

RTCA Special Committee 209
Mode S Transponder MOPS Maintenance
Working Group #1, Meeting #6

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Proposed Resolution for Action Item 7-3

Robert “Bob” Saffell
Rockwell Collins

SUMMARY

This Working Paper presents the necessary changes to both the drafts of DO-181D and ED-73C to satisfy the specifics of Action Item 7-3.

Action Item: 7-3
Assigned to: R.H. "Bob" Saffell
Description: Rewrite §2.5.4.19 to be consistent with changes made to Data Link Capability Reporting in §2.2.19.1.13. Also check §2.6.2.3. Also check ED-73C for correct references.

Introduction:

This document addresses the changes necessary to address the action item referenced above.

1. RTCA DO-181D, section §2.2.19.1.13. Requirements

The requirements previously provided in section 2.2.17.1.3 of DO-181C were removed when ported to DO-181D section 2.2.19.1.13. This was done based on the expectation that all the requirements for Aircraft Identification would be covered in the new section on Elementary Surveillance, e.g., section 2.2.24. Such coverage was not established in section 2.2.24 as it addresses the extreme details of implementing Elementary Surveillance which includes Aircraft Identification. Section 2.2.24 was written based on the precept that the reporting needs and encoding were already specified in section 2.2.17.

Therefore, DO-181D section 2.2.19.1.13 must be updated (e.g., returned) to read as provided in **Part 1: Update of DO-181D Requirements** which follows after the introductory portion of this document.

2. RTCA DO-181D, section 2.5.4.19. Test Procedures

Test procedures developed for Elementary Surveillance are currently provided in section 2.6 of DO-181D to validate the requirements provided in section 2.2.24. These procedures also validate all of the requirements of section 2.2.19.1.13.

Therefore, DO-181D section 2.5.4.19 must be updated to read as provided in **Part 2: Update of DO-181D Test Requirements** which follows after the Part 1: Update of DO-181D Requirements.

3. EUROCAE ED-73C, section 3.23.1.13. Requirements

No Change is needed in section 3.23.1.13 as ED-73C has retained the requirements that are being re-inserted into RTCA DO-181D.

4. EUROCAE ED-73C, section 5.5.8.20. Test Procedures

Eurocae ED-73C, section 5.5.8.20 needs to be updated as provided in **Part 4** below.

5. EUROCAE ED-73C, 5.6. Test Procedures for ELS

Eurocae ED-73C, section 5.6 needs to be updated as marked up in Part 5 below.

Required Updates:

Part 1: Update of DO-181D Requirements.

Update DO-181D section 2.2.19.1.13 to read as given below. Added text is highlighted in YELLOW.

2.2.19.1.13 Aircraft Identification Reporting and AIS Aircraft Identification Subfield in MB

If a transponder is equipped for AIS reporting (Aircraft Identification Reporting), it **shall** report the information in the AIS subfield as described below.

a. Aircraft Identification Reporting

If so equipped, the transponder shall report the aircraft identification (aircraft radio call sign) used in the flight plan. This may be either the trip number assigned to commercial flights or the aircraft registration number, where applicable.

Note: There are indications that a firm requirement may exist for the AIS feature in European Airspace. In such usage, the identification number entered in field 7 of the ICAO flight plan format shall be transmitted in the AIS subfield.

b. AIS Aircraft Identification Subfield in MB

If a surveillance or Comm-A interrogation (UF=4, 5, 20, 21) contains RR= 18 and DI other than 7, or DI=7 and RRS=0, the transponder shall report its aircraft identification number in the 48-bit (4 1-88) AIS subfield in MB.

c. Coding of the AIS Subfield

The MB field containing the AIS subfield shall be coded as follows:

1	9	15	21	27	33	39	45	51
BDS	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8
8	14	20	26	32	38	44	50	56

Note: Aircraft Identification coding permits up to eight characters.

Each character shall be coded as a six-bit subset of the ICAO 7-unit coded character set (ICAO Annex 10) as illustrated in the following table. The character code shall be transmitted with the most significant bit b6 first. The reported aircraft code shall begin with the left-most character, character 1 (abbreviated as Ch 1 in the above diagram). Characters shall be coded consecutively without an intervening SPACE code. Any unused character spaces at the end of the subfield shall contain a SPACE character code.

d. Aircraft Identification Capability Reporting

Transponders that respond to a ground-initiated request for aircraft identification shall report this capability in the Data Link Capability Report according to subparagraph 2.2.17.1.12.7.

e. Change of Aircraft Identification

If the aircraft identification reported in the AIS subfield is changed in flight, then the transponder shall report the new identification to the ground by use of the Comm-B Broadcast Message protocol.

f. Six-Bit Character Set for Coding Aircraft Identification in the AIS Subfield

SP - SPACE code

				B6	0	0	1	1
				B5	0	1	0	1
B4	B3	B2	B1					
0	0	0	0			P	SP	0
0	0	0	1		A	Q		1
0	0	1	0		B	R		2
0	0	1	1		C	S		3
0	1	0	0		D	T		4
0	1	0	1		E	U		5
0	1	1	0		F	V		6
0	1	1	1		G	W		7
1	0	0	0		H	X		8
1	0	0	1		I	Y		9
1	0	1	0		J	Z		
1	0	1	1		K			
1	1	0	0		L			
1	1	0	1		M			
1	1	1	0		N			
1	1	1	1		O			

SP - SPACE code

Part 2: Update of DO-181D Test Requirements:

Update DO-181D section 2.5.4.19 to read as given below. Added text is highlighted in YELLOW.

2.5.4.19 Procedure #19 AIS Flight Identification, Protocol and Interface

The requirements provided in section 2.2.19.1.13 establish the baseline reporting and method of encoding Aircraft Identification. Section 2.2.24 addresses Elementary Surveillance requirements which specify detailed implementation requirements for Aircraft Identification. Section 2.6 provides detailed test procedures to validate the requirements of section 2.2.24. As section 2.6 must address testing of all Aircraft Identification requirements, appropriate procedures to validate the requirements of section 2.2.19.1.13 are provided as detailed in the following subparagraphs:

a. 2.2.19.1.13.a **Aircraft Identification Reporting**

Appropriate Test Procedures are provided in section 2.6.6.1 –through- 2.6.6.x. Specific subsections are 2.6.6.1.b, 2.6.6.2.b, 2.6.6.3.b, 2.6.6.4.b, 2.6.6.5.b, 2.6.6.6.b, 2.6.6.7.b, and 2.6.6.8.b and e.

b. 2.2.19.1.13.b **AIS Aircraft Identification Subfield in MB**

Appropriate Test Procedures are provided in section 2.6.6.1 –through- 2.6.6.x. Specific subsections are 2.6.6.1.b, 2.6.6.2.b, 2.6.6.3.b, 2.6.6.4.b, 2.6.6.5.b, 2.6.6.6.b, 2.6.6.7.b, and 2.6.6.8.b and e.

c. 2.2.19.1.13.c Coding of the AIS Subfield

Appropriate Test Procedures are provided in section 2.6.6.1 –through-2.6.6.x. Specific subsections are 2.6.6.1.b and c, 2.6.6.2.b, 2.6.6.3.b, 2.6.6.4.b, 2.6.6.5.b, 2.6.6.6.b, 2.6.6.7.b, and 2.6.6.8.b and e.

d. 2.2.19.1.13.d Aircraft Identification Capability Reporting

Appropriate Test Procedures are provided in section 2.6.6.1 –through-2.6.6.x. Specific subsections are 2.6.6.1.g, and 2.6.6.8.c and f.

e. 2.2.19.1.13.e Change of Aircraft Identification

Appropriate Test Procedures are provided in section 2.6.6.1 –through-2.6.6.x. Specific subsections are 2.6.6.1.b and c, 2.6.6.2.b and c, 2.6.6.3.b and c, and 2.6.6.4.b and c.

f. 2.2.19.1.13.f Six-Bit Character Set for Coding Aircraft Identification in the AIS Subfield

Appropriate Test Procedures are provided in section 2.6.6.1 –through-2.6.6.x. Specific subsections are 2.6.6.1.b, 2.6.6.2.b, 2.6.6.3.b, 2.6.6.4.b, 2.6.6.5.b, 2.6.6.6.b, 2.6.6.7.b, and 2.6.6.8.b and e.

Part 3: EUROCAE ED-73C. Section 3.23.1.13 Requirements:

No Change Required.

