15-20 November 2010

RTCA SC-209 / EUROCAE WG-49

ATCRBS / MODE S TRANSPONDER MAINTENANCE

JOINT MEETING #12

EUROCAE Headquarters

15-20 November 2010

Reconsideration of the

Proposal to Increase the Interrogator Codes to Include 48 additional values

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Summary

It is recognized that states will field the number of military Mode S interrogators necessary to support national soverienty and defense. The SI and II codes assigned to interrogators must be carefully done to achieve the most efficient use of the 1090MHz specturm.

SI and II codes are limited and, thereby, difficult to assign. In particular, military interrogators have such a limited number of allocated values that various methods of operation are necessary that can cause more 1090MHz replies to all-calls than is optimal.

The update of transponders to DO 181D and ED 73C to satisfy ADS-B standards is mandated to be completed by 2017 in Europe (date not final) and 2020 in the United States. Thus, this is an opportunity to include this additional capability with a defined operational date.

1 Introduction

It is recognized that states will field the number of military Mode S interrogators (many of them are mobile) necessary to support national soverienty and defense. There are few SI and II codes available for military use, per currnet plans, because the civilian autorities have few additional codes to allocate. Military interrogators have such a limited number of allocated codes that various methods of operation are necessary that can cause more 1090 MHz replies to all-calls than is optimal.

The number of Mode S interrogators has increased in both the United States and Europe to the extent that the II and SI code allocation to fixed ground interrogators is difficult in many instances. No spare values are available for use in military mobile interrogators, for example. The use of “clusters” of interrogators does reduce the number of active II

and SI codes in use, but it is necessary to allocate codes to mitigate the risk of the loss of network connection between clustered interrrogators. Thus, the use of clusters does not eliminate the difficulty in assigning codes.

This paper proposes changes to the DO 181D, ED 73C, ICAO Annex 10 volume 4, and ICAO Document 9871 to extend the SI code processing to include 47 additional values. The original Mode S standard identified 15 interrogator codes to be used to lockout transponders from replying to Mode S only all-call interrogations. The collection of interrogator codes was extended to include an additional 63 SI codes (ZERO not included) of the remaining 112[1] values for transponder lockout to support more efficient management of the airspace. When the SI codes were added to the protocol and data content, it was decided to limit the number to 63 to control the number of additional interrogators. This method for limiting the interrogators has been adequate to date, but there is value in extending the list to include the remaining 47 values (ZERO is not used).

2 Proposed changes

The addition of the 47 additional interrogator codes currently not defined does not introduce major changes to the Mode S lockout protocol or data structures. All of the data changes use existing unassigned bits. The identification of the extended values (referred to here as "XI" codes) uses existing unassingned bit configurations of the CL field of the Mode S only All-Call interrogation in a manner fully consistent with the II and SI code processing and use. One additional bit is assigned in the DI=3 field in UF=4/5/20/21 to support Transponder Lockout, and a bit in the BDC code 1,0 to indicate XI code processing capability.

Existing interrogators will work without modification. Transponders that are not XI code processing capable may missinterpret the XI values in the Mode S only All-Call interrogations. So, it is necessary to ensure full equipage of the airborne fleet before unrestrained use of XI codes. This is comparable to the restriction that is imposed on the use of SI codes.

The next section provides details on the changes to the DO 181D that are necessary to implement the XI codes. In the left column of the table is the current DO 181D text and in the right column is the corresponding modification with the new text in red. In a small number of instances some material is highlighted in blue. These are cases in the testing which will take broader consideeration to finalize.

It is recognized that there are several additional points in the document where additions or changes are necessary to complete the insertion of XI code processing capability. However, it is clear from the currently provided information that the additional changes are not extensiver on unconstrained.

[1] Seven bits have been allocated for interrogator indetification codes. These seven bits are the IC field (3 bits) and the CL field (4 bits). The values IC=0 are not used (except by military mobile interrogators). The II codes are CL=0 and IC=1 to 15. Since 2^7=128 the remaining available codes are 128 – (15 +1)=112.

