

RTCA SC-186 WG-3
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ADS-B Fail Indication

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Summary

The requirement for an ADS-B Fail indication needs to be clarified. This proposal separates an ADS-B Device Failure from an ADS-B Function Failure. This proposal defines exactly what functional criteria should be evaluated to assert the ADS-B Device and Function Fail signals.

[This is revision includes changes to address comments from the March telecon.](#)

1. Introduction

There is currently some confusion surrounding the ADS-B Fail indication in DO-260A, particularly with regard to the existing transponder fail indication. The requirement for an ADS-B Fail indication needs to be clarified. This proposal separates an ADS-B Device Failure from an ADS-B Function Failure. This proposal defines exactly what functional criteria should be evaluated to assert the ADS-B Device and Function Fail signals.

If accepted these requirements changes will drive changes in the corresponding test paragraphs. Honeywell will provide those text changes to the committee as needed.

2. Discussion

The following text is the existing text with the recommended changes included. You can use the MS Word View Markup feature to see the change bars and added/deleted text. The gist of the changes is to separate an ADS-B Device Failure from an ADS-B Transmit Function Failure and define the conditions for asserting those signals.

DO-181D Existing Text with Suggested Changes Shown (use MS Word View Markup)

2.2.10.2 Squitter Monitor

A squitter monitor **shall** be provided to verify that the Mode S transponder generates short and Extended Squitters correctly (e.g. low power, corrupt data) and at their nominal rates (see 2.2.18.2.6 and 2.2.23.1). Event Driven Squitter rates are not required to be monitored to meet this requirement. The transponder **shall** be considered failed when the monitor has detected squitter failure.

DO-260A Existing Text with Suggested Changes Shown (use MS Word View Markup)

2.2.11 Self Test and Monitors

2.2.11.1 Self Test

If a self-test feature or monitor is provided as part of the equipment:

- a. The device which radiates test ADS-B Messages or prevents messages from being broadcast during the test period **shall** be limited to no longer than that required to determine the status of the system.
- b. The self-test message signal level at the antenna end of the transmission line **shall** not exceed -40 dBm.
- c. If provision is made for automatic periodic self-test procedure, such self-testing **shall** not radiate ADS-B Messages at an average rate exceeding one broadcast every ten seconds.

2.2.11.2 Broadcast Monitoring

2.2.11.2.1 Transponder Based Equipment

If the ADS-B Transmitting Subsystem is implemented ~~as a non-broadcast only equipment installation as part of a Mode S Transponder,~~ the squitter monitor required by DO-181D 2.2.10.2 is sufficient to ensure proper operation of the transmit chain. If the squitter monitor indicates a failure, the device failure indication shall be asserted. ~~a squitter monitor shall be provided to verify that DF=17 transmissions are generated at the rates specified in §2.2.3.3 through §2.2.3.3.2.10. If any of the DF=17 message types for which the equipment is certified is not transmitted at the specified rates, then the equipment shall be considered as failed and the appropriate “Fail/Warn” indicators shall be set to the “Fail/Warn” state.~~

2.2.11.2.2 Non-Transponder Based Equipment

If the ADS-B Transmitting Subsystem is a broadcast only device, then a monitor **shall** be provided to verify that DF=18 transmissions are generated at the applicable rates specified in §2.2.3.3 through §2.2.3.3.2.10. 3. Event Driven Squitter rates are not required to be monitored to meet this requirement. If the DF=18 transmissions cannot be transmitted properly ~~If any of the DF=18 message types for which the device is certified is not transmitted at the specified rates, the device failure indication shall be asserted (see §2.2.2.11.5.1).~~ then the broadcast only device shall be considered as failed and the appropriate “Fail/Warn” indicators shall be set to the Fail/Warn” state.

2.2.11.3 Address Verification

2.2.11.3.1 Transponder-Based Equipment

Transponder implemented ADS-B Transmitting Subsystems **shall** declare a device failure in the event that it's own ICAO 24-bit Address (i.e., the Mode-S Address) is set to all "ZEROS" or all "ONES."

