APPENDIX 1. 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 Appendix prescribes the Minimum Performance Standards (MPS) for 1090 MHz Extended Squitter Transmitting and Receiving Subsystems, modified by the FAA in this TSO. The applicable standards for those changes requested in this Appendix 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, and Change 1 to RTCA/DO-260A, issued June 27, 2006.

In all of the following requested changes, for those items where existing text is requested to change, the changes are highlighted in yellow. In those changes where a totally new section or text is inserted, no highlighting will be indicated.

SECTION 1 -

(**1.1**) In Change 1 to RTCA/DO-260A several changes were made to add a reasonableness test for Globally Unambiguous CPR Decodes. In each of the changes made to DO-260A for this addition, the term "maximum reception range" was used. For each of the following cases appearing in Change 1 to RTCA/DO-260A, change this phrase to "maximum operating range." The locations of these changes in Change 1 to RTCA/DO-260A include:

(change 1.29) - §2.2.10.3.1, subparagraph "a"
(change 1.30) - §2.2.10.3.2, subparagraph "a"
(change 1.62) - §2.4.10.3.1, Purpose/Introduction, subparagraph "a"
(change 1.63) - §2.4.10.3.1, Step 1, subparagraph "h"
(change 1.64) - §2.4.10.3.2, Purpose/Introduction, subparagraph "a"
(change 1.66) - §2.4.10.3.2, Step 1, subparagraph "h"
(change 1.71) - §2.4.10.6, Step 1, Test Inputs for Pair 1 and Pair 2
(change 1.71) - §2.4.10.6, Step 5, Test Inputs for Pair 1 and Pair 2
(change 1.102) - §A.1.7.10.2, Definition of the Reasonableness Test for Global Decode

(**1.2**) In Change 1 to RTCA/DO-260A (change 1.5), in section §2.2.3.2, a change was made to Figure 2-2 for a Message with DF=18 and CF=6 in order to add the definition of an ADS-B Rebroadcast (ADS-R) Message. Replace that Figure 2-2 with the following Figure in order to change the definition of a Message with DF=18 and CF=4 to read "TIS-B and ADS-R Management Messages."

<table>
<tr><th colspan="7">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 colspan="2">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 colspan="2">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 colspan="2" 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 colspan="2">TIS-B Message ME Field
[56]</td><td>PI
[24]</td></tr>
<tr><td>CF = 4
[3]</td><td colspan="3">TIS-B and ADS-R Management Messages</td><td>PI
[24]</td></tr>
<tr><td>CF = 5
[3]</td><td>AA
non-ICAO Address
[24]</td><td colspan="2">TIS-B Message ME Field
[56]</td><td rowspan="3">PI
[24]</td></tr>
<tr><td>CF = 6
[3]</td><td colspan="3">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="3">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 colspan="2">ADS-B Message ME Field
[56]</td><td>PI
[24]</td></tr>
<tr><td>AF = 1 to 7
[3]</td><td colspan="4">Reserved for Military Applications</td></tr>
<tr><td></td><td>MSB LSB</td><td>MSB LSB</td><td>MSB LSB</td><td colspan="2">MSB LSB</td><td>MSB LSB</td></tr>
</table>

Figure 2-2: ADS-B and TIS-B Message Baseline Format Structure

(**1.3**) In Change 1 to RTCA/DO-260A (change 1.6), in section §2.2.3.2, the last paragraph was completely replaced in order to add the definition of a DF=18 and CF=6 ADS-R Message. Please replace the second to last, and the last, paragraphs of section §2.2.3.2 with the following paragraphs and additional *Note*:

ADS-B Airborne Receiving Subsystems **shall** accept, and process as ADS-B Messages, any Extended Squitter transmissions in which DF=17, or in which DF=18 and CF=0, 1 or 6. ADS-B Airborne Receiving Subsystems may accept and process ADS-B Messages in which DF=19 and AF=0, but need not do so. ADS-B Airborne Receiving Subsystems **shall not** process as ADS-B Messages any Extended Squitter receptions in which DF=18 and CF is not equal to 0, 1 or 6, or any Extended Squitter receptions in which DF=19 and AF is not equal to 0.