Part 4: EUROCAE ED-73C. Section 5.5.8.20 Test Procedures:

Change section 5.5.8.20 to read as follows:

5.5.8.20 Procedure #19 AIS Flight Identification, Protocol and Interface

The requirements provided in section 3.23.1.13 establish the baseline reporting and method of encoding Aircraft Identification. Section 3.29 addresses Elementary Surveillance requirements which specify detailed implementation requirements for Aircraft Identification. Section 5.6 provides detailed test procedures to validate the requirements of section 3.29. As section 5.6 must address testing of all Aircraft Identification requirements, appropriate procedures to validate the requirements of section 3.23.1.13 are provided as detailed in the following subparagraphs:

a. 3.23.1.13.a Aircraft Identification Reporting

Appropriate Test Procedures are provided in section 5.6.6.1 –through-5.6.6.9. Specific subsections are 5.6.6.1.b, 5.6.6.2.b, 5.6.6.3.b, 5.6.6.4.b, 5.6.6.5.b, 5.6.6.6.b, 5.6.6.7.b, and 5.6.6.8.b and e.

b. 3.23.1.13.b AIS Aircraft Identification Subfield in MB

Appropriate Test Procedures are provided in section 5.6.6.1 –through-5.6.6.9. Specific subsections are 5.6.6.1.b, 5.6.6.2.b, 5.6.6.3.b, 5.6.6.4.b, 5.6.6.5.b, 5.6.6.6.b, 5.6.6.7.b, and 5.6.6.8.b and e.

c. 3.23.1.13.c Coding of the AIS Subfield

Appropriate Test Procedures are provided in section 5.6.6.1 –through- 5.6.6.9. Specific subsections are 5.6.6.1.b and c, 5.6.6.2.b, 5.6.6.3.b, 5.6.6.4.b, 5.6.6.5.b, 5.6.6.6.b, 5.6.6.7.b, and 5.6.6.8.b and e.

- d. 3.23.1.13.d Aircraft Identification Capability Reporting
Appropriate Test Procedures are provided in section 5.6.6.1 –through-5.6.6.9. Specific subsections are 5.6.6.1.g, and 5.6.6.8.c and f.
- e. 3.23.1.13.e Change of Aircraft Identification
Appropriate Test Procedures are provided in section 5.6.6.1 –through-5.6.6.9. Specific subsections are 5.6.6.1.b and c, 5.6.6.2.b and c, 5.6.6.3.b and c, and 5.6.6.4.b and c.
- f. 3.23.1.13.f Six-Bit Character Set for Coding Aircraft Identification in the AIS Subfield
Appropriate Test Procedures are provided in section 5.6.6.1 –through-5.6.6.9. Specific subsections are 5.6.6.1.b, 5.6.6.2.b, 5.6.6.3.b, 5.6.6.4.b, 5.6.6.5.b, 5.6.6.6.b, 5.6.6.7.b, and 5.6.6.8.b and e.

Part 5: EUROCAE ED-73C. Section 5.6 Test Procedures:

Add section 5.6, with markup in blue highlights to read as follows:

(Basically updated references and got rid of any references to DO-181X)

- 5.6 **Test Procedures for Elementary Surveillance (ELS) Compliant Transponder (Paragraph 3.29)**
No test procedure required as Paragraph 3.29 is introductory material for ELS.
- 5.6.1 **Ground Initiated Comm-B (Paragraph Error! Reference source not found.)**
No test procedure required as multiple GICB extractions of the applicable registers are performed in subsequent tests.
- 5.6.2 **Surveillance Identifier (“SI”) Code Requirements (Paragraph Error! Reference source not found. and Error! Reference source not found.)**
 - a. Perform Procedure #4 - Non-Selective Lockout Tests for all “II” and “SI” codes as required by Paragraph Error! Reference source not found.. (Paragraph 3.22Error! Reference source not found.)
 - b. Perform Procedure #5 - Selective Lockout Tests for all “II” and “SI” codes as required by Paragraph 5.5.8.5. (Paragraph Error! Reference source not found.)
- 5.6.2.1 **MOPS Requirements Relevant to “SI” (ParagraphError! Reference source not found.)**
Appropriate test requirements to validate “SI” functions were previously provided in Paragraph 5.6.2.
- 5.6.3 **Declaration of Capability in Register 10₁₆ – Data Link Capability Report (Paragraph 3.29.3)**
No test procedure required.
- 5.6.3.1 **Purpose and Definition (Paragraph 3.29.3.1)**
No direct test procedure required as format of each required bit in Register 10₁₆ is verified in subsequent tests.

5.6.3.2 Data Requirements (Paragraph 3.29.3.2)

Introduction:

The purpose of this procedure is to verify the setting of the Data Link Capability Report as required in Paragraph 3.29.3.2 when no capability has been established. The setting of appropriate bits in Register 10₁₆ as capability is established or changed is demonstrated or verified in subsequent sections.

Test Procedure:

Ensure that **NO** Aircraft Identification or Aircraft Registration data is being provided to the transponder.

Ensure that the TCAS / Transponder interface is **NOT ACTIVE**. If the interface is active, TCAS will provide data to set the Data Link Capability and thereby compromise the results of the following tests. Likewise, TCAS could attempt to set the Resolution Advisory Report and thereby compromise the results of the following tests.

Ensure that no other data is being provided to the transponder that could result in the loading of BDS registers internal to the transponder.

Disable the Extended Squitter and Mode-S Specific Services (“MSSS”) functions prior to starting the following procedures in order to keep from setting various BDS registers during the following tests.

5.6.3.2.1 Bit 1 –through- 8, BDS Code (Paragraph 3.29.3.2.1)

Test Procedure:

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 10₁₆ Data Link Capability Report.

REGISTER 10 ₁₆ DATA LINK CAPABILITY GICB EXTRACTION					
DATA SOURCE INTERROGATION SETUP					
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF”	“PC”	“RR”	“DI”	“IIS”	“NOT ASSIGNED”
=	=	=	=	=	=
4	0	17 (11 HEX)	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with bit **33** –through- **40** (“BDS” subfield (bit **1** –through- **8** of the “MB” field)] set to 10 HEX (0001 0000 binary).

5.6.3.2.2 Bit 17 –through- 23, Declaration of Mode-S Subnetwork Number (Paragraph 3.29.3.2.2)

Test Procedure:

Continue to interrogate the transponder as required in Paragraph 5.6.3.2.1.

Verify that the transponder replies with a “DF” = 20 reply with bit **49** – through- **55** [(“Mode S Subnetwork Version Number” subfield (bit **17** –through- **23** of the “MB” field)] encoded with a value of “**3**” or more.

5.6.3.2.3 Bit 25, Declaration of No Mode S Specific Services Capability (Paragraph 3.29.3.2.3)

Test Procedure:

Continue to interrogate the transponder as required in Paragraph 5.6.3.2.1.

Verify that the transponder replies with a “DF” = 20 reply with bit **57** [Mode S Specific Services Capability (bit **25** of the “MB” field)] set to ZERO (0) to indicate NO Mode S Specific Services Capability.

Note: Servicing of Registers 02₁₆, 03₁₆, 04₁₆, 10₁₆, 17₁₆ to 1C₁₆, 20₁₆ and 30₁₆ does not constitute Mode S Specific Services Capability.

5.6.3.2.4 Bit 33, Aircraft Identification Reporting Capability (Paragraph 3.29.3.2.4)

Test Procedure:

Continue to interrogate the transponder as required in Paragraph 5.6.3.2.1.

Verify that the transponder replies with a “DF” = 20 reply with bit 65 [“AIS” subfield (bit 33 of the “MB” field)] set to ZERO (0) to indicate NO Aircraft Identification capability.

5.6.3.2.5 Bit 35, Surveillance Identifier Code (SI) (Paragraph 3.29.3.2.5)

Test Procedure:

Continue to interrogate the transponder as required in Paragraph 5.6.3.2.1.

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.

5.6.3.2.6 Bit 36, Common Usage GICB Capability Report (Paragraph 3.29.3.2.6 and 3.29.4.4)

Test Procedure:

Continue to interrogate the transponder as required in Paragraph 5.6.3.2.1.

Verify that the transponder replies with a “DF” = 20 reply with bit 68 [Common Usage GICB Capability Report (bit 36 of the “MB” field)] set to ZERO (0) to indicate that there has been no change in the Common Usage GICB Capability Report, Register 17₁₆.

5.6.4 Register 17₁₆, Common Usage GICB Capability Report (Paragraph 3.29.4)

No test procedure required.

5.6.4.1 Purpose and Definition (Paragraph 3.29.1)

No direct test procedure required as format of each required bit in Register 17₁₆ is verified in subsequent tests.

5.6.4.2 Data Requirements (Paragraph 3.29.2)

Introduction:

The purpose of this procedure is to verify the setting of the Common Usage GICB Capability Report as required in §3.29.4.2 when no capability has been established. The setting of appropriate bits in Register 17₁₆ as capability is established or changed is demonstrated or verified in subsequent sections.

Test Procedure:

Ensure that the conditions established in Paragraph 5.6.3.2 are retained.

5.6.4.2.1 Required Servicing of Register 17₁₆ Associated with Register 20₁₆ and 21₁₆ as an Option (Paragraph 3.29.4.2.1 and 3.29.4.2.2)

Test Procedure:

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17₁₆ Common Usage GICB Capability Report.

