

SAFETY NOTICE

S.N. N° SN GEN-23-001
DATE: June 30, 2023
REV. 0

POTENTIAL INTERFERENCE OF
RADAR-ALTIMETER (RA) BY WIRELESS BROADBAND
OPERATIONS (5G)

FAA AD 2023-11-07

SUMMARY AND DISCLAIMER

This Safety Notice (SN) has been prepared in order to support operators by providing technical and safety information concerning the potential effect on Helicopter behavior due to potential interference on Radio Altimeters measurements caused by Wireless broadband operations (5G), as recently identified by FAA Airworthiness Directive AD 2023-11-07.

The main objective of this SN is to provide customers with technical information relevant to Leonardo Helicopters (LH) fleet, as to the potential effects of a potential Radio Altimeter vulnerability. Furthermore, the SN suggests possible recommendations for the relevant Customer Operative Manual, to be considered in operations where the Radio Altimeter is expected to be used by the specific Avionic Suites.

Although specifically addressing the concern identified by the abovementioned FAA Airworthiness Directive, it is recognized that this document provides technical and operational information, which may have wider utility in the context of 5G deployment in other geographies. It is however underlined that in absence of specific national authorities' restrictions, and due to possible differences in 5G frequency/power allocations in the various countries, the information provided here is not directly applicable to situations other than the FAA Airworthiness Directive.

Leonardo Helicopters to the extent permitted under the applicable laws, accepts no liability for any damage arising out or in any way connected with the use of this document.

SUBJECT: Potential interference of Radar-Altitude (RA) by wireless broadband operations (5G).**For the attention of: [Operators, Flight Crew]****Aircraft Concerned: [AW139, AW169, AW189, AW109, AW119]**

Dear customer,

FAA has recently published the Airworthiness Directives AD 2023-11-07 addressing potential unsafe conditions existing when performing certain operations in the presence of 5G transmissions in the 3.7-3.98GHz frequency range (C-band) affecting the proper function of radio altimeters. AD 2023-11-07 is requiring Operators to revise the RFM (Rotorcraft Flight Manual) to prohibit such operations unless operating a radio altimeter tolerant rotorcraft, as defined by the AD itself. An option to request and obtain Alternative Means of Compliance (AMOC) from FAA is also allowed by the AD.

All helicopters fitted with one or more Radar-Altitude system are affected by the FAA AD 2023-11-07.

AD 2023-11-07 supersedes the previous AD 2021-23-13, which provided flight limitations based on a NOTAM approach, and which was addressed by the previously released Leonardo Helicopters (LH) Safety Information Notice SN GEN-22-001.

In line with SN GEN-22-001, this Safety Notice SN GEN-23-001 provides operators of LH products with information about the vulnerability of the Radio Altimeters installed on LH fleet (§1..). This SN provide also mitigation measures to incorporate in your Standard Operating Procedures (SOP) or Flight Crew Operating Manual (FCOM) if applicable, in case of predicted operations in presence of 5G C-Band interference (§2 and §3).

This SN GEN-23-001 provides updated and comprehensive information against FAA AD 2023-11-07.

It's worth to highlight that since the issue of the initial AD 2021-23-13, the consequent deployment of 5G C-band transmitters there identified, and the feedback request raised by SN GEN-23-001, no flight occurrence of unreliable Radio Altimeter data correlated to 5G transmitters has been identified and reported to LH.

The information provided in this document does not supersede or take precedence over the information provided other published technical information (e.g. but not limited to Rotorcraft Flight Manuals), however could be useful to operators involved in preparing specific AMOCs against the subject AD.

1. Background information, issue description:

FAA AD 2023-11-07 supersedes the previous AD 2021–23–13, both applying to all helicopters equipped with a radio (also known as radar) altimeter. AD 2021–23–13 required revising the limitations section of the existing rotorcraft flight manual (RFM) to incorporate limitations prohibiting certain operations requiring radio altimeter data when in the presence of 5G C-Band interference in areas as identified by Notices to Air Missions (NOTAMs). Since the FAA issued AD 2021–23–13, the FAA determined that additional limitations are needed due to the continued deployment of new 5G C-Band base stations whose signals are expected to cover most of the contiguous United States at transmission frequencies between 3.7–3.98 GHz.

