Issue 1

BT's response to:

"Consultation and information on technical licence conditions for 800 MHz and 2.6 GHz spectrum and related matters"

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Executive Summary

1. BT welcomes this consultation on the technical licence conditions for the proposed combined 800 MHz and 2.6 GHz spectrum award. BT has considered this together with the supporting technical studies by Real Wireless and we are pleased to provide our views and opinions on the outstanding matters that were not included in Ofcom's main consultation on the combined award. This response should be read together with the BT response to that earlier consultation.
2. BT is generally in agreement with the proposed technical licence conditions for the 800 MHz band and for the restricted unpaired 2.6 GHz blocks.
3. BT's preferred solution for the low power shared licences is a bandwidth of 2 x 20 MHz dedicated (and reserved) for this use. The hybrid solution that Ofcom proposes, where 2 x 10 MHz is dedicated to shared low power use and a further 2 x 10 MHz is shared between low power licensees and one standard power licensee, is not the best solution from BT's viewpoint as this reduces (depending on the details) the utility of the low power spectrum, but we concede that this would be better than if just 2 x 10 MHz of spectrum were dedicated to low power use.
4. If the hybrid sharing option is adopted it should not be constructed with the burden of sharing solely placed on the low power systems - complicated, potentially costly and impractical measures should be avoided. The sharing of standard and low power use could be promoted by limiting the EIRP of shared low power systems and relying on techniques such as scheduling within the standard power systems to reduce the potential for interference between the different power uses.
5. BT supports placement of the shared low power use towards the middle of the paired 2.6 GHz spectrum bands. This is the best option if adjacent band services are to be protected in the way Ofcom has assumed.
6. BT proposes that EIRP limits for the shared 2.6 GHz low power use should be set at two different levels, suited to different types of low power applications. This would have the advantage of creating a more predictable interference environment and the ability for bidders to better value the shared spectrum according to its utility, noting that in the consultation Ofcom demonstrates the diminishing resources available as the number of licensees sharing in the same area increases. In this scenario we propose power levels of 10 dBm and 30 dBm for low power base stations. If Ofcom instead proceeds with a single category of low power lot, we agree that an EIRP limit of 30 dBm is appropriate, but we suggest that the 12 m antenna height constraint is unnecessary.
7. BT supports Ofcom's proposals in relation to a Code of Practice on Engineering Coordination for the low power shared use. This is an important and effective means of managing the shared use of the 2.6 GHz low power spectrum. We would also note that wholesale access arrangements would provide an additional and effective means of managing interference issues.
8. BT agrees with Ofcom's proposals for the licence-exemption of terminal stations.

BT's response to "Consultation and information on technical licence conditions for 800 MHz and 2.6 GHz spectrum and related matters"

1 Introduction

BT is pleased to respond to this consultation that is focused on the technical aspects of the proposed 800MHz and 2600 MHz auction. In our response to the main consultation on this 800/2600MHz award[1] submitted on 31 May 2011, we included views on technical matters. This latest response provides additional views in light of Ofcom's further proposals and the availability of new supporting material from Real Wireless.

In section 2 we provide a summary of BT's views in relation to the issues raised within this technical consultation. We also reiterate some of the relevant points made in our previous submission. Finally, in section 3 BT provides answers to the specific questions posed by Ofcom.

2 Overview of BT views on the consultation proposals

BT recognises that the technical licence conditions must largely follow the parameters laid down in the relevant binding EC Decisions. In the case of the standard power licences in the 800 MHz and 2600 MHz bands, we have very few comments to offer in relation to the proposals in this latest consultation paper. Our response is focused on the proposed arrangements for the low power shared 2.6 GHz spectrum, which we continue to believe to be a key component of the auction. It will be important to finalise the arrangements for these licences to ensure that new competition and innovation is promoted and the very significant benefits that will arise for UK consumers through the delivery of services using low power shared spectrum can be realised. In this response we focus on technical issues, noting that commercial aspects including the anticipated consumer benefits of Ofcom's proposals are addressed in other submissions.

