

**Summary of Meeting #8, of RTCA SC-186, Working Group 5  
For the Development of a MOPS for UAT**  
<http://adsb.tc.faa.gov/ADS-B/186-subf.htm>

The meeting was held on 6 – 9 November 2001, in the conference room in the BOQ on the Norfolk Naval Station, hosted by Cmdr Richard Weathers. The meeting was called to order at 9 a.m. on 6 November 2001 by Co-Chairman George Ligler. George provided introductory remarks, welcomed all attendees and asked that each one introduce themselves and their organization. The attendees included:

John Ashley – Mitre Corp.	Richard Jennings FAA (AIR-130)	Brent Phillips – FAA ASD
Larry Bachman – JHU – APL	Stan Jones – Mitre CAASD	Ei Mon Phyu – Titan – FAATC – ACT-350
John Barrows – Supporting the FAA	Greg Kuehl – UPS Airlines	Bernald Smith – Soaring Society of America
Mike Biggs – FAA – ASR-200	George Ligler – PMEI	Ken Staub – Trios Assoc.(supporting FAA)
Mike Castle – JHU – APL	Robert Manning – HQ USAF/XOR GANS	Ed Valovage – Sensis Corp.
John Doughty – Garmin International	Chris Moody – Mitre CAASD	Cmdr Richard Weathers – US Navy JCS J6T
Nikos Fistas – Eurocontrol	Tom Mosher – UPS Aviation Technologies	Warren Wilson – Mitre Corp.
Gary Furr – Titan Corp - FAATC – ACT-350	Al Muaddi – JHU – APL	Gene Wong – FAA – AND-530
Carl Gleason – Advancia – FAA/NISC	Azhar Osmanbhoy – Boeing Air Traffic Mgt	Tom Wright – Joint Spectrum Center
James Higbie – JHU – APL	Tom Pagano – FAA Tech Ctr – ACT-350	

- The following known regrets to attendance to this meeting were received prior to the meeting:
  - Vincent Nguyen – FAA
  - Bob Saffell – Rockwell Collins
- The Working Group was asked to review and approve the Minutes to Meeting #7. Hearing no comments or objections, the Minutes to Meeting #7 were approved as published.
- The Working Group discussed future meeting dates and locations. The following table indicates the currently agreed upon meeting dates and places for meetings of RTCA SC-186 Working Group #5.

<b>Dates/Time</b>	<b>Meeting Place</b>
9am Monday, 10 Dec to 4pm Friday, 14 Dec	To be held in conjunction with the SC-186 Plenary at the new RTCA facilities at: 1828 L Street NW, Suite 805, MacIntosh Rm (202-833-9339) WG-5 to meet Monday, Tuesday, Friday with Plenary on Wed. & Thurs. Travel info and lodging details are available on the ADS-B/UAT web site
9am Monday, 28 Jan to noon, Friday, 1 Feb	Confirmed at the Atlanta Airport Marriott. 20 rooms held under “RTCA UAT MOPS” at \$93. Govt rate. Must make reservation prior to 6 January 2002. Gary will announce to WG when reservations can be made.
9am Monday, 4 March to 4pm, Thursday, 7 March	Location TBD – expected European location to be either Brussels, Paris or London. Exact plans to be firmed up by Nikos Fistas and report during the December meeting in Washington.
9am Monday, 8 April to noon Friday, 12 April	To be held in conjunction with the SC-186 Plenary at the new RTCA facilities at 1828 L Street NW, Suite 805 (202-833-9339) Plenary plans to meet two days, with specific days <b>TBD</b> Travel info and lodging details are available on the ADS-B/UAT web site
9am Monday, 29 April to 4pm Friday, 3 May	Hosted at the William J Hughes FAA Technical Center in Atlantic City NJ Travel info and lodging details are available on the ADS-B/UAT web site
9am Monday, 17 June to 4pm Friday, 21 June	To be held in conjunction with the SC-186 Plenary at the new RTCA facilities at: 1828 L Street NW, Suite 805 (202-833-9339) WG-5 to meet Mon, Tues & Wed with Plenary on Thurs & Fri Travel info and lodging details are available on the ADS-B/UAT web site