TIS-B Messages ~~**shall**~~ use 1090 MHz Extended Squitter formats in which DF=18 and 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 the 1090 MHz Extended Squitter ~~**shall**~~ uses 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. 1090 MHz Extended Squitter Messages with DF=18 and CF=4 convey management information for TIS-B and ADS-R. 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.

Note: *A primary purpose of the TIS-B/ADS-R Management Messages (i.e., DF=18 and CF=4) is to convey the TIS-B and the ADS-R service volumes and to provide a 'heartbeat' indicator. This information is provided in order that airborne applications using TIS-B and/or ADS-R received information can determine if their own ship is within the designated TIS-B and/or ADS-R service volume (i.e., by comparing own ship position with the service volume information conveyed by the management message) and current service availability (i.e., with the 'heartbeat' function conveyed by the management message). Although the explicit data contents of the TIS-B/ADS-R Management Messages are not defined within this document, the overall message structure and purpose is defined.*

(**1.4**) In RTCA/DO-260A, in section §2.2.3.2.1.3, replace the last two sentences of the first paragraph with the following:

For TIS-B Messages, the CF field serves to categorize the TIS-B Message as being a "fine format" TIS-B Message, a "coarse format" TIS-B Airborne Position and Velocity Message, a Fine TIS-B Message that uses non-ICAO 24-bit addresses, or a TIS-B/ADS-R Management Message. The coding of the CF field **shall** be as specified in Table 2-11.

(**1.5**) In Change 1 to RTCA/DO-260A (change 1.8), in section §2.2.3.2.1.3, Table 2-11 and the paragraph that followed it were totally replaced in order to add the definition of a

Message with DF=18 and CF=6 as an ADS-R Message. Replace Table 2-11 and the paragraph that follows it with the following Table and text in order to change the definition of an ADS-B Message with DF=18 and CF=4 to read "TIS-B and ADS-R Management Messages."

Table 2-11: "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 and ADS-R Messages	Fine TIS-B Message using ICAO 24-bit address
011	3		Coarse TIS-B Airborne Position and Velocity Message.
100	4		TIS-B and ADS-R 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 not 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**~~ uses formats in which DF=18 and CF=6, and ~~**shall use**~~ the same 1090ES 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 7 is reserved for future standardization and **shall not** be transmitted by equipment that conforms to these MOPS (RTCA DO-260A).

(**1.6**) In Change 1 to RTCA/DO-260A (change 1.9), in section §2.2.3.2.1.5, Table 2-13 was totally replaced in order to add the definition of a Message with DF=18 and CF=6 as an ADS-R Message. Replace Table 2-13, the paragraph that follows it, and all three *Notes* with the following Table, text and *Notes*, in order to change the definition of a Message with DF=18 and CF=4 to read "TIS-B and ADS-R Management Messages," and provide information about the AA field of the TIS-B/ADS-R Management Message.

Table 2-13: Determining the Kind 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	TIS-B and ADS-R Management Messages; AA field contains TIS-B/ADS-R management 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.

For Extended Squitter transmissions in which DF=17, or in which DF=18 and CF=0, or in which DF=19 and AF=0, the AA field contains the 24-bit ICAO address of the transmitting participant.

The TIS-B/ADS-R Management Messages (i.e., DF=18 and CF=4) do not relate to an aircraft but rather relate to the coverage and availability of the TIS-B or ADS-R service that is being provided by the local ground infrastructure. Therefore, the coding of the AA field for TIS-B/ADS-R Management Messages is used to convey additional information in the TIS-B/ADS-R Management Message and must be included in the data delivered to ADS-B applications.

Notes:

1. *For Extended Squitter transmissions in which DF=18 and CF=1, the CF field indicates that the ME field holds an ADS-B Message and that the AA field holds an address other than the standard ICAO 24-bit address of the transmitting ADS-B participant.*
2. *For Extended Squitter transmissions in which DF=18 and CF=2, 3 or 5, the CF field indicates that the ME field holds the TIS-B Message. In these cases the meaning of the AA field – whether or not it contains the ICAO 24-bit address of the aircraft being described in the TIS-B Message – depends on the value of the CF field, as described in §2.2.3.2.1.3.*
3. *These requirements are consistent with the requirements of ICAO Annex 10, Volume IV, as well as the requirements of RTCA DO-181C, §2.2.14.4.1 (EUROCAE ED-73B, §3.18.4.1).*