AD 2023-11-07 addresses the unsafe condition of helicopters equipped with a radio altimeter, and requires revising the limitations section of the existing RFM to incorporate limitations prohibiting certain operations requiring radio altimeter data, due to the presence of 5G C-Band interference, for those helicopters which are not demonstrated to be “radio altimeter tolerant aircraft”.

The FAA proposed that a “radio altimeter tolerant rotorcraft” is one for which the radio altimeter, as installed, demonstrates the tolerance to specific requirements defined in AD 2023-11-07 itself. For rotorcraft with radio altimeters that meet the proposed minimum performance levels, the FAA proposed to terminate the operational limitations imposed by AD 2021-23-13 with no further action.

For rotorcraft with radio altimeters that do not meet the proposed minimum performance levels, the FAA proposed to maintain the flight prohibitions of AD 2021-23-13 by requiring revising the limitations section of the existing RFM to incorporate them. Such limitations prohibit certain operations requiring radio altimeter data, due to the presence of 5G C-Band interference as identified by NOTAM until June 30, 2023. On or before June 30, 2023, the FAA proposed to also require, for non-radio altimeter tolerant rotorcraft, revising the existing RFM to incorporate limitations prohibiting these same operations in the contiguous U.S. airspace.

AMOCs approved for AD 2021-23-13 are approved as AMOCs for the requirements specified in paragraph (h) of the new AD 2023-11-07 until June 30, 2023.

LH confirms that, since the deployment of 5G C-band transmitters, no occurrence of unreliable Radio Altimeter data correlated to 5G transmitters for all its fleets, has been identified and reported to LH.

2. Current Fleet Status

LH mapped the make and model of Radio Altimeters installed on AW109/119 Families, AW139, AW169, AW189. As for the information currently available to LH by the various Radio Altimeter manufacturers (Rockwell Collins, Honeywell, FreeFlight and Garmin), the Radio Altimeter as installed on LH fleet do not currently meet the FAA AD 2023-11-07 proposed minimum performance levels. As a consequence, the abovementioned helicopters cannot be currently declared as “radio altimeter tolerant rotorcraft”

The various LH radio altimeter manufacturers are working to provide 5G tolerant radio altimeter solutions. Two type of solutions are being investigated by manufacturers: an external in-line filter to be added to the existing radio altimeter equipment, or updated radio altimeter equipment including internal filters.

LH is working strictly with the Radio Altimeter manufacturers to monitor development on the on-going testing in order to evaluate the best solutions for the integration within the various LH Helicopters models.

Customers interested in the installation of radio altimeter 5G tolerant or other technical solution (as external filter installation) to provide a terminating action against the FAA AD requirement should contact LH for more information about solutions availability.

Until radio altimeter tolerant solutions for helicopter are made available, the AD 2023-11-07 requires the operator to apply specific Flight Restrictions of AD 2023-11-07, or to apply for an AMOC.

An assessment of the implications of the AD 2023-11-07 Flight Restrictions to LH helicopters is proposed in Section 3.

In addition, Sections 3 and 4 provide technical information and operative considerations/recommendations supporting possible AMOCs to be proposed to FAA by the helicopter operators.

3. RFM Limitations and mitigations for LH helicopters

AD 2023-11-07 requires the following Flight Restrictions to be applied to helicopters which are not “radio altimeter tolerant”:

(Required by AD 2023-11-07)

Radio Altimeter Flight Restrictions

Due to the presence of 5G C-Band wireless broadband interference, when operating in the contiguous U.S. airspace, the following operations requiring radio altimeter are prohibited:

- Performing approaches that require radio altimeter minimums for rotorcraft offshore operations. Barometric minimums must be used for these operations instead.
- Engaging hover autopilot modes that require radio altimeter data.
- Engaging Search and Rescue (SAR) autopilot modes that require radio altimeter data.
- Performing takeoffs and landings in accordance with any procedure (Category A, Category B, or by Performance Class in the Rotorcraft Flight Manual or Operations Specification) that requires the use of radio altimeter data.

