

RTCA Special Committee 209 and EUROCAE WG-49**ATCRBS / Mode S Transponder MOPS Maintenance****Meeting #13****In Joint Teleconference and WebEx Session****9 December 2010****9:00am EST (New York)****ELS and EHS Test Procedure Corrections****R.H. "Bob" Saffell****Rockwell Collins****SUMMARY**

This Working Paper details some changes that were brought to our attention by Kevin Wilson of Honeywell as he reviewed the ELS and EHS test procedure sections. Changes are necessary in the ELS and EHS test procedures in order to allow for the maximum time of 60 seconds for a change in BDS 1,7 to be reflected into BDS 1,0.

Make changes in the following ELS and EHS sections as indicated by track changes and change bars in green. Make only the changes as noted since direct copying of the sections will result in loss of hyperlinks which have been removed in this document.

Note that changes are necessary in the ELS and EHS test procedures in order to allow for the maximum time of 60 seconds for a change in BDS 1,7 to be reflected into BDS 1,0.

The changes are summarized as being in the following sections:

2.6.6.1.g	2.7.6.10.f	2.7.7.6.f
2.7.6.2.f	2.7.6.12.f	2.7.7.8.f
2.7.6.3.f	2.7.6.14.f	2.7.7.10.f
2.7.6.4.f	2.7.7.2.f	2.7.7.12.f
2.7.6.6.f	2.7.7.3.f	2.7.7.14.f
2.7.6.8.f	2.7.7.4.f	

2.6.6.1 Part 1: Aircraft Identification and Aircraft Registration Startup

Note 1: This Part 1 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 §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:**

- (1). Provide the transponder with Aircraft Identification Data as specified in the following table at a maximum update interval of 1.5 seconds for each character provided.

Aircraft Identification Input Data				
Character Number (see Note 1)	Character	IA-5 Encoding (see Note 2)	DO-181E 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:
1. Aircraft Identification only uses eight characters in the downlink “MB” field; however, some equipment has 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, last** update. Encoding is shown above being MSB left justified (e.g., b7, b6,b2, b1.).
3. **DO-181E** encoding refers to **DO-181E** §2.2.19.1.13.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). **If Implementing Aircraft Registration:**

Provide the transponder with Aircraft Registration Data as specified in the following table at a maximum update interval of 1.5 seconds for each character provided.

Aircraft Registration Input Data				
Character Number	Character	IA-5 Encoding (see Note 1)	DO-181E 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:

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, last** update. Encoding is shown above being MSB left justified (e.g., b7, b6,b2, b1.).
2. **DO-181E** encoding refers to **DO-181E** §2.2.19.1.13.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. **Comm-B Broadcast and Aircraft Identification Verification:**

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 transponder 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.

- (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:

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 because of the annunciation of a broadcast, because of a change in the contents of Register 20₁₆. The annunciation should persist for 18 ± 1 second.

c. **Comm-B Broadcast Extraction because of Aircraft Identification Change:**

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"

Repeat the extraction with the following Comm-B Broadcast Extraction interrogation in order to extract the Comm-B broadcast message using an SI code (DI=3).

COMM-B BROADCAST EXTRACTION INTERROGATION SETUP USING DI=3							
1 --- 5	6 --- 8	9 --- 13	14-16	17 - 22	23	24-27	28 --- 32
				"SD"			
"UF"	"PC"	"RR"	"DI"	"SIS"	"LSS"	"RRS"	"XX"
=	=	=	=	=	=	=	=
4	0	16 (10 HEX)	3	1	1	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 because of Data Link Capability Change Extraction:**

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.

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 annunciate 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 because of 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 because of a change in Data Link Capability, should have terminated.*

f. **Aircraft Registration Verification: (Optional)**

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” =	“DI” =	“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:**

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 ~~66~~~~SIX (6)~~ seconds of starting the interrogations, verify that the transponder replies with a DF=20 reply with:

Note: The ~~SIX (6)~~~~66~~ seconds is based on the update rate specified for Register 17₁₆ plus the update ~~time of up to 60 seconds~~~~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.
- (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 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:**

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

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

Repeat the extraction of Register 17₁₆ using the following GICB extraction interrogation in order to use the format for SI code (DI=3) and verify that the content is the same as the content of Register 17₁₆ previously extracted using DI=7.

REGISTER 17 ₁₆ COMMON USAGE GICB CAPABILITY GICB EXTRACTION EXTENDED DATA SOURCE INTERROGATION SETUP USING DI=3							
1 --- 5	6 --- 8	9 --- 13	14-16	17 - 22	23	24-27	28 --- 32
				“SD”			
“UF” =	“PC” =	“RR” =	“DI” =	“SIS” =	“LSS” =	“RRS” =	Not Assigned
4	0	17 (11 HEX)	3	1	1	7	0

i. **Mode S Specific Services GICB Capability, Register 18₁₆:**

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

Repeat the extraction of Register 18₁₆ using the following GICB extraction interrogation in order to use the format for SI code (DI=3) and verify that the content is the same as the content of Register 18₁₆ previously extracted using DI=7.

REGISTER 18 ₁₆ MODE S SPECIFIC SERVICES CAPABILITY GICB EXTRACTION							
EXTENDED DATA SOURCE INTERROGATION SETUP USING DI=3							
1 --- 5	6 --- 8	9 --- 13	14-16	17 - 22	23	24-27	28 --- 32
				“SD”			
“UF” =	“PC” =	“RR” =	“DI” =	“SIS” =	“LSS” =	“RRS” =	Not Assigned =
4	0	17 (11 HEX)	3	1	1	8	0

2.7.6.2 Part 2 – Register 50₁₆ - Track and Turn Report Validation

Notes:

1. The primary intent of Part 2 beyond data validation in Register 50₁₆ is to validate capability declaration.
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. **Data Input Initialization:**

(1). **Roll Angle Data Input:**

Via an appropriate input interface, provide the transponder with the following Roll Angle data at a minimum rate of 5 per second in order to provide appropriate Roll Angle information.

Roll Angle (degrees)			
[See Note 1]		[See Note 2,3]	
Data Value (degrees)	Typical Binary Encoding	Rounded Input Data Value (degrees)	Rounded Input Encoding
+ 29.99816895	0_001 0101 0101 0101	+ 30.05859375	0_0 1010 1011
Notes:			
<p>1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = Right Wing Down, 1 = Left Wing Down</p> <p>2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 50₁₆. Data must be rounded to a resolution of 0.17578125 degrees; therefore,</p> $\begin{array}{r} 0_001\ 0101\ 010\ 1\ 0101 \\ +\ 000\ 0000\ 000\ 1\ 0000 \\ \hline 0_001\ 0101\ 011\ 0\ 0101 \end{array}$ <p>Register 50₁₆ "MB" encoding = 0_00 1010 1011 (bits 2 through 11) (0AB Hex)</p> <p>3. Data is shown encoded with the "Sign Bit", e.g., bit 2 being to the left of the "Underscore".</p>			

(2). True Track Angle Data Input:

Via an appropriate input interface, provide the transponder with the following Track Angle (True) data at a minimum rate of 5 per second in order to provide appropriate Track Angle (True) information.

Track Angle (True) (degrees)			
[See Note 1]		[See Note 2,3]	
Data Value (degrees)	Typical Binary Encoding	Rounded Input Data Value (degrees)	Rounded Input Encoding
+ 119.9981689	0_101 0101 0101 0101	+ 120.0585938	0_10 1010 1011
Notes:			
<p>1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = East, 1 = West.</p> <p>2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 50₁₆. Data must be rounded to a resolution of 0.17578125 degrees; therefore,</p> $\begin{array}{r} 0_101\ 0101\ 010\ 1\ 0101 \\ +\ 000\ 0000\ 000\ 1\ 0000 \\ \hline 0_101\ 0101\ 011\ 0\ 0101 \end{array}$ <p>Register 50₁₆ "MB" encoding = 0_10 1010 1011 (bits 13 through 23) (2AB Hex)</p> <p>3. Data is shown encoded with the "Sign Bit", e.g., bit 13 being to the left of the "Underscore".</p>			

(3). Ground Speed:

Via an appropriate input interface, provide the transponder with the following Ground Speed data at a minimum rate of 5 per second in order to provide appropriate Ground Speed information.

Ground Speed (knots)			
[See Note 1]		[See Note 2,3]	
Data Value (knots)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
+ 2,730.625	0__101 0101 0101 0101	2,046	11 1111 1111
<p>Notes:</p> <ol style="list-style-type: none"> <i>Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").</i> <i>Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 50₁₆.</i> <i>Maximum Ground Speed that can be mapped into Register 50₁₆ is 2,046 knots. If valid input data exceeds this value, then the Register 50₁₆ "MB" (bit 25 through 34) encoding should be set to ALL ONE's.</i> 			

(4). Track Angle Rate Data Input:

Via an appropriate input interface, provide the transponder with the following Track Angle Rate data at a minimum rate of 5 per second in order to provide appropriate Track Angle Rate information.

Track Angle Rate (degrees/second)			
[See Note 1]		[See Note 2,3]	
Data Value (degrees/second)	Typical Binary Encoding	Rounded Input Data Value (degrees/second)	Rounded Input Encoding
+ 21.328125	0__101 0101 0101	15.96875	0_1 1111 1111
<p>Notes:</p> <ol style="list-style-type: none"> <i>Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = Clockwise (CW) = Right, 1 = Counter-Clockwise (CCW) = Left.</i> <i>The input data if +21.328125 degrees/second exceeds the maximum allowable value of 15.96875 degrees/second that can be encoded in Register 50₁₆; therefore, the data in Register 50₁₆ shall be set to all ONE's with the exception of the sign bit.</i> <i>Data is shown encoded with the "Sign Bit", e.g., bit 36 being to the left of the "Underscore".</i> 			

(5). True Air Speed - ADS:

Via an appropriate input interface, provide the transponder with the following True Air Speed data at a minimum rate of 5 per second in order to provide appropriate True Air Speed information.

True Air Speed (knots) - ADS			
[See Note 1]		[See Note 2]	
Data Value (knots)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
1365.3125	0_101 0101 0101 0101	1,366.00	10 1010 1011
Notes:			
1. <i>Data Input Value and Typical Binary Encoding</i> represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").			
2. <i>Rounded Input Data Value and Rounded Input Encoding</i> represent the data as it is expected to be seen in the "MB" field of Register 50 ₁₆ . Data must be rounded to a resolution of 2.0 knots; therefore,			
$\begin{array}{r} 10\ 1010\ 1010\ 1\ 0101 \\ +\ 00\ 0000\ 0000\ 1\ 0000 \\ \hline 10\ 1010\ 1011\ 0\ 0101 \end{array}$			
Register 50 ₁₆ "MB" encoding = 10 1010 1011 (bit 47 through 56) (2AB Hex)			

b. **Register 50₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 2.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents of Register 50₁₆ changing. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the "DR" field. If the "DR" field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the "DR" field changes, start a Test Timer to monitor that the "B"-Timer runs for 18 ±1.0 seconds.

"DR" = 4 or 5 if TCAS Information IS NOT available
= 6 or 7 if TCAS Information IS available.

(3). Verify that the “DF”=20 reply “MB” field provides data with:

Part 2.b.(3) DF = 20, Track and Turn Report “MB” Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
“MB” Bits:	1	2	3 ----- 11	12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	1	0	0 1010 1011	1	0	10 1010 1011	1	11 1111 1111	1	0	1 1111 1111	1	10 1010 1011

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 2.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” =	“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:

Bit 48 (bit 16 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established and that data is valid.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 2.a, 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 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 2.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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:

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 2.a.

