AIRPORTS COUNCIL INTERNATIONAL

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ACI ADVISORY BULLETIN

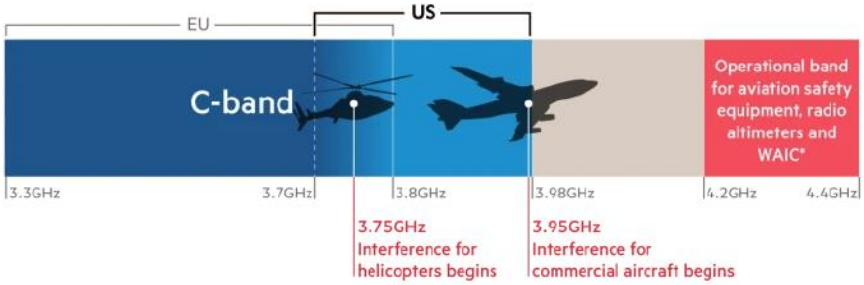
Deployment of C-band 5G around airports

Montreal, 25 January 2022 – Over the past few weeks, considerable media attention has been focused on the associated disruptions to aircraft operations caused by the deployment of C-band 5G telecommunication services at airports in the United States. This Advisory Bulletin for ACI Members seeks to provide some background information and point to available resources for further information.

Background information

Deployment of 5G use of mid-band spectrum, which encompasses frequencies from 1 GHz to 6 GHz and includes the C-band, has been underway in many regions of the world for several years. ICAO and the aviation community have been monitoring the development and deployment of 5G services for several years as well. From the outset, the potential interference between 5G signals and aircraft instrumentation, specifically the radio altimeter that allows pilots to know precisely how far above the ground they are during low altitude flight, had been identified as a potential safety risk.

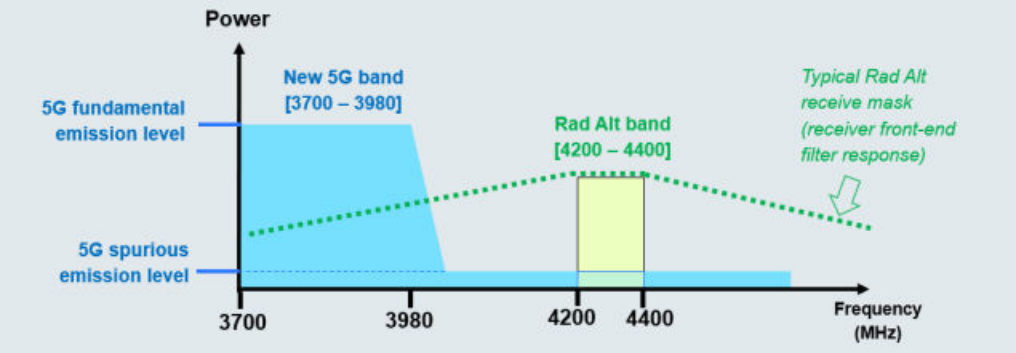
The root cause of the 5G issues in the United States stems from potential interference between aircraft radio altimeters, which utilize frequencies of 4.2 to 4.4 GHz, and 5G telecommunications that use C-band spectrum from 3.7 GHz to 3.98 GHz.[1]



Source: Financial Times and Aerospace Industries Association

[1] Global standards organization define the C-band anywhere from 4 GHz to 6 GHz. The U.S. Federal Communications Commission has used 3.7 to 4.2 GHz. This article by IEEE provides a more thorough discussion of how spectrum is defined globally as well as international differences in how this spectrum has been allocated and licensed.

The fundamental emissions generated by a 5G antenna may lead to blocking interference in the radar altimeter receiver, whereby a strong signal outside of the normal receive bandwidth cannot be sufficiently filtered in the receiver to prevent overload or other effects. On the other hand, the spurious emissions fall within the normal receive bandwidth of the radar altimeter. These may produce undesirable effects such as desensitization due to reduced signal-to-interference-plus-noise ratio (SINR), or false altitude determination due to the erroneous detection of the interference signal as a radar return.[2]



The figure above *(source: RTCA 5G Interference Report / RTCA Paper No. 274-20/PMC-2073)* shows the frequency ranges and potential for interference between radio altimeters and 5G spurious emission levels.

Erroneous or interrupted radio altimeter outputs that occur during critical phases of flight, in particular during low altitude operations such as landing and takeoff, may create safety risks to aircraft operators. They may also interfere with other critical aircraft automation systems, including auto throttles, auto land capability, aircraft ground and air mode sensing, auto trim, wing leveling, and automatic spoilers, as well as other safety capabilities like enhanced ground proximity warning systems (EGPWS) and traffic collision avoidance warning systems (TCAS). In the US case, the FAA has provided a list of potentially affected aircraft systems in a Safety Alert to Operators (SAFO) on 23 December.

Many countries have taken actions to address this risk proactively. In Europe, somewhat lower frequencies have been allocated to 5G services than in the United States. In other cases, regulators have required C-band 5G transmitter power to be limited near airports and/or for 5G antennas to be directed downward to prevent spurious skyward signals.

