NUC_P Codes from Version Zero Transmitting Subsystems When Received by Version One or above ADS-B Receiving Subsystems

Values Sent By Version Zero Transmitting Subsystem		Values Inferred by Version One or Above Receiving Subsystem			Notes
Message TYPE Codes	NUC_P	NAC (§2.2.3.2.7.2.7)	NIC (§2.2.3.2.7.2.6)	SIL (§2.2.3.2.7.2.9)	
0	0	0 (HFOM ≥ 10 NM)	0 (R_C ≥ 20 NM)	0 (No Integrity)	
5	9	11 (HFOM < 3 m)	11 (R_C < 7.5 m)	2 ("5 nines")	
6	8	10 (HFOM < 10 m)	10 (R_C < 25 m)	2 ("5 nines")	
7	7	8 (HFOM < 0.05 NM)	8 (R_C < 0.1 NM)	2 ("5 nines")	
8	6	0 (HFOM ≥ 0.05 NM)	0 (R_C ≥ 0.1 NM)	0 (No Integrity)	[1]
9	9	11 (HFOM < 3 m)	11 (R_C < 7.5 m)	2 ("5 nines")	
10	8	10 (HFOM < 10 m)	10 (R_C < 25 m)	2 ("5 nines")	
11	7	8 (HFOM < 0.05 NM)	8 (R_C < 0.1 NM)	2 ("5 nines")	
12	6	7 (HFOM < 0.1 NM)	7 (R_C < 0.2 NM)	2 ("5 nines")	
13	5	6 (HFOM < 0.3 NM)	6 (R_C < 0.5 NM)	2 ("5 nines")	
14	4	5 (HFOM < 0.5 NM)	5 (R_C < 1.0 NM)	2 ("5 nines")	
15	3	4 (HFOM < 1.0 NM)	4 (R_C < 2.0 NM)	2 ("5 nines")	
16	2	1 (HFOM < 10.0 NM)	1 (R_C < 8 NM)	2 ("5 nines")	
17	1	1 (HFOM < 10 NM)	1 (R_C < 20 NM)	2 ("5 nines")	
18	0	0 (HFOM ≥ 10 NM)	0 (R_C ≥ 20 NM)	0 (No Integrity)	
20	9	11 (HFOM < 3 m, VFOM < 4 m)	11 (R_C < 7.5 m)	2 ("5 nines")	[2]
21	8	10 (HFOM < 10 m, VFOM < 15 m)	10 (R_C < 25 m)	2 ("5 nines")	[2]
22	TBD	0 (HFOM ≥ 10 NM or unknown)	0 (R_C ≥ 25 m or unknown)	0 (No Integrity)	[2]

(1.50) In RTCA/DO-260A, in section §2.4.8.4.1, in the third line of the first paragraph of the "Purpose/Introduction" and again in the second line of the "Equipment" paragraph, and finally in the first line of the 'Step 2' test procedure, change "TYPE 9 or 10" **to** "TYPE 9, 10, 20 or 21."

(1.51) In RTCA/DO-260A, in section §2.4.10.3.1, in the "<u>Purpose / Introduction</u>," after subparagraph "a," and prior to subparagraph "b," place the following *Note*:

<u>Note:</u> *If the Airborne Participant has already been in the Track State as a Surface Participant, then it is not necessary to perform the Globally Unambiguous CPR Decode.*

(1.52) In RTCA/DO-260A, in section §2.4.10.3.1, replace Step #1 of the test procedure with the following:

<u>Step 1:</u> <u>Globally Unambiguous CPR Decode</u>

a. For each test case in Table 2.4.10.3.1, provide the CPR Decoder function with the "**odd**" and "**even**" Airborne Encodings. Provide the "**odd**" and "**even**" Encodings to the CPR Decoder function (see §A.1.7.7 of Appendix A) within ten (10) seconds of each other.

<u>Table 2.4.10.3.1:</u> Input Data for Global Unambiguous Airborne Decode Zone Checks

Input Data for Global Unambiguous Airborne Decode Zone Checks										
	Angular Weighted Binary (AWB)Position of the Encoder in Degrees				**Even Airborne Encoding**			**Odd Airborne Encoding**		
Test Case	**Latitude**		**Longitude**		**Lat.**	**Lon.**	**NL**	**Lat.**	**Lon.**	**NL**
	(Decimal)	**(HEX)**	**(Decimal)**	**(HEX)**	**(HEX)**	**(HEX)**	**(Dec.)**	**(HEX)**	**(HEX)**	**(Dec.)**
1	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFE0	10D8D	53	0D79C	033F0	53
2	27.938976	13DE22A7	45.0000	20000000	15020	14000	53	12864	10000	53
3	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFE0	033F0	**52**	0D79C	033F0	53
4	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFE0	10D8D	53	0D79C	15A53	**52**
5	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFE0	033F0	**52**	0D79C	15A53	**52**

b. For test cases 1 and 2 in Table 2.4.10.3.1, verify that the CPR Decoder function (see §A.1.7.7 of Appendix A) provides an output **latitude** position within **0.00015** degrees of the **latitude** position indicated for test cases 1 and 2.

c. For test cases 1 and 2 in Table 2.4.10.3.1, verify that the CPR Decoder function (see §A.1.7.7 of Appendix A) provides an output **longitude** position within **0.00015** degrees of the **longitude** position indicated for test cases 1 and 2.

d. For test case 3 in Table 2.4.10.3.1, verify that the CPR Decoder function (see §A.1.7.7 of Appendix A) does **not** provide an output **longitude** position that is consistent with the **longitude** position indicated for test case 3.

Note: *The "**even**" encoding for test case 3 has been established by forcing the NL lookup to **52** for encoding as opposed to **53**. This will result in significant error in the decoded position. This condition can be corrected if the Decoder function has prior knowledge of the expected position. However, correction is not recommended since the Global Decode assumes that there is no prior knowledge of the position.*

e. For test case 4 in Table 2.4.10.3.1, verify that the CPR Decoder function (see §A.1.7.7 of Appendix A) does **not** provide an output **longitude** position consistent with the **longitude** position indicated for test case 4.

Note: *The "**odd**" encoding for test case 4 has been established by forcing the NL lookup to **52** for encoding as opposed to **53**. This will result in significant error in the decoded position. This condition can be corrected if the Decoder function has prior knowledge of the expected position. However, correction is not recommended since the Global Decode assumes that there is no prior knowledge of the position.*

f. For test case 5 in Table 2.4.10.3.1, verify that the CPR Decoder function (see §A.1.7.7 of Appendix A) does **not** provide an output **longitude** position consistent with the **longitude** position indicated for test case 5.

Note: *The "**odd**" and "**even**" encodings for test case 5 have been established by forcing the NL lookup to **52** for encoding as opposed to **53**. This will result in the Decoder Function selecting NL "**odd**" equal to NL "**even**" and will produce what appears to be a valid decode of the position. However, the decoded position will not be consistent with the position indicated for test case 5 in Table 2.4.10.3.1 and should be discarded.*

g. If the CPR Decoder function (see §A.1.7.7 of Appendix A) does not provide the appropriate results in subparagraph b -through- f, then verify that the decoded position is discarded by the CPR Decoder function.

h. Using the Airborne scenario and simulation set up in Step 1 of §2.4.10.1.3 above, verify that for each Participant for which and "**even**" and an "**odd**" pair of encoded Airborne Position Messages is received within a ten (10) second period that the Report Assembly Function correctly performs a successful Globally Unambiguous CPR Decode in accordance with §A.1.7.7 of Appendix A.

(1.53) In RTCA/DO-260A, in section §2.4.10.3.2, insert a new paragraph immediately following the "Purpose / Introduction," and prior to the existing first paragraph as follows:

Verify that the Decoder Function properly executes Globally Unambiguous CPR Decodes for Surface Participants in accordance with §A.1.7.8 of Appendix A when latitude position is close to a transition boundary.

(1.54) In RTCA/DO-260A, in section §2.4.10.3.2, in the "Purpose / Introduction," replace subparagraph "a" with the following:

a. Perform a successful Globally Unambiguous CPR Decode of the Participant Position in accordance with §A.1.7.8 of Appendix A.

(1.55) In RTCA/DO-260A, in section §2.4.10.3.2, in the "Purpose / Introduction," after subparagraph "a," and prior to subparagraph "b," place the following *Note*:

Note: *If the Surface Participant has already been in the Track State as an Airborne Participant, then it is not necessary to perform the Globally Unambiguous CPR Decode.*

(1.56) In RTCA/DO-260A, in section §2.4.10.3.2, in the "Purpose / Introduction," in subparagraph "f," and in the *Note* following subparagraph "f," change all references from "Local Unambiguous" **to** "Globally Unambiguous."

(1.57) In RTCA/DO-260A, in section §2.4.10.3.2, replace Step 1 of the test procedure with the following:

Step 1: Globally Unambiguous CPR Decode

a. For each test case in Table 2.4.10.3.2, provide the CPR Decoder function with the "**odd**" and "**even**" Surface Encodings. Provide the "**odd**" and "**even**" Encodings to the CPR Decoder function (see §A.1.7.8 of Appendix A) within fifty (50) seconds of each other.