(**1.7**) In RTCA/DO-260A, in section §2.2.3.2.1.7, replace the *Note* with the following:

Note: *In ADS-B and TIS-B Messages (those transmitted with downlink format DF=17, or with DF=18 and CF in the range from 0 to 6, or with DF=19 and AF=0) both CL=0 and IC=0. In other words, in ADS-B and TIS-B Messages the parity is overlaid with a 24-bit pattern of ALL ZEROs.*

(**1.8**) In Change 1 to RTCA/DO-260A (change 1.11), in section §2.2.3.2.2, Table 2-15 was totally replaced in order to correct the naming of the TIS-B Velocity Message. Replace Table 2-15 with the following Table in order to change the definition of a Message with DF=18 and CF=4 to read "TIS-B and ADS-R Management Messages."

Table 2-15: Determining TIS-B or ADS-R Message Type (DF=18, CF=2 to 6)

CF Field Value	TYPE Code ("ME" bits 1-5)	SUBTYPE Code ("ME" bits 6-8)	TIS-B or ADS-R 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	TIS-B and ADS-R Management Message
6	0 – 31	See Table 2-14	ADS-B Rebroadcast (see §2.2.18)

(**1.9**) In RTCA/DO-260A, in section §2.2.10.4.1.2, replace subparagraph "a.(1)" with the following:

(1). Perform a Local CPR decode of the Airborne Participant Position in accordance with §A.1.7.4 and §A.1.7.5 of Appendix A. Perform the reasonableness test identified in §2.2.10.6.3 to verify that the most recently received position does not represent an unreasonable offset from the previous aircraft position. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the position decodes resulting from the reasonableness test of §2.2.10.6.3 are less than or equal to 6 NM, then the validation is successful and complete, and the position can be used to update the track. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the reported position in the most recently received Position Message differs from the previously reported position by more than 6 NM, then the most recently received position **shall not** be used to update the track.

(**1.10**) In RTCA/DO-260A, in section §2.2.10.4.2.2, replace subparagraph "a.(1)" with the following:

(1). Perform a Local CPR decode of the Surface Participant Position in accordance with §A.1.7.4 and §A.1.7.6 of Appendix A. Perform the reasonableness test identified in §2.2.10.6.3 to verify that the most recently received position does not represent an unreasonable offset from the previous aircraft position. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the position decodes resulting from the reasonableness test of §2.2.10.6.3 are less than or equal to 0.75 NM, then the validation is successful and complete, and the position can be used to update the track. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the reported position in the most recently received Position Message differs from the previously reported position by more than 0.75 NM, then the most recently received position **shall not** be used to update the track.

(**1.11**) In Change 1 to RTCA/DO-260A (change 1.32), a new section §2.2.10.6 was added in order to define a reasonableness test for Global CPR decodes. Replace the title of section §2.2.10.6 with the following new titles, AND insert new sections §2.2.10.6.1, §2.2.10.6.2 and §2.2.10.6.3. Complete the text of section §2.2.10.6.2 with the revised text below to replace the original text ~~while using the original text of §2.2.10.6~~ from Change 1 to DO-260A, change (1.32):

2.2.10.6 Reasonableness Tests for CPR Decoding of Received Position Messages

2.2.10.6.1 Reasonableness Test Overview

Although receptions of Position Messages will normally lead to a successful target position determination, it is necessary to safeguard against Position Messages that would be used to initiate or update a track with an erroneous position. A reasonableness test applied to the computed position resulting from receipt of a Position Message can be used to discard erroneous position updates. Since an erroneous Globally Unambiguous CPR Decode could potentially exist for the life of a track, a reasonableness test and validation of the position protects against such occurrences. Likewise, an erroneous Locally Unambiguous CPR Decode could result in an incorrect position that potentially remains incorrect for the life of the track.