2.1 General Text Changes

2.1.1 Changes to RTCA DO 181D

<table>
<tr><th>Current DO 181D</th><th>Proposed Changes to DO 181D</th></tr>
<tr><td>1.4.4 Optional Additional Features</td><td>1.4.4 Optional Additional Features

Add item to the list

• Extended Surveillance Identifier Code (XI) – transponders with the ability to process XI codes have the capabilities of [fill in references

Add line to table

<table><tr><td>Extended Surveillance Identifier code (XI)</td><td>x</td></tr></table>
Modify the Note:

Note: SI and XI capability is included by meeting the requirements in these MOPS.</td></tr>
<tr><td>1.4.6 Transponder Labeling</td><td>1.4.6 Transponder Labeling

No change necessary since only examples are provided.</td></tr>
</table>

<table>
<tr><th>Current DO 181D</th><th>Proposed Changes to DO 181D</th></tr>
<tr><td>2.2.14.4 Field Descriptions</td><td>2.2.14.4 Field Descriptions

Add rows to Figure 2-7: Field Index
<table>
<tr><td></td><td></td><td colspan="2">BITS</td><td colspan="2">FORMATS</td><td colspan="2">REF. PARA</td></tr>
<tr><td>FIELD</td><td>SUB FIELD</td><td>NO.</td><td>POSITION</td><td>UP</td><td>DOWN</td><td>CONT.</td><td>PROT</td></tr>
<tr><td>MB</td><td>XIC</td><td>1</td><td>10</td><td>x</td><td>x</td><td></td><td></td></tr>
</table></td></tr>
</table>

Current DO 181D

2.2.14.4.9 CL Code Label

This 3-bit (14-16) uplink field shall define the contents of the IC field.

Coding (in binary):

Code	
000	IC Field contains the II code
001	IC Field contains SI codes 1 to 15
010	IC Field contains SI codes 16 to 31
011	IC Field contains SI codes 32 to 47
100	IC Field contains SI codes 48 to 63

The other values of the CL field shall not be used.

Note: The II code is defined in §2.2.14.4.17 and the SI code is defined in §2.2.14.4.37.

Proposed Changes to DO 181D

.2.14.4.9 CL Code Label

This 3-bit (14-16) uplink field shall define the contents of the IC field.

Coding (in binary):

Code	
000	IC Field contains the II code
001	IC Field contains SI codes 1 to 15
010	IC Field contains SI codes 16 to 31
011	IC Field contains SI codes 32 to 47
100	IC Field contains SI codes 48 to 63
101	IC Field contains XI codes 1 to 15
110	IC Field contains SI codes 16 to 31
111	IC Field contains SI codes 32 to 47

The other values of the CL field shall not be used.

Note: The II code is defined in §2.2.14.4.17, the SI code is defined in §2.2.14.4.37, and the XI code is defined in §2.2.14.4.38.

<table>
<tr><th>Current DO 181D</th><th>Proposed Changes to DO 181D</th></tr>
<tr><td>2.2.14.4.1.1 DI Designator Identification</td><td>2.2.14.4.1.1 DI Designator Identification

Modify line in table
<table><tr><td>3</td><td>SC contains multisite SI and XI lockout information …</td></tr></table></td></tr>
<tr><td>2.2.14.4.15 IC Interrogator code</td><td>2.2.14.4.15 IC Interrogator code

… 6-bit SI or XI code (2.2.14.4.36 and 37 …</td></tr>
<tr><td>2.2.14.4.29 PI Parity/Interrogator Identity</td><td>2.2.14.4.29 PI Parity/Interrogator Identity

Modify last line:

… and the SI or XI (see 2.2.14.4.36 and 2.2.14.4.37) codes shall be ZERO.</td></tr>
</table>