In our response to the main consultation paper, whilst supporting the inclusion of the licences for low power shared 2.6 GHz spectrum, BT argued that it would be better to construct the award in a way that would better reflect the differing requirements of low power licensees (i.e. those primarily interested in indoor systems only, where lowest power is needed and sharing is easiest to arrange, and those who may include outdoor small cell networks requiring slightly higher power, where sharing is more difficult as the number of licensees increases). BT proposed a solution whereby two categories of low power licence lots would be provided, with different power levels suited to the different types of small cell use and the consequent advantage of a more predictable interference environment and the ability to better value the shared spectrum according to its utility. Our response to the questions now posed by Ofcom set out the technical conditions that we think are compatible with our preferred solution as well as the solution Ofcom proposes.

[1] "Consultation on assessment of future mobile competition and proposals for the award of 800MHz and 2.6GHz spectrum and related issues", Ofcom, 22 March 2011

We would additionally like to point out that wholesale access is a very effective way of sharing the spectrum, although this has not been mentioned within the consultation. It can significantly reduce potential interference and improve coverage. The wholesale roaming access could be agreed among low power licensees and in the hybrid scenario also between low power and standard power licensees.

Technical licence conditions for the 800 MHz band

Question 1: Do you have any comment on the proposal to apply the limits defined in Case A of Commission Decision 2010/267/EU for out-of-block emissions from base stations into all frequencies in the range 470 to 790 MHz, as set out in Table 4.4?

Individual mobile base station deployments may not be individually frequency coordinated with broadcasting reception on specific TV channels in the nearby area and flexibility may be needed to change the DTT channel assignments in future, therefore we agree that the proposed out of block emission limits set out in Table 4.4 of the consultation document are appropriate in this particular situation of the 800 MHz spectrum licence award.

Question 2: Do you have any comment on the proposal to set an in-block emission limit of 61dBm/(5 MHz) for base stations in the 800 MHz band?

BT has no particular issues with this proposal. We note that it seems consistent with information in Annex 6 on power limits for other mobile bands.

Technical licence conditions for the 2.6 GHz band

Question 3: Do you agree with the proposed conditions on antenna placement that would permit the use of the alternative block-edge mask for restricted unpaired blocks? If not, please explain your reasoning and your alternative proposals, bearing in mind the need to remain consistent with the framework provided in Commission Decision 2008/477/EC.

Yes, BT agrees with the proposed licence conditions.

Question 4: Meeting the conditions on the use of the alternative block edge mask for restricted TDD blocks would require certain licensees to share information about the locations of their base stations. Do you agree with this proposed approach?

Yes, BT agrees that the proposed approach seems reasonable.

Low-power shared access in paired 2.6 GHz spectrum

Question 5: We welcome comments on stakeholders' preference for the dedicated or hybrid options for low-power shared access as discussed above.

Amount of spectrum available for shared low power use
BT considers that low power shared spectrum deployments need access to 2 x 20 MHz of spectrum for the quality of future services that customers require and in order to maximise the potential to successfully share spectrum between multiple operators. A secondary issue is then whether this spectrum is dedicated (and reserved, as we believe to be appropriate) for low power systems, or whether part of the 2 x 20 MHz is also shared with standard power use (the hybrid approach).

Dedicated versus hybrid low power use
Our clear preference is for 2 x 20 MHz of dedicated shared low power spectrum, rather than a hybrid approach. This is especially the case if the hybrid approach were to be constructed with the burden for sharing placed on the low power systems, rather than significant obligations also being placed on the standard power use. We do however acknowledge that the hybrid option would be better than the solution of just 2 x 10 MHz dedicated low power spectrum. We explained the reasons why 2 x 20 MHz is the most appropriate provision for low power shared use in our response to the main consultation paper on the combined award.

Please see our response to Question 7 where we address the technical issues relating to conditions for shared low power use and our response to Question 8 where we elaborate fully on our views about the specific technical issues in relation to the proposed hybrid use.

Question 6: We welcome comments on the appropriate frequency placement for low-power spectrum blocks.