Verify that the “DR” field in DF=20 replies is set to DR= 4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 2.f., interrogate the transponder with the following Comm-B Extraction interrogation 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” =	“DF” =	“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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
 - (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
 - (4). Bit 67 [“SIC” subfield (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 Register 17₁₆ is being serviced or has changed.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 2. g. (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 2.b.(2) is 18 ±1 second.

Note: *At this time, the “B” timer started in Part 2.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.6.3

Part 3 – Register 50₁₆ - Track and Turn Report - Data Change Validation

Notes:

1. *The primary intent of Part 3 beyond data validation in Register 50₁₆ is to validate Declaration of Capability as data has been terminated.*
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. **Data / Source Change:**

- (1). **Roll Angle Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with Roll Angle data.
- (2). **True Track Angle Data Input**
Via an appropriate input interface, terminate provision of valid data to the transponder with True Track Angle data.
- (3). **Ground Speed Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with Ground Speed data.
- (4). **Track Angle Rate Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with Track Angle Rate data.
- (5). **True Airspeed Data Input:**
Via an appropriate input interface, terminate provision of valid data to the

transponder with True Airspeed data.

b. **Register 50₁₆ Validation:**

Within 1.3 seconds of changing the data sources in Part 3.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ Track and Turn Report Data:

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents (e.g., servicing) of Register 50₁₆ changing as data for Register 50₁₆ has been terminated. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ±1.0 seconds.

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

- (3). Verify that the “DF”=20 reply “MB” field provides data with:

Part 3.b.(3) DF = 20, Track and Turn Report “MB” Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
“MB” Bits:	1	2	3 ----- 11	12	13	14 ----- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	0	0	0 0000 0000	0	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	00 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation/reply sequence in Part 3.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” =	“DI” =	“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 having:

Bit 48 (bit 16 of the “MB” field) set to “0” to indicate that Register 50₁₆ servicing capability has been changed as data for Register 50₁₆ has been terminated.

d. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation/reply sequence in Part 3.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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” =	“DI” =	“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 having:

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation/reply sequence in Part 3.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

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

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.

- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Within ~~65TEN~~(40) seconds of providing the transponder with data as detailed in Part 3.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 3.f, interrogate the transponder with the following Comm-B Extraction interrogation 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

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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability during the power-on cycle.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “0” (from “1”) to indicate that Register 17₁₆ has changed.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 3.g. (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 3.b.(2) is 18 ±1 second.

Note: *At this time, the “B” timer started in Part 3.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.6.4 Part 4 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 2

Notes:

1. *The primary intent of Part 4 beyond data validation in Register 50₁₆ is to validate Declaration of Capability while starting Register 50₁₆ Servicing with a single parameter, e.g., Roll Angle.*
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. **Data / Source Change - Set 2:**

(1). **Roll Angle Data Input:**

Via an appropriate input interface, provide the transponder with the following Roll Angle data at a minimum rate of 5 per second in order to provide appropriate Roll Angle information.

Roll Angle (degrees)			
[See Note 1]		[See Note 2]	
Data Value (degrees)	Typical Binary Encoding	Rounded Input Data Value (degrees)	Rounded Input Encoding
- 29.9981689 (330.0018311)	1_110 1010 1010 1011	-30.0585937 (329.9414063)	1_1 0101 0101
Notes:			
1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = Right Wing Down, 1 = -180 or Left Wing Down			
2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 50 ₁₆ .			
Data must be rounded a resolution of 0.17578125 degrees; therefore,			
$\begin{array}{r} 1_110\ 1010\ 101\ 0\ 1011 \\ +\ 000\ 0000\ 000\ 1\ 0000 \\ \hline 1_110\ 1010\ 101\ 1\ 1010 = 1_1\ 0101\ 0101 \end{array}$			
Register 50 ₁₆ "MB" encoding = 1_1 0101 0101 (bits 2 through 11) (355 Hex)			
Note that Register 50 ₁₆ does not take the 90 degree bit: Therefore, to get the real value of the 355 Hex encoding, the sign must be extended to result in the actual two's complement encoding of 755 Hex which is equivalent to 329.9414063 or -30.0585937 degrees.			

(2). True Track Angle Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with True Track Angle data.

(3). Ground Speed Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with Ground Speed data.

(4). Track Angle Rate Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with Track Angle Rate data.

(5). True Airspeed Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with True Airspeed data.

b. Register 50₁₆ Capability Verification:

Within 1.3 seconds of providing the transponder with data as detailed in Part 4.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ± 1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents (e.g., servicing) of Register 50_{16} changing as Roll Angle data has been re-started. This change causes a change to Register 17_{16} , which then forces a change to Register 10_{16} , which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ± 1.0 seconds.

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

- (3). Verify that the DF=20 reply “MB” field provides Track and Turn Report Data as follows:

Part 4.b.(3) DF = 20, Track and Turn Report “MB” Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
“MB” Bits:	1	2	3 ----- 11	12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	1	1	1 0101 0101	0	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	00 0000 0000

c. **Common Usage GICB Capability Report, Register 17_{16} :**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 4.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17_{16} 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 having:

Bit 48 (bit 16 of the “MB” field) set to “1” to indicate that Register 50_{16} servicing capability has been re-started because of Roll Angle data being provided.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 4.a, 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)	“DF” = 7	“IIS” = 0	“RRS” = 8	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 4.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DF” = 7	“IIS” = 0	“RRS” = 9	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 4.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 4.f, interrogate the transponder with the following Comm-B Extraction interrogation 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” =	“DF” =	“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 having:

- (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 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability during the power-on cycle.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed as servicing on Register 50₁₆ has changed because of having Roll Angle data.

h. Comm-B Broadcast because of Data Link Capability Change Termination:

Continue to interrogate the transponder with the interrogation described in Part 4. g. (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 4.b.(2) is 18 ±1 second.

Note: At this time, the “B” timer started in Part 4.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.

2.7.6.5 Part 5 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 3

Repeat Part 3:

2.7.6.6 Part 6 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 4

Notes:

1. The primary intent of Part 6 beyond data validation in Register 50₁₆ is to validate Declaration of Capability while starting Register 50₁₆ Servicing with a single parameter, e.g., True Track Angle.
2. 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 / Source Change - Set 4:

(1). Roll Angle Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with Roll Angle data.

(2). True Track Angle Data Input:

Via an appropriate input interface, provide the transponder with the following Track Angle (True) data at a minimum rate of 5 per second in order to provide appropriate True Track Angle information.

Track Angle (True) (degrees)			
[See Note 1]		[See Note 2]	
Data Value (degrees)	Typical Binary Encoding	Rounded Input Data Value (degrees)	Rounded Input Encoding
+ 59.9963379	0_010 1010 1010 1010	59.94140625	0_01 0101 0101
<p>Notes:</p> <ol style="list-style-type: none"> 1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = East, 1 = West. 2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the “MB” field of Register 50₁₆. Data must be rounded to a resolution of 0.17578125 degrees; therefore, $\begin{array}{r} 0_010\ 1010\ 101\ 0\ 1010 \\ + \quad 000\ 0000\ 000\ 1\ 0000 \\ \hline 0_010\ 1010\ 101\ 1\ 1010 \end{array}$ Register 50₁₆ “MB” encoding = 0_01 0101 0101 (bits 13 through 23) (155 Hex) 			

- (3). Ground Speed Data Input:
Via an appropriate input interface, terminate provision of valid data to the transponder with Ground Speed data.
- (4). Track Angle Rate Data Input:
Via an appropriate input interface, terminate provision of valid data to the transponder with Track Angle Rate data.
- (5). True Airspeed Data Input:
Via an appropriate input interface, terminate provision of valid data to the transponder with True Airspeed data.

b. **Register 50₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 6.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0		

Notes:

1. The transponder should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents (e.g., servicing) of Register 50₁₆ changing as True Track Angle data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the "DR" field. If the "DR" field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.
When the "DR" field changes, start a Test Timer to monitor that the "B"-Timer runs for 18 ±1.0 seconds.

"DR"	=	4 or 5	if TCAS Information IS NOT available
	=	6 or 7	if TCAS Information IS available.

- (3). Verify that the DF=20 reply "MB" field provides Track and Turn Report Data as follows:

Part 6.b.(3) DF = 20, Track and Turn Report "MB" Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
"MB" Bits:	1	2	3 ----- 11	12	13	14 ----- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	0	0	0 0000 0000	1	0	01 0101 0101	0	00 0000 0000	0	0	0 0000 0000	0	00 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 6.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” =	“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 having:

Bit 48 (bit 16 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been re-started because of True Track Angle data.

d. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 6.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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 having:

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 6.a, 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 having:

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 6.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 6.f, interrogate the transponder with the following Comm-B Extraction interrogation 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

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

- (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 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability during the power-on cycle.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed as servicing on Register 50₁₆ has changed because of having True Track Angle data

h. Comm-B Broadcast because of Data Link Capability Change Termination:

Continue to interrogate the transponder with the interrogation described in Part 6. g. (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 6.b.(2) is 18 ±1 second.

Note: *At this time, the “B” timer started in Part 6.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.6.7 Part 7 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 5 (§2.2.25.6 and 2.2.25.6.1)

Repeat Part 3:

2.7.6.8 Part 8 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 6 (§2.2.25.6 and 2.2.25.6.1)

Notes:

1. *The primary intent of Part 8 beyond data validation in Register 50₁₆ is to validate Declaration of Capability while starting Register 50₁₆ servicing with a single parameter, e.g., Ground Speed data.*
2. *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 / Source Change - Set 6: (§2.2.25.6.2)

- (1). **Roll Angle Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with Roll Angle data.
- (2). **True Track Angle Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with True Track Angle data.

(3). Ground Speed Data Input:

Via an appropriate input interface, provide the transponder with the following Ground Speed data at a minimum rate of 5 per second in order to provide appropriate Ground Speed information.

Ground Speed (knots)			
[See Note 1]		[See Note 2]	
Data Value (knots)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
+ 1365.25	0__010 1010 1010 1010	1364.00	10 1010 1010

Notes:

- Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").*
- Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 50₁₆.*
Data must be rounded a resolution of 2.0 knots; therefore,

$$\begin{array}{r} 10\ 1010\ 1010\ 1010 \\ +\ 00\ 0000\ 0000\ 1000 \\ \hline 10\ 1010\ 1011\ 0010 \end{array}$$
Register 50₁₆ "MB" encoding = 10 1010 1011 (bits 25 through 34) (2AA Hex)

(4). Track Angle Rate Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with Track Angle Rate data.

(5). True Airspeed Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with True Airspeed data.

b. Register 50₁₆ Capability Verification:

Within 1.3 seconds of providing the transponder with data as detailed in Part 8.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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” = 21 (15 HEX)	“DF” = 7	“IIS” = 0	“RRS” = 0	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

Notes:

- The transponder should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
- In this case, the Comm-B Broadcast is caused by the contents (e.g., servicing) of Register 50₁₆ changing as Ground Speed data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- Verify that the transponder replies with a DF=20 reply.
- During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ±1.0 seconds.

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

- Verify that the DF=20 reply “MB” field provides Track and Turn Report Data as follows:

Part 8.b.(3) DF = 20, Track and Turn Report “MB” Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
“MB” Bits:	1	2	3 ----- 11	12	13	14 ----- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	0	0	0 0000 0000	0	0	00 0000 0000	1	10 1010 1011	0	0	0 0000 0000	0	00 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 8.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)	“DF” = 7	“IIS” = 0	“RRS” = 7	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

Bit 48 (bit 16 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been re-started because of Ground Speed data.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 8.a, 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

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

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 8.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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” =	“DI” =	“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 having:

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Within ~~65TEN~~(10) seconds of providing the transponder with data as detailed in Part 8.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 8.f, interrogate the transponder with the following Comm-B Extraction interrogation 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” =	“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 having:

- (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 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability during the power-on cycle.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed as servicing on Register 50₁₆ has changed because of having Ground Speed data.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 8.g. (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 8.b.(2) is 18 ± 1 second.