Available safety information

Aviation authorities have been following the deployment of 5G across the globe as well as the analyses conducted by technical experts to determine its potential impact on the safety of flight operations.

[2] RTCA Paper No. 274-20/PMC-2073 - Assessment of C-Band Mobile Telecommunications Interference Impact on Low Range Radar Altimeter Operations

In early 2021, the ICAO Air Navigation Commission conducted a full review of the situation on a global level following which a State Letter (SL 022 - SP 74/121/22) was issued to all ICAO Member States.[3]

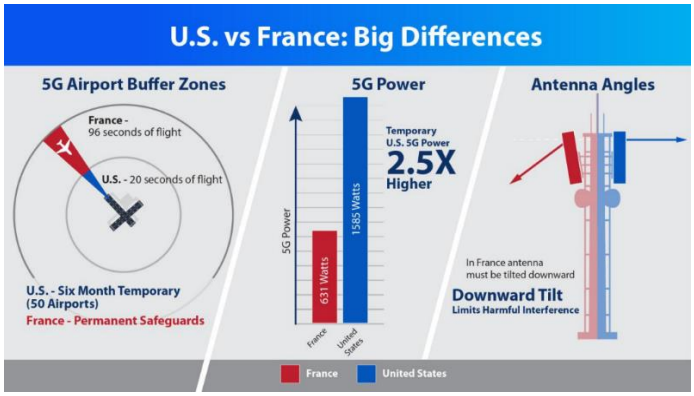
The primary conclusion of the analysis conducted by ICAO was that "some radio altimeters will be impacted if high power cellular systems are implemented near the frequency band used by radio altimeters." It was further concluded that "Several States have already implemented temporary technical, regulatory and operational mitigations on new 5G systems in order to protect radio altimeters while more permanent solutions are being devised."[2]

In Europe, the European Union Aviation Safety Agency (EASA) issued a Safety Information Bulletin (SIB 2021-16) in December 2021. The SIB was developed by the agency following assessments conducted with aircraft manufacturers, national airworthiness authorities, and national spectrum regulators to identify the risk of radio altimeter interference by 5G transmissions, the effect of such interference on aircraft systems, and the subsequent effect on the safety of flight operations. The assessments concluded that at this stage, no risk of unsafe interference had been identified in Europe.[4]

Specific situation in the United States

In the United States, the situation is somewhat different than that identified globally by ICAO or in the European Union. The Federal Aviation Administration has published a comprehensive analysis of the situation explained on its website. The primary differences between the situation in the US and in other regions of the world are the use of higher power transmitters that are placed in closer proximity to aerodromes, meaning that the buffer zones are more limited, and the use of antenna with no tilt on the transmitters.

As an example, the differences in a 5G implementation in France compared to the US are depicted in the infographic below sourced from the FAA.



[3] ICAO State Letter SP 74/1-21/22 Potential safety concerns regarding interference to radio altimeters
[4] EASA SIB 2021-16 Operations to aerodromes located in United States with potential risk of interference from 5G ground stations (as published through aerodrome NOTAMs)

To address the potential interference concerns between C-band 5G and radio altimeters, the FAA issued two Airworthiness Directives, one for transport and commuter category aircraft and one for helicopters. These noted that the FAA would issue Notices to Airmen (NOTAM) prohibiting use of low visibility approach procedures and certain aircraft capabilities when C-band 5G networks became operational on 19 January.

Following significant efforts by the aviation industry, the telecommunication companies agreed to provide buffer zones within approximately 2 nautical miles of airports in which no C-band 5G antennas would be operated. These buffer zones are expected to remain in place until at least 5 July 2022 but will probably be in place longer as the FAA works with aircraft and avionics manufacturers to refine 5G safety assessments.

With the buffer zones in place, the FAA has been able to approve Alterative Methods of Compliance (AMOCs) for large swaths of the commercial aircraft fleet, including most major Boeing and Airbus aircraft and some Embraer aircraft. These AMOCs are specific to the radio altimeter models installed on the aircraft and are specified for individual airport instrument approach procedures. Aircraft type/radio altimeter combinations that have AMOCs in place can use low visibility approaches prohibited by 5G NOTAM.

For more information about the US situation, ACI North America has developed a resource centre on the specific situation in the US on their website.

Action for ACI Members

Even though on a global level there are no immediate safety concerns that have been identified related to the deployment of C-band 5G around airports, ACI recommends that Airport Operators:

1. Proactively engage with their National Civil Aviation Authority and National Spectrum Regulators to identify potential deployment plans and any mitigation measures that have been decided for the State.
2. Initiate discussions with their local air operator community to ensure that they are aware of the potential for disruption, in particular with regards to aircraft equipped with lower performance radio altimeters.
3. Where necessary, establish contact with telecommunication providers to identify their plans for deployment of C-band 5G around airports and ensure that antenna locations and actual power levels are shared with air operators so they can conduct risk assessments for various aircraft type and radio altimeter combinations.

Ends