

RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS (DO-282), Revision A

Meeting #19

Teleconference on 1.12.04

**Proposal for Changing the Test Procedures for
Air/Ground Determination and Validation**

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SUMMARY

This Working Paper contains a proposal for the changes needed for the test procedures for the testing of the revised Air/Ground Determination and Validation requirements of §2.2.4.5.2.5.1 and §2.2.4.5.2.5.2, as they have been agreed to be changed by WG-5 in accordance with the agreed upon text in the ASA MASPS (RTCA DO-289), which is detailed in Working Paper UAT-WP-17-03.

The revisions in the test procedures occur **only** in the “Purpose/Introduction” of each paragraph, and in the Tables within each respective paragraph that reflect the required outcome of the tests. There is no proposed change to any of the text of the individual steps of the test procedures, outside of the changes proposed to Table 2-82 and Table 2-83. The two Tables shown in this Working Paper should be considered complete replacements for the existing tables in DO-282.

velocity input shall be greater than 0 knots but less than 1000 knots, as in Step 1. Raise the East/West velocity to a value of 1023 knots.

Verify that ADS-B Messages are generated with Subsonic/Supersonic Flag (bit 2 of byte 13) set to ONE (1), indicating the “Supersonic” scale.

Decrease the East/West velocity input to a value of 999 knots. Verify that ADS-B Messages are generated with “Subsonic/Supersonic” bit (bit 2 of byte 13) set to ZERO (0). Raise the North/South velocity to a value of 1023 knots.

Verify that ADS-B Messages are generated with the “Subsonic/Supersonic” bit (bit 2 of byte 13) set to ONE (1).

Decrease the North/South velocity input to a value of 999 knots.

Verify that ADS-B Messages are generated with the “Subsonic/Supersonic” bit (bit 2 of byte 13) set to ZERO (0).

Raise both North/South and East/West input values to 1023 knots, and verify that ADS-B Messages are generated with “Subsonic/Supersonic” bit (bit 2 of byte 13) set to ONE (1).

Decrease both North/South and East/West input values to 999 knots, and verify that ADS-B Messages are generated with “Subsonic/Supersonic” bit (bit 2 of byte 13) set to ZERO (0).

2.4.4.5.2.5.1 Verification of Determination of Vertical Status (§2.2.4.5.2.5.1)

Purpose/Introduction:

The UAT ADS-B Transmitting Subsystem **shall** determine its Vertical Status (i.e., AIRBORNE or ON-GROUND condition) using the procedures described in §2.2.4.5.2.5.1.

Measurement Procedure:

Step 1 Verify Vertical Status (with automatic means)

Provide input to the UUT to the Automatic AIRBORNE/ON-GROUND Indication data input to indicate ON-GROUND condition. Set up the UUT to broadcast ADS-B Messages by providing data from the navigation source. Provide no radio altitude data, or speed data to the UUT. Verify that the ADS-B Messages broadcasted properly contain Vertical Status (bit 1 of byte 13) equal to ONE.

Provide input to the UUT to the Automatic AIRBORNE/ON-GROUND Indication data input to indicate AIRBORNE condition. Set up the UUT to broadcast ADS-B Messages by providing data from the navigation source. Provide no radio altitude data, or speed data to the UUT. Provide both East/West Velocity input and the North/South Velocity input data less than 1000 knots. Verify that the ADS-B Messages broadcasted properly contain Vertical Status (bit 1 of byte 13) equal to ZERO.

Step 2 Verify Vertical Status (without automatic means)

Set up the ADS-B Transmitting Subsystem to broadcast messages by providing data from the navigation source. Provide Emitter Category, radio altitude data, and ground speed to the UUT according to the values defined in [Table 2-82](#) or in the case of no data, do not provide the data as indicated. In the cases of “no data,” discontinue the input for the “data lifetime” value in [Table 2-98](#) to verify that the input is no longer used to determine the “ON-GROUND” condition. Conversely, prior to the timeout, verify that the value is used to determine the “ON-GROUND” condition. Ensure that NO input is applied to the Automatic AIRBORNE/ON GROUND indication data input. Verify that the UUT broadcasts ADS-B Messages that contain the proper Vertical Status (bit 1 of byte 13) as indicated for each row of [Table 2-82](#).

Table 2-82: Vertical Status Determination when no Automatic AIRBORNE/ON-GROUND Indication is Available

Vertical Status Determination				
Emitter Category / Coding ¹	Ground Speed (knots)	Speed (knots)	Radio Altitude (feet)	Resulting Vertical Status Bit (Bit 1 of byte 13)
2 – 6, 15	100	100	50	AIRBORNE
2 – 6, 15	100	50	25	AIRBORNE
2 – 6, 15	50	100	25	AIRBORNE
2 – 6, 15	50	50	50	AIRBORNE
2 – 6, 15	99	99	49	ON-GROUND
2 – 6, 15	50	25	No Data	AIRBORNE
2 – 6, 15	25	50	No Data	AIRBORNE
2 – 6, 15	49	49	No Data	ON-GROUND
2 – 6, 15	No Data	25	No Data	AIRBORNE
2 – 6, 15	25	No Data	No Data	AIRBORNE
2 – 6, 15	100	No Data	25	AIRBORNE
2 – 6, 15	No Data	100	25	AIRBORNE
2 – 6, 15	99	No Data	49	ON-GROUND
2 – 6, 15	No Data	99	49	ON-GROUND
2 – 6, 15	25	No Data	50	AIRBORNE
2 – 6, 15	No Data	25	50	AIRBORNE
2 – 6, 15	No Data	No Data	25	AIRBORNE
2 – 6, 15	No Data	No Data	No Data	AIRBORNE

Note: The Air/Ground State bit for other Emitter Categories shall be in accordance with [Table 2-17](#).

