



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Advisory Circular

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**Subject:** Airworthiness Approval of Installed  
Radio Frequency Identification (RFID) Tags and  
Sensors

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**Date:** 10/11/2018

**AC No:** 20-162B

**Initiated By:** AIR-6B0

## 1 **PURPOSE.**

This advisory circular (AC) provides certification applicants with airworthiness guidance for installing passive, battery-assisted passive (BAP), and active radio frequency identification (RFID) tags and sensors on aviation products and equipment. This AC is not mandatory and does not constitute a regulation. This AC describes an acceptable means, but not the only means of accomplishing airworthiness approval for the installation of these RFID tags and sensors on aircraft. However, if you use the means described in this AC, you should follow it in all important respects unless alternate means are proposed and accepted by the Federal Aviation Administration (FAA). 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 is for manufacturers and installers seeking airworthiness certification for passive RFID tags, BAP and active RFID tags and sensors when installed on type certificated aircraft, aircraft engines, propellers, parts, and components via Title 14 of the Code of Federal Regulations (14 CFR) parts 23, 25, 27, 29, 33, and 35.

## 3 **CANCELLATION.**

This AC cancels AC 20-162A, *Airworthiness Approval of Installed Passive Ultra High Frequency (UHF) Radio Frequency Identification (RFID) Tags*, dated April 6, 2016.

## 4 **SCOPE.**

This AC addresses RFID tags and sensors meeting the requirements of SAE International’s Aerospace Standard (AS) 5678A, *Passive RFID Tags Intended for*

*Aircraft Use, or AS6023, Active and Battery Assisted Passive Tags Intended for Aircraft Use.* This AC only covers ultrahigh frequency (UHF) RFID tags and sensors meeting the requirements pursuant to Title 47 of the Code of Federal Regulations (47 CFR) 15.245. This AC does not cover RFID tags and sensors that communicate using cellular or satellite telephone technology, wireless wide area networks, high power radio transmitters, and all other devices that do not meet the requirements pursuant to 47 CFR 15.245.

This AC covers installed RFID tags and sensors that provide an alternative means of performing certain aircraft maintenance tasks. These tasks can include inspections for presence, serviceability, security of installation, or identity of components. Refer to AC 119-2, *Operational Use of Radio Frequency Identification Systems Onboard Aircraft*, dated October 17, 2017 for a comprehensive definition of applicable maintenance tasks.

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

### 5.1 **General Characteristics.**

The data from a RFID tag or sensor 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 tags, sensors, and respective readers (or interrogator). RFID tags have varying data storage capacity and field programmable utility. Many RFID tags and sensors may also incorporate means to monitor and transmit time-in-service, temperature, humidity, or other conditions.

### 5.2 **Passive 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 an 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 also influence the operating range.

### 5.3 **Active RFID Tags or Sensors.**

Active RFID tags or sensors rely on a self-contained power source. Active RFID tags and sensors have greater operating range and often provide more information than passive RFID tags or sensors. Active RFID tags or sensors consist of a low power RF transponder or transmitter, microcontroller, memory, antenna, and power source. Active RFID tags or sensors operate in one or more modes to discriminate the time and period of transmission or reply to an interrogation.

### 5.4 **Battery-Assisted Passive RFID Tags or Sensors.**

BAP RFID or “semi-passive” tags and sensors are similar to active devices in terms of requiring a power source, however they only respond to the interrogation from the

reader (or interrogator). They have their own power source to power the microcontroller.

## 6 **AIRWORTHINESS CONSIDERATIONS OF INSTALLED RFID TAGS AND SENSORS.**

### 6.1 **Intended Function.**

#### 6.1.1 Alternative Means of Conducting Aircraft Maintenance Tasks.

Pursuant to 14 CFR 23.2505 and 25/27/29.1301, you must show that your RFID tag or sensor meets its intended function. One means of showing your installed RFID tag or sensor meets its intended function, is to demonstrate the installed tag or sensor meets the performance requirements defined in SAE AS5678A or AS6023.

#### 6.1.2 Other Functions.

Your RFID tag or sensor may perform additional functions. Examples of other functions include temperature logging, vibration monitoring, weight records, or time-in-service computation. If your RFID tags and sensors perform additional functions, pursuant to 14 CFR 23.2505 and 25/27/29.1301, each item of installed equipment must function as intended.

### 6.2 **14 CFR Part 45, Subpart B Compliance.**

The installed RFID tag or sensor must not interfere with the marking required by 14 CFR part 45, Subpart B.

#### 6.2.1 Ancillary Compliance Means.

RFID tags or sensors are an ancillary to, and not a substitute for, meeting the marking requirements pursuant to 14 CFR Part 45, Subpart B. The part, which hosts the RFID tag or sensor, must continue to meet the part marking requirements pursuant to 14 CFR Part 45.

#### 6.2.2 Data Consistency between 14 CFR Part 45, Subpart B and RFID Tags or Sensors.

The data contained on the RFID tag or sensor must not conflict with readable markings required pursuant to 14 CFR Part 45. The RFID tag or sensor may contain additional data.

#### 6.2.3 Integrated Nameplate.

An integrated nameplate is an identification or part marking that contains the human readable 14 CFR Part 45, Subpart B part marking as well as an embedded RFID tag. The human readable marking will act as the primary part marking and the RFID enabled segment is still considered ancillary part marking. When replacing an integrated nameplate, ensure the human readable and the RFID segment part marking contain the same part marking information.

