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■ White Paper

Spectrum clearance in the Civil Aviation bands

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Advanced Radiocommunications

Introduction

The lack of spectrum resources is self-evident – as is the government-imposed duty placed on every relevant public body to examine the assets it holds and identify ones that have the potential to be liberated.

The problem is that public bodies hold spectrum for good reasons, and those reasons range from matters of national security to the safety of individual passengers on everything from planes to buses. The key to completing the political mandate of identifying which frequencies can be divested is to ascertain whether the rest of spectrum held by the organisation can be made to carry out the organisation’s task.

ATDI has built up a bank of expertise in working with all manner of public bodies to make this identification and to verify the spectrum being retained is fit for purpose and will not be affected by interference from new users of the released frequencies.

Overview

The Civil Aviation Authority (CAA) in the UK undertook a comprehensive review of the frequencies it uses for radar and looked at whether any could be released without aircraft safety being compromised. Specifically, CAA was tasked with identifying if 100MHz of spectrum could be released from the S-Band radar frequency allocation by the 2020 deadline set by the UK regulator Ofcom.

Background

The CAA divided the task into three key areas which it designated as: squash, shift, share. Squash is the possibility to improve the efficiency in the use of spectrum. Shift is the possibility of using alternative bands for radar. Share is the option to share the radar band with other users.

CAA portrays its feasibility study as an investigation into the possible. The organisation sought to understand what adjustments could be made and the potential for interference in each scenario. CAA believes that modelling coexistence in this manner bridges the gap between the technical radar performance and the impact on the end user.

CAA has been using ATDI planning and modelling tools, notably ICS telecom, in this process, and has been relying on expertise from ATDI experts to help it complete its analyses.

Scope and objectives

The objectives of the first phase of the project was to develop and document a methodology that would allow the CAA to undertake interference calculations between the radars and also do spectrum assignment for the radars.

Method

The methodology developed should be flexible enough to allow CAA to investigate the effects of various parameters on the interference / assignment calculations.

- Determine today's interference state by modelling. That will establish the interference state currently experienced by users of the band (whether or not they actually consider they are aware of it);
- Provide a benchmark for the subsequent work so that the interference state can be compared when future demand is included and when potential re-planning scenarios are developed and tested;
- Develop some spectrum assignment rules and re-assign the radars with a given amount of spectrum;
- With reference to the benchmark, determine what the degradation of the radars is versus the amount of spectrum available.

The study examined the S-Band spectrum from 2700 – 3100MHz. The figure below displays the spectrum of interest and the services that the band is allocated to. This information is taken from the UK Frequency Allocation Table.

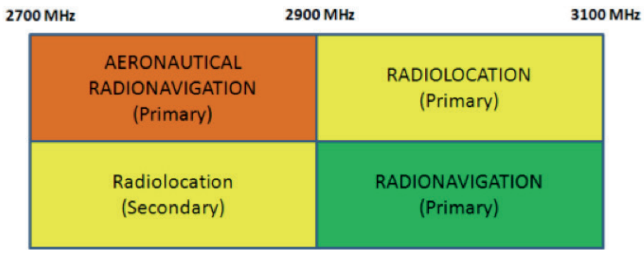

Figure. 1 Illustrates the S-Band spectrum being considered from 2700MHz to 3100MHz

The primary services are in upper case and secondary services in mixed upper and lower case.

In the UK, frequency assignment within the S-Band domain is co-ordinated by CAA, MOD and MCA. The main stakeholders are the MOD, MCA and Air Navigation Service Providers (ANSPs) at Civil Aerodromes.

The principal users of this band can be divided into the following applications:

- Air traffic control (ATC) radars using the entire frequency range;
- Civil marine radars using the upper half of the frequency range (2900 to 3100 MHz); this is both land based port radars as well as ship borne radar systems (these will not be considered in this work).
- Military radars using the entire range (military radars include Air Defence, ATC and Naval).

Results

The study remains a work in progress. What has been established so far is the need to finish defining rules for planning to confirm parameters and determine when interference becomes unacceptable.

The real effect will lie between the red and green lines, since the degradation of the noise floor is dependent on the interfering radars' rotational position in respect to the victim radar.

