Aviation Spectrum Resources Inc. ♦ [✂ - redacted for publication]

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RESPONSE OF ASRI TO UK OFCOM CONSULTATION
Enabling opportunities for innovation

On behalf of commercial airlines and other airspace operators based in the United States (US) who regularly fly in Europe, Aviation Spectrum Resources, Inc. (ASRI) has the following comments on the UK Ofcom consultation for introducing new radiocommunication services in the 3.8-4.2 GHz.[1] Over 2500 flights cross the Atlantic every day, giving US based airlines and aviation operators a significant interest in European initiatives affecting aeronautical equipment. Given the potentially affected user community described above, ASRI provides below a more expansive response to *Q.15 - Do you agree with our proposal not to assign spectrum to new users in the 3800-3805 MHz band and the 4195-4200 MHz band?*

Suggested operational model for radio altimeter/base station RF interactions

As the author of the ICAO paper cited in the consultation's Annex 5, it must be reiterated that the study was a working paper from one author that provided a preliminary assessment to bracket a potential issue for aviation[2]. As noted in the study's conclusion '*This initial study does not accurately model the effect of an aircraft flying beyond a BS and passing through its main beam pointed towards the airport while accounting for the effect of aircraft shielding. Critically, it does not include possible multipath effects or aggregate power from multiple BSs or UEs situated at different points around the approach path or airport*'. Additionally, a separate study from another attendee was also submitted to the same conference which used slightly different parameters and modelling[3]. This study also noted that *'…a more comprehensive study should be carried out to determine the true impact of such signals on a radio altimeter receiver'*. Therefore, the ICAO working papers should only be seen as identifying a potential problem, and not a definitive ICAO model of the potential interactions and interference an aircraft may encounter.

ICAO has since released additional information on altimeter operations given interest in the frequencies within and adjacent to the radio altimeter. A liaison sent to the CEPT WG SE regarding potential interactions between altimeters and Ultra-Wide Band systems provided guidance that '*Based on studies in ICAO it is estimated that the minimum vertical distance of a fixed-wing aircraft above vehicle outside airport area or a vehicle operated for airport service is about 19m*.'[4] Furthermore, ICAO also noted that

[1] ASRI is the communications company of the US commercial aviation industry and is owned by the US airlines and other airspace users. As sponsor of the US Aeronautical Frequency Committee (AFC), ASRI brings together expertise and opinions from across the US aviation sector to promote the safe and effective operation of commercial aviation radio communications and navigation systems in use within the US and overseas.
[2] ICAO Working Paper 14 - Preliminary Study into Radio Altimeter Adjacent Band Compatibility – Presented by Andrew Roy, ASRI. 13 – 19 Mar 2014
[3] ICAO Working Paper 17 - POTENTIAL LEVEL OF INTERFERENCE FROM IMT SYSTEMS ON ADJACENT BAND RADIO ALTIMETERS, Presented by John Mettrop, UK CAA. 13 – 19 Mar 2014
[4] ICAO Liaison Statement to CEPT WG SE, ICAO meeting report, Appendix K – Dated 15 Feb 2018

helicopters should also be accounted for with a '*…minimum separation distance to vehicles on the order of 5 meters should be assumed.'*.

Given that ICAO cannot account for all national requirements for aviation, it is recommended that Ofcom seek guidance from the UK CAA on separation distance between all aircraft types and potential new services in the 3.8-4.2 GHz band. This is particularly relevant with new Unmanned Air Systems (UAS) being considered domestically and internationally, as many medium and larger sized UAS designs may incorporate radio altimeters onto their airframes. These may operate in much closer proximity to the ground and other obstacles than traditional manned aviation and should be considered in any assessment of the radio altimeters.

