# BT Response to the Ofcom Consultation on Award of Available Spectrum: 2500-2690MHz, 2010-2025MHz and 2290-2300MHz

**Response date:**
**9th March 2007**

# BT Response to the Ofcom Consultation on Award of Available Spectrum: 2500-2690MHz, 2010-2025MHz and 2290-2300MHz

## Executive Summary

1 BT Welcomes Ofcom's latest Consultation Document[1] relating to the awards of spectrum in the frequency bands 2010-2025MHz, 2500-2690MHz and 2290-2300MHz. We believe these to be important bands, and their availability to the market via technology neutral awards should help to bring wireless innovation to consumers at a time of growing interest in personal broadband and convergence.

2 Through responses to earlier Ofcom consultation documents, BT has already provided views and positions on many of the issues addressed in this present Consultation. It is our view that these earlier inputs to Ofcom remain valid and continue to form part of our position, and they should thus be considered alongside the additional comments provided here although we have included those aspects central to this consultation in what follows.

3 BT has reviewed Ofcom's proposal for a spectrum cap. Whilst we can support this concept, we believe that it must cease to apply once the award is complete. To continue it beyond the auction would, we believe, run counter to Ofcom's core policies of allowing spectrum aggregation, spectrum trading and spectrum liberalization (see **§2.3 below**).

4 BT believes that Ofcom should provide the maximum possible level of transparency during the auction. Within the main text of the CD Ofcom only commits to a low level of transparency. However, we fully support Ofcom's implicit position in §§A8.174-A8.176 that the general presumption should indeed be for more transparency. In BT's view there is no case for limiting transparency (see **§2.4** below).

5 We have carefully reviewed the current SUR proposals and are concerned that these ideas are not yet sufficiently well formed to be used in these spectrum awards. BT is therefore of the view that the more conventional approach of employing spectrum masks to define the emission constraints for systems using these bands remains preferable. We develop our arguments for this in **§2.4** and in our answers to Questions 17 – 22 inclusive that are set out in **§3.**

6 BT can in general support the proposed spectrum masks. However, we comment in greater detail in our response to Question 11.

[1] Consultation Document: *Award of available spectrum: 2500-2690MHz, 2010-2025MHz and 2290-2300MHz*, Ofcom, 11th December 2006.

7 BT has important concerns with the draft licence (Annex 9 of the CD). As stated in **§2.6** of this response, BT believes that Ofcom should issue some clarity and guidance on this issue as soon as practicable, giving as much confidence as possible to prospective bidders that their solution will be mirrored by appropriate CPE licensing as necessary within a reasonable timeframe from the award. Ultimately, the ease with which 3rd party users are able to participate in the use of networks will be fundamentally business case affecting.

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## Contents

# BT Response to the Ofcom Consultation on Award of Available spectrum: 2500-2690MHz, 2010-2025MHz and 2290-2300MHz

## 1 Introduction

BT Welcomes Ofcom's latest Consultation Document (CD) relating to the awards of spectrum in the frequency bands 2010-2025MHz, 2500-2690MHz and 2290-2302MHz. We believe these to be important frequency bands, and their availability to the market via technology and service neutral awards, at the earliest opportunity, should help to bring wireless innovation to consumers at a time of growing interest in personal broadband and convergence.

Through responses to earlier Ofcom consultation documents[2,3,4,5,6] BT has already provided views and positions on many of the issues addressed in this present Consultation. It is our view that these earlier inputs to Ofcom remain valid and continue to form part of our position, and they should thus be considered alongside the additional comments provided here although we have included those aspects central to this consultation in what follows.

BT has carefully considered the Consultation Document and the supporting literature published by Ofcom. Obviously, since we have previously been supportive of many of the ideas that Ofcom has developed as the Spectrum Framework Review and its Implementation Plan have progressed, there is much within this latest consultation document with which we can also agree. However, there are several points that we believe require comment and further attention, and these are set out below.

In **§2** below we provide some general remarks relating to our principal residual concerns. In **§3** we provide answers to the questions raised by Ofcom in the CD. Finally we provide summary conclusions.

Paragraph and section references in **bold** refer to material in this document. Those in normal text reference CD material.

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[2] BT Response to the Ofcom Consultation: *Spectrum liberalisation*. Response date 11th November 2004.
[3] BT Response to the Ofcom Consultation: *Spectrum Framework Review, a consultation on Ofcom's views as to how the spectrum should be managed*. Response Date 15th February 2005.
[4] BT Response to the Ofcom Consultation: *Spectrum Framework Review: Implementation Plan.* Response date 24th March 2005.
[5] BT Response to the Ofcom Consultation: *Spectrum Usage Rights*. Response date 21st June 2006.
[6] copies of the BT responses are available from:-
http://www.btplc.com/Thegroup/Regulatoryinformation/Consultativeresponses/Ofcom/

# 2 Overall comments

## *2.1 General views*

As already noted in **§1** above, there is much within this consultation document (CD) with which we can agree.

BT is pleased to see that Ofcom is in favour of an early award of these 3 frequency bands and we share the view that the time is right to remove the somewhat artificial barriers to spectrum access, thus releasing to the market the pent up wireless innovation that is currently being held back. Releasing the spectrum in a technology and service neutral manner with explicit spectrum liberalization and spectrum trading rights is likely to prove a strong catalyst for commercial and technical creativity in wireless solutions, with consequential significant benefits for consumers. In our view Ofcom are therefore to be commended on the flexible and timely award process that they are now proposing.

