

## A.2 Traffic Information Service – Broadcast (TIS-B) Formats and Coding

### A.2.1 Introduction

**Notes:**

1. *This section of Appendix A defines the formats and coding for a Traffic Information Service Broadcast (TIS-B) based on the same 112-bit 1090 MHz signal transmission that is used for ADS-B on 1090 MHz.*
2. *TIS-B complements the operation of ADS-B by providing ground-to-air broadcast of surveillance data on aircraft that are not equipped for 1090 MHz ADS-B. The basis for this ground surveillance data may be an ATC Mode S radar, a surface or approach multilateration system or a multisensor data processing system. The TIS-B ground-to-air transmissions use the same signal formats as 1090 MHz ADS-B and can therefore be accepted by a 1090 MHz ADS-B receiver.*
3. *TIS-B service is the means for providing a complete surveillance picture to 1090 MHz ADS-B users during a transition period. After transition, it also provides a means to cope with a user that has lost its 1090 MHz ADS-B capability.*

### A.2.2 TIS-B Format Definition

TIS-B information is broadcast using the 112-bit Mode S DF=18 format as shown below in Figure A.2.2:



**Figure A.2.2: TIS-B Format Definition**

### A.2.3 Control Field Allocation

The content of the DF=18 transmission is defined by the value of the control field, as specified in Table A.2.3.

**Table A.2.3: “CF” Field Code Definitions in DF=18 ADS-B and TIS-B Messages.**

CF Value	ICAO/Mode A Flag (IMF)	Meaning
0	N/A	ADS-B message from a non-transponder device, AA field holds 24-bit ICAO aircraft address
1	N/A	Reserved for ADS-B message in which the AA field holds anonymous address or ground vehicle address or fixed obstruction address
2	0	Fine TIS-B message, AA field contains the 24-bit ICAO aircraft address
	1	Fine TIS-B message, AA field contains the 12-bit Mode A code followed by a 12-bit track file number
3	0	Coarse TIS-B airborne position and velocity message, AA field contains the 24-bit ICAO aircraft address
	1	Coarse TIS-B airborne position and velocity message, AA field contains the 12-bit Mode A code followed by a 12-bit track file number.
4	N/A	Reserved for TIS-B management message AA field holds TIS-B service volume ID + other information (e.g., MSB of reference position for the service volume)
5	0	Reserved for TIS-B messages that relay ADS-B messages using anonymous 24-bit addresses
	1	Reserved
6 – 7	N/A	Reserved

#### A.2.4 TIS-B Surveillance Message Definition

##### A.2.4.1 TIS-B Fine Airborne Position Message

The TIS-B fine airborne position ME field shall be formatted as specified in Figure A.2.5A.

**Note:** Additional details are specified in the following paragraphs.

##### A.2.4.1.1 ICAO/Mode A Flag (IMF)

This one-bit field (bit 8) shall indicate the type of identity associated with the aircraft data reported in the TIS-B message. IMF equal to ZERO (0) shall indicate that the TIS-B data is identified by an ICAO 24-bit address. IMF equal to ONE (1) shall indicate that the TIS-B data is identified by a “Mode A” code. ~~A “Mode A” code of all zeroes shall indicate a primary radar target.~~ A TIS-B report on a primary radar target shall indicate a “Mode A” code of all ZEROs.

**Notes:**

**1.** —The AA field is coded differently for 24-bit addresses and Mode A codes as specified in Table A.2.3.

**2.** A target with a ZERO “Mode A” code and a reported altitude, is an SSR target.

**A.2.4.1.2 Pressure Altitude**

This 12-bit field shall provide the aircraft pressure altitude. This field shall contain barometric altitude encoded in 25 or 100-foot increments (as indicated by the Q Bit). All zeroes in this field shall indicate that there is no altitude data.

**A.2.4.1.3 Compact Position Reporting (CPR) Format (F)**

This field shall be set as specified in subparagraph A.1.4.2.1

**A.2.4.1.4 Latitude/Longitude**

The latitude/longitude fields in the TIS-B fine airborne position message shall be set as specified in subparagraph A.1.4.2.3.