4. Moving to Agenda Item #4, Brent Phillips reviewed the summary of the presentations that were made by some members of Working Group 5 at the recent October meeting of the ICAO AMCP WG-C in Anchorage AK. It was pointed out that all of the presentations made by WG-5 members, as well as the published minutes (report) of the meeting are available inside the ZIP file that has been posted on the UAT web site for Meeting #8, as well as on the web site of the AMCP WG-C. Brent reported that the idea of starting SARPS for UAT were generally well received by many member states. The next step is for the ANC to formally request that the WG-C begin the SARPS process. Brent and George Ligler will make a presentation to the ANC near the end of November 2001.
5. The Working Group continued with a review of a matrix that was put together by Chris Moody and Richard Jennings prior to the meeting as a review of “Key Physical Layer Parameters” which need to be decided upon for inclusion in the UAT MOPS. All of the undecided elements were highlighted in yellow, as shown in the initial matrix at the end of these Minutes in Figure 1. As the Working Group progressed through the meeting, we referenced this matrix and made modifications to it as elements were agreed upon and decided. The matrix as it stood at the end of the meeting is reflected in Figure 2 at the end of these Minutes. Figure 2 will be the beginning point for continuing discussions at Meeting #9 at RTCA, Washington DC, beginning at 9am, 10 December 2001.
6. Following Agenda Item 5a, Larry Bachman began the review of Working Paper WP-8-07, which is the analysis of simulations run for the Core Europe portion of Action Item 7-1. Because of delays in obtaining test data from Pre-MOPS units processed into the receiver performance model changes, and delays in obtaining the worst-case DME environment, some of the simulations requested in Action Item 7-1 were not run. However, with the assumptions as started in WP-8-07, Larry observes that the 0.8MHz filter performs slightly better than the 1.2MHz filter, and that on-channel DMEs are not greatly affected by filter selection. In both current and future scenarios, the A1 and A3 equipment performance meets MASPS requirements, but some strange behavior is being observed in the performance curves for the A2 equipment. Larry will review the data and simulation code to try to explain this behavior.
7. Larry Bachman continued with the presentation of Working Paper WP-8-08, which is the analysis of simulations run for the LA 2020 portion of Action Item 7-1. Again, not all of the simulations requested in Action Item 7-1 were run. In this scenario, both the 0.8 and 1.2 MHz filters meet all current air-to-air MASPS update requirements out past 90 NM, with no DMEs and little L16 effects. Air-to-ground requirements were met out past 150 NM. As a result of discussions, Working Group 5 agreed to use the 1.2 MHz filter for receiving on A2 class equipment.
8. Opening up the discussion on Wednesday morning, George Ligler reports that Per Enge, Advisor to the FAA Navigation Program Office, has discussed the possibility of using the UAT uplink as a means for providing DGPS corrections. This would supplement the Geosynchronous downlink for providing WAAS GPS corrections to the avionics, at least in high-latitude areas. This raises some certification issues, but does plug a well known, and long-standing hole in the WAAS architecture. This could increase the certification level of the UAT Receive function to Level B criticality (if it were used for vertical guidance), rather than the D or C level it would have for advisory FIS-B products or backup timing capability. This will result in the UAT MOPS committee taking a bit of extra care to guarantee the integrity of the Uplink segment, so that this potentially killer application has a chance to flourish.
9. George continued on with a discussion of the Standard Interference Environment (SIE). The SIE would have the following three elements:
  - a) Core Europe

- 2015 Self Interference
  - 978 MHz DMEs re-assigned
  - 979 MHz DMEs – all assignments populated
  - JTIDS Baseline version “B” as defined in UAT-WP-4-04
  - Definition of Co-Site Interference as per the TLAT Report
  - Ground:
    - DME at 979 MHz at 1KW with separation of 1000 ft
    - No DME Ground Station at 979 MHz
- b) LA 2020
- Self Interference
  - JTIDS Baseline version “B” as defined in UAT-WP-4-04
  - Definition of Co-Site Interference as per the TLAT Report
- c) Low Density (TLAT scenario)
- JTIDS Heaviest as defined in UAT-WP-4-04, Scenario 2, Option A
  - 979 MHz DMEs – all assignments populated
  - Worst-case DMEs for the future scenario
  - Definition of Co-Site Interference as per the TLAT Report

**Action Item 8-5** was accepted by Larry Bachman, Tom Pagano and Mike Biggs to document the SIE in a Working Paper for review by WG-5 prior to the December Meeting in preparation for presentation to the SC-186 Plenary. Attached to or incorporated into this Working Paper will be the information in Al Muaddi’s Working Paper on the “worst-case” DME. Additionally the information from the TLAT Co-Site Interference will need to be included.

