



## INTERNATIONAL CIVIL AVIATION ORGANIZATION

**Sixth Meeting of the APIRG Infrastructure and Information Management Sub-Group  
(IIM/SG6)***(Nairobi, 31 July - 3 August 2023)***Agenda Item 3.5: Other Air Navigation initiatives****Impact of 5G interference on the radio altimeters***(Presented by the Secretariat)*

SUMMARY
This paper presents issues and actions to be taken related to the impact of 5th Generation (5G) of telecommunications interference on the Radio Altimeter systems (Rad Alt) in the frequency band 4 200-4 400 MHZ.
<b>Action by the meeting in paragraph 3</b>
<b>REFERENCE(S):</b> <ul style="list-style-type: none"><li>▪ ICAO PANS-OPS, Volume II, Part III, Chapter 21</li><li>▪ ICAO SL 21/22, ‘Potential safety concerns regarding interference to radio altimeters’, issued 25 March 2021 – and references contained therein.</li><li>▪ RTCA 2020 Report</li><li>▪ CAAs information Bulletins (FAA, UK CAA, etc.)</li></ul>
This working document relates to <b>ICAO Strategic Objectives:</b> <b>A – Safety and B – Air Navigation Capacity and Efficiency.</b>

**1. INTRODUCTION**

1.1 The recent and ongoing rollout of 5G in the frequency band below the Radio Altimeter band at 4200-4400 MHz and the potential associated interference issues to radio altimeters that 5G base stations may cause has resulted in questions being asked to the ICAO Secretariat, by Aeronautical Regulators and others.

1.2 There is a major risk that 5G telecommunications systems in the 3.7–3.98 GHz band will cause harmful interference to radio altimeters on all types of civil aircraft—including commercial transport airplanes; business, regional, and general aviation airplanes; and both transport and general aviation helicopters.

## 2. DISCUSSIONS

### *Issues statements*

2.1 The fundamental emission (3,7 - 3.98 GHz signals) from 5G Base Station using active antenna systems could cause harmful interference to Usage Category 1 (Commercial Air transport Aircraft) in certain circumstances. Noting that fundamental emission creates effects on Radio-Altitude like blocking, saturation and intermodulation.

2.1.1 For Usage category 2 (Regional Business Aviation and General Aviation) and Usage Category 3 (Helicopter) every 5G base station configuration will result in harmful interference, from both fundamental and spurious emissions, being present in virtually all operating scenarios and geometries.

2.2 5G User Equipment (UE) operating on the ground are not expected to cause harmful interference to radio altimeters while 5G UE operating on board Usage Category 2 & 3 aircraft could cause harmful interference to radio altimeters.

2.3 Radio Altimeters can support a range of function on board an aircraft and provide critical data for the safe execution of aircraft operation. The roll-out of 5G telecommunications networks continues to expand worldwide at a rapid pace, with many nations electing to allocate currently unused spectrum that is located closer to the Aerospace Reserved Band used by Radio Altimeters, to 5G operations.

2.4 Consequently, concern has been raised by several National Aviation Authorities (CAA) that Radio Altimeters may be prone to interference from 5G telecommunications frequencies that could result in loss or malfunction of Radio Altitude functionality.

2.5 The deployment of 5G mobile technology varies by state and is individually managed by state radio regulators. Deployment of 5G mobile technology is across a range of different frequency bands, output powers and other technical variables which dictate the operating environment that radio altimeters will be required to function in.

2.6 Interference to the function of the radio altimeter could result in serious safety risks during any phase of flight. These risks may arise in RVSM airspaces where Large Height Deviations (LHDs) are regularly observed. The same situation prevails in the take-off phase and in the critical approach and landing phases during which the barometric VNAV (baro-VNAV) provides information on the vertical path.

2.7 It should be noted that in some states, 5G infrastructure is not yet in place and that past performance is not a guarantee for future applications and some countries have introduced temporary technical, regulatory or operational mitigations on mobile telecommunications providers and/or aviation industry to mitigate against the potential risk of interference. It should also be noted that some CAAs, including FAA, CASA and UK CAA have published information bulletins on this subject.

2.8 As guidance, ICAO issued State letter referenced SP 74/1-21/22 dated 25 March 2021, on the potential safety concerns related to interference on radio altimeters by new broadband cellular technologies (e.g., 5G IMTs) in frequency bands close to those used by radio altimeters (4.2 – 4.4 GHz).

### *Action to be Taken*

2.9 In consideration of the severity of the risk, the persistent and growing threat resulting in the escalation of the deployment of new broadband cellular technologies in the concerned frequency band, Administration should initiate and conduct preventive/remedial actions. Coordination actions towards the National Authority in charge of Telecommunication regulation, on the potential safety concerns of civil aviation, related to interference of radio altimeters by the IMTs could minimize the risk. For this purpose, provisions of the ICAO Handbook on Radio Frequency Spectrum Requirements for Civil Aviation Doc.9718 Volume I - *ICAO spectrum strategy, policy statements and related information, Chapter 7. Statement of Frequency Allocations Technical Details and ICAO Policy*, and the various studies to which the State Letter refers to are relevant technical guidance

material, for discussions on the concern with stakeholders, including the Authority of Regulation of Telecommunication

2.10 Operators should ensure their flight crew are aware of the possible implications of radio altimeter malfunctions for the types of aircraft operated; this may be particularly relevant when conducting Precision Instrument Approaches during Low Visibility Operations.

2.11 Where a state, based on safety analysis of its own 5G roll out, has issued a NOTAM or similar directive, air operators are required to adhere to any state operational restrictions. The absence of a NOTAM does not necessarily imply that interference will not be encountered.

2.12 Flight crew experiencing radio altimeter or autoflight malfunctions should not assume that this has been caused by 5G interference and should follow normal operating procedures for any malfunctions or failures. Although flight crew should be aware of the possibility of 5G interference, any malfunctions observed may well be caused by other factors such as radio altimeter and associated antenna technical failures.

2.13 Any flight crew observations of radio altimeter or autoflight malfunction should be reported using normal company safety reporting procedures. Flight crew should include as much detail regarding the type of malfunction, including duration and location (particularly if during an approach or departure phase), the runway in use and the height above the ground that the malfunction was observed. If the commander assesses that the malfunction resulted in a significant risk to aviation safety, the report should be submitted as a Mandatory Occurrence Reporting (MOR).

2.14 Aerodromes should also be aware of the potential risk of interference and associated trends that may emerge, which could impact operations more widely.

### **3. ACTIONS BY THE MEETING**

1. The meeting is invited to:
  - a) Take note of the above information
  - b) Approve the following draft conclusion

**Draft Conclusion IIM/SG/6-XXXX: *Protection of radio altimeters against harmful interference by 5G signals***

**That;**

**States/Organizations take all necessary measures around airports and heliports, to address aviation concerns on the main operational risks resulting from the deployment of 5G technology including:**

- a) **Conducting a detailed survey of the current or potential status of spectrum allocation for new broadband technologies to adapt the strategy to the situation.**
- b) **Requesting, if the transfer is not yet effective, the assurance of adequate protection of the 4200-4400 MHZ frequency band allocated to the radio altimeter, taking into account the relevant studies already carried out.**
- c) **Otherwise, by requesting immediate protection of the radio altimeter frequency band and, on the other hand, by informing users to carry out an evaluation of the risk of interference, while requiring greater vigilance on the part of crews.**

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