2.4.4.5.2.5.2 Verification of Validation of Vertical Status (§2.2.4.5.2.5.2)

Purpose/Introduction:

When an automatic means of determining Vertical Status indicates the “ON-GROUND,” condition, then the following additional tests **shall** be performed to validate the “ON-GROUND” condition:

If one or more of the following parameters is available to the UAT ADS-B Transmitting Subsystem participant:

Ground Speed (GS), or
Airspeed (AS), or
Radio Height (RH) from radio altimeter

And of the following parameters that are available:

GS > 100 knots, or
AS > 100 knots, or
RH > 50 feet

Then, the participant **shall** set its Vertical Status to the “AIRBORNE” condition.

Otherwise, the participant **shall** set its Vertical Status to the “ON-GROUND” condition.

If any of the inputs used to derive the override of the “ON-GROUND” condition as specified above are “unavailable” for the “Data Lifetime” timeout duration listed in [Table 2-98](#), then the input **shall** no longer be used for the purposes of overriding the “ON-GROUND” condition.

Note: *The Vertical Status can be used by ADS-B Transmitting Subsystems to select only the TOP antenna when in the ON-GROUND condition. A false indication of the automatic means could therefore impact signal availability. To minimize this possibility, this validation procedure has been established.*

Measurement Procedure:

Step 1 ON-GROUND Override Verification - input data variation

For ADS-B Transmitting Subsystems with automatic means of determining on the ground status, provide input external to the UUT to indicate ON-GROUND condition. Set up the UUT to broadcast ADS-B Messages by providing data from the navigation source. Provide Emitter Category, radio altitude data, and ground speed to the UUT according to the values defined in [Table 2-83](#) or in the case of no data, do not provide the data or discontinue providing the data as indicated. In the cases of “no data,” discontinue the input for the “data lifetime” timeout value in [Table 2-98](#) to verify that the input is no longer used to determine the “ON-GROUND” override condition. Conversely, prior to the timeout, verify that the value is used to determine the “ON-GROUND” override condition. Verify that the UUT transmits ADS-B Messages with the Vertical Status bit as indicated in [Table 2-83](#) for each run.

Table 2-83: ON-GROUND Override Verification

ON-GROUND Override				
Emitter Category / Coding ¹	Ground Speed (knots)	Speed (knots)	Radio Altitude (feet)	Resulting Vertical Status Indication (Bit 1 of byte 13)
2 – 6, 15	100	100	50	ON-GROUND
2 – 6, 15	100	100	51	AIRBORNE
2 – 6, 15	100	101	50	AIRBORNE
2 – 6, 15	101	100	50	AIRBORNE
2 – 6, 15	No Data	100	50	ON-GROUND
2 – 6, 15	No Data	100	51	AIRBORNE
2 – 6, 15	No Data	101	50	AIRBORNE
2 – 6, 15	No Data	No Data	50	ON-GROUND
2 – 6, 15	No Data	No Data	51	AIRBORNE
2 – 6, 15	100	No Data	50	ON-GROUND
2 – 6, 15	101	No Data	50	AIRBORNE
2 – 6, 15	100	No Data	51	AIRBORNE
2 – 6, 15	100	No Data	No Data	ON-GROUND
2 – 6, 15	101	No Data	No Data	AIRBORNE
2 – 6, 15	No Data	100	No Data	ON-GROUND
2 – 6, 15	No Data	101	No Data	AIRBORNE
2 – 6, 15	100	101	No Data	AIRBORNE
2 – 6, 15	101	100	No Data	AIRBORNE
2 – 6, 15	100	100	No Data	ON-GROUND
2 – 6, 15	No Data	No Data	No Data	ON-GROUND

Note: The Air/Ground State bit for other Emitter Categories shall be in accordance with [Table 2-17](#).

Step 2 ON-GROUND Override Verification – Velocity Input Data Variation

For ADS-B Transmitting Subsystems with automatic means of determining on the ground status, provide input external to the UUT to indicate ON-GROUND condition. Set up the UUT to broadcast ADS-B Messages by providing data from the navigation source. Provide position data and North/South Velocity and East/West Velocity initially to 1000 knots. Provide Heading input value of 45 Degrees. Provide Emitter Category and radio altitude data to the UUT according to the values defined in [Table 2-83](#) or in the case of no data, do not provide the data or discontinue providing the data as indicated. Verify that the UUT transmits ADS-B Messages with the Vertical Status State bit as indicated in [Table 2-83](#) for each run. For each run that results in Airborne state, verify that the “A/G STATE” Field equals ZERO (binary 00) and that the correct Horizontal Velocity subfield value (North/South Velocity and East/West Velocity) is contained in the ADS-B Transmitted Message. For each run that results in ON-GROUND state, verify that the “A/G STATE” Field equals TWO (binary 10) and that the correct Horizontal Velocity subfield value (Ground Speed and Heading) is contained in the ADS-B Transmitted Message.

Repeat above except provide North/South Velocity and East/West Velocity data equal to 1200 knots. For each run that results in Airborne state, verify that the "A/G STATE" Field equals ONE (binary 01).

2.4.4.5.2.6 Verification of "HORIZONTAL VELOCITY" Subfields (§2.2.4.5.2.6)