Pair 2: A Position Message set consisting of first an "***even***" and then an "***odd***" Position Message, both encoded with the same NL value but different than Pair 1 that produces a Globally Unambiguous CPR decode within the maximum operating range of the receiver, and both input to the receiver within 25 seconds of each other.

Along with the Position Messages, configure the target to output Aircraft ID and Type Messages and Aircraft Operational Status Messages beginning at the same time the input of the Position Messages in the steps below and at the proper Surface transmit rate.

Step 6: Verify Surface Position Not Validated

Input a Pair 1 and verify that a State Vector Report is generated by the receipt of the "***odd***" Position Message of Pair 1. Input a Pair 2 and verify that no State Vector Report is output by the receipt of the "***odd***" Position Message.

Step 7: Verify Surface Position Validated – Case 1

Input a Pair 1 and verify that a State Vector Report consistent with the Globally Unambiguous CPR position of Pair 1 is generated by the receipt of the "***odd***" Position Message of Pair 1. Input a Pair 2 and verify that no State Vector Report is output by the receipt of the "***odd***" Position Message. Repeat input of Pair 1 and verify that no State Vector Report is output by the receipt of the "even" Position Message and that a State Vector Report consistent with the Globally Unambiguous CPR position of Pair 1 is generated by the receipt of the "***odd***" Position Message. Repeat input of Pair 1 and verify that each Position Message received results in a State Vector Report with position consistent with the Globally Unambiguous CPR position of Pair 1.

Step 8: Verify Surface Position Validated – Case 2

Input a Pair 1 and verify that a State Vector Report consistent with the Globally Unambiguous CPR position of Pair 1 is generated by the receipt of the "***odd***" Position Message of Pair 1. Input a Pair 2 and verify that no State Vector Report is output by the receipt of the "***odd***" Position Message. Repeat input of Pair 2 and verify that no State Vector Report is output by the receipt of the "even" Position Message and that a State Vector Report consistent with the Globally Unambiguous CPR position of Pair 2 is generated by the receipt of the "***odd***" Position Message. Repeat input of Pair 2 and verify that each Position Message received results in a State Vector Report with position consistent with the Globally Unambiguous CPR position of Pair 2.

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

Purpose/Introduction:

These test procedures verify that the proper validation is being performed to verify the Locally Unambiguous CPR decode established per §2.2.10.4.1.2~~2.2.10.4.1.2~~, subparagraph

"a.(1)" for Airborne Participants, or §2.2.10.4.2.2~~2.2.10.4.2.2~~, subparagraph "a.(1)" for Surface Participants, using the steps specified in §2.2.10.6.3~~2.2.10.6.3~~.

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 matches the 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 matches the 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. Verify that, instead, these two position messages are used to

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initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

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 matches the corresponding values in the table above. Verify that these two position messages are **not** used to initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

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 matches the corresponding values in the Step 2 table. Verify that these two position messages are **not** used to initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

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

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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. Verify that the Time=0 position message is **not** used to initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

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. Verify that the T=18 position message is used to initiate a candidate duplicate track in accordance with §2.2.10.7~~2.2.10.7~~.

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. Verify that the Time=40 position message is **not** used to initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

Step 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 matches the 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 matches the corresponding values in the above table.

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Step 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. Verify that these position messages are used to initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

Step 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 matches the corresponding values in the table above. Verify that these position messages are **not** used to initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

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Step 9: Verification of Reasonableness Test with Timing Test

Rerun the test procedure in Step 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 matches the corresponding values in the Step 7 table. Verify that these position messages are **not** used to initiate or to update a candidate duplicate track or to update a duplicate address track in accordance with §2.2.10.7~~2.2.10.7~~.

2.4.10.7 Verification of Duplicate Address Processing

No specific test procedure is required to validate §2.2.10.7

2.4.10.7.1 Verification of Candidate Duplicte Address Report

Measurement Procedure:

Step 1: Initialization

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 matches the 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 matches the corresponding values in the above table.

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Step 2: Verification of Candidate Duplicate Address Track Initiation

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. Verify that, instead, these two position messages are used to initiate a candidate duplicate track.

Step 3: Verification of Priority Association of Subsequent Address Receptions

Input additional ADS-B position messages being sure to include messages that will pass the validation test of §2.2.10.6.3b and other that will fail. Verify that those messages that passed the validation test of §2.2.10.6.3b were used to update the Primary ADS-B Report and that those that failed were associated with the Candidate Duplicate Address Report.

2.4.10.7.2 Verification of Duplicate Address Condition

Measurement Procedure:

Step 1: Initialization

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 matches the corresponding values in the above table.

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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 matches the corresponding values in the above table.

Step 2: Verification of Duplicate Address Flag

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. Verify that, instead, these two position messages are used to initiate a candidate duplicate track. Verify that the Duplicate Address Flag in any subsequent State Vector Report is set to "ON."

Step 3: Verification of Duplicate Address Association with Reports

Input additional ADS-B position messages and verify that each additional message was associated with each report in the duplicate address condition and that each report in the duplicate address condition was updated upon reception of each Extended Squitter Message containing the duplicate 24-bit address.

Step 4: Verification of Version ZERO (0) format Processing

Input additional ADS-B Position, Velocity, Aircraft Identification and Category and Emergency / Priority Status (Subtype=1) Messages with the 24-bit addresses identifying them as duplicate addresses. Verify that all such messages were processed as Version ZERO (0) format Messages.

Step 5: Verification of Duplicate Adress Timeout

Rerun the test procedure in Step 2 above using the same Latitude and Longitude values, allow 60 seconds to pass without a position message update. Verify that the relevant ADS-B Report for the Participant was deleted from the output storage

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buffer. Verify that Duplicate Address Flag in any subsequent State Vector Report is set to "OFF."

2.4.11 Verification of Self Test and Monitors (§2.2.11)

No specific test procedure is required to validate §2.2.11.

2.4.11.1 Verification of Self Test (§2.2.11.1)

Purpose/Introduction:

These test procedures verify that self test transmissions from ADS-B Transmitting Subsystem comply with the requirements of §2.2.11.1.

Equipment Required:

Provide a method of loading valid data for ADS-B broadcast messages into the ADS-B equipment under test. Provide a Wide Band Dual Channel Oscilloscope (HP 1710, or equivalent). Provide a method of detecting and monitoring ADS-B broadcast messages.

Measurement Procedure:

Load valid data into the ADS-B Airborne Position format and ensure that the expected ADS-B transmissions occur. Monitor all ADS-B broadcast messages for the occurrence of a "TYPE" Code = "23."

Measure the single pulse in the "TYPE" Code = "23" message that has the highest RF power and verify that the power does not exceed -40 dBm. Verify that the average rate of the "TYPE" Code = "23" messages does not exceed one in a 10 second interval.

2.4.11.2 Verification of Broadcast Monitoring (§2.2.11.2)

No specific test procedure is required to validate §2.2.11.2.

2.4.11.2.1 Verification of Transponder-Based Equipment Broadcast Monitoring (§2.2.11.2.1)

Purpose/Introduction:

These test procedures verify that the ADS-B Transmitting Subsystem properly enunciates the "Fail/Warn" state if DF=17 transmissions do not occur at the rates specified in §2.2.3.3 through §2.2.3.3.2.10.

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