2.2.10.6.2 Reasonableness Test Applied to Positions Determined from Globally Unambiguous CPR Decoding

A validation **shall** be performed to verify the Globally Unambiguous CPR decode established per §2.2.10.3.1, subparagraph "a" or §2.2.10.3.2, subparagraph "a," using the following steps:

a. Compute a second Globally Unambiguous CPR decode based on reception of a new "***odd***" and an "***even***" Position Message as per §2.2.10.3.1, subparagraph "a" for an Airborne Participant, or per §2.2.10.3.2, subparagraph "a" for a Surface Participant, both received subsequent to the respective "***odd***" and "***even***" Position Message used in the Globally Unambiguous CPR decode under validation.

b. Compare the position decode resulting from the Globally Unambiguous CPR decode as per subparagraph "a" above to the Locally Unambiguous CPR decode computed from the receipt of the current Position Message satisfying subparagraph "a" above,

Note: *The Locally Unambiguous CPR decode is based on the update of the position derived from the current Globally Unambiguous*

CPR decode established in §2.2.10.3.1, subparagraph "a," or §2.2.10.3.2, subparagraph "a."

c. If the position decodes resulting from subparagraph "b" above are identical to within one LSB, then the validation is complete. Otherwise, the following subparagraph applies:

d. No State Vector Report is generated from the receipt of the current Position Message. The Report Mode for the given Participant Report Mode is reset to the Initialization State. All "***even***" and "***odd***" Position Messages received prior to the respective "***even***" or "***odd***" Position Message used in the Globally Unambiguous CPR decode in subparagraph "a" above are discarded.

Note: *Completion of validation requires reception of both an additional "**even**" and "**odd**" Position Message subsequent to the Position Messages used to satisfy the Globally Unambiguous CPR decode in Acquisition State. In the case of Airborne Participants, since reception of an Airborne Velocity Message causes a transition from Acquisition State to Track State, as per §2.2.10.4.1.1, then validation may not be completed until the Airborne Participant is in the Track State.*

~~[Retain the text of the original new §2.2.10.6 from Change 1 to DO-260A]~~

2.2.10.6.3 Reasonableness Test Applied to Positions Determined from Locally Unambiguous CPR Decoding

A validation **shall** be performed to verify the Locally Unambiguous CPR decode established per §2.2.10.4.1.2, subparagraph "a.(1)" for Airborne Participants, or §2.2.10.4.2.2, subparagraph "a.(1)" for Surface Participants, using the following steps:

a. Compare the Locally Unambiguous CPR decode computed from the reception of a new "***odd***" or "***even***" Position Message as per §2.2.10.4.1.2, subparagraph "a.(1)" for an Airborne Participant, or per §2.2.10.4.2.2, subparagraph "a.(1)" for a Surface Participant, to the current position that was computed from the previously received Position Message.

b. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the difference in the position decodes resulting from subparagraph "b" above are less than or equal to **X** NM (where **X**=6 for Airborne, and **X**=0.75 for Surface), then the validation is successful and complete, and the position can be used to update the track. Otherwise, the most recently received position **shall not** be used to update the track.

Note: *The position threshold value is based on the assumption of a maximum aircraft velocity of **V** knots (where **V**=600 for Airborne and **V**=50 for Surface) over a maximum time period of 30 seconds. This yields a maximum positional difference of approximately 5 NM for Airborne, and 0.5 NM for Surface. An additional measure of 1 nautical mile for Airborne, and 0.25 for Surface are added to account for additional ADS-B positional measurement uncertainty.*

(**1.12**) In Change 1 to RTCA/DO-260A (change 1.33), in section §2.2.17.2, Table 2-106 was totally replaced in order to add the use of DF=18 and CF=6 as an ADS-R Message. Replace Table 2-106 with the following Table in order to change the definition of a Message with DF=18 and CF=4 to read "TIS-B and ADS-R Management Messages."

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	TIS-B and ADS-R Management Message AA contains TIS-B/ADS-R management information.
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

(**1.13**) In Change 1 to RTCA/DO-260A (change 1.34), in section §2.2.17.2.2, text was added on to the paragraph in order to add the definition of a DF=18 and CF=6 ADS-R Message. Replace section §2.2.17.2.2 with the following text:

The "CF" field of DF=18 Messages is a 3-bit field (bits 6 through 8) used by Non-Transponder based installations. This field will be set to 2, 3, 4 or 5 depending upon the TIS-B Message as specified in Table 2-106. The ADS-B Receiving Subsystem **shall** accept and process DF=18, with CF=2, CF=3, CF=4, and CF=5 as TIS-B Messages. 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.