With respect to such prohibition items above, the following considerations and mitigations specific to LH helicopters are provided, for possible use of AMOCs by helicopter operators. Considerations are grouped in respect to impact to autopilot modes (a.) and impact to approach, takeoff and landing procedures (b.)

a. **“Engaging hover autopilot modes that require radio altimeter data”,**

“Engaging Search and Rescue (SAR) autopilot modes that require radio altimeter data”.

The AFCS modes requiring radio altimeters data for the various models are defined in Table 1, second column. Functional impacts as due to unreliable Radio Altimeter data are identified in column 3, together with the proposed operational mitigations which are identified in column 4.

As a summary, when the relevant operational mitigations identified in Table 1 are enforced, as required by the relevant RFM, the severity of the impacts of unreliable radio altimeter data to AFCS is mitigated to no higher than an increased pilot workload. Also, except for AW109SP model, all other 109/119 variants do not use Radio Altimeter data for AFCS functions.

Helicopter Model	AFCS Modes/Functions Utilizing radio altimeter data	Functional Impacts due to unreliable Radio Altimeter Data	Operational Mitigations
AW139	RHT, ALVL, MOT, TD(H), TU, (Low HT / Fly Up protection)		
AW169	RHT, TD, TDH, TU, MOT, CSF - LOW HT (if active any collective upper mode) ALVL	The most critical impact is limited to possible “AFCS single-axis or multi-axis <u>slowover</u> ” conditions, which could result in the helicopter to <u>slowly drift</u> from the expected flight path.	i. availability of baro-altitude and/or external visual references, as required by the relevant procedures ii. highest workload operations, such as SAR operations, requiring two pilots iii. fly-manually / fly-attentive RFM recommendations for high workload operations (e.g. Hoist Operations)
AW189	RHT, TD, TDH, TU, MOT, HPA(TDH phase), OFSH APP, CSF - LOW HT (if active any collective upper mode) ALVL		
AW109SP	RHT,TU CSF - LOW HT (if active any collective upper mode) ALVL		
A109A, All, C, E, KII, S, S-Trekker, AW119	<i>none</i>	<i>none</i>	<i>none required</i>

Table 1 – Helicopter AFCS modes utilizing Radio Altimeter data, and existing mitigations

b. **“Performing approaches that require radio altimeter minimums for rotorcraft offshore operations. Barometric minimums must be used for these operations instead”,**

“Performing takeoff and landings in accordance with any procedure (Category A, Category B, or by Performance Class in the Rotorcraft Flight Manual or Operations specification”.

The most critical approach, takeoff and landing procedures utilizing Radio Altimeter Data for the various models are identified in Table 2, second column. Potential functional impacts as due to unreliable Radio Altimeter data are identified in column 3, together with the proposed operational mitigations which are identified in column 4.

Note that with respect to these procedures the AW119 model is not affected by the AD limitations. The impact of unreliable Radio Altimeter Height data to LH helicopter models is limited to a possible increase of pilot’s workload, in the most critical conditions and considering the related mitigations. See Table 2 for details.

Helicopter Model	Most Critical approach, takeoff and landing procedures utilizing radio altimeter data	Functional Impacts due to unreliable Radio Altimeter Data	Operational Mitigations
AW139 AW189	Oli rig approaches	The worst case possible effects of unreliable Radio Altimeter data are limited to the transition to level-off flight during custom approaches for few seconds at RHT capture.	Normal and emergency extant RFM procedures are considered to adequately cover possible Radio Altimeter malfunctions Use of dual pilot is also considered as an operational mitigation
AW139 AW169 AW189 AW109	Cat. A	The worst impact is due to the recognition of CDP in OEI	Use of Baro Altitude data instead of Radio Altitude data, as already recommended for operations from elevated heliport/helideck or when obstacles are present, is an effective mitigation Use of dual pilot is also considered as an operational mitigation

Table 2 – Helicopter most critical approach, takeoff and landing procedures utilizing Radio Altimeter data

4. Further considerations for AMOCs

Customers that are impacted by the FAA AD 2023-11-07 flight restrictions are invited to point to Section 2 of this document for more information about the specific helicopter operational impacts as well as the related mitigations which are already in place as due to the architecture and the RFM procedures of the various models.