## *2.2 The proposed auction format*

BT certainly agrees that an auction is the appropriate approach in situations where the demand for the spectrum will likely exceed the supply. However, while in general the proposed award scheme is reasonable, and we understand and concur with much of the rationale for the proposed auction format, it is nevertheless complex. Unless fully scrutinized at this stage, the potential for the auction design to have an unintended outcome far from that originally envisaged could go unrecognised. We have therefore considered the auction design carefully and in some detail. As a result we have developed the view that there is both ambiguity and a lack of clarity in the description and/or processes set out in §6 of the CD. We provide more detailed comments in our answers to Questions 8, 9 and **12-16** in **§3** below [ ].

## *2.3 The proposed spectrum cap*

BT can generally support the concept of a spectrum cap, but assumes that this will only remain for the period of the auction. To continue it beyond the auction would we believe, run counter to Ofcom's core policies of allowing spectrum aggregation, spectrum trading and spectrum liberalization. We give further attention to this topic in our answer to Question 8**.**

## *2.4 Transparency during the Auction*

BT notes that in the Consultation Document, Ofcom commits to a relatively low level of transparency. In the summary table on p. 10, the CD states:

*"In the 2.6 GHz / 2010 MHz auction the identity of the bidders will be made public. Information on the volume of bids will be released after each round. Prices at which lots are awarded after stage 2 will be published. At the end of the auction, all bids made, including best and final offers and stage 2 bids, and the prices paid by the winning bidders will be published."*

Elsewhere, however, the Consultation Document discusses the possibility of releasing more information than this. For example, in paragraphs A8.174-A8.176, Ofcom discusses the issues involved in releasing information on clock bids and best-and-final offers.

BT supports Ofcom's implicit position in these paragraphs, that there should be a general presumption for more transparency. Transparency should be limited only where there is a compelling case to the contrary. In BT's view, there is no such case.

There is a general trade-off when deciding on the degree of transparency. On the one hand, greater transparency allows bidders to gain as much information as possible about the common value of lots in the auction (a point made by Ofcom in paragraph 8.9 of the Consultation Document). On the other hand, transparency can be used by bidders to engage in collusion and entry deterrence. More information allows bidders potentially to collude tacitly, using punishment strategies if a bidder is seen to deviate from the implicit agreement about how bidding should proceed.

In our view the importance of transparency for dealing with common value uncertainty cannot be overstated. It is likely that significant sums of money will be committed by bidders in this auction. The business cases supporting these bids involve technologies and services that are highly uncertain in a number of dimensions. In order for the auction to proceed efficiently and successfully, it is crucial that bidders receive as much information as possible to inform their bidding. Indeed, the design of the auction for 2010 MHz and 2.6 GHz bands reflects exactly this key fact. The open, ascending price format should ensure effective price discovery for bidders.

Against this main concern, BT argues that the risk of tacit collusion and entry deterrence is small. Tacit collusion is not a major concern, given the design of the auction, and in particular the final best-and-final offers phase. Tacit collusion in auctions requires that bidders have an opportunity to "punish" those who deviate from the implicit agreement about how bidding should proceed. This in turn requires that bidders can observe deviating behaviour. While this is possible during the clock auction, it is not possible during the best-and-final offers phase, which is sealed-bid. This feature means that those bidders who remain at the end of the clock auction can bid without fear of punishment, should a tacit agreement be in place. The use of sealed bids for the best-and-final offers phase also helps to mitigate the effect of bidder asymmetries.

In fact, the format proposed by Ofcom shares many characteristics of an Anglo-Dutch auction. As Paul Klemperer (2002)[7] argues, the Anglo-Dutch format, in which an open ascending price phase is followed by a sealed bid phase, is robust to collusion and effective in encouraging entry. In BT's view, therefore, the design of the auction in the Consultation Document should prove sufficient to ensure that tacit collusion and entry deterrence cannot be supported.

Ofcom has noted that residual concerns about tacit collusion might be dealt with by releasing information on an anonyms basis (i.e., not revealing the identity of a bidder associated with a particular bid); see e.g., paragraph A8.155 of the Consultation

[7] Klemperer, Paul (2002): "What Really Matters in Auction Design," *Journal of Economic Perspectives*, 16(1), 169-189.

Document. BT argues that this is unlikely to be necessary, and that there are efficiency gains from allowing bidders to observe the identity (and hence likely uses) of bidders.

Hence BT argues that the following information should be provided during the clock auction:

- The identity of auction participants.
- The price, number and type (or combination) of lots bid for at the end of each clock round, including best-and-final offers made during the auction; and the identity of the bidders.
- Waivers placed or "time outs" called for.
- Changes in eligibility.

BT does concede that prices bid in best-and-final offers could be rounded, to avoid the possibility of signaling.

An additional benefit of revealing best-and-final offers made during the clock auction is that it will help to accelerate the progress of the auction, particularly in the early rounds. The auction will be expensive to run: considerable resources will be devoted by bidders and Ofcom during the auction. There are considerable gains, therefore, to including features that will allow the auction to progress more quickly. One way to speed up the auction is to have large clock price increments. In general, however, this is poor for price discovery; and in later stages of the auction, runs the risk of "over-shoot". But during the early rounds of the auction, a reasonably large clock price increment could be used in conjunction with revealing the details of best-and-final offers. The large increment will help to move the auction through the early rounds at a reasonable pace. Revealing the best-and-final offers will help to "fill in the gaps" of the price discovery process, that would occur otherwise with a large price increment.

BT also believes that the identity of the winning bidders should be made known at the end of the first stage, and before the second stage of frequency assignment is entered. This will allow bidders to reflect in the second stage bids their valuations of being adjacent to other identifiable bidders. There is a small potential that this could be used as part of a broader scheme of tacit collusion. However, we believe that the likelihood of this is small. By this stage of the auction, bidders will be assured about the amount of spectrum that they will receive, and will be able to obtain that amount of spectrum for no more than they have bid in the first stage. (They would do so by placing no active bid in the second stage, and accepting whatever frequency assignment results.) Hence the potential for punishment is distinctly limited. In contrast, there may be substantial efficiency gains to bidders being able to reflect their valuations of being adjacent to alternative users of spectrum.

