

# European Aviation Safety Agency

## European Technical Standard Order

**Subject:** Secondary Surveillance Radar Mode S Transponder

### 1 — Applicability

This ETSO provides the requirements which Secondary Surveillance Radar Mode S Transponder that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

### 2 — Procedures

#### 2.1 — General

Applicable procedures are detailed in CS-ETSO, Subpart A.

#### 2.2 — Specific

None.

### 3 — Technical Conditions

#### 3.1 — Basic

##### 3.1.1 — Minimum Performance Standard

Standards set forth in the EUROCAE ED-73E, Minimum Operational Performance Standards for Secondary Surveillance Radar Mode S Transponders, dated May 2011 as amended by Appendix 1 to this ETSO.

**Note:** Level 2 transponders are expected to comply with the Overlay Command Capability as per ED-73E section 3.23.1.12 and 3.18.4.40.

##### 3.1.2 — Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

##### 3.1.3 — Computer Software

See CS-ETSO, Subpart A, paragraph 2.2.

##### 3.1.4 — Electronic Hardware Qualification

See CS-ETSO, Subpart A, paragraph 2.3.

#### 3.2 — Specific

None.

##### 3.2.1 — Failure Condition Classification

See CS-ETSO, Subpart A, paragraph 2.4.

Failure of the function defined in paragraph 3.1.1 of this ETSO resulting in misleading information is a major failure condition.

**ETSO-C112e**

Failure of the function defined in paragraph 3.1.1 of this ETSO resulting in loss of function is a minor failure condition.

#### 4 — Marking

##### 4.1 — General

Marking as detailed in CS-ETSO, Subpart A, paragraph 1.2.

##### 4.2 — Specific

The marking must also include the transponder's functional level and optional additional features as provided in ED-73E, Section 1.4.2.2, as well as minimum peak output power identified by the transponder class as defined in ED-73E, Section 1.4.2.4.

#### 5 — Availability of Referenced Document

See CS-ETSO, Subpart A, paragraph 3.

## APPENDIX 1

### SECONDARY SURVEILLANCE RADAR MODE S TRANSPONDER

#### AMENDMENT TO EUROCAE ED-73E REQUIREMENTS

This Appendix lists the EASA modification to MPS for Secondary Surveillance Radar Mode S Transponder.

The applicable standard is EUROCAE ED-73E Secondary Surveillance Radar Mode S Transponder, dated May 2011, amended as described below.

Text from EUROCAE ED-73E is provided here as needed to provide context. Text to be added is underlined. Text to be removed is ~~lined through~~.

1. *EUROCAE ED-73E, page 59, Section 3.23.1.12.d, is modified here to ensure multiple Comm-B message changes are processed properly.*

#### d. Comm-B Broadcast

**Note 1:** *A Comm-B broadcast is a message directed to all active interrogators in view. Messages are alternately numbered 1, 2, and are available for 18 seconds unless a waiting air-initiated Comm-B interrupts the cycle. Interrogators have no means to cancel the Comm-B broadcast.*

**Note 2:** *If there is more than one Comm-B message waiting for transmission, the timer is only started once the message becomes the current Comm-B broadcast.*

A Comm-B broadcast starts, when no air-initiated Comm-B transaction is in effect, with the loading of the broadcast message into the Comm-B buffer, insertion of DR codes 4, 5, 6 or 7 into downlink transmissions of DFs 4, 5, 20, 21 and with the starting of the B-timer for the current Comm-B message. On receipt of the above DR codes, interrogators may extract the broadcast message by transmitting RR=16 with DI≠3 or 7 or with DI=3 or 7 and RRS=0 in subsequent interrogations. The change of the DR value is used by the interrogator to detect that a new Comm-B broadcast is announced and to extract the new Comm-B message. A new Comm-B broadcast shall not interrupt a current Comm-B broadcast. When the B-timer runs out after 18 ± 1 seconds, the transponder will reset the DR codes as required, will discard the previous broadcast message, and changes the broadcast message number from 1 to 2 (or vice versa).

If an air-initiated Comm-B transaction is initiated during the broadcasting interval (i.e., while the B-timer is running), the B-timer is stopped and reset, the appropriate code is inserted into the DR field, and the Comm-B transaction proceeds per Figure 3-18. The previous Comm-B broadcast message remains ready to be reactivated for 18 ± 1 seconds after conclusion of the air-initiated Comm-B transaction.

Waiting Comm-B broadcasts shall be retained for transmission once the current Comm-B broadcast is finished. If the contents of a waiting Comm-B broadcast changes, only the most recent value shall be broadcast. This prevents multiple changes from generating a sequence of broadcasts. Currently only BDS registers 1,0, Downlink Capability Report and, 2,0, Flight ID, make use of the Comm-B Broadcast protocol.