**A.2.4.2 TIS-B Surface Position Message**

The TIS-B surface position ME field shall be formatted as specified in Figure A.2.5B.

**Note:** Additional details are specified in the following paragraphs.

**A.2.4.2.1 Movement**

This field shall be set as specified in subparagraph A.1.4.3.1

**A.2.4.2.1.1 Ground Track (true)****A.2.4.2.1.1.1 Ground Track Status**

This field shall be set as specified in subparagraph A.1.4.3.2.1.

**A.2.4.2.1.1.2 Ground Track Angle**

This field shall be set as specified in subparagraph A.1.4.3.2.2.

**A.2.4.2.1.2 ICAO/Mode A Flag (IMF)**

This one-bit field (bit 21) shall indicate the type of identity associated with the aircraft data reported in the TIS-B message. ~~IMF equal to ZERO (0) shall indicate that the TIS-B data is identified by an ICAO 24-bit address. IMF equal to ONE (1) shall indicate that the TIS-B data is identified by a "Mode A" code. A "Mode A" code of all zeroes shall indicate a primary radar target. Coding shall be as specified in subparagraph A.2.4.1.1.~~

~~*Note: The AA field is coded differently for 24-bit addresses and Mode A codes as specified in Table A.2.3.*~~

**A.2.4.2.1.3 Compact Position Reporting (CPR) Format (F)**

This field shall be set as specified in subparagraph A.1.4.3.3.

**A.2.4.2.1.4 Latitude/Longitude**

The latitude/longitude fields in the TIS-B fine surface position message shall be set as specified in subparagraph A.1.4.3.5.

**A.2.4.3 Identification and Category Message**

The TIS-B identification and category ME field shall be formatted as specified in Figure A.2.5C. This message shall only be used for aircraft identified with an ICAO 24-bit address.

*Note: Additional details are specified in the following paragraphs.*

**A.2.4.3.1 Aircraft Identification Coding**

This field shall be set as specified in subparagraph A.1.4.4.1.

**A.2.4.4 Airborne Velocity Message**

The TIS-B airborne velocity ME field shall be formatted as specified in the Figure A.2.5D.

*Note: Additional details are specified in the following paragraphs.*

**A.2.4.4.1 Subtype Field**

Only subtypes 1 and 2 shall be used for the TIS-B airborne velocity message. Subtype 1 shall be used for velocities under 1000 knots and subtype 2 shall be used for aircraft capable of supersonic flight when the velocity might exceed 1022 knots.

The supersonic version of the velocity coding shall be used if either the east-west OR north-south velocities exceed 1022 kt. A switch to the normal velocity coding shall be made if both the east-west AND north-south velocities drop below 1000 kt.

**A.2.4.4.2 ICAO/Mode A Flag (IMF)**

This one-bit field (bit 9) shall indicate the type of identity associated with the aircraft data reported in the TIS-B message. ~~IMF equal to ZERO (0) shall indicate that the TIS-B data is identified by an ICAO 24-bit address. IMF equal to ONE (1) shall indicate that the TIS-B data is identified by a "Mode A" code. A "Mode A" code of all zeroes shall indicate a primary radar target. Coding shall be as specified in subparagraph A.2.4.1.1.~~

~~*Note: The AA field is coded differently for 24-bit addresses and Mode A codes as specified in Table A.2.3.*~~

**A.2.4.4.3 Navigation Integrity Category (NIC) Supplement**

This one-bit field (ME bit 46) shall be used together with the message type code to define the NIC value for the airborne and surface position messages.

Coding of the NIC Supplement field shall be as specified for the Operational Status Message in Table 2.2.3.2.3.1-B.

**A.2.4.4.4 Navigation Accuracy Coding (NAC)**

This four-bit field (ME bits 47-50) shall define the NAC value for the airborne and surface position messages.

Coding of the NAC field shall be as specified for the Operational Status Message in Table 2.2.3.2.7.3.7.

**A.2.4.4.5 Surveillance Integrity Level (SIL)**

This two-bit field (ME bits 51-52) shall define the SIL value for the airborne and surface position messages.