10. Following continued discussion on the SIE and JHU-APL simulations, the Working Group agreed to specify a B1 class for Aircraft as transmit only. It was further agreed by the Working Group to specify a B2 class for a ground vehicle subsystem as transmit only. **Action Item 8-6** was accepted by Larry Bachman, Stan Jones and Chris Moody to prepare for Meeting #9 a recommended Class B2 Power Budget, transmit rate and message content. They will use the assumption of 100 vehicles in the movement area at the highest density airports.
11. Basically continuing with Agenda Item 5a, Albert Muaddi presented Working Paper WP-8-09 as an effort continuing toward defining the “worst-case” DME environment. The assumptions that were made included looking at today’s environment with only operational DME/TACAN stations and with aircraft at 15,000 and 40,000 feet. For the year 2015, 978 MHz (17X) is cleared, all planned DME/TACAN stations are operational, the location of the mobile TACAN in Germany is subject to the 8dB D/U rule, and aircraft were at both 15, 000 and 40,000 feet. After discussion, it was concluded that further discussion would be necessary with Eurocontrol prior to solidifying the “worst-case” DME environment.
12. Continuing on with Agenda Item 5a, Thomas Wright of the Joint Spectrum Center in Annapolis MD presented Working Paper WP-8-10 as the results of efforts to test the UAT Datalink Performance and BER in a DME and JTIDS Pulsed RF Environment. Thomas detailed the setup of the equipment and testing at JSC, and interfaces with Mitre and JHU-APL. **Action Item 8-7** was accepted by a group of members, to be led by Tom Pagano, to define the next round of MER testing at JSC for Pre-MOPS units.
13. Again, under the banner of Agenda Item 5a, James Higbie presented Working Paper WP-8-04A as the results to date of a continuing effort of BER Testing at JHU-APL on Pre-MOPS UAT units.

14. Larry Bachman and Mike Castle presented what was labeled as Working Paper UAT-WP-8-11, which contained the results of simulations run during the meeting from specifications in bullets 1 and 2 of **Action Item 8-1**. During review of WP-8-11 it was apparent that we have problems with A2 equipment. It was not, however, clear as to why we see the kinds of problems with A2 that were presented in WP-8-11. Larry Bachman and others accepted **Action Item 8-8** to review the simulation model accuracy, ground receiver design and potential solutions for the A2 problems and report back during Meeting #9.
15. Starting out Thursday morning, Chris Moody reported on discussions held by a subgroup of WG-5 members concerning **Action Item 8-2** with respect to out-of-band rejection and performance in the context of self-interference. It was agreed that this subgroup, led by Chris, would work on a draft of text for presentation at the December meeting for A2 and A3 equipment for sections 2.2 and 2.4.
16. Finishing up with papers related to UAT Compatibility and Performance in Agenda Item 5a, Chris Moody briefly presented Working Paper WP-8-06. This Working Paper was put together as a product of requests from the AMCP WG-C meeting in Anchorage AK, during which the question was asked regarding the “worst-case” DME environment worldwide, as opposed to specifically in Europe. WP-8-06 shows several DMEs in the Pacific Region, and Albert Muaddi accepted **Action Item 8-10** to investigate those DME entries in the Pacific Region.
17. Moving to Agenda Item 5d, Chris Moody reported on Working Paper WP-8-05, which presented the spectral characteristics of an operational DME station and the rejection response possible from a cavity tuned filter that could be used at a UAT ground station to reject DME interference. WP-8-05 proposed some simplified conditions that will allow simulation of UAT ground station performance in a severe adjacent channel DME environment considering the spectral characteristics of the DME beacon and the performance that should be possible with a practical cavity tuned filter. It was agreed during discussions that the information in this Working Paper would be reflected in Appendix D relating to the Ground Infrastructure. Additionally, Larry Bachman agreed to take this into account when re-running the next round of simulations after resolving issues relating to A2 equipment identified in Action Item 8-8.
18. The Working Group then began the review of the latest draft of Section 2.2 under Agenda Item 7c as presented in Working Paper WP-8-01 by Chris Moody. Changes that were agreed upon were made to WP-8-01 during the review process during the meeting. Some other minor changes and additions were made to WP-8-01 based on a follow-up meeting involving Chris Moody and FAA Technical Center personnel on Tuesday, 13 November 2001. The result of these changes are reflected in UAT-WP-8-01A, that has been posted on the UAT web site.
19. During each meeting, the Working Group reviews the latest drafts of some of the sections of the proposed UAT MOPS that are made available for that meeting. The following table is the result of the assignments of those writing actions, updated with the most current versions of any draft sections that were available for review during this meeting. The asterisk (\*) beside a name indicates the lead person or organization.