Table 2.4.10.3.2: Input Data for Global Unambiguous Surface Decode Zone Checks

Input Data for Global Unambiguous Surface Decode Zone Checks										
	Angular Weighted Binary (AWB)Position of the Encoder in Degrees				**Even Surface Encoding**			**Odd Surface Encoding**		
Test Case	**Latitude**		**Longitude**		**Lat.**	**Lon.**	**NL**	**Lat.**	**Lon.**	**NL**
	(Decimal)	**(HEX)**	**(Decimal)**	**(HEX)**	**(HEX)**	**(HEX)**	**(Dec.)**	**(HEX)**	**(HEX)**	**(Dec.)**
1	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	03636	53	15E70	0CFC1	53
2	27.938976	13DE22A7	45.0000	20000000	14081	10000	53	0A190	00000	53
3	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	0CFC1	**52**	15E70	0CFC1	53
4	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	03636	53	15E70	1694C	**52**
5	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	0CFC1	**52**	15E70	1694C	**52**

b. For test cases 1 and 2 in Table 2.4.10.3.2, verify that the CPR Decoder function (see §A.1.7.8 of Appendix A) provides an output **latitude** position within **0.00015** degrees of the **latitude** position indicated for test cases 1 and 2.

c. For test cases 1 and 2 in Table 2.4.10.3.2, verify that the CPR Decoder function (see §A.1.7.8 of Appendix A) provides an output **longitude** position within **0.00015** degrees of the **longitude** position indicated for test cases 1 and 2.

d. For test case 3 in Table 2.4.10.3.2, verify that the CPR Decoder function (see §A.1.7.8 of Appendix A) does **not** provide an output **longitude** position consistent with the **longitude** position indicated for test case 3.

Note: *The "**even**" encoding for test case 3 has been established by forcing the NL lookup to **52** for encoding as opposed to **53**. This will result in significant error in the decoded position. This condition can be corrected if the Decoder function has prior knowledge of the expected position. However, correction is not recommended since the Global Decode assumes that there is no prior knowledge of the position.*

e. For test case 4 in Table 2.4.10.3.2, verify that the CPR Decoder function (see §A.1.7.8 of Appendix A) does **not** provide an output **longitude** position consistent with the **longitude** position indicated for test case 4.

Note: *The "**odd**" encoding for test case 4 has been established by forcing the NL lookup to **52** for encoding as opposed to **53**. This will result in significant error in the decoded position. This condition can be corrected if the Decoder function has prior knowledge of the expected position. However, correction is not recommended since the Global Decode assumes that there is no prior knowledge of the position.*

f. For test case 5 Table 2.4.10.3.2, verify that the CPR Decoder function (see §A.1.7.8 of Appendix A) does **not** provide an output **longitude** position consistent with the **longitude** position indicated for test case 5.

Note: *The "**odd**" and "**even**" encodings for test case 5 have been established by forcing the NL lookup to **52** for encoding as opposed to **53**. This will result in the Decoder Function selecting NL "**odd**" equal to NL "**even**" and will produce what appears to be a valid decode of the position. However, the decoded position will not be consistent with the position indicated for row 5 in Table 2.4.10.3.2 and should be discarded.*

g. If the CPR Decoder function (see §A.1.7.8 of Appendix A) does not provide the appropriate results in subparagraph b -through- f, then verify that the decoded position is discarded by the CPR Decoder function.

h. Using the Surface scenario and simulation set up in Step 2 of §2.4.10.1.3 above, verify that for each Participant for which an "**even**" and an "**odd**" pair of encoded Surface Position Messages is received within a fifty (50) second period that the Report Assembly Function correctly performs a successful Globally Unambiguous CPR Decode in accordance with §A.1.7.8 of Appendix A.

(1.58) In RTCA/DO-260A, section §2.4.10.4.1.1, insert a new paragraph immediately following the "Purpose / Introduction," and prior to the existing first paragraph as follows:

Verify that the Decoder Function properly executes Locally Unambiguous CPR Decodes for Airborne Participants in accordance with §A.1.7.5 of Appendix A when latitude position is close to a transition boundary.

(1.59) In RTCA/DO-260A, in section §2.4.10.4.1.1, replace Step 1 of the test procedure with the following:

Step 1: Locally Unambiguous CPR Decode and Set Report Mode to Track

a. For each test case in Table 2.4.10.4.1.1, provide the CPR Decoder function (see §A.1.7.5 of Appendix A) with the "**odd**" and "**even**" Airborne Encodings within five (5) seconds of each other.

Table 2.4.10.4.1.1: Input Data for Local Unambiguous Airborne Decode Zone Checks

Input Data for Local Unambiguous Airborne Decode Zone Checks											
	Angular Weighted Binary (AWB)Position of the Encoder in Degrees				Even Airborne Encoding			Odd Airborne Encoding			
Test Case	Latitude		Longitude		Lat.	Lon.	NL	Lat.	Lon.	NL	
	(Decimal)	(HEX)	(Decimal)	(HEX)	(HEX)	(HEX)	(Dec.)	(HEX)	(HEX)	(Dec.)	Notes
1	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFEO	10D8D	53	0D79C	033F0	53	1
2	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFEO	033F0	**52**	0D79C	033F0	53	2
3	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFEO	10D8D	53	0D79C	15A53	**52**	3
4	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0AFEO	033F0	**52**	0D79C	15A53	**52**	4

Notes:

1. The input position of the decoder is as given in Row 1 and the **"even"** and **"odd"** Encodings use the proper NL=**53** zone for Encoding.
2. The NL was forced to **52** (e.g., the next closest zone) for Encoding of the **"even"** Airborne Encoding and should result in a decoded longitude position of approximately 150.1229992 degrees for the "**even**" decode if the receiver decoder does not recognize the boundary condition. Since the Decoder NL lookup is based on the encoded latitude the initial NL lookup will be 53. The Decoder function will have to change this to 52 and then re-compute the longitude position in order to correct the longitude error.
3. The NL was forced to **52** (e.g., the next closest zone) for Encoding of the **"odd"** Airborne Encoding and should result in a decoded longitude position of approximately 150.067485 degrees for the **"odd"** decode if the receiver decoder does not recognize the boundary condition. Since the Decoder NL lookup is based on the encoded latitude the initial NL lookup will be 53. The Decoder function will have to change this to 52 and then re-compute the longitude position in order to correct the longitude error.
4. The NL was forced to **52** (e.g., the next closest zone) for Encoding of both **"even"** and **"odd"** Airborne Encoding and should result in a decoded longitude position of approximately 150.122992 degrees for the **"even"** decode and 150.067485 degrees for the **"odd"** decode if the receiver decoder does not recognize the boundary condition. Since the Decoder NL lookups are based on the encoded latitudes the initial NL lookups will be 53. The Decoder function will have to change these to 52 and then re-compute the longitude positions in order to correct the longitude errors.

b. For test cases 1 -through- 4 in Table 2.4.10.4.1.1, verify that the CPR Decoder function (see §A.1.7.5 of Appendix A) provides an "**even**" and "**odd**" output **latitude** position within **0.00015** degrees of the **latitude** position indicated for each test case in Table 2.4.10.4.1.1.

c. For test cases 1 -through- 4 in Table 2.4.10.4.1.1, verify that the CPR Decoder function (see §A.1.7.5 of Appendix A) provides an "**even**" and "**odd**" output **longitude** position within **0.00015** degrees of the **longitude** position indicated for each test case in Table 2.4.10.4.1.1.

d. If the CPR Decoder function (see §A.1.7.5 of Appendix A) does **not** provide the appropriate results in subparagraph b -through- c, then verify that the decoded position is discarded by the CPR Decoder function.

e. Start this test procedure step with the assumption that for a given Airborne Participant, the Acquisition State has been established in accordance with the Test Procedures in §2.4.10.3.1.

Verify that for each Participant in the Airborne scenario and simulation set up in Step 1 of §2.4.10.1.3 above, where it has been verified that the Acquisition State has been established, and upon receipt of the first Airborne Velocity Message for the given Participant, verify that the Report Assembly Function correctly sets the Report Mode to "Track" in the State Vector Report in accordance with the formatting in §2.2.8.1.22.

(1.60) In RTCA/DO-260A, section §2.4.10.4.2.1, insert a new paragraph immediately following the "Purpose / Introduction," and prior to the existing first paragraph as follows:

Verify that the Decoder Function properly executes Locally Unambiguous CPR Decodes for Surface Participants in accordance with §A.1.7.6 of Appendix A when latitude position is close to a transition boundary.

(1.61) In RTCA/DO-260A, in section §2.4.10.4.2.1, create a new Step 1 of the test procedure immediately after the Measurement Procedure with the following:

Step 1: Locally Unambiguous CPR Decode

a. For each test case in Table 2.4.10.4.2.1, provide the CPR Decoder function (see §A.1.7.6 of Appendix A) with the "**odd**" and "**even**" Surface Encodings within five (5) seconds of each other.

Table 2.4.10.4.2.1: Input Date for Local Unambiguous Surface Decode Zone Check

Input Data for Local Unambiguous Surface Decode Zone Checks											
	Angular Weighted Binary (AWB)Position of the Encoder in Degrees				**Even Surface Encoding**			**Odd Surface Encoding**			
Test Case	**Latitude**		**Longitude**		**Lat.**	**Lon.**	**NL**	**Lat.**	**Lon.**	**NL**	
	(Decimal)	**(HEX)**	**(Decimal)**	**(HEX)**	**(HEX)**	**(HEX)**	**(Dec.)**	**(HEX)**	**(HEX)**	**(Dec.)**	**Notes**
1	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	03636	53	15E70	0CFC1	53	1
2	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	0CFC1	**52**	15E70	0CFC1	53	2
3	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	03636	53	15E70	1694C	**52**	3
4	-27.93897726	EC21DD4A	153.00998	6CCE9DE7	0BF7F	0CFC1	**52**	15E70	1694C	**52**	4

Notes:

1. The input position of the decoder is as given in Row 1 and the **"even"** and **"odd"** Encodings use the proper NL=**53** zone for Encoding.
2. The NL was forced to **52** (e.g., the next closest zone) for Encoding of the **"even"** Surface Encoding and should result in a decoded longitude position of approximately 0.5092509 degrees for the **"even"** decode if the receiver decoder does not recognize the boundary condition. Since the Decoder NL lookup is based on the encoded latitude the initial NL lookup will be 53. The Decoder function will have to change this to 52 and then re-compute the longitude position in order to correct the longitude error.
3. The NL was forced to **52** (e.g., the next closest zone) for Encoding of the **"odd"** Surface Encoding and should result in a decoded longitude position of approximately 0.5190433 degrees for the **"odd"** decode if the receiver decoder does not recognize the boundary condition. Since the Decoder NL lookup is based on the encoded latitude the initial NL lookup will be 53. The Decoder function will have to change this to 52 and then re-compute the longitude position in order to correct the longitude error.
4. The NL was forced to **52** (e.g., the next closest zone) for Encoding of both **"even"** and **"odd"** Surface Encoding and should result in a decoded longitude position of approximately 0.5092509 degrees for the **"even"** decode and 0.5190433 degrees for the **"odd"** decode if the receiver decoder does not recognize the boundary condition. Since the Decoder NL lookups are based on the encoded latitudes the initial NL lookups will be 53. The Decoder function will have to change these to 52 and then re-compute the longitude positions in order to correct the longitude errors.

b. For test cases 1 -through- 4 in Table 2.4.10.4.2.1, verify that the CPR Decoder function (see §A.1.7.6 of Appendix A) provides an "**even**" and "**odd**" output **latitude** position within **0.00015** degrees of the **latitude** position indicated for each test case in Table 2.4.10.4.2.1.

c. For test cases 1 -through- 4 in Table 2.4.10.4.2.1, verify that the CPR Decoder function (see §A.1.7.6 of Appendix A) provides an "**even**" and "**odd**" output **longitude** position within **0.00015** degrees of the **longitude** position indicated for each test case in Table 2.4.10.4.2.1.

d. If the CPR Decoder function (see §A.1.7.6 of Appendix A) does **not** provide the appropriate results in subparagraph b -through- c, then verify that the decoded position is discarded by the CPR Decoder function.