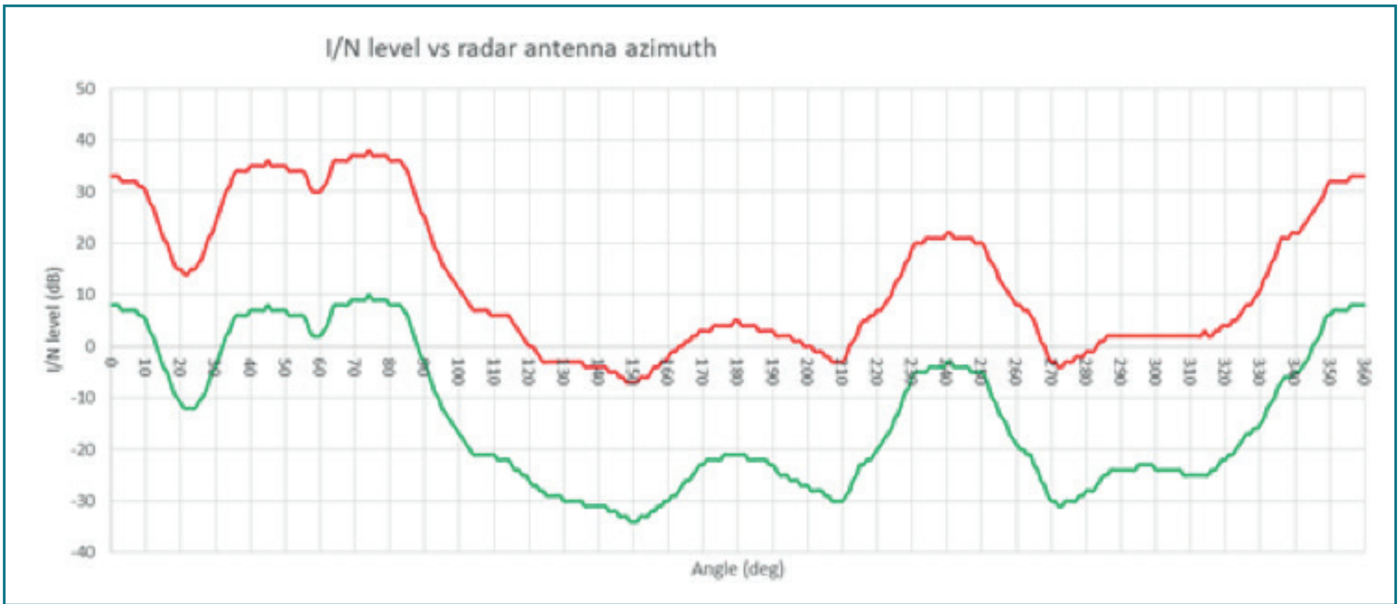

Figure. 2 Typical results showing the I/N level at the radar receiver as the radar rotates through 360°

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This information can then be used to determine the effect on the radars service area.

This plot shows the cumulative effect of both terrain and interference on the radar with the circle illustrating the radar published range. Similar to the graph on page 2, a best and worst case scenario can be calculated depending on the interfering radars (black diamonds) rotational positions.

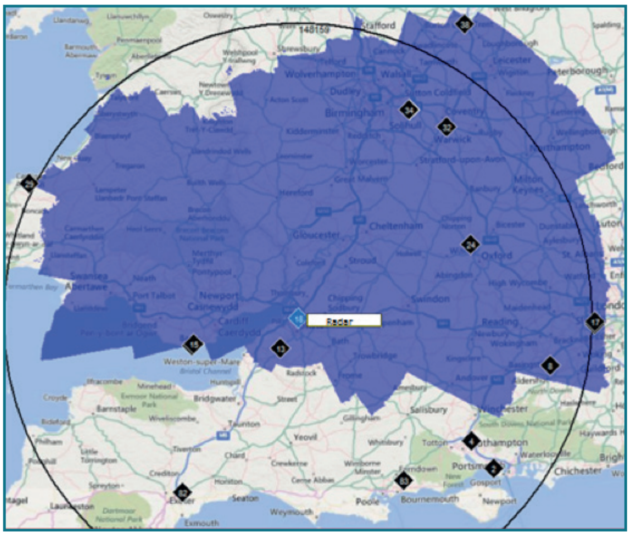

Figure. 3 Effect of terrain and interference on the radar

Conclusion

ATDI supported CAA as it undertook a comprehensive review of the frequencies it assigns to radar in the S-band. The review was to establish whether enhanced frequency planning method could result in spectrum being released. ATDI provided tools and methodology to model existing radar configurations and demonstrated the tools' ability to optimise frequency assignment. The evidence produced by the review was a key component in formulating CAA's recommendations for the potential release of spectrum.

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