



# Advisory Circular

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**Subject:** Airworthiness Approval of Installed  
Passive Ultra High Frequency (UHF) Radio  
Frequency Identification (RFID) Tags

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**Date:** 4/6/16

**AC No:** 20-162A

**Initiated By:** AIR-100

1 **PURPOSE.**

This advisory circular (AC) provides applicants with guidance for installing and using passive radio frequency identification (RFID) tags on aviation products and equipment. Specifically, this AC provides guidance for the proper installation and use of passive RFID tags as installed on aircraft parts and components. This AC is not mandatory and does not constitute a regulation. This AC describes an acceptable means, but not the only means, to comply with these requirements. However, if you use the means described in this AC, you must follow it in all important aspects. The term “must” is used to indicate mandatory requirements driven by regulation when following the guidance in this AC. The term “should” is used to indicate that the guidance is recommended, but not required, to comply with this AC.

2 **AUDIENCE.**

This AC affects manufacturers and modifiers of aviation products and equipment who want to install passive RFID tags on 14 CFR parts 23, 25, 27, 29, 33, and 35 aircraft, aircraft engines, propellers, parts, and components thereof.

3 **CHANGES.**

This AC includes the latest revision of SAE International’s Aerospace Standard (AS) 5678A, *Passive RFID Tags Intended for Aircraft Use*. This revision removes guidance on operational approval of RFID tags and airworthiness approval of low-power active RFID tags or battery assisted passive RFID tags. It adds criteria to prevent changes to identification record and data of RFID tags.

4 **CANCELLATION.**

This AC cancels AC 20-162, dated September 22, 2008.

5 **EFFECTIVE DATE.**

This AC is effective April 6, 2016.

## 6 **SCOPE.**

In this AC, we cover only passive UHF RFID tags installed on aircraft, engines, propellers, parts, and components. This AC does not cover RFID tags that communicate using cellular or satellite telephone technology, wireless wide area networks, high power radio transmitters, or other types of tracking devices. This AC also does not cover battery assisted passive RFID tags or active RFID tags.

## 7 **TYPES OF RFID TAGS COVERED BY THIS AC.**

### 7.1 **General Characteristics.**

The data from a passive RFID tag may identify or give specific information about the product or equipment onto which it is installed. RFID interrogation typically does not require line-of-sight or contact between RFID tag and respective readers (or interrogators). RFID tags have varying data storage capacity and field programmable utility.

### 7.2 **Passive UHF RFID Tags.**

A passive RFID tag has no integral power source. The tag provides information during interrogation using “backscatter” energy, which is the reflected radio frequency energy modulated by the RFID chip and antenna. Passive RFID tags are usually made up of an integrated circuit (containing information) and integral antenna. The size of the passive RFID tag is determined by many factors which may include desirable energy-to-distance range. The backscatter energy, as it applies to passive RFID antenna, is directly proportional to the incident power from the reader or interrogator which can influence the operating range.

## 8 **AIRWORTHINESS CONSIDERATIONS WITH INSTALLED RFID TAGS.**

Airworthiness concerns about passive RFID tags installed on aircraft, engines, propellers, parts, and components include integrity, accuracy, and authenticity of both safety-related and identification data from RFID tags, fire and environmental effects, and maintenance required for RFID tags.

### 8.1 **Intended Function of Installed RFID Tags.**

If you’re applying for system approval or certification, define the intended function of the installed passive RFID tags. The standard intended functions for installed passive RFID tags covered in this AC are as follows:

#### 8.1.1 **Part Marking.**

Passive RFID part marking is not an alternative to meeting the part marking requirements of 14 CFR 45.15 or 45.16.

##### 8.1.1.1 **Ancillary Part Marking.**

We consider the passive RFID tags and data ancillary if they are performing a non-required, non-essential function. When using passive RFID tags for part marking of aircraft, engine, or propeller critical or life-limited components, those tags should include digital data described in 14 CFR Parts 45.15(a)(2), (a)(3), (a)(4), and 45.16. A part number “roll” or

change is not required on parts, components and/or appliances for the installation of passive RFID tags.