REGISTER 17 ₁₆ COMMON USAGE GICB CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF”	“PC”	“RR”	“DF”	“IIS”	“RRS	“X”	“LOS”	“XX”	“TMS”
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	7	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

- Bits **33** –through- **60** (bits **1** –through- **28** of the “MB” field) set to ZERO (0) to indicate NO Capability or capability changes in the Common Usage GICB Capability Report, Register 17₁₆.
- Bits **61** –through- **88** (bits **29** –through- **56** of the “MB” field) set to ZERO (0) since these bits are Reserved or “Don’t Care”.

5.6.4.2.2 Required Servicing of Register 17₁₆ Associated with Optional Register 21₁₆ (Paragraph 3.29.4.2.2)

Appropriate procedures to validate the setting of Register 17₁₆ bits associated with Register 21₁₆ prior to establishing any capability in the transponder installation were demonstrated in (Paragraph 5.6.4.2.1).

5.6.5 Register 18₁₆ –to- 1C₁₆, Mode S Specific Services Capability Reports (§3.29.5)

No test procedure required.

5.6.5.1 Purpose and Definition (Paragraph 3.29.5.1)

No direct test procedure required as format of each required bit in Registers 18₁₆ –through- 1C₁₆ are verified in subsequent tests.

5.6.5.2 Data Requirements (Paragraph 3.29.5.2)

Introduction:

The purpose of this procedure is to verify the settings of the Mode S Specific Services Capability Reports as required in Paragraph 3.29.5.2 when no capability has been established. The setting of appropriate bits in Registers 18₁₆ –through- 1C₁₆ as capability is established or changed is demonstrated or verified in subsequent sections.

5.6.5.2.1 Required Servicing of Register 18₁₆ Associated with Register 10₁₆ (Paragraph 3.29.1 and 3.29.5.2.1)

Test Procedure:

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 18₁₆ Mode S Specific Services Capability Report.

REGISTER 18 ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF”	“PC”	“RR”	“DF”	“IIS”	“RRS	“X”	“LOS”	“XX”	“TMS”
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	8	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

Bits 33 –through- 88 (bits 1 –through- 56 of the “MB” Field) set to ZERO (0) to indicate NO Capability has been established to service the BDS Codes designated in Register 18₁₆.

5.6.5.2.2 Required Servicing of Register 18₁₆ Associated with Register 17₁₆ (Paragraph 3.29.5.2.2)

Appropriate procedures to validate the setting of Register 18₁₆ bits associated with Register 17₁₆ prior to establishing any capability in the transponder installation were demonstrated in (Paragraph 5.6.5.2.1).

5.6.5.2.3 Required Servicing of Register 18₁₆ Associated with Register 18₁₆ (Paragraph 3.29.5.2.3)

Appropriate procedures to validate the setting of Register 18₁₆ bits associated with Register 18₁₆ prior to establishing any capability in the transponder installation were demonstrated in (Paragraph 5.6.5.2.1).

5.6.5.2.4 Required Servicing of Register 18₁₆ Associated with Register 20₁₆ (Paragraph 3.29.5.2.4)

Appropriate procedures to validate the setting of Register 18₁₆ bits associated with Register 20₁₆ prior to establishing any capability in the transponder installation were demonstrated in (Paragraph 5.6.5.2.1).

5.6.5.2.5 Required Servicing of Register 18₁₆ Associated with Register 21₁₆ (Paragraph 3.29.5.2.5)

Appropriate procedures to validate the setting of Register 18₁₆ bits associated with Register 21₁₆ prior to establishing any capability in the transponder installation were demonstrated in (Paragraph 5.6.5.2.1).

5.6.5.3 Mode S Specific Services Capability Report, Register 19₁₆ (Paragraph 3.29.1 and 3.29.5)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services Capability Report.

REGISTER 19 ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF”	“PC”	“RR”	“DF”	“IIS”	“RRS”	“X”	“LOS”	“XX”	“TMS”
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	9	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

Bits 33 –through- 88 (bits 1 –through- 56 of the “MB” field) set to ZERO (0) to indicate NO Capability has been established to service the BDS Codes designated in Register 19₁₆.

5.6.5.4 Mode S Specific Services Capability Report, Register 1A₁₆ (Paragraph 3.29.1 and 3.29.5)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 1A₁₆ Mode S Specific Services Capability Report.

REGISTER 1A ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF”	“PC”	“RR”	“DF”	“IIS”	“RRS”	“X”	“LOS”	“XX”	“TMS”
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	A	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

Bits 33 –through- 88 (bits 1 –through- 56 of the “MB” field) set to ZERO (0) to indicate NO Capability has been established to service the BDS Codes designated in Register 1A₁₆.

5.6.5.5 Mode S Specific Services Capability Report, Register 1B₁₆ (Paragraph 3.29.1 and 3.29.5)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 1B₁₆ Mode S Specific Services Capability Report.

REGISTER 1B ₁₆ , MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACT. EXTENDED DATA SOURCE INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” =	“PC” =	“RR” =	“DF” =	“IIS” =	“RRS” =	“X” =	“LOS” =	“XX” =	“TMS” =
4	0	17 (11 HEX)	7	0	B	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

Bits 33 –through- 88 (bits 1 –through- 56 of the “MB” field) set to ZERO (0) to indicate NO Capability has been established to service the BDS Codes designated in Register 1B₁₆.

5.6.5.6 Mode S Specific Services Capability Report, Register 1C₁₆ (Paragraph 3.29.1 and 3.29.5)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 1C₁₆ Mode S Specific Services Capability Report.

REGISTER 1C ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” =	“PC” =	“RR” =	“DF” =	“IIS” =	“RRS” =	“X” =	“LOS” =	“XX” =	“TMS” =
4	0	17 (11 HEX)	7	0	C	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

Bits 33 –through- 88 (bits 1 –through- 56 of the “MB” field) set to ZERO (0) to indicate NO Capability has been established to service the BDS Codes designated in Register 1C₁₆.

Note: Up to this point, the ELS Test Procedures have been written sequentially so as to align with the sequence of the requirements given in Paragraph 3.29. This was possible up to this point as neither Aircraft Identification nor Aircraft Registry data has been provided to the unit under test. Once data is being provided to the unit under test, the changing of the data drives changes into multiple registers at virtually the same time. This presents a problem in attempting to develop test procedures that sequentially track the requirements which have been stated on a register basis as opposed to a functional basis. Therefore, the remainder of the ELS Test Procedures are developed on a functional basis with traceability to the requirements in Paragraph 3.29 indicated in the procedures as appropriate.

5.6.6 Baseline Aircraft Identification and Aircraft Registration Testing (Paragraph 3.23.1.13, 3.29.6 and 3.29.7)

No test procedure required as such procedures are provided in the following subparagraphs.

5.6.6.1 Part 1: Aircraft Identification and Aircraft Registration Startup (Paragraph 3.23.1.13, 3.29.6 and 3.29.7)

Note 1: This Part includes validation that back to back broadcasts are generated by the transponder. The first broadcast for the change in Aircraft Identification data in Register 20₁₆ and the second broadcast for the change in Data Link Capability in Register 10₁₆ caused by the change in Register 10₁₆. Subsequent Parts of section 2.6. do not need to validate both broadcasts.

Note 2: Review all subparagraphs of Part 1 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.

a. **Data Initialization:** (Paragraph 3.29.6.2.1, 3.29.6.3.a, and 3.29.7.2)

(1). Provide the transponder with Aircraft Identification Data as specified in the following table at a minimum rate of once per second for each character provided.

Aircraft Identification Input Data				
Character Number (See Note 1)	Character	IA-5 Encoding (See Note 2)	ED-73C Encoding (See Note 3)	LSB Encoding (See Note 4)
1	“U”	1010101	010101	1010101
2	“J”	1001010	001010	0101001
3	“U”	1010101	010101	1010101
4	“J”	1001010	001010	0101001
5	“U”	1010101	010101	1010101
6	“J”	1001010	001010	0101001
7	“U”	1010101	010101	1010101
8	“J”	1001010	001010	0101001
9	“X”	1011000	011000	0001101
10	“Y”	1011001	011001	1001101

Notes:

- Aircraft Identification only uses eight characters in the downlink “MB” field; however, some equipments have indicated that ten input characters may be desired in the future. Therefore, this table provides for up to ten input characters.
- IA-5 refers to International Alphabet No. 5 (IA-5) as provided in Table 8-2 of ICAO Annex 10, Volume III, Part 1, Amendment 71, last update. Encoding is shown above being MSB left justified (e.g., b7, b6,b2, b1.).
- ED-73C encoding refers to ED-73C Paragraph Error! Reference source not found.f encoding which is equivalent to ICAO Annex 10, Volume IV, §3.1.2.9.1.2, Table 3-7. Encoding is shown above being MSB left justified (e.g., b6, b5, b2, b1.).
- LSB Encoding shows the IA-5 Encoding reversed with the LSB being Left Justified. This encoding is typical of serial input protocols which transmit data LSB first.

