BT's response to Ofcom's

"A framework for spectrum sharing"

(Issued by Ofcom on 31 July 2015)

Introduction

BT agrees that a more formal framework for Ofcom to address spectrum sharing is helpful. There are many examples of successful spectrum sharing that have occurred for decades, such as: satellite Earth stations and fixed links; TV broadcasting and wireless microphones; and Wi-Fi applications.

Shared spectrum access is appropriate in some instances, especially where exclusive licensed access is not possible nor necessary. A more formal framework could be helpful in building further on the very successful spectrum sharing that already occurs today and we are grateful for the opportunity to contribute to the thinking on how this framework should be shaped.

We view frequency sharing as a complement to exclusive licence access rather than a priority or an alternative to the exclusive national licensing arrangements that are needed for certain applications.

Recent practical examples of proposed spectrum sharing, such as Ofcom's TV White Spaces initiative and their support for investigation of possible expansion of the 5GHz RLAN spectrum, demonstrate just how difficult and time consuming it can be to achieve successful frequency sharing arrangements. We therefore support the need to develop a more formal framework for developing frequency sharing arrangements to ensure that the best possible outcomes can be achieved and that efforts are prioritized on initiatives that may be most likely to succeed and deliver greatest value.

Our responses to the consultation questions are provided below.

Responses to 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?

Ofcom have identified a valid set of barriers to establishing spectrum sharing.

We would agree that often it will be a commercial decision whether or not to share a band. However there are also valid strategic factors, such as the preference (in the case of a block assignment) to hold some channels available for expedient use, and also retaining the ability to reorganise the channels used within a network, without the complication of requiring a sharing party. Therefore spectrum sharing should be treated as voluntary (on the part of the incumbent) rather than compulsory for block assignments, although Ofcom should encourage incumbent users in certain cases to share, particularly where there is under-occupied spectrum assigned to Government or public bodies.

Availability of information could be a barrier to sharing given that in general only the basic information on spectrum use is publically available, but then that could be easily addressed if the incumbent wants to make the information available. So in the event that an incumbent decides that they would like to make their block assignment available for spectrum sharing (i.e. there is a commercial opportunity to allow another user to share the band), they should be able to make the relevant information publically available. (This is analogous to a landlord making available details of properties that are available to rent.)

Market barriers might be seen as particularly significant, particularly where there is little or no experience of spectrum sharing, given that considerably more effort will be required for the initial examples.

Technological challenges will certainly exist; in some cases it may be preferable for another user to share the band using the same technology because it will be easier to co-exist (e.g. another mobile network), while it other cases it may be preferred to allow a completely different application and technology in order to "fill the gaps" in the incumbent use.

Another challenge relates to unwanted emissions; the immunity to / production of unwanted emissions should be similar among the sharing parties, to avoid as far as possible the need to retro-modify transmitters or receivers belonging to the existing users of spectrum.

Authorisation constraints certainly need to be considered, as an incumbent will typically have a licence for a particular purpose. If they have identified that another application / service could share the band, then it may be necessary for the incumbent's licence to be amended to allow the sharing, albeit on a limited basis.

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

One of the anticipated spectrum sharing opportunities that has been much discussed but appears to have not yet significantly progressed has been the potential for the release of Government spectrum for shared use. This is an example of where more information about potential supply would be helpful (as well as a need to ensure that demand is also understood). The release of Government spectrum, in compliance with the EU regulatory framework, could be relevant to Ofcom's proposed framework for spectrum sharing.

BT has supported the principle of dynamic spectrum access and has been involved in the TVWS programme of Ofcom. That activity has taken much longer than we believe all parties would have envisaged at the outset and may provide useful learning about the various technical, legal/regulatory and information barriers that can arise when ambitious and transformational initiatives around spectrum sharing are embarked upon.

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?

Information about actual use (rather than licence ownership) may be commercially sensitive and not something that would be readily shared publically. It may be possible to provide such information to an independent third party, for interrogation in a limited manner, such as is proposed for the TVWS database. However as noted above, it should be possible to make available details of what is <u>available</u> (rather than what is <u>used</u>), in terms of frequency/geography/times that spectrum would be available to another user.