If there is a residual concern about collusion, then this could be reduced by not revealing the details of the best-and-final offers at the end of the clock phase. These details are obviously not needed for price discovery. The absence of detailed information will make it more difficult for bidders to infer whether deviation from a collusive agreement occurred during the sealed-bid phase.

## 2.5 Spectrum masks and spectrum usage rights

We have considered carefully and with great interest Ofcom's alternative proposals for *Spectrum Masks* and *Spectrum Usage Rights* (SURs).

BT has been generally supportive of Ofcom's exploratory work on the use of SURs, and whenever possible we have contributed to the relevant discussions, consultations and meetings that Ofcom has arranged on this topic. BT continues to believe that the SUR concept may ultimately be worth pursuing. However**,** in our view, the proposals contained in this present consultation remain insufficiently well formulated both technically and as regards procedural clarity or regulatory certainty to be adopted for these awards. We expand on this in our answers to Questions 19, 20 and 22 in **§3** of this response. The bands in question are potentially at the heart of the next phase of wireless innovation and thus it could be catastrophic to "experiment" with an innovative and previously untested methodology such as SURs, particularly as it remains very unclear to us how any resulting problems could be rectified without protracted and complex legal proceedings.

One point in particular that has made it difficult to support the SUR proposals is that the "most probable usage" parameters adopted by Ofcom's consultants when determining the SUR values.

The parameters that were used as inputs to the "Visualize" tool for developing the SURs for the paired and unpaired spectrum (Tables 55, 57, 59 and 60 of the CD) are very limiting. For example, the working assumptions of (hexagonal) cell radii of 315m FDD and 200m TDD could both be inappropriate in the early days of a network build when the criteria is generally coverage rather than capacity. As another example, the "Average Transmit Power for a TDD MS is quoted as 1.6dBm" (7.6dBm maximum). This does not seem to be a good basis for flexible use.

BT would argue that SURs based on such constrained input assumptions discriminate against innovation and could inhibit the delivery of new services to as many consumers as possible as quickly as possible and at lowest cost. The SUR input assumptions used have also led to a significant asymmetry in SURs between Paired and Unpaired spectrum which cannot be justified in a "technology neutral auction".

The proposed spectrum masks do not carry the same disadvantages, and BT can generally support these. However, we do have a few comments to make on the masks and these are included in our response to Question 18.

## 2.6 The draft licence

There is no specific question in the CD relating to the example licence in Annex 9. However, BT has a few points to make on the draft text.

We note that the licence is structured around the spectrum masks approach. BT fully supports this because we do not believe the SURs to be yet ready for "active duty".

There is no indication that Ofcom intends to address the key issue of the exemption from individual licensing of the Mobile Stations for applications including consumer terminals. Whatever genre of technology is employed for future mobile/wireless systems, it will undoubtedly be the case that the consumer radio units will be increasingly embedded

within an extremely wide range of terminals, e.g. smartphones, cameras, games, laptops, PDAs, payment systems, automotive applications etc.

The consumer terminals will be purchased from a range of suppliers, with the radios approved to some international specification supported by, for example, an ETSI Harmonised Standard against which they can be certified in order that they can then be placed on the market.

Terminals will increasingly and regularly roam across networks, nationally and internationally, and from technology to technology (e.g. from HSDPA to WiFi etc). It is therefore essential that CPE is not reliant on these individual licences but authorised via such Interface Requirements as are determined to be required following the clarity of use which will follow from the successful award of this spectrum and backed up by appropriate licence exemption conditions which must then be adhered to for use in the UK.

We therefore believe the definition of “The Equipment” in this draft licence should apply to the Base Stations only. While we appreciate that this may require further detailed consideration, it is clear that the need to register location, antenna height etc. cannot apply to the terminal devices and this provides one example of our concerns in this matter.

We acknowledge that Ofcom has given this matter some consideration as evidenced during the 8th February 2007 seminar where it was stated that the authorization of the user equipment “might be in the licence, might be in the IR or might be in a licence exemption regulation”. We understand that it may not be possible to “pre-ordain” the licensing regime for the CPE, as it may be dependent on the application and the chosen technology of the successful bidders. Yet, it must be recognized that this is a significant issue for any prospective users of the bands to be awarded, as it can have a major impact on business models and business cases.

BT therefore believes that Ofcom should issue some clarity and guidance on this issue as soon as practicable, giving as much confidence as possible to prospective bidders that their solution will be mirrored by appropriate CPE licensing as necessary within a reasonable timeframe from the award.

# 3 Answers to the questions in the consultation document

*Question 1: Do you agree with these proposals for the awards of the three bands or have any other comments on the contents of this document?*

In principal BT agrees with the proposals. However, as set out in **§2** of the main text above, BT has identified a few areas where further work and/or clarification from Ofcom is required. The comments in **§2** are deemed to be part of BT’s answers to these questions.

*Question 2: Do you agree with the analysis in section 5 or have any comments on adjacent interference issues?*

BT agrees that the correct relevant adjacent user interference issues have been identified in §5 of the CD. However, as presented, the material does not necessarily provide sufficient information upon which prospective bidders can independently verify Ofcom's assumptions and/or determine the value of the spectrum on offer.

In particular the limited information on Radar systems (§5 of the CD) should be expanded by Ofcom at an early opportunity. History has shown that the individual characteristics of different Radar platforms can have very different impacts on radio and wireless systems, and thus the information to be provided should be sufficient to allow meaningful evaluation of the potential impact on different types of wireless systems, and hence the value of the spectrum.