(2). **As an Option:**

Provide the transponder with Aircraft Registration Data as specified in the following table at a minimum rate of once per second for each character provided.

Aircraft Registration Input Data				
Character Number	Character	IA-5 Encoding (See Note 1)	ED-73C Encoding (See Note 2)	LSB Encoding (See Note 3)
1	“J”	1001010	001010	0101001
2	“U”	1010101	010101	1010101
3	“J”	1001010	001010	0101001
4	“U”	1010101	010101	1010101
5	“J”	1001010	001010	0101001
6	“U”	1010101	010101	1010101
7	“J”	1001010	001010	0101001
8	“U”	1010101	010101	1010101
9	“J”	1001010	001010	0101001

Notes:

- IA-5 refers to International Alphabet No. 5 (IA-5) as provided in Table 8-2 of ICAO Annex 10, Volume III, Part 1, Amendment 71, last update. Encoding is shown above being MSB left justified (e.g., b7, b6,b2, b1.).
- ED-73C encoding refers to ED-73C Paragraph Error! Reference source not found.f encoding which is equivalent to ICAO Annex 10, Volume IV, §3.1.2.9.1.2, Table 3-7. Encoding is shown above being MSB left justified (e.g., b6, b5, b2, b1.).
- LSB Encoding shows the IA-5 Encoding reversed with the LSB being Left Justified. This encoding is typical of serial input protocols which transmit data LSB first.

b. **Comm-B Broadcast and Aircraft Identification Verification:** (Paragraph 3.23.13.a,b,c,e and f, 3.29.3.3, 3.29.6.2.1 and 3.29.6.5)

For up to 10.0 seconds after completing Part 1, Step a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF” =	“PC” =	“RR” =	“DI” =	“IIS” =	“NOT ASSIGNED” =
4	0	18 (12 HEX)	0	0	0

Note 1: The interrogation should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated when Aircraft Identification Data is changed.

Within FIVE (5) seconds of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note 2: The 5 seconds is based on the update rate specified for Register 20₁₆.

“DR” = 4 or 5 if TCAS Information **IS NOT** available
(1).
= 6 or 7 if TCAS Information **IS** available.

(2). And the “MB” field of the reply provides Aircraft Identification Data as follows:

Note 3: “DR” = 4, 5, 6, or 7 indicates that Broadcast information is available.

Part 1. b.(2). DF = 20, Register 20 ₁₆ - Aircraft Identification "MB" Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
"MB" Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	010101	001010	010101	001010	010101	001010	010101	001010
Character:		"U"	"J"	"U"	"J"	"U"	"J"	"U"	"J"

As soon as "DR" = 4, 5, 6, or 7 is observed, start a Test Timer in order to monitor the "B" timer.

Note 4: At this time, the "B" timer should be running due to the annunciation of a broadcast due to a change in the contents of Register 20₁₆. The annunciation should persist for 18 +/- 1 second.

- c. **Comm-B Broadcast Extraction due to Aircraft Identification Change:** (Paragraph 3.23.1.13.e, 3.29.3.2.1, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.3.b, 3.29.3.4 and 3.29.6.3)

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 1, Step b, interrogate the transponder with the following Comm-B Broadcast Extraction interrogations in order to extract the Comm-B broadcast message which should be the Aircraft Identification contained in Register 20₁₆.

COMM-B BROADCAST EXTRACTION INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				"SD"					
"UF"	"PC"	"RR"	"DI"	"IIS"	"RRS"	"X"	"LOS"	"XX"	"TMS"
=	=	=	=	=	=	=	=	=	=
4	0	16 (10 HEX)	7	0	0	0	0	0	0

Verify that the transponder replies with a "DF" = 20 reply with the "MB" field providing Aircraft Identification data as follows:

Part 1. c. DF = 20, Register 20 ₁₆ - Aircraft Identification "MB" Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
"MB" Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	010101	001010	010101	001010	010101	001010	010101	001010
Character:		"U"	"J"	"U"	"J"	"U"	"J"	"U"	"J"

- d. **Comm-B Broadcast due to Data Link Capability Change Extraction:** (Paragraph 3.29.3.2.1, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.3.b, 3.29.3.4 and 3.29.6.3)

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). Bit 33 –through- 40 (bit 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,

Note 1: At this time, the “B” timer started in Part 1.b. should have expired and a second (e.g., new) “B” Timer started to announce a Datalink Capability Report Change for 18 +/- 1 seconds. Verification that the first “B” Timer has expired is demonstrated by the transponder replying with the contents of Register 10₁₆ as opposed to Register 20₁₆.

As soon as the reply specified above in this step is observed, start a new Test Timer in order to monitor the “B” timer.

Verify that the elapsed time of the Test Timer started in Part 1.b. is 18 +/- 1 second.

e. **Comm-B Broadcast due to Data Link Capability Change Termination:**

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 “DR” NOT EQUAL to 4, 5, 6, or 7.

Verify that the elapsed time of the Test Timer started in Part 1.d (e.g., the last step) is 18 +/- 1 second.

Note: At this time, the “B” timer started in Part 1.d. as broadcast due to a change in Data Link Capability should have terminated.

f. **Aircraft Registration Verification: (Optional)** (Paragraph 3.29.7.1, 3.29.7.2 and 3.29.7.3)

Note 1: Servicing of Register 21₁₆ is Optional.

Stop providing data as specified in Part 1, Step a.(2) for a period of 20 seconds, then restart providing the same data to the transponder.

Within 15 seconds of providing such Aircraft Registration data interrogate the transponder with the following GICB Extraction interrogations in order to extract the Register 21₁₆ - Aircraft Registration.

Note 2: The 15 seconds is based on the update rate specified for Register 21₁₆

REGISTER 21 ₁₆ AIRCRAFT REGISTRATION GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” =	“PC” =	“RR” =	“DF” =	“IIS” =	“RRS” =	“X” =	“LOS” =	“XX” =	“TMS” =
4	0	18 (12 HEX)	7	0	1	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply having the following “MB” field:

Part 1. f DF = 20, Register 21 ₁₆ - Aircraft Registration “MB” Field											
Reply Bits:	33	34 -- 39	40 -- 45	46 -- 51	52 -- 57	58 -- 63	64 -- 69	70 --75	76	77 -- 82	83 -- 88
“MB” Bits:	1	2 -- 7	8 -- 13	14 -- 19	20 -- 25	26 -- 31	32 -- 37	38 -- 43	44	45 -- 50	51 -- 56
Field:	Status	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Status	Char. 1	Char. 2
Data:	1	001010	010101	001010	010101	001010	010101	001010	0	000000	000000
Character:		“J”	“U”	“J”	“U”	“J”	“U”	“J”			

- g. **Data Link Capability Report, Register 10₁₆:** (Paragraph 3.23.1.13.d, 3.29.3.1, 3.29.3.2.1, 3.29.3.2.3, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.2.6, 3.29.3.3.b, 3.29.4.4 and 3.29.6.4.1)

Discontinue providing the transponder with Aircraft Identification (Part 1, Step a.(1)) and Aircraft Registration data (Part 1, Step a.(2)). Then Repeat Part 1, Step a. and Step b.

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 1. Step b in accordance with the previous paragraph, interrogate the transponder with the following GICB Extraction interrogations in order to extract the Register 10₁₆ Data Link Capability Report.

REGISTER 10 ₁₆ DATA LINK CAPABILITY GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
					"SD"
"UF"	"PC"	"RR"	"DI"	"IIS"	"NOT ASSIGNED"
=	=	=	=	=	=
4	0	17 (11 HEX)	0	0	0

Within SIX (6) seconds of starting the interrogations, verify that the transponder replies with a "DF" = 20 reply with:

Note: The SIX (6) seconds is based on the five second update rate specified for Register 17₁₆ plus the one second update rate for Register 10₁₆ to update Bit 68.

- (1). Bit 33 –through- 40 (bit 1 –through- 8 of the "MB" field) set to 10 HEX (0001 0000).
- (2). Bit 65 ["AIS" subfield (bit 33 of the "MB" field)] set to ONE (1) to indicate Aircraft Identification capability,

- Bit 57 [Mode S Specific Services Capability (bit 25 of the "MB" field)] set to
- (3). ZERO (0) to indicate NO Mode S Specific Services Capability,

Note 1: Servicing of Registers 02₁₆, 03₁₆, 04₁₆, 10₁₆, 17₁₆ to 1C₁₆, 20₁₆ and 30₁₆ does not constitute Mode S Specific Services Capability.