(**1.14**) In Change 1 to RTCA/DO-260A (change 1.38), in section §2.2.17.4.6, the first paragraph was replaced totally in order to indicate that the contents of a TIS-B Management Message should be passed through the 1090ES Report Formatter unaltered to the airborne applications. Replace the first paragraph of §2.2.17.4.6 as follows, in order to clarify that the entire 112-bit content should be passed through to the applications:

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 (i.e., including the complete 88-bit content of the DF, CF, AA ~~field plus the~~and ME fields of the Extended Squitter Message) 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.

(**1.15**) In Change 1 to RTCA/DO-260A (change 1.39), a new section §2.2.18 was added as the definition of ADS-B Rebroadcast Service formats and codes. Replace section §2.2.18.3 with the following in order to clarify the use of DF=18 and CF=4 ADS-R Management Messages:

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 Rebroadcasts (i.e., ADS-R) transmissions **shall** use CF=6 and ADS-R Management information transmissions (i.e., defining ADS-R Service Volume and service availability) use CF=4.

(**1.16**) In RTCA/DO-260A, in section §2.4.10.4.1.2, replace subparagraph "a.(1)" in the Purpose/Introduction with the following:

(1). Perform a Local CPR decode of the Airborne Participant Position in accordance with §A.1.7.4 and §A.1.7.5 of Appendix A. Perform the reasonableness test identified in §2.2.10.6.3 to verify that the most recently received position does not represent an unreasonable offset from the previous aircraft position. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the position decodes resulting from the reasonableness test of §2.2.10.6.3 are less than or equal to 6 NM, then the validation is successful and complete, and the position can be used to update the track. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the reported position in the most recently received Position Message differs from the previously reported position by more than 6 NM, then the most recently received position **shall not** be used to update the track.

(**1.17**) In RTCA/DO-260A, in section §2.4.10.4.1.2, replace Step 1, subparagraph "a" with the following:

a. performs a locally unambiguous CPR decode of the Airborne Participant Position in accordance with §A.1.7.4 and §A.1.7.5 of Appendix A, and that the reasonableness test defined in §2.2.10.6.3 is performed and that if the difference in the position decodes resulting from the reasonableness test are less than or equal to 6 NM, that the track is updated. However, if the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the reported position in the most recently received Position Message differs from the previously reported position by more than 6 NM, then the most recently received position **is not** used to update the track.

(**1.18**) In RTCA/DO-260A, in section §2.4.10.4.2.2, replace subparagraph "a.(1)" in the Purpose/Introduction with the following:

(1). Perform a Local CPR decode of the Surface Participant Position in accordance with §A.1.7.4 and §A.1.7.6 of Appendix A. Perform the reasonableness test identified in §2.2.10.6.3 to verify that the most recently received position does not represent an unreasonable offset from the previous aircraft position. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the position decodes resulting from the reasonableness test of §2.2.10.6.3 are less than or equal to 0.75 NM, then the validation is successful and complete, and the position can be used to update the track. If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the reported position in the most recently received Position Message differs from the previously reported position by more than 0.75 NM, then the most recently received position **shall not** be used to update the track.

(**1.19**) In RTCA/DO-260A, in section §2.4.10.4.2.2, replace Step 1, subparagraph "a" with the following:

a. performs a locally unambiguous CPR decode of the Surface Participant Position in accordance with §A.1.7.4 and §A.1.7.6 of Appendix A, and that the reasonableness test defined in §2.2.10.6.3 is performed and that if the difference in the position decodes resulting from the reasonableness test are less than or equal to 0.75 NM that the track is updated. However, if the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the reported position in the most recently received Position Message differs from the previously reported position by more than 0.75 NM, then the most recently received position **is not** used to update the track.

(**1.20**) In Change 1 to RTCA/DO-260A (change 1.71), a new section §2.4.10.6 was added in order to define a test procedure for a reasonableness test for Global CPR decodes. Replace the title of section §2.4.10.6 with the following new titles, AND insert new sections §2.4.10.6.1, §2.4.10.6.2 and §2.4.10.6.3 while using the original text from §2.4.10.6 in Change 1 to DO-260A, with the Purpose/Introduction revised with the modified text of section §2.2.10.6.2 as shown above in this Appendix in change 1.11:

2.4.10.6 Verification of Reasonableness Tests for CPR Decoding of Received Position Messages (§2.2.10.6)

No specific test procedure is required to validate §2.2.10.6.

2.4.10.6.1 Verification of Reasonableness Test Overview (§2.2.10.6.1)

No specific test procedure is required to validate §2.2.10.6.1.

