DSA Response to Ofcom Consultation on Spectrum Sharing

General Response

The Dynamic Spectrum Alliance welcomes the opportunity to respond to Ofcom's consultation on a framework for spectrum sharing.[1] DSA supports Ofcom's work in improving the efficiency of spectrum use through sharing. Effective sharing enables more intensive of use of spectrum while protecting existing users from harmful interference. As such, spectrum sharing has several benefits:

- First, sharing has the ability to increase capacity because it makes fallow spectrum available without displacing incumbent users. Ofcom will need to consider methods beyond the traditional model of dedicating spectrum to individual uses if rapidly rising demand is to be met. Spectrum sharing will be an important way to unlock maximum value from wireless applications.
- Second, because using shared spectrum need not require significant up-front investments on the part of network operators, it should serve as a flexible way to increase capacity, reducing artificial scarcity.
- Third, spectrum sharing can create increased coverage for wireless devices. For example, spectrum under 1 GHz has favorable propagation characteristics, allowing signals to penetrate buildings and irregular terrain. Sharing in these bands has the potential to increase the reach of wireless broadband, especially in rural and hard-to-reach areas.
- Fourth, sharing can be accomplished quickly. It offers a much faster route to increased capacity than is possible with traditional clearing or re-farming approaches. And in some cases, database-based sharing technologies will be able to use newly available spectrum without requiring a change in hardware, further speeding improved spectrum utilization. More intensive dynamic spectrum sharing should be a key regulatory objective, enabling regulators to accommodate varying demands of different uses. Over time, sharing, rather than static, exclusive allocations, should become Ofcom's default policy for spectrum management.

 General Responses to Specific Questions

Question 1: Do you have any comments on the barriers to increased sharing that we have identified above? Which are the most significant and why? Are there others we should take into account?

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[1] Ofcom, *A Framework for Spectrum Sharing*, at 1 (July 31, 2015) (Consultation), *available at* http://stakeholders.ofcom.org.uk/binaries/consultations/spectrum-sharing-framework/summary/spectrum-sharing-framework.pdf.

Ofcom's approach highlights a number of key barriers to spectrum sharing. The significance of these barriers is context dependent.

In general, while market mechanisms can develop the technology to improve sharing, regulators have an important role to play in facilitating the development of sharing regimes. For example, it has been proposed that parts of the 5 GHz band currently used for radars and earth exploration satellites be opened up for unlicensed sharing with Wi-Fi devices and applications. Ofcom is well-positioned to bring together government, industry, and international stakeholders to develop sharing mechanisms for this band. In particular, Ofcom can facilitate dialogue regarding (1) minimizing interference risks associated with coexistence and (2) aligning incentives among existing and new users to encourage both groups to participate actively in developing specific spectrum sharing frameworks.

Additional barriers include regulatory delay. For example, Ofcom commenced work on enabling access to television white spaces in 2008 but did not release an implementation framework until 2015. Investors are reluctant to invest in new technologies when the regulator's commitment to enabling innovation is unduly hesitant. We encourage Ofcom to build on the flexibility afforded by the new dynamic spectrum access framework, created for TVWS, to accelerate the process of defining spectrum sharing regimes in other bands in a way which allows consumers to enjoy the benefits of innovation earlier, without compromising existing services.

We applaud Ofcom for its efforts to adhere to its end of year target for completing the TVWS framework. At the same time, we urge it to build on this investment by applying dynamic spectrum access to other bands and enabling multi-tiered sharing, where needed. We see the 5 GHz band as a priority in this respect. In this way, Ofcom would continue to be a leader in encouraging innovation and enabling greater economic and social benefits to flow from this amazing resource.

Question 2: Have you experienced or are you experiencing the effects of these barriers? If so, in what circumstances and with what impact?

Yes. Limits on license-exempt access to the 5 GHz band are curbing the broadband access performance that at least one DSA member can deliver to its consumer and business customers. Expanding access to this spectrum would improve broadband access performance in homes and enterprises and would ease congestion at public Wi-Fi hot spots.

Question 3: Are the categories of information set out in paragraph 5.5 the right ones? Are there any areas here that you think we should prioritise? Are there other types of information that we should be improving?

Yes. Going forward, Ofcom should require government users and licensees to provide information regarding use of their spectrum, and Ofcom should consider amending the terms in

existing licenses so as to require spectrum licensees to provide usage information. Understanding actual usage is essential in designing effective spectrum sharing frameworks.

Question 4: **Do you think the information about spectrum characteristics described in paragraph 5.9 would be useful? What information would need to be included as a minimum to make it useful?**

Collecting the information Ofcom describes will be useful. Clear and easily accessible information regarding the characteristics of individual spectrum bands—including harmonization, constraints imposed by incumbent use, interference environment, and propagation characteristics—would provide industry with useful data points in evaluating spectrum opportunities.

