

**RTCA Special Committee 186, Working Group 3**

**ADS-B 1090 MOPS, Revision A**

**Meeting #13**

**Proposed DO-260A Changes to Class A1 Receiver MTL for Improved  
TIS-B Reception**

**Presented by Ron Jones, FAA, ASD-140**

**SUMMARY**

**The 1090 MHz receiver MTL values specified in DO-260 for each avionics class appear to have been based on the air-to-air reception range requirements of the ADS-B MASPS. It is not clear that A1 receivers would have sufficient sensitivity to support TIS-B reception at the potential limits of the TIS-B ground station's service volume.**

References:     1.     DO-260, MOPS for 1090 MHz ADS-B, Sept. 2000

## 1. Introduction

The 1090 MHz receiver MTL values specified in DO-260 for each avionics class appear to have been based on the air-to-air reception range requirements of the ADS-B MASPS. It is not clear that either Class A0 or A1 receivers would have sufficient sensitivity to support TIS-B reception at the limits of the TIS-B ground station's service volume. While Class A0 avionics are only applicable for low performance aircraft that operate below 15,000 ft., Class A1 avionics are intended to be applicable to aircraft that operate in the high altitude en route airspace. As a result the ground-to-air ranges needed to provide TIS-B services to a Class A1 equipped aircraft may be the same as for Class A2 and Class A3 equipped aircraft. DO-260 specifies the MTL requirements for a Class A1 receiver as  $-74$  dBm which is 5 dB less sensitive than a Class A2 receiver. Using the link budget information presented in Table E-1 of DO-260 one can estimate the ground-to-air TIS-B reception range as shown in the following tables (assumes line of sight is available). For these tables a ground station antenna gain of 6dB is assumed as this would be a nominal gain for a "DME style" ground station omni antenna. Two alternative ground station transmitter power levels were considered. The lower transmitter power level of 400 watts at the antenna would require at least a 500 watt transmitter unit as measured at the output port of the transmitter itself. Likewise the 800 watt case would require at least a 1000 watt transmitter unit. I would suggest that a 1 KW transmitter is a realistic upper bound on the type of transmitter that would be used for the TIS-B ground station.

### **CLASS A0 Receiver**

Transmitter Power (at antenna)	400 Watts (56 dBm)	800 Watts (59 dBm)
Antenna Gain (transmitter)	6 dB	6 dB
Antenna Gain (receiver)	0 dB	0 dB
Received Power at antenna	-72 dBm	-72 dBm
MTL	-72 dBm	-72 dBm
Available Path Loss	134 dB	137 dB
Link Budget Ranges	59 nmi	84 nmi

### **CLASS A1 Receiver**

Transmitter Power (at antenna)	400 Watts (56 dBm)	800 Watts (59 dBm)
Antenna Gain (transmitter)	6 dB	6 dB
Antenna Gain (receiver)	0 dB	0 dB
Received Power at antenna	-74 dBm	-74 dBm
MTL	-74 dBm	-74 dBm
Available Path Loss	136 dB	139 dB
Link Budget Ranges	75 nmi	106 nmi

### **CLASS A2 Receiver**

Transmitter Power (at antenna)	400 Watts (56 dBm)	800 Watts (59 dBm)
Antenna Gain (transmitter)	6 dB	6 dB
Antenna Gain (receiver)	0 dB	0 dB
Received Power at antenna	-79 dBm	-79 dBm
MTL	-79 dBm	-79 dBm
Available Path Loss	141 dB	144 dB
Link Budget Ranges	133 nmi	186 nmi

### **CLASS A3 Receiver**

Transmitter Power (at antenna)	400 Watts (56 dBm)	800 Watts (59 dBm)
Antenna Gain (transmitter)	6 dB	6 dB
Antenna Gain (receiver)	0 dB	0 dB
Received Power at antenna	-84 dBm	-84 dBm
MTL	-84 dBm	-84 dBm
Available Path Loss	146 dB	149 dB
Link Budget Ranges	236 nmi	330 nmi

## 2. Proposal

The ranges shown in the above tables are purely a link budget calculation and does not consider any reduction in reception range that will result from the presence of 1090 MHz fruit as well as actual line-of-site limitations. Given the recent U.S. ADS-B link decision, the role for Class A0 1090 MHz ADS-B airborne installations will be quite limited and the TIS-B reception range limitations are not of serious concern. However, the TIS-B reception range limitations for Class A1 receivers could be of concern since this could prevent continuous TIS-B coverage in geographic locations where the TIS-B ground stations are widely spaced, as might be the case in parts of the U.S. where there are few airports and/or where it would be desirable to have TIS-B service ranges for en route extend out to substantially over 100 nmi.

To address this situation it is proposed to add a note to under the first table in para. 2.1.11.2 (Receiving Subsystem) that would apply to the Class A1 MTL specification. The note would state:

Note: The specified Class A1 receiver equipment MTL of  $-74$  dBm is considered sufficient to satisfy the air-to-air ADS-B reception range requirement. However, a MTL of  $-79$  dBm is considered more appropriate for the reception of ground-to-air TIS-B transmissions in support of high altitude en route services.