Specifically, we would wish to see information provided on the operating frequencies and locations of the civil radars operating above 2700 MHz. We also note that, according to the report of the audit of public spectrum holdings carried out by Professor Cave dated December 2005, there are MOD radars operating above 2700 MHz. We would ask that Ofcom also provides the latest available information on this usage so that its impact can be assessed.

We have noted the information on international coordination with Ireland and France as contained in the consultation paper, and the further information given at the Ofcom seminar on 8th February 2007. We welcome Ofcom's efforts towards a timely conclusion of these agreements in a manner which ensures that the ability to use the spectrum flexibly in the UK is safeguarded as far as possible. We believe that it would be essential for prospective spectrum buyers to have full and timely details of the technical aspects of these international co-ordination agreements, so that the impact on spectrum utility and value can be more accurately determined.

Without the abovementioned information on co-ordination and radars we would not consider that Ofcom had fulfilled its obligations to declare all information material to the award.

*Question 3: Do you agree that Ofcom should authorise use of the spectrum bands 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz?*

Yes, BT believes that Ofcom should authorize the bands in a timely manner and with the minimum necessary regulatory constraints.

*Question 4: Do you agree that awarding licences by auction would be the appropriate mechanism for authorising use of the spectrum bands 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz?*

All the signs are that demand for this spectrum exceeds the supply, and thus auctions must be the logical approach to making the awards. However, if the spectrum requirements of the potential spectrum owners are to be met, then during the auction design Ofcom should pay particular attention to the likely utility of the spectrum once awarded. We believe Ofcom must be careful to balance efficient spectrum allocation against effective (and therefore valued) allocation, hence ensuring that the auction design

itself does not inhibit/diminish the usability of the spectrum given the broad potential range of uses of the spectrum.

*Question 5: Do you agree that it is likely to be in the interests of citizens and consumers to proceed with the award of the 2.6 GHz and 2010 MHz bands as soon as practicable, rather than to delay the award pending reduction in uncertainty relating to other bands?*

Yes, There is clear demand for this spectrum and BT fully agrees with Ofcom's arguments in §§6.79-6.89 of the CD for releasing this spectrum quickly.

*Question 6: Do you agree Ofcom should aim to award the bands 2500-2690 MHz, 2010-2025 MHz and 2290-2302 MHz by the end of 2007, while keeping the position on the 2.6 GHz and 2010 MHz bands under review in the light of possible developments in European regulatory fora?*

BT has consistently encouraged Ofcom to award these frequency bands at the earliest opportunity, on the grounds that unused spectrum is of little social, economic or consumer benefit. An efficient award must therefore be one which proceeds without further delay.

We understand that Ofcom is obliged to indicate to potential spectrum users that the European (CEPT/ECC and/or EC) policy on the use of these bands may change (hopefully in a clarifying direction), but we do not believe that Ofcom should await the settlement of all details unless clear signals emerge that the EC could be moving towards an EC Decision that would be harmful to Ofcom's policy of technology and service neutral spectrum awards. We believe that such a move by the EC would be unlikely, especially given the progress on the WAPECS[8] project. Any delay to await EC developments could detract from the window of opportunity that now presents itself to use these bands to the common good for a range of possible applications and services.

We note with interest in this context the recent Communication[9] from the European Commission to the Parliament and Council on spectrum flexibility, and the related Resolution[10] from the Parliament which were both fully supportive of the Commission's spectrum management objectives in the context of ensuring flexible spectrum usage.

These are very positive signs. Industry is engaged in depth at all levels to support what the Commission is doing, and is particularly assisting in the work of CEPT/ECC Project Team SE42 on the WAPECS issue. BT believes that Ofcom can help to ensure the success of the UK's objectives of spectrum liberalization but providing high level support in the SE42 and other projects related to WAPECS. BT believes that many administrations are watching to see how the UK policies and auctions progress, and sustained high level UK leadership across the related CEPT activities would send clear signals that the UK remains fully committed to the goals which it has previously set out.

[8] WAPECS: *Wireless Access Policies for Electronic Communications Systems*
[9] COM (2007) 50 Final: Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions – *Rapid access to spectrum for wireless electronic communications services through more flexibility.* Brussels, 12th February 2007.
[10] European Parliament Resolution: *Towards a European policy on the radio spectrum* (2006/2212(INI))

*Question 7: Do you agree with Ofcom's proposals for licence conditions (technology neutrality, tradability, conditions of tenure and absence of roll-out obligations)?*

Yes, BT fully agrees with these proposals. They are fully in line with positions and views that BT has expressed to Ofcom in earlier consultation documents.

*Question 8 - Do you have views on whether or not there should be a "safeguard" cap on the amount of spectrum that any one bidder could win in an award for the 2.6 GHz bands and, if so, do you have a view on whether 90 MHz would be an appropriate size for a safeguard cap?*

The rationale behind the concept of a safeguard cap is understood. Provided that it is set appropriately and for the right reasons, and provided that it is maintained only during the award process, the concept is generally supported.

BT agrees with Ofcom that there is a fine balance to be made with regards to the proposed spectrum cap. BT considers that an appropriate balance needs to be set between:

- encouraging entry and participation in the initial award process
- not unnecessarily limiting competition in the post award market
- not facilitating spectrum fragmentation to a level where it is commercially unusable by the potential range of innovative uses, to meet customer needs

The cap is a maximum amount of spectrum which can be bid for during the award process itself. Ofcom have stated that they set the current proposal at 150% of the largest indicated level of interest (which Ofcom received). It would therefore appear that the current proposal of 90MHz is highly unlikely to prevent entry of players and thereby does not act as an entry barrier to new, innovative players into the market. As a maximum level, the cap also does not prohibit players who wish to acquire smaller quantities of spectrum either.

With regards to the ability of a small number of bidders to acquire all of the spectrum, and in extremis (where no cap existed) one bidder, BT believes Ofcom's proposals strike a pragmatic balance between the needs of individual bidders and those of the wider market. If the cap were set significantly lower, the resulting fragmentation of the spectrum could significantly impair its efficient utilisation and flexibility by prospective operators, service providers and ultimately customers.

