



International Civil Aviation Organization

MIDANPIRG/19 and RASG-MID/9 Meetings

(Riyadh, Saudi Arabia, 14 – 17 February 2022)

Agenda Item 5.8: CNS

G-5 INTERFERENCE TO AIRCRAFT RADIO ALTIMETERS

(Presented by IATA)

SUMMARY

Radio altimeter is a mandated safety-critical aircraft system used to determine an aircraft's height above terrain. It is the only sensor onboard the aircraft capable of providing a direct measurement of the clearance height above the terrain and obstacles. The information from the radio altimeters is essential to enable several safety related flight operations and navigation functions on all commercial aircraft and are potentially impacted by 5G interference and would pose a serious safety risk to passengers, crew, and people on the ground.

Action by the meeting is at paragraph 3.

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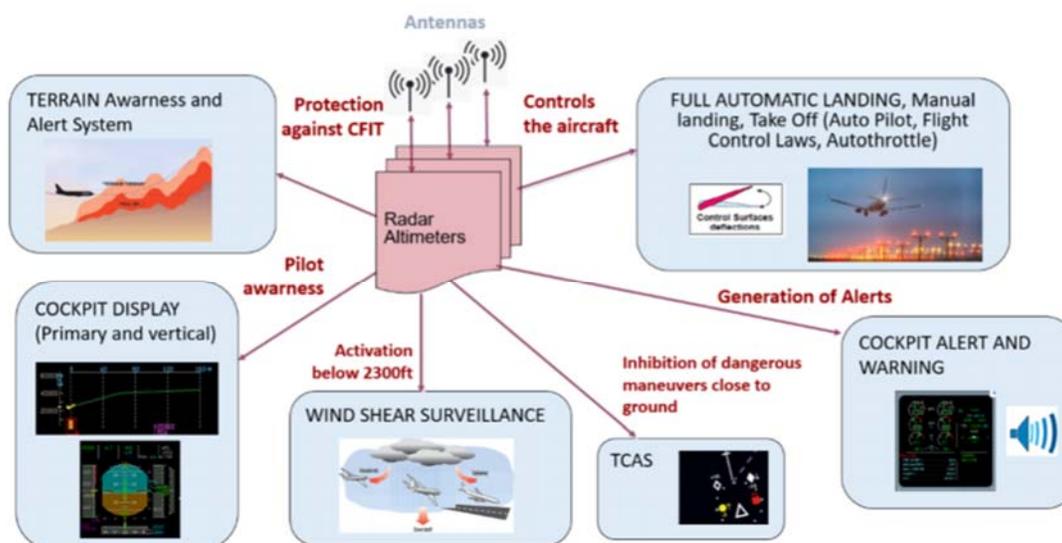
1. INTRODUCTION

CRITICAL ROLES OF RADIO (RADAR) ALTIMETERS ON-BOARD AIRCRAFT

1.1 Radio Altimeter (RA) is a mandated safety-critical aircraft system used to determine aircraft's height above terrain. Globally operating at 4.2-4.4 GHz frequency range, it is to be noted the full band of 4.2-4.4 is required to meet accuracy and integrity requirements for RA. The altimeters are deployed on tens of thousands of commercial and general aviation aircraft as well as helicopters worldwide. The Altimeter system input is used by aircraft systems when altitude Above Ground Level (AGL) is below 2500 ft.

1.2 The information provided by the Radio altimeter is more precise than a barometric altimeter and for that reason is used where aircraft height over the ground needs to be precisely measured, such as auto-land, manual landings, or other low altitude operations. Undetected failure of this sensor can therefore lead to catastrophic results; and false alarms have the potential to undermine trust in the avionics systems.