Step 2: Track State Initialization
[the original Measurement Procedure paragraphs "a" through "d" come under the new Step 2 heading.]

(1.62) In RTCA/DO-260A, section §2.4.17.4.6, replace the first paragraph of the "Purpose/Introduction" with the following:

As TIS-B Messages are received, the information is reported to applications. All received information elements, other than position, **shall** be reported directly, including all reserved fields for the TIS-B fine format messages (§2.2.17.3.1 to §2.2.17.3.4) and the entire message content of any received TIS-B Management Message (Table 2-106, CF Value =4). The reporting format is not specified in detail, except that the information content reported **shall** be the same as the information content received. The report **shall** be issued within 0.5 seconds of the message reception.

(1.63) In RTCA/DO-260A, insert a new section §2.4.18 as follows:

2.4.18 Verification of ADS-B Rebroadcast Service – Formats and Coding

2.4.18.1 Verification of ADS-R Introduction (§2.2.18.1)

No specific test procedure is required to validate §2.2.18.1.

2.4.18.2 Verification of ADS-R Format Definition (§2.2.18.2)

Appropriate test procedures required to validate the transmission and reception of ADS-B Rebroadcast Messages are provided in the subparagraphs of §2.4.18.4 below.

2.4.18.3 Verification of ADS-R Control Field Allocation (§2.2.18.3)

Appropriate test procedures required to validate the transmission and reception of ADS-B Rebroadcast Messages are provided in the subparagraphs of §2.4.18.4 below.

2.4.18.4 Verification of ADS-R Surveillance Message Definitions (§2.2.18.4)

Purpose/Introduction:

The Rebroadcast of ADS-B information on the 1090 MHz Extended Squitter data link is accomplished by utilizing the same ADS-B Message formats defined in Figure A-1 through Figure A-10, with the exception of the need to transmit an indication to the 1090 MHz Receiving Subsystem as to the type of identity associated with the aircraft data being reported in the ADS-B Rebroadcast Message. This identification is performed using the ICAO/Mode A Flag (IMF), which was previously discussed in §2.2.17.3.1.2 for the TIS-B transmissions.

The insertion of this one bit into the ADS-B Messages identified in the subparagraphs below allows the ADS-B Receiving Subsystem to interpret the Address Field (AF) in the following manner:

IMF = 0 **shall** indicate that the ADS-B Rebroadcast data is identified by an ICAO 24-bit Address.

IMF = 1 **shall** indicate that the ADS-B Rebroadcast data is identified by an anonymous 24-bit address or ground vehicle address or fixed obstruction address.

Measurement Procedure:

Appropriate test procedures required to validate the transmission and reception of ADS-B Rebroadcast Messages are provided in §2.4.18.4.1 through §2.4.18.4.7 below.

2.4.18.4.1 Verification of ADS-R Airborne Position Message (§2.2.18.4.1)

Purpose/Introduction:

The ME Field of the Rebroadcast Airborne Position Message **shall** be formatted as specified in Figure 2-3, except that ME bit 8 is redefined to be the ICAO/Mode A Flag (IMF).

Measurement Procedure:

Step 1: Establish Initial Conditions

Configure the ADS-B Transmitting Subsystem to transmit Airborne Position Messages by providing position information at the nominal rate. Ensure that the ADS-B Transmitting Subsystem correctly receives a known value of Latitude and Longitude position data from the Navigation source and that it outputs encoded Latitude and Longitude data for the Airborne Position Message in accordance with the CPR Format described in Appendix A. Format the Airborne Position Message with DF=18 and CF=6.

Step 2: Valid Message Contents When Selecting ICAO 24-Bit Address

Input an IMF value of ZERO (0) into ME Bit 8 of the Airborne Position Message to be transmitted. Input AAAAAA {HEX} for the ICAO 24-Bit Address. Select "ICAO 24-Bit Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals 9 to 18 or 20 to 22
IMF field (Message Bit 40) equals ZERO (0)
Lat/Lon fields equal transmitted Lat/Lon

Verify that the remaining fields of the ADS-R Airborne Position Message, that is received and decoded, was encoded in the proper format, i.e., "odd" and "even" encoding, by correlating the received Message to the stimulus data provided by the test equipment.

Step 3: Valid Message Contents When Selecting Anonymous Address

Input an IMF value of ONE (1) into ME Bit 8 of the Airborne Position Message to be transmitted. Input 555555 {HEX} for the Anonymous Address. Select "Anonymous Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals 555555 {HEX}
TYPE Code field (Message Bits 33 – 37) equals 9 to 18 or 20 to 22
IMF field (Message Bit 40) equals ONE (1)
Lat/Lon fields equal transmitted Lat/Lon

Verify that the remaining fields of the ADS-R Airborne Position Message, that is received and decoded, was encoded in the proper format, i.e., “odd” and “even” encoding, by correlating the received Message to the stimulus data provided by the test equipment.

2.4.18.4.2 Verification of ADS-R Surface Position Message (§2.2.18.4.2)

Purpose/Introduction:

The ME Field of the Rebroadcast Surface Position Message **shall** be formatted as specified in Figure 2-5, except that ME bit 21 is redefined to be the ICAO/Mode A Flag (IMF).

Measurement Procedure:

Step 1: Establish Initial Conditions

Configure the ADS-B Transmitting Subsystem to transmit Surface Position Messages by providing position information at the nominal rate. Ensure that the ADS-B Transmitting Subsystem correctly receives a known value of Latitude and Longitude position data from the Navigation source and that it outputs encoded Latitude and Longitude data for the Surface Position Message in accordance with the CPR Format described in Appendix A. Format the Surface Position Message with DF=18 and CF=6.

Step 2: Valid Message Contents When Selecting ICAO 24-Bit Address

Input an IMF value of ZERO (0) into ME Bit 21 of the Surface Position Message to be transmitted. Input AAAAAA {HEX} for the ICAO 24-Bit Address. Select “ICAO 24-Bit Address” at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 5 to 8
IMF field (Message Bit 53) equals ZERO (0)
Lat/Lon fields equal transmitted Lat/Lon

Verify that the remaining fields of the ADS-R Surface Position Message, that is received and decoded, was encoded in the proper format, i.e., "odd" and "even" encoding, by correlating the received Message to the stimulus data provided by the test equipment.

Step 3: Valid Message Contents When Selecting Anonymous Address

Input an IMF value of ONE (1) into ME Bit 8 of the Surface Position Message to be transmitted. Input 555555 {HEX} for the Anonymous Address. Select "Anonymous Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals 555555 {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 5 to 8
IMF field (Message Bit 53) equals ONE (1)
Lat/Lon fields equal transmitted Lat/Lon

Verify that the remaining fields of the ADS-R Surface Position Message, that is received and decoded, was encoded in the proper format, i.e., "odd" and "even" encoding, by correlating the received Message to the stimulus data provided by the test equipment.

2.4.18.4.3 Verification of ADS-R Aircraft Identification and Category Message (§2.2.18.4.3)

Purpose/Introduction:

The ME Field of the Rebroadcast Aircraft Identification and Category Message **shall** be formatted exactly as specified in Figure 2-6.

Note: *Any Rebroadcast Aircraft Identification and Category Message does not contain the IMF bit since aircraft using an anonymous 24-bit address will not provide identity and category information.*

Measurement Procedure:

The test procedures provided in §2.4.3.2.5 and its subparagraphs **shall** be used to validate the transmission and reception of Rebroadcast Aircraft Identification and Category Messages.

2.4.18.4.4 Verification of ADS-R Airborne Velocity Messages (§2.2.18.4.4)

Purpose/Introduction:

The ME Field of the Rebroadcast Airborne Velocity Messages **shall** be formatted as specified in Figure 2-7 for Subtype 1 & 2 Messages, and in Figure 2-8 for Subtype 3 & 4 Messages, except that ME bit 9 is redefined to be the ICAO/Mode A Flag (IMF).

Measurement Procedure:

Step 1: Establish Initial Conditions

Configure the ADS-B Transmitting Subsystem to transmit Airborne Velocity Messages by providing velocity information at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set up the system to enable broadcast of Airborne Velocity Messages (see additional information in §2.2.3.3.2.5). Set the ADS-B Transmitting Subsystem to Airborne status.