File Names	Dated	Description	Responsibility
Sec_1a.pdf	3/27/01	Draft 1 of Section 1 – Introduction	Bill Flathers * Jerry Anderson
Sec_2-1c.pdf	9/21/01	Draft 3 of the General Requirements	Tom Mosher

File Names	Dated	Description	Responsibility
Sec_2-2f.pdf	11/14/01	Draft 6A of the Equipment Performance Requirements	Chris Moody * Bob Saffell Rich Weathers Jim Maynard JHU-APL (?)
		Section 2.3 – Environmental	Small 2.4 group
		Section 2.4 – Equipment Test Procedures	Tom Pagano * Bob Saffell UPS-AT JHU-APL (?)
		Section 3 – Installed Equipment Performance	
Sec_4c.pdf	6/07/01	Draft 3 of the Equipment Performance Characteristics	Greg Kuehl
App_A4.pdf	10/1/01	Draft 4 of the Glossary and Acronyms	Rich Jennings
App_B2.pdf	7/19/01	Draft 2 of the MASPS Cross Reference Matrix	Greg Kuehl * Jim Maynard Nikos Fistas JHU-APL (?)
		Appendix C – Example ADS-B Message Encoding	Chris Moody + 2.2 Writers
App_D1.pdf	2/14/01	Draft 1 of the UAT Ground Infrastructure	Ed Valovage * Paul Gross
		Appendix E – Aircraft Antenna Characteristics	
		Appendix F – Link Budgets and Scenario Dependent Ranges	Larry Bachman
		Appendix G – Standard Interference Environments	Mike Biggs
App_H1.pdf	9/14/01	Appendix H – Synchronization Processing Information	Warren Wilson
App_I1.pdf	9/17/01	Appendix I – UAT Timing Considerations	Chris Moody
		Appendix J – Recommended Report Output Format	Chris Moody * Tom Mosher John Doughty

20. The following **Action Items** were identified during the course of this and previous meetings. The asterisk (\*) beside a name or organization indicates that they are the lead for the resolution of that Action Item. Actions shown here are those **Action Items** that remain OPEN, in total or in part, after the end of the Meeting being report on in these Minutes.

Action Number	Action Description	Assigned to	Status
3-6	Mike and Gondo to determine criteria for acceptable DME performance in the presence of UAT interference	Mike Biggs Gondo Gulean	Assess again at Meeting 10
4-3	Run his models on all JTIDS scenarios (9), two 1 MHz offset DME scenarios, and self interference, as appropriate to the JTIDS scenarios, with power levels agreed to at Meeting #3 -- with labeled axes (and no yellow lines) -- for Meeting 9	Stan Jones	
6-6	Draft Appendix B.2 on FIS-B MASPS compliance.	George Ligler Chris Moody	Assess at Meeting 10
7-2	Proposed text for Section 2.2.2.4 [Modulation Accuracy], to be provided at Meeting 9	Tom Pagano Warren Wilson	

