Freedom4 response to the Ofcom Consultation:

"*Digital Dividend: Geolocation for Cognitive Access*".

Freedom4 is a UK based mobile and fixed broadband wireless operator with considerable experience in the regulatory, technical and operational aspects of deploying wireless broadband services in the UK market. Freedom4 welcomes the opportunity to respond to the Ofcom Consultation.

The discussion document put forward by Ofcom addresses the specific case of using Geolocation techniques facilitating use of the interleaved spectrum released by the Digital Switchover programme for efficient use by Cognitive Access devices. There is a danger that in addressing this specific case principles may gain credibility that would not be appropriate for the more general case of coexistence of spectrum users. The responses below address the more general case, highlighting the significant issues that are raised by Geolocation techniques. While we recognise that some of these issues may not apply to the same extent in the specific case being addressed by this consultation, Freedom4 believes that, as this is the first time this subject area has been discussed in this way, it is important to include consideration of the more general case to ensure a wide understanding of any generally applicable principles rather than just those applicable to the Digital Dividend spectrum.

The specific case considers an environment where there are relatively few, widely spread, high power broadcast transmitters, each serving an extensively modelled coverage area, providing a unidirectional service to users employing a generally fixed, generally high gain antenna which has conventionally been selected and oriented during installation to give an acceptable performance. The service does not attempt to give coverage at every location within an area, and users are accustomed to moving portable devices as needed to find a location where they can immediately see the service is acceptable. In this environment it may be possible to predict propagation to a level or accuracy to ensure the intended service is not unacceptably degraded by the presence of other transmitters but geolocation accuracy is still an issue. Freedom4 supports attempts to get maximum efficiency from available spectrum and will maintain an interest in this and future work on cognitive access.

In the more general case the communication is bidirectional. The terminals are more portable, with smaller, lower gain antenna. The users are less likely to be able to immediately assess service performance, and are less likely to accept relocation of the terminal unit to improve service. The increasing expectation to use mobile devices inside buildings adds huge complexity to predicting signal levels, both for the intended signal and for interfering signals, particularly for uplink (the terminal to "base station" link) where power budgets are far tighter. In such an environment consideration would have to be given to every transmitter and every receiver in a potentially highly dynamic environment, with fast moving user terminals in cars and on trains.

Freedom4 believes that a number of serious issues are raised by the general situation, particularly;

- the difficulty in establishing with acceptable accuracy and resolution the location of the transmitting (interfering) antenna, especially from non-GPS data sources;
- the impracticality of establishing the location of a potentially large number of user terminal receivers for the primary service;
- predicting the intended and interfering propagation characteristics particularly within buildings;
- the potentially large number of transmitters and receivers in a relevant area; and
- the speed at which propagation conditions would change as terminals move.

These issues could only be solved by building large confidence margins into any propagation models. These margins would be so large as to nullify, or worse, any gains in levels of spectrum use that may have been expected from applying geolocation techniques. The approach would place a significant cost on any services using this approach to the detriment of the market.

Aside from the technical issues raised, the effect on the Spectrum Rights enjoyed by authorised users needs to be considered. In the environment considered it would appear that usage rights change from an absolute right to use, subject to the usual constraints, coupled with an expectation of a known radio environment, to a preferential right to use with a less predictable radio environment. The rights of the spectrum sharers with respect to each other would also need clarification.

Freedom4 therefore urges caution with this and future geolocation studies for cognitive access, responses to specific questions posed in the discussion paper are detailed below:

Q1: Should we suggest only high level parameters, leaving further work to industry, or should we seek to set out full details of parameters to be exchanged?

The parameters to be specified would depend on the nature of the service that may suffer interference, which in a technology neutral regulation environment may change over time. The regulator should take responsibility for these specifications.

Q2: Should both closed and open approaches be allowed? Should there be any additional requirements on the providers of closed databases?

The approach taken would have to be acceptable to the holder(s) of the spectrum usage rights for the particular spectrum/geography.

Q3: What information should be provided to the database? Are our assumptions about fields and default values appropriate?

Freedom4 makes no comment on this question.

Q4: Should the translation from transmitter location to frequency availability be performed in the database or in the device?

In Freedom4's view, this performance challenge is simply not consistent with low cost devices.

Q5: Have we outlined an appropriate information set for the database to provide to the device? Can industry be expected to develop the detailed protocols?

Freedom4 makes no comment on this question.

Q6: Is a two-hourly update frequency an appropriate balance between the needs of licence holders and of cognitive device users?

The impact on propagation conditions by even small changes in location, and by terminal mobility strongly suggests that update frequency needs to take into account not just time intervals but also movement of the devices. Account needs to be taken of an environment where spectrum is used dynamically in response to traffic demand. This would have the effect of requiring 100% avoidance if transmissions are detected.

Q7: Is there benefit to devices receiving a time validity along with any database request and to act accordingly?

Freedom4 makes no comment on this question.

Q8: What role could push technology play?

Freedom4 makes no comment on this question.

Q9: Do you have any comments on the suggested approach to implementing the database for DTT?

Freedom4 makes no comment on this question.

Q10: Do you have any comments on the suggested approach to implementing the database for PMSE?

Freedom4 makes no comment on this question.

Q11: Do you believe it is practical to implement such a database?

In the general case we do not believe this approach is practical. In the specific case the database would need to take into account the presence and location of both transmitters and receivers for other users of the spectrum as they appear. Depending on the number of transactions this may make the approach impractical.

Q12: Is it appropriate for third parties to host the database? If so should there be any constraints? If not, who should host the database instead?

The holder of the database, and the service levels assured, would need to be acceptable to the holder of the spectrum usage rights.

Q13: How can any costs best be met?

All costs, including those of the holder of the spectrum usage rights would need to be met by the sharers of the spectrum.

Q14: What are the difficulties and expected costs to licence holders in providing the necessary information to the database? Could this information be provided in any other way?

Freedom4 makes no comment on this question.