If adjacent radar systems need protection from out of band emissions from mobile base stations to the degree that Ofcom has examined, BT agrees with Ofcom's proposal to preferably locate the 2.6 GHz low power shared FDD spectrum toward the middle of the paired 2.6 GHz spectrum bands in order to minimise adjacent band compatibility issues. The smaller number of full power base stations and their physical implementation would mean that these could more readily incorporate any additional filtering that might be required.

BT notes that Ofcom's proposed emission limits for full power base stations given in Table 6.1 provide for a maximum mean out of block EIRP of -45 dBm measured in 1 MHz. We are therefore unclear why a level of -65dBm is considered in Table 7.1 for the discussions about frequency location of low power base stations, which would typically be mounted at low height and mostly indoors and thus would represent lower interference levels into radar systems than might be expected from high power base stations. Consideration of higher rather than lower emission levels might therefore be more relevant. In fact we are unclear where the level of -65 dBm/MHz EIRP originates from or why it was chosen. The favourable

impact on sharing with lower base station heights was illustrated in a contribution from Germany to the CEPT SE Project Team 21 in April 2011[2].

The existing work in the CEPT ECC SE21 and PT1 groups on compatibility between 2.6 GHz mobile systems and 2.7 GHz radar systems is based on mobile systems with high gain (e.g. 18dBi) antennas and therefore any conclusions that indicate that spurious emission levels need to be reduced must be interpreted carefully before translating these to low power small cell systems which will have much lower antenna gain and in-band power (thus improving the compatibility with radar systems compared to full power systems).

In general we believe that a reasonable coordination procedure in the case of deployment of mobile systems very close to the limited number of specific radar sites would be more appropriate than imposing a general and potentially costly requirement to reduce unwanted emissions to levels below those in standards for all mobile base stations. This is especially a concern for equipment produced in large volumes (i.e. small cell systems) for which price is expected to be a key determinate of a commercial business case. Coordination is however much less practicable for a large number of small cells than for full power base stations, not least since small cell systems may not be able to automatically determine their exact location. Thus if coordination for small cells can be avoided (except in very close proximity to radars) by locating these towards the middle of the paired 2.6 GHz spectrum, then this is a further merit of Ofcom's proposal (as detailed in Table 7.1).

Question 7: Do you agree with our proposed technical licence conditions for low-power access?

BT agrees that if Ofcom proceeds to award concurrent low power licences as a single category of lot, the following technical conditions that are now proposed by Ofcom would be reasonable:

- maximum in block power of 30 dBm for low power base stations;
- maximum in block power of 23 dBm for low power terminals; and
- no antenna height restriction for indoor deployment.

