

**Table 2-96: Payload Type and Tx Antenna Selection vs. Equipment Class**

Eqpt Class ->	A0, B0	A1L, A1H, B1		A1H, B1 (w/TS)		A2		A3	
	Antenna	Bot	Top	Bot	Top	Bot	Top	Bot	Top
1	1		1		3		1		1
2	0		0		6		4		4
3	2	2		0		4		5	
4	0	0		6		4		4	
5	0		0		6		4		4
6	1		1		3		1		1
7	0	0		6		4		4	
8	2	2		0		4		5	
9	2		2		0		4		5
10	0		0		6		4		4
11	1	1		3		1		1	
12	0	0		6		4		4	
13	0		0		6		4		4
14	2		2		0		4		5
15	0	0		6		4		4	
16	1	1		3		1		1	

#### 2.4.6.2 Verification of ADS-B Message Transmit Timing (§2.2.6.2)

No specific test procedure is required to validate §2.2.6.2.

#### 2.4.6.2.1 Verification of The Message Start Opportunity (MSO) (§2.2.6.2.1)

##### Purpose/Introduction:

ADS-B Messages **shall** be transmitted at discrete Message Start Opportunities (MSO) chosen by a pseudo-random process. The specific pseudo-random number ( $R$ ) chosen by an aircraft depends on the aircraft's current position and on the previously chosen random number. Let:

$$N(0) = 12 \text{ L.S.B.'s of the most recent valid "LATITUDE"}$$

$$N(1) = 12 \text{ L.S.B.'s of the most recent valid "LONGITUDE"}$$

where the "LATITUDE" and "LONGITUDE" are as defined in §2.2.4.5.2.1.

The procedure below **shall** be employed to establish the transmission timing for the current UAT frame  $m$ .

$$\text{When } m = 0, R(0) = N(0) \bmod 3200$$

$$\text{When } m \geq 1, R(m) = \{4001 \cdot R(m-1) + N(m \bmod 2)\} \bmod 3200$$

1. When in the first frame after power up, and whenever the Vertical Status is determined to be in the AIRBORNE condition, the transmitter **shall** be in the *full MSO range* mode, where the MSO is determined as follows:

$$MSO = 752 + R(m)$$

2. Under all other conditions the transmitter **shall** be in the *restricted MSO range* mode, where the MSO is determined as follows:

$$\text{MSO} = 752 + R^* + R(m) \bmod 800$$

With  $R^* = R(k) - R(k) \bmod 800$ , where “k” is the frame just prior to entering the *restricted MSO range* mode.

This test procedure verifies that the UAT Transmitter output transmission timing meets the requirements of §2.2.6.2.1. The transmitter is required to output at the discrete MSO determined by a pseudo-random calculation based on the last ownship valid latitude and longitude position. The following procedure verifies that the output occurs at the proper MSO based on the calculation.

#### Equipment Required:

The test configuration requires data sources be provided to the appropriate UAT Transmitter interfaces to enable transmission of ADS-B Messages. This could also be accomplished by the use of an internally generated ADS-B test message with controllable data content. Determine the elapsed time by an external timing source capable of measuring the time from message transmission relative to the UTC time mark. The interval may vary from the time to the first MSO to the last MSO in the one second epoch.

#### Measurement Procedures:

Set up the UAT Transmitting equipment as configured in [Figure 2-12](#). The time of transmission is measured relative to the UTC Time Mark or equivalent to the start of the first bit of the synchronization sequence of the transmitted message. The timing measurement is required to provide a minimum of a 50 nanosecond timing resolution.

Provide a means to indicate the Vertical Status to the UAT equipment, if the UAT equipment supports such an interface.

#### Step 1: Airborne Message Start Opportunity Verification

Apply a Vertical Status of AIRBORNE to the UAT equipment, if provided. Provide data to the UAT transmitting equipment to output the following fixed latitude and longitude values:

Latitude:	000 1000 1010 1000 0110 1000
	(MSB) (LSB)
Longitude:	0000 0101 1010 0010 0011 1010

Maintain this input to the latitude and longitude inputs to enable verification of correct MSO assignment. Power down the transmitter so that the last valid latitude and longitude values stored by the UAT transmitting equipment are as indicated. Power on the UAT Transmitting equipment with the latitude and longitude data input maintained at the fixed values. The sequence of MSOs that are valid assuming an initialization at  $t = 0$  are as indicated in [Table 2-97](#). Due to differences in power up timing and initialization procedures, the transmission sequence may not commence from the very beginning of the table but once aligned with the table, verify the transmission times for a minimum of 10 transmissions. The time interval from the UTC Time Mark to the first bit of the synchronization sequence establishes the MSO number. If the MSO is

contained in the output message, it can be used to validate the proper MSO timing.