Coding of the SIL field shall be as specified for the Operational Status Message in Table 2.2.3.2.7.3.8.

**A.2.4.5 Coarse Airborne Position Message**

The TIS-B coarse airborne position ME field shall be formatted as specified in Figure A.2.5E.

**Notes:**

1. *This message is used if the surveillance source for TIS-B is not of high enough quality to justify the use of the fine formats. An example of such a source is a scanning beam Mode S interrogator.*
2. *Additional details are specified in the following paragraphs.*

**A.2.4.5.1 ICAO/Mode A Flag (IMF)**

This one-bit field (bit 1) shall indicate the type of identity associated with the aircraft data reported in the TIS-B message. ~~IMF equal to ZERO (0) shall indicate that the TIS-B data is identified by an ICAO 24-bit address. IMF equal to ONE (1) shall indicate that the TIS-B data is identified by a "Mode A" code. A "Mode A" code of all zeroes shall indicate a primary radar target. Coding shall be as specified in subparagraph A.2.4.1.1.~~

~~**Note:**—The AA field is coded differently for 24-bit addresses and Mode A codes as specified in Table A.2.3.~~

**A.2.4.5.2 Service Volume ID (SVID)**

The 4-bit SVID field shall identify the TIS-B site that delivered the surveillance data.

**Note:** *In the case where TIS-B messages are being received from more than one TIS-B ground stations, the SVID can be used to select coarse messages from a single source. This will prevent the TIS-B track from wandering due to the different error biases associated with different sources.*

#### **A.2.4.5.3 Pressure Altitude**

This 12-bit field shall provide the aircraft pressure altitude. This field shall contain barometric altitude encoded in 25 or 100-foot increments (as indicated by the Q Bit).

#### **A.2.4.5.4 Ground Track Status**

This one bit (ME bit 20) field shall define the validity of the ground track value. Coding for this field shall be as follows: 0=not valid and 1= valid.

#### **A.2.4.5.5 Ground Track Angle**

This 5-bit (ME bits 21-25) field shall define the direction (in degrees clockwise from true north) of aircraft motion. The ground track shall be encoded as an unsigned angular weighted binary numeral, with an MSB of 180 degrees and an LSB of 360/32 degrees, with ZERO (0) indicating true north. The data in the field shall be rounded to the nearest multiple of 360/32 degrees.

#### **A.2.4.5.6 Ground Speed**

This 6-bit (ME bits 26-31) field shall define the aircraft speed over the ground. Coding of this field shall be as specified in 2.2.17.3.5.6.

#### **A.2.4.5.7 Latitude/Longitude**

The latitude/longitude fields in the TIS-B coarse airborne position message shall be set as specified in subparagraph A.1.4.2.3, except that the 12-bit form of CPR coding shall be used.

### **A.2.5 Reserved for TIS-B Management Messages**

**Note:** *TIS-B management messages could announce information such as location and the service volume of the TIS-B ground station. There is no requirement in the TIS-B MASPS (DO-TBD) for management messages. Format DF=18 with CF=4 has been reserved for management messages should they be required in the future.*

**Figure A.2.5A: TIS-B Fine Airborne Position Message**

1	
2	
3	FORMAT TYPE CODE
4	(See A.1.4.1 and Note 1)
5	
6	SURVEILLANCE STATUS
7	LSB
8	IMF (See A.2.4.1.1)
9	
10	
11	PRESSURE ALTITUDE
12	
13	
14	The altitude code (AC) as specified
15	in section 2.2.13.1.2 of DO-181B but
16	with the M-bit removed
17	
18	
19	
20	
21	Reserved
22	CPR FORMAT (F) (See A.1.4.2.1)
23	MSB
24	
25	
26	
27	
28	
29	
30	CPR ENCODED LATITUDE
31	
32	(CPR Airborne Format
33	See A.1.7.1 to A.1.7.5)
34	
35	
36	
37	
38	
39	LSB
40	MSB
41	
42	
43	
44	
45	
46	
47	CPR ENCODED LONGITUDE
48	
49	(CPR Airborne Format
50	See A.1.7.1 to A.1.7.4)
51	
52	
53	
54	
55	
56	LSB

**Purpose:** To provide airborne position information for aircraft that are not equipped with 1090 MHz ADS-B when the TIS-B service is based on high quality surveillance data.