1.3 There is a major risk that 5G telecommunications systems in the adjacent frequency bands to radio altimeters, including 3.7–3.98 GHz, will cause harmful interference to radio altimeters on all types of civil aircraft. If there is no proper mitigation, this **risk has the potential for broad impacts to aviation operations** in all regions including ICAO MID Region where the 5G network is being implemented close to the 4.2-4.4 GHz frequency band. The function of Aircraft Radio Altimeter is as in figure (1)



1.4 Interference to RA operations can affect potential equipment on board aircraft including:

- Enhanced Ground Proximity Warning Systems (EGPWS)
- Traffic Alert and Collision Avoidance Systems (TCAS II)
- Take-off guidance systems
- Flight Control (control surface)
- Tail strike prevention systems
- Windshear detection systems
- Envelope Protection Systems
- Altitude safety call outs/alerts
- Auto-throttle
- Thrust reversers
- Flight Director
- Primary Flight Display of height above ground
- Alert/warning or alert/warning inhibit
- Stick pusher / stick shaker
- Engine and wing anti-ice systems
- Automatic Flight Guidance and Control Systems (AFGCS)
- Autoland functions particularly in low visibility auto approach operation,
- Class A Terrain Awareness Warning Systems (TAWS-A)

Global summary of 5G deployment proposals

1.5 Globally, auctions/proposals for 5G spectrum are being planned/conducted in various countries. As of this writing, the following figure summarized some 5G deployment proposals being considered.

1.6 It is to be noted that the decisions on spectrum allocations rest fully within each national telecommunication regulator. Adding to the complexity, 5G deployment proposals and associated conditions are varied technically from one country to another. The differences can be, for example, in terms of which spectrum will be considered for 5G, where the 5G transmitter can be located and what the maximum transmitting power 5G base station can use.

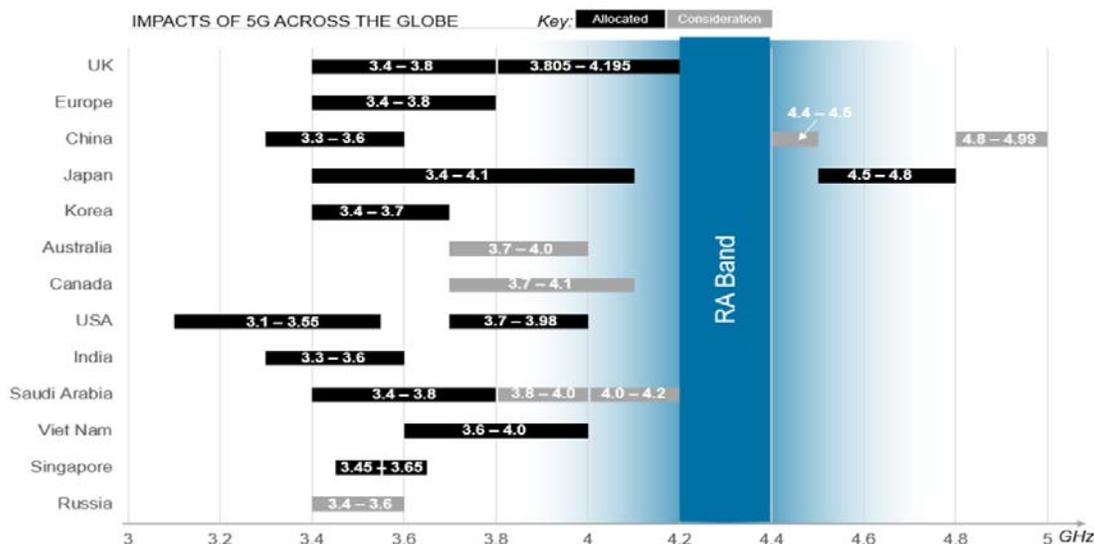


Figure 2: 5G proposals across the globe

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2. DISCUSSION

2.1 The collective global aviation community formally recognizes and expresses safety concerns arising from harmful interference to radio altimeters, if not properly mitigated. Below are some of the concerns expressed:

- ICAO — In ICAO State Letter dated 25 March 2021, ICAO Secretary General notes that “harmful interference to the function of the radio altimeter during any phase of flight may pose a serious safety risk to passengers, crew and people on the ground” and encourages “Administration[s] to consider as a priority, public and aviation safety when deciding how to enable cellular broadband/5G services in radio frequency bands near the bands used by radio altimeters.”.
- ICAO HIGH-LEVEL CONFERENCE ON COVID-19 (HLCC 2021) held in Montréal, Canada, 12 to 22 October 2021 adopted recommendation related to Radio Altimeters:

Recommendation 5/5 — Mitigating the risk of 5G implementation to safety-critical radio altimeter functions

That States:

a) consider, as a priority, public and aviation safety when deciding how to enable cellular broadband/5G services.

b) consult with aviation safety regulators, subject matter experts and airspace users, to provide all necessary considerations and regulatory measures to ensure that incumbent aviation systems and services are free from harmful interference; and

That ICAO:

c) continue coordinated aviation efforts, particularly at the International Telecommunication Union (ITU), to protect radio frequency spectrum used by aeronautical safety

- IATA and IFALPA — In a problem statement endorsed by ICAO Flight Operations Panel, IATA and IFALPA jointly states that “the radar altimeter is one of the most critical components to an aircraft’s operations; and the only sensor onboard an aircraft providing a direct measurement of the aircraft’s clearance over the terrain or other obstacles. This information is the most critical information in many automated landing and collision avoidance systems. Undetected failure of this sensor can therefore lead to catastrophic results; and false alarms have the potential to undermine trust in the avionics systems.”
- United States Department of Transportation — The US Secretary of Transportation emphasized the “very concern on the potential for harmful interference to radio altimeters” and committed to engage with industries and in interagency conversations in upholding “safety” as the fundamental “North Star.”
- Radio Tele Communication for Aeronautics (RTCA) — The results in the recent RTCA Paper Assessment of C-Band Mobile Telecommunications Interference Impact on Low Range Radar “revealed a major risk of harmful interference to radar altimeters on all types of civil and commercial aircraft caused by 5G telecommunications systems in the 3.7–3.98 GHz

2.2 The FAA issued AD 2021-23-12 for commercial operators and AD 2021-23-13 for Helicopter operators because the agency has determined that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 3.7-3.98 GHz frequency band (5G C-Band). The AD requires revising the limitations section of the existing AFM on or before 4 January 2022 to incorporate limitations prohibiting certain operations requiring radio altimeter data when in the presence of 5G C-Band wireless broadband signals as identified by NOTAM. These limitations prohibit Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III ; Required Navigation Performance (RNP) Procedures with Authorization Required (AR), RNP AR IAP ;Use of Enhanced Flight Vision System (EFVS) to touchdown ; Manual Flight Control Guidance System operations to landing/head-up display (HUD) to touchdown operation and Automatic Landing operations .These limitations could prevent dispatch of flights to certain locations with low visibility and could also result in flight diversions.

2.2 The FAA agreed to delay deployment for two weeks until 19 January 2022, averting an aviation safety standoff.

2.3 As a minimum, some actions and regulatory measures need to be taken and put in place to safeguard the use of Radar Altimeters. Several Countries have implemented mitigations measures on 5G systems in order to protect radio altimeters while permanent solutions are being devised. In some cases, this has included implementing precautionary or exclusion and buffer zones around airports with restrictions placed on 5G service providers have set an example by cooperating with 5G network providers with regards to provision of location information for their stations as well as details of the transmission characteristics (e.g., antenna radiation patterns, power levels) required. The measures adopted include:

- limiting the installation of 5G stations within 2-3 km of the approach ends of runways (Exclusion and buffer zones)
- prescribing a downward-looking radiation pattern for 5G transmitting stations. The antenna tilt must always be below the horizon, to ensure the maximum gain towards the aircraft is lower (about 5dB) than the maximum gain of the antenna

- States consider evaluations of their operations, especially at international airports, to assess the impact that the implementation of 5G technology may have on operational safety.

1.4 While the aviation community understands the economic importance of making spectrum available to support next generation commercial 5G telecommunication systems, we insist that maintaining current levels of safety of passengers, flight crews, and aircraft must continue to be one of States' and governments' highest priorities.

1.5 ICAO and industry standards are under development for the "future" RA, focusing especially on the interference environment. This however will be a longer-term solution.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) review and acknowledge the safety concerns and potential operational impacts;
- b) adopt actions taken by some states to mitigate 5 G interference in section 2.1.7 and to suggest additional actions, as necessary and appropriate;and
- c) request States to brief their governmental/political affairs and Telecommunication agencies of the impact of 5 G to take necessary considerations to ensure the Radio Altimeter frequency is free from harmful interference, at and around airports.