Parameters used in the interference assessment of Annex 5

In reviewing the radio altimeter assessment of Annex 5, ASRI would note that only a single interference source is apparently considered in the three scenarios, *'an outdoor low power BS with 2 dBi antenna gain and two medium power BSs with 8 dBi and 16 dBi antenna gain'*.[5] Given the licensed areas are anticipated to be approx. 50m in diameter, and multiple overlapping areas may create a large enough contiguous licensed area, ASRI would strongly recommend an aggregate interference analysis is conducted for an aircraft operating above such a potential area[6]. As noted in the ICAO working papers discussed above, aggregate interference was a significant factor requiring further assessment before any definitive conclusions could be made. Therefore, a single interferer will only provide one measure of interference but is not a comprehensive assessment of the proposed worst-case RF environment.

Secondly, the consultation assumes that out of block emissions would be reduced by between 5 and 10 dB below the current regulatory masks as '*…manufacturers design their products to meet the regulatory levels with some margin.'*. ASRI disagrees with this assumption when considering assessments against aviation safety systems. Whilst ASRI does not dispute that RF performance is often better that the required limits for many different radio communication systems, it is not guaranteed to be that way. This is the reason regulatory limits are established, and this is what should be assessed for safety critical applications. Alternatively, if there is a high confidence that these improved limits will be met by all equipment manufacturers, then Ofcom should recommend that the regulatory standards be changed to meet the improved performance profiles.

Lastly, ASRI would also note that at this time ITU-R Recommendation M.2059 is considered an appropriate resource for radio altimeter RF performance details. However, in light of multiple administrations reviewing the adjacent bands either side of 4.2-4.4 GHz, aviation has initiated testing of existing radio altimeters to better understand the performance the avionics in the presence of adjacent band OFDM signals. Such signals were not common or expected when radio altimeters where originally designed in the 1970s, and the sudden change in the RF environment has prompted a reassessment of interference analysis to ensure all performance is known[7]. Conducted by a consortium of avionics manufacturers under the Aerospace Vehicle System Institute (AVSI), the testing was conceived in 2016 and is due to be completed by Mar 2019. Once all results have been analyzed, they will be summarized and published in approx. Q2 2019. This data should provide a more accurate assessment for those

[5] See Para A5.50, Ofcom 3.8-4.2 GHz Consultation
[6] See para 4.10, Ofcom 3.8-4.2 GHz Consultation
[7] ICAO Job Card FSMP.006.001 - Develop radio frequency and interference rejection characteristics for radio altimeters. Dated 24 Nov 2016

administrations exploring spectrum changes near 4.2-4.4 GHz, and ASRI would strongly recommend such information is considered by Ofcom before implementing changes below 4.2 GHz. This is especially relevant for the 4.1-4.2 GHz range, which is of most concern to aviation operators.

Enforcement of new entrants into 3.8-4.2 GHz

When operating within close margins of aviation safety systems, appropriate reporting and enforcement mechanism are critical to ensure the new radio services are implemented as planned. Consequently, ASRI would seek clarification from Ofcom on what measures are being put in place and considered to detect, mitigate and remove sources of emissions not planned or authorized under the proposed consultation? Interference to radio altimeters is a significant safety threat to aircraft operations, greatly increasing the risk of aviation safety incidents by misleading or not reporting aircraft position data to the pilot. Should new radiocommunication services be introduced into the 3.8-4.2 GHz band, then clarification of Ofcom's enforcement processes for this issue will be critical to commercial aircraft operators operating within the UK.

Conclusion

Whilst the proposed concept for 3.8-4.2 GHz services in the UK has considered several mitigations for protecting the radio altimeter, ASRI still has concerns about several unknowns that should be considered a potential safety risk to US aviation operators while in the UK. ASRI would therefore strongly encourage Ofcom to account for the above points when assessing new services below 4.2 GHz, and conclusions be drawn only after a full and comprehensive assessment of the operating scenarios and the radio altimeter performance. US aviation's long-term position has always been to promote a full assessment of all factors when considering aviation safety systems, especially when critical avionics such as the radio altimeter are involved.

Yours sincerely,

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