Current DO 181D	Proposed Changes to DO 181D
2.2.14.4.37 SI Surveillance Identifier This 6-bit value shall define a surveillance identifier (SI) code which is derived from the CL and IC fields of UF=11, or received directly in the SIS subfield (see §2.2.19.2.1.1). These SI code values are assigned to interrogators in the range of 1 to 63. An SI value of ZERO will not be used. The SI codes are used with the multisite lockout protocols (see §2.2.18.2.5). The SI codes are not be used with the multisite communications protocols, which require the use of II codes. Therefore, an interrogator operating with an SI code will be limited to the following data link capabilities: a. Unlinked Comm-A b. Broadcast Comm-A c. Ground-Initiated Comm-B (GICB) d. Broadcast Comm-B e. TCAS/ACAS Downlink Transactions Notes: 1. The SI lockout facility can not be used unless all Mode S transponders within coverage range are equipped for this purpose. 2. This specifically excludes the use of air-initiated Comm-B (AICB) protocol, which is required for data flash and downlink MSPs.	2.2.14.4.38 XI Extended Surveillance Identifier This 6-bit value shall define an extended surveillance identifier (XI) code which is derived from the CL and IC fields of UF=11, or received directly in the SIS subfield (see §2.2.19.2.1.1). These SI code values are assigned to interrogators in the range of 1 to 47. An XI value of ZERO will not be used. The XI codes are used with the multisite lockout protocols (see §2.2.18.2.5). The XI codes are not be used with the multisite communications protocols, which require the use of II codes. Therefore, an interrogator operating with an XI code will be limited to the following data link capabilities: a. Unlinked Comm-A b. Broadcast Comm-A c. Ground-Initiated Comm-B (GICB) d. Broadcast Comm-B e. TCAS/ACAS Downlink Transactions Notes: 1. The XI lockout facility can not be used unless all Mode S transponders within coverage range are equipped for this purpose. 2. This specifically excludes the use of air-initiated Comm-B (AICB) protocol, which is required for data flash and downlink MSPs.
	Increment the paragraph references for 2.2.14.4.40 to 2.2.14.44 by one to 2.2.14.4.41 to 2.2.14.45, and update all references accordingly.

Current DO 181D	Proposed Changes to DO 181D
2.2.18.2.2 Interrogator Acceptance Protoc9l (Figure 2-12)	2.2.18.2.2 Interrogator Acceptance Protoc9l (Figure 2-12) Add decision blocks for CL=1 to 4 to SI code 1-64 and CL=5-7 to XI code 1-47
2.2.18.2.4 Lockout Protocol (Figure 2-13)	2.2.18.2.4 Lockout Protocol (Figure 2-13)

Current DO 181D	Proposed Changes to DO 181D
2.2.18.2.5 Multisite Lockout Protocol (Figure 2-12) The multisite lockout command shall be transmitted in the SD field (§2.2.14.4.36). A lockout command for an II code shall be transmitted in an SD with DI=1 or DI=7. An II lockout command shall be indicated by LOS equals ONE in the presence of a non-zero interrogator identifier in the IIS subfield of SD. A lockout command for an SI code shall be transmitted in an SD with DI=3. An SI lockout shall be indicated by LSS (§2.2.19.2.1.1) equals ONE in the presence of a non-zero interrogator identifier in the SIS subfield of SD (§2.2.19.2.1). After a transponder has accepted an interrogation containing a multisite lockout command, that transponder shall commence to lock out (i.e., not accept) any Mode S-only All-Call interrogation which includes the identifier of the interrogator that commanded the lockout. The lockout shall persist for an interval 18 ±1 seconds after the last acceptance of an interrogation containing the multisite lockout command. Multisite lockout shall not prevent acceptance of a Mode S-only All-Call interrogation containing PR codes 8 to 12. If a lockout command (LOS=1) is received together with IIS=0, it shall be interpreted as a non-selective all-call lockout Notes: 1. Fifteen interrogators can send independent multisite II lockout commands. In addition, sixty-three interrogators can send independent SI lockout commands. Each of these lockout commands must be timed separately. 2. Multisite lockout (which uses only non-zero II codes) does not affect the response of the transponder to a Mode S-only All-Call interrogation containing II equals 0 or to Mode A/C/S All-Call interrogations.	2.2.18.2.5 Multisite Lockout Protocol (Figure 2-12) The multisite lockout command shall be transmitted in the SD field (§2.2.14.4.36). A lockout command for an II code shall be transmitted in an SD with DI=1 or DI=7. An II lockout command shall be indicated by LOS equals ONE in the presence of a non-zero interrogator identifier in the IIS subfield of SD. A lockout command for an SI or XI code shall be transmitted in an SD with DI=3. An SI lockout shall be indicated by LSS (§2.2.19.2.1.1) equals ONE in the presence of a non-zero interrogator identifier in the SIS subfield of SD (§2.2.19.2.1) and bit 28 equals ZERO. An XI lockout shall be indicated by LSS (§2.2.19.2.1.1) equals ONE in the presence of a non-zero interrogator identifier in the SIS subfield of SD (§2.2.19.2.1) and bit 28 equals ONE. After a transponder has accepted an interrogation containing a multisite lockout command, that transponder shall commence to lock out (i.e., not accept) any Mode S-only All-Call interrogation which includes the identifier of the interrogator that commanded the lockout. The lockout shall persist for an interval 18 ±1 seconds after the last acceptance of an interrogation containing the multisite lockout command. Multisite lockout shall not prevent acceptance of a Mode S-only All-Call interrogation containing PR codes 8 to 12. If a lockout command (LOS=1) is received together with IIS=0, it shall be interpreted as a non-selective all-call lockout Notes: 1. Fifteen interrogators can send independent multisite II lockout commands. In addition, sixty-three interrogators can send independent SI lockout commands, and forty-seven interrogators can send independent XI lockout commands. Each of these lockout commands must be timed separately. 2. Multisite lockout (which uses only non-zero II codes) does not affect the response of the transponder to a Mode S-only All-Call interrogation containing II equals 0 or to Mode A/C/S All-Call interrogations.