BT believes that the safeguard cap should only apply to the 1st stage of the auction. Ofcom has indicated that it may create additional packages at the start of the 2nd stage that incorporate guard blocks and unsold lots. Remaining bidders should not be excluded from bidding for these packages in the 2nd stage due to the spectrum cap.

BT presumes that the proposed cap must only be applicable during the 2.6 GHz award process. Following the closure of the award process, we presume that any spectrum cap (adopted for the proposed award process) will be dissolved and an open market for the trading of spectrum will take place thereafter. If the imposition of a cap were to continue post award, this would distort any ongoing market for traded spectrum as well as run

counter to Ofcom's stated policy of allowing spectrum aggregation through market processes.

Ofcom is requested to clarify the duration of applicability of the spectrum cap.

*Question 9 - Do you agree with Ofcom's proposal to package spectrum as lots of 2 x 5 MHz for paired use and 5 MHz lots for unpaired spectrum and to allow the aggregation of lots by bidders?*

BT agrees that Ofcom's proposal for generic lots of 2 x 5MHz for paired use and 5MHz for unpaired spectrum, combined with an ability to aggregate is an appropriate approach. It is noted that the proposals are in line with the ECC spectrum plan and one option adopted by ITU-R Working Party 8F, and that they are consistent with the requirements of the most likely candidate technologies.

Ofcom's stated intention, and one supported by BT, is that the spectrum should be awarded nationally, in a technology neutral manner, with no "build out" obligations and with the ability for commercial trading post auction. So as not to pre-judge and thereby limit the market's uses of this spectrum in satisfying customer needs, BT believes the award process should be mindful of the largest number possible of different innovative uses of the spectrum from the outset. As such, the award process, including spectrum packages should be designed to satisfy the largest number of potential requirements that can be reasonably accommodated without making the auction overly complex or compromising efficiency.

There is unlikely to be an "ideal" process which meets all requirements, however BT believes Ofcom's proposed spectrum packages achieve a pragmatic balance. Whilst there may be a small number of technically specific solutions which require different packaging arrangements, on balance it is believed the technology neutral award process including the spectrum packages should seek to meet the majority of needs. A post award, spectrum trading market (which is an Ofcom stated policy) could resolve such niche packaging requirements, be they within this band or linked to other bands.

The combination of these two processes, in this instance, provides both opportunities for market innovation as well as flexibility to facilitate niche technical requirements.

*Question 10 - Do you agree with Ofcom's proposed approach to allowing the respective amounts of paired to unpaired spectrum for the band 2500-2690 MHz to be varied (maintaining the 120 MHz duplex spacing and allowing additional unpaired spectrum, if needed, at the top end of the band)?*

It is understood that Ofcom's proposal for maintaining the 120MHz duplex spacing for paired spectrum within the 2500-2690 MHz band, is based upon international (3GPP) standards and industry agreements or proposals. Maintaining the 120MHz duplex spacing for paired spectrum, and thereby adhering to international standards for vendor equipment removes the risk of users of paired spectrum requiring manufacturers to create (non-standard) "UK special" solutions with the consequential negative impact on operators' deployment and operation costs and therefore ultimately on customers. As such BT agrees with Ofcom's current proposal, including allowing additional unpaired spectrum, if needed, to be placed at the top end of the band.

Any alternate paired duplex spacing proposed, which deviates from the current Ofcom proposal of 120MHz duplex spacing, would fail to comply with 3GPP standards. Such a proposal could result in more of the unpaired spectrum being allocated for paired use, which could adversely impact the requirements of bidders for unpaired spectrum. In such circumstances, Ofcom is recommended to adopt a spectrum allocation which flexes the unpaired spectrum demand within the centre of the 2500-2690 MHz band, with the paired spectrum allocated to both end of the band (and hence no split in the unpaired spectrum). This has already been identified by Ofcom in paragraph 1.25 of the Consultation Document as a possible solution for non-120MHz duplex spaced paired spectrum, and provides the added benefit of minimising the number of required guard blocks.

BT recognises that Ofcom has sought to strike a pragmatic balance in its proposals for this award process. However, it should be noted that Ofcom's proposal for 120MHz duplex spaced paired spectrum combined with the proposed auction process is not without its problems as it creates potential imbalances for bidders (and ultimately users) of unpaired spectrum, in comparison to bidders of paired spectrum. The problem arises because the proposed auction format attempts to treat different objects as identical. Paired and unpaired lots are different, at least because the latter carry the risk of a split assignment plus additional guard bands.

Whilst BT recognises that the currently proposed identical, but in reality imbalanced, treatment of paired and unpaired spectrum is a risk of the proposed process, BT does not consider that the risk is sufficient to warrant a major re-configuration of the award process or in extremis a completely new award process. BT believes this is an issue of detail which could be addressed through a minor modification of the current proposal. It is noted that there are a number of areas in the Consultation Document relating to the award process that will require further refinement and conclusion. As such, this could be one of those. Ofcom is urged to consider simple remedies to the award process to mitigate these difficulties and prevent a market imbalance being built in from the beginning by the award process itself.

*Question 11: Do you agree with Ofcom's proposals for a 5 MHz restricted block between FDD and TDD neighbours and between TDD and TDD neighbours and with a modified out-of-band base station mask for second adjacent 5 MHz blocks?*

BT could accept this approach as a pragmatic solution to the problem of controlling emissions beyond the block-edge.