Note 2: If Register 21₁₆ is being serviced, then Bit 57 (bit 25 of the "MB" field) is set to ONE (1).

- (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,
- (5). Bit 68 [Common Usage GICB Capability Report (bit 36 of the "MB" field)] set to ONE (1) to indicate that there has been a change in the Common Usage GICB Capability Report, Register 17₁₆.

- h. **Common Usage GICB Capability Report, Register 17₁₆:** (Paragraph 3.29.4.2, 3.29.4.3, 3.29.6.4.2 and 3.29.7.4.1)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17₁₆ Common Usage GICB Capability Report:

REGISTER 17 ₁₆ COMMON USAGE GICB CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				"SD"					
"UF"	"PC"	"RR"	"DI"	"IIS"	"RRS"	"X"	"LOS"	"XX"	"TMS"
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	7	0	0	0	0

Within **FIVE** (5) seconds of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 5 seconds is based on the update rate specified for Register 17₁₆.*

- (1). Bit **39** (7 of the “MB” field) set to ONE (1) to indicate that Aircraft Identification Capability is established.
- (2). Bit **40** (8 of the “MB” field) set to ONE (1) to indicate that Aircraft Registration Capability is established.

Note: *If Register 21₁₆ is not being serviced, then Bit 40 (bit 8 of the “MB” field) is set to ZERO (0).*

- i. **Mode S Specific Services GICB Capability, Register 18₁₆:** (Paragraph 3.29.5.2, 3.29.5.3.a and b, 3.29.6.4.3 and 3.29.7.4.2)

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 1, Step b as required in Part 1, Step g, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 18₁₆ Mode S Specific Services GICB Capability:

REGISTER 18 ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP											
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32		
				“SD”							
“UF” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DI” = 7	“IIS” = 0	“RRS” = 8	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0		

Within **FIVE** (5) seconds of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 5 seconds is based on the update rate specified for Register 18₁₆.*

- (1). Bit **73** (41 of the “MB” field) set to ONE (1) to indicate that Data Link Capability 10₁₆ is established.
- (2). Bit **57** (25 of the “MB” field) set to ONE (1) to indicate that Aircraft Identification Capability 20₁₆ is established.
- (3). Bit **56** (24 of the “MB” field) set to ONE (1) to indicate that Aircraft Registration Capability 21₁₆ is established.
- (4). Bit **66** (34 of the “MB” field) set to ONE (1) to indicate that Register 17₁₆ Servicing Capability is established.
- (5). Bit **65** (33 of the “MB” field) set to ONE (1) to indicate that Register 18₁₆ Servicing Capability is established.

5.6.6.2 Part 2: Aircraft Identification Data Termination

Note 1: *This Part 2 validates that character data in Register 20₁₆ is set to zero when Aircraft Identification data is lost and not replaced by Aircraft Registration data if such data is available.*

Note 2: *Review all subparagraphs of Part 2 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.*

a. **Aircraft Identification Data Termination:** (Paragraph 3.29.6.2.1 and 3.29.7.2)

Discontinue the provision of Aircraft Identification data to the transponder. Continue to provide Aircraft Registration data as required in Part 1.a. and restarted in Part 1.g.

b. **Comm-B Broadcast and Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c,e and f, 3.29.6.2.1 and 3.29.6.5)

For up to 10.0 seconds after completing Part 2.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				"SD"	
"UF"	"PC"	"RR"	"DI"	"IIS"	"NOT ASSIGNED"
=	=	=	=	=	=
4	0	18 (12 HEX)	0	0	0

Note 1: The interrogation should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated when Aircraft Identification Data is changed.

Within TEN (10) seconds of completing Part 2.a, verify that the transponder replies with a "DF" = 20 reply with:

Note 2: The 10 seconds is based on the twice the update rate specified for Register 20₁₆.

- (1). "DR" = 4 or 5 if TCAS Information **IS NOT** available
 = 6 or 7 if TCAS Information **IS** available.

(2). And the "MB" field of the reply provides Aircraft Identification Data as follows:

Part 2. b.(2). DF = 20, Register 20 ₁₆ - Aircraft Identification "MB" Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
"MB" Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	000000	000000	000000	000000	000000	000000	000000	000000
Character:		"NUL"							

c. **Comm-B Broadcast Extraction:** (Paragraph 3.23.1.13.e, 3.29.3.2.1, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.3.a and b, 3.29.3.4 and 3.29.6.3)

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 2, Step b, interrogate the transponder with the following Comm-B Extraction interrogations in order to extract the Comm-B broadcast message which should be the Data Link Capability Report contained in Register 10₁₆.

COMM-B BROADCAST EXTRACTION INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				"SD"					
"UF"	"PC"	"RR"	"DI"	"IIS"	"RRS"	"X"	"LOS"	"XX"	"TMS"
=	=	=	=	=	=	=	=	=	=
4	0	16 (10 HEX)	7	0	0	0	0	0	0

Within **ONE** (1) second of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 1 second is based on the update rate specified for Register 10₁₆.*

- (1). “DR” = 4 or 5 if TCAS Information **IS NOT** available
 = 6 or 7 if TCAS Information **IS** available.
- (2). Bit **33** –through- **40** (bit 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 ZERO (0) to indicate loss of Aircraft Identification capability,

d. **Common Usage GICB Capability Report, Register 17₁₆:** (Paragraph 3.29.4.1, 3.29.4.2, 3.29.4.3, 3.29.4.4, 3.29.7.1 and 3.29.7.2)

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 2, Step b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17₁₆ Common Usage GICB Capability Report:

REGISTER 17 ₁₆ COMMON USAGE GICB CAPABILITY GICB EXTRACTION									
EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” =	“PC” =	“RR” =	“DF” =	“IIS” =	“RRS” =	“X” =	“LOS” =	“XX” =	“TMS” =
4	0	17 (11 HEX)	7	0	7	0	0	0	0

Within **FIVE** (5) seconds of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 5 seconds is based on the update rate specified for Register 17₁₆.*

- (1). Bit **39** (**7** of the “MB” field) set to ZERO (0) to indicate that Aircraft Identification Capability has changed.
- (2). Bit **40** (**8** of the “MB” field) set to ONE (1) to indicate that Aircraft Registration Capability is established.

Note: *Bit 40 will be set to ZERO (0) if Aircraft Registration data is not being provided as provision of such data is optional.*

e. **Mode S Specific Services GICB Capability, Register 18₁₆:** (Paragraph 3.29.3.1, 3.29.3.2.1, 3.29.3.2.3, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.2.6, 3.29.5.1, 3.29.5.2.3, 3.29.5.3 and 3.29.6.4.3)

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 2, Step b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 18₁₆ Mode S Specific Services GICB Capability:

REGISTER 18 ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF”	“PC”	“RR”	“DI”	“IIS”	“RRS”	“X”	“LOS”	“XX”	“TMS”
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	8	0	0	0	0

Within **FIVE** (5) seconds of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 5 seconds is based on the update rate specified for Register 18₁₆.*

- (1). Bit **57** (**25** of the “MB” field) set to ONE (1) to indicate that Aircraft Identification Capability is established.
- (2). Bit **56** (**24** of the “MB” field) set to ONE (1) to indicate that Aircraft Registration Capability is established.

Note: *Bit 56 will be set to ZERO (0) if Aircraft Registration data is not being provided as provision of such data is optional.*

- (3). Bit **66** (**34** of the “MB” field) set to ONE (1) to indicate that Register 17₁₆ Servicing Capability is established.
- (4). Bit **65** (**33** of the “MB” field) set to ONE (1) to indicate that Register 18₁₆ Servicing Capability is established.

5.6.6.3 PART 3: Power-On Restart (NO Aircraft Ident.)

Note 1: *This Part 3 verifies that Optional Aircraft Registration data (if provided) is used at power-on for Aircraft Identification if actual Aircraft Identification data is not provided.*

Note 2: *Review all subparagraphs of Part 3 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.*

- a. **Power-On Restart:** (Paragraph 3.29.6.2.1 and 3.29.7.2)

Remove power from the transponder for approximately 10 seconds.

Continue application of Aircraft Registration data to the transponder as defined in Part 1.a. Do not re-apply Aircraft Identification data to the transponder at this time.

Re-apply power to the transponder.

- b. **Comm-B Broadcast and Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c,e and f, 3.29.3.3, 3.29.6.2.1 and 3.29.6.5)

For up to 10.0 seconds after completing Part 3.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification (now Aircraft Registration) data.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				"SD"	
"UF"	"PC"	"RR"	"DI"	"IIS"	"NOT ASSIGNED"
=	=	=	=	=	=
4	0	18 (12 HEX)	0	0	0

Note 1: The interrogation should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated when Aircraft Identification Data is changed.

Within TEN (10) seconds of completing Part 3.a, verify that the transponder replies with a "DF" = 20 reply with:

Note 2: The 10 seconds is based on the twice the update rate specified for Register 20₁₆.