<table>
<tr><th>Current DO 181D</th><th>Proposed Changes to DO 181D</th></tr>
<tr><td></td><td></td></tr>
<tr><td>2.2.18.2.6 Acquisition Squitter Protocols

Mode S transponders shall transmit Acquisition squitters to facilitate acquisition.

a. Acquisition Squitter Format – The format used for the acquisition squitter transmissions shall be the All-Call reply, DF=11 using II=0 and SI=0 in generating the PI field.</td><td>2.2.18.2.6 Acquisition Squitter Protocols

Mode S transponders shall transmit Acquisition squitters to facilitate acquisition.

a. Acquisition Squitter Format – The format used for the acquisition squitter transmissions shall be the All-Call reply, DF=11 using II=0, SI=0, and XI=0 in generating the PI field.</td></tr>
<tr><td>2.2.18.2.9 All-Call Reply Protocol

Upon acceptance of a Mode S-Only All-Call interrogation (UF=11) the transponder shall reply by overlaying the received II or SI code on parity according to §2.2.18.2.1, resulting in the PI field which shall be used in the reply (DF=11). Upon acceptance of an ATCRBS/Mode S All-Call interrogations the transponder shall generate the PI field using II=0.</td><td>2.2.18.2.9 All-Call Reply Protocol

Upon acceptance of a Mode S-Only All-Call interrogation (UF=11) the transponder shall reply by overlaying the received II, SI, or XI code on parity according to §2.2.18.2.1, resulting in the PI field which shall be used in the reply (DF=11). Upon acceptance of an ATCRBS/Mode S All-Call interrogations the transponder shall generate the PI field using II=0.</td></tr>
<tr><td><table><tr><td>11</td><td>Transponder locked out to interrogator identifier II or SI
Stochastic reply test fails
Otherwise</td><td>No reply
No reply
11</td></tr></table>
Figure 2-17: All Level 2 Transponders: Coordination</td><td><table><tr><td>11</td><td>Transponder locked out to interrogator identifier II, SI, or XI
Stochastic reply test fails
Otherwise</td><td>No reply
No reply
11</td></tr></table>
Figure 2-17: All Level 2 Transponders: Coordination</td></tr>
</table>

Current DO 181D	Proposed Changes to DO 181D
2.2.19.1.12.7 Coding of the Data Link Capability Report … SIC: This one bit (67) SI capability subfield **shall** report the capability of the transponder to process SI codes. It **shall** be set to ONE for transponders with SI code capability. Otherwise it **shall** be set to ZERO. …	2.2.19.1.12.7 Coding of the Data Link Capability Report … SIC: This one bit (67) SI capability subfield **shall** report the capability of the transponder to process SI codes. It **shall** be set to ONE for transponders with SI code capability. Otherwise it **shall** be set to ZERO. XIC: This one bit (42) XI capability subfield shall report the capability of the transponder to process XI codes. It shall be set to ONE for transponders with XI code capability. Otherwise it shall be set to ZERO. …
2.2.19.2.1.1 Subfields in SD … f. If the DI=3: SIS: The 6-bit (17-22) surveillance identifier subfield in SD shall contain an assigned SI code of the interrogator (see §2.2.14.4.37). LSS: The 1-bit (23) lockout surveillance subfield if set to ONE shall signify a multisite lockout command from the interrogator indicated in SIS. LSS set to ZERO shall be used to signify that no change in lockout state is commanded. RRS: This 4-bit (24-27) reply request subfield in SD shall be coded as specified in subparagraph d. …	2.2.19.2.1.1 Subfields in SD … f. If the DI=3: SIS: The 6-bit (17-22) surveillance identifier subfield in SD shall contain an assigned SI and XI code of the interrogator (see §2.2.14.4.37 and §2.2.14.4.38). LSS: The 1-bit (23) lockout surveillance subfield if set to ONE shall signify a multisite lockout command from the interrogator indicated in SIS. LSS set to ZERO shall be used to signify that no change in lockout state is commanded. RRS: This 4-bit (24-27) reply request subfield in SD shall be coded as specified in subparagraph d. …