**Surveillance Status** coding

- 0 = no condition information
- 1 = permanent alert (emergency condition)
- 2 = temporary alert (change in Mode A identity code other than emergency condition)
- 3 = SPI condition

Codes 1 and 2 take precedence over code 3.

**Figure A.2.5B: TIS-B Fine Surface Position Message**

1	
2	
3	FORMAT TYPE CODE
4	(See A.1.4.1)
5	
6	
7	
8	
9	MOVEMENT
10	(See A.1.4.3.1)
11	
12	
13	STATUS for Gnd Tk (1 =valid, 0 = not valid)
14	MSB
15	
16	GROUND TRACK (7 bits)
17	(See A.1.4.3.2)
18	
19	<b>Resolution = 360/128 deg</b>
20	LSB
21	IMF (See A.2.4.2.12)
22	CPR FORMAT (F) (See A.1.4.2.1)
23	MSB
24	
25	
26	
27	
28	
29	
30	CPR ENCODED LATITUDE
31	
32	(CPR Surface Format See A.1.7.1 to A.1.7.4 and A.1.7.6)
33	
34	
35	
36	
37	
38	
39	LSB
40	MSB
41	
42	
43	
44	
45	
46	
47	CPR ENCODED LONGITUDE
48	
49	(CPR Surface Format See A.1.7.1 to A.1.7.4)
50	
51	
52	
53	
54	
55	
56	LSB

**Purpose:** To provide surface position information for aircraft that are not equipped with 1090 MHz ADS-B.

**Figure A.2.5C: TIS-B Identification and Category Message**

1	
2	
3	FORMAT TYPE CODE
4	(See A.1.4.1)
5	
6	
7	EMITTER CATEGORY
8	
9	MSB
10	
11	CHARACTER 1
12	
13	
14	LSB
15	MSB
16	
17	CHARACTER 2
18	
19	
20	LSB
21	MSB
22	
23	CHARACTER 3
24	
25	
26	LSB
27	MSB
28	
29	CHARACTER 4
30	
31	
32	LSB
33	MSB
34	
35	CHARACTER 5
36	
37	
38	LSB
39	MSB
40	
41	CHARACTER 6
42	
43	
44	LSB
45	MSB
46	
47	CHARACTER 7
48	
49	
50	LSB
51	MSB
52	
53	CHARACTER 8
54	
55	
56	LSB

**Purpose:** To provide aircraft identification and category for aircraft that are not equipped with 1090 MHz ADS-B.

**Type coding:**

- 1 = Aircraft identification, category set D
- 2 = Aircraft identification, category set C
- 3 = Aircraft identification, category set B
- 4 = Aircraft identification, category set A

**ADS-B Emitter Category coding:**

Set A

- 0 = No ADS-B Emitter Category Information
- 1 = Light (< 15 500 lbs.)
- 2 = Small (15 500 to 75 000 lbs.)
- 3 = Large (75 000 to 300 000 lbs.)
- 4 = High Vortex Large (aircraft such as B-757)
- 5 = Heavy (> 300 000 lbs.)
- 6 = High Performance (> 5 g acceleration and > 400kts)
- 7 = Rotorcraft

Set B

- 0 = No ADS-B Emitter Category Information
- 1 = Glider/sailplane
- 2 = Lighter-than-Air
- 3 = Parachutist/Skydiver
- 4 = Ultralight/hang-glider/paraglider
- 5 = Reserved
- 6 = Unmanned Aerial Vehicle
- 7 = Space/Trans-atmospheric Vehicle

Set C

- 0 = No ADS-B Emitter Category Information
- 1 = Surface Vehicle – Emergency Vehicle
- 2 = Surface Vehicle – Service Vehicle
- 3 = Fixed Ground or Tethered Obstruction
- 4-7 = Reserved