- (1). "DR" = 4 or 5 if TCAS Information **IS NOT** available
 = 6 or 7 if TCAS Information **IS** available.
- (2). And the "MB" field of the reply provides Aircraft Identification (now Aircraft Registration) Data as follows:

Part 3. b.(2). DF = 20, Register 20 ₁₆ - Aircraft Identification (now Aircraft Registration) "MB" Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
"MB" Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	001010	010101	001010	010101	001010	010101	001010	010101
Character:		"J"	"U"	"J"	"U"	"J"	"U"	"J"	"U"

- c. **Comm-B Broadcast Extraction:** (Paragraph 3.23.1.13.e, 3.29.3.2.1, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.3.b, 3.29.3.4 and 3.29.6.3)

Note 1: This test does not repeat testing of the timing of the "B" Timer as was done in Part 1. Rather, it is intended only to demonstrate that the broadcast is generated and contains the proper information.

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 3, Step b, interrogate the transponder with the following Comm-B Extraction interrogations in order to extract the Comm-B broadcast message which should be the Data Link Capability Report contained in Register 10₁₆.

COMM-B BROADCAST EXTRACTION INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				"SD"					
"UF"	"PC"	"RR"	"DI"	"IIS"	"RRS"	"X"	"LOS"	"XX"	"TMS"
=	=	=	=	=	=	=	=	=	=
4	0	16 (10 HEX)	7	0	0	0	0	0	0

Within **ONE** (1) second of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note 2: *The 1 second is based on the update rate specified for Register 10₁₆.*

- (1). “DR” = 4 or 5 if TCAS Information **IS NOT** available
 = 6 or 7 if TCAS Information **IS** available.
- (2). Bit **33** –through- **40** (bit 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.

d. **Common Usage GICB Capability Report, Register 17₁₆:** (Paragraph 3.29.4.2, 3.29.4.3, 3.29.6.4.2 and 3.29.7.4.1)

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 3, Step b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17₁₆ Common Usage GICB Capability Report:

REGISTER 17 ₁₆ COMMON USAGE GICB CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DI” = 7	“IIS” = 0	“RRS” = 7	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

Within **FIVE** (5) seconds of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 5 seconds is based on the update rate specified for Register 17₁₆.*

- (1). Bit **39** (7 of the “MB” field) set to ONE (1) to indicate that Aircraft Identification Capability has changed.
- (2). Bit **40** (8 of the “MB” field) set to ONE (1) to indicate that Aircraft Registration Capability is established.

e. **Mode S Specific Services GICB Capability, Register 18₁₆:** (Paragraph 3.29.5 3.29.6.4.3 and 3.29.7.4.2)

As soon as the transponder has replied with the proper Register 20₁₆ reply in Part 3, Step b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 18₁₆ Mode S Specific Services GICB Capability:

REGISTER 18 ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DI” = 7	“IIS” = 0	“RRS” = 8	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

Within **FIVE** (5) seconds of starting the interrogations, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 5 seconds is based on the update rate specified for Register 18₁₆.*

- (1). Bit **57** (**25** of the “**MB**” field) set to “**1**” to indicate that Aircraft Identification Capability has been established during the power-on cycle.
- (2). Bit **56** (**24** of the “**MB**” field) set to “**1**” to indicate that Aircraft Registration Capability is established.
- (3). Bit **66** (**34** of the “**MB**” field) set to “**1**” to indicate that Register 17₁₆ Servicing Capability is established.
- (4). Bit **65** (**33** of the “**MB**” field) set to “**1**” to indicate that Register 18₁₆ Servicing Capability is established.

5.6.6.4 PART 4: Re-Apply Aircraft Identification

No test procedure required.

Note 1: *This Part 4 verifies that Aircraft Identification data will replace Aircraft Registration data once such Aircraft Identification data is available.*

Note 2: *Review all subparagraphs of Part 4 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.*

a. **Aircraft Identification Restart:** (Paragraph 3.29.6.2.1 and 3.29.7.2)

Continue application of Aircraft Registration data to the transponder as defined in Part 1.a. Re-apply Aircraft Identification data to the transponder as defined in Part 1.a.

b. **Comm-B Broadcast and Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c,e and f, 3.29.3.3, 3.29.6.2.1 and 3.29.6.5)

For up to **10.0** seconds after completing Part 4.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification data.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF”	“PC”	“RR”	“DF”	“IIS”	“NOT ASSIGNED”
=	=	=	=	=	=
4	0	18 (12 HEX)	0	0	0

Within **TEN** (10) seconds of completing Part 4.a, verify that the transponder replies with a “DF” = 20 reply with:

Note: *The 10 seconds is based on the twice the update rate specified for Register 20₁₆.*

- (1). “DR” = 4 or 5 if TCAS Information **IS NOT** available
 = 6 or 7 if TCAS Information **IS** available.
- (2). And the “**MB**” field of the reply provides Aircraft Identification Data as follows

Part 4. b.(2). DF = 20, Register 20 ₁₆ - Aircraft Identification "MB" Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
"MB" Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	010101	001010	010101	001010	010101	001010	010101	001010
Character:		"U"	"J"	"U"	"J"	"U"	"J"	"U"	"J"

- c. **Comm-B Broadcast Extraction:** (Paragraph 3.23.1.13.e, 3.29.3.2.1, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.3.b, 3.29.3.4 and 3.29.6.3)

Note: This test does not repeat testing of the timing of the "B" Timer as was done in Part 1. Rather, it is intended only to demonstrate that the broadcast is generated and contains the proper information.

Interrogate the transponder with the following Comm-B Extraction interrogation in order to extract the Comm-B broadcast message which should be the Aircraft Identification contained in Register 20₁₆.

COMM-B BROADCAST EXTRACTION INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				"SD"					
"UF"	"PC"	"RR"	"DP"	"IIS"	"RRS"	"X"	"LOS"	"XX"	"TMS"
=	=	=	=	=	=	=	=	=	=
4	0	16 (10 HEX)	7	0	0	0	0	0	0

Verify that 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). And the "MB" field of the reply provides Aircraft Identification Data as follows

Part 4. c.(2). DF = 20, Register 20 ₁₆ - Aircraft Identification - "MB" Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
"MB" Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	010101	001010	010101	001010	010101	001010	010101	001010
Character:		"U"	"J"	"U"	"J"	"U"	"J"	"U"	"J"

- d. **Common Usage GICB Capability Report, Register 17₁₆:** (Paragraph 3.29.4.2, 3.29.4.3, 3.29.6.4.2 and 3.29.7.4.1)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17₁₆ Common Usage GICB Capability Report:

REGISTER 17 ₁₆ COMMON USAGE GICB CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				"SD"					
"UF"	"PC"	"RR"	"DP"	"IIS"	"RRS"	"X"	"LOS"	"XX"	"TMS"
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	7	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

- (1). Bit 39 (7 of the “MB” field) set to “1” to indicate that Aircraft Identification Capability has changed.
- (2). Bit 40 (8 of the “MB” field) set to “1” to indicate that Aircraft Registration Capability is established.

e. **Mode S Specific Services GICB Capability, Register 18₁₆:** (Paragraph 3.29.5 3.29.6.4.3 and 3.29.7.4.2)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 18₁₆ Mode S Specific Services GICB Capability:

REGISTER 18 ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 ---- 5	6 ---- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27—28	29 --- 32
				“SD”					
“UF”	“PC”	“RR”	“DF”	“IIS”	“RRS	“X”	“LOS”	“XX”	“TMS”
=	=	=	=	=	=	=	=	=	=
4	0	17 (11 HEX)	7	0	8	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply with:

- (1). Bit 57 (25 of the “MB” field) set to “1” to indicate that Aircraft Identification Capability has been established during the power-on cycle.
- (2). Bit 56 (24 of the “MB” field) set to “1” to indicate that Aircraft Registration Capability is established.
- (3). Bit 66 (34 of the “MB” field) set to “1” to indicate that Register 17₁₆ Servicing Capability is established.
- (4). Bit 65 (33 of the “MB” field) set to “1” to indicate that Register 18₁₆ Servicing Capability is established.

5.6.6.5

PART 5: Data Mix #1

Note: Review all subparagraphs of Part 5 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.

a. **Data Mix #1 Initialization:** (Paragraph 3.29.6.2.1 and 3.29.7.2)

- (1). Provide the transponder with Aircraft Identification Data as specified in the following table at a minimum rate of once per second for each character provided.