Step 2: Verification of Subtype 1 Messages with ICAO 24-Bit Address

Provide velocity information in the form of Velocity Over Ground (i.e., Ground Speed) with a valid value that is greater than ZERO, but non-supersonic (i.e., both North/South and East/West Velocity inputs are less than 1000 knots). Input an IMF value of ZERO (0) into ME Bit 9 of the Airborne Velocity Message to be transmitted. Input AAAAAA {HEX} for the ICAO 24-Bit Address. Select "ICAO 24-Bit Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Airborne Velocity Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 19
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 1
IMF field (Message Bit 41) equals ZERO (0)
Decoded N/S and E/W Velocity values equal transmitted values

Verify the remaining fields of the ADS-R Airborne Velocity Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Step 3: Verification of Subtype 2 Messages with ICAO 24-Bit Address

Repeat the same setup as in Step 2 above. Increase the North/South velocity to 1050 knots. Verify the following ADS-R Airborne Velocity Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 19
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 2
IMF field (Message Bit 41) equals ZERO (0)
Decoded N/S and E/W Velocity values equal transmitted values

Verify the remaining fields of the ADS-R Airborne Velocity Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Step 4: Verification of Subtype 3 Messages with ICAO 24-Bit Address

Provide velocity information in the form of Airspeed and Heading information with a valid Airspeed value that is greater than ZERO, but non-supersonic (i.e., the Airspeed input is less than 1000 knots). Input an IMF value of ZERO (0) into ME Bit 9 of the Airborne Velocity Message to be transmitted. Input AAAAAA {HEX} for the ICAO 24-Bit Address. Select "ICAO 24-Bit Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Airborne Velocity Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 19
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 3
IMF field (Message Bit 41) equals ZERO (0)
Decoded Airspeed Velocity value equals transmitted value

Verify the remaining fields of the ADS-R Airborne Velocity Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Step 5: Verification of Subtype 4 Messages with ICAO 24-Bit Address

Repeat the same setup as in Step 4 above. Increase the Airspeed velocity to 1050 knots. Verify the following ADS-R Airborne Velocity Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 19
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 4
IMF field (Message Bit 41) equals ZERO (0)
Decoded Airspeed Velocity value equals transmitted value

Verify the remaining fields of the ADS-R Airborne Velocity Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Step 6: Verification of Airborne Velocity Messages with Anonymous Addresses

Repeat the setups of Steps 2, 3, 4 and 5, respectively, except that the input for the Address **shall** be 555555 {HEX} for the Anonymous Address. Select "Anonymous Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem for each respective Test Step. Input an IMF value of ONE (1) into ME Bit 9 of each respective Airborne Velocity Message to be transmitted. Verify that the content of the ADS-R Airborne Velocity Message upon decode of the transmitted data matches those outputs defined in Steps 2, 3, 4 and 5, respectively, except that the AA field (Message Bits 9 – 32) equals 555555 {HEX}, and the IMF field (Message Bit 41) equals ONE (1), in each case.

2.4.18.4.5 Verification of ADS-R Aircraft Emergency/Priority Status Message (§2.2.18.4.5)

Purpose/Introduction:

The ME Field of the Rebroadcast Aircraft Emergency/Priority Status Message **shall** be formatted as specified in Figure 2-14, except that ME bit 56 is redefined to be the ICAO/Mode A Flag (IMF).

Measurement Procedure:

Step 1: Establish Initial Conditions

Perform set up of the unit under test as specified in the Test Procedure in §2.4.3.2.7.8.

Step 2: Valid Message Contents When Selecting ICAO 24-Bit Address

Input an IMF value of ZERO (0) into ME Bit 56 of the Aircraft Emergency/Priority Status Message to be transmitted. Input AAAAAA {HEX} for the ICAO 24-Bit Address. Select "ICAO 24-Bit Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 28
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 1
IMF field (Message Bit 88) equals ZERO (0)

Verify the remaining fields of the ADS-R Aircraft Emergency/Priority Status Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Step 3: Valid Message Contents When Selecting Anonymous Address

Reinitialize the unit under test as in Step 1 above. Input an IMF value of ONE (1) into ME Bit 56 of the Aircraft Emergency/Priority Status Message to be transmitted. Input 555555 {HEX} for the Anonymous Address. Select "Anonymous Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals 555555 {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 28
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 1
IMF field (Message Bit 88) equals ONE (1)

Verify the remaining fields of the ADS-R Aircraft Emergency/Priority Status Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

2.4.18.4.6 Verification of ADS-R Target State and Status Message (§2.2.18.4.6)

Purpose/Introduction:

The ME Field of the Rebroadcast Target State and Status Message **shall** be formatted as specified in Figure 2-10, except that ME bit 51 is redefined to be the ICAO/Mode A Flag (IMF).

Measurement Procedure:

Step 1: Establish Initial Conditions

Configure the ADS-B Transmitting Subsystem to transmit Target State and Status Messages by providing valid trajectory information at the nominal rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to Airborne status.

Step 2: Valid Message Contents When Selecting ICAO 24-Bit Address

Input an IMF value of ZERO (0) into ME Bit 51 of the Target State and Status Message to be transmitted. Input AAAAAA {HEX} for the ICAO 24-Bit Address. Select "ICAO 24-Bit Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 29
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 0
IMF field (Message Bit 83) equals ZERO (0)

Verify the remaining fields of the ADS-R Target State and Status Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Step 3: Valid Message Contents When Selecting Anonymous Address

Reinitialize the unit under test as in Step 1 above. Input an IMF value of ONE (1) into ME Bit 51 of the Target State and Status Message to be transmitted. Input 555555 {HEX} for the Anonymous Address. Select "Anonymous Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals 555555 {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 29
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 0
IMF field (Message Bit 83) equals ONE (1)

Verify the remaining fields of the ADS-R Target State and Status Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

2.4.18.4.7 Verification of ADS-R Aircraft Operational Status Message (§2.2.18.4.7)

Purpose/Introduction:

The ME Field of the Rebroadcast Aircraft Operational Status Message **shall** be formatted as specified in Figure 2-11, except that ME bit 56 is redefined to be the ICAO/Mode A Flag (IMF).

Measurement Procedure:

Step 1: Establish Initial Conditions

Configure the ADS-B Transmitting Subsystem to transmit Aircraft Operational Status Messages by providing valid trajectory information at the nominal rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to Airborne status.

Step 2: Valid Message Contents When Selecting ICAO 24-Bit Address

Input an IMF value of ZERO (0) into ME Bit 56 of the Aircraft Operational Status Message to be transmitted. Input AAAAAA {HEX} for the ICAO 24-Bit Address. Select "ICAO 24-Bit Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals AAAAAA {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 31
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 0
IMF field (Message Bit 88) equals ZERO (0)

Verify the remaining fields of the ADS-R Aircraft Operational Status Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Repeat this step after setting the ADS-B Transmitting Subsystem to the "On-Ground" status. Verify that the only difference in the decoded output of the Message from those specified above is that Message Bits 38 – 40 are set to ONE (1) in the output of the Aircraft Operational Status Message.

Step 3: Valid Message Contents When Selecting Anonymous Address

Reinitialize the unit under test as in Step 1 above. Input an IMF value of ONE (1) into ME Bit 56 of the Aircraft Operational Status Message to be transmitted. Input 555555 {HEX} for the Anonymous Address. Select "Anonymous Address" at the Address Qualifier input to the ADS-B Transmitting Subsystem. Verify the following ADS-R Message content upon decode of the transmitted data:

DF field (Message Bits 1 – 5) equals decimal 18
CF field (Message Bits 6 – 8) equals decimal 6
AA field (Message Bits 9 – 32) equals 555555 {HEX}
TYPE Code field (Message Bits 33 – 37) equals decimal 31
SUBTYPE Code field (Message Bits 38 – 40) equals decimal 0
IMF field (Message Bit 88) equals ONE (1)

Verify the remaining fields of the ADS-R Aircraft Operational Status Message, by correlating the decoded Message to the stimulus data provided by the test equipment.

Repeat this step after setting the ADS-B Transmitting Subsystem to the "On-Ground" status. Verify that the only difference in the decoded output of the Message from those specified above is that Message Bits 38 – 40 are set to ONE (1) in the output of the Aircraft Operational Status Message.

(1.64) In RTCA/DO-260A, section §3.3.4.6.1, in the definition for Equation #3 at the top of page 751, where the value (-1.574302725) is raised to the power of 10. These values are backwards and should be reversed. Change the value to 10 raised to the power of (-1.574302725).

(1.65) In RTCA/DO-260A, Appendix A, section §A.1.4.1.2.3, subparagraph "a," second line, replace "Airborne" **with** "Surface."

(1.66) In RTCA/DO-260A, Appendix A, section §A.1.4.8, in the last line of the paragraph, change "Figure A-7" to Figure A-8."

(1.67) In RTCA/DO-260A, Appendix A, section §A.1.4.9, in the last line of the paragraph, change "Figure A-8" to Figure A-9."

(1.68) In RTCA/DO-260A, Appendix A, section §A.1.4.9.6, add the following onto the end of the paragraph in section §A.1.4.9.6 and prior to Table A-10.

In this version of these MOPS (RTCA/DO-260A), the Vertical Mode Indicator **shall** be set to ZERO (binary 00).

Note: *Inconsistencies have been identified with how existing onboard data sources represent the data associated with the Vertical Mode Indicator parameter. Until these inconsistencies are resolved through a future update to these MOPS (RTCA DO-260A), this parameter must be encoded as ALL ZEROs, indicating Unknown Mode or Information Unavailable.*

(1.69) In RTCA/DO-260A, Appendix A, section §A.1.4.9.11, add the following onto the end of the paragraph in section §A.1.4.9.11 and prior to Table A-14.

In this version of these MOPS (RTCA/DO-260A), the Horizontal Mode Indicator **shall** be set to ZERO (binary 00).