Current DO 181D	Proposed Changes to DO 181D
2.2.23.1.1 Extended Squitter Format The format used for the Extended Squitter shall be the 112-bit downlink format DF=17 using II=0 and SI=0 in generating the PI field (§2.2.14.4.30).	2.2.23.1.1 Extended Squitter Format The format used for the Extended Squitter shall be the 112-bit downlink format DF=17 using II=0, SI=0, and XI=0 in generating the PI field (§2.2.14.4.30).
2.2.23.3.1 ES/NT Format The format used for ES/NT shall be a 112 bit downlink format (DF=18) using II=0 and SI=0 in generating the PI field (see §2.2.14.4.30). The format shall contain the flowing fields: …	2.2.23.3.1 ES/NT Format The format used for ES/NT shall be a 112 bit downlink format (DF=18) using II=0, SI=0, and XI=0 in generating the PI field (see §2.2.14.4.30). The format shall contain the flowing fields: …
2.5.4.4.2 Required Negative Tests … d. II and SI Discrimination The interrogation patterns are: UF = 11. PR = 0. CL = 0 through 4. IC = 1 through 15. Total number of patterns = 75. With the transponder in non-selective lockout state, interrogate with all of the above patterns and verify that the corresponding II or SI code is not locked out. …	2.5.4.4.2 Required Negative Tests … d. II, SI, and XI Discrimination The interrogation patterns are: UF = 11. PR = 0. CL = 0 through 4. IC = 1 through 15. XIC = 0 and 1. Total number of patterns = 122. With the transponder in non-selective lockout state, interrogate with all of the above patterns and verify that the corresponding II , SI, and XI code is not locked out. …

Current DO 181D	Proposed Changes to DO 181D
2.5.4.5 Procedure #5 Selective Lockout Tests (§2.2.18.2.5) Selective lockout is initiated on receipt of a correctly addressed interrogation UF=4, 5, 20, or 21 containing DI=1, 7; LOS=1 and IIS from 1 to 15, or DI=3, LSS=1 and SIS from 1 to 63. This starts the TL timer associated with the received II or SI code and holds the lockout condition for 18 1.0 seconds. Selective lockout applies only to UF=11 with II or SI corresponding to the running T_L timer. The lockout state, duration, termination and restart are defined and tested as described in §2.5.4.4. Negative tests follow the same procedures and have the same purpose as described in §2.5.4.4. Pattern Definition for Level 1 Transponders Positive Interrogation Patterns Per Timer <u>Total Interrogation Patterns Per Timer</u> UF: 2 codes. DI: 2 codes with LOS=1 or 1 code with LSS=1. Total: 4 patterns for II timers, 2 patterns for SI timers starting lockout. <u>Total Interrogation Patterns Per Timer</u> UF: 2 codes. DI: 2 codes with LOS=0,1; 1 code with LSS=0, 1 5 codes with SD field bits 23 & 26 = 1 Total: 20 possible patterns for II timers, 18 possible patterns for SI timers. Positive test patterns: 2 or 4. Negative test patterns: 16. Pattern Definition of All Other Transponder Designs Positive Interrogation Patterns Per Timer	2.5.4.5 Procedure #5 Selective Lockout Tests (§2.2.18.2.5) Selective lockout is initiated on receipt of a correctly addressed interrogation UF=4, 5, 20, or 21 containing DI=1, 7; LOS=1 and IIS from 1 to 15; or DI=3, LSS=1, XIC=0 and SIS from 1 to 63, or DI=3, LSS=1, XIC=1 and SIS from 1 to 47. This starts the TL timer associated with the received II, SI, or XI code and holds the lockout condition for 18 1.0 seconds. Selective lockout applies only to UF=11 with II, SI, or XI corresponding to the running T_L timer. The lockout state, duration, termination and restart are defined and tested as described in §2.5.4.4. Negative tests follow the same procedures and have the same purpose as described in §2.5.4.4. Pattern Definition for Level 1 Transponders Positive Interrogation Patterns Per Timer <u>Total Interrogation Patterns Per Timer</u> UF: 2 codes. DI: 2 codes with LOS=1 or 1 code with LSS=1. Total: 6 patterns for II timers, 2 patterns for SI timers, 2 patterns for XI timers starting lockout. <u>Total Interrogation Patterns Per Timer</u> UF: 2 codes. DI: 2 codes with LOS=0,1; 1 code with LSS=0, 1; and 1 code with XIC = 1,0 6 codes with SD field bits 23 & 26 = 1 Total: 20 possible patterns for II timers, 18 possible patterns for SI timers. Positive test patterns: 2 or 4. Negative test patterns: 16.

