



International Civil Aviation Organization

ICAO FIFTH MEETING OF SPECTRUM REVIEW WORKING GROUP (SRWG/5)

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Agenda Item 7: State and regional updates

ACTIONS TAKEN IN FRANCE TO MITIGATE INTERFERENCE INTO THE RADIO ALTIMETERS SYSTEMS FROM 5G/MFCN IN THE BAND 3.4-3.8 GHz

(DSNA, France)

SUMMARY

Last June 2020, ICAO secretary brought to the attention of FSMP members, a Liaison Statement informing ECC about the issue of potential interference to aeronautical Radio Altimeters operating in the 4200 - 4400 MHz frequency band, caused by IMT systems currently operating or planned to operate in the frequency band 3400 - 3800 MHz in Europe. This Liaison Statement mainly focused on the fact that there is no specific limit of unwanted emissions from IMT base stations within the frequency band 4200-4400 MHz. The recent RTCA Report SC-239 raised another risk from MFCN (5G in the band 3.7-3.98 GHz) into some radio altimeters.

DGAC (French Civil Aviation) and the French Aeronautical and Space Industries Group (GIFAS) considered that there is a need to have more thorough assessment of the risk of 5G interference in the frequency band 3.4-3.8 GHz and a need to clarify the assumptions to be used, beyond the elements given by the RTCA Report.

After studying the information collected from the various manufacturers, it was concluded that the subject required immediate measures.

This information paper describes the actions/mitigations techniques that were taken in France.

1. INTRODUCTION

1.1 Background

One may say that the aeronautical community is raising rather late the issue of radio altimeters susceptibility from 5G emissions in non-adjacent frequency bands, while 5G deployment has already started in some part of the world. It is important to note that collecting essential elements allowing to conduct accurate studies on the Radio Altimeters susceptibility from 5G emissions is very difficult. For

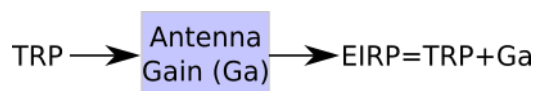
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example in France, DGAC¹ had to wait for the base station notification from mobile operators into the National Frequency Agency (ANFR²) database to know the maximum EIRP³ that can be emitted from a 5G base station operating in the frequency band 3.4-3.8 GHz. Up until now, it has been not possible for DGAC to get access to some AAS antenna diagrams (Advanced antenna systems) in elevation, due to Non-Disclosure Agreements between antenna manufacturers and mobile operators. Without these essential elements, it is impossible to conduct an accurate study. However, thanks to the cooperation of our national regulator (ANFR) and GIFAS⁴, DGAC was able to conduct the studies described in this document, identify issues, and take appropriate mitigation techniques in an effective manner and a very short time.

1.2 Previously

Last June 2020, ICAO secretary brought to the attention of FSMP members, a Liaison Statement informing ECC about the issue of potential interference due the fact that there is no specific limit of unwanted emissions from IMT Base Stations (BS) within the frequency band 4200-4400 MHz. CEPT concluded that the spurious TRP⁵ limit of -30 dBm/MHz should apply but without defining the antenna gain in the band 4.2-4.4 GHz. EIRP still remains unknown.



Last October 2020, RTCA Report SC-239 has showed another risk from MFCN (5G in the band 3.7-3.98 GHz) into radio altimeters operated in the frequency band 4 200- 4 400 MHz. The final version of this report was released few days before the end of the French's auctions for the 5G in the frequency band 3.4-3.8 GHz.

2. FRENCH ACTIONS CARRIED OUT TO MITIGATE THE RISKS OF INTERFERENCE FROM IMT SYSTEM INTO THE RADIO ALTIMETER SYSTEM.

2.1 RTCA report SC-239 in the French/European context.

The RTCA report SC-239 is assessing the interference risk from the IMT frequency band 3.7-3.98 GHz in the United States context. It is therefore obvious that not all elements can be used for the French/European context.

2.1.1 Unwanted emission

It was concluded that the US problematic for the unwanted emissions of the frequency band 3.7-3.98 GHz into the Radio altimeter frequency band 4.2-4.4 GHz is totally different and not applicable to the European context. DGAC therefore did not take into account the unwanted emission assessment of the RTCA report.

¹ DGAC : French Civil Aviation

² Agence Nationale des Fréquences (ANFR)

³ Effective Isotropic Radiated Power (EIRP)

⁴ French Aeronautical and Space Industries Group

⁵ Total Radiated Power (TRP)

2.1.2 Blocking Effect

Some GIFAS members, who did participate actively to the development of the RTCA report, provided us data regarding the susceptibility of some Radio altimeters below 3.7 GHz (down to 3.4 GHz). The analysis showed that some Radio altimeters in category 1 (according to RTCA report classification) are not sufficiently protected from 5G emission operating within the frequency band 3.4-3.8 GHz and are even more susceptible at 3.4 GHz than at 3.750 GHz. Therefore, the blocking effect issue that is described in the RTCA Report SC-239 is also applicable to the European context.