Note: *Inconsistencies have been identified with how existing onboard data sources represent the data associated with the Horizontal Mode Indicator parameter. Until these inconsistencies are resolved through a future update to these MOPS (RTCA DO-260A), this parameter must be encoded as ALL ZEROs, indicating Unknown Mode or Information Unavailable.*

(1.70) In RTCA/DO-260A, Appendix A, section §A.1.4.9.14, entitled "(Surveillance Integrity Level (SIL)," replace the entire section, including Table A-17, with the following:

This 2-bit (ME bits 45 – 46, Message bits 77 – 78) subfield will be used to define the probability of the integrity containment radius used in the NIC subfield being exceeded, without alerting, including the effects of the airborne equipment condition, which airborne equipment is in use, and which external signals are used by the navigation source. The SIL subfield will be encoded as shown in Table A-17. For installations where the SIL value is being dynamically updated, if an update has not been received from an on-board data source for SIL within the past 5 seconds, then the SIL subfield will be encoded as a value indicating "Unknown."

Table A-17: Surveillance Integrity Level (SIL) Encoding

SIL Coding		(Probability of Exceeding the Radius of Containment R_C Without Detection)
(Binary)	(Decimal)	
00	0	Unknown
01	1	$\leq 1 \times 10^{-3}$ per flight hour or per operation
10	2	$\leq 1 \times 10^{-5}$ per flight hour or per operation
11	3	$\leq 1 \times 10^{-7}$ per flight hour or per operation

Notes:

1. *The NIC parameter is broadcast partly in the TYPE subfield of Airborne Position and Surface Position Messages, and partly in the NIC Supplement subfield of Aircraft Operational Status Message.*

2. *The Surveillance Integrity Level (SIL) defines the probability of exceeding the integrity containment radius, R_C, used in the NIC parameter without being detected at the transmitting ADS-B participant.*

3. *Since the SIL is intended to reflect the integrity of the navigation source of the position information broadcast, the SIL value transmitted should be indicative of the true integrity of the ADS-B position data. A problem for installations that include currently available GNSS receivers and FMS systems is that SIL is not output by these systems. With the lack of SIL information being provided by the navigation source, implementers should not arbitrarily set a SIL value of zero indicating unknown integrity. It is suggested, unless there is a tightly coupled navigation source where SIL can be unambiguously determined and set dynamically, that the ADS-B Transmitting Subsystem should provide for the static setting of SIL as part of the installation procedure. Most implementers are expected to determine SIL by off-line analysis of the installed configuration. This off-line analysis can be performed on the various primary and alternate means of determining the reported position. SIL is a static value for each of these configurations.*

(1.71) In RTCA/DO-260A, Appendix A, section §A.1.4.10, in the first line of the paragraph, change "Register 63 {HEX}" to "Register 65 {HEX}."

(1.72) In RTCA/DO-260A, Appendix A, section §A.1.4.10.9, at the beginning of the fourth line of the paragraph, change "Table A.4.9.14" to "Table A-17."

(1.73) In RTCA/DO-260A, Appendix A, section §A.1.4.10.9, entitled "(Surveillance Integrity Level (SIL)," replace the entire paragraph with the following:

This 2-bit (ME bits 51 – 52, Message bits 83 – 84) subfield will be used to announce the integrity level associated with the containment radius (R_C) being broadcast in the NIC parameter. Encoding of the subfield will be as shown in Table A.4.9.14. For installations where the SIL value is being dynamically updated, if an update has not been received from an on-board data source for SIL within the past 5 seconds, then the SIL subfield will be encoded as a value indicating "Unknown."

Note: *Since the SIL is intended to reflect the integrity of the navigation source of the position information broadcast, the SIL value transmitted should be indicative of the true integrity of the ADS-B position data. A problem for installations that include currently available GNSS receivers and FMS systems is that SIL is not output by these systems. With the lack of SIL information being provided by the navigation source, implementers should not arbitrarily set a SIL value of zero indicating unknown integrity. It is suggested, unless there is a tightly coupled navigation source where SIL can be unambiguously determined and set dynamically, that the ADS-B Transmitting Subsystem should provide for the static setting of SIL as part of the installation procedure. Most implementers are expected to determine SIL by off-line analysis of the installed configuration. This off-line analysis can be performed on the various primary and alternate means of determining the reported position. SIL is a static value for each of these configurations.*

(1.74) In RTCA/DO-260A, Appendix A, section §A.1.4.10.10, at the end of the fourth line of the paragraph, change "Table A.4.1.9.13" to "Table A-16."

(1.75) In RTCA/DO-260A, Appendix A, section §A.1.4.10.11, replace the last sentence of the first paragraph with the following:

Once the actual Length and Width of the A/V has been determined, each A/V will be assigned the smallest A/V Length and Width Code from Table 2-74 for which the actual length is less than or equal to the upper bound length for that Length/Width Code, and for which the actual width is less than or equal to the upper bound width for that Length/Width Code.

(1.76) In RTCA/DO-260A, Appendix A, section §A.1.4.10.11, replace Table A-26 with the following:

<u>Table A-26:</u> Aircraft/Vehicle Length and Width Code

A/V - L/W Code (Decimal)	Length Code			Width Code	Upper-Bound Length and Width for Each Length/Width Code	
	ME Bit 49	ME Bit 50	ME Bit 51	ME Bit 52	Length (meters)	Width (meters)
0	0	0	0	0	15	11.5
1				1		23
2	0	0	1	0	25	28.5
3				1		34
4	0	1	0	0	35	33
5				1		38
6	0	1	1	0	45	39.5
7				1		45
8	1	0	0	0	55	45
9				1		52
10	1	0	1	0	65	59.5
11				1		67
12	1	1	0	0	75	72.5
13				1		80
14	1	1	1	0	85	80
15				1		90

If the Aircraft or Vehicle is longer than 85 meters, or wider than 90 meters, then decimal Aircraft/Vehicle Length/Width Code 15 **shall** be used.

(1.77) In RTCA/DO-260A, Appendix A, section §A.1.5.4, replace the existing paragraph with the following:

Non-Transponder Devices will provide the same functionality for initialization; register timeout and broadcast termination as specified for the transponder case in §A.1.5.1 through §A.1.5.3, except that:

1. A Non-Transponder Device will not broadcast acquisition squitters, and

2. A Non-Transponder Device operating on the surface will continue to broadcast DF=18 Messages with the TYPE Code = 0 at a rate specified for the Surface Position Message, even though it has lost its navigation input.

<u>Note:</u> *Continued broadcast of the Surface Position Message is needed to support the operation of surface multi-lateration systems.*

(1.78) In RTCA/DO-260A, Appendix A, section §A.1.7.2, replace subparagraph "1" with the following:

1. The number of bits used to encode a position coordinate, *Nb*, is set as follows:

For airborne encoding, used in the ADS-B Airborne Position Message and the TIS-B Fine Airborne Position Message:	$Nb = 17$
For surface encoding, used in the ADS-B Surface Position Message and the TIS-B Fine Surface Position Message:	$Nb = 19$
For intent encoding:	$Nb = 14$
For TIS-B encoding, used only in the TIS-B Coarse Airborne Position Message:	$Nb = 12$

(1.79) In RTCA/DO-260A, Appendix A, section §A.1.7.2, under subparagraph "d," *Note* #5, and just prior to §A.1.7.3, add the following text onto the end of *Note* #5:

When using the look up table established by using the equation above, the NL value is not expected to change to the next lower NL value until the boundary (latitude established by the above equation) has actually been crossed when moving from the equator towards the pole.

(1.80) In RTCA/DO-260A, Appendix A, section §A.1.7.3, subparagraphs "b," "c," "e," and "f" make the following replacements:

Replace:	For airborne encoding:	**with**	For $Nb = 17$:
Replace:	For surface encoding:	**with**	For $Nb = 19$:
Replace:	For intent encoding:	**with**	For $Nb = 14$:
Replace:	For TIS-B encoding:	**with**	For $Nb = 12$:

(1.81) In RTCA/DO-260A, Appendix A, section §A.1.7.3, in subparagraph "d," after the equation for $Dlon_i$, and just prior to subparagraph "e," insert the following *Note*:

Note: *When performing the NL function, the encoding process must ensure that the NL value is established in accordance with Note 5 of §A.1.7.2.d.*

(1.82) In RTCA/DO-260A, Appendix A, section §A.1.7.3, in subparagraphs "b" and "e" the factor *k* used to describe the "TIS-B encoding for *Nb=12* is unnecessary, as this factor should always be equal to ONE (1). Also, delete the line under each equation that references the factor *k*.

(1.83) In RTCA/DO-260A, Appendix A, replace the title of section §A.1.7.5 with the following:

A.1.7.5 Locally Unambiguous CPR Decoding for Airborne, TIS-B and Intent Lat/Lon

(1.84) In RTCA/DO-260A, Appendix A, section §A.1.7.5, in subparagraphs "a" and "d" the factor *k* is unnecessary, as this factor should always be equal to ONE (1). Also, delete the line under each equation that references the factor *k*.

(1.85) In RTCA/DO-260A, Appendix A, section §A.1.7.5, at the end of subparagraph "d" and just prior to subparagraph "e," insert the following *Note*:

Note: *When performing the NL function, the encoding process must ensure that the NL value is established in accordance with Note 5 of §A.1.7.2.d.*

(1.86) In RTCA/DO-260A, Appendix A, section §A.1.7.5, after subparagraph "f" and just prior to section §A.1.7.6, add a new subparagraph "g" as follows:

g) To guard against the possibility that the decoder selects a different value of *NL* from the value that was used by the encoder, a reasonableness test **shall** be applied.

Note: *If the decoded value of longitude differs excessively from the previous value, then this should be considered an error. Furthermore, if this occurs when the latitude is close to an NL boundary, then an alternative decode should be made, trying the next nearest NL value, and if the resultant decode is consistent with the track, then the new decoded value should be used for the report.*

(1.87) In RTCA/DO-260A, Appendix A, replace the title of section §A.1.7.6 with the following:

A.1.7.6 Locally Unambiguous CPR Decoding for Surface Position

(1.88) In RTCA/DO-260A, Appendix A, section §A.1.7.6, after subparagraph "4" and just prior to subparagraph "5," insert the following *Note*:

Note: *When performing the NL function, the encoding process must ensure that the NL value is established in accordance with Note 5 of §A.1.7.2.d.*

(1.89) In RTCA/DO-260A, Appendix A, at the end of section §A.1.7.6, after subparagraph "6" and just prior to section §A.1.7.7, insert a new subparagraph "7" as follows:

7. To guard against the possibility that the decoder selects a different value of *NL* from the value that was used by the encoder, a reasonableness test **shall** be applied.