Action Number	Action Description	Assigned to	Status
7-3	Complete Sections 2.2.3.1.4.2 and 2.2.3.2.4.2 prior to the December meeting and present a draft of Appendix C	Chris Moody John Barrows Ei Mon Phyu	
7-4	Develop for an Appendix, with potential impact on Section 2.2.4, a method of transmitting <u>more than</u> two (2) TCPs for Type A equipment.	Chris Moody Stan Jones (*) Jim Maynard	
7-6	Assessment of existing self-interference model relative to Pre-MOPS units measurement.	Larry Bachman Tom Pagano (*)	Mtg 9
8-1	During Meeting #8, to answer the question of whether or not we have A0. If not, then what is a Low power A1: 1. Air-to-ground simulation in Core Europe to validate the lowest power, switched: (a) Co-site 979 MHz Ground Station at Brussels, and (b) no Co-Site 979 MHz Ground Station 2. Source: A0 Bottom only transmit/receive LAX power at 38.5 – 42.5 dBm, with 1.2 MHz filter, air-to-air range, below 18,000 ft. Observer: 15,000 ft altitude, (a) A0, (b) A1 3. Same as (2), except that A0 transmitter is switched top/bottom.	Larry Bachman	Partially addressed during Meeting 8 by <b>WP-8-11 CLOSED</b>
8-2	For the December meeting draft the requirements for A2 and A3 equipment classes in section 2.2 and outline appropriate test procedures for section 2.4, pertaining to out of band rejection and performance in the context of self-interference.	Tom Pagano Chris Moody (*) Warren Wilson Tom Mosher John Doughty	
8-3	What fraction of the aircraft meets the 95% time criteria? How do we perform at 150NM?	Larry Bachman	
8-4	Simulation run for the “Low Density” Standard Interference Environment.	Larry Bachman	
8-5	Put together the document detailing the “Standard Interference Environment” for distribution to WG-5 and eventually to SC-186 for the purpose of having a discussion during the December 12-13 SC-186 Plenary.	Larry Bachman Mike Biggs (*) Tom Pagano	
8-6	Prepare for Meeting 9 a recommended Class B2 Power Budget, transmit rate and message content. Assume 100 vehicles in the movement area at the highest density airports.	Larry Bachman Stan Jones (*) Chris Moody	
8-7	For Meeting 9 define the next round of MER testing at JSC for Pre-MOPS units.	Tom Pagano (*) John Barrows Tom Wright James Higbie John Ashley Warren Wilson	
8-8	Air-Ground coverage for Core Europe 2015; assess model accuracy, ground receiver design, and potential solutions for A2 equipment class. Come back with: What was it? What should we do?	Larry Bachman Mike Castle Nikos Fistas Stan Jones	
8-9	Run the simulations for LA2020 and Core Europe 2015 for switched A1, at power levels of 38.5 to 42.5 dBm for 20NM air-to-air, 150NM air-to-ground, 84% of the A1’s below 18,000 ft only.	Larry Bachman Mike Castle	
8-10	Investigate the DME entries for the Pacific Region that are identified in WP-8-06.	Al Muaddi	
8-11	Revalidate the co-site testing on the Pre-MOPS boxes, stretching 1090 pulses until it breaks.	Tom Pagano	
8-12	Produce a draft of Appendix J for December Meeting containing a recommendation for the Report Output Formats	Chris Moody (*) Tom Mosher John Doughty	

Action Number	Action Description	Assigned to	Status
8-13	Identify requirements for B1 class equipment, based on discussions during Meeting 8.	Tom Mosher	
8-14	How many transmissions in the ground segment before we lose continuity.	Larry Bachman Stan Jones	
8-15	Draft of section 2.2.6.3.2 for December Meeting #9.	James Higbie Stan Jones Tom Mosher (*) Tom Pagano John Doughty Bob Saffell Ken Staub	
8-16	Draft of Section 2.2.6.3.3 for the December Meeting #9, regarding Latency for NUC $\leq 7$ and for $>7$ .	George Ligler (*) Stan Jones	

21. The **Working Papers** shown in the following table are specifically for the Meeting being reported in these Meeting Minutes. Working Papers for all WG-5 Meetings, as well as the Meeting Agendas, Meeting Minutes, Meeting Schedules and files leading to the production of a UAT MOPS are posted on the ADS-B UAT web site at: <http://adsb.tc.faa.gov/ADS-B/186-subf.htm>

Working Paper	Size	Description	Introduced At:
UAT-WP-8-01	81KB	Draft 6 of Section 2.2 of the UAT MOPS, presented by Chris Moody	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-02	12KB	Concept for Test Procedure Interfaces, presented by Tom Mosher	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-03	293KB	Brief Analysis of Raised Cosine Transmit Filtering, presented by Tom Mosher	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-04	357KB	Results to Date of BER Tests on Pre-MOPS UATs, presented by James Higbie in partial response to Action Item 7-1	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-05	795KB	Assumptions for Simulating Ground Station Performance in a Severe DME Environment, presented by Chris Moody, in response to Action Item 7-5	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-06	8KB	DME/TACAN Assignments on 978 and 979 MHz Worldwide, presented by Chris Moody	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-07	200KB	Core Europe Simulation Results, presented by Larry Bachman in partial response to Action Item 7-1	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-08	77KB	LA 2020 Simulation Results, presented by Larry Bachman in partial response to Action Item 7-1	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-09	265KB	The European DME/TACAN Environment, presented by Albert Muaddi	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-10	104KB	UAT Datalink Performance and BER Testing in a DME and JTIDS Pulsed RF Environment, presented by Tom Wright	Meeting #8, 11/6/01 Norfolk, VA
UAT-WP-8-11	77KB	European Air-Ground and LA 2020 Bottom Only Results, presented by Larry Bachman in partial response to Action Item 8-1, run during Meeting #8	Meeting #8, 11/6/01 Norfolk, VA

22. As part of an on-going effort to retain knowledge of items that might otherwise be forgotten, we have created and maintain the following table of “Un-Resolved” or “Orphaned” Issues. This list is reviewed during each meeting and is updated as needed.