#### 6.2.4 RFID Data Format.

Using the automated identification and data capture standards identified in Airlines for America ATA Spec 2000 is one means to ensure data standardization and traceability supports the intended functions defined in this AC and AC 119-2. Applicants are not required to use ATA Spec 2000.

#### 6.2.5 Unchanged Identification Record.

Once the RFID tag is installed, there should be no means for the user to change the identification data contained on the RFID tag.

#### 6.2.6 Part Number Revision for RFID Tag Addition.

A part number “roll” or change is not required on parts, components and/or appliances for the installation of RFID tags or sensors used as alternative part marking means to meet the requirement of 14 CFR Part 45, Subpart B.

### 6.3 **Safety Assessment.**

Conduct the system safety assessment according to 14 CFR 25.1309, 23.2510, 33.28, 33.75 and/or 35.23 considering the potential adverse effects, malfunction, and loss of tag or sensor data integrity. Your safety analysis of the design and installation of RFID tags and sensors should demonstrate that normal operation, failures, or malfunctions will not have greater adverse impact than “minor effect” according to the latest revision of 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*. The RFID tag or sensor functions with adverse effects more severe than minor failure condition are outside the scope of this AC.

### 6.4 **Electromagnetic Compatibility (EMC).**

#### 6.4.1 EMC Requirements for Passive RFID Tags.

You do not need to perform laboratory or aircraft EMC tests for passive RFID tags meeting the scope and applicability of this AC and SAE AS5678A, Section 6.2.

#### 6.4.2 EMC Requirements for BAP and Active RFID Tags and Sensors.

Pursuant to 14 CFR 23.2510, 25.1353(a), 25.1431(c), 29.1353(a), 29.1431(b), and Part 27, Appendix B, you must demonstrate that the installed BAP, active RFID tags, and sensors do not adversely affect aircraft electrical and electronic systems. You may use the guidance in SAE ARP 60493, *Guide to Civil Aircraft Electromagnetic Compatibility (EMC)*, to show compliance. Qualifying the BAP, active RFID tags and sensors to Category M, H, or P of RTCA/DO-160G, *Environmental Conditions and Test Procedures for Airborne Equipment*, Section 21 is one acceptable means of showing compliance for the laboratory portion of the qualification test.

## 6.5 **Environmental Qualification (Other Than EMC).**

### 6.5.1 Flammability Requirements of RFID Tags or Sensors.

Pursuant to 14 CFR 25/27/29.853, 25/27/29.855, 23.2325, and Part 25 Appendix F, the RFID tag must comply with the applicable flammability requirements and tests. Using RFID tags meeting the flammability requirements and tests included in SAE AS5678A Table 3 or SAE AS6023 Table 1 is one acceptable means to show compliance. Include the adhesive or means of attachment of the RFID tags and sensors in the flammability testing as part of meeting the flammability requirements.

## 6.6 **Battery Safety.**

For batteries in RFID tags and sensors, safety concerns include the possibility of fire and explosion caused by failures of lithium ion batteries.

### 6.6.1 Non-Rechargeable Lithium Batteries.

The FAA is developing an advisory circular for non-rechargeable lithium batteries. We recommend you follow the guidance in this future AC when it becomes available. Prior to availability of the non-rechargeable lithium battery AC, we recommend you consult your aircraft certification office regarding airworthiness certification of your non-rechargeable lithium batteries.

### 6.6.2 Rechargeable Lithium Batteries.

If you use rechargeable lithium batteries, refer to AC 20-184, Guidance on Testing and Installation of Rechargeable Lithium Battery and Battery Systems on Aircraft.

### 6.6.3 Nickel-Cadmium, Nickel Metal-Hydride, and Lead-Acid Batteries.

If you use nickel-cadmium, nickel metal-hydride, and lead-acid batteries, you should ensure the batteries meet the requirements of RTCA/DO-293A, *Minimum Operational Performance Standards for Nickel-Cadmium, Nickel Metal-Hydride, and Lead-Acid Batteries*.

## 6.7 **Corrosion on Aircraft Parts and Components.**

The adhesive or means of attachment of the RFID tags and sensors should not be corrosive.

## 6.8 **Mounting and Attachment Integrity.**

The installed RFID tags and sensors should be securely affixed to aircraft parts using approved adhesives, methods and processes. Installations of RFID tags and sensors must comply with 14 CFR 25/27/29.605, and 23.2260 by design data review, analysis, or test.

## 6.9 **Maintaining RFID System Hardware.**

Refer to AC 119-2, Section 8.7, for guidance on maintaining RFID system hardware. Replacement of RFID tags described in this AC does not necessitate re-certification of the whole part.

**7 RELATED PUBLICATIONS.****7.1 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).

**7.2 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).

**7.3 14 CFR.**

Order copies of the 14 CFR parts referenced in this AC from the Superintendent of Documents, Government Printing Office, PO 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> or download copies at <https://www.ecfr.gov>.

**7.4 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> or on the FAA website at [https://www.faa.gov/regulations\\_policies/advisory\\_circulars/index.cfm/go/document.list](https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.list).

**8 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

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) emailing this form to [9-AWA-AVS-AIR-DMO@faa.gov](mailto:9-AWA-AVS-AIR-DMO@faa.gov) or (2) faxing it to (202) 267-1813.

Subject: AC 20-162B

Date: \_\_\_\_\_

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