2.4.10.6.2 Verification of the Reasonableness Test Applied to Positions Determined from Globally Unambiguous CPR Decoding (§2.2.10.6.2)

[Retain the text of the original new §2.4.10.6 from Change 1 to DO-260A, (change 1.71), with the Purpose/Introduction revised with the modified text of section §2.2.10.6.2 as shown above in this Appendix in change 1.11]

2.4.10.6.3 Verification of the Reasonableness Test Applied to Positions Determined from Locally Unambiguous CPR Decoding (§2.2.10.6.3)

Purpose/Introduction:
[The requirement text from section §2.2.10.6.3 is repeated in this section.]

Measurement Procedure:

Step 1: Airborne Target Setup

Set up the Test Generator to transmit an ADS-B Airborne Position Message with an "**even**" format containing the exact latitude and longitude data pair provided in the following table. Within 10 seconds, input another ADS-B Airborne Position Message with "**odd**" format containing the exact latitude and longitude data pair provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon
0	38.99836	-74	71361	65500		
1	38.99836	-74	98304	51301	38.998346	-74.000000

Verify that a Global CPR Decode has occurred and that the output of the ADS-B State Vector Report ~~contains~~ matches the ~~exact information as~~corresponding values in the above table.

Input another ADS-B Airborne Position Message to the Receiving Subsystem with "**even**" format and data as provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon
0	39.0000	-74.0000	71361	65536	39.000000	-74.000025

Verify that the output of the ADS-B State Vector Report ~~contains~~ matches the ~~exact information as~~corresponding values in the above table.

Step 2: Verification of Reasonableness Test with Distance Greater Than 6 NM

Input another ADS-B Airborne Position Message pair with "**even**" and "**odd**" formats containing the exact latitude and longitude data pair provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon	Delta Distance (NM)
0	39.099888	-73.998536	71386	67718	39.099884	-73.998533	6.004688
1	39.099888	-73.998536	98328	53482	39.099876	-73.998535	6.004220

Verify that the reception of either of the Position Messages **does not** produce updates to the established Participant Track nor the output of an ADS-B State Vector Report.

Step 3: Verification of Reasonableness Test with Distance Less Than 6 NM

Input an ADS-B Airborne Position Message pair with "**even**" and "**odd**" formats containing the exact latitude and longitude data pair provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon	Delta Distance (NM)
0	39.099788	-73.997803	71398	67716	39.099792	-73.997816	5.999666
1	39.099788	-73.997803	98340	53480	39.099783	-73.997803	5.999118

Verify that the reception of both of these Position Messages **does** produce updates to the established Participant Track and the output of an ADS-B State Vector Report ~~containing~~ matches the ~~exact data~~corresponding values in the table above.

Step 4: Verification of Reasonableness Test with Timing Test

Rerun the test procedure in Step 2 above using the same Latitude and Longitude values, but with a difference between the TOMRs of the previously received Position Message and the most recently received Position Message at a value greater than 30 seconds. Verify that the reception of each of these Position Messages **does** produce updates to the established Participant Track and the output of an ADS-B State Vector Report ~~containing~~ matches the ~~exact data~~corresponding values in the Step 2 table.

Step 5: Verification of Proper Timer Reset

Rerun the Airborne Target Setup as in Step 1 above. With the Global CPR Decode having been established, input an Airborne Position Message at what will become Time=0 with the parameters shown in the following table.

Injection Timing (seconds)	**CPR Format**	**Lat**	**Lon**	**XZ**	**YZ**	**Decoded Lat**	**Decoded Lon**	**Delta Distance (NM)**
0	0	39.099788	-73.997803	71398	67716	39.099792	-73.997816	5.999666
18	1	39.099888	-73.998536	98328	53482	39.099876	-73.998535	6.004220
40	0	39.099888	-73.998536	71386	67718	39.099884	-73.998533	6.004688

Verify that the reception of the initial Position Message at Time=0 **does** produce updates to the established Participant Track and that the output of the ADS-B State Vector Report matches the corresponding values in the above table.

Input an Airborne Position Message at Time=18 with the parameters shown in the above table. Verify that the reception of this Position Message **does not** produce updates to the established Participant Track, nor the output of an ADS-B State Vector Report.