**Note:** In this AC the following definitions apply:

**Life-Limited Parts:** Life-limited or time-controlled parts and/or components are defined and designated during the certification process and the results are mandatory replacement limits specified either in the type design, Instructions for Continued Airworthiness (ICA), or the Aircraft Maintenance Manual. As specified in the type certificate, they may not exceed a specified time, or number of operating cycles in service.

The type certificate for an aircraft, engine, or propeller either calls out the mandatory replacement limit for parts specifically within the content of the type certificate or it may refer to another document that calls out the limitations.

The limits and status are characterized by either accumulated cycles, hours, or any other mandatory replacement limits of the life-limited part. The replacement limits are a mandatory replacement limit and not a recommended replacement limit.

**Critical Parts:** They are manufactured parts for which a replacement time, inspection interval, or related procedure is specified in the Airworthiness Limitations section of a manufacturer's maintenance manual or ICA. The part must be permanently and legibly marked with a serial number (or equivalent), unique to that part in addition to any other applicable requirements.

It indicates that a part and/or component has been identified as critical by the design approval holder during the product type design validation process, or otherwise by a civil aviation exporting authority. Also, there are components that contain parts for which a replacement time, inspection interval, or related procedures that are specified in the Airworthiness Limitations section or Certification Maintenance Requirements of the manufacturer's maintenance manual or ICA.

#### 8.1.1.2

##### **Integrated Nameplate.**

An integrated nameplate is an identification or part marking containing an embedded RFID chip or device which may be utilized in the same manner as other identification and markings as shown in 14 CFR 21.182 and part 45, subpart B. The exterior or human readable portion of the integrated nameplate must conform to the regulatory requirements in 14 CFR 21.182 and part 45, subpart B. The RFID enabled segment of the integrated nameplate may contain the same part identification information (for example, part birth record elements as defined in Airlines for America

(A4A), formerly known as Air Transport Association of America, Inc. (ATA), Spec 2000 encoded in digital and printed in text formats). The human readable segment will act as the primary part marking and the RFID enabled segment is still considered ancillary part marking. An integrated nameplate is only interchangeable with an identical integrated nameplate.

#### 8.1.2 **Other Functions.**

Evaluate passive RFID tags that perform other functions to determine any adverse effects from the tag installation and function. Address those considerations, including loss of tag data integrity, in your system safety assessment. Passive RFID tag functions with adverse effects which could cause catastrophic, hazardous/severe-major, or major failure conditions are outside the scope of this AC. They should be addressed in a specific certification plan.

#### 8.2 **Passive RFID Tags.**

Passive RFID tags should meet the requirements of SAE AS5678A. The use of passive UHF RFID tags and devices is considered ancillary part marking and does not replace the original part marking as shown in 14 CFR Parts 45.15 and 45.16. Therefore, the life expectancy of the RFID tag and/or device should meet the life requirements as shown in SAE AS5678A.

#### 8.3 **Passive RFID Tags Data.**

Passive RFID tags data should meet the latest revision of A4A Spec 2000, chapter 9-5.

### 9 **SPECIFIC REQUIREMENTS.**

In addition to paragraph 8, the specific requirements necessary for installing passive RFID tags are described in detail in the following sub-paragraphs.

#### 9.1 **Unchanged Identification Record.**

When using passive RFID tags for part marking, the record containing identification data from the RFID tags should not be changeable.

#### 9.2 **Safety Assessment.**

Conduct the system safety assessment according to 14 CFR 23, 25, 27, or 29.1309, 33.28, 33.75 and/or 35.23 considering the potential adverse effects of installed passive RFID tags. Identify the hazard levels associated with installing and using the passive RFID tags. Determine the maximum acceptable levels of “probability of failure” for the system as installed on the aircraft. Show that the system complies with safety objectives. Your safety analysis of the design and installation of passive RFID tags should demonstrate that normal operation, failures, or malfunctions will not have greater adverse impact than “minor effect” according to AC 23.1309-1, *Equipment, Systems, and Installations in Part 23 Airplanes*, AC 25.1309-1, *System Design and Analysis*, AC 27-1, *Certification of Normal Category Rotorcraft* or AC 29.2, *Certification of Transport Category Rotorcraft*.