Set D : Reserved

**Aircraft identification coding:**

Coding as specified for A.1.4.4

**Figure A.2.5D: TIS-B Airborne Velocity Messages  
(Subtypes 1 and 2: Velocity Over Ground)**

BDS 0,9

1	MSB	1
2		0
3	FORMAT TYPE CODE = 19	0
4		1
5	LSB	1
6	SUBTYPE 1 0	SUBTYPE 2 0
7	0	1
8	1	0
9	IMF (See A.2.4.4.2)	
10	Reserved (4 bits)	
11		
12		
13		
14	DIRECTION BIT for E-W velocity (0=East, 1=West)	
15	EAST-WEST VELOCITY (10 bits)	
16	NORMAL : LSB = 1 knot	SUPERSONIC : LSB =4 knots
17	All zeros = no velocity info	All zeros = no velocity info
18	<u>Value</u> <u>Velocity</u>	<u>Value</u> <u>Velocity</u>
19	1              0 kts	1              0 kt
20	2              1 kt	2              4 kt
21	3              2 kt	3              8 kt
22	-              -	-              -
23	1022          1021 kt	1022          4084 kt
24	1023          >1021.5 kt	1023          > 4086kt
25	DIRECTION BIT for N-S velocity (0=North, 1=South)	
26	NORTH-SOUTH VELOCITY (10 bits)	
27	NORMAL : LSB = 1 knot	SUPERSONIC : LSB =4 knots
28	All zeros = no velocity info	All zeros = no velocity info
29	<u>Value</u> <u>Velocity</u>	<u>Value</u> <u>Velocity</u>
30	1              0 kts	1              0 kt
31	2              1 kt	2              4 kt
32	3              2 kt	3              8 kt
33	-              -	-              -
34	1022          1021 kt	1022          4084 kt
35	1023          >1021.5 kt	1023          > 4086kt
36	Reserved (1 bit)	
37	SIGN BIT FOR VERTICAL RATE: 0 = up, 1 = down	
38	VERTICAL RATE (9 bits)	
39	All zeros – no vertical rate information, LSB = 64 ft/min	
40	<u>Value</u>	<u>Vertical rate</u>
41	1	0 ft/min
42	2	64 ft/min
43	-	-
44	510	32576 ft/min
45	511	> 32608 ft/min
46		
47	NIC Supplement (See A.2.4.4.3)	
48		
49	Navigation Accuracy Coding (NAC) (4 bits)	
50	(See A.2.4.4.4)	
51		
52	Surveillance Integrity Level (SIL) (2 bits)	
53	(See A.2.4.4.5)	
54		
55	Reserved (3 bits)	
56		

**Purpose:** To provide velocity information for aircraft that are not equipped with 1090 MHz ADS-B when the TIS-B service is based on high quality surveillance data.

**Subtype Coding**

Code	Velocity	Type
1	Ground speed	normal
2		supersonic

**Figure A.2.5E: TIS-B Coarse Airborne Position Message**

1	IMF (See A.2.4.5.1)
2	SURVEILLANCE STATUS
3	
4	MSB
5	SERVICE VOLUME ID (SVID)
6	
7	LSB
8	MSB
9	
10	
11	
12	
13	PRESSURE ALTITUDE
14	
15	
16	
17	
18	
19	LSB
20	GRND TRACK STATUS (1=valid, 0=invalid)
21	GROUND TRACK ANGLE
22	
23	(See A.2.4.5.5)
24	
25	
26	GROUND SPEED
27	
28	(See A.2.4.5.6)
29	
30	
31	
32	CPR FORMAT (F) (0 = even, 1 = odd)
33	
34	
35	
36	
37	
38	CPR-ENCODED LATITUDE
39	
40	(See A.2.4.5.7)
41	
42	
43	
44	LSB
45	MSB
46	
47	
48	
49	
50	CPR-ENCODED LONGITUDE
51	
52	(See A.2.4.5.7)
53	
54	
55	
56	LSB

**Purpose:** To provide airborne position information for aircraft that are not equipped with 1090 MHz ADS-B when the TIS-B service is based on moderate quality surveillance data..