If the UAT equipment does not support a Vertical Status interface, the remaining Steps of this procedure do not need to be performed.

**Table 2-97: MSO Sequence Validation**

<u>m</u>	<u>N(0)</u>	<u>N(1)</u>	<u>temp</u>	<u>R(m)</u>	<u>MSO</u>
<u>0</u>	<u>2152</u>	<u>570</u>	<u>undefined</u>	<u>2152</u>	<u>2904</u>
<u>1</u>	<u>2152</u>	<u>570</u>	<u>8610722</u>	<u>2722</u>	<u>3474</u>
<u>2</u>	<u>2152</u>	<u>570</u>	<u>10892874</u>	<u>74</u>	<u>826</u>
<u>3</u>	<u>2152</u>	<u>570</u>	<u>296644</u>	<u>2244</u>	<u>2996</u>
<u>4</u>	<u>2152</u>	<u>570</u>	<u>8980396</u>	<u>1196</u>	<u>1948</u>
<u>5</u>	<u>2152</u>	<u>570</u>	<u>4785766</u>	<u>1766</u>	<u>2518</u>
<u>6</u>	<u>2152</u>	<u>570</u>	<u>7067918</u>	<u>2318</u>	<u>3070</u>
<u>7</u>	<u>2152</u>	<u>570</u>	<u>9274888</u>	<u>1288</u>	<u>2040</u>
<u>8</u>	<u>2152</u>	<u>570</u>	<u>5155440</u>	<u>240</u>	<u>992</u>
<u>9</u>	<u>2152</u>	<u>570</u>	<u>960810</u>	<u>810</u>	<u>1562</u>
<u>10</u>	<u>2152</u>	<u>570</u>	<u>3242962</u>	<u>1362</u>	<u>2114</u>
<u>11</u>	<u>2152</u>	<u>570</u>	<u>5449932</u>	<u>332</u>	<u>1084</u>
<u>12</u>	<u>2152</u>	<u>570</u>	<u>1330484</u>	<u>2484</u>	<u>3236</u>
<u>13</u>	<u>2152</u>	<u>570</u>	<u>9939054</u>	<u>3054</u>	<u>3806</u>
<u>14</u>	<u>2152</u>	<u>570</u>	<u>12221206</u>	<u>406</u>	<u>1158</u>
<u>15</u>	<u>2152</u>	<u>570</u>	<u>1624976</u>	<u>2576</u>	<u>3328</u>
<u>16</u>	<u>2152</u>	<u>570</u>	<u>10308728</u>	<u>1528</u>	<u>2280</u>
<u>17</u>	<u>2152</u>	<u>570</u>	<u>6114098</u>	<u>2098</u>	<u>2850</u>
<u>18</u>	<u>2152</u>	<u>570</u>	<u>8396250</u>	<u>2650</u>	<u>3402</u>
<u>19</u>	<u>2152</u>	<u>570</u>	<u>10603220</u>	<u>1620</u>	<u>2372</u>
<u>20</u>	<u>2152</u>	<u>570</u>	<u>6483772</u>	<u>572</u>	<u>1324</u>
<u>21</u>	<u>2152</u>	<u>570</u>	<u>2289142</u>	<u>1142</u>	<u>1894</u>
<u>22</u>	<u>2152</u>	<u>570</u>	<u>4571294</u>	<u>1694</u>	<u>2446</u>
<u>23</u>	<u>2152</u>	<u>570</u>	<u>6778264</u>	<u>664</u>	<u>1416</u>
<u>24</u>	<u>2152</u>	<u>570</u>	<u>2658816</u>	<u>2816</u>	<u>3568</u>
<u>25</u>	<u>2152</u>	<u>570</u>	<u>11267386</u>	<u>186</u>	<u>938</u>
<u>26</u>	<u>2152</u>	<u>570</u>	<u>746338</u>	<u>738</u>	<u>1490</u>
<u>27</u>	<u>2152</u>	<u>570</u>	<u>2953308</u>	<u>2908</u>	<u>3660</u>
<u>28</u>	<u>2152</u>	<u>570</u>	<u>11637060</u>	<u>1860</u>	<u>2612</u>
<u>29</u>	<u>2152</u>	<u>570</u>	<u>7442430</u>	<u>2430</u>	<u>3182</u>
<u>30</u>	<u>2152</u>	<u>570</u>	<u>9724582</u>	<u>2982</u>	<u>3734</u>