Note: *At this time, the “B” timer started in Part 8.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.6.9 **Part 9 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 7**

Repeat Part 3:

2.7.6.10 **Part 10 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 8**

Notes:

1. *The primary intent of Part 10 beyond data validation in Register 50₁₆ is to validate Declaration of Capability while starting Register 50₁₆ servicing with a single parameter, e.g., Track Angle Rate data.*
2. *Review all subparagraphs of Part 10 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.*

a. **Data / Source Change - Set 8:** (§2.2.25.6.2)

(1). **Roll Angle Data Input:** (§2.2.25.6.2.1)

Via an appropriate input interface, terminate provision of valid data to the transponder with Roll Angle data.

(2). **True Track Angle Data Input:** (§2.2.25.6.2.2)

Via an appropriate input interface, terminate provision of valid data to the transponder with True Track Angle data.

(3). **Ground Speed Data Input:** (§2.2.25.6.2.3)

Via an appropriate input interface, terminate provision of valid data to the transponder with Ground Speed data.

(4). **Track Angle Rate Data Input:** (§2.2.25.6.2.4)

Via an appropriate input interface, provide the transponder with the following Track Angle Rate data at a minimum rate of 5 per second in order to provide appropriate Track Angle Rate information.

Track Angle Rate (degrees/second)			
[See Note 1]		[See Note 2]	
Data Value (degrees/second)	Typical Binary Encoding	Rounded Input Data Value (degrees/second)	Rounded Input Encoding
+ 10.65625	0_010 1010 1010	+10.65625	0_1 0101 0101

Notes:

- Data Input Value and Typical Binary Encoding** represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = Clockwise (CW) = Right, 1 = Counter-Clockwise (CCW) = Left.
- Rounded Input Data Value and Rounded Input Encoding** represent the data as it is expected to be seen in the "MB" field of Register 50₁₆.
Data must be rounded a resolution of 0.03125 degrees; therefore,

$$\begin{array}{r} 0_010\ 1010\ 101\ 0 \\ + \quad 000\ 0000\ 0001 \\ \hline 0_010\ 1010\ 101\ 1 \end{array}$$
Register 50₁₆ "MB" encoding = 0_1 0101 0101 (bit 36 through 45) (155 Hex)

(5) **True Airspeed Data Input:** (§2.2.25.6.2.5)

Via an appropriate input interface, terminate provision of valid data to the transponder with True Airspeed data.

b. **Register 50₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 10.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Notes:

- The transponder should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
- In this case, the Comm-B Broadcast is caused by the contents (e.g., servicing) of Register 50₁₆ changing as Ground Speed data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- Verify that the transponder replies with a DF=20 reply.
- During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the "DR" field. If the "DR" field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the "DR" field changes, start a Test Timer to monitor that the "B"-Timer runs for 18 ±1.0 seconds.

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

- (3). Verify that the DF=20 reply “MB” field provides Track and Turn Report Data as follows:

Part 10.b.(3) DF = 20, Track and Turn Report “MB” Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
“MB” Bits:	1	2	3 ----- 11	12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	0	0	0 0000 0000	0	0	00 0000 0000	0	00 0000 0000	1	0	1 0101 0101	0	00 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 10.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”	“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 having:

Bit 48 (bit 16 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been re-started because of Track Angle Rate data.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 10.a, 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 having:

- Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.

- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 10.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DI” = 7	“IIS” = 0	“RRS” = 9	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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” = 21 (15 HEX)	“DI” = 7	“IIS” = 0	“RRS” = 0	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

Within ~~65TEN(10)~~ seconds of providing the transponder with data as detailed in Part 10.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 10.f, interrogate the transponder with the following Comm-B Extraction interrogation 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” = 4	“PC” = 0	“RR” = 16 (10 HEX)	“DP” = 7	“IIS” = 0	“RRS” = 0	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

- (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 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability during the power-on cycle.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed as servicing on Register 50₁₆ has changed because of having Track Angle Rate data.

h. Comm-B Broadcast because of Data Link Capability Change Termination:

Continue to interrogate the transponder with the interrogation described in Part 10.g. (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 10.b.(2) is 18 ±1 second.

Note: At this time, the “B” timer started in Part 10.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.

2.7.6.11 Part 11 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 9

Repeat Part 3:

2.7.6.12 Part 12 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Set 10

Notes:

1. The primary intent of Part 12 beyond data validation in Register 50₁₆ is to validate Declaration of Capability while starting Register 50₁₆ servicing with a single parameter, e.g., True Airspeed data.
2. Review all subparagraphs of Part 12 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.

a. **Data / Source Change - Set 10:**

- (1). **Roll Angle Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with Roll Angle data.
- (2). **True Track Angle Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with True Track Angle data.
- (3). **Ground Speed Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with Ground Speed data.
- (4). **Track Angle Rate Data Input:**
Via an appropriate input interface, terminate provision of valid data to the transponder with Track Angle Rate data.
- (5). **True Airspeed Data Input:**
Via an appropriate input interface, provide the transponder with the following True Airspeed data at a minimum rate of 5 per second in order to provide appropriate True Airspeed information.

True Air Speed (knots) - ADS			
[See Note 1]		[See Note 2]	
Data Value (knots)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
682.625	0_010 1010 1010 1010	682.00	01 0101 0101
Notes:			
1. <i>Data Input Value and Typical Binary Encoding</i> represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").			
2. <i>Rounded Input Data Value and Rounded Input Encoding</i> represent the data as it is expected to be seen in the "MB" field of Register 50 ₁₆ . Data must be rounded to a resolution of 2.0 knots; therefore:			
$ \begin{array}{r} 0_010\ 1010\ 101\ 0\ 1010 \\ + \quad 000\ 0000\ 000\ 1\ 0000 \\ \hline 0_010\ 1010\ 101\ 1\ 1010 \quad 01\ 0101\ 0101 \end{array} $			
Register 50 ₁₆ "MB" encoding = 01 0101 0101 (bits 47 through 56) (155 Hex)			

b. **Register 50₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 12.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ± 1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents (e.g., servicing) of Register 50_{16} changing as True Airspeed data has been re-started. This change causes a change to Register 17_{16} , which then forces a change to Register 10_{16} , which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ± 1.0 seconds.

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

- (3). Verify that the DF=20 reply “MB” field provides Track and Turn Report Data as follows:

Part 12.b.(3) DF = 20, Track and Turn Report “MB” Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
“MB” Bits:	1	2	3 ----- 11	12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	0	0	0 0000 0000	0	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	1	01 0101 0101

c. **Common Usage GICB Capability Report, Register 17_{16} :**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 12.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 17_{16} 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

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

Bit 48 (bit 16 of the “MB” field) set to “1” to indicate that Register 50_{16} servicing capability has been re-started because of True Airspeed data.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 12.a, 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 having:

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 12.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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 having:

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21	7	0	0	0	0	0	0

		(15 HEX)							
--	--	----------	--	--	--	--	--	--	--

Within ~~65TEN~~ (10) seconds of providing the transponder with data as detailed in Part 12.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 12.f, interrogate the transponder with the following Comm-B Extraction interrogation 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

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

- (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 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability during the power-on cycle.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed as servicing on Register 50₁₆ has changed because of having True Airspeed data.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 12.g. (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 12.b.(2) is 18 ±1 second.

Note: At this time, the “B” timer started in Part 12.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.

2.7.6.13 Part 13 – Register 50₁₆ - Track and Turn Report - Data Change Validation - Sets 11
a. Data / Source Change - Sets 11:
(1). Roll Angle Data Input:

For each line Item # in the following table (Table 13.a(1)), provide the transponder with Roll Angle data having a value as indicated in the “Data Value” (degrees) Column in the table.

Table 13.a(1): Register 50₁₆ (Register 50₁₆) Roll Angle (degrees)								
Item #	Type of Value	Generic Roll Angle Input (degrees) [Binary (BNR)]			Register 50₁₆ (Register 50₁₆) Roll Angle (degrees)			
		Status	Sense (See Note 2)	Data Value (degrees)	Status (bit 1)	Sense (See Note 2)	Decimal Value (degrees)	Binary Value (bit 2 ----- 11) (See Note 3)
1	Basic	Valid	Left (CCW)	- 29.88 (330.12)	1	Left	- 29.8828125 (330.1171875)	1_1 0101 0110
2	Basic	Valid	Right (CW)	59.94	1	Right	59.94140611	0_1 0101 0101
3	Basic	Valid	Left (CCW)	- 65.92 (294.08)	1	Left	65.91796875	1_0 1000 1001
4	Basic	Valid	Left (CCW)	-77.87 (282.13)	1	Left	- 77.8710944 (282.1289056)	1_0 0100 0101
5	Basic	Valid	Right (CW)	83.85	1	Right	83.84765606	0_1 1101 1101
6	Basic	Valid	Left (CCW)	- 41.84 (318.1600)	1	Left	- 41.8359375 (318.1640625)	1_1 0001 0010
7	Max	Valid	Left (CCW)	- 100.00 (260.00)	1	Left	-90 (270)	1_0 0000 0000
8	Min	Valid	Right (CW)	0	1	Left	0	0_0 0000 0000
9	Rounded (½ LSB)	Valid	Right (CW)	60.21	1	Right	60.29296875	0_1 0101 0111
10	Rounded (¼ LSB)	Valid	Right (CW)	59.98	1	Right	59.94140625	0_1 0101 0101
11	Invalid	Invalid	Not Applicable	0	0	N/A	0	0_0 0000 0000

Notes:

1. Input data Sense refers to (a) Positive, being Clockwise (CW), commonly meaning Right Wing Down, or (b) Negative, being Counter-Clockwise (CCW), commonly meaning Left Wing Down.
2. Register 50₁₆ Sense refers to (a) “1” for negative or Left Wing Down, or (b) “0” for positive or Right Wing Down.
3. Data is shown encoded with the “Sign Bit”, e.g., bit 2 being to the left of the “Underscore”.

(2). True Track Angle Data Input:

For each line Item # in the following table (Table 13.a(2)), provide the transponder with True Track Angle data having a value as indicated in the “Data Value” (degrees) Column in the table.

Table 13.a(2): Register 50 ₁₆ (Register 50 ₁₆) True Track Angle (degrees)								
Item #	Type of Value	Generic True Track Angle Input (degrees) [Binary (BNR)]			Register 50 ₁₆ (Register 50 ₁₆) True Track Angle (degrees)			
		Status	Sense (See Note 2)	Data Value (degrees)	Status (bit 12)	Sense (See Note 2)	Decimal Value (degrees)	Binary Value (bit 13 ----- 23) (See Note 3)
1	Basic	Valid	Left (CCW)	- 120.10 (239.9)	1	Left	- 120.0585937 (239.9414063)	1_01 0101 0101
2	Basic	Valid	Right (CW)	119.90	1	Right	119.8828125	0_10 1010 1010
3	Basic	Valid	Left (CCW)	- 24.10 (335.9)	1	Left	- 24.0820312 (335.9179688)	1_11 0111 0111
4	Basic	Valid	Right (CW)	167.85	1	Right	167.8710938	0_11 1011 1011
5	Basic	Valid	Left (CCW)	- 96.15 (263.85)	1	Left	- 96.1523437 263.8476563	1_01 1101 1101
6	Basic	Valid	Left (CCW)	- 48.15 (311.85)	1	Left	- 48.1640625 (311.8359375)	1_10 1110 1110
7	Basic	Valid	Left (CCW)	- 0.20 (359.80)	1	Left	- 0.1757812 (359.8242188)	1_11 1111 1111
8	Basic	Valid	Right (CW)	0	1	Right	0	0_00 0000 0000
9	Rounded (½ LSB)	Valid	Right (CW)	60.25	1	Right	60.29296875	0_01 0101 0111
10	Rounded (¼ LSB)	Valid	Right (CW)	60.00	1	Right	59.94140625	0_01 0101 0101
11	Invalid	Invalid	Not Applicable	0	0	N/A	0	0_00 0000 0000

Notes:

1. Input data Sense refers to (a) Positive, being Clockwise (CW), commonly meaning East of North, or (b) Negative, being Counter-Clockwise (CCW), commonly meaning West of North.
2. Register 50₁₆ Sense refers to (a) "1" for negative or West, or (b) "0" for positive or East.
3. Data is shown encoded with the "Sign Bit", e.g., bit 13 being to the left of the "Underscore".

