

**RTCA Special Committee 186,
Working Group 3
and EUROCAE WG-51, Subgroup 1**

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Correction of CA=0 values

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SUMMARY
This WP proposes to correct the DF17 messages containing CA=0 as Extended Squitter transponders are defined as Level 2 or above transponders which cannot use CA=0.

1 Introduction

In September 2010 EADS presented comments on the Mode S transponder MOPS (ED-73/DO-181) about a difference on CA=0 between the transponder MOPS and the 1090 MOPS (see [SC209-WP11-10R1](#)). This issue is listed as point (1.33) of [1090-WP34-03](#).

It was recognized that CA=0 should not be authorized for an Extended Squitter capable transponder, as such transponders are at a minimum defined as a Level 2 transponder.

At that time it was noted that the test procedure in DO-260B/ED-102A §2.4.3.2.1.2.1 rightly does not verify CA=0, however CA=0 is kept in the description of the CA field and is used in a number of other test procedures in DO-260B/ED-102A.

This Working Paper proposes to correct the DF17 messages containing CA=0, as Extended Squitter transponders are defined as Level 2 or above transponders, which cannot use CA=0.

2 Review of CA=0 in DO-260B/ED-10A and proposed modifications

2.1 CA= 0 in the requirement section

2.2.3.2.1.2 “CA” Capability Field (used in DF=17)

a. Definition:

... the codes used in the ‘CA’ field are as specified in Table 2-8

This section provides the definition of the different values that CA can have. It covers also the definition of CA=0. This is not wrong, however a note indicating that the CA field values used for an ES transponder will be 4 or greater would help avoid misinterpretation.

2.2.3.2.1.2 b. Transponder Use -- The “CA” code definitions provided herein are intended for use when implemented with the Mode-S Transponder functions.

Note: Since a transponder supporting Extended Squitter is required to be at a minimum of Level 2 or greater, the CA field can only have values equal to 4, 5, 6, or 7.

2.2 In ADS-B Receiver Characteristics tests

Replace in ES messages format (only true when DF=17)

“DF”	= 17
“CA”	= 0

with

“DF”	= 17
“CA”	= 4, 5, 6 or 7

in the following sections:

2.3.2.3.1 TCAS Compatibility (§2.2.4.2.1.1)

Purpose/Introduction:

This test verifies that no more than 10% of ADS-B Messages received at a level of 78 dBm or below **shall** be passed to the TCAS surveillance function.

2.3.2.3.2 Re-Triggerable Reply Processor (§2.2.4.2.2)

Purpose/Introduction:

The following procedures verify the capability of the TCAS shared ADS-B receiver to detect overlapping Mode-S replies or ADS-B Messages in the TCAS level range.

ADS-B Message Format (Intruder 1):

2.3.2.4.1 In-Band Acceptance (§2.2.4.3.1.1.a)

Purpose/Introduction:

This test verifies the compliance of the ADS-B receiver with the sensitivity requirements specified for the particular ADS-B equipage class.

2.3.2.4.2 Dynamic Range (§2.2.4.3.1.1.b)

Purpose/Introduction:

This test verifies that the ADS-B receiver can detect and decode valid ADS-B Messages over the equipment's specified dynamic range.

2.3.2.4.3 Re-Triggerable Capability (§2.2.4.3.1.2)

Purpose/Introduction:

The following procedures verify the capability of the Stand alone ADS-B receiver to detect overlapping ADS-B broadcast messages.

2.3.2.4.4 Out-of-Band Rejection (§2.2.4.3.2)

Purpose/Introduction:

This test verifies that the ADS-B out-of-band rejection is in accordance with the specified values.

2.3.2.4.5 Dynamic Minimum Trigger Level (DMTL) (§2.2.4.3.3)

Purpose/Introduction:

This test verifies that, when DMTL control is implemented (see §2.2.4.3.3), then the ADS-B receiver DMTL is capable of rejecting low level signals during a valid squitter reception and that DMTL is capable of recovering in not more than 128 microseconds after the leading edge of the first preamble pulse of a valid ADS-B Message.