Current DO 181D

Test #2 Multisite T_L Timer and Lockout: Restart Capability and Sensitivity to All Valid Formats (All Transponder)

Time (sec)	Action
0.0	Start timer with UF=4.
0.02	Verify lockout to timer's II or SI.
4.5	Restart timer with UF=5.
21.4	Verify lockout for timer's II or SI.
23.6	Verify non-lockout for timer's II or SI.

Proposed Changes to DO 181D

Test #2 Multisite T_L Timer and Lockout: Restart Capability and Sensitivity to All Valid Formats (All Transponder)

Time (sec)	Action
0.0	Start timer with UF=4.
0.02	Verify lockout to timer's II, SI, or XI.
4.5	Restart timer with UF=5.
21.4	Verify lockout for timer's II, SI, or XI.
23.6	Verify non-lockout for timer's II, SI, or XI.

Current DO 181D	Proposed Changes to DO 181D
2.5.4.8 Procedure #8 PI (Parity/Identity) Verification (§2.2.18.2.9) This test procedure verifies the PI field generation. A separate test sequence is not required. <u>Required Verification:</u> During the lockout tests, the transponder generates replies to All-Call interrogations and the reply receiver receives the PI field and extracts the II or SI code received by the transponder in the preceding interrogation. Verify that the extracted code agrees with the II or SI of the preceding All-Call. Verify that the extracted code equals 0 if the preceding All-Call was an ATCRBS/Mode S type.	2.5.4.8 Procedure #8 PI (Parity/Identity) Verification (§2.2.18.2.9) This test procedure verifies the PI field generation. A separate test sequence is not required. Required Verification: During the lockout tests, the transponder generates replies to All-Call interrogations and the reply receiver receives the PI field and extracts the II, SI, or XI code received by the transponder in the preceding interrogation. Verify that the extracted code agrees with the II, SI, or XI of the preceding All-Call. Verify that the extracted code equals 0 if the preceding All-Call was an ATCRBS/Mode S type.
2.6.2 Surveillance Identifier ("SI") Code Requirements (§2.2.24.2 and §2.2.24.2.1) a. Perform Procedure #4 - Non-Selective Lockout Tests for all "II" and "SI" codes as required by §2.5.4.4 (see §2.2.18.2.4). b. Perform Procedure #5 - Selective Lockout Tests for all "II" and "SI" codes as required by §2.5.4.5 (see §2.2.18.2.5). **2.6.2.1 MOPS Requirements Relevant to "SI" (§2.2.24.2.1)** Appropriate test requirements to validate "SI" functions were previously provided in §2.6.2.	Replace "II" and "SI" with II, SI, and XI Replace validate "SI" with validate SI and XI