To further facilitate increased used of spectrum, Ofcom should consider giving online access to their frequency coordination tools (e.g. those used for fixed microwave links, satellite Earth station and business radio planning), in order to allow users to undertake sample (indicative) coordination requests. This would allow applicants to gain a better understanding of where (both in frequency

and geography) there may be the opportunity to successfully operate new links, sharing with existing use in the band.

Provision of *information on actual interference* would seem to be a worthy objective, however, we need to be aware this may be of limited value. In many cases it may not be possible to identify that interference has occurred, or that the source of a degradation of a radio link has been attributable to another radio link which is sharing the band. Consequently the absence of an interference report does not mean that interference has not occurred. (See also our response to Question 6 below.)

Spectrum demand is often difficult to quantify, other than in general terms (as a trend). In the case of a new network, there will be a trade-off between the amount of spectrum and the network capability, and hence demand could be quantified as the essential minimum to provide a service, the desired amount to deploy a full network, or somewhere in between.

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?

Depending on the circumstances of the particular band, some of those characteristics could be useful.

Application – in some cases a licence holder may prefer to share the band with another user deploying the same application (e.g. another mobile network), as they will have better understanding of the potential for interference and/or sharing. In other cases, it may be preferred to permit sharing by different application (such as the operation of wireless microphones in the TV broadcast band) because of their different characteristics, which would be able to operate "in the gaps".

International harmonisation – clearly any international harmonisation that exists for the band would be relevant, although this may not necessarily preclude use of the band for other purposes.

Constraints on geographical and population coverage – this would clearly be beneficial for those cases where a band is being shared because it is "under-used" in certain areas. Such information would clearly help to identify and match a sharing opportunity.

Interference environment – this is important so that the quality of the available spectrum and the reliability of the proposed new application can be properly assessed.

Propagation indicator – this is suggested as a proxy for the extent of infrastructure, which implies that it is an indicator for range. However, range would be dependent on the transmitter power and receiver sensitivity of the new application, and a qualitative term for the propagation is unlikely to provide a meaningful indication of the system range.

Many of these characteristics should already be available to radio spectrum / regulatory managers, and therefore the information that really needs to be provided is the information relating to constraints due to the existing network operations (e.g. geographical constraints), and any specific preferences from the existing licence holder (e.g. prefer another similar application, or prefer a different application to share).

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?

The market enablers listed appear to cover all possible opportunities.

Spectrum trading and leasing is possible under current rules and could enable spectrum sharing agreements to be effected, but to our understanding few if any of the reported trades relate to spectrum sharing.

Spectrum pricing is (as noted) a recognised form of market based mechanism, although it is questionable whether it is relevant for spectrum sharing. It is possible that licences could be offered on a shared basis, in which case the AIP could be divided between the sharing licence holders. However, it is more likely that the licence will be issued to a primary licence holder who will pay the AIP, and then that licence holder will offer partial trades to others who wish to share the licence, thereby benefitting from revenue that could help offset the cost to the primary licence holder of the AIP, or reduced AIP if the other sharers pay AIP separately.

Auctions could take into account the opportunity for sharing, and one suggestion given is the creation of specific licences for sharers. However, we note that this was tried in the 4G licence auction of 2013 when low power licences were available on a shared basis, however, the manner in which that was implemented did not encourage bidding for those licences.

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?

We consider that there are distinct similarities between the *listen before talk* protocols and *sensing*. In some cases a device simply detects the presence of signal energy to determine whether a channel is sufficiently clean to support a go / no-go decision, whilst in other cases (particularly where there is only one technology using the spectrum) a device will recognise the incumbent user(s) and then try to identify how it can best share the spectrum with those existing user(s).

As noted in the context of sensing, the inherent weakness of such technologies is that they actually detect another transmitter yet it is receivers that potentially suffer the interference. Therefore these technologies really only work well when each receiver can be identified by a co-located transmitter, or some other beacon.