Aircraft Identification Input Data				
Character Number (See Note 1)	Character	IA-5 Encoding (See Note 2)	ED-73C Encoding (See Note 3)	LSB Encoding (See Note 4)
1	“6”	0110110	110110	0110110
2	“SP”	0100000	100000	0000010
3	“9”	0111001	111001	1001110
4	“SP”	0100000	100000	0000010
5	“6”	0110110	110110	0110110
6	“SP”	0100000	100000	0000010
7	“9”	0111001	111001	1001110
8	“SP”	0100000	100000	0000010
9	“X”	1011000	011000	0001101
10	“Y”	1011001	011001	1001101

Notes:

1. Aircraft Identification only uses eight characters in the downlink “MB” field; however, some equipments have indicated that ten input characters may be desired in the future. Therefore, this table provides for up to ten input characters.
2. IA-5 refers to International Alphabet No. 5 (IA-5) as provided in Table 8-2 of ICAO Annex 10, Volume III, Part 1, Amendment 71, last update. Encoding is shown above being MSB left justified (e.g., b7, b6,b2, b1.).
3. ED-73C encoding refers to ED-73C Paragraph Error! Reference source not found.f encoding which is equivalent to ICAO Annex 10, Volume IV, §3.1.2.9.1.2, Table 3-7. Encoding is shown above being MSB left justified (e.g., b6, b5, b2, b1.).
4. LSB Encoding shows the IA-5 Encoding reversed with the LSB being Left Justified. This encoding is typical of serial input protocols which transmit data LSB first.

(2). Provide the transponder with Aircraft Registration Data as specified in the following table at a minimum rate of once per second for each character provided.

Aircraft Registration Input Data				
Character Number	Character	IA-5 Encoding (See Note 1)	ED-73C Encoding (See Note 2)	LSB Encoding (See Note 3)
1	“W”	1010111	010111	1110101
2	“X”	1011000	011000	0001101
3	“SP”	0100000	100000	0000010
4	“Y”	1011001	011001	1001101
5	“Z”	1011010	011010	0101101
6	“SP”	0100000	100000	0000010
7	“4”	0110100	110100	0010110
8	“2”	0110010	110010	0100110
9	“SP”	0100000	100000	0000010

Notes:

1. IA-5 refers to International Alphabet No. 5 (IA-5) as provided in Table 8-2 of ICAO Annex 10, Volume III, Part 1, Amendment 71, last update. Encoding is shown above being MSB left justified (e.g., b7, b6,b2, b1.).
2. ED-73C encoding refers to ED-73C Paragraph Error! Reference source not found.f encoding which is equivalent to ICAO Annex 10, Volume IV, §3.1.2.9.1.2, Table 3-7. Encoding is shown above being MSB left justified (e.g., b6, b5, b2, b1.).
3. LSB Encoding shows the IA-5 Encoding reversed with the LSB being Left Justified. This encoding is typical of serial input protocols which transmit data LSB first.

- b. **Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c and f, 3.29.6.1 and 3.29.6.2.1)

For up to **10.0** seconds after completing Part 5.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification data.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF” =	“PC” =	“RR” =	“DF” =	“IIS” =	“NOT ASSIGNED” =
4	0	18 (12 HEX)	0	0	0

Within **TEN** (10) seconds of completing Part 5.a, verify that the transponder replies with a “DF” = 20 reply with:

Note: The 10 seconds is based on the twice the update rate specified for Register 20₁₆.

Part 5. b. DF = 20, Register 20 ₁₆ - Aircraft Identification “MB” Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
“MB” Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	110110	111001	110110	111001	011000	011001	100000	100000
Character:		“6”	“9”	“6”	“9”	“X”	“Y”	“SP”	“SP”

- c. **Aircraft Registration Verification:** (Paragraph 3.29.6.2.1, 3.29.7.1 and 3.29.7.2)

Within **30.0** seconds of completing Part 5.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 21₁₆ - Aircraft Registration.

REGISTER 21 ₁₆ AIRCRAFT REGISTRATION GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” =	“PC” =	“RR” =	“DF” =	“IIS” =	“RRS” =	“X” =	“LOS” =	“XX” =	“TMS” =
4	0	18 (12 HEX)	7	0	1	0	0	0	0

Verify that the transponder replies with a “DF” = 20 reply and that the “MB” field of the reply provides Aircraft Registration Data as follows:

Part 5. c. DF = 20, Register 21 ₁₆ - Aircraft Registration “MB” Field											
Reply Bits:	33	34 -- 39	40 -- 45	46 -- 51	52 -- 57	58 -- 63	64 -- 69	70 --75	76	77 -- 82	83 -- 88
“MB” Bits:	1	2 -- 7	8 -- 13	14 -- 19	20 -- 25	26 -- 31	32 -- 37	38 -- 43	44	45 -- 50	51 -- 56
Field:	Status	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Status	Char. 1	Char. 2
Data:	1	010111	011000	011001	011010	110100	110010	100000	0	000000	000000
Character:		“W”	“X”	“Y”	“Z”	“4”	“2”	“SP”			

5.6.6.6 PART 6: Data Mix #2

Note: Review all subparagraphs of Part 6 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.

- a. **Data Mix #2 Initialization:** (Paragraph 3.29.6.2.1 and 3.29.7.2)

(1). Provide the transponder with Aircraft Identification Data as specified in the following table at a minimum rate of once per second for each character provided.

Aircraft Identification Input Data				
Character Number (See Note 1)	Character	IA-5 Encoding (See Note 2)	ED-73C Encoding (See Note 3)	LSB Encoding (See Note 4)
1	“SP”	0100000	100000	0000010
2	“SP”	0100000	100000	0000010
3	“SP”	0100000	100000	0000010
4	“SP”	0100000	100000	0000010
5	“D”	1000100	000100	0010001
6	“L”	1001100	001100	0011001
7	“SP”	0100000	100000	0000010
8	“4”	0110100	110100	0010110
9	“SP”	0100000	100000	0000010
10	“5”	0110101	110101	1010110

Notes:

1. Aircraft Identification only uses eight characters in the downlink “MB” field; however, some equipments have indicated that ten input characters may be desired in the future. Therefore, this table provides for up to ten input characters.
2. IA-5 refers to International Alphabet No. 5 (IA-5) as provided in Table 8-2 of ICAO Annex 10, Volume III, Part 1, Amendment 71, last update. Encoding is shown above being MSB left justified (e.g., b7, b6,b2, b1.).
3. ED-73C encoding refers to ED-73C Paragraph Error! Reference source not found.f encoding which is equivalent to ICAO Annex 10, Volume IV, §3.1.2.9.1.2, Table 3-7. Encoding is shown above being MSB left justified (e.g., b6, b5, b2, b1.).
4. LSB Encoding shows the IA-5 Encoding reversed with the LSB being Left Justified. This encoding is typical of serial input protocols which transmit data LSB first.

(2). Provide the transponder with Aircraft Registration Data as specified in the following table at a minimum rate of once per second for each character provided.

b. **Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c and f, 3.29.6.1 and 3.29.6.2.1)

Within TEN (10) seconds of completing Part 6.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification data.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF” =	“PC” =	“RR” =	“DI” =	“IIS” =	“NOT ASSIGNED” =
4	0	18 (12 HEX)	0	0	0

Within TEN (10) seconds of completing Part 6.a, verify that the transponder replies with a “DF” = 20 reply with:

Note: The 10 seconds is based on the twice the update rate specified for Register 20₁₆.

Part 6. b. DF = 20, Register 20 ₁₆ - Aircraft Identification “MB” Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
“MB” Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	000100	001100	110100	110101	100000	100000	100000	100000
Character:		“D”	“L”	“4”	“5”	“SP”	“SP”	“SP”	“SP”

c. **Aircraft Registration Verification:** (Paragraph 3.29.6.2.1, 3.29.71 and 3.29.7.2)

Within **30.0** seconds of completing Part 6.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 21₁₆ - Aircraft Registration.

REGISTER 21 ₁₆ AIRCRAFT REGISTRATION GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				"SD"					
"UF" = 4	"PC" = 0	"RR" = 18 (12 HEX)	"DI" = 7	"IIS" = 0	"RRS" = 1	"X" = 0	"LOS" = 0	"XX" = 0	"TMS" = 0

Verify that the transponder replies with a "DF" = **20** reply and that the "MB" field of the reply provides Aircraft Registration Data as follows:

Part 6. c. DF = 20, Register 21 ₁₆ - Aircraft Registration "MB" Field											
Reply Bits:	33	34 -- 39	40 -- 45	46 -- 51	52 -- 57	58 -- 63	64 -- 69	70 -- 75	76	77 -- 82	83 -- 88
"MB" Bits:	1	2 -- 7	8 -- 13	14 -- 19	20 -- 25	26 -- 31	32 -- 37	38 -- 43	44	45 -- 50	51 -- 56
Field:	Status	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Status	Char. 1	Char. 2
Data:	1	000100	001100	110100	110100	100000	100000	100000	0	000000	000000
Character:		"D"	"L"	"4"	"4"	"SP"	"SP"	"SP"			

5.6.6.7 **PART 7: Data Mix 4 - No Data**

Note: Review all subparagraphs of Part 8 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.

a. **Data Mix #4 Initialization:** (Paragraph 3.29.6.2.1 and 3.29.7.2)

- (1). Disable the capability to provide the transponder with Aircraft Identification Data.
- (2). Disable the capability to provide the transponder with Aircraft Registration Data.

b. **Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c and f, 3.29.6.1, 3.29.6.2.1 and 3.29.6.3)

Within **TEN** (10) seconds of completing Part 7.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification data.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				"SD"	
"UF" = 4	"PC" = 0	"RR" = 18 (12 HEX)	"DI" = 0	"IIS" = 0	"NOT ASSIGNED" = 0

Verify that the transponder replies with a "DF" = **20** reply and that the "MB" field of the reply provides Aircraft Identification Data as follows:

Note: The 10 seconds is based on the twice the update rate specified for Register 20₁₆.