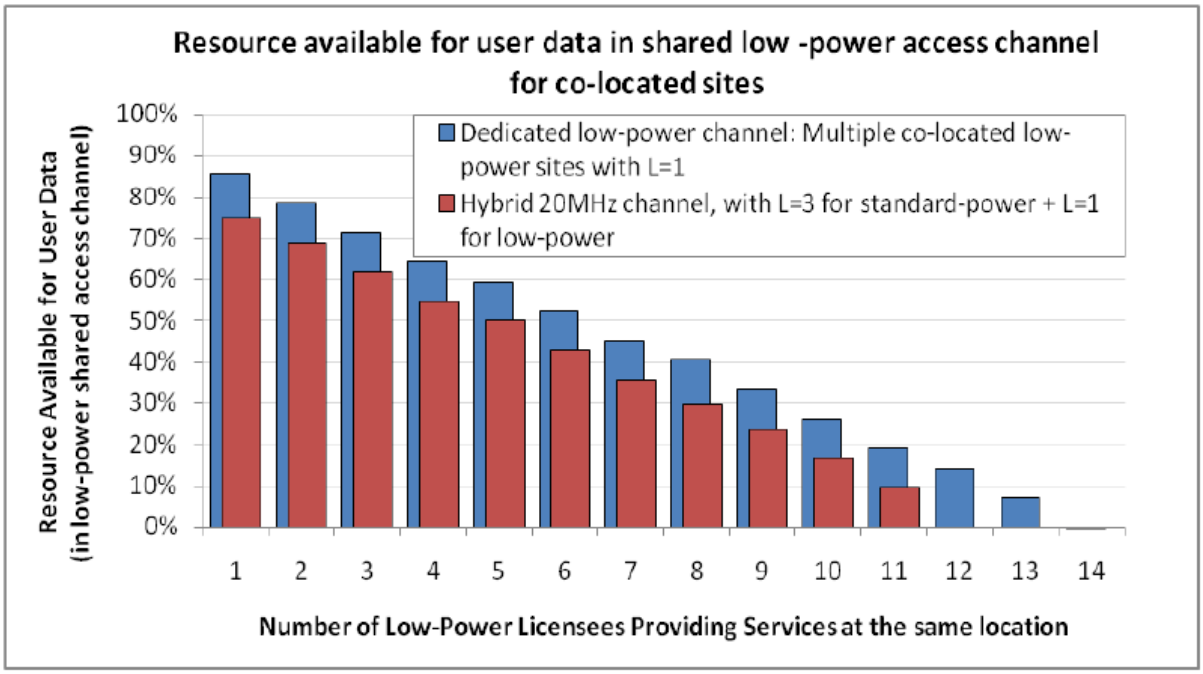
We are unclear as to why the proposed maximum antenna height of 12 m for outdoor deployment is necessary. It may also be difficult to clearly define what is indoor and what is outdoors in some situations, such as shopping centres. In the case of the TDD alternative out of block emission limit, we understand that the height restriction is to manage the TDD base station to FDD base station interference. However, in this instance where the low power FDD use is proposed to be located in the middle of the FDD band, we believe the 12 metre restriction is unwarranted and may constrain certain applications. Therefore, we propose that there should be no height restriction on low power FDD licences.

Furthermore, in line with the position that we have taken in our response to the main consultation[3], we are of the view that a better way to proceed would be to differentiate

[2] SE21(11)21 "Impact of mobile service to radar above 2700 MHz", Germany, 14 April 2011

between the types of low power use, in order to limit the number of operators that would share in the outdoor scenario, where there is greatest potential for interference between networks. The results of our technical analyses and simulations, that were included in our previous submission, proposed that Ofcom defines two categories of low power lot with different in-band power limits depending on whether the low power use is intended for indoor only use or for outdoor/indoor use.

This proposal for two categories of low power lot is due to the concern of co-channel interference particularly in hotspot areas where multiple operators access the spectrum, where we believe that the number of operators should be restricted to far fewer than the theoretical maximum of ten that Ofcom have proposed. Our concern about the number of licensees is in fact re-confirmed by the Real Wireless study and illustrated in Figure 7.2 of the present Ofcom consultation (reproduced below) where it can be seen that less than 50% of the resource is available if four or more operators co-locate in the same area. It should be noted that this figure only reflects resource reduction due to signalling and control overheads but, crucially, does not include the interference between operators that will result in substantial reduction in throughput. This latter aspect has been analysed by BT and is illustrated in Figure 2 of Annex C of BT's response to the main consultation.[4]



Based on our studies, we therefore propose that a maximum of 30dBm EIRP is suitable for a limited number of low power licensees deploying outdoors, but to reduce the power of the remaining (larger number) of lower power licences targeting indoor use. A limit of approximately 10 dBm EIRP should provide good coverage for typical residential houses,

[3] See BT's response to the Ofcom Consultation on "assessment of future mobile competition and proposals for the award of 800MHz and 2.6GHz spectrum and related issues" submitted on 31 May 2011 (http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/responses/BT.pdf).
[4] *ibid*

while reducing co-channel interference. Such low power use indoors may also not require coordination with radars. In summary, BT recommends the following technical conditions for dedicated shared low power 2.6 GHz spectrum use:

Low power shared 2.6GHz lot category (BT proposal)	Base station In-band EIRP limit
D1 (typically Indoor use)	10dBm
D2 (Outdoor or indoor use)	30dBm

Question 8: We welcome comments from stakeholders on the additional restrictions and technical measures we have outlined for the management of interference under the hybrid approach, and the technical licence conditions that would be necessary to implement them.

