

Organisation (if applicable):

ARM Holdings

What additional details do you want to keep confidential?:

No

If you want part of your response kept confidential, which parts?:

Ofcom may publish a response summary:

Yes

I confirm that I have read the declaration:

Yes

Additional comments:

Question 1:How is demand for indoor wireless data connection speeds and capacity likely to develop over the next 5?10 years?:

Demand for access to broadband will grow. Demand will be split into two groups - user generated/demanded content that will continue to drive faster speeds for large data transfer and a large group of small data devices like sensors and switches (the 'Internet of Things'). This will mean that there will be a minimum of two separate wireless networks (e.g wifi and 6LoWPAN)that have to exist together and not interfere. The challenge will be having enough space in the 2.4GHz space as most 802.15.4 radios use the same spectrum as Wifi

Question 2:How is demand for indoor wireless data connection speeds and capacity likely to develop over the next 5?10 years?:

Yes. Expanding the use of 5GHz and moving more of the high data rate content to that spectrum will free up 2.4GHz for low power radio use like Bluetooth LE and Zigbee.

Question 3:Are there other types of indoor wireless applications will require access to alternative spectrum other than that provided by the licence exempt 2.4 and 5 GHz bands used by Wi-Fi?:

Allocating a slice of spectrum in the sub-1GHz spectrum for generic low power radio applications would be great - rather than pieces of spectrum being allocated to a specific application. In due course, Li Fi (using light to deliver radio signals) might revolutionise our approach to connectivity in certain situations.

Question 4:What role do you think Wi-Fi will play in providing wireless broadband connectivity outdoors over the coming 5-10 years?:

There is huge potential. The key is to develop ways of delivering wifi economically to the street. One option might be power lines communications. Another could be to use streetlights: as streetlights are modernised it could be easy to use them to build the necessary infrastructure for power and antenna height. This would enable wifi to cover a significant amount of outdoor space. There are already projects in the UK demonstrating that installation of smarter street lighting can save c 40% on running costs: this money could be used to put in place the wifi infrastructure.

Question 5: Will the increased deployment of Wi-Fi access points outdoors create a risk of reduced quality of service performance over the longer term and, if so, will approaches to co-ordinate access point performance be able to mitigate this risk?:

A framework which limits the number of outdoor wifi providers in any one location will enable us to preserve a performance level by reducing conflicting channels. APs that can switch channel based on local needs will also be needed. Some devices are already able to operate on wifi and cellular concurrently.

Question 6: Will improved approaches to accessing spectrum in licence exempt bands be needed in the longer term to maintain the quality of service achievable for outdoor public mobile broadband and/or M2M services? If so, which approaches are most likely to be adopted and how likely do you think they are to be successful in improving access to spectrum?:

Quality of service could become an issue if user experience degrades as a result of airwaves congestion. It may be that licensed and unlicensed approaches could complement each other. We will need to monitor developments to check that unlicensed access does not significantly work against optimal spectrum efficiency. Providing access to more spectrum under a "Dynamic Spectrum Access" model should be increased and accelerated. This is not limited to TV whitespace but should include whitespace and any slices of spectrum that are significantly under utilised.

Question 7: Which frequency bands are most likely to be best suited to providing geographical shared access, including via a geolocation database approach, for use by mobile broadband, for example small cells and M2M applications?:

Access to sub-1GHz spectrum for long range low power radio connections for M2M will be critical for the realisation of the Internet of Things outdoor and across large land masses.

Question 8: Would access to these bands best be realised through licensing or licence exemption?:

License exempt with Dynamic Spectrum Access (DSA). Look at the impact of 2.4GHz exemption.

Question 9: Do you believe that tiered shared access to a range of spectrum bands has a role in meeting demand for mobile and wireless data and, if so,

which applications and devices do you think will be particularly suited to this access model?:

Yes. Non-real time sensor and switching applications can be served by DSA. Time critical and/or life/property threatening applications will likely need private access

Question 10:Do you believe DSA could play an important future role in the future in enabling a better quality of service and low barriers to spectrum access alongside conventional licensed and LE spectrum approaches?:

Yes - a lot of spectrum is VERY underutilised and even unused and DSA could open up a lot of spectrum for other uses

Question 11:What barriers still remain to the realisation of cost-effective sensing appropriate for low-cost consumer devices and what activities are ongoing to try to address them?:

Question 12:Over what timescales could DSA become a mass market proposition?:

The technology is here today. It needs a brave regulator to bring it to reality.

Question 13:What role should Ofcom play, if any, to support the development of DSA and relevant technologies?:

Question 14:Do you have any other views on any of the issues discussed in this consultation?:

Question 15:What are the frequency bands that would be of most value for R&D purposes?:

Question 16:What are the potential benefits of using a geolocation database approach for short-term access to spectrum for R&D and how would you see this working from a practical perspective? Are there alternative approaches that could deliver similar benefits?:

Question 17:What characteristics do you view as important to researchers in arrangements to facilitate temporary access to spectrum for research and development purposes?: