

Australian Technical Standard Order

Subject: AIR TRAFFIC CONTROL RADAR BEACON SYSTEM/MODE SELECT (ATCRBS/MODE S) AIRBORNE EQUIPMENT

1. **PURPOSE.** This Australian Technical Standard Order (ATSO) prescribes the Minimum Operational Performance Standards (MOPS) for airborne ATCRBS/Mode S Air Traffic Control (ATC) transponder equipment.
2. **APPLICABILITY.** This ATSO is effective for new transponders manufactured after the effective date of this ATSO.
3. **REQUIREMENTS.** New models of airborne ATCRBS/Mode S transponder equipment that are manufactured on or after the effective date of this ATSO and seek to gain ATSO Approval (ATSOA) must meet the latest or other agreed version of either:
 - MOPS specified in Section 2 of RTCA Inc. document RTCA/DO-181() “*Minimum Operational Performance Standards for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment*”; or
 - European Organisation for Civil Aviation Equipment (EUROCAE) document ED-73()

Note: These standards, whilst similar, are mutually exclusive.

3.1 Functionality. The standards of this ATSO apply to equipment intended to serve as an airborne ATCRBS/Mode S transponder.

3.2 Failure Condition Classification. Failure of the function defined in paragraph 3.1 of this ATSO has been determined to be a major failure condition and the applicant must ensure the system has a design assurance level commensurate with this failure condition classification.

Note: For a definition of failure condition categories refer to United States Federal Aviation Administration (FAA) Advisory Circular (AC), System Design and Analysis AC 25.1309-1A, Equipment, Systems and Installations in Part 23 Airplanes AC 23.1309-1C or European Joint Airworthiness Authorities (JAA) Advisory Material Joint (AMJ), System Design and Analysis AMJ 25.1309 or later amendments.

3.3 Environmental Qualification. The equipment shall be subject to the test conditions specified in the latest or other agreed version of RTCA/EUROCAE Document

DO-160()/ED-14(), “*Environmental Conditions and Test Procedures for Airborne Equipment*”.

3.4 **Software Qualification.** Software must be developed in accordance with the latest or other agreed version of RTCA/EUROCAE Document DO-178()/ED-12(), “*Software Considerations in Airborne Systems and Equipment Certification*”.

3.5 **Fire Protection.** All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire.

3.6 **Deviations.** The Civil Aviation Safety Authority (CASA) has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MOPS of this ATSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per the Civil Aviation Safety Regulation (CASR) 21.609.

4. **MARKING.** Articles manufactured under this ATSO must be marked in accordance with CASR 21.607(c). The following additional markings shall be applied:

4.1 **Environment.** The environmental categories over which it has been designed to operate, as set forth in the latest or other agreed version of Appendix A of RTCA/EUROCAE DO-160()/ED-12(), must be permanently and legibly marked on the equipment. Where an environmental test procedure is not applicable and the test is not conducted, an “X” should be placed in the space assigned for that category.

4.2 **Class or Level.** The class or level that the equipment meets must be permanently and legibly marked on the equipment. Equipment that meets the requirements of more than one class/level need only be marked with the class/level that contains the more severe requirements. RTCA and EUROCAE MOPS are identified differently, RTCA uses Class exclusively whilst EUROCAE utilises Class and Level.

4.2.1 **RTCA MOPS**

- **Class 1A.** Class 1A must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes exceeding 15,000 feet or must be equipment intended for installation in aircraft that have a normal cruising speed in excess of 175 knots on a standard day.
- **Class 1B.** Class 1B must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes not exceeding 15,000 feet.
- **Class 2A.** Class 2A must meet all performance and environmental standards for equipment marked Class 1A, and in addition, must have the operational function of the minimum data link transponder (Comm A and Comm B), including multisite message protocol.
- **Class 2B.** Class 2B must meet all performance and environmental standards for equipment marked Class 1B, and in addition, must have the operational function of the

minimum data link transponder (Comm A and Comm B), including multisite message protocol.

- **Class 3A.** Class 3A must meet all performance and environmental standards for equipment marked Class 2A, and in addition, must have the operational function of the Uplink Extended Length Message (ELM) Capability (Comm C).
- **Class 3B.** Class 3B must meet all performance and environmental standards for equipment marked Class 2B, and in addition, must have the operational function of the Uplink Extended Length Message (ELM) Capability (Comm C).
- **Class 4.** Class 4 must meet all performance and environmental standards for equipment marked Class 3A, and in addition, must have the operational function of the Full Extended Length Message (ELM) Capability (Comm D).

4.2.2 **EUROCAE MOPS**

4.2.2.1 **Level.** EUROCAE MOPS defines the functionality associated with each designated level.

- **Level 1** - Surveillance only (no 112 bit Mode S format capabilities).
- **Level 2** - Surveillance and Comm A/B.
- **Level 3** - Surveillance, Comm A/B, and Uplink ELM.
- **Level 4** - Surveillance, Comm A/B, Uplink ELM and Downlink ELM.
- **Level 5** - Full level 4 plus enhanced protocols for parallel processing of Comm-B, Uplink ELM and Downlink ELM transactions.

4.2.2.2 **Class.** EUROCAE MOPS defines two classes of equipment, Class 1 and Class 2 based related to intended use and/or the type of aircraft in which the equipment is to be installed.