However, we consider that the in-band power constraint on the restricted unpaired channels might be more severe than necessary. We believe that these could be relaxed, provided that the stated out-of-band emission requirements are still met. In particular the technical justification for restricting the Base Station (BS) in-band power of the guard channel 24 (to be allocated as a restricted channel in the final stage) and the bottom unpaired channel in the "upper" unpaired block (if applicable) to 28 dBm/MHz, whilst not restricting the Mobile Station (MS) in-band power, is not clear. We say this because the adjacent victim FDD mobiles would receive no more interference from the TDD BS than the already adjacent FDD BS and interference from the TDD mobiles would not be controlled since no special reduced power has been proposed for these. The TDD BS could employ appropriate filtering to protect them from FDD BS interference if they wished to make use of these channels for higher power. This is an area where Ofcom may wish to review the technical conditions, or at least ensure that commercial discussions are

encouraged post auction to ensure that the unpaired channel(s) adjacent to FDD downlink are used as efficiently as possible.

*Question 12 - Do you agree with Ofcom's proposals to award the 2010 MHz band as a single 15 MHz lot?*

BT agrees with Ofcom's proposal to award the 2010 MHz band as a single 15 MHz lot as sub-dividing this block is likely to be inefficient and sub-optimal.

The 2010 band of unpaired spectrum offers opportunities for a number of services and in some instances is a substitute for 2.6GHz spectrum. However, due to the volume of available spectrum at 2010MHz, fragmenting it further would severely limit its commercial uses and therefore attractiveness to the market. If Ofcom's objective is to put this spectrum into the hands of those that value it most as quickly as possible, keeping the 2010MHz band as a single block should achieve this objective, while avoiding the complexities necessitated by and balances that need to be struck to accommodate the varied market requirements for the larger 2.6GHz band.

*Question 13 - Do you agree with Ofcom's proposals to award the 2290 MHz band as a single 10 MHz lot?*

BT agrees with Ofcom's proposal to award the 2290 MHz band as a single 10 MHz lot as sub-dividing this block is likely to be inefficient and sub-optimal.

*Question 14 - Do you agree with Ofcom's proposals to combine the award of the 2.6 GHz and 2010 MHz bands and to hold the award of the 2290 MHz band separately and in advance?*

BT agrees with Ofcom's proposal to combine the award of the 2.6 GHz and 2010 MHz bands and to hold the award of the 2290 MHz band separately and in advance.

The 2010 band of unpaired spectrum offers opportunities for a number of services and in some instances could be considered to be a substitute for 2.6GHz spectrum. As such, it would appear to be a pragmatic approach to link the award processes for the 2.6GHz and 2010MHz bands.

With regards to the 2290MHz band, there appear to be sufficient differences in the potential uses to deny the substitutability of the bands for each other, thereby removing the need for simultaneous linked awards of the 2290MHz band with the others under consideration here.

*Question 15 - Do you agree with Ofcom's proposals for a two-stage auction design for the 2.6 GHz and 2010 MHz bands?*

The overall auction design proposed by Ofcom is simultaneously novel and non-intuitive in terms of its operation.

BT recognises that Ofcom has sought to balance different objectives in its proposals for this award process. The objective of awarding the spectrum on a technology neutral basis, and thereby not pre-judging and restricting the market's uses of this spectrum requires an award process which reflects the need for flexibility and market choice. As such, BT believes the award process should be mindful of the largest number possible of different innovative uses of the spectrum from the outset. The award process should be designed to satisfy the largest number of potential requirements that can be reasonably accommodated without making the auction overly complex or compromising efficiency.

There is unlikely to be an "ideal" process which meets all requirements, however BT believes the general structure of Ofcom's proposed process achieves a pragmatic balance. Whilst there may be a small number of technically specific solutions which are not directly accommodated by the proposed process, a post award, spectrum trading market (which is an Ofcom stated policy) could resolve such niche packaging requirements, be they within this band or linked to other bands.

The combination of these two processes, in this instance, provides both opportunities for market innovation as well as flexibility to facilitate niche technical requirements.

However, the real issue is with the details of the proposed process, rather than the number of stages involved. Some of these have been raised in response to earlier questions. In particular, see BT's response to question 10.

There are many possible ways of awarding spectrum, however whilst other alternative generic award structures may be proposed, they may seek only to resolve a technology specific issue. Adopting these would not uphold the ethos of a technology neutral award process as it would be designing in technology specific remedies – with potentially unintended consequences on alternative innovative solutions and spectrum uses.

*Question 16 - Do you agree with Ofcom proposals to award the 2290 MHz band through a second price sealed bid auction?*

BT agrees with Ofcom's proposal to award the 2290 MHz band through a second price sealed bid auction.

As the 2290MHz band has significantly different uses to the 2010MHz and the 2.6GHz bands it would seem appropriate to consider a different award process. The reduced volume of available spectrum at 2290MHz in comparison to 2010MHz and 2.6GHz combined with the reduced flexibility (of the spectrum) required by the market would suggest that a simpler award process would be the most pragmatic solution in this instance. As such:

- The common value uncertainty is less of an issue for this band, and therefore a sealed-bid format is appropriate
- The proposed second-price format will, in this instance, ensure an efficient allocation

*Question 17: Do you have a preference for either of the two approaches to specifying technical licence conditions?*

BT has previously been supportive of the general concept of SURs. However, we do not believe that Ofcom's proposed instance of such a regulatory device is yet sufficiently mature or stable to be usable for these present awards.

In particular, at several points during their development thus far, BT has requested that Ofcom set out the embryonic SURs as example regulatory language, as this would have allowed rigorous testing and evaluation. However, such text has not as yet become available, and we unfortunately do not consider that this CD contains the required regulatory clarity and certainty that would allow us to fully evaluate this approach.

Deploying innovative technology is always a challenge. BT considers that to do so within an innovative SUR regime with many residual uncertainties represents a risk that is just too great when set against the levels of investment that might be under discussion for systems in these bands.