2.2.11.3.2 Non-Transponder-Based Equipment

Non-transponder implemented ADS-B Transmitting Subsystems **shall** declare a device failure in the event that it's own ICAO 24-bit Address is set to all "ZEROS" or all "ONES."

2.2.11.4 Receiver Self Test Capability

ADS-B Receiving Devices **shall** be designed to provide sufficient self-test capability to detect a loss of capability to receive ADS-B Messages, structure appropriate ADS-B reports, and make such reports available to the intended user interface. Should the receiving device detect that these basic functions cannot be performed properly, ~~then the receiving device unit shall declare a device failure. Loss of data on external interfaces should not cause the Receiver Device Failure to be asserted. be considered as failed and the appropriate "Fail/Warn" indicators shall be set to the "Fail/Warn" state.~~

2.2.11.5 Device Failure Annunciation

2.2.11.5.1 ADS-B Transmission Device Failure Annunciation

An output **shall** be provided to indicate the validity/non-validity of the ADS-B Transmitting Subsystem ~~hardware~~. Failure to ~~correctly transmit~~~~generate~~ ADS-B Messages ~~at a nominal rate, a failure~~ detected by self-test, ~~or the broadcast~~ monitoring function, or ~~failure of the address verification~~ **shall** cause the output to ~~assume the invalid~~~~assert the FAIL~~ state. Momentary power interrupts **shall** not cause the output to ~~assume the invalid~~~~assert the FAIL~~ state. ~~Loss of data on external interfaces should not cause the Transmit Device Failure to be asserted.~~ The status of the ADS-B Transmitting Subsystem **shall** be enunciated to the flight crew where applicable. When the ADS-B Transmit Subsystem is integrated with a Mode S Transponder, the Transponder Fail signal may be used to indicate ADS-B Transmission Device Failure (refer to DO-181D 2.2.10.4).

2.2.11.5.2 ADS-B Receiving Device Failure Annunciation

An output shall be provided to indicate the validity/non-validity of the ADS-B receiving device. Failure to accept ADS-B Messages, structure appropriate ADS-B reports, make such reports available to the intended user interface, or failure detected by self-test or monitoring functions shall cause the output to assume the invalid state. Loss of data on external interfaces should not cause the Receiver Device Failure to be asserted. Momentary power interrupts shall not cause the output to assume the invalid state. The status of the ADS-B receiving device shall be enunciated to the flight crew where applicable.

2.2.11.5.3 Co-Located ADS-B Transmission and Receiving Device Failure Annunciation

In installations where the ADS-B transmission and receiving functions are implemented in a common unit, it shall be permissible to use a single Fail/Warn output that is used in common to satisfy the requirements of §2.2.11.5.1 and §2.2.11.5.2. Otherwise, the Fail/Warn mechanisms for the ADS-B transmission function and the ADS-B Receiving Subsystem shall be independent.

2.2.11.6 ADS-B Function Fail Annunciation

The ADS-B transmit and receive subsystems depend on a position source to provide the data to populate the ADS-B messages and reports. These sources or interconnects between them and the ADS-B device may fail and prevent the system from transmitting ADS-B messages or reports. In this case, the ADS-B transmit/receive subsystem cannot function, but there is not a failure of the ADS-B device itself. It is desirable to indicate that the ADS-B function is failed independently of the ADS-B device Failure Annunciation.

If the latitude, longitude, position accuracy, or position integrity are invalid, the ADS-B Function Fail Annunciation **shall** be asserted. When the position integrity is marked as unavailable (also known as No Computed Data) that is not considered Invalid for the purposes of this requirement. This can happen when there are insufficient satellites to perform Receiver Autonomous Integrity Monitoring (RAIM). When the position integrity is marked as a Non-Isolated Satellite Failure (NISF), that will be considered Invalid for the purposes of this requirement. The status of the ADS-B Function **shall** be indicated to the flight crew.

3. Recommendations

WG3 is requested to consider the changes in section 2 relevant for inclusion in DO-260A.