(3). Ground Speed Data Input:

For each line Item # in the following table (Table 13.a(3)), provide the transponder with Ground Speed data having a value as indicated in the "Data Value" (degrees) Column in the table.

Table 13.a(3): Register 50 ₁₆ (Register 50 ₁₆) Ground Speed (knots)						
Item #	Type of Value	Generic Ground Speed (knots) [Binary (BNR)]		Register 50 ₁₆ (Register 50 ₁₆) Ground Speed (knots)		
		Status	Data Value (knots)	Status (bit 24)	Decimal Value (knots)	Binary Value (bit 25 ----- 34)
1	Basic	Valid	1,364	1	1,364	10 1010 1010
2	Basic	Valid	682	1	682	01 0101 0101
3	Basic	Valid	1,774	1	1,774	11 0111 0111
4	Basic	Valid	1,910	1	1,910	11 1011 1011
5	Basic	Valid	954	1	954	01 1101 1101
6	Basic	Valid	1,500	1	1,500	10 1110 1110
7	Max	Valid	3,006	1	2,046	11 1111 1111
8	Min	Valid	0	1	0	00 0000 0000
9	Rounded (½ LSB)	Valid	683	1	684	01 0101 0110
10	Rounded (¼ LSB)	Valid	682.5	1	682	01 0101 0101
11	Invalid	Invalid	Not Applicable	0	0	00 0000 0000

(4). Track Angle Rate Data Input:

For each line Item # in the following table (Table 13.a(4)), provide the transponder with Track Angle Rate data having a value as indicated in the “Data Value” (degrees) Column in the table.

Item #	Type of Value	Generic Track Angle Rate Input (degrees/second) [Binary (BNR)]			Register 50 ₁₆ (Register 50 ₁₆) Track Angle Rate (degrees/second)			
		Status	Sense (See Note 2)	Data Value (degrees)	Status (bit 35)	Sense (See Note 2)	Decimal Value (degrees)	Binary Value (bits 36 ---- 45) (See Note 3)
1	Basic	Valid	Left (CCW)	- 10.68	1	Left	- 10.6875	1_0 1010 1010
2	Basic	Valid	Right (CW)	10.65	1	Right	10.65625	0_1 0101 0101
3	Basic	Valid	Left (CCW)	- 4.275	1	Left	- 4.28125	1_1 0111 0111
4	Basic	Valid	Left (CCW)	- 2.16	1	Left	- 2.15625	1_1 1011 1011
5	Basic	Valid	Left (CCW)	14.91	1	Left	14.90625	0_1 1101 1101
6	Basic	Valid	Left (CCW)	- 8.565	1	Left	- 8.5625	1_0 1110 1110
7	Basic	Valid	Left (CCW)	-0.030	1	Left	- 0.03125	1_1 1111 1111
8	Basic	Valid	Right (CW)	0	1	Right	0	0_0 0000 0000
9	Rounded (½ LSB)	Valid	Right (CW)	10.68	1	Right	10.6875	0_1 0101 0110
10	Rounded (¼ LSB)	Valid	Right (CW)	10.665	1	Right	10.6875	0_1 0101 0110
11	Invalid	Invalid	Not Applicable	0	0	N/A	0	0_0 0000 0000

Notes:

1. Input data Sense refers to (a) Positive, being Clockwise (CW), commonly meaning East of North, or (b) Negative, being Counter-Clockwise (CCW), commonly meaning West of North.
2. Register 50₁₆ Sense refers to (a) “1” for negative or West, or (b) “0” for positive or East.
3. Data is shown encoded with the “Sign Bit”, e.g., bit 36 being to the left of the “Underscore”.

(5) True Airspeed Data Input:

For each line Item # in the following table (Table 13.a(5)), provide the transponder with True Airspeed data having a value as indicated in the “Data Value” (degrees) Column in the table.

Item #	Type of Value	Generic True Airspeed (knots) [Binary (BNR)]		Register 50 ₁₆ (Register 50 ₁₆) True Airspeed (knots)		
		Status	Data Value (knots)	Status (bit 46)	Decimal Value (knots)	Binary Value (bits 47 ---56)
1	Basic	Valid	1,364	1	1,364	10 1010 1010
2	Basic	Valid	682	1	682	01 0101 0101
3	Basic	Valid	1,774	1	1,774	11 0111 0111
4	Basic	Valid	1,910	1	1,910	11 1011 1011
5	Basic	Valid	954	1	954	01 1101 1101
6	Basic	Valid	1,500	1	1,500	10 1110 1110
7	Max	Valid	3,006	1	2,046	11 1111 1111
8	Min	Valid	0	1	0	00 0000 0000
9	Rounded (½ LSB)	Valid	683.125	1	684	01 0101 0110
10	Rounded (¼ LSB)	Valid	682.625	1	682	01 0101 0101
11	Invalid	Invalid	Not Applicable	0	0	00 0000 0000

b. **Register 50₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 13.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Verify that the transponder replies with a DF=20 reply.

- (1). For each line Item # in Table 13.a(1) with “MB” field Status (bit 1) equivalent to that shown in the Status (bit 1) column of Table 13.a(1).
- (2). For each line Item # in Table 13.a(1), with “MB” field bits 2 - 11 equivalent to that shown in the Binary Value (bits 2 - 11) column of Table 13.a(1).
- (3). For each line Item # in Table 13.a(2) with “MB” field Status (bit 12) equivalent to that shown in the Status (bit 14) column of Table 14.a(2).
- (4). For each line Item # in Table 13.a(2), with “MB” field bits 13 - 23 equivalent to that shown in the Binary Value (bits 13 - 23) column of Table 13.a(2).
- (5). For each line Item # in Table 13.a(3) with “MB” field Status (bit 24) equivalent to that shown in the Status (bit 24) column of Table 13.a(3).
- (6). For each line Item # in Table 13.a(3), with “MB” field bits 25 - 34 equivalent to that shown in the Binary Value (bits 25 - 34) column of Table 13.a(3).
- (7). For each line Item # in Table 13.a(4) with “MB” field Status (bit 35) equivalent to that shown in the Status (bit 35) column of Table 13.a(4).
- (8). For each line Item # in Table 13.a(4), with “MB” field bits 36 - 45 equivalent to that shown in the Binary Value (bits 36 - 45) column of Table 13.a(4).
- (9). For each line Item # in Table 13.a(5) with “MB” field Status (bit 46) equivalent to that shown in the Status (bit 46) column of Table 13.a(5).
- (10). For each line Item # in Table 13.a(5), with “MB” field bits 47 - 56 equivalent to that shown in the Binary Value (bits 47 - 56) column of Table 13.a(5).

Note: Cumulative results are as shown in the following table.

Part 13.b. DF = 20, Track and Turn Report "MB" Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
"MB" Bits:	1	2	3 ----- 11	12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
Data: Item #	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
1	1	1	1 0101 0110	1	1	01 0101 0101	1	10 1010 1010	1	1	0 1010 1010	1	10 1010 1010
2	1	0	1 0101 0101	1	0	10 1010 1010	1	01 0101 0101	1	0	1 0101 0101	1	01 0101 0101
3	1	1	0 1000 1001	1	1	11 0111 0111	1	11 0111 0111	1	1	1 0111 0111	1	11 0111 0111
4	1	1	0 0100 0101	1	0	11 1011 1011	1	11 1011 1011	1	1	1 1011 1011	1	11 1011 1011
5	1	0	1 1101 1101	1	1	01 1101 1101	1	01 1101 1101	1	0	1 1101 1101	1	01 1101 1101
6	1	1	1 0001 0010	1	1	10 1110 1110	1	10 1110 1110	1	1	0 1110 1110	1	10 1110 1110
7	1	1	0 0000 0000	1	1	11 1111 1111	1	11 1111 1111	1	1	1 1111 1111	1	11 1111 1111
8	1	0	0 0000 0000	1	0	00 0000 0000	1	00 0000 0000	1	0	0 0000 0000	1	00 0000 0000
9	1	0	1 0101 0111	1	0	01 0101 0111	1	01 0101 0110	1	0	1 0101 0110	1	01 0101 0110
10	1	0	1 0101 0101	1	0	01 0101 0101	1	01 0101 0101	1	0	1 0101 0110	1	01 0101 0101
11	0	0	0 0000 0000	0	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	00 0000 0000

2.7.6.14 Part 14 – Reduced Data Rate

Notes:

1. The primary intent of Part 14 beyond data validation in Register 50₁₆ is to validate Declaration of Capability as data inputs are reduced to rates that are less than the minimum acceptable rate.
2. Review all subparagraphs of Part 14 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.

a. Data / Source Change:

(1). Roll Angle Data Input:

Via an appropriate input interface, set the rate at which valid Roll Angle data is provided to less than once in 2.6 seconds.

(2). True Track Angle Data Input:

Via an appropriate input interface, set the rate at which valid True Track Angle data is provided to less than once in 2.6 seconds.

(3). Ground Speed Data Input:

Via an appropriate input interface, set the rate at which valid Ground Speed data is provided to less than once in 2.6 seconds.

(4). Track Angle Rate Data Input:

Via an appropriate input interface, set the rate at which valid Track Angle Rate data is provided to less than once in 2.6 seconds.

(5). True Airspeed Data Input:

Via an appropriate input interface, set the rate at which valid True Airspeed data is provided to less than once in 2.6 seconds.

b. Register 50₁₆ Validation

Within 1.3 seconds of changing the data sources in Part 14.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ Track and Turn Report Data:

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents (e.g., servicing) of Register 50₁₆ changing as data for Register 50₁₆ has effectively been terminated. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ±1.0 seconds.

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

- (3). Verify that the “DF”=20 reply “MB” field provides data with:

Part 3.b.(3) DF = 20, Track and Turn Report “MB” Field													
Reply Bits:	33	34	35 ----- 43	44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79 ----- 88
“MB” Bits:	1	2	3 ----- 11	12	13	14 ----- 23	24	25 ----- 34	35	36	37 ----- 45	46	47 ----- 56
Field:	Roll Angle			True Track Angle			Ground Speed		Track Angle Rate			True Airspeed	
	Status	Sign	Data	Status	Sign	Data	Status	Data	Status	Sign	Data	Status	Data
Data:	0	0	0 0000 0000	0	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	00 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation/reply sequence in Part 14.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

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

Bit 48 (bit 16 of the “MB” field) set to “0” to indicate that Register 50₁₆ servicing capability has been changed as data for Register 50₁₆ has been terminated.

d. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation/reply sequence in Part 14.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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 having:

Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 50₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation/reply sequence in Part 14.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” =	“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 having:

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 50₁₆ - Track and Turn Report data monitor the “DR” field in the reply.

REGISTER 50 ₁₆ TRACK AND TURN REPORT 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	21 (15 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 14.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 14.f, interrogate the transponder with the following Comm-B Extraction interrogation 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” =	“DF” =	“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). Bits 33 through 40 (bits 1 through 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability during the power-on cycle.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB”

field)] toggled to “0” (from “1”) to indicate that Register 17₁₆ has changed.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 14.g. (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 14.b.(2) is 18 ±1 second.

