

Circular No. 3-011

Periodic Inspection  
for  
Secondary Radar Transponder Equipment

February 6, 2004	First issue
June 30, 2011	Amended

Airworthiness Division, Aviation Safety and Security Department  
Japan Civil Aviation Bureau  
Ministry of Land, Infrastructure, Transport and Tourism

(translated on May 12, 2016)

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JCAB Circular

Director, Airworthiness Division  
Aviation Safety and Security Department  
Japan Civil Aviation Bureau  
Ministry of Land, Infrastructure, Transport and Tourism

Subject: Periodic Inspection for Secondary Radar Transponder Equipment

We inform that we reissue the “Periodic Inspection for Secondary Radar Transponder Equipment,” issued by the director-general of the Japan Civil Aviation Bureau (KOKU-KU-KI-1062-1, February 6, 2004) as a JCAB Circular.

Supplementary Provision

1. TCL-126-77 shall be superseded by this JCAB Circular.

Supplementary Provision (June 30, 2011)

1. This JCAB Circular shall be enforced on July 1, 2011.

Contact the following for inquiries, opinions, etc. concerning this JCAB Circular.

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### Periodic Inspection for Secondary Radar Transponder Equipment

Along with today's sophistication of air navigation systems, including the emergence of Mode S secondary surveillance radar for air navigation, ensuring normal operation of secondary radar transponders equipped on aircraft is increasingly becoming an important factor to secure smooth air traffic and the safe flight of aircraft.

We inform that the "Guidelines on Standards and Inspection for Secondary Radar Transponder Equipment Installed on Aircraft" (KU-KEN-434 issued on August 28, 1974) was revised as follows.

#### 1. Inspection Interval

A period not exceeding 24 months after installing the equipment or after a previous inspection

#### 2. Inspection Methods

##### 2-1 Reply Carrier Frequency

- a. For all classes of ATCRBS transponders, confirm that the reply carrier frequency in the case of adding an interrogation signal to the transponder is within the range of  $1090 \pm 3$  MHz.
- b. For Mode S transponders of classes 1B, 2B, and 3B (excluding those listed in Section 2-1-c), confirm that the reply carrier frequency in the case of adding an interrogation signal to the transponder is within the range of  $1090 \pm 3$  MHz.
- c. For Mode S transponders of classes 1B, 2B, and 3B with a reply carrier frequency of  $1090 \pm 1$  MHz, confirm that the reply carrier frequency in the case of adding an interrogation signal is within this range.
- d. For Mode S transponders of classes 1A, 2A, 3A, and 4, confirm that the reply carrier frequency in the case of adding an interrogation signal is within the range of  $1090 \pm 1$  MHz.

##### 2-2 Reply and Suppression

In regard to ATCRBS transponders of classes 1B and 2B or Mode S transponders of classes 1B, 2B, and 3B, when receiving a Mode 3/A interrogation signal at an interrogation repetition frequency of 230 to 1000 per second; in regard to ATCRBS transponders of classes 1A and 2A or Mode S transponders of classes 1B, 2A, 3A, and 4, when receiving a Mode 3/A interrogation signal at an interrogation repetition frequency of 230 to 1200 per second:

- a. When  $P_2$  pulse amplitude is equal to  $P_1$  pulse amplitude, confirm that said transponder does not respond to a Mode 3/A interrogation signal at 1 percent or higher.
- b. When  $P_2$  pulse amplitude is 9 dB or below  $P_1$  pulse amplitude, confirm that said transponder responds to a Mode 3/A interrogation signal at 90 percent or higher. When a test is performed using a radiative test signal, the interrogation repetition frequency shall be  $235 \pm 5$  interrogations per second, except in cases where the

test facility used is allowed to generate a higher interrogation repetition frequency.

