RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #13

Proposed DO-260A Change for Class B2 and B3 Equipment Transmit Power

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SUMMARY
The current DO-260 and draft DO-260A define Class B2 and Class B3 systems for use on surface vehicles and fixed obstructions respectively. The allowed transmit power is from 70 Watts to an unspecified upper limit. There appears no valid reason for allowing 1090 ADS-B systems on surface vehicles or fixed obstructions to transmit at high power levels. If such high power levels were widely used, especially on surface vehicles, the 1090 MHz interference environment could be adversely impacted.

References:
1. DO-260, Sept. 2000
2. DO-260A, August 2002 Draft

1. Introduction

The current DO-260 (Table 2-4) and draft DO-260A define Class B2 and Class B3 systems for use on surface vehicles and fixed obstructions respectively. The allowed transmit power is from 70 Watts to an upper limit of 500 Watts as specified in para. 2.2.2.2.10.3. There appears no valid reason for allowing 1090 ADS-B systems on surface vehicles or fixed obstructions to transmit at high power levels. If high power levels were widely used, especially on surface vehicles, the 1090 MHz interference environment could be adversely impacted. On the airport surface the range requirements are quite modest and the factors that influence the achieve range will be dominated by line-of-sight limitations and the effects of multipath. Increased transmission power will not offer significant benefits when the reception is hampered by these factors. Also the ranges in all cases are quite modest and link budget is generally not an issue. The other factor that contributes to the effective range for surface traffic is interference from 1090 MHz fruit. A receiver located on an aircraft on or near (e.g., final approach) the airport surface will not be subjected to the very high 1090 MHz fruit levels that could be experienced by aircraft operating at higher altitudes. Likewise 1090 MHz ADS-B ground stations will experience substantially lower 1090 MHz fruit level that would airborne platforms and if necessary ground stations could use the enhanced reception techniques if necessary to deal with fruit.

2. Proposal

The 4 places where the minimum and/or maximum transmit power level requirements related to Class B equipment appear in DO-260A are in under para. 2.1.11.1 in Tables 2-3 and 2-4, in para. 2.2.2.2.10.2, in para. 2.2.2.2.10.3 and in para. 3.1.2. The maximum transmit power level for all Class A and Class B systems is currently limited to 500 Watts for all equipment classes by para.2.2.2.1.2 for transponder based Class A1, A2 and A3 systems and by para. 2.2.2.2.10.3 for Class A0 and all Class B non-transponder based systems. It is proposed to limit the transmit power range for Class B2 (ground vehicles) and for Class B3 (obstructions) to 50 watts minimum and to 100 watts maximum. Further investigations may show that these power levels can be reduced even further for ground vehicles. The following changes to DO-260A are proposed:

1. It is proposed to modify Table 2-4 to change the minimum transmit power for Class B2 and B3 systems to 50 Watts.

2. It is proposed to modify para. 2.2.2.2.10.2 as follows:

   The minimum RF peak output power for Class B1 equipment **shall**:

   a. not be less than 18.5 dBW (70 W) for aircraft ~~(or other installations)~~ not capable of operating at altitudes exceeding 15,000 feet (4,570 meters);

   b. not be less than 21.0 dBW (125 W) for aircraft ~~(or other installations)~~ capable of operating above 15,000 feet (4,570 meters);

   c. not be less than 21.0 dBW (125 W) for aircraft ~~(or other installations)~~ with a maximum cruising speed exceeding 175 knots (324 km/h).

   The minimum RF peak output power for Class B2 and Class 3 equipment **shall** not be less than 15 dBW (50 W) for installations on ground vehicles and fixed obstructions.

3. It is proposed to modify para. 2.2.2.2.10.3 as follows:

The maximum RF peak output power of each pulse of each transmitted message at the terminals of the antenna **shall** be fixed at 27.0 dBW (500 W) for all classes of stand alone transmitter based equipment except the maximium RF peak output power for Class B2 and B3 equipment **shall** be fixed at 20 dBW (100 W).

Note: *These requirements are consistent with the requirements of ICAO Annex 10, Volume IV, second edition, July 1998, §3.1.2.10.2, as well as with the requirements of RTCA Document No. DO-181C, §2.2.3.2 (EUROCAE ED-73A, §3.3.3) for installations on aircraft.*

4. It is proposed to modify para. 3.1.2 to specify both a minimum and a maximum transmit power level for all Class A and Class B systems. Specifically, for all Class A systems and for Class B1 systems the maximum allowed transmit power would be specified as 500 Watt to be consistent with the Mode S transponder MOPS, DO-181C and section 2.2.2 of DO-260A. For Class B2 and B3 systems, it is proposed to add a 100 Watt maximum transmit power limit and reduce the minimum power limit to 50 Watts. Furthermore, is proposed to assign an Action to perform an investigation into the most appropriate minimum and maximum values of transmit power for Class B2 and B3 systems and to adjust the values as appropriate as DO-260A is finalized. The following specific additions to 3.1.2 are proposed:

For aircraft operating at altitudes in excess of 15,000 feet MSL or having a normal cruise speed of 175 KIAS or more, the ADS-B transmitter shall have a minimum effective radiated power (ERP) at the antenna of 125 watts (ref. 2.2.2.1.1.2 and 2.2.2.1.1.3) and a maximum ERP at the antenna of 500 watts. For A0 and B1 equipage class aircraft operating exclusively below 15,000 feet MSL and have a normal cruise speed below 175 KIAS, the ADS-B transmitter shall have a minimum ~~effective radiated power (~~ERP~~)~~ at the antenna of 70 watts and a maximum ERP at the antenna of 500 watts. For Class B2 and B3 equipage classes for ground vehicles and fixed obstructions respectively, the minimum ERP at the antenna shall be 50 watts and the maximum ERP at the antenna shall be 100 watts.

Note 1: A references to effective radiated power at the antenna assumes a Zero (0) dB antenna gain. Thus ERP values and transmit power as measured at the antenna terminal are equivalent.

Note 2: As noted in 2.2.2.1.1.4, Future versions of these MOPS may require Class A3 1090 MHz ADS-B systems have a transmission capability with a minimum RF peak power of 23 dBW (200 Watts) measured at the antenna terminals.