BT has carefully considered the material in the second Real Wireless report where the possible measures for standard power and low power hybrid use are studied. BT has identified a further measure that could substantially reduce the interference to the standard power system while retaining the benefits of wider bandwidth that can be achieved in the hybrid solution.

Our suggestion is to reduce the power limit for low power licences to 15 dBm EIRP in the shared 10MHz portion of the 20 MHz low power downlink spectrum. This should not substantially limit the utility of indoor low power usage, but would significantly reduce interference to the standard power system and the interference among low power licensees. We propose this in order to avoid the possible requirement for mandatory implementation of more complicated and non-standardised techniques, such as location databases and carrier sensing power back-off. We do not consider that the specific measures proposed in the consultation, involving measurement of downlink power from base stations of standard power networks and adjustment of power level accordingly, are an appropriate solution because the identity of the individual interference sources (whether from low or standard power networks) cannot be determined.

Although the consultation states that “we have not decided the relative priority for access to spectrum shared between standard power networks and low power networks”, the Real Wireless report only considers interference mitigation techniques that assume the standard power network has priority. We believe that if the hybrid option were selected a more balanced approach is appropriate and, as is explained below, standard power networks are able to implement necessary additional technical measures to facilitate sharing of spectrum. Thus the low power systems should not have challenging (and potentially impractical) requirements imposed in the licence conditions.

We believe there are simple techniques that the standard power operator can adopt to significantly reduce interference and hence optimise the performance for all licensees. For example, the Real Wireless report pointed out that the cell edge of macro coverage is the

most susceptible to interference from low power networks. To solve this, the standard power operator can avoid using the shared 10 MHz for the cell edge users. Assuming an OFDMA system (LTE or WiMAX), with advanced schedulers, it is possible to allocate the OFDM subcarriers in the shared 10 MHz to cell centre terminals. As the standard power base stations continuously measure the channel conditions of all attached terminals, they can assign shared spectrum subcarriers to the terminals in good channel conditions and dedicated spectrum subcarriers to the terminals in less favourable channel conditions. Given that the standard power operator would most likely adopt a frequency reuse 1 approach, the standard power base station should have advanced schedulers from day 1 to intelligently schedule radio resource and actively mitigate interference.

In summary, complicated, potential costly and impractical measures should be avoided. The sharing of standard and low power use could be promoted by limiting the EIRP of shared low power systems and relying on techniques such as scheduling within the standard power systems to reduce the interference.

Question 9: Do you agree that a Code of Practice on Engineering Coordination, as outlined, is the appropriate approach to manage the coexistence between low-power licensees?

Yes, we agree that a Code of Practice on Engineering Coordination is a very pragmatic approach which is proved to work well in the case of low power GSM spectrum and provides a flexible and efficient way of managing sharing between licensees. We also support the proposal that Ofcom retains backstop powers and reserves the right to arbitrate in some unpredictable circumstances. We agree that in the case of the hybrid scenario, the standard power operator may choose to participate in the development of the Code of Practice on Engineering Coordination, but only those aspects relevant to sharing between the low power and standard power use.

Terminal stations

Question 10: Do you agree that we should proceed with the approach that terminal stations complying with the relevant technical parameters be exempted from the requirement for individual licensing?

Yes, BT agrees with the approach, including the specific technical parameters that are described in the consultation paper.

We note that Ofcom intends to consult on the draft licence-exemption regulations for 800 MHz and 2.6 GHz terminals in summer 2012 and that these regulations should be effective by the end of 2012. This would be compatible with Ofcom's proposal that the 800 MHz and 2.6 GHz spectrum auction licences will have a commencement date of 1 January 2013.

As Ofcom has indicated that the auction process could commence with submission of applications in Q1 of 2012, this raises the question of whether use of the auction spectrum bands would be available for testing purposes after the award but prior to 2013. We suggest

that Ofcom should, if required, grant temporary non-operational licences for this purpose where early use is technically feasible.