Such customers which require more information as AFCS modes or flight procedures using Radio Altimeter are invited to contact LHD to assess if an AMOC is suitable for removing the AD 2023-11-07 restrictions for flight operations.

In addition, the following considerations are considered generally applicable:

- For operations far offshore or in very remote locations (e.g., desert or mountainous terrain) far away from any wireless broadband operations (5G) antennas the risk to have the Radar-Altitude malfunction should be considered unlikely. The experience acquired in 2022-2023, with the initial deployment of the 5G C-band stations showed no occurrence of interference to helicopter Radio Altimeter. The risk was considered as extremely unlikely in SN GEN-22-001, however the increase in deployment of base stations as well as the increase in the C-band bandwidth should be considered as per AD 2023-11-07.
- Transmitting Portable Devices (T-PEDs) with 5G capabilities and taken onboard the aircraft are required to be switched OFF during flight operations. The clearance to use other T-PEDs services remains as per the extant aircraft / operator obtained clearance.
- LHD also encourages each operator in considering in its operational risk assessment the interference from 5G ground stations that might impair the reliable functioning of Radar-Altitude. Among the possible mitigations, operators should:
 - For all phases of flight and particularly for the approach and take-off phases and overwater operations: consider exposing flight crews to unreliable Radar-Altitude scenarios in recurring flight training sessions conducted in the Flight Simulation Training Devices. Such mitigation is particularly relevant in case flight crews undergo Low Visibility Operations training.
 - Whatever the type of approach conducted, ensure awareness of the crews of the possible degradation in the performance of installed Radar-Altitude and of other systems dependent on data from Radar-Altitude.

In case of operators getting an AMOCs approval by the FAA, the following recommendations provided by SN GEN-22-001 are still considered as applicable:

- The use of barometric altitude rather than Radar-Altitude data is recommended for all operations, unless radio altimeter tolerant solutions are adopted.
- If not possible, before engaging the intended maneuver:
 - Check appropriately the barometric altimeter setting (Reference Pressure – QNH/QFE (Hpa or Hg),
 - Respect the minimum altitude as provided in the RFM (visual references need to be acquired before this minimal altitude),
 - During the flight/manoeuvre cross check Radar-Altitude data with barometric altitude,
 - Be ready for possible failure/degradation annunciations, altitude and attitude of the aircraft and its environment,
 - If erratic behavior is detected or suspected, RFM procedures relevant to failure/loss of Radar-Altitude must be applied.

5. Feedback Request:

To support our investigation, LHD kindly invites you to forward the following information associated with possible Radar-Altitude malfunction or erratic behavior experienced on your aircraft in the vicinity of 5G antennas:

- Aircraft type and S/N
- Radar-Altitude information :
 - P/N
 - S/N
 - System Configuration (1x or 2x Radar-Altitude)
- Flight Phase (Hovering, Approaching, En-Route..)
- Estimated distance altitude and bearing from the 5G antenna (if known)
- Country, town and Position (area, lat/long)
- Height of the aircraft (MSL and AGL)
- Type of terrain
- Duration of the phenomenon
- Brief description of anomaly and aircraft / system behavior
 - Nature of Radar Altitude interference:
 - Frozen display
 - Failed Radar Altitude
 - Erratic display
 - Under- or over-estimation of height
 - AFCS (please detail AFCS status: upper mode(s) engaged / Armed, etc.)
 - Displayed Radar Altitude, associated caution/warning
 - Other Systems
 - Etc.

To the following address: engineering.support.lhd@leonardo.com

LHD will monitor in service findings and will continue investigation/analysis.