- **Class 1.** Intended for use in aircraft that operate at altitudes above 15000 ft, or have a maximum cruising true airspeed in excess of 175 kt (324 km/h), and shall meet the following requirements:
 - RF peak output power > 21 dBW
 - Reply transmission frequency tolerance + 1 MHz
 - Mode A and C reply rate capability > 1200 replies/second
- **Class 2.** May be used in aircraft that operate at altitudes not exceeding 15 000 ft, and have a maximum cruising true airspeed not exceeding 175 kt (324 km/h), and shall meet the following requirements:
 - RF peak output power > 18.5 dBW
 - Reply transmission frequency tolerance + 1 MHz
 - Mode A and C reply rate capability > 1000 replies/second

4.3 **Additional Markings.** Each separate component of equipment (antenna, transmitter, etc.) must be permanently and legibly marked with at least the name of the

manufacturer, the ATSO number and the environmental categories over which it is designed to operate.

5. DATA REQUIREMENTS

5.1 Application Data. In addition to the data requirements of CASR 21.605(c) the manufacturer must provide the CASA with one copy of the following technical data:

5.1.1 Manufacturer's operating instructions and equipment limitations. The descriptions of the limitations shall be sufficient to describe the operational capability of the equipment. In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

5.1.2 Installation procedures and limitations. The descriptions of the limitations shall be sufficient to ensure that the transponder, when installed according to the installation procedures, continues to meet the requirements of this ATSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations shall also include a note with the following statement:

"The conditions and tests required for ATSO approval of this article are minimum performance standards. It is the responsibility of the person installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the ATSO standards. ATSO articles must have separate approval for installation in an aircraft. "

5.1.3 Schematic drawings, as applicable to the installation procedures.

5.1.4 Wiring diagrams, as applicable to the installation procedures.

5.1.5 List of the components, by part number, that make up the system complying with the standards prescribed in this ATSO. Manufacturers should include vendor part number cross-references when applicable.

5.1.6 Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair for the continued airworthiness of installed equipment, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph 3.6 of this ATSO, may also be described in the CMM

5.1.7 Material and process specifications list.

5.1.8 The quality control system description required by CASR 21.605(2)(c) and CASR 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this ATSO.

5.1.9 Manufacturer's ATSO qualification test report(s).

5.1.10 Nameplate drawing providing the information required by paragraph 4 (Markings) of this ATSO.

5.1.11 A list of all drawings and processes, including revision level, necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

5.1.12 An environmental qualifications form as described in RTCA/EUROCAE document DO-160()/ED-14(), or the most current version for each component of the system.

5.1.13 Computer Software. If the article includes a digital computer, the software must be developed in accordance with RTCA/EUROCAE document DO-178()/ED-12(). In accordance with DO-178()/ED-12(), the applicant must submit a Software Aspects of Certification Plan (SACP) for review and approval.

Note: The CASA recommends that this plan be submitted as early as possible in the certification process. This will allow for early discussion and agreement between the applicant and the CASA on the software level or levels, the verification approach, and the documentation to be prepared and submitted.

5.2 **Manufacturer's Data.** In addition to the data to be directly furnished to the CASA, each manufacturer must have the following technical data available for review by the CASA:

5.2.1 The functional qualification specifications to be used to qualify each production article to ensure compliance with this ATSO.

5.2.2 Equipment calibration procedures.

5.2.3 Corrective maintenance procedures within 12 months after ATSO authorization.

5.2.4 Schematic drawings.

5.2.5 Wiring diagrams.

5.2.6 Material and process specifications.

5.2.7 The results of the environmental qualification tests conducted in accordance with RTCA/EUROCAE document DO-160()/ED-14().

5.2.8 If the article includes a digital computer, the appropriate documentation as defined in RTCA/EUROCAE document DO-178()/ED-12(), including all data supporting the applicable objectives found in Annex A.

5.3 **Furnished data.**

5.3.1 One copy of the technical data and information specified in paragraph 5 of this ATSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the equipment, must accompany each article or multiple articles, if furnished to one source, i.e. operator, repair station etc., manufactured under this ATSO.

5.3.2 If the appliance accomplishes any additional functions beyond that described in paragraph 3 of this ATSO, then a copy of the data and information specified in paragraphs 5a(11) through (13) must also go to each person receiving for use one or more articles manufactured under this ATSO.

6. AVAILABILITY OF REFERENCED DOCUMENTS

6.1 Copies of the CASRs may be obtained from the CASA.
(web site <http://www.casa.gov.au>)

6.2 Copies of RTCA Documents may be purchased from:
RTCA Inc.,

1140 Connecticut Avenue, NW, Suite 1020, Washington, D.C. 20036.
(web site is <http://www.rtca.org/>)

6.3 Copies of FAA Advisory Circulars (AC) may be obtained from the FAA.
(web site
http://www1.airweb.faa.gov/Regulatory_and_Guidance_Library/rgWebcomponents.nsf/HomeFrame?OpenFrameSet)

6.4 Copies of EUROCAE documents may be purchased from:
European Organisation for Civil Aviation Equipment
17, rue Hamelin 75116 Paris Cedex 16 - France
(web site <http://www.eurocae.org>)

Greg Vaughan
General Manager
Manufacturing, Certification and New Technologies Office

May 2006