Issue #	Issue/Question Description	Raised by	Date Raised	Status
5	Can a minimal installation without an "On Ground" indication continue alternating top and bottom antennas for transmit without significantly sacrificing performance?	Chris Moody UAT-WP-2-06	20 Feb 01	
6	What is the minimum isolation required for antenna switching (20 dB in 1090 MOPS)?	Chris Moody UAT-WP-2-06	20 Feb 01	
10	Whether or not to require an algorithm to determine On-the-Ground status	Section 2.2 discussion	2 May 01	
11	Given that the agreed-upon solution to Coding Selected Altitude appears to add 2 bits, we will remember that we can revisit this issue later if we need to recover those bits.	Discussion on Coding Selected Altitude in WP-4-03	3 May 01	

**Figure 1**  
**Key Physical Layer Parameters to be Decided for Inclusion in the UAT MOPS**

ADS-B Equipment Classes Supported in UAT MOPS							
		<b>A0</b> (will this Class exist??)	<b>A1</b>	<b>A2</b>	<b>A3</b>	<b>B1</b> (Aircraft Tx-only)	<b>B2</b> (Ground Vehicle Tx-only)
Message structure and FEC definition		Short ADS-B → RS (30,18); Long ADS-B → RS (48,34); Uplink → 6XRS(92,72) interleaved					
Transmitter ERP (dBm at antenna end of feedline)		38.5-42.5	42-46 (Lower power for low altitude subclass possible)	42-46	50-54 (Lower power possible)	Same as A1	28-32
Receiver Sensitivity (dBm for 90% MSR at antenna end of feed line)		-93	-93	-93	-93	N/A	N/A
RX Filtering		Regular selectivity requirement (1.2 MHz)	Regular selectivity requirement (1.2 MHz)	Narrow selectivity requirement (0.8 MHz)	Narrow selectivity requirement (0.8 MHz)	N/A	N/A
Antenna Diversity	TX	Bottom only	Alternate T/B*	Alternate T/B	Alternate T/B	Same as A1	Single Antenna
	RX	Bottom only	Alternate T/B*	Full time dual	Full time dual	N/A	N/A

\*Single antenna exemptions for special categories of aircraft (e.g. balloons and gliders)

Yellow highlight shows areas yet to be closed by the MOPS committee

**Figure 2**  
**Key Physical Layer Parameters to be Decided for Inclusion in the UAT MOPS**

ADS-B Equipment Classes Supported in UAT MOPS							
		<b>A0</b> (will this Class exist??)	<b>A1</b>	<b>A2</b>	<b>A3</b>	<b>B1</b> (Aircraft Tx-only)	<b>B2</b> (Ground Vehicle Tx Subsystem)
Message structure and FEC definition		Short ADS-B → RS (30,18); Long ADS-B → RS (48,34); Uplink → 6XRS(92,72) interleaved					
Transmitter ERP (dBm at antenna end of feedline)		38.5-42.5	42-46 (Lower power for low altitude subclass possible)	42-46	50 – 54	Same as A1	28-32
Receiver Sensitivity (dBm for 90% MSR at antenna end of feed line)		-93	-93	-93	-93	N/A	N/A
RX Filtering		Regular selectivity requirement (1.2 MHz)	Regular selectivity requirement (1.2 MHz)	Regular selectivity requirement (1.2 MHz)	Narrow selectivity requirement (0.8 MHz)	N/A	N/A
Antenna Diversity	TX	Bottom only	Alternate T/B*	Alternate T/B	Alternate T/B	Same as A1*	Single Antenna
	RX	Bottom only	Alternate T/B*	Full time dual	Full time dual	N/A	N/A

\*Single antenna exemptions for special categories of aircraft (e.g. balloons and gliders)

**Yellow highlight** shows areas yet to be closed by the MOPS committee