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ADS-B 1090ES MOPS Maintenance

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Proposed DO-260B Test Procedure Changes Required Because of Requirement Changes

Revision 1

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Introduction:

This working paper was written to update the test procedures to reflect the intended changes leading to DO-260B.

Proposals: Replace the existing DO-260A test procedures with the following:

2.4.17.2.2 Verification of the "CF" Control Field (§2.2.17.2.2)

Purpose/Introduction:

These test procedures verify the use of the "CF" field of DF=18 messages being used by Non-Transponder-Based installations as specified in §2.2.17.2.2.

Measurement Procedure:

Step 1: Verification of DF=18, CF=2

Set up to transmit TIS-B Messages. Input a simulated ADS-B DF=18, CF=2 Message. Verify that a TIS-B Report is generated.

Step 2: Verification of DF=18, CF=3

Set up to transmit TIS-B Messages. Input a simulated ADS-B DF=18, CF=3 Message. Verify that a TIS-B Report is generated.

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 Management Report is generated.

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

Set up to transmit TIS-B Messages. Input a simulated ADS-B DF=18, CF=5 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.

2.4.17.3.1.1 Verification of the Relationship to ADS-B Format (§2.2.17.3.1.1)

Purpose/Introduction:

This test procedure verifies that the following fields are decoded as specified for the ADS-B Airborne Position Message defined in §2.2.3.2.3:

TYPE Code	Surveillance Status
Altitude	CPR Format
Encoded Latitude	Encoded Longitude

Measurement Procedure:

Set up to simulate TIS-B Transmitted Messages by inputting TIS-B Message information directly to the Receiving Subsystem. Input a simulated TIS-B Fine Airborne Position Message.

Verify that the input TYPE, Surveillance Status, Altitude, CPR Format, Encoded Latitude and Encoded Longitude fields are all reflected in the output TIS-B Report. Repeat this procedure for TYPE Codes 9 through 18 and 20, 21 and 22, which are the TYPE Codes of the Airborne Position Message.

2.4.17.3.4.1 Verification of the Relationship to ADS-B Format (§2.2.17.3.4.1)

Purpose/Introduction:

These test procedures verify that the following fields are coded as specified for the ADS-B Velocity Message with Subtype=1, as specified in §2.2.3.2.6.1, or with Subtype=2, as specified in §2.2.3.2.6.2:

TYPE Code	Subtype Code
E/W Direction Bit	E/W Velocity
N/S Direction Bit	N/S Velocity
Vertical Rate Sign	Vertical Rate
Height Difference Sign Bit	Geometric Height Difference from Baro
Vertical Rate Type	

Measurement Procedure:

Set up to simulate TIS-B Transmitted Messages by inputting TIS-B Message information directly to the Receiving Subsystem. Input a simulated TIS-B Velocity Message, TYPE=19, Subtype=1.

Verify that the input TYPE, Subtype, E/W Direction Bit, E/W Velocity, N/S Direction Bit, N/S Velocity, "Sign Bit for Vertical Rate", "Vertical Rate", Height Difference Sign Bit, Geometric Height Difference from Baro and Vertical Rate Type subfields are all reflected in the output TIS-B Report. Repeat this procedure for TIS-B Velocity Messages, TYPE=19 and Subtype=2.

Set up to simulate TIS-B Transmitted Messages by inputting TIS-B Message information directly to the Receiving Subsystem. Input a simulated TIS-B Velocity Message, TYPE=19, Subtype=1, GEO=1. Verify that the input Vertical Rate Type, Height Difference Sign Bit and Geometric Height Difference from Baro are all reflected in the output TIS-B Report. Repeat this procedure for TIS-B Velocity Messages, TYPE=19 and Subtype=2, GEO=1.

2.4.17.3.4.3 Verification of Navigational Integrity Category (NIC) Supplement (§2.2.17.3.4.3)

The table references in this procedure should now point to an appendix N table.

2.4.17.3.4.4 Verification of the Navigation Accuracy Category for Position (NAC_P) (§2.2.17.3.4.4)

The table references in this procedure should now point to an appendix N table.

2.4.17.3.4.6 Verification of the Surveillance Integrity Level (SIL) (§2.2.17.3.4.6)

The table references in this procedure should now point to an appendix N table.

2.4.17.4.6 Verification of TIS-B Report Generation (§2.2.17.4.6)

Purpose/Introduction:

This test procedure verifies the requirements of TIS-B Report Generation as specified in §2.2.17.4.6.

Measurement Procedure:

Step 1: Verification of Non-Position Report Elements and Timing

Set up to simulate TIS-B Transmitted Messages by inputting TIS-B Message information directly to the Receiving Subsystem. Input a simulated TIS-B message.

Verify that within 0.5 seconds of the receipt of this message that all of the non-position elements are reported directly as received. Repeat this step for each of the TIS-B message types.

Step 2: Verification of Position Report Elements and Timing

Set up to simulate TIS-B Transmitted Messages by inputting TIS-B Message information directly to the Receiving Subsystem. Input simulated TIS-B messages being sure to include a TIS-B Management Message.

Verify that within 0.5 seconds of the receipt of this message that all of the position elements (latitude, longitude, altitude, address and TOA) are reported directly as well as all of the other information received, 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 and ME fields of the Extended Squitter Message) of any received TIS-B Management Message (Table 2-106, for CF=4). Repeat this step for each of the TIS-B message types.

2.4.18.4.1 Verification of the Rebroadcast of ADS-B Airborne Position Messages (§2.2.18.4.1)

Purpose/Introduction:

These test procedures verify that the ME Field of the Rebroadcast Airborne Position Message is 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~~test equipment to transmit Airborne Position Messages by providing position information at the nominal rate. Be sure to initially broadcast a Type 31 Operational Status Message to

allow the receiving subsystem to determine the proper format. Ensure that the ADS-B ~~Transmitting Subsystem correctly receives~~test equipment provides 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 Messages with DF=18 and CF=4 and also 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~~test equipment. 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 4 or 6 as appropriate
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~~test equipment. 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 4 or 6 as appropriate
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 the Rebroadcast of ADS-B Surface Position Messages (§2.2.18.4.2)

Purpose/Introduction:

These test procedures verify that the ME Field of the Rebroadcast Surface Position Message is 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 test equipment~~Transmitting Subsystem~~ to transmit Surface Position Messages by providing position information at the nominal rate. Ensure that the ADS-B test equipment provides~~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 Messages with DF=18 and CF=4 and also 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 test equipment~~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 4 or 6 as appropriate
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 test equipment~~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 4 or 6 as appropriate
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.

2.4.18.4.4 Verification of the Rebroadcast of ADS-B Airborne Velocity Messages (§2.2.18.4.4)

Purpose/Introduction:

These test procedures verify that the ME Field of the Rebroadcast Airborne Velocity Messages is 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~~test equipment to transmit Version One (1) and Two (2) Airborne Velocity Messages by providing velocity information at the nominal update rate. Provide the data externally at the interface to the ADS-B test equipment~~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 test equipment input~~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 test equipment~~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 being sure to match the data format to the correct version number.

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 being sure to match the data format to the correct version number.

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 test equipment~~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 being sure to match the data format to the correct version number.

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 being sure to match the data format to the correct version number.

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 test equipment~~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, again being sure to match the data format to the correct version number.

2.2.18.5 *I think this Section should probably hold a pointer to the previous test sections*