2.3.2.4.6.1 Criteria for ADS-B Message Transmission Pulse Detection for Receivers not using Enhanced Reception Techniques

Purpose/Introduction:

These test procedures verify that the ADS-B reply processor correctly detects the presence of a valid ADS-B preamble whose pulse characteristics are within the allowable limits and rejects preambles having pulse spacing and position characteristics that are outside the allowable limits.

2.3.2.4.6.2 Criteria for ADS-B Message Transmission Pulse Detection for Receivers using Enhanced Reception Techniques

Purpose/Introduction:

These tests verify that the ADS-B reply processor correctly detects the presence of a valid ADS-B preamble whose pulse characteristics are within the allowable limits and rejects preambles having pulse spacing and position characteristics that are outside the allowable limits.

2.3.2.4.7 Criteria for Data Block Acceptance in ADS-B Message Signals (§2.2.4.3.4.7.3)

Purpose/Introduction:

This test procedure verifies that ADS-B Messages are accepted when DF field is 17 or 18 and when no more than seven consecutive bits fail the confidence test, as specified by §2.2.4.3.4.7.3.

2.3 In equipment test procedures

Set 1 is not a possible set in 2.4.3.2.1.7 as it contains DF=17 and CA=0. It is therefore proposed to remove set 1 as indicated below.

2.4.3.2.1.7 Verification of “PI” Parity / Identity (§2.2.3.2.1.7, §2.2.5.1.1)

Purpose/Introduction:

The following test will verify that the ADS-B Transmitting Subsystem correctly outputs the Address (AA) field of ADS-B Messages, calculates the proper parity of ADS-B Messages and correctly outputs the PI field in the transmitted ADS-B Messages.

Measurement Procedure:

Configure the ADS-B Transmitting Subsystem to emit ADS-B Messages having TYPE Code equal to ZERO (0) and no Altitude data. Effectively, establish the messages with the “ME” field set to all ZEROs as indicated in Table 2-136. Refer to Table 2-136 and select the appropriate Set of stimulus to run for the type of equipment being tested as follows:

- ~~a.~~ For equipment that can transmit “DF” = 17 and “CA” = 0, use Set 1.
- ~~b.~~ For equipment that can transmit “DF” = 17 and “CA” = 4, use Set 2 **1.**
- ~~c.~~ For equipment that can transmit “DF” = 17 and “CA” = 5, use Set 3 **2.**
- ~~d.~~ For equipment that can transmit “DF” = 17 and “CA” = 6, use Set 4 **3.**
- ~~e.~~ For equipment that can transmit “DF” = 17 and “CA” = 7, use Set 5 **4.**
- ~~f.~~ For equipment that can transmit “DF” = 18 with “CA” = 0, use Set 6 **5.** Note that this is the case where the equipment is non-Transponder device.
- ~~g.~~ For equipment that can transmit “DF” = 19 with “CA” = 0, use Set 7 **6.** Note that this case is where the equipment is for Military Applications.
- ~~h.~~ **g.** Where an equipment is capable of transmitting several of the cases described in paragraphs “a.” through “~~g.~~” above, it should suffice that the equipment be testing to only one of the cases since the parity encoding should work the same for all. For the Set of stimulus given in Table 2-136 that is selected for the equipment under test,

Table 2-136: “PI” Field Encoding

Column #	1	2	3	4	5	6	
	Bit #	1 – 5	6 – 8	9 – 32	33 – 88	89 – 112	
SET #	CASE #	Field Name	“DF”	“CA” (“CF”)	“AA” [HEX]	“ME” [HEX]	“PI” [HEX]
#1	1		1 0001	000	AA AA AA	ALL ZEROs	46E012
	2		1 0001	000	55 55 55	ALL ZEROs	5B7924
	3		1 0001	000	77 77 77	ALL ZEROs	7DC67B
	4		1 0001	000	BB BB BB	ALL ZEROs	AA45B9
	5		1 0001	000	DD DD DD	ALL ZEROs	C18458
	6		1 0001	000	EE EE EE	ALL ZEROs	B9EAC
	7		1 0001	000	FE DC BA	ALL ZEROs	7790F4
	8		1 0001	000	AB CD EF	ALL ZEROs	7EE5D2
#2	1		1 0001	100	AA AA AA	ALL ZEROs	D8D1FB
	2		1 0001	100	55 55 55	ALL ZEROs	C548CD
	3		1 0001	100	77 77 77	ALL ZEROs	E3F792
	4		1 0001	100	BB BB BB	ALL ZEROs	347450
	5		1 0001	100	DD DD DD	ALL ZEROs	5FB5B1
	6		1 0001	100	EE EE EE	ALL ZEROs	95AF45
	7		1 0001	100	FE DC BA	ALL ZEROs	E9A11D
	8		1 0001	100	AB CD EF	ALL ZEROs	E0D43B
	1		1 0001	101	AA AA AA	ALL ZEROs	80A083