Question 5: **Have we identified the relevant market enablers, or are there others we should take into account? For each one, what is the potential for it to facilitate sharing and what are the downsides? Are there any that you think would be particularly effective or problematic?**

Ofcom has identified a number of critical enablers of spectrum sharing. Ofcom should take advantage of these strategies now, or as soon as legislation allows. Below, DSA offers specific suggestions regarding several of the approaches identified by Ofcom:

- Spectrum trading and leasing: Trading and leasing in spectrum won through auction processes should be allowed by default, subject to competition concerns.
- Spectrum pricing: Spectrum pricing may be appropriate where necessary to recover Ofcom's costs. However, where there is little administrative overhead and multiple users can effectively share access to the same spectrum, fee-based approaches should be disfavored for reasons similar to those supporting allocations for license-exempt use, as discussed below.
- Auctions: DSA encourages Ofcom to develop its policy on sharing for spectrum licensed by auction as flexibly as possible to allow a range of sharing scenarios.

In addition to the market enablers identified in the Consultation, Ofcom should consider adopting sharing regimes that allow license-exempt or other opportunistic uses. Licensed and license-exempt spectrum meet different, complementary needs in the wireless ecosystem. Access to licensed spectrum provides the certainty to make large investments in wide-area networks. At the same time, access to license-exempt spectrum fosters diverse contributions to innovation and fast-paced investment in emerging technologies because manufacturers can develop equipment quickly, avoiding the delays and cost associated with the licensing process. Spectrum sharing regimes should accommodate both types of sharing.

Question 6: Have we identified the relevant technology enablers, or are there others we should take into account? For each one, what is the potential for it to facilitate sharing and what are the downsides? Are there any that you think would be particularly effective or problematic? What, if any, role should Ofcom play in helping to develop them?

Ofcom has identified a critical set of technological spectrum sharing enablers. DSA discusses a number of these technologies in greater detail below.

- Protocols: Detect and avoid protocols are an established and successful means of sharing the use of spectrum between users in the same priority tier. However, when used as a means of protecting incumbent users, they have the potential to introduce significant inefficiency (e.g., false detections of higher tier activities) and additional costs. Therefore, such methods should be carefully evaluated to determine whether they provide the most effective means to share spectrum, taking into consideration both how much spectrum they make available and under what conditions, as well how expensive they are to implement.

- Geolocation database technologies: Using records of licensed and actual spectrum use, which could be temporal as well as spatial, is likely to be the most efficient means of providing for efficient sharing subject to the co-existence framework being realistic. Ofcom should expand the use of the technology to other bands beyond UHF, to build on the encouraging TVWS use case for managing spectrum use from a database using geo-location and time dimensions. For example, in the United States, the FCC has established a sharing regime in the 3.5 GHz bands that builds on existing database-based spectrum sharing frameworks and allows three tiers of users to share 150 MHz of spectrum in the 3.5 GHz band.

- Sensing: Using sensing in conjunction with geolocation database technologies could lead to significant efficiency improvements while providing protection from interference. One possible approach for active primary systems would be to use sensors to detect spectrum use in specific locations and to communicate the availability through the network. For passive primary systems, spectrum management systems could be enabled to communicate to the sensor equipment in real time, to ensure that spectrum is vacated whenever there is a risk of interference.

- Automatic reporting of interference: Automatic reporting of interference holds great promise in improving efficiency between spectrum users at the same level and helping to reduce the level of over-protection afforded to incumbent users by conservative co-existence frameworks.

- Frequency and band agile equipment: As Ofcom states, implementing frequency-agile technology adds cost but it can also make equipment more valuable and extend its life. To maximize this potential benefit and thereby justify investment in frequency-agile technology, Ofcom should provide as much insight as possible on future spectrum allocations so that industry can plan the development of services/devices which maximize consumer value from spectrum and protect consumer investment by avoiding premature obsolescence.

Question 7: Do you have any comments on the authorization tools that we have identified above? Are there others we should take into account? For each one, what is the potential for it to facilitate sharing and what are the downsides? Are there any that you think would be particularly effective or problematic?

The various tiered access approaches documented by Ofcom seem likely to lead to more efficient use of spectrum. However, a number of factors will affect the overall success of two-tier or more sophisticated spectrum sharing regimes:

- Coexistence parameters for each tier should be based on real-world information regarding use and protection requirements, not cascading worst-case scenarios.
- Sharing should be as simple as possible.
- Multi-tier approaches can be improved with additional transparency. For example, in the broadcast bands, DTT is assigned tier 1, PMSE tier 2 and TVWS devices tier 3. If PMSE devices continued to have priority over TVWS devices but were required to register their operations as TVWS devices do, additional insight regarding PMSE operations could improve transparency and efficiency of spectrum use.
- Ofcom should consider three-tiered sharing wherever a secondary licensed tier may be created. The technologies used to protect incumbent users from secondary licensed users may be equally effective in protecting secondary licensed users from opportunistic users. And in order to maximize use of finite spectrum resources, vacant spectrum should be opened to license-exempt users in areas and at times where it is not being used either by incumbents or secondary licensees. This 'use it or share it' requirement should be made explicit in license conditions.

Question 8: Are the characteristics of use we have identified sensible and sufficient to provide a high level indication of sharing potential? Are there other factors that we should expect to take into account? Are there any factors that you consider to be particularly significant? Are there any which we should attach less weight to?

The characteristics of use are sensible. For license-exempt spectrum use, true figures may be difficult to find for some applications; if this proves to be the case, Ofcom should obtain realistic estimates rather than worst-case assumptions when making policy decisions.

Respectfully submitted,

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