Note: *At this time, the “B” timer started in Part 14.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.6.15 Part 15 – Multiple Data Sources

If Multiple Data Sources of Register 50₁₆ parameters are provided to the Unit-Under-Test (UUT), then REPEAT all applicable sections of Part 2 for each additional data source that was not tested while performing Parts 1 through 13 above.

Note: *GPS Data Sources may not provide data more often than once every 1.2 seconds. If GPS Data Sources are used to provide data, ensure that the data is provided at the minimum rate of once every 1.2 seconds. For Register 5016, this may apply to the True Track Angle data and/or Ground Speed data.*

2.7.7.2 Part 2 – Register 60₁₆ - Heading and Speed Report Validation

Notes:

1. *The primary intent of Part 2 beyond data validation in Register 60₁₆ is to validate capability declaration.*
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. **Data Input Initialization:**

(1). **Magnetic Heading Data Input:**

Via an appropriate input interface, provide the transponder with the following Magnetic Heading data at a minimum rate of 5 per second in order to provide appropriate Magnetic Heading information.

Magnetic Heading (degrees)			
[See Note 1]		[See Note 2,3]	
Data Value (degrees)	Typical Binary Encoding	Rounded Input Data Value (degrees)	Rounded Input Encoding
+ 119.9981689	0_101 0101 0101 0101	+ 120.0585938	0_10 1010 1011
Notes:			
<p>1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = East, 1 = West.</p> <p>2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60₁₆. Data must be rounded to a resolution of 0.17578125 degrees; therefore,</p> $\begin{array}{r} 0_101\ 0101\ 010\ 1\ 0101 \\ +\ 000\ 0000\ 000\ 1\ 0000 \\ \hline 0_101\ 0101\ 011\ 0\ 0101 \end{array}$ <p>Register 60₁₆ "MB" encoding = 0_10 1010 1011 (bits 2 through 12) (2AB Hex)</p> <p>3. Data is shown encoded with the "Sign Bit", e.g., bit 2 being to the left of the "Underscore".</p>			

(2). Indicated Airspeed Data Input - ADS:

Via an appropriate input interface, provide the transponder with the following Indicated Airspeed data at a minimum rate of 5 per second in order to provide appropriate Indicated Airspeed information.

Indicated Airspeed Speed (knots) - ADS			
[See Note 1]		[See Note 2]	
Data Value (knots)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
341.3125	0_01 0101 0101 0101	341.00	01 0101 0101
Notes:			
<p>1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").</p> <p>2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60₁₆. Data must be rounded to a resolution of 1.0 knots; therefore,</p> $\begin{array}{r} 01\ 0101\ 0101\ 0\ 101 \\ +\ 00\ 0000\ 0000\ 1\ 000 \\ \hline 01\ 0101\ 0101\ 1\ 101 \end{array}$ <p>Register 60₁₆ "MB" encoding = 01 0101 0101 (bits 14 through 23) (155 Hex)</p>			

(3). Mach Data Input - ADS:

Via an appropriate input interface, provide the transponder with the following Mach data at a minimum rate of 5 per second in order to provide appropriate Mach information.

Mach (milli-Mach) - ADS			
[See Note 1]		[See Note 2]	
Data Value (mill-Mach)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
+1365.3125 (1.3653125 Mach)	0__0101 0101 0101 0101	341.00	01 0101 0101
<p>Notes:</p> <p>1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").</p> <p>2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60₁₆. Data must be rounded to a resolution of 4 milli-mach; therefore,</p> $\begin{array}{r} 0101\ 0101\ 0\ 1\ 01\ 0101 \\ +\ 0000\ 0000\ 0\ 0\ 10\ 0000 \\ \hline 0101\ 0101\ 0\ 1\ 11\ 0101 \end{array}$ <p>Register 60₁₆ "MB" encoding = 01 0101 0101 (bits 25 through 34) (155 Hex)</p>			

(4). Barometric Altitude Rate Data Input - ADS:

Via an appropriate input interface, provide the transponder with the following Barometric Altitude Rate data at a minimum rate of 5 per second in order to provide appropriate Barometric Altitude Rate information.

Barometric Altitude Rate (feet/minute) - ADS			
[See Note 1]		[See Note 2,3]	
Barometric Altitude Rate (feet/minute)	Typical Binary Encoding	Rounded Input Data Value (feet/minute)	Rounded Input Encoding
+13,648.00	0__011 0101 0101	13,648.00	0_1 1010 1011
<p>Notes:</p> <p>1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is "0" for "UP" and "1" for "Down".</p> <p>2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60₁₆. Data must be rounded to a resolution of 32 feet/minute; therefore,</p> $\begin{array}{r} 0_011\ 0101\ 01\ 0\ 1 \\ +\ 0\ 000\ 0000\ 00\ 0\ 1 \\ \hline 0_011\ 0101\ 01\ 10 \end{array}$ <p>Register 60₁₆ "MB" encoding = 0_1 1010 1011 (bits 36 through 45) (IAB Hex)</p> <p>3. Data is shown encoded with the "Sign Bit", e.g., bit 36 being to the left of the "Underscore".</p>			

(5). Inertial Vertical Rate Data Input - FMS / IRS:

Via an appropriate input interface, provide the transponder with the following Inertial Vertical Rate data at a minimum rate of 5 per second in order to provide appropriate Inertial Vertical Rate information.

Inertial Vertical Rate (feet/minute) - FMS / IRS			
[See Note 1]		[See Note 2,3]	
Inertial Vertical Rate (feet/minute)	Typical Binary Encoding	Rounded Input Data Value (feet/minute)	Rounded Input Encoding
+9,637.00	0_010 0101 1010 0101	9,632.00	0_1 0010 1101

Notes:

- Data Input Value and Typical Binary Encoding** represent the data as it is provided to the transponder in two's complement format. Sign Bit is "0" for "UP" and "1" for "Down".
- Rounded Input Data Value and Rounded Input Encoding** represent the data as it is expected to be seen in the "MB" field of Register 60₁₆.
Data must be rounded to a resolution of 32 feet/minute; therefore,

$$\begin{array}{r} 0_010\ 0101\ 10\ 1\ 0\ 0101 \\ +\ 0_000\ 0000\ 00\ 0\ 1\ 0000 \\ \hline 0_010\ 0101\ 10\ 1\ 1\ 0101 \end{array}$$
Register 60₁₆ "MB" encoding = 0_1 0010 1101 (bits 47 through 56)(12D Hex)
- Data is shown encoded with the "Sign Bit", e.g., bit 47 being to the left of the "Underscore".

b. **Register 60₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 2.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

- The transponder should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
 - In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.
- Verify that the transponder replies with a DF=20 reply.
 - During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the "DR" field. If the "DR" field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ± 1.0 seconds.

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

- (3). Verify that the “DF”=20 reply “MB” field provides Data with:

Part 2.b.(3) DF = 20, Heading and Speed “MB” Field														
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88	
“MB” Bits:	1	2	3 ----- 12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56	
Field:	Magnetic Heading			Indicated Airspeed			Mach			Barometric Altitude Rate			Inertial Vertical Rate	
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data	
Data:	1	0	10 1010 1011	1	01 0101 0101	1	01 0101 0101	1	0	1 1010 1011	1	0	1 0010 1101	

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 2.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”	“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:

Bit 56 (bit 24 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established and that data is valid.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 2.a, 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:

- Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established.
- Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established.

- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of providing the transponder with data as detailed in Part 2.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DF” = 7	“IIS” = 0	“RRS” = 9	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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” = 22 (16 HEX)	“DF” = 7	“IIS” = 0	“RRS” = 0	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 2.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 2.f., interrogate the transponder with the following Comm-B Extraction interrogation 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”	“DF”	“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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 2. g. (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 2.b.(2) is 18 ±1 second.

Note: At this time, the “B” timer started in Part 2.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.

2.7.7.3

Part 3 – Register 60₁₆ - Heading and Speed Report - Data Change Validation

Notes:

1. The primary intent of Part 3 beyond data validation in Register 60₁₆ is to validate Declaration of Capability as data has been terminated.
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. **Data / Source Change - Set 1:**

(1). Magnetic Heading Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with Magnetic Heading data.

(2). Indicated Airspeed Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(3). Mach Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Mach data.

(4). Barometric Altitude Rate Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Barometric Altitude Rate data.

(5). Inertial Vertical Rate Data Input - FMS / IRS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Inertial Vertical Rate data.

b. **Register 60₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 2.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing as provision of all parameter data has been terminated. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

(1). Verify that the transponder replies with a DF=20 reply.

(2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ±1.0 seconds.

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

(3). Verify that the “DF”=20 reply “MB” field provides Data with:

Part 2.b.(3) DF = 20, Heading and Speed “MB” Field															
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88		
“MB” Bits:	1	2	3 ----- 12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56		
Field:	Magnetic Heading			Indicated Airspeed			Mach			Barometric Altitude Rate			Inertial Vertical Rate		
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data		
Data:	0	0	00 0000 0000	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	0	0 0000 0000		

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 3.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

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

Bit 56 (bit 24 of the “MB” field) set to “0” to indicate that Register 60₁₆ servicing capability has been changed as data for Register 60₁₆ has been terminated.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 3.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”	“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 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 3.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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:

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Within ~~65TEN~~ (10) seconds of providing the transponder with data as detailed in Part 2.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 3.f., interrogate the transponder with the following Comm-B Extraction interrogation 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” =	“DF” =	“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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “0” (from “1”) to indicate that Register 17₁₆ has changed.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 3. g. (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 3.b.(2) is 18 ±1 second.

Note: *At this time, the “B” timer started in Part 3.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.7.4 Part 4 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 2

Notes:

1. *The primary intent of Part 4 beyond data validation in Register 60₁₆ is to validate Declaration of Capability while starting Register 6016 servicing with a single parameter, e.g., Roll Angle.*
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. **Data / Source Change - Set 2:**

- (1). **Magnetic Heading Data Input:**

Via an appropriate input interface, provide the transponder with the following Magnetic Heading data at a minimum rate of 5 per second in order to provide appropriate Magnetic Heading information.

Magnetic Heading (degrees)			
[See Note 1]		[See Note 2]	
Data Value (degrees)	Typical Binary Encoding	Rounded Input Data Value (degrees)	Rounded Input Encoding
<ul style="list-style-type: none"> 120.0036621 (239.9963379) 	1_010 1010 1010 1010	- 120.0585937 (239.9414062)	1_01 0101 0101
<p>Notes:</p> <p>1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit often referred to as 0 = East, 1 = West.</p> <p>2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60₁₆. Data must be rounded to a resolution of 0.17578125 degrees; therefore, $\begin{array}{r} 1\ 010\ 1010\ 101\ 0\ 1010 \\ +\ 0\ 000\ 0000\ 000\ 1\ 0000 \\ \hline 1\ 010\ 1010\ 101\ 1\ 1010 \end{array}$ Register 60₁₆ "MB" encoding = 1_01 0101 0101 (bits 2 through 12) (555 Hex)</p> <p>3. Data is shown encoded with the "Sign Bit", e.g., bit 2 being to the left of the "Underscore".</p>			

(2). Indicated Airspeed Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(3). Mach Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Mach data.

(4). Barometric Altitude Rate Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Barometric Altitude Rate data.

(5). Inertial Vertical Rate Data Input - FMS / IRS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Inertial Vertical Rate data.

b. Register 60₁₆ Capability Verification:

Within 1.3 seconds of providing the transponder with data as detailed in Part 4.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ± 1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing as Magnetic Heading data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ± 1.0 seconds.

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

- (3). Verify that the “DF”=20 reply “MB” field provides Data with:

Part 4.b.(3) DF = 20, Heading and Speed "MB" Field													
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88
“MB” Bits:	1	2	3 ----- 12	13	14 ----- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56
Field:	Magnetic Heading			Indicated Airspeed		Mach		Barometric Altitude Rate			Inertial Vertical Rate		
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data
Data:	1	1	01 0101 0101	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	0	0 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 4.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

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

Bit 56 (bit 24 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been re-started because of Magnetic Heading data being provided.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 4.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

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

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 4.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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”	“DI”	“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:

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Within ~~65~~~~TEN~~(10) seconds of providing the transponder with data as detailed in Part 4.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 4.f., interrogate the transponder with the following Comm-B Extraction interrogation 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

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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed servicing on Register 60₁₆ has changed because of having Magnetic Heading data.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 4.g, (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 4.b.(2) is 18 ±1 second.

Note: At this time, the “B” timer started in Part 4.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.

2.7.7.5 Part 5 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 3

Repeat Part 3:

2.7.7.6 Part 6 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 4**Notes:**

1. *The primary intent of Part 6 beyond data validation in Register 60₁₆ is to validate Declaration of Capability while starting Register 60₁₆ Servicing with a single parameter, e.g., Indicated Airspeed.*
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. Data / Source Change - Set 4:**(1). Magnetic Heading Data Input:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Magnetic Heading data.

(2). Indicated Airspeed Data Input - ADS:

Via an appropriate input interface, provide the transponder with the following Indicated Airspeed data at a minimum rate of 5 per second in order to provide appropriate Indicated Airspeed information.

Indicated Airspeed Speed (knots) - ADS			
[See Note 1]		[See Note 2]	
Data Value (knots)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
682.625	0_10 1010 1010 1010	683.00	10 1010 1011
<u>Notes:</u>			
1. <i>Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").</i>			
2. <i>Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60₁₆. Data must be rounded to a resolution of 1.0 knots; therefore,</i>			
$ \begin{array}{r} 10\ 1010\ 1010\ 1\ 010 \\ +\ 00\ 0000\ 0000\ 1\ 000 \\ \hline 10\ 1010\ 1011\ 0\ 010 \end{array} $			
<i>Register 60₁₆ "MB" encoding = 10 1010 1011 (bits 14 through 23) (2AB Hex)</i>			

(3). Mach Data Input - ADS: (§2.2.25.8.2.3)

Via an appropriate input interface, terminate provision of valid data to the transponder with Mach data.

(4). Barometric Altitude Rate Data Input - ADS: (§2.2.25.8.2.4)

Via an appropriate input interface, terminate provision of valid data to the transponder with Barometric Altitude Rate data.

(5). Inertial Vertical Rate Data Input - FMS / IRS: (§2.2.25.8.2.5)

Via an appropriate input interface, terminate provision of valid data to the transponder with Inertial Vertical Rate data.

b. **Register 60₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 6.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

- The transponder should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
- In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing as Indicated Airspeed data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- Verify that the transponder replies with a DF=20 reply.
- During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ±1.0 seconds.

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

- Verify that the “DF”=20 reply “MB” field provides Data with:

Part 6.b.(3) DF = 20, Heading and Speed “MB” Field													
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88
“MB” Bits:	1	2	3 ----- 12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56
Field:	Magnetic Heading			Indicated Airspeed		Mach		Barometric Altitude Rate			Inertial Vertical Rate		
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data
Data:	0	0	00 0000 0000	1	10 1010 1011	0	00 0000 0000	0	0	0 0000 0000	0	0	0 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 6.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	7	0	7	0	0	0	0

		(11 HEX)							
--	--	----------	--	--	--	--	--	--	--

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

Bit 56 (bit 24 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been re-started because of Indicated Airspeed data being provided.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 6.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)	“DF” = 7	“IIS” = 0	“RRS” = 8	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 6.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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” = 4	“PC” = 0	“RR” = 17 (11 HEX)	“DF” = 7	“IIS” = 0	“RRS” = 9	“X” = 0	“LOS” = 0	“XX” = 0	“TMS” = 0

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

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 6.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 6.f., interrogate the transponder with the following Comm-B Extraction interrogation 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” =	“DF” =	“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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed

servicing on Register 60₁₆ has changed because of having Indicated Airspeed data.

h. **Comm-B Broadcast because of Data Link Capability Change Termination:**

Continue to interrogate the transponder with the interrogation described in Part 6.g, (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 6.b.(2) is 18 ±1 second.

Note: *At this time, the “B” timer started in Part 6.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.7.7 Part 7 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 5

Repeat Part 3:

2.7.7.8 Part 8 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 6

Notes:

1. *The primary intent of Part 8 beyond data validation in Register 60₁₆ is to validate Declaration of Capability while starting Register 60₁₆ servicing with a single parameter, e.g., Mach.*
2. *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 / Source Change - Set 2:**

(1). **Magnetic Heading Data Input:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(2). **Indicated Airspeed Data Input - ADS:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(3). **Mach Data Input - ADS:**

Via an appropriate input interface, provide the transponder with the following Mach data at a minimum rate of 5 per second in order to provide appropriate Mach information.

Mach (milli-Mach) - ADS			
[See Note 1]		[See Note 2]	
Data Value (mill-Mach)	Typical Binary Encoding	Rounded Input Data Value (knots)	Rounded Input Encoding
+2730.625 (2.730625 Mach)	0__1010 1010 1010 1010	2,732.00	10 1010 1011
Notes:			
1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is always positive (e.g., = "0").			
2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60 ₁₆ . Data must be rounded to a resolution of 4 milli-mach; therefore,			
$ \begin{array}{r} 1010\ 1010\ 1\ 0\ 10\ 1010 \\ + \quad 0000\ 0000\ 0\ 0\ 10\ 0000 \\ \hline 1010\ 1010\ 1\ 1\ 10\ 1010 \end{array} $			
Register 60 ₁₆ "MB" encoding = 10 1010 1011 (bits 25 through 34) (2AB Hex)			

(4). **Barometric Altitude Rate Data Input - ADS:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Barometric Altitude Rate data.

(5). **Inertial Vertical Rate Data Input - FMS / IRS:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Inertial Vertical Rate data.

b. **Register 60₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 8.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing as Mach data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ± 1.0 seconds.

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

- (3). Verify that the “DF”=20 reply “MB” field provides Data with:

Part 8.b.(3) DF = 20, Heading and Speed “MB” Field													
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88
“MB” Bits:	1	2	3 ----- 12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56
Field:	Magnetic Heading			Indicated Airspeed		Mach		Barometric Altitude Rate			Inertial Vertical Rate		
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data
Data:	0	0	00 0000 0000	0	00 0000 0000	1	10 1010 1011	0	0	0 0000 0000	0	0	0 0000 0000

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 8.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

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

Bit 56 (bit 24 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been re-started because of Mach data being provided.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 8.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”	“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 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 8.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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:

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 8.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 8.f, interrogate the transponder with the following Comm-B Extraction interrogation 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”	“DF”	“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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed servicing on Register 60₁₆ has changed because of having Mach data.

h. Comm-B Broadcast because of Data Link Capability Change Termination:

Continue to interrogate the transponder with the interrogation described in Part 8.g. (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 8.b.(2) is 18 ±1 second.

Note: At this time, the “B” timer started in Part 8.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.

2.7.7.9 Part 9 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 7

Repeat Part 3:

2.7.7.10 Part 10 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 8

Notes:

1. The primary intent of Part 10 beyond data validation in Register 60₁₆ is to validate Declaration of Capability while starting Register 60₁₆ servicing with a single parameter, e.g., Barometric Altitude Rate.
2. Review all subparagraphs of Part 10 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.

a. Data / Source Change - Set 2:

(1). Magnetic Heading Data Input:

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(2). Indicated Airspeed Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(3). Mach Data Input - ADS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Mach data.

(4). Barometric Altitude Rate Data Input - ADS:

Via an appropriate input interface, provide the transponder with the following Barometric Altitude Rate data at a minimum rate of 5 per second in order to provide appropriate Barometric Altitude Rate information.

Barometric Altitude Rate (feet/minute) - ADS			
[See Note 1]		[See Note 2,3]	
Barometric Altitude Rate (feet/minute)	Typical Binary Encoding	Rounded Input Data Value (feet/minute)	Rounded Input Encoding
-13,648.00	1_100 1010 1010	-13,664.00	1_0 0101 0101

Notes:

1. **Data Input Value and Typical Binary Encoding** represent the data as it is provided to the transponder in two's complement format. Sign Bit is "0" for "UP" and "1" for "Down".
2. **Rounded Input Data Value and Rounded Input Encoding** represent the data as it is expected to be seen in the "MB" field of Register 60₁₆. Data must be rounded to a resolution of 32 feet/minute; therefore,

$$\begin{array}{r}
 0_011\ 0101\ 01\ 0\ 1\ (+13,648) \\
 +0\ 000\ 0000\ 00\ 0\ 1\ (\text{round LSB}) \\
 \hline
 0_011\ 0101\ 01\ 1 \\
 1_100\ 1010\ 10\ 0\ (\text{complement}) \\
 +0\ 000\ 0000\ 00\ 1 \\
 \hline
 1_100\ 1010\ 10\ 1\ (2's\ complement) \\
 \text{Register } 60_{16}\ \text{"MB"}\ \text{encoding} = 1_0\ 0101\ 0101\ (\text{bits } 36\ \text{through } 45) \\
 (\text{IAB Hex})
 \end{array}$$
3. Data is shown encoded with the "Sign Bit", e.g., bit 36 being to the left of the "Underscore".

(5). Inertial Vertical Rate Data Input - FMS / IRS:

Via an appropriate input interface, terminate provision of valid data to the transponder with Inertial Vertical Rate data.

b. Register 60₁₆ Capability Verification:

Within 1.3 seconds of providing the transponder with data as detailed in Part 10.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing as Barometric Altitude Rate data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ±1.0 seconds.

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

- (3). Verify that the “DF”=20 reply “MB” field provides Data with:

Part 8.b.(3) DF = 20, Heading and Speed “MB” Field														
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88	
“MB” Bits:	1	2	3 ----- 12	13	14 ----- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56	
Field:	Magnetic Heading			Indicated Airspeed			Mach			Barometric Altitude Rate			Inertial Vertical Rate	
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data	
Data:	0	0	00 0000 0000	0	00 0000 0000	0	00 0000 0000	1	1	0 0101 0101	0	0	0 0000 0000	

c. Common Usage GICB Capability Report, Register 17₁₆:

Within FIVE (5) seconds of the interrogation / reply sequence in Part 10.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” =	“DI” =	“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:

Bit 56 (bit 24 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been re-started because of Barometric Altitude Rate data being provided.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 10.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

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

- (1). Bit 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 10.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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” =	“DI” =	“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:

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (10)~~ seconds of providing the transponder with data as detailed in Part 10.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 10.f, interrogate the transponder with the following Comm-B Extraction interrogation 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

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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.

- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed servicing on Register 60₁₆ has changed because of having Barometric Altitude Rate data.

h. Comm-B Broadcast because of Data Link Capability Change Termination:

Continue to interrogate the transponder with the interrogation described in Part 10.g. (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 10.b.(2) is 18 ±1 second.

Note: *At this time, the “B” timer started in Part 10.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.7.11 Part 11 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 9

Repeat Part 3:

2.7.7.12 Part 12 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 10

Notes:

1. *The primary intent of Part 12 beyond data validation in Register 60₁₆ is to validate Declaration of Capability while starting Register 60₁₆ servicing with a single parameter, e.g., Inertial Vertical Rate.*
2. *Review all subparagraphs of Part 12 prior to performing tests. This is necessary to establish the appropriate timing between changing data inputs and interrogations.*

a. Data / Source Change - Set 2:

(1). **Magnetic Heading Data Input:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(2). **Indicated Airspeed Data Input - ADS:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Indicated Airspeed data.

(3). **Mach Data Input - ADS:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Mach data.

(4). **Barometric Altitude Rate Data Input - ADS:**

Via an appropriate input interface, terminate provision of valid data to the transponder with Barometric Altitude Rate data.

(5). **Inertial Vertical Rate Data Input - FMS / IRS:**

Via an appropriate input interface, provide the transponder with the following Inertial Vertical Rate data at a minimum rate of 5 per second in order to provide appropriate Inertial Vertical Rate information.

Inertial Vertical Rate (feet/minute) - FMS / IRS			
[See Note 1]		[See Note 2,3]	
Inertial Vertical Rate (feet/minute)	Typical Binary Encoding	Rounded Input Data Value (feet/minute)	Rounded Input Encoding
- 9,557	1_101 1010 1010 1011	9,568	1_0 1101 0101
Notes:			
1. Data Input Value and Typical Binary Encoding represent the data as it is provided to the transponder in two's complement format. Sign Bit is "0" for "UP" and "1" for "Down".			
2. Rounded Input Data Value and Rounded Input Encoding represent the data as it is expected to be seen in the "MB" field of Register 60 ₁₆ . Data must be rounded to a resolution of 32 feet/minute; therefore,			
$ \begin{array}{r} 0_010\ 0101\ 01\ 0\ 1\ 0101\ (+9,557) \\ +\ 0\ 000\ 0000\ 00\ 0\ 1\ 0000\ (\text{round LSB}) \\ \hline 0_010\ 0101\ 01\ 1\ 0\ 0110 \\ 1_101\ 1010\ 10\ 0\ (\text{complement}) \\ +\ 0\ 000\ 0000\ 00\ 1 \\ \hline 1_101\ 1010\ 10\ 1\ (2's\ complement) \end{array} $			
Register 60 ₁₆ "MB" encoding = 1_0 1101 0101 (bits 47 through 56)			
3. Data is shown encoded with the "Sign Bit", e.g., bit 47 being to the left of the "Underscore".			

b. **Register 60₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 10.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

- The transponder should initiate the "B" timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
- In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing as Inertial Vertical Rate data has been re-started. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.
 - Verify that the transponder replies with a DF=20 reply.
 - During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the "DR" field. If the "DR" field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ± 1.0 seconds.

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

(3). Verify that the “DF”=20 reply “MB” field provides Data with:

Part 8.b.(3) DF = 20, Heading and Speed “MB” Field													
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88
“MB” Bits:	1	2	3 ----- 12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56
Field:	Magnetic Heading			Indicated Airspeed		Mach		Barometric Altitude Rate			Inertial Vertical Rate		
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data
Data:	0	0	00 0000 0000	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	1	1	0 1101 0101

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 12.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

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

Bit 56 (bit 24 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been re-started because of Inertial Vertical Rate data being provided.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 12.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”	“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 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.

- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 12.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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:

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Within ~~SIXTEN (10)~~ seconds of providing the transponder with data as detailed in Part 12.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 12.f, interrogate the transponder with the following Comm-B Extraction interrogation 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”	“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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “1” (from “0”) to indicate that Register 17₁₆ has changed servicing on Register 60₁₆ has changed because of having Inertial Vertical Rate data.

h. Comm-B Broadcast because of Data Link Capability Change Termination:

Continue to interrogate the transponder with the interrogation described in Part 12.g, (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 12.b.(2) is 18 ±1 second.

Note: At this time, the “B” timer started in Part 12.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.

2.7.7.13

Part 13 – Register 60₁₆ - Heading and Speed Report - Data Change Validation - Set 11

a. Data Input Initialization:

(1). Magnetic Heading Data Input:

For each line Item # in the following table (Table 13.a(1)), provide the transponder with Magnetic Heading data having a value as indicated in the “Data Value” (degrees) Column in the table.

Table 13.a(1): Register 60 ₁₆ - Magnetic Heading (degrees)								
Item #	Type of Value	Generic Magnetic Heading Input (degrees) [Binary (BNR)]			Register 60 ₁₆ Magnetic Heading (degrees)			
		Status	Sense (See Note 2)	Data Value (degrees)	Status (bit 1)	Sense (See Note 2)	Decimal Value (degrees)	Binary Value (bits 2 ---- 12) (See Note 3)
1	Basic	Valid	West (CCW)	- 120.05859375 (239.9414063)	1	Left	- 120.0585937 (239.9414063)	1_01 0101 0101
2	Basic	Valid	East (CW)	119.8828125	1	Right	119.8828125	0_10 1010 1010
3	Basic	Valid	West (CCW)	- 24.08203125 (335.9196875)	1	Left	- 24.08203125 (335.9179688)	1_11 0111 0111
4	Basic	Valid	East (CW)	167.87109375	1	Right	167.87109375	0_11 1011 1011
5	Basic	Valid	Left (CCW)	- 96.15234375 (263.8476563)	1	Left	- 96.15234375 263.8476563	1_01 1101 1101
6	Basic	Valid	Left (CCW)	- 48.1640625 (311.8359375)	1	Left	- 48.1640625 (311.8359375)	1_10 1110 1110
7	Basic	Valid	Left (CCW)	- 0.16479 (359.83521)	1	Left	- 0.17578125 (359.8242188)	1_11 1111 1111
8	Basic	Valid	Right (CW)	0	1	Right	0	0_00 0000 0000
9	Rounded ($\frac{1}{2}$ LSB)	Valid	Right (CW)	60.25	1	Right	60.29296875	0_01 0101 0111
10	Rounded ($\frac{1}{4}$ LSB)	Valid	Right (CW)	60.00	1	Right	59.94140625	0_01 0101 0101
11	Invalid	Invalid	Not Applicable	0	0	N/A	0	0_00 0000 0000

Notes:

1. Input data Sense refers to (a) Positive, being Clockwise (CW), commonly meaning East of North, or (b) Negative, being Counter-Clockwise (CCW), commonly meaning West of North.
2. Register 60₁₆ Sense refers to (a) "1" for negative or West of North, or (b) "0" for positive or East of North.
3. Data is shown encoded with the "Sign Bit", e.g., bit 2 being to the left of the "Underscore".

(2). Indicated Airspeed Data Input - ADS:

For each line Item # in the following table (Table 13.a(2)), provide the transponder with Indicated Airspeed data having a value as indicated in the "Data Value" (degrees) Column in the table.

Table 13.a(2): Register 60 ₁₆ - Indicated Airspeed (knots)						
Item #	Type of Value	Generic Indicated Airspeed (knots) [Binary (BNR)]		Register 60 ₁₆ Indicated Airspeed (knots)		
		Status	Data Value (knots)	Status (bit 13)	Decimal Value (knots)	Binary Value (bits 14 ---23)
1	Basic	Valid	682	1	682	10 1010 1010
2	Basic	Valid	341	1	341	01 0101 0101
3	Basic	Valid	887	1	887	11 0111 0111
4	Basic	Valid	955	1	955	11 1011 1011
5	Basic	Valid	477	1	477	01 1101 1101
6	Basic	Valid	750	1	750	10 1110 1110
7	Max	Valid	1,024	1	1,023	11 1111 1111
8	Min	Valid	0	1	0	00 0000 0000
9	Rounded ($\frac{1}{2}$ LSB)	Valid	342.75	1		01 0101 0111
10	Rounded ($\frac{1}{4}$ LSB)	Valid	341.25	1		01 0101 0101
11	Invalid	Invalid	Not Applicable	0	0	00 0000 0000

(3). Mach Data Input - ADS:

For each line Item # in the following table (Table 13.a(3)), provide the transponder with Mach data having a value as indicated in the “Data Value” (degrees) Column in the table.

Table 13.a(3): Register 60 ₁₆ - Mach (milli-Mach)						
Item #	Type of Value	Generic Mach (milli-Mach) [Binary (BNR)]		Register 60 ₁₆ Mach (milli-Mach)		
		Status	Data Value (knots)	Status (bit 24)	Decimal Value (knots)	Binary Value (bits 25 ---34)
1	Basic	Valid	1,928	1	1,928	01 1110 0010
2	Basic	Valid	1,364	1	1,364	01 0101 0101
3	Basic	Valid	3,548	1	3,548	11 0111 0111
4	Basic	Valid	3,820	1	3,820	11 1011 1011
5	Basic	Valid	1,908	1	1,908	01 1101 1101
6	Basic	Valid	3,000	1	3,000	10 1110 1110
7	Max	Valid	4,096	1	4,902	11 1111 1111
8	Min	Valid	0	1	0	00 0000 0000
9	Rounded (½ LSB)	Valid	1,370	1	1,372	01 0101 0111
10	Rounded (¼ LSB)	Valid	1,365	1	1,364	01 0101 0101
11	Invalid	Invalid	Not Applicable	0	0	00 0000 0000

(4). Barometric Altitude Rate Data Input - ADS:

For each line Item # in the following table (Table 13.a(4)), provide the transponder with Barometric Altitude Rate data having a value as indicated in the “Data Value” (degrees) Column in the table.

Table 13.a(4): Register 60 ₁₆ - Barometric Altitude Rate (feet / minute)								
Item #	Type of Value	Generic Barometric Altitude Rate (feet / minute) [Binary (BNR)]			Register 60 ₁₆ Barometric Altitude Rate (feet / minute)			
		Status	Sense (See Note 2)	Data Value (feet / minute)	Status (bit 35)	Sense (See Note 2)	Decimal Value (feet / minute)	Binary Value (bits 36 ---- 45) (See Note 3)
1	Basic	Valid	0, +, UP	10,912	1	UP	10,912	0_1 0101 0101
2	Basic	Valid	1, -, Down	- 10,912	1	Down	- 10,912	1_0 1010 1011
3	Basic	Valid	1, -, Down	- 4,384	1	Down	- 4,384	1_1 0111 0111
4	Basic	Valid	1, -, Down	- 2,208	1	Down	- 2,208	1_1 1011 1011
5	Basic	Valid	0, +, UP	15,264	1	UP	15,264	0_1 1101 1101
6	Basic	Valid	1, -, Down	- 8,768	1	Down	- 8,768	1_0 1110 1110
7	Basic	Valid	1, -, Down	- 16,384	1	Down	- 16,356	1_0 0000 0000
8	Basic	Valid	0, +, UP	16,356	1	UP	16,352	0_1 1111 1111
9	Rounded (½ LSB)	Valid	0, +, UP	15,248	1	UP	15,264	0_1 1101 1101
10	Rounded (¼ LSB)	Valid	0, +, UP	15,272	1	UP	15,264	0_1 1101 1101
11	Invalid	Invalid	Not Applicable	0	0	N/A	0	0_00 0000 0000

Notes:

1. Input data Sense refers to (a) Positive, being “UP”, or (b) Negative, being “Down”.
2. Register 60₁₆ Sense refers to (a) “1” for negative or “Down”, or (b) “0” for positive or “UP”.
3. Data is shown encoded with the “Sign Bit”, e.g., bit 36 being to the left of the “Underscore”.

(5). Inertial Vertical Rate Data Input - FMS / IRS:

For each line Item # in the following table (Table 13.a(5)), provide the transponder with Inertial Vertical Rate data having a value as indicated in the “Data Value” (degrees) Column in the table.

Table 13.a(5): Register 60₁₆ - Inertial Vertical Rate (feet / minute)								
Item #	Type of Value	Generic Inertial Vertical Rate (feet / minute) [Binary (BNR)]			Register 60 ₁₆ Inertial Vertical Rate (feet / minute)			
		Status	Sense (See Note 2)	Data Value (feet / minute)	Status (bit 46)	Sense (See Note 2)	Decimal Value (feet / minute)	Binary Value (bits 47 ---- 56) (See Note 3)
1	Basic	Valid	0, +, UP	10,912	1	UP	10,912	0_1 0101 0101
2	Basic	Valid	1, -, Down	- 10,912	1	Down	- 10,912	1_0 1010 1011
3	Basic	Valid	1, -, Down	- 4,384	1	Down	- 4,384	1_1 0111 0111
4	Basic	Valid	1, -, Down	- 2,208	1	Down	- 2,208	1_1 1011 1011
5	Basic	Valid	0, +, UP	15,264	1	UP	15,264	0_1 1101 1101
6	Basic	Valid	1, -, Down	- 8,768	1	Down	- 8,768	1_0 1110 1110
7	Basic	Valid	1, -, Down	- 16,384	1	Down	- 16,356	1_0 0000 0000
8	Basic	Valid	0, +, UP	16,356	1	UP	16,352	0_1 1111 1111
9	Rounded (½ LSB)	Valid	0, +, UP	15,248	1	UP	15,264	0_1 1101 1101
10	Rounded (¼ LSB)	Valid	0, +, UP	15,272	1	UP	15,264	0_1 1101 1101
11	Invalid	Invalid	Not Applicable	0	0	N/A	0	0_0 0000 0000

Notes:

- Input data Sense refers to (a) Positive, being “UP”, or (b) Negative, being “Down”.
- Register 60₁₆ Sense refers to (a) “1” for negative or “Down”, or (b) “0” for positive or “UP”.
- Data is shown encoded with the “Sign Bit”, e.g., bit 47 being to the left of the “Underscore”.

b. Register 60₁₆ Capability Verification:

Within 1.3 seconds of providing the transponder with data as detailed in Part 13.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Verify that the transponder replies with a DF=20 reply.

- For each line Item # in Table 13.a(1) with “MB” field Status (bit 1) equivalent to that shown in the Status (bit 1) column of Table 13.a(1).
- For each line Item # in Table 13.a(1), with “MB” field bit 2 through 12 equivalent to that shown in the Binary Value (bits 2 - 12) column of Table 13.a(1).
- For each line Item # in Table 13.a(2) with “MB” field Status (bit 13) equivalent to that shown in the Status (bit 13) column of Table 14.a(2).

- (4). For each line Item # in Table 13.a(2), with “MB” field bits 14 through 23 equivalent to that shown in the Binary Value (bits 14 - 23) column of Table 13.a(2).
- (5). For each line Item # in Table 13.a(3) with “MB” field Status (bit 24) equivalent to that shown in the Status (bit 24) column of Table 13.a(3).
- (6). For each line Item # in Table 13.a(3), with “MB” field bits 25 through 34 equivalent to that shown in the Binary Value (bits 25 - 34) column of Table 13.a(3).
- (7). For each line Item # in Table 13.a(4) with “MB” field Status (bit 35) equivalent to that shown in the Status (bit 35) column of Table 13.a(4).
- (8). For each line Item # in Table 13.a(4), with “MB” field bits 36 through 45 equivalent to that shown in the Binary Value (bits 36 - 45) column of Table 13.a(4).
- (9). For each line Item # in Table 13.a(5) with “MB” field Status (bit 46) equivalent to that shown in the Status (bit 46) column of Table 13.a(5).
- (10). For each line Item # in Table 13.a(5), with “MB” field bits 47 through 56 equivalent to that shown in the Binary Value (bits 47 - 56) column of Table 13.a(5).

Note: Cumulative results are as shown in the following table.

Part 13.b. DF = 20, Heading and Speed -“MB” Field													
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88
“MB” Bits:	1	2	3 ----- 12	13	14 ----- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56
Field:	Magnetic Heading			Indicated Airspeed		Mach		Barometric Altitude Rate			Inertial Vertical Rate		
Data:	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data
Item #													
1	1	1	01 0101 0101	1	10 1010 1010	1	01 1110 0010	1	0	1 0101 0101	1	0	1 0101 0101
2	1	0	10 1010 1010	1	01 0101 0101	1	01 0101 0101	1	1	0 1010 1011	1	1	0 1010 1011
3	1	1	11 0111 0111	1	11 0111 0111	1	11 0111 0111	1	1	1 0111 0111	1	1	1 0111 0111
4	1	0	11 1011 1011	1	11 1011 1011	1	11 1011 1011	1	1	1 1011 1011	1	1	1 1011 1011
5	1	1	01 1101 1101	1	01 1101 1101	1	01 1101 1101	1	0	1 1101 1101	1	0	1 1101 1101
6	1	1	10 1110 1110	1	10 1110 1110	1	10 1110 1110	1	1	0 1110 1110	1	1	0 1110 1110
7	1	1	11 1111 1111	1	11 1111 1111	1	11 1111 1111	1	1	0 0000 0000	1	1	0 0000 0000
8	1	0	00 0000 0000	1	00 0000 0000	1	00 0000 0000	1	0	1 1111 1111	1	0	1 1111 1111
9	1	0	01 0101 0111	1	01 0101 0111	1	01 0101 0111	1	0	1 1101 1101	1	0	1 1101 1101
10	1	0	01 0101 0101	1	01 0101 0101	1	01 0101 0101	1	0	1 1101 1101	1	0	1 1101 1101
11	0	0	00 0000 0000	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	0	0 0000 0000

2.7.7.14 Part 14 – Reduced Update Rate

Notes:

1. The primary intent of Part 3 beyond data validation in Register 60₁₆ is to validate Declaration of Capability as data inputs are reduced to rates that are less than the minimum acceptable rate.
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. Data / Source Change - Set 1: (§2.2.25.8.2)

- (1). Magnetic Heading Data Input: (§2.2.25.8.2.1)

Via an appropriate input interface, set the rate at which valid Magnetic Heading data is provided to less than once in 2.6 seconds.

- (2). Indicated Airspeed Data Input - ADS: (§2.2.25.8.2.2)
Via an appropriate input interface, set the rate at which valid Indicated Airspeed data is provided to less than once **in 2.6** seconds.
- (3). Mach Data Input - ADS: (§2.2.25.8.2.3)
Via an appropriate input interface, set the rate at which valid Mach data is provided to less than once **in 2.6** seconds.
- (4). Barometric Altitude Rate Data Input - ADS: (§2.2.25.8.2.4)
Via an appropriate input interface, set the rate at which valid Barometric Altitude Rate data is provided to less than once **in 2.6** seconds.
- (5). Inertial Vertical Rate Data Input - FMS / IRS: (§2.2.25.8.2.5)
Via an appropriate input interface, set the rate at which valid Inertial Vertical Rate data is provided to less than once **in 2.6** seconds.

b. **Register 60₁₆ Capability Verification:**

Within 1.3 seconds of providing the transponder with data as detailed in Part 2.a, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Notes:

1. The transponder should initiate the “B” timer for 18 ±1.0 seconds since a Comm-B Broadcast is initiated.
2. In this case, the Comm-B Broadcast is caused by the contents of Register 60₁₆ changing as provision of all parameter data has effectively been terminated. This change causes a change to Register 17₁₆, which then forces a change to Register 10₁₆, which then results in the initiation of the Comm-B Broadcast.

- (1). Verify that the transponder replies with a DF=20 reply.
- (2). During replies to this interrogation sequence and subsequent interrogations during this test procedure, monitor the “DR” field. If the “DR” field changes to 4, 5, 6, or 7, then the transponder has initiated a Comm-B Broadcast.

When the “DR” field changes, start a Test Timer to monitor that the “B”-Timer runs for 18 ±1.0 seconds.

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

(3). Verify that the “DF”=20 reply “MB” field provides Data with:

Part 2.b.(3) DF = 20, Heading and Speed “MB” Field														
Reply Bits:	33	34	35 ----- 44	45	46 ---- 55	56	57 ----- 66	67	68	69 ----- 77	78	79	80 ----- 88	
“MB” Bits:	1	2	3 ----- 12	13	14 ---- 23	24	25 ----- 34	35	36	37 ----- 45	46	47	48 ----- 56	
Field:	Magnetic Heading			Indicated Airspeed			Mach			Barometric Altitude Rate			Inertial Vertical Rate	
	Status	Sign	Data	Status	Data	Status	Data	Status	Sign	Data	Status	Sign	Data	
Data:	0	0	00 0000 0000	0	00 0000 0000	0	00 0000 0000	0	0	0 0000 0000	0	0	0 0000 0000	

c. **Common Usage GICB Capability Report, Register 17₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 3.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

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

Bit 56 (bit 24 of the “MB” field) set to “0” to indicate that Register 60₁₆ servicing capability has been changed as data for Register 60₁₆ has been terminated.

d. **Mode S Specific Services GICB Capability, Register 18₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 3.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”	“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 64 (bit 32 of the “MB” field) set to “1” to indicate that Register 19₁₆ servicing capability has been established during the power-on cycle.
- (2). Bit 65 (bit 33 of the “MB” field) set to “1” to indicate that Register 18₁₆ servicing capability has been established during the power-on cycle.
- (3). Bit 66 (bit 34 of the “MB” field) set to “1” to indicate that Register 17₁₆ servicing capability has been established during the power-on cycle.

e. **Mode S Specific Services GICB Capability, Register 19₁₆:**

Within FIVE (5) seconds of the interrogation / reply sequence in Part 3.b, interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 19₁₆ Mode S Specific Services GICB Capability:

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:

Bit 49 (bit 17 of the “MB” field) set to “1” to indicate that Register 60₁₆ servicing capability has been established during the power-on cycle.

f. **Comm-B Broadcast Validation:**

Continue to interrogate the transponder with the following GICB Extraction interrogation in order to extract the Register 60₁₆ - Heading and Speed Report data monitor the “DR” field in the reply.

REGISTER 60 ₁₆ HEADING AND SPEED REPORT 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	22 (16 HEX)	7	0	0	0	0	0	0

Within ~~65TEN (40)~~ seconds of providing the transponder with data as detailed in Part 2.a.

Verify that the “DR” field in DF=20 replies is set to DR=4, 5, 6, or 7 to indicate that a Comm-B Broadcast is active.

g. **Comm-B Broadcast Extraction:**

After determining that the “DR” field has been set to DR=4, 5, 6, or 7 in Part 3.f, interrogate the transponder with the following Comm-B Extraction interrogation 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” =	“DF” =	“IIS” =	“RRS” =	“X” =	“LOS” =	“XX” =	“TMS” =
4	0	16	7	0	0	0	0	0	0

		(10 HEX)							
--	--	----------	--	--	--	--	--	--	--

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). Bits 33 - 40 (bits 1 - 8 of the “MB” field) set to 10 HEX (0001 0000).
- (3). Bit 57 [“Mode S Specific Services Capability” (bit 25 of the “MB” field)] set to ONE (1) to indicate that the transponder has established Mode S Specific Services Capability.
- (4). Bit 67 [“SIC” subfield (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 (bit 36 of the “MB” field)] toggled to “0” (from “1”) to indicate that Register 17₁₆ has changed.

h. Comm-B Broadcast because of Data Link Capability Change Termination:

Continue to interrogate the transponder with the interrogation described in Part 3.g, (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 3.b.(2) is 18 ± 1 second.

Note: *At this time, the “B” timer started in Part 3.b.(2), as broadcast because of a change in Data Link Capability, should have terminated.*

2.7.6.1

Part 15 – Multiple Data Sources

If Multiple Data Sources of Register 60₁₆ parameters are provided to the Unit-Under-Test (UUT), then REPEAT all applicable sections of Part 2 for each additional data source that was not tested while performing Parts 1 through 13 above.

Note: *GPS Data Sources may not provide data more often than once every 1.2 seconds. If GPS Data Sources are used to provide data, ensure that the data is provided at the minimum rate of once every 1.2 seconds. For Register 60₁₆, this may apply to the Inertial Vertical Rate data.*