Sensing can also be undertaken in a more detailed and rigorous manner by having a deployed field of sensors.

Since such technologies are typically used by licence exempt devices, these will need to be agreed and implemented through European regulations and standards, rather than at a national level.

Geolocation database technologies should be able to work well, although we believe that this would be best suited to applications when the location and characteristics of the incumbent receivers are well known. The use of a geolocation database by TVWS devices should have been a good example of this. However, the uncertainty about the locations for the receivers (using a given channel), and also the variability in the performance of individual receive stations (antenna location and

orientation, wiring and receiver performance) has introduced too much uncertainty. For applications where there is greater certainty (e.g. military installations, satellite earth stations, etc) then the geolocation database should be a more practical solution.

Automatic reporting of interference would seem to be an ideal solution, providing it can be reliably identified when interference is occurring. A degradation in radio link performance could be interpreted as being due to interference, but this may not necessarily be the case. In the case of a mobile link, any degradation in performance is more likely to be due to a path obstruction problem, or insufficient coverage. For fixed links (both terrestrial and satellite), a degradation in performance is more likely to be due to interference, although there is still a possibility that it has been due to adverse propagation effects.

We would agree that increasing *Frequency and band agile equipment* would enhance the flexibility of spectrum sharing, and should be encouraged, although this could result in increased cost for wideband programmable filtering and higher bandwidth processing.

We believe that Ofcom is best placed to identify applications which are used in only limited geographical areas (e.g. military test ranges, satellite earth stations, radio astronomy sites, etc), and then identify geographical areas where those frequency bands / channels could be used for other purposes.

We note that sharing may be feasible in some cases where the new system is constrained to low density or certain geographical areas, an example being a decision by Ofcom's predecessor where fixed wireless access systems restricted to remote rural areas were considered to be able to share with space science service satellites in the 2025-2110 / 2200-2290MHz bands (in the event authorised new use did not occur as it proved not to be commercially viable).

One very important point that is not prominent in the consultation document is the fact that the framework for frequency sharing should include necessary international action to promote frequency sharing. This could be in the form of agenda items for ITU World Radiocommunication Conferences (such as the present proposals for new spectrum above 6 GHz for IMT and the proposal for possible extension of 5 GHz RLAN spectrum). Other examples could be getting European harmonisation in place to enable spectrum sharing. In the context of 5G, international sharing studies will be important in the run up to the ITU WRC-19 (assuming WRC-15 adopts this as a topic for the next conference). Thus we consider that international influencing should be an important element of the Ofcom framework for spectrum sharing.

Question 7: Do you have any comments on the authorisation 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 notion of *tiered access* is an interesting approach (as described for the TV broadcasting bands), and this is worth developing further.

Whilst we can understand that there may be a desire for some licence exempt applications to take priority over others, this may not be so easy to achieve in practice. This is because licence exempt devices typically operate according to limits set by the manufacturing of the equipment, and these are normally defined by the European standards. Therefore any priority between licence exempt

devices could probably not be implemented only on a national basis, but would need to be written into the European regulations and standards for such devices.

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?

It would appear that the list of high level characteristics given appears to include the key parameters which we believe would need to be determined to identify whether there might be the scope for sharing between an incumbent and a new user.

We suggest that the first two parameters given (*Time* and *Geography/coverage*) would be the most important for opening any discussion on possible band sharing.

The question of *international harmonisation* would then be a factor in determining whether it would be possible to police any band sharing arrangement.

Having then identified whether sharing might be possible in practice, the *High level technical characteristics* and *Density of use* would then need to be considered, to determine whether the two systems would be able to operate as envisaged, without adversely affecting each other.

Finally, the anticipated value/benefit of the new shared use would be a relevant factor to take into account when deciding whether a proposal is likely to be feasible for detailed analysis.

The remaining characteristics would then be used to determine whether any sharing arrangement is likely to remain compatible in the medium / longer term.

END