### 2-3 Transponder Sensitivity

- a. In regard to ATCRBS transponders of all classes, confirm that the minimum trigger level (MTL) of a receiver is within the range of  $-73\pm 4$  dBm; in regard to Mode S transponders of all classes, confirm that MTL to an interrogation signal through Mode S format ( $P_6$  pulse used) is within the range of  $-74\pm 3$  dBm. In both cases, testing equipment under any of the following conditions shall be used to confirm:
  - (i) connect the testing equipment to the antenna terminal of the transmission line;
  - (ii) correct transmission line loss and connect to the antenna terminal of the transponder; and
  - (iii) use a radiative signal.
- b. In regard to ATCRBS transponders of all classes or Mode S transponders of all classes, confirm that the sensitivity difference of a receiver to an interrogation signal of Mode 3/A and Mode C does not exceed 1 dB.

### 2-4 RF Output

Confirm that transponder RF output is within the range of the specification corresponding to each class of the transponder. This inspection shall be performed under the conditions as specified in (i), (ii), and (iii) of Section 2-3-a above.

- a. In regard to ATCRBS transponders of classes 1A and 2A, confirm that the minimum RF output is 21.0 dBW (125 watts) or greater.
- b. In regard to ATCRBS transponders of classes 1B and 2B, confirm that the minimum RF output is 18.5 dBW (70 watts) or greater.
- c. In regard to Mode S transponders of 1A, 2A, 3A, 4, 1B, 2B, and 3B that are capable of high RF output, confirm that the minimum RF output is 21.0 dBW (125 watts) or greater.
- d. In regard to Mode S transponders of classes 1B, 2B, and 3B (excluding those listed in Section 2-4-c), confirm that the minimum RF output is 18.5 dBW (70 watts) or greater.
- e. In regard to ATCRBS transponders of all classes or Mode S transponders of all classes, confirm that the maximum RF output is 27.0 dBW (500 watts) or smaller.

Note: Hereinafter, the inspections in Sections 2-5 to 2-10 are applied only to Mode S transponders.

### 2-5 Selectivity

In regard to Mode S transponders of all classes that perform diverse operations, confirm that the RF output emitted from a selected antenna is 20 dB or more greater than the RF output emitted from an unselected antenna.

### 2-6 Mode S Address

Add an interrogation signal to a Mode S transponder and confirm that the transponder responds only to assigned addresses. In this case, an accurate address and at least two or more inaccurate addresses shall be used. 50 interrogations shall be made per second.

## 2-7 Mode S Signal Format

Add an interrogation signal of uplink format (UF) to a Mode S transponder and confirm that a reply is made in an accurate format.

Surveillance formats UF=4 and 5 shall be used. Confirm that the altitude reply to UF=4 is the same as the altitude report to ATCRBS Mode C. Also, confirm that the identification reply to UF=5 is the same as the identification reply to ATCRBS Mode 3/A.

If the test facility used is able to generate an air-to-air surveillance (ACAS) format UF=0, it is preferable to jointly use the format.

If the transponder has applicable capabilities, communication formats UF=20, 21, and 24 shall be used.

## 2-8 Mode S All-Call Interrogation

Add an interrogation signal to a Mode S transponder in UF=11, all-aircraft call format only of Mode S, and in an all-aircraft call format to both ATCRBS and Mode S ( $P_4$  pulse=1.6  $\mu$ s), and confirm that the accurate addresses and capabilities are responded through downlink format (DF=11).

## 2-9 ATCRBS only All-Call Interrogation

Add an ATCRBS only All-Call ( $P_4$  pulse=0.8  $\mu$ s) interrogation signal to a Mode S transponder, and confirm that no reply signal is generated.

## 2-10 Squitter

Confirm that a Mode S transponder generates accurate squitter at the rate of approximately once per second.

## Supplementary Provision (February 6, 2004)

1. The "Standards and Periodic Inspection for Secondary Radar Transponder Equipment," a circular issued by director-general of the Japan Civil Aviation Bureau (KU-KEN-434 issued on August 28, 1974), shall be superseded by this circular.