Considering the data collected, the massive deployment of high power base station around the frequency band 4.2-4.4GHz is likely to be an issue for radio altimeters worldwide.

2.2 French mitigation

Licenses in the band 3.4-3.8 GHz for 5G/MFCN operators in France mainland have been issued by Arcep⁶ on 12th November 2020. Taking into account the additional concerns expressed by DGAC on the basis of the RTCA Report, published on 8th of October 2020 and showing that some radio altimeters exhibit poor susceptibility performances, some immediate measures have been defined in France until the issue can be more thoroughly studied.

2.2.1 Phase 1 (Nov 2020): immediate actions

2.2.1.1 List of measures

Three immediate preliminary measures have been decided for the protection of radio altimeters:

1. Operators must implement only downward tilt;
2. Operators have to take measures to avoid grating lobes as far as practicable;
3. Special protection zones are applied to all IFR aerodromes and to some helicopter platforms.

Measures 1 and 3 are verified by ANFR on the basis of the information provided by mobile operators and in close cooperation with DGAC.

2.2.1.2 Definition of the protection zones

The protection zones dimensions are based on MCL calculations and take into account the free space model (ITU-R P.525) at the frequency of 3750 MHz.

- Two kinds of protection zones have been defined around IFR aerodromes. “*zone de sécurité*” (safety zone) where 5G base stations are not authorized to transmit. This area is defined to protect the Radio altimeters in the phase where the aircraft is at or below 200 ft (61 m) and is based on the following assumptions:
 - 3° slope⁷ with a tolerance of 0.375° (ie 2.625°). Therefore, the aircraft may be below 200 ft on a line corresponding to the runway threshold extended by 1130 m each side Base station maximum EIRP.
 - 6 dB ICAO Safety margin

⁶ Autorité de régulation des communications électroniques, des postes et de la distribution de la presse (ARCEP)

⁷ France doesn't have any glide slope below 3°

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- 0 dBi maximum Radio altimeters antenna gain below 3.8 GHz (RTCA Report)
- -19 dBm interference threshold (RTCA Report Cat.1 below 200 ft)
- The rectangular safety zone has a width on each side of the runway (protection distance) calculated with these assumptions and a length extended from each runway threshold by 1130 m + the protection distance
 - The protection distance value depends on the max EIRP of the BASE Station (e.g: for a Base Station with the Maximum EIRP of +78dBm, the protection distance value is 910m)
- “*zone de precaution*” (precaution zone) where 5G base stations implementation are coordinated. This area is defined on each side of the “*zones de sécurité*” to protect the landing approach below 1000 ft (305 m), based on the following assumptions:
 - 3° slope with a tolerance of 0.375° (ie 2.625°) and a vertical margin of 80 m, ie, the aircraft will be at 1000 ft from the ground at 8393 m from the touchdown point (8193 from runway edge)
 - Lateral tolerance assumed to be 91 m
 - Base station maximum TRP
 - BS antenna gain: to get EIRP
 - Envelope provided by the operator (if any.)
 - In the absence of the envelope from the operator, the maximum grating lobes is taken as 18 dBi, as per ITU-R draft characteristics for AAS in the band 3-6 GHz, 54° vertical beam width.
 - No safety margin
 - 0 dBi maximum Radio altimeters antenna gain below 3.8 GHz (RTCA Report)
 - -26 dBm interference threshold (RTCA Report Cat.1 @1000 ft), with logarithmic interpolation between 200 ft and 1000 ft

The precaution zone does not apply in the case where calculations based on the antenna gain envelope provided by the operator and worst case location of BS outside the safety zone show that the Radio altimeters remains protected under the above assumptions.

These two zones are described in figure 1 for the following assumptions of 78 dBm EIRP, and in the absence of any antenna gain envelope from the operator.