Current DO 181D	Proposed Changes to DO 181D
2.6.3.2.5 **Bit 35, Surveillance Identifier Code ("SI") (§2.2.24.3.2.5)** Test Procedure: Continue to interrogate the transponder as required in §2.6.3.2.1. Verify that the transponder replies with a DF=20 reply with bit 67 (Surveillance Identifier (SI) [bit 35 of the "MB" field]) set to ONE (1) to indicate that the transponder DOES HAVE "SI" Capability.	2.6.3.2.xx Bit 10, Extended Identifier Code ("XI") (2.2.24.3.2.xx) Test Procedure: … Replace bit 67 (Surveillance Identifier (SI) [bit 35… with bit 47 (Extended Identifier (XI) [bit 10… and DOES HAVD "SI" with DOES HAVD "XI"
2.6.6.1 d. **Comm-B Broadcast because of Data Link Capability Change Extraction:** (§2.2.24.3.2.1, §2.2.24.3.2.4, §2.2.24.3.2.5, §2.2.24.3.3.b, §2.2.24.3.4 and §2.2.24.6.3) Continue to interrogate the transponder with the interrogation described in Part 1. c. (e.g., the last step) until the transponder replies with a DF=20 reply with: (1). "DR" = 4 or 5 if TCAS Information IS NOT available = 6 or 7 if TCAS Information IS available. (2). Bits 33 - 40 (bits 1 through 8 of the "MB" field) set to 10 HEX (0001 0000). (3). Bit 65 ["AIS" subfield (bit 33 of the "MB" field)] set to ONE (1) to indicate Aircraft Identification capability. (4). Bit 67 [Surveillance Identifier (SI) (bit 35 of the "MB" field)] set to ONE (1) to indicate that the transponder DOES Have "SI" Capability.	Add (5) Bit 42 (Extended Identifier (XI) (bit 10 of the "MB"field)] set to ONE (1) to indicate that the tansponder Does have "XI" capability.
	2.6.6.1 g. data link capability report, register 10_{16} add (6) Bit 42 (Extended Identifier (XI) (bit 10 of the "MB"field)] set to ONE (1) to indicate that the tansponder Does have "XI" capability.

Current DO 181D	Proposed Changes to DO 181D
2.6.6.8	2.6.6.8 f. add (5) Bit 42 (Extended Identifier (XI) (bit 10 of the “MB”field)] set to ONE (1) to indicate that the tansponder Does have “XI” capability.
2.7.1.2.4 Bit 35, Surveillance Identifier Code (“SI”) (§2.2.25.1.2.4) Test Procedure: Continue to interrogate the transponder as required in §2.7.1.2.1. Verify that the transponder replies with a DF=20 reply with bit 67 (Surveillance Identifier (SI) [bit 35 of the “MB” field]) set to ONE (1) to indicate that the transponder DOES Have “SI” Capability.	Add new section 2.7.1.2.xx Bit10, Extended Identifier Cod (“XI”) … Bit 10 (Extended Identifier (SI) [bit 10 of the “MB” field) set to ONE (1) to indicagte that the transponder DOES have “SI” Capability.
	2.7.5.2 Part 2 – Register 40_{16} - … g. Broadcast extraction, register 10_{16} … (7) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
2.7.5.6	2.5.7.6 Part 6 – register 40_{16} … … g. Broadcast Extraction, Register 10_{16} … (7) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.

Current DO 181D	Proposed Changes to DO 181D
2.7.5.7	2.7.5.7 Part 7 … … g. Broadcast Extraction, Register 10_{16} … (7) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
2.7.5.11	2.7.5.11 Part 11 … … g. Broadcast Extraction, Register 10_{16} … (7) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.5.15 Part 15 … … g. Broadcast Extraction, Register 10_{16} … (7) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.

Current DO 181D	Proposed Changes to DO 181D
	2.7.6.1 Part 1 … … c. Data Link Capability Report, Register 10_{16} … (5) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.6.2 Part 2 … … g. Broadcast Extraction, Register 10_{16} … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.6.4 Part 4 … … g. Broadcast Extraction, … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.

Current DO 181D	Proposed Changes to DO 181D
	2.7.6.6 Part 6 … … g. Broadcast Extraction, … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.6.8 Part 8 … … g. Broadcast Extraction, Register 10_{16} … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.6.10 Part 10 … … g. Broadcast Extraction, Register 10_{16} … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.

Current DO 181D	Proposed Changes to DO 181D
	2.7.6.12 Part 12 … … g. Broadcast Extraction, Register 10_{16} … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.6.13 Part 13 … … g. Broadcast Extraction, Register 10_{16} … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.7.1 Part 1 … … c. data link capabilty report , Register 10_{16} … (5) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.

Current DO 181D	Proposed Changes to DO 181D
g.	2.7.7.2 Part 2 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.7.3 Part 3 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.7.4 Part 4 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.

Current DO 181D	Proposed Changes to DO 181D
	2.7.7.6 Part 6 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.7.8 Part 8 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.7.10 Part 10 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.