Note: *If the decoded value of longitude differs excessively from the previous value, then this should be considered an error. Furthermore, if this occurs when the latitude is close to an NL boundary, then an alternative decode should be made, trying the next nearest NL value, and if the resultant decode is consistent with the track, then the new decoded value should be used for the report.*

(1.90) In RTCA/DO-260A, Appendix A, section §A.1.7.7, just after subparagraph "d" and before subparagraph "e," insert the following *Note*:

Note: *When performing the NL function, the encoding process must ensure that the NL value is established in accordance with Note 5 of §A.1.7.2.d. This is more important in the Global Unambiguous Decode because large longitude errors are induced if the decode function is not selecting the NL value properly as discussed in Note 5 of §A.1.7.2.d.*

(1.91) In RTCA/DO-260A, Appendix A, section §A.1.7.7, just after subparagraph "g" and before section §A.1.7.8, insert a new subparagraph "h" as follows:

h) To guard against the possibility that the decoder selects a different value of *NL* from the value that was used by the encoder, a reasonableness test **shall** be applied.

Note: *If the decoded value of longitude differs excessively from the previous value, then this should be considered an error. Furthermore, if this occurs when the latitude is close to an NL boundary, then an alternative decode should be made, trying the next nearest NL value, and if the resultant decode is consistent with the track, then the new decoded value should be used for the report.*

(1.92) In RTCA/DO-260A, Appendix A, renumber section §A.1.7.8, and its subsections, beginning with §A.1.7.9.

(1.93) In RTCA/DO-260A, Appendix A, insert a new section §A.1.7.8 entitled "**Globally Unambiguous CPR Decoding of Surface Position**" with content as follows:

A.1.7.8 Globally Unambiguous CPR Decoding of Surface Position

This algorithm **shall** utilize one CPR surface position encoded "**even**" format message together with one CPR surface position encoded "**odd**" format message, to regenerate the geographic position of the aircraft or target.

As surface-format messages are initially received from a particular aircraft, if there is no prior history of this aircraft, then a global decode **shall** be performed using even and odd format receptions, as described in this section.

Note 1: *If the aircraft has been transmitting airborne format messages and their receptions were in-track, then it is not necessary to use even-odd decoding. Beginning with the first individual surface message reception, the location can be decoded using the local-decode technique, based on the previous target location as the reference.*

Note 2: *Even if the aircraft is appearing for the first time in surface format receptions, any single message could be decoded by itself into multiple locations, one being the correct location of the transmitting aircraft, and all of the others being separated by 90 NM or more from the correct location. Therefore, if it were known that the transmitting aircraft cannot be farther away than 45 NM from a known location, then the first received message could be decoded using the locally unambiguous decoding method described in §A.1.7.6. Under some circumstances it may be possible for an aircraft to be first detected when it is transmitting surface position messages farther than 45 NM away from the receiving station. For this reason, even-odd decoding is required when messages are initially received from a particular aircraft. After this initial decode, as subsequent messages are received, they can be decoded individually (without using the even-odd technique), provided that the intervening time is not excessive. This subsequent decoding is based on the fact that the aircraft location has not changed by more than 45 NM between each new reception and the previously decoded location.*

The even-odd decoding process **shall** begin by identifying a pair of receptions, one in the even format, the other in the odd format, and whose separation in time does not exceed 25 seconds.

Note: *The limit of 25 seconds is based on the possible change of location within this time interval. Detailed analysis of CPR indicates that if the change of location is 0.75 NM or less, then the decoding will yield the correct location of the aircraft. To assure that the change of location is actually no larger, and considering the maximum aircraft speed of 100 kt specified for the transmission of the surface format, the combination indicates that 25 seconds will provide the needed assurance.*

Given a CPR 17-bit surface position encoded in the "**even**" format ($XZ0$, $YZ0$) and another encoded in the "**odd**" format ($XZ1$, $YZ1$), separated by no more than 25 seconds, the algorithm shall regenerate the geographic position (latitude *Rlat*, and longitude *Rlon)* of the aircraft or target by performing the following sequence of steps:

a. Compute the latitude zone sizes $Dlat_0$ and $Dlat_1$ from the equation:

$$Dlat_i = \frac{90°}{60 - i}$$

b. Compute the latitude index:

$$j = floor\left(\frac{59 \cdot YZ_o - 60YZ_1}{2^{17}} + \frac{1}{2}\right)$$

c. Latitude. The following formulas will yield two mathematical solutions for latitude (for each value of *i*), one in the northern hemisphere and the other in the southern hemisphere. Compute the northern hemisphere solution of $Rlat_0$ and $Rlat_1$ using the following equation:

$$Rlat_i = Dlat_i\left(MOD(j, 60 - i) + \frac{YZ_i}{2^{17}}\right)$$

The southern hemisphere value is the above value minus 90 degrees.

To determine the correct latitude of the target, it is necessary to make use of the location of the receiver. Only one of the two latitude values will be consistent with the known receiver location, and this is the correct latitude of the transmitting aircraft.

d. The first step in longitude decoding is to check that the even-odd pair of messages do not straddle a transition latitude. It is rare, but possible, that NL($Rlat_0$) is not equal to NL($Rlat_1$). If so, a solution for longitude cannot be calculated. In this event, abandon the decoding of this even-odd pair, and examine further receptions to identify another pair. Perform the decoding computations up to this point and check that these two NL values are equal. When that is true, proceed with the following decoding steps.

Note: *When performing the NL function, the encoding process must ensure that the NL value is established in accordance with Note 5 of §A.1.7.2.d. This is more important in the Global Unambiguous Decode because large longitude errors are induced if the decode function is not selecting the NL value properly as discussed in Note 5 of §A.1.7.2.d.*

e. Compute the longitude zone size $Dlon_i$, according to whether the most recently received surface position message was encoded with the even format (*i*=0) or the odd format (*i*=1):

$$Dlon_i = \frac{90°}{n_i},$$ where n_i is the greater of [$NL(Rlat_i) - i$] and 1.

f. Compute m, the longitude index:

$$m = floor\left(\frac{XZ_0 \cdot (NL-1) - XZ_1 \cdot NL}{2^{17}} + \frac{1}{2}\right)$$

where $NL = NL\,(Rlat_i\,)$

g. Longitude. The following formulas will yield four mathematical solutions for longitude (for each value of *i*), one being the correct longitude of the aircraft, and the other three separated by at least 90 degrees. To determine the correct location of the target, it will be necessary to make use of the location of the receiver. Compute the longitude, $Rlon_0$ or $Rlon_1$, according to whether the most recently received surface position message was encoded using the even format (that is, with i=0) or the odd format (i=1):

$$Rlon_i = Dlon_i \cdot \left(MOD(m, n_i) + \frac{XZi}{2^{17}} \right)$$

where n_i is the greater of [$NL(Rlat_i\,) - i$] and 1.

This solution for $Rlon_i$ will be in the range 0° to 90°. The other three solutions are 90°, 180°, and 270° to the east of this first solution.

h. To guard against the possibility that the decoder selects a different value of *NL* from the value that was used by the encoder, a reasonableness test **shall** be applied.

Note: *If the decoded value of longitude differs excessively from the previous value, then this should be considered an error. Furthermore, if this occurs when the latitude is close to an NL boundary, then an alternative decode should be made, trying the next nearest NL value, and if the resultant decode is consistent with the track, then the new decoded value should be used for the report.*

To then determine the correct longitude of the transmitting aircraft, it is necessary to make use of the known location of the receiver. Only one of the four mathematical solutions will be consistent with the known receiver location, and this is the correct longitude of the transmitting aircraft.

Note: *Near the equator the minimum distance between the multiple longitude solutions is more than 5000 NM, so there is no question as to the correct longitude. For locations away from the equator, the distance between solutions is less, and varies according to the cosine of latitude. For example at 87 degrees latitude, the minimum distance between solutions is 280 NM. This is sufficiently large to provide assurance that the correct aircraft location will always be obtained. Currently no airports exist within 3 degrees of either pole, so the decoding as specified here will yield the correct location of the transmitting aircraft for all existing airports.*

(1.94) In RTCA/DO-260A, Appendix A, section §A.1.8, Figure A-8, replace *Note #1* with the following text:

1. Message delivery is accomplished once per 0.8 second using the Event-Driven protocol.

(1.95) In RTCA/DO-260A, Appendix A, section §A.1.8, Figure A-10, replace "**BDS 6,3**" with "**BDS 6,5**."

(1.96) In RTCA/DO-260A, Appendix A, section §A.2.3, to add the use of DF=18 and CF=6 as a Rebroadcast by ground equipment of an ADS-B Message from an alternate data link using the same TYPE Codes and Message formats as are defined for DF=17 ADS-B Messages, with the exception of bits modified as identified in Section §2.2.18, replace Table A-29 with the following:

Table A-29: CF Field Code Definitions in DF=18 ADS-B and TIS-B Messages

CF Value	ICAO/Mode A Flag (IMF)	Meaning
0	N/A	ADS-B Message from a non-transponder device, AA field holds 24-bit ICAO aircraft address
1	N/A	Reserved for ADS-B Message in which the AA field holds anonymous address or ground vehicle address or fixed obstruction address
2	0	Fine TIS-B Message, AA field contains the 24-bit ICAO aircraft address
	1	Fine TIS-B Message, AA field contains the 12-bit Mode A code followed by a 12-bit track file number
3	0	Coarse TIS-B Airborne Position and Velocity Message, AA field contains the 24-bit ICAO aircraft address
	1	Coarse TIS-B Airborne Position and Velocity Message, AA field contains the 12-bit Mode A code followed by a 12-bit track file number.
4	N/A	Reserved for TIS-B Management Message AA field holds TIS-B Service Volume ID + other information (e.g., MSB of reference position for the service volume)
5	0	Fine TIS-B Message AA field contains a non-ICAO 24-bit address
	1	Reserved
6	0	Rebroadcast of ADS-B Message from an alternate data link AA field holds 24-bit ICAO aircraft address
	1	Rebroadcast of ADS-B Message from an alternate data link AA field holds anonymous address or ground vehicle address or fixed obstruction address
7	N/A	Reserved

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(1.97) In RTCA/DO-260A, Appendix A, section §A.2.4.4, in order to rename the previous "TIS-B Airborne Velocity Message" to only the "TIS-B Velocity Message," delete the word "Airborne" from the title of §A.2.4.4 and from the first line of the paragraph.