2. *A test procedure is added here to ensure the modified requirements in Section 1 of this Appendix are met. This test is intended to be introduced in EUROCAE ED-73E, Section 5.5.8.23, on pages 253 and 254.*

### 5.5.8.23 **Procedures #21A and #21B Comm-B Broadcast**

(§3.23.1.12 d protocol)

#### 5.5.8.23.1 **Test Procedure #21A Comm-B Broadcast**

**Note 1:** *The command to the transponder that a Comm-B broadcast message shall be sent originates in a peripheral device or in the device that holds the extended capability report.*

**Note 2:** *The Comm-B broadcast does not affect the existing Comm-B protocol, air- or ground-initiated. The existing test procedures remain unchanged.*

**Note 3:** *Verification of interface patterns is already part of the Comm-B test procedures and need not be repeated for the Comm-B Broadcast.*

This test procedure verifies that the DR code command and the MB field of the Comm-B broadcast protocol is carried out correctly.

##### a. STEP 1 — General Broadcast Protocol Test

During the Comm-B protocol test procedure (Procedure #18) insert the appropriate DR Code command and the MB field of the Comm-B broadcast into the transponder.

Verify that:

- (1) The transponder can correctly show the DR codes 4, 5, 6, 7 when NO air initiated Comm B is in progress and that it cannot show DR codes 4, 5, 6, 7 when an air initiated Comm B is in progress.
- (2) The Comm-B broadcast message can be extracted by the interrogator for  $18 \pm 1$  seconds.
- (3) The Comm-B broadcast annunciation (DR = 4, 5, 6, or 7) and the Comm-B broadcast MB field are interrupted by an air-initiated Comm-B and reappear when that transaction is concluded. For transponders implementing the enhanced air-initiated Comm-B protocol, the transponder will be independently interrupted by up to 16 Comm-B messages that are assigned to each II code. After the Comm-B is concluded for each II code, the Comm-B broadcast is again available to that interrogator. Verify that the next waiting broadcast message is not announced to any interrogators until the current broadcast message has timed out.
- (4) After interruption another  $18 \pm 1$  seconds of broadcast time is available to the interrogator. For transponders implementing the enhanced air-initiated Comm-B protocol, the transponder will be independently interrupted by up to 16 Comm-B messages that are assigned to each II code. After interruption, another  $18 \pm 1$  seconds of broadcast time is available for each II code.
- (5) A subsequent and different Comm-B broadcast message is announced with the alternate DR code and that this DR code also follows the verifications above. For transponders implementing the enhanced air-initiated Comm-B protocol, the transponder will be independently interrupted by up to 16 Comm-B messages that are assigned to each II code. The subsequent Comm-B broadcast is announced only after each Comm-B is broadcast timer has expired for all II codes.

b. STEP 2 — Transponder-Initiated Broadcast

- (1) Enter an AIS Flight Identification into the transponder.

Verify that a broadcast is automatically initiated by the transponder.

Extract the broadcast and verify the correct flight ID.

Wait 20 seconds to allow the broadcast timer to time out and enter the same AIS value again.

Verify that no new broadcast is initiated by the transponder.

Repeat the test with a different AIS flight identification.

- (2) Enter a datalink capability report into the transponder.

Verify that a broadcast is automatically initiated by the transponder.

Extract the broadcast and verify the correct datalink capability report.

Wait 20 seconds to allow the broadcast timer to time out and enter the same datalink capability report again.

Verify that no new broadcast is initiated by the transponder.

Repeat the test with a different datalink capability report.

**5.5.8.23.2 Test Procedure #21B Processing of multiple Comm-B messages**

**Note 1:** The command to the transponder that a Comm-B broadcast message shall be sent originates in a peripheral device or in the device that holds the extended capability report.

**Note 2:** The Comm-B broadcast does not affect the existing Comm-B protocol, air- or ground-initiated. The existing test procedures remain unchanged.

**Note 3:** Verification of interface patterns is already part of the Comm-B test procedures and need not be repeated for the Comm-B Broadcast.

This test procedure verifies that multiple Comm-B broadcast messages are queued and processed correctly.

Generate one flight identification change followed by a data link capability report change and two more flight identification changes in less than 18 seconds.

Verify that:

- (1) The first Flight ID change is available as a Comm-B Broadcast.
- (2) The data link capability report change is made available as a Comm-B broadcast after the Flight ID Broadcast times out.
- (3) The last flight ID change is made available as a Comm-B Broadcast after the Data Link Capability Broadcast times out.
- (4) All three Comm-B Broadcasts are available for  $18 \pm 1$  seconds each.