Current DO 181D	Proposed Changes to DO 181D
	2.7.7.12 Part 12 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	2.7.7.14 Part 14 … … g. … (6) Bit 42 [“XIC” subfield (bit 10 of the “MB” field)] set to ONE (1) to indicate that the tronsponder does hae “XI” capability.
	B.4.1.11 Bit 10 (XI) code capability This bit should be set as specified in Table B-3-16, item 11 The Identifier (XI) bit is to be interpretes as follows: 0 = no extended identifier code capability 1 = extended identifier code capability XIC: This 1-bit extended identifier capability subfield reports the capability of the transponder to support Extended Identifier (XI) codes. The setting of this bit is static. If the transponder software version handles XI codes then this bit should be set to one (1).

Current DO 181D	Proposed Changes to DO 181D
	Table B-3-16 shown below this table.
	C.2.2.4 Transpondeer to Application Entity (AE) Interface … Note: Transponders will … Use of SI and XI codes ae limited to Comm-A and Comm-A broadcaset interrogations.
	C.2.2.5 Application Entity (AAE) to Transponder Interface … Note: Use of SI and XI codes limited to Ground-initiated Comm-B and Comm-B Broadcast.

Table 2-16. BDS code 1,0 — Data link capability report

MB FIELD

1	
2	
3	
4	BDS code 1,0
5	
6	
7	
8	
9	Continuation flag (see 9)
10	Extended interrogators (XI) see 10)
11	
12	RESERVED
13	
14	
15	
16	Reserved for ACAS
17	
18	
19	
20	Mode S subnetwork version number
21	
22	
23	
24	Transponder enhanced protocol indicator (see 4)
25	Mode S specific services capability (see 2)
26	
27	Uplink ELM capability
28	
29	
30	Downlink ELM capability
31	
32	
33	Aircraft identification capability
34	Squitter capability subfield (SCS) (see 5)
35	Surveillance identifier (SI) (see 6)
36	Common usage GICB capability report (see 7)
37	
38	RESERVED FOR ACAS
39	
40	
41	MSB
42	
43	
44	
45	
46	
47	Bit array indicating the support status of DTE
48	subaddresses 0 to 15 (see 3 and 8)
49	
50	
51	
52	
53	
54	
55	
56	LSB

PURPOSE: To report the data link capability of the Mode S transponder/data link installation.

The coding of this register shall conform to:

1) Annex 10, Volume III, 5.2.9.

2) When bit 25 is set to 1, it shall indicate that at least one Mode S specific service is supported and the particular capability reports shall be checked.

Note.— Registers accessed by BDS codes 0,2; 0,3; 0,4; 1,0; 2,0 and 3,0 do not affect the setting of bit 25.

3) Starting from the MSB, each subsequent bit position shall represent the DTE subaddress in the range from 0 to 15.

4) The enhanced protocol indicator shall denote a Level 5 transponder when set to 1 and a Level 2 to 4 transponder when set to 0.

5) The squitter capability subfield (SCS) shall be interpreted as follows:

0 = squitter registers are not updated
1 = squitter registers are being updated

6) The surveillance identifier (SI) bit shall be interpreted as follows:

0 = no surveillance identifier code capability
1 = surveillance identifier code capability

7) Bit 36 shall be toggled each time the common usage GICB capability report (BDS code 1,7) changes. To avoid the generation of too many broadcast capability report changes, BDS code 1,7 shall be sampled at approximately one minute intervals to check for changes.

8) The current status of the on-board DTE shall be periodically reported to the GDLP by on-board sources. Since a change in this field results in a broadcast of the capability report, status inputs shall be sampled at approximately one minute intervals.

9) In order to determine the extent of any continuation of the data link capability report (into those registers reserved for this purpose: BDS 1,1 to BDS 1,6), bit 9 shall be reserved as a 'continuation flag' to indicate if the subsequent register shall be extracted. For example: upon detection of bit 9 = 1 in BDS 1,0 then BDS 1,1 shall be extracted. If bit 9 = 1 in BDS 1,1 then BDS 1,2 shall be extracted, and so on (up to BDS 1,5). Note that if bit 9 = 1 in BDS 1,6 then this shall be considered as an error condition.

10) The extended identifier (X) bit shall be interpreted as follows:

0 – no extended identifier code capability

1 – extended identifier code capability