Input an Airborne Position Message at Time=40 with the parameters shown in the above table. Verify that the reception of this Position Message **does** produce updates to the established Participant Track and that the output of the ADS-B State Vector Report matches the corresponding values in the above table.

Step ~~5~~6: Surface Target Setup

Set up the Test Generator to transmit an ADS-B Surface Position Message with the "**even**" format containing the exact latitude and longitude data pair provided in the following table. Within 10 seconds, input another ADS-B Surface Position Message with "**odd**" format containing the exact latitude and longitude data pair provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon
0	38.99836	-74	23302	130929		
1	38.99836	-74	0	74133	38.998357	-74.000000

Verify that a Global CPR Decode has occurred and that the output of the ADS-B State Vector Report ~~contains~~ matches the ~~exact information as~~corresponding values in the above table.

Input another ADS-B Surface Position Message to the Receiving Subsystem with "**even**" format and data as provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon
0	39.0000	-74.0000	23302	0	39.000000	-73.999995

Verify that the output of the ADS-B State Vector Report ~~contains~~ matches the ~~exact information as~~corresponding values in the above table.

Step ~~6~~7: Verification of Reasonableness Test with Distance Greater Than 0.75 NM

Input an ADS-B Airborne Position Message pair with "**even**" and "**odd**" formats containing the exact latitude and longitude data pair provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon	Delta Distance (NM)
0	39.061486	-73.99817	23424	5373	39.061489	-73.998174	3.697247
1	39.061486	-73.99817	120	79557	39.061482	-73.998169	3.696844

Verify that the reception of either of these Position Messages **does not** produce updates to the established Participant Track nor the output of an ADS-B State Vector Report.

Step ~~7~~8: Verification of Reasonableness Test with Distance Less Than 0.75 NM

Input an ADS-B Surface Position Message pair with "**even**" and "**odd**" formats containing the exact latitude and longitude data pair provided in the following table.

CPR Format	Lat	Lon	XZ	YZ	Decoded Lat	Decoded Lon	Delta Distance (NM)
0	39.01028	-73.99817	23424	898	39.010277	-73.998174	0.623613
1	39.01028	-73.99817	120	75157	39.010275	-73.998169	0.623531

Verify that each of these Position Messages **does** produce updates to the established Participant Track and the output of an ADS-B State Vector Report ~~containing~~ matches the ~~exact data~~corresponding values in the table above.

Step ~~8~~9: Verification of Reasonableness Test with Timing Test

Rerun the test procedure in Step ~~6~~ 7 above using the same Latitude and Longitude values, but with a difference between the TOMRs of the previously received Position Message and the most recently received Position Message at a value greater than 30 seconds. Verify that the reception of each of these Position Messages **does** produce updates to the established Participant Track and the output of an ADS-B State Vector Report ~~containing~~ matches the ~~exact data~~corresponding values in the Step ~~6~~ 7 table.

(**1.21**) In RTCA/DO-260A, in section §2.4.17.2.2, replace the text in the Purpose/Introduction with the following:

The "CF" field of DF=18 Messages is a 3-bit field (bits 6 through 8) used by Non-Transponder based installations. This field will be set to 2, 3, 4 or 5 depending upon the TIS-B Message as specified in Table 2-106. The ADS-B Receiving Subsystem **shall** accept and process DF=18, with CF=2, CF=3, CF=4, and CF=5 as TIS-B Messages. 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.

(**1.22**) In RTCA/DO-260A, in section §2.4.17.2.2, insert a new Step 3, renumber the existing Step 3 to Step 4, and insert a new Step 5 as follows:

Step 3: Verification of DF=18, CF=4

Set up to transmit TIS-B Messages. Input a simulated ADS-B DF=18, CF=4 Message. Verify that a TIS-B Report is generated containing the full 112-bits of the received Extended Squitter Message.

Step 4: Verification of DF=18, CF=5

Set up to transmit TIS-B Messages. Input a simulated ADS-B DF=18, CF=4, and IMF=0 Message. Verify that a TIS-B Report is generated. Input a simulated ADS-B DF=18, CF=5 and IMF=1 Message. Verify that a TIS-B Report is not generated.

Step 5: Verification of DF=18, CF=6

Set up to transmit TIS-B Messages. Input a simulated ADS-B DF=18, CF=6 Message. Verify that a TIS-B Report is generated.