(1.98) In RTCA/DO-260A, Appendix A, section §A.2.4.4.1, in order to rename the previous "TIS-B Airborne Velocity Message" to only the "TIS-B Velocity Message," delete the word "Airborne" from the first line of the paragraph.

(1.99) In RTCA/DO-260A, Appendix A, after the existing section §A.2.5, insert a new section §A.2.6 entitled "**Formats for 1090 MHz TIS-B Messages**."

(1.100) In RTCA/DO-260A, Appendix A, in order to rename the previous "TIS-B Airborne Velocity Message" to only the "TIS-B Velocity Message," and to correct an incorrect specification of the use of the Vertical Rate Type in ME Bit #56, replace Figure A-15 with the following:

Figure A-15: TIS-B Velocity Messages (Subtypes 1 and 2: Velocity Over Ground)

Bit				
1	MSB	**1**		
2		**0**		
3	FORMAT TYPE CODE = 19	**0**		
4		**1**		
5	LSB	**1**		
6	SUBTYPE 1	**0**	SUBTYPE 2	**0**
7		**0**		**1**
8		**1**		**0**
9	IMF (See §A.2.4.4.2)			
10	MSB			
11	Navigation Accuracy Category for Position (NAC_P)			
12	(§A.1.4.10.7)			
13	LSB			
14	DIRECTION BIT for E-W Velocity **(0=East, 1=West)**			
15	EAST – WEST VELOCITY (10 bits)			
16	NORMAL: LSB = 1 knot		SUPERSONIC: LSB = 4 knots	
17	All zeros = no velocity info		All zeros = no velocity info	
18	Value	Velocity	Value	Velocity
19	1	0 kts	1	0 kts
20	2	1 kt	2	4 kts
21	3	2 kts	3	8 kts
22	---	---	---	---
23	1022	1021 kts	1022	4084 kts
24	1023	>1021.5 kts	1023	> 4086 kts
25	DIRECTION BIT for N – S Velocity **(0=North, 1=South)**			
26	NORTH – SOUTH VELOCITY (10 bits)			
27	NORMAL: LSB = 1 knot		SUPERSONIC: LSB = 4 knots	
28	All zeros = no velocity info		All zeros = no velocity info	
29	Value	Velocity	Value	Velocity
30	1	0 kts	1	0 kts
31	2	1 kt	2	4 kt
32	3	2 kts	3	8 kts
33	---	---	---	---
34	1022	1021 kts	1022	4084 kts
35	1023	>1021.5 kts	1023	>4086 kts
36	GEO Flag Bit (1 bit) **GEO = 0** (Barometric)		GEO Flag Bit (1 bit) **GEO = 1** (Geometric)	
37	SIGN BIT FOR VERTICAL RATE: **(0 = up, 1 = down)**		SIGN BIT FOR VERTICAL RATE: **(0 = up, 1 = down)**	
38	VERTICAL RATE (9 bits)		VERTICAL RATE (9 bits)	
39	All zeros = no vertical rate information, LSB = 64 ft/min		All zeros = no vertical rate information, LSB = 64 ft/min	
40	Value	Vertical Rate	Value	Vertical Rate
41	1	0 ft/min	1	0 ft/min
42	2	64 ft/min	2	64 ft/min
43	---	---	----	---
44	510	32576 ft/min	510	32576 ft/min
45	511	> 32608 ft/min	511	> 32608 ft/min
46				
47	NIC Supplement (See §A.1.4.10.6)		NIC Supplement (See §A.1.4.10.6)	
48	Navigation Accuracy Category for Velocity (NAC_V)		Reserved (1 bit)	
49	(See §A.1.4.5.5)		DIFFERENCE SIGN BIT **(0 = above baro, 1 = below baro)**	
50				
51	Surveillance Integrity Level (SIL)		GEOMETRIC HEIGHT DIFFERENCE FROM BARO ALT	
52	LSB (See §A.1.4.10.9)		(7 bits)	
53			Same coding as Airborne Velocity Message	
54	Reserved (4 bits)			
55				
56				

Purpose: To provide velocity information for aircraft that are not equipped with 1090 MHz ADS-B when the TIS-B service is based on high quality surveillance data.

Subtype Coding

Code	**Velocity**	**Type**
1	Ground Speed	Normal
2		Supersonic

Note: The "Vertical Rate" and "Geometric Height Difference From Barometric" fields for surface aircraft do not need to be processed by TIS-B receivers.

(1.101) In RTCA/DO-260A, Appendix A, in order to rename the previous "TIS-B Airborne Velocity Message" to only the "TIS-B Velocity Message," and to correct an incorrect specification of the use of the Vertical Rate Type in ME Bit #56, replace Figure A-16 with the following:

<u>Figure A-16:</u> TIS-B Velocity Messages (Subtypes 3 and 4: Air Referenced Velocity)

Purpose: To provide velocity information for aircraft that are not equipped with 1090 MHz ADS-B when the TIS-B service is based on high quality surveillance data.

Subtype Coding

Code	**Velocity**	**Type**
3	Air Speed	Normal
4		Supersonic

Note: The "Vertical Rate" and "Geometric Height Difference From Barometric" fields for surface aircraft do not need to be processed by TIS-B receivers.

Bit					GEO = 1 (Geometric)	
1	MSB	**1**				
2		**0**				
3	FORMAT TYPE CODE = 19	**0**				
4		**1**				
5	LSB	**1**				
6	SUBTYPE 3	**0**	SUBTYPE 4	**1**		
7		**1**		**0**		
8		**1**		**0**		
9	IMF (See §A.2.4.4.2)					
10	MSB					
11	Navigation Accuracy Category for Position (NAC_P)					
12	(§A.1.4.10.7)					
13	LSB					
14	HEADING STATUS BIT **(0=not available, 1=available)**					
15	MSB					
16						
17						
18	HEADING (10 bits)					
19	(§A.1.4.5.6)					
20						
21						
22						
23						
24	LSB					
25	AIRSPEED TYPE **(0 = IAS, 1 = TAS)**					
26	AIRSPEED (10 bits)					
27	NORMAL: LSB = 1 knot		SUPERSONIC: LSB = 4 knots			
28	All zeros = no velocity info		All zeros = no velocity info			
29	<u>Value</u>	<u>Velocity</u>	<u>Value</u>	<u>Velocity</u>		
30	1	0 kts	1	0 kts		
31	2	1 kt	2	4 kt		
32	3	2 kts	3	8 kts		
33	---	---	---	---		
34	1022	1021 kts	1022	4084 kts		
35	1023	>1021.5 kts	1023	>4086 kts		
36	GEO Flag Bit (1 bit) **GEO = 0** (Barometric)				GEO Flag Bit (1 bit) **GEO = 1** (Geometric)	
37	SIGN BIT FOR VERTICAL RATE: **(0 = up, 1 = down)**				SIGN BIT FOR VERTICAL RATE: **(0 = up, 1 = down)**	
38	VERTICAL RATE (9 bits)				VERTICAL RATE (9 bits)	
39	All zeros = no vertical rate information, LSB = 64 ft/min				All zeros = no vertical rate information, LSB = 64 ft/min	
40	<u>Value</u>	<u>Vertical Rate</u>			<u>Value</u>	<u>Vertical Rate</u>
41	1	0 ft/min			1	0 ft/min
42	2	64 ft/min			2	64 ft/min
43	---	---			----	---
44	510	32576 ft/min			510	32576 ft/min
45	511	> 32608 ft/min			511	> 32608 ft/min
46						
47	NIC Supplement (See §A.1.4.10.6)				NIC Supplement (See §A.1.4.10.6)	
48	Navigation Accuracy Category for Velocity (NAC_V)				Reserved (1 bit)	
49	(See §A.1.4.5.5)				DIFFERENCE SIGN BIT **(0 = above baro, 1 = below baro)**	
50						
51	Surveillance Integrity Level (SIL)				GEOMETRIC HEIGHT DIFFERENCE FROM BARO ALT	
52	LSB (See §A.1.4.10.9)				(7 bits)	
53	Reserved				Same coding as Airborne Velocity Message	
54	Reserved					
55	True/Magnetic Heading **(0 = True, 1 = Magnetic)**					
56	Reserved					

(1.102) In RTCA/DO-260A, Appendix A, after the end of Appendix A, following Figure A-17, add the following as a new section §A.3:

A.3 ADS-B Rebroadcast Service – Formats and Coding

A.3.1 Introduction

Notes:

1. *This section of Appendix A defines the formats and coding for an ADS-B Rebroadcast Service based on the same 112-bit 1090 MHz Extended Squitter signal transmission that is used for ADS-B Messages on 1090 MHz.*
2. *ADS-B Rebroadcast complements the operation of ADS-B and TIS-B by providing ground-to-air rebroadcast of ADS-B data about aircraft that are not equipped for 1090 MHz Extended Squitter ADS-B, but are equipped with an alternate form of ADS-B (e.g., Universal Access Transceiver (UAT)). The basis for the ADS-B Rebroadcast transmission is the ADS-B Report received at the ground station using a receiver compatible with the alternate ADS-B data link.*
3. *The ADS-B Rebroadcast ground-to-air transmissions use the same signal formats as the 1090 MHz Extended Squitter ADS-B and can therefore be accepted by a 1090 MHz ADS-B Receiving Subsystem, with the exceptions identified in the following sections.*

A.3.2 ADS-B Rebroadcast Format Definition

ADS-B Rebroadcast information is transmitted using the 112-bit Mode S DF=18 format specified in Figure A-11.

A.3.3 Control Field Allocation

The content of the DF=18 transmission is defined by the value of the Control Field (CF). As specified in Table A-29, ADS-B Rebroadcast transmissions use CF=6.

A.3.4 ADS-B Rebroadcast Surveillance Message Definitions

The Rebroadcast of ADS-B information on the 1090 MHz Extended Squitter data link is accomplished by utilizing the same ADS-B Message formats defined in Figure A-1 through Figure A-10, with the exception of the need to transmit an indication to the 1090 MHz Receiving Subsystem as to the type of identity associated with the aircraft data being reported in the ADS-B Rebroadcast Message. This identification is performed using the ICAO/Mode A Flag (IMF), which was previously discussed in §A.2.4.1.1 for the TIS-B transmissions.

The insertion of this one bit into the ADS-B Messages identified below allows the ADS-B Receiving Subsystem to interpret the Address Field (AF) in the following manner:

IMF = 0 indicates that the ADS-B Rebroadcast data is identified by an ICAO 24-bit Address

IMF = 1 indicates that the ADS-B Rebroadcast data is identified by an anonymous 24-bit Address

A.3.4.1 Rebroadcast Airborne Position Message

The ME Field of the Rebroadcast Airborne Position Message will be formatted as specified in section A.1.4.2 and Figure A-1, except that ME bit 8 is redefined to be the ICAO/Mode A Flag (IMF).

A.3.4.2 Rebroadcast Surface Position Message

The ME Field of the Rebroadcast Surface Position Message will be formatted as specified in section §A.1.4.3 and Figure A-2, except that ME bit 21 is redefined to be the ICAO/Mode A Flag (IMF).

A.3.4.3 Rebroadcast Aircraft Identification and Category Message

The ME Field of the Rebroadcast Aircraft Identification and Category Message will be formatted exactly as specified in section §A.1.4.4 and Figure A-4.

<u>Note:</u> *Any Rebroadcast Aircraft Identification and Category Message does not contain the IMF bit since aircraft using an anonymous 24-bit address will not provide identity and category information.*

A.3.4.4 Rebroadcast Airborne Velocity Messages

The ME Field of the Rebroadcast Airborne Velocity Messages will be formatted as specified in section §A.1.4.5.1 and Figure A-5 for Subtype 1 & 2 Messages, and in section §A.1.4.5.2 and Figure A-6 for Subtype 3 & 4 Messages, except that ME bit 9 is redefined to be the ICAO/Mode A Flag (IMF).

A.3.4.5 Rebroadcast Aircraft Emergency/Priority Status Message

The ME Field of the Rebroadcast Aircraft Emergency/Priority Status Message will be formatted as specified in section §A.1.4.8 and Figure A-8, except that ME bit 56 is redefined to be the ICAO/Mode A Flag (IMF).

A.3.4.6 Rebroadcast Target State and Status Message

The ME Field of the Rebroadcast Target State and Status Message will be formatted as specified in section §A.1.4.9 and Figure A-9, except that ME bit 51 is redefined to be the ICAO/Mode A Flag (IMF).

A.3.4.7 Rebroadcast Aircraft Operational Status Message

The ME Field of the Rebroadcast Aircraft Operational Status Message will be formatted as specified in section §A.1.4.10 and Figure A-10, except that ME bit 56 is redefined to be the ICAO/Mode A Flag (IMF).

(1.103) In RTCA/DO-260A, Appendix E, replace Table E-1 with the following table:

Table E-1: Air-To-Air Link Budget Ranges for Equipage Classes

	Class →	A0	A1	A2	A3
Basic Requirements	Transmitter power (dBm at antenna)	48.5 to 57	51 to 57	51 to 57	53 to 57
	Receiver MTL (dBm at antenna)	≤ -72	≤ -79	≤ -79	≤ -84
Transmitter power	dBm at antenna, worst case (minimum power)	48.5	51.0	51.0	53.0
Antenna gain, transmitter	dB	0	0	0	0
Antenna gain, receiver	dB	0	0	0	0
Received Power	dBm at antenna	-72.0	-79.0	-79.0	-84.0
MTL	dBm at antenna, worst case	-72.0	-79.0	-79.0	-84.0 (90%) -87.0 (15%)
Link Budget Ranges	NM	14	38	38	84 (90%) 119 (15%)

(1.104) In RTCA/DO-260A, Appendix N, replace Table N-4 with the following table and delete Note #3 after the Table.

Table N-4: Version Zero (0) Format Type Code Mapping to Navigation Source Characteristics

"TYPE" Subfield Code Definitions (DF = 17 or 18)				
TYPE Code	**Format**	**Horizontal Protection Limit, HPL**	**Altitude Type**	**Reported NIC**
0	No Position Information		Baro Altitude or No Altitude Information	0
5	Surface Position	HPL < 7.5 m	No Altitude Information	11
6	Surface Position	HPL < 25 m	No Altitude Information	10
7	Surface Position	HPL < 185.2 m (0.1 NM)	No Altitude Information	8
8	Surface Position	HPL ≥ 185.2 m (0.1 NM)	No Altitude Information	0
9	Airborne Position	HPL < 7.5 m	Baro Altitude	11
10	Airborne Position	7.5 m ≤ HPL < 25 m	Baro Altitude	10
11	Airborne Position	25 m ≤ HPL < 185.2 m (0.1 NM)	Baro Altitude	8
12	Airborne Position	185.2 m (0.1 NM) ≤ HPL < 370.4 m (0.2 NM)	Baro Altitude	7
13	Airborne Position	380.4 m (0.2 NM) ≤ HPL < 926 m (0.5 NM)	Baro Altitude	6
14	Airborne Position	26 m (0.5 NM) ≤ HPL < 1852 m (1.0 NM)	Baro Altitude	5
15	Airborne Position	1852 m (1.0 NM) ≤ HPL < 3704 m (2.0 NM)	Baro Altitude	4
16	Airborne Position	7.704 km (2.0 NM) ≤ HPL < 18.52 km (10 NM)	Baro Altitude	1
17	Airborne Position	18.52 km (10 NM) ≤ HPL < 37.04 km (20 NM)	Baro Altitude	1
18	Airborne Position	HPL ≥ 37.04 km (20 NM)	Baro Altitude	0
20	Airborne Position	HPL < 7.5 m	GNSS Height (HAE)	11
21	Airborne Position	HPL < 25 m	GNSS Height (HAE)	10
22	Airborne Position	HPL ≥ 25 m	GNSS Height (HAE)	0

(1.105) In RTCA/DO-260A, Appendix O, replace Table O-3 with the following table. Changes are highlighted in gray.

<u>Table O-3:</u> Bit Allocation for Messages Supporting Trajectory Change Reports

	TC Report Element #	**Contents**	**How conveyed by 1090 MHz ADS-B Messages**	**Trajectory Change Message SUBTYPEs**		
				TC+0 Basic	**TC+1 Basic**	**Supplemental TC**
ID	1	Participant Address	Conveyed in Message Header	0 bits	0 bits	0 bits
	2	Address Qualifier	Conveyed in Aircraft ID and Type Message	N/A	N/A	N/A
TOA	3	Time of Applicability	Added by Receiver	N/A	N/A	N/A
TC Report #	4	TC Report Sequence Number (conveyed by the SUBTYPE Code)	TYPE 27 ADS-B Message	2 bits	2 bits	2 bits
TC Report Version	5a	TC Report Cycle Number	TYPE 27 ADS-B Message	2 bits	2 bits	2 bits
	5b	(Reserved for TC Management Indicator)	TYPE 27 ADS-B Message	N//A	N/A	[note 1]
TTG	6	Time To Go	TYPE 27 ADS-B Message	9 bits	9 bits	N/A
Horizontal TC Report Information	7a	Horizontal Data Available and Horizontal TC Type	TYPE 27 ADS-B Message	3 bits [note 2]	3 bits [note 2]	N/A [note 2]
	7b	TC Latitude	TYPE 27 ADS-B Message	10 bits	10 bits	N/A
	7c	TC Longitude	TYPE 27 ADS-B Message	10 bits	10 bits	N/A
	7d	Turn Radius	TYPE 27 ADS-B Message	N/A	N/A	7 bits
	7e	Track to TCP	TYPE 27 ADS-B Message	N/A	N/A	9 bits
	7f	Track from TCP	TYPE 27 ADS-B Message	N/A	N/A	9 bits
	7g	(Reserved for Horizontal Conformance)	TYPE 27 ADS-B Message	N/A	N/A	[note 1]
	7h	Horizontal Command/Planned Flag	TYPE 27 ADS-B Message	1 bit	1 bit	N/A
Vertical TC Report Information	8a	Vertical Data Available and Vertical TC Type	TYPE 27 ADS-B Message	3 bits [note 2]	3 bits [note 2]	N/A
	8b	TC Altitude	TYPE 27 ADS-B Message	10 bits	10 bits	N/A
	8c	TC Altitude Type	TYPE 27 ADS-B Message	1 bit	1 bit	N/A
	8d	(Reserved for Altitude Constraint Type)	TYPE 27 ADS-B Message	N/A	N/A	[note 1]
	8e	(Reserved for Able/Unable Altitude Constraint)	TYPE 27 ADS-B Message	N/A	N/A	[note 1]
	8f	(Reserved For Vertical Conformance)]	TYPE 27 ADS-B Message	N/A	N/A	[note 1]
	8g	Vertical Command/Planned Flag	TYPE 27 ADS-B Message	N/A	N/A	1 bit
Spare Bits				0	0	19
ME Bits for TYPE Code				5	5	5
TOTAL ME Bits				56	56	56