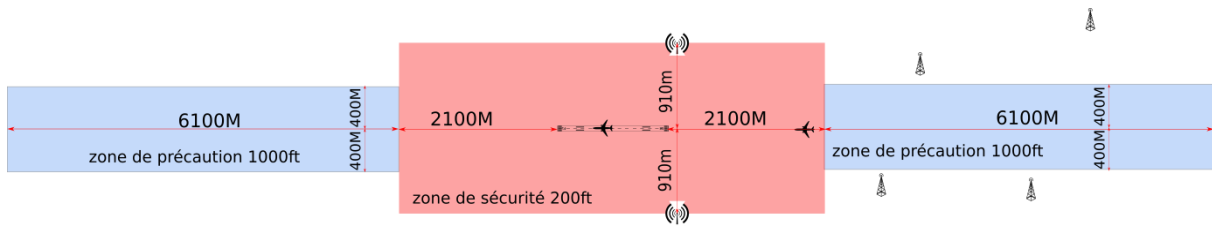


Figure 1: safety zone and precaution zone

Regarding helicopter platforms, a circular safety zone with a radius of 1 km was also applied for some heliports to accommodate states aircraft that are under the responsibility of the “Ministère de l’intérieur” (Department Homeland Security).

2.2.1.3 Categories 2 and 3 Radio altimeters of the SC-239 report

Regarding the most sensitive Categories 2 and 3 Radio altimeters identified in the SC-239 report, it was noted that mitigation techniques would not allowed any deployment of 5G over the national territory. Therefore, DGAC tried to identify different scenario for aircraft equipped with this type of equipment.

Different scenario, like those with helicopters flight of MEDEVAC at low altitude during the night were identified by DGAC. The only mitigation techniques being currently implemented is the limit of antenna tilt above the horizon over the national territory.

Category II Radio altimeters, identified in the SC-239 report, are installed on some regional and business jet aircraft models. Among these populations, DGAC identified those using the radio altimeters with the poorest selectivity. This corresponds to approximately hundred aircraft registered in France (F-XXXX) with some of them equipped with two radio altimeters. This information has been shared with EASA. DGAC can only note with regret the long time spent in order to identify these radio altimeters models in France, while some industrial knew already the issue through the RTCA process.

DGAC would like to use this opportunity to thank Japan for their work and the valuable information shared together during this period.

2.2.1.4 Impact of these immediate measures

At the end of the phase 1 step 1, under these immediate measures, about 98% of 3.6 GHz 5G stations declared by the operators were accepted. Some work is ongoing with each operator to take into account an adaptive envelope that they declared in order to accept more stations in the precautionary zones.

2.2.2 Phase 2 Step 1 (February 2021)

The 5G represents very important economic, industrial and political stakes for France. Considering both the lack of evidence of actual impact on safety (waiting for airworthiness authority evaluation) and the fact that France is the only European country who has taken action to protect radio altimeters; the French government took the decision beginning of February to release the restrictions around Airports.

It was decided to limit applications of mitigation techniques (list of measures in §2.2.1.1) only to airport with runway CAT II or/and CAT III, also to heliports previously identified. On demand of the “ministère de l’intérieur”, the negative tilt remains applicable to all base stations until practical tests show there is no risk for them.

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The Radio altimeter blocking issue was brought to the attention of CEPT PT18 by our national regulator (France ANFR). This led to a new work item, supported by 5 other administrations, which will be introduced to the next ECC meeting. Despite the matter of urgency, some administrations did oppose to start a dedicated correspondence group as soon as possible and expressed their opposition for some preventive regulatory actions before receiving more detailed on the situation including radio altimeters characteristics.

The massive deployment of high power base station around the frequency band 4.2-4.4 GHz is likely to be an issue for radio altimeters worldwide therefore DGAC established an OPS directive⁹ or safety information for the attention of French companies flying abroad.

EASA, Eurocontrol and DGAC will collaborate together on this topic. A virtual workshop "5G – Potential interference on Low Range Radio Altimeters" was organized on February 25th. 2021.

2.2.3 Phase 2 On going: additional studies at National and European level

- DGAC plan to attend PT1 and EASA Workshop.
- Enabling a better assessment of the criticality of the risk for which it would be necessary to have both additional data from 5G operators and equipment manufacturers.
- In collaboration with the ANFR, Airbus, mobile operators and DGAC, flight tests are under study to measure and record the 5G signal received at aircraft level.
- EASA involvement is expected in this phase since the idea is to complete a European validation of the RTCA study.

3. CONCLUSION

This radio altimeter vs 5G issue represents very important economic and political stakes for the aeronautical community.

France and in particular DGAC is very isolated in Europe. Although DGAC has received a lot of support from the aeronautical world, there is no much involvement of other European CAAs. But it is obvious that this issue must be raised first in countries where there are aircraft and Radio altimeters manufacturers (US and France). The Japanese mitigations have shown that France is not alone in the world, but this situation will not be sustainable without active support from European countries.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matter as appropriate

⁸ ECC Project Team 1 (ECC PT1) is responsible for mobile (IMT) issues

⁹ https://www.ecologie.gouv.fr/sites/default/files/info_securite_2021_01_IS_Brouillage_5G.pdf