In BT's earlier response to the Ofcom Consultation on *Spectrum Usage Rights* we indicated that, at that time, we believed that spectrum masks were probably still the right approach for in-band and out-of-band interference control (we also suggested that SURs might be OK for cross border interference management). As time is now of the essence we must now reinforce this earlier position and state BT's clear preference for the more traditional and stable "spectrum mask" approach.

However, we would encourage Ofcom to continue with the development of SURs with a view to their future use once widely accepted, and BT would certainly be happy to help with their ongoing development outside the context of this present award.

*Question 18: Do you have any comments on the transmitter spectrum masks defined below?*

BT has examined the spectrum mask proposals and believes that, overall, Ofcom has achieved a reasonable balance between the need to limit interference and the need to allow effective and efficient spectrum utilization. We also believe that a reasonable balance of burden on systems using the paired and unpaired spectrum has been achieved in terms of the shape of the spectrum mask (and hence any necessary filtering requirements). We would be concerned if this balance was changed. Even with the scheme proposed it will be necessary to require reasonable cooperation and a degree of coordination between operators to limit any interference issues that could arise.

As noted in **§2.4** above – We have concluded that we prefer the spectrum mask approach over that of the SURs, which we are unable to support as written.

*Question 19: Do you have any comments on the SUR parameters defined below?*

We here refer to our answer to Question 22 below, in which we indicate the issues we have with the input parameters used for the derivation of the SUR values presented in §9 of the CD. We believe that these have caused a number of potential problems within the SUR approach and this has led us to conclude that the spectrum mask approach remains preferable for this award.

We note that (depending on the scenario) there can be some significant differences in the constraints on certain channels between the spectrum mask and SUR approaches. Our reflection on both methods leads us to the firm conclusion that the logic of the spectrum mask approach yields the clearer, more technically consistent and more workable solution, and that Ofcom must adopt the spectrum mask approach.

*Question 20: Do you have any comments on the SUR methodology and assumptions detailed in this annex?*

As noted in our response to Q22 below, the "measurement areas" (A) of 0.34km$^2$ for paired spectrum and 0.14km$^2$ for unpaired spectrum are both small, constraining the utility of the spectrum, and different, creating the potential for distortions in the market.

We note in the 2nd bullet of §A11.4 it is stated "*Where practicable, the measurement area A is also set to cover around 10 cells…*" A strict interpretation of this is that the small areas A should embrace 10 cells. This is clearly unrealistic, and we presume that Ofcom means that 10 different areas of size A should be measured.

In the 2nd sub-bullet of this same Bullet point it states "*The in-band and out-of-band PFD limits are defined as the average values measured over a period of time sufficiently long to eliminate effects such as fading and the transmission cycle times. The justification for defining the SUR parameters in terms of average PFD is that it captures variations in time due to propagation effects (e.g. ducting and scatter), activity factor power control variation, traffic etc*". To BT, the inclusion of ducting and traffic variations suggests a long measurement period. BT's strong background in ducting measurements suggests that the determination or average value conditions requires about 5 years of measurement! Traffic needs at least a 24 hour cycle and probably a week to capture the average effect. In §A13.4 a "measurement period" of 1 second was used for deriving the SURs. This analysis could not have addressed some of the factors introduced above.

In the same sub-bullet, it is stated "*The average PFD approach also has the advantage that any user transmitting high powers for a short period of time runs the risk of exceeding the average PFD, conversely to setting a PFD based on 50% of time validity.*" This we do not understand. By definition, an average PFD will be exceeded for 50% of time.

§A11.6 suggests a minimum of 25 measurement locations across area A. For any meaningful result these measurements would need to be simultaneous, given the dynamic nature of the signal for a mobile system with traffic moving about and customers coming on and off line. Smart antennas would compound the issue. We do not believe measurement is particularly workable, although it could be attempted as a special exercise to resolve disputes.

§A11.7 offers the spectrum user the option of propagation prediction, and §A11.8 indicates the use of the Visualyse tool and the forthcoming Ofcom Generic Radio Modeling Tool. If the calculation is to be performed to 25 points in an area as small as 0.14km$^2$ the points will be but a few meters apart. This implies that such tools should be capable of resolving the propagation loss to this kind of resolution and that exceedence of the PFD criteria for >50% of such points can be meaningfully determined. With appropriately high resolution 3D building data and precision GTD diffraction analysis there might be a chance of undertaking such a calculation, but we do not believe the tools mentioned offer this capability. Modeling to the resolution suggested in the CD would be very challenging, and could make the planning of a network a complex and extremely expensive task.

It is a requirement of the SUR approach to take account of all transmitters in the wanted network (at least all those that could realistically impact on the PFDs within the area A). For a prediction based approach this requires the aggregation of PFDs arriving over a large number of propagation paths that must be predicted individually. Ofcom's own proposed model offers a standard deviation of 8dB. Most models fall in the range 6-10dB so this is reasonable. However, the aggregation of a large number of results with this level of uncertainty leads to an aggregate PFD also with significant uncertainty. Specifying PFD limits to the precision used in §9 of the CD, whilst doing no real harm, does not imply that such precision can ever really be achieved. PFD levels of -101.5 or -67.3dBW/$m^2$/MHz for example really have little meaning.

The same is true of measurements, as these always have errors. A 1 second measurement period says little about the next second or the previous second.

In conclusion, BT believes that there are significant practical issues with the SURs and that further work is needed before these can be introduced into UK spectrum regulation.

*Question 21: Do you have any comments on the use of the Visualyse tool as described, on the assumptions or the propagation model proposed in this annex?*

BT has no fundamental problem with the Visualyse Tool *per. se.* – but we remain concerned about the way the propagation models contained therein may be used. In particular we are concerned to know how multiple interference entries might be reliably aggregated (see Q20 above).