**9.3 Software and Complex Hardware.**

This requirement applies to passive RFID tag installations that perform critical component/life-limited part marking or “other” functions. This requirement does not apply to passive RFID tag installations that perform ancillary part marking. Consider the appropriate software level, per RTCA, Inc. Document Number (DO)-178C, *Software Considerations in Airborne Systems and Equipment Certification*, for RFID tags using software. If your application uses complex electronic hardware, consider the appropriate hardware level according to AC 20-152. RFID tag software and hardware qualification requirements are determined by system failure condition level.

**9.4 Alterations.**

The installation of passive RFID tags under an alteration is considered a minor alteration unless the tags installation meets the requirements in paragraph (a) of Appendix A to part 43.

**Note:** Performing a minor alteration does not invalidate the existing approval of the parts, and components. In that case, a part number “roll” is not required.

**9.5 Configuration Control.**

To ensure passive RFID tag and system interoperability or compatibility between those components, it may be necessary to enter the RFID tag’s make, model, part number, and, if included, serial number onto the product or equipment ICA or maintenance record entry (see paragraph 9.11 on ICA and maintenance information). In addition, if there are particular details and requirements about how the tag is mounted, located, oriented and used where configuration control is significant, ensure those details are entered in the ICA or maintenance record entry.

**9.6 Electromagnetic Compatibility (EMC) Requirements for RFID Tags.**

Passive RFID tags meeting the scope and applicability of this AC and meet SAE AS5678A, Section 6.2 are exempt from laboratory RF emissions tests, like those in RTCA, Inc. document RTCA/DO-160, *Environmental Conditions and Test Procedures for Airborne Equipment*. No aircraft EMC tests are required for installed passive RFID tags.

**9.7 Environmental Qualification (Other Than EMC).**

Qualify passive RFID tags according to SAE AS5678A, Section 6.3.5. Paragraph 9.8.1 in this AC provides guidance on flammability requirements for passive RFID tags used for part marking of critical or life-limited components.

**9.8 Flammability and Fire Safety.**

The adhesive or means of attachment of the passive RFID tags should be included in the flammability testing as part of meeting the flammability requirements.

9.8.1 Passive RFID tags used for part marking of critical or life-limited components must meet the following flammability requirements.

- 9.8.1.1 All tags with a longest dimension greater than 50 mm must comply pursuant to the flammability requirements specified in SAE AS 5678A, Table 3 and 14 CFR 25.853(a), and Appendix F part 1 paragraph (a)(1)(ii).
- 9.8.1.2 All tags with a longest dimension less than 50 mm must comply pursuant to the requirements specified in SAE 5678A, Table 3 and 14 CFR 25.853(a) and Appendix F part 1 paragraph (a)(1)(v).

**Note:** 14 CFR 25.865, *Fire protection of flight controls, engine mounts, and other flight structure*, and 25.869 (a)(2), *Fire protection: systems*, govern flammability requirements for parts/materials of equipment and systems in the aircraft located outside the compartment interior. These requirements do not address specific flammability criteria. To comply with the regulatory requirements of 14 CFR Part 21.21(b)(1) that reads: "... any airworthiness provisions not complied with are compensated for by factors that provide an equivalent level of safety." The FAA determined that 14 CFR 25.853 and Appendix F, Part 1 provides acceptable flammability criteria for parts/materials of aircraft equipment and systems exterior to the compartment interior.

- 9.8.2 Passive RFID tags used for ancillary part marking should meet the flammability requirements of RTCA/DO-160, Section 26.

9.9 **Corrosion on Aircraft Parts and Components.**

The adhesive or means of attachment of the passive RFID tags should not be a source of corrosion where attached to the aircraft parts and components.

