Variation of UK Broadband's 3.4 GHz Licence

Ofcom's consideration of a request to extend the licence term indefinitely

Consultation

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About this Document

This consultation document sets out a proposal to grant an extension to the spectrum licence held by UK Broadband Ltd. within the 3.4 GHz band. It presents an assessment of the potential impact of this proposal within the context of our statutory duties.

UK Broadband's request is for an indefinite extension of its existing licence beyond the current expiry date of July 2018. The licence authorises use of two 20 MHz blocks of spectrum in the frequency ranges 3480-3500 MHz and 3580-3600 MHz.

Ofcom believes granting the request would promote competition and encourage investment and innovation, in line with our