2.4.3.2.1.2 Verification of “CA” Capability Field (used in DF=17) (§2.2.3.2.1.2, §2.2.5.1.3)
 CA field verification procedure 2.4.3.2.1.2 has been verified. The procedure correctly tests CA=4, 5, 6. No modification is required.

Replace in ES messages format (only true when DF=17)

“DF” = 17

“CA” = 0

with

“DF” = 17

“CA” = **4, 5, 6 or 7**

in the following sections:

2.4.3.4 Verification of ADS-B Transmitted Message Error Protection (§2.2.3.4)

ADS-B Transmitted Error Protection performance was previously tested in §2.4.3.2.1.7.

2.4.4.2.1.1 Verification of TCAS Compatibility (§2.2.4.2.1.1)

2.4.4.2.2 Verification of Re-Triggerable Reply Processor (§2.2.4.2.2)

2.4.4.3.1.1.1 Verification of In-Band Acceptance (§2.2.4.3.1.1.a)

2.4.4.3.1.1.2 Verification of Dynamic Range (§2.2.4.3.1.1.b, §2.2.4.3.1.1.c)

2.4.4.3.1.2 Verification of Re-Triggerable Capability (§2.2.4.3.1.2)

2.4.4.3.2 Verification of Out-of-Band Rejection (§2.2.4.3.2)

2.4.4.3.3 Verification of Dynamic Minimum Trigger Level (DMTL) (§2.2.4.3.3)

2.4.4.3.4.2 Verification of Narrow Pulse Discrimination (§2.2.4.3.4.2)

2.4.4.3.4.7.1 Verification of Criteria for ADS-B Message Transmission Pulse Detection (§2.2.4.3.4.7.1 and §2.2.4.3.4.7.2)

2.4.4.3.4.7.3 Verification of Criteria for Data Block Acceptance in ADS-B Message Signals (§2.2.4.3.4.7.3)

2.4.4.4.2.2 Four-Pulse Preamble Detection Tests

2.4.4.4.2.3 Preamble Validation Tests

2.4.4.4.3.2 Verification of Error Correction Restrictions (§2.2.4.4.3.2)

3 Proposal

In summary, in order to avoid correcting all test procedures the corrigenda can contain

- the note proposed for inclusion in 2.2.3.2.1.2 b.
- the correction of 2.4.3.2.1.7 where set #1 is removed
- A text indicating that “CA”= 0 must be replaced by “CA” = 4, 5, 6 or 7 in all “DF”=17 messages used in the following sections: 2.3.2.3.1, 2.3.2.3.2, 2.3.2.4.1, 2.3.2.4.2, 2.3.2.4.3, 2.3.2.4.4, 2.3.2.4.5, 2.3.2.4.6.1, 2.3.2.4.6.2, 2.3.2.4.7, 2.4.3.4 , 2.4.4.2.1.1, 2.4.4.2.2, 2.4.4.3.1.1.1, 2.4.4.3.1.1.2, 2.4.4.3.1.2, 2.4.4.3.2, 2.4.4.3.3, 2.4.4.3.4.2, 2.4.4.3.4.7.1, 2.4.4.3.4.7.3, 2.4.4.4.2.2, 2.4.4.4.2.3, 2.4.4.4.3.2

4 Action

The Working Group is invited to consider the proposed CA=0 corrections for inclusion in DO-260B/ED-102A corrigenda.