Part 6. b. DF = 20, Register 20 ₁₆ - Aircraft Identification "MB" Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 -- 76	77 -- 82	83 -- 88
"MB" Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	000000	000000	000000	000000	000000	000000	000000	000000
Character:		"NUL"							

c. **Aircraft Registration Verification:** (Paragraph 3.29.6.2.1, 3.29.7.1, 3.29.7.2 and 3.29.7.3)

Within **30.0** seconds of completing Part 7.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 21₁₆ - Aircraft Registration.

Note: The 30 seconds is based on the twice the update rate specified for Register 21₁₆

REGISTER 21 ₁₆ AIRCRAFT REGISTRATION GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” = 4	“PC” = 0	“RR” = 18 (12 HEX)	“DI” = 7	“IIS” = 0	“RRS” = 1	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

Verify that the transponder replies with a “DF” = 20 reply and that the “MB” field of the reply provides Aircraft Registration Data as follows:

Part 6. c. DF = 20, Register 21 ₁₆ - Aircraft Registration “MB” Field											
Reply Bits:	33	34 -- 39	40 -- 45	46 -- 51	52 -- 57	58 -- 63	64 -- 69	70 --75	76	77 -- 82	83 -- 88
“MB” Bits:	1	2 -- 7	8 -- 13	14 -- 19	20 -- 25	26 -- 31	32 -- 37	38 -- 43	44	45 -- 50	51 -- 56
Field:	Status	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Status	Char. 1	Char. 2
Data:	1	000000	000000	000000	000000	000000	000000	000000	0	000000	000000
Character:		“NUL”									

d. **Common Usage GICB Capability Report, Register 17₁₆:** (Paragraph 3.29.4.2, 3.29.4.3, 3.29.6.4.2 and 3.29.7.4.1)

Within **TEN** (10) seconds of completing Part 7.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17₁₆ Common Usage GICB Capability Report:

REGISTER 17 ₁₆ COMMON USAGE GICB CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP									
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 -- 24	25	26	27--28	29 --- 32
				“SD”					
“UF” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DI” = 7	“IIS” = 0	“RRS” = 7	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

Verify that the transponder replies with a “DF” = 20 reply with:

- (1). Bit **39** (7 of the “MB” field) set to ZERO (0) to indicate that Aircraft Identification Capability has been lost.
- (2). Bit **40** (8 of the “MB” field) set to ZERO (0) to indicate that Aircraft Registration Capability has been lost.

5.6.6.8 PART 8: Data Link Capability Report Update Interval (Paragraph 3.29.3.3)

a. **Data Initialization:** (Paragraph 3.29.6.2.1 and 3.29.6.3.a)

After completion of Part 7, re-apply Aircraft Identification Data as specified in Part 1.a.(1).

- b. **Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c and f, 3.29.6.1 and 3.29.6.2.1)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification data.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF” =	“PC” =	“RR” =	“DI” =	“IIS” =	“NOT ASSIGNED” =
4	0	18 (12 HEX)	0	0	0

Verify that the transponder replies with the following “DF” = 20 reply:

Part 8. b. DF = 20, Register 20 ₁₆ - Aircraft Identification “MB” Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
“MB” Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	010101	001010	010101	001010	010101	001010	010101	001010
Character:		“U”	“J”	“U”	“J”	“U”	“J”	“U”	“J”

- c. **Data Link Capability Report, Register 10₁₆:** (Paragraph 3.23.1.13.d, 3.29.3.1, 3.29.3.2.1, 3.29.3.2.3, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.2.6, 3.29.3.3.a and b, 3.29.4.4 and 3.29.6.4.1)

As soon as the transponder replies with the reply required in Part 8.b., interrogate the transponder with the following interrogation:

REGISTER 10 ₁₆ DATA LINK CAPABILITY GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF” =	“PC” =	“RR” =	“DI” =	“IIS” =	“NOT ASSIGNED” =
4	0	17 (11 HEX)	0	0	0

Within **ONE** (1) second of initiating the above interrogation, verify that the transponder replies with a “DF” = 20 reply with:

- (1). Bit **33** –through- **40** (bit **1** –through- **8** of the “MB” field) set to 10 HEX (**0001 0000**).
- (2). Bit **65** [“AIS” subfield (bit **33** of the “MB” field)] set to ONE (1) to indicate Aircraft Identification capability,
- (3). Bit **57** [Mode S Specific Services Capability (bit **25** of the “MB” field)] set to ZERO (0) to indicate NO Mode S Specific Services Capability,
Note: Servicing of Registers 02₁₆, 03₁₆, 04₁₆, 10₁₆, 17₁₆ to 1C₁₆, 20₁₆ and 30₁₆ does not constitute Mode S Specific Services 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,

- d. **Aircraft Identification Termination:** (Paragraph 3.29.6.2.1, and 3.29.6.3.a)

Terminate provisioning of the Aircraft Identification data started in Part 8.a.

- e. **Aircraft Identification Verification:** (Paragraph 3.23.1.13.a,b,c and f, 3.29.6.1 and 3.29.6.2.1)

Interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 20₁₆ - Aircraft Identification data.

REGISTER 20 ₁₆ AIRCRAFT IDENTIFICATION GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF” =	“PC” =	“RR” =	“DI” =	“IIS” =	“NOT ASSIGNED” =
4	0	18 (12 HEX)	0	0	0

Verify that the transponder replies with the following “DF” = 20 reply:

Part 8. e. DF = 20, Register 20 ₁₆ - Aircraft Identification “MB” Field									
Reply Bits:	33 --- 40	41 -- 46	47 -- 52	53 -- 58	59 -- 64	65 -- 70	71 --76	77 -- 82	83 -- 88
“MB” Bits:	1 --- 8	9 --- 14	15 -- 20	21 -- 26	27 -- 32	33 -- 38	39 -- 44	45 -- 50	51 -- 56
Field:	BDS	Char. 1	Char. 2	Char. 3	Char. 4	Char. 5	Char. 6	Char. 7	Char. 8
Data:	0010 0000	000000	000000	000000	000000	000000	000000	000000	000000
Character:		NULL							

- f. **Data Link Capability Report, Register 10₁₆:** (Paragraph 3.23.1.13.d, 3.29.3.1, 3.29.3.2.1, 3.29.3.2.3, 3.29.3.2.4, 3.29.3.2.5, 3.29.3.2.6, 3.29.3.3.c, 3.29.4.4 and 3.29.6.4.1)

As soon as the transponder replies with the reply required in Part 8.b., interrogate the transponder with the following interrogation:

REGISTER 10 ₁₆ DATA LINK CAPABILITY GICB EXTRACTION DATA SOURCE INTERROGATION SETUP					
1 --- 5	6 --- 8	9 --- 13	14-16	17 -- 20	21 ----- 32
				“SD”	
“UF” =	“PC” =	“RR” =	“DI” =	“IIS” =	“NOT ASSIGNED” =
4	0	17 (11 HEX)	0	0	0

Within **EIGHT** (8) seconds of initiating the above interrogation, verify that the transponder replies with a “DF” = 20 reply with:

- (1). Bit **33** –through- **40** (bit **1** –through- **8** of the “MB” field) set to 10 HEX (**0001 0000**).
- (2). Bit **65** [“AIS” subfield (bit **33** of the “MB” field)] set to ZERO (0) to indicate Aircraft Identification capability,
- (3). Bit **57** [Mode S Specific Services Capability (bit **25** of the “MB” field)] set to ZERO (0) to indicate NO Mode S Specific Services Capability,

Note: Servicing of Registers 02₁₆, 03₁₆, 04₁₆, 10₁₆, 17₁₆ to 1C₁₆, 20₁₆ and 30₁₆ does not constitute Mode S Specific Services 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,

5.6.6.9

PART 9: Multiple Data Sources (Paragraph 3.29)

If Multiple Data Sources of Register 20₁₆ and/or Register 21₁₆ are provided to the Unit-Under-Test (UUT), then **REPEAT** all applicable sections of Part **5** and **6** for each additional data source that was not tested while performing Parts **1** –through- **7**above.