We might have some difficulty at present were this single commercial tool to be mandated as the sole analysis tool for exploring changes to SURs on change of use or for resolving interference disputes. This presents too much of a risk given that the tool has not yet been freely available to potential spectrum users for evaluation.

We assume that if this tool is finally adopted by Ofcom in some form it would be made freely available in some way to spectrum users with a reasonable period being then made available for questions and comments from the user community.

*Question 22: Do you have any comments on the assumptions detailed in this annex?*

BT does have some very significant concerns about the parameters used for the derivation of the SUR values, as set out in Annex 13 of the CD.

We believe that there is a fundamental flaw in the assumption by Ofcom's consultants that the most likely scenario for the 2.6GHz band is street level microcell/picocell systems. Defining the SURs around such low power (especially CDMA) systems tends to preclude the use of the channels for anything else.

We note that the consultants derived this information from ECC Report 45. However, that Report stems from a world of 3G FDD dominance and pre-dates the upsurge of interest in these subject bands for the deployment of innovative systems, terminals and applications, smart antennas etc. Furthermore, it is strange to see UMTS TDD micro/pico cells quoted as this is the one area of application of 3G technology that never materialised. Indeed, the UK 3G TDD spectrum remains unused to this day. For such systems to be cited as the most likely use seems to be strange indeed.

Reference to Tables 55, 57, 59 and 60 of the CD illustrates the point on the overly constrained Visualyse input parameters (for a 5MHz channel):-

- Base station heights of 10m
- Assumed cell radius of just 315m (FDD) and 200m (TDD) cell radii;
- Maximum Base Station EIRP of 40dBm (FDD) and 24dBm (TDD) (for the non-restricted channels §9 allows 54dBm/MHz EIRP);
- Maximum Mobile Station EIRP of 9.6dBm (FDD) and 7.6dBm (TDD) (§9 allows +28dBm/MHz);
- Base station antenna gain of 5dB (FDD) and 0dB (TDD);
- Measurement areas (for 50% of which the PFD values of the SURs must not be exceeded) of 0.34km$^2$ (FDD) and 0.14km$^2$ (TDD) (we assume the 34km$^2$ values in §A13.4 of the CD should be 0.34km$^2$).

These parameters represent just one area of application ("street level" micro/pico-cells), and this would certainly not encourage business model creativity and the deployment of technical innovation.

A compounding issue is the assumption that TDD would be of lesser power/coverage area to FDD, and hence would be of lower power. This is somewhat discriminatory, and probably goes too far in determining "probable applications". It remains BT's understanding that Ofcom's expression of the "probable use" remains far more generic, i.e. it encompasses at least FDD, TDD, Cellular, Broadband Wireless, PMSE etc, but not the engineering or commercial detail of these applications. The pre-judgment on power levels, cell size etc. tends to return us to a situation where regulation tries to determine what the market wants and can have.

Not all of the problems propagate through into the SURs in §9 of the CD, but the derived PFD values do and, more crucially, so do the small cell areas (0.34km$^2$ (FDD) and 0.14km$^2$ (TDD)) which now become the mandated measurement areas. As noted in §2.4 of this response, these constrain the range of applications for both TDD and FDD, penalizing the former more than the latter.

At the Ofcom Seminar of 8th February 2007, Ofcom re-iterated its intention that SURs would provide flexibility, allowing several low power base stations to be interchanged with fewer high power base stations, depending on the system and application. However, with the SURs being devised around low power systems in small measurement areas, BT believes that fulfillment of this essential objective for SURs is at risk. Spectrum that is unnecessarily constrained by regulation and/or that is disadvantaged vis-à-vis other similar spectrum could distort the wireless market.

In a related context, we would disagree fundamentally with the statement in Annex 11, §A11.30, that UMTS TDD and WiMAX TDD are similar for the purposes of calculating SUR parameters. These and other wireless technologies that could possibly be used in this band all operate in very different ways and such a generalization is not at all acceptable.

# Conclusions

From our review of the proposals within the Consultation Document and the supporting material we conclude that:-

- The release of these frequency bands (2010-2025MHz, 2500-2690MHz and 2290-2300MHz) to the market via technology neutral awards should help to bring wireless innovation to consumers at a time of growing interest in personal broadband and convergence, and we encourage Ofcom to proceed with the minimum of delay.

- Whilst we can support the concept of a spectrum cap, we firmly believe that such a cap must cease to apply once the award is complete. To continue it beyond the auction would, we believe, run counter to Ofcom's core policies of allowing spectrum aggregation, spectrum trading and spectrum liberalization.

- Ofcom should achieve the maximum level of transparency during the auction. Whilst within the main text of the CD Ofcom commits to a low level of transparency, we have a strong preference for, and fully support, Ofcom's implicit position in §§A8.174-A8.176 that the general presumption should indeed be for more transparency. In BT's view there is no case for limiting transparency.

- Having carefully reviewed the current SUR proposals, we are concerned that these ideas are not yet sufficiently well formed to be used in these spectrum awards. BT is therefore of the view that the more conventional approach of employing conventional spectrum masks to define the emission constraints for systems using these bands remains preferable. We develop our arguments for this have been provided in **§2.4** and in our answers to Questions 17 – 22 inclusive that are set out in **§3**

- BT can generally support the proposed spectrum masks as set out in §9 of the CD. However, we have made some comments t on the detail of these, and our views have been included in our response to Question 11.

- BT has important concerns with the draft licence (Annex 9 of the CD). As stated in **§2.6** of this response, BT believes that Ofcom should issue some clarity and guidance on this issue as soon as practicable, giving as much confidence as possible to prospective bidders that their solution will be mirrored by appropriate CPE licensing as necessary within a reasonable timeframe from the award. Ultimately, the ease with which 3rd party users are able to participate in the use of networks will be fundamentally business case affecting.