9.10 **Mounting and Attachment Integrity.**

The installed passive RFID tag should be permanently affixed to aircraft parts using approved adhesives, methods and processes. Describe the mounting or attachment method you use in the certification plan to show compliance with the 14 CFR requirements referenced in this paragraph. Installers of passive RFID tags must comply with 14 CFR 23/25/27/29.605, 23.787, 25.787(a),(b) and 25.789, 27.787(a),(b),(c), or 29.787(a),(b),(c) by design data review, analysis or test.

9.11 **ICA and Maintenance Information.**

- 9.11.1 If passive RFID tags are installed under a supplemental type certificate (STC), then the applicant must document the RFID's ICA in the applicable ICA section of the STC. If the passive RFID tag has a service life limit, then the applicant must state the mandatory replacement limit in the ICA, see 14 CFR 43.10. The applicant should state if and when the passive RFID tag requires any other periodic maintenance. The applicant should state whether the passive RFID tag, if malfunctioning, should be removed from the aircraft and replaced with one of the same type and configuration. Your responsible aircraft certification office (ACO) will use FAA Order 8110.54,

*Instructions for Continued Airworthiness Responsibilities, Requirements, and Contents*, to give you further requirements or details for preparing the ICA.

- 9.11.2 If the passive RFID tag is being installed as part of a major alteration, then the installer must comply with the maintenance record entry required by 14 CFR 49.3(a) and the form creation and disposition required by 14 CFR 43.9(d) and Appendix B. Your responsible Flight Standards District Office (FSDO) will use FAA Order 8300.16, *Major Repair and Alteration Data Approval*, and the current revision of AC 43-210 to give you further guidance for preparing the maintenance documentation.
- 9.11.3 If the passive RFID tag is being installed as part of a minor alteration, then the installer must comply with the maintenance record entry required by 14 CFR 43.9(a). See the current revision of AC 43-210 for guidance on completing the required maintenance record entry.

## **10 RELATED PUBLICATIONS.**

### **10.1 RTCA Documents.**

Order copies of the RTCA documents referenced in this AC from RTCA Inc., 1150 18<sup>th</sup> Street NW, Suite 910, Washington, DC 20036. Telephone (202) 833-9339, fax (202) 833-9434. You also can order copies online at [www.rtca.org](http://www.rtca.org).

### **10.2 SAE Documents.**

Order copies of the SAE documents referenced in this AC from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Telephone (724) 776-4970, fax (724) 776-0790. You can also order copies online at [www.sae.org](http://www.sae.org).

### **10.3 ATA Documents.**

Non-ATA members may order copies of the ATA documents referenced in this AC from the A4A Publications Department, 1301 Pennsylvania Avenue, N.W., Suite 1100, Washington, DC 20004. Telephone (202) 626-4062. You may also order copies by emailing your request to [pubs@airlines.org](mailto:pubs@airlines.org).

### **10.4 14 CFR.**

Order copies of the 14 CFR parts referenced in this AC from the Superintendent of Documents, Government Printing Office, P.O. Box 37154, Pittsburgh, PA 15250-7954. Telephone (202) 512-1800, fax (202) 512-2250. You may also order copies online at <http://bookstore.gpo.gov>. Select "Access," then "Online Bookstore," select "Aviation," then "Code of Federal Regulations."

### **10.5 FAA Advisory Circulars.**

Order copies of the ACs referenced in this AC from the U.S. Department of Transportation, Subsequent Distribution Office, M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20795. Telephone (301) 322-5377, fax (301) 386-5394. You may also obtain copies from our Regulatory and Guidance Library

(RGL) at <http://rgl.faa.gov>. On the RGL website, select “Advisory Circulars,” then select “By Number.”

11 **WHERE TO FIND THIS AC.**

You may find this AC at <http://rgl.faa.gov>.

If you have any suggestions for improvements or changes, you may use the template provided at the end of this AC.



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## Advisory Circular Feedback

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