(**1.23**) In Change 1 to RTCA/DO-260A, change (1.102), replace the third paragraph of §A.1.7.10.2 with the following:

A further validation of the Globally Unambiguous CPR decode, passing the above test, **shall** be performed by the computation of a second Globally Unambiguous CPR decode based on reception of a new "***odd***" and an "***even***" Position Message as per §A.1.7.7 for an Airborne Participant, or per §A.1.7.8 for a Surface Participant, both received subsequent to the respective "***odd***" and "***even***" Position Message used in the Globally Unambiguous CPR decode under validation. Upon accomplishing the additional Globally Unambiguous CPR decode, this decoded position and the position from the locally unambiguous CPR decode resulting from the most recently received Position Message **shall** be checked to be identical to within one LSB. If the two positions are not identical

to within one LSB, the validation is failed and the initial Globally Unambiguous CPR decode under validation **shall** be discarded and the track **shall** be reinitialized.

(1.24) In RTCA/DO-260A, add a new section §A.1.7.10.3, entitled "**Reasonableness Test Applied to Position Determined from Locally Unambiguous Decoding.**"

A.1.7.10.3 Reasonableness Test Applied to Position Determined from Locally Unambiguous Decoding

A reasonableness test **shall** be applied to a position computed using the Locally Unambiguous CPR decoding per §A.1.7.5 for Airborne, TIS-B or Intent Participants, or per §A.1.7.6 for Surface Participants. Upon receipt of the "***even***" or "***odd***" encoded Position Message that completes the Locally Unambiguous CPR decode, the receiver **shall** perform a reasonableness test on the most recently received position decode by performing the following test:

If the difference between the TOMRs of the previously received Position Message and the most recently received Position Message is 30 seconds or less, and the reported position in the most recently received Position Message differs from the previously reported position by more than **X** NM (where **X**=6 for Airborne, and **X**=0.75 for Surface), then the most recently received position **shall not** be used to update the track.

Note: *The position threshold value is based on the assumption of a maximum aircraft velocity of **V** knots (where **V**=600 for Airborne and **V**=50 for Surface) over a maximum time period of 30 seconds. This yields a maximum positional difference of approximately 5 NM for Airborne, and 0.5 NM for Surface. An additional measure of 1 NM for Airborne, and 0.25 NM for Surface are added to account for additional ADS-B positional measurement ~~uncertainty~~uncertainty.*

(**1.~~24~~25**) In Change 1 to RTCA/DO-260A (change 1.105), in section §A.2.3, Table A-29 was totally replaced in order to add the use of DF=18 and CF=6 as an ADS-R Message. Replace Table A-29 with the following Table in order to change the definition of a Message with DF=18 and CF=4 to read "TIS-B and ADS-R Management Messages."

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	TIS-B and ADS-R Management Message AA field contains TIS-B/ADS-R management information.
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.~~25~~26**) In RTCA/DO-260A, in section §A.2.5, replace the title of the section, and replace the existing *Note* with the following:

A.2.5 TIS-B and ADS-R Management Messages

The TIS-B/ADS-R Management Messages uses Extended Squitter format DF=18 and CF=4 to provide information related to the provision of the TIS-B and/or ADS-R Service Volume in the specific airspace being serviced by the local ground broadcast site(s).

The TIS-B/ADS-R Management Message is used to provide a specific announcement of the Service Volume and the service availability in local airspace where the TIS-B and/or ADS-R service is being supported by the ground infrastructure.

(**1.~~26~~27**) In Change 1 to RTCA/DO-260A (change 1.111), a new section §A.3 was added as the definition of ADS-B Rebroadcast Service formats and codes. Replace section §A.3.3 with the following text in order to clarify the use of DF=18 and CF=4 ADS-R Management Messages:

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 Rebroadcasts (i.e., ADS-R) transmissions **shall** use CF=6 and ADS-R Management information transmissions (i.e., defining ADS-R Service Volume and service availability) **shall** use CF=4.

(**1.28**) In RTCA/DO-260A, Appendix B, section §B.2, add the definition for "Maximum Operating Range" as follows:

Maximum Operating Range – The maximum range at which it is expected that the ADS-B Airborne System will provide the performance necessary to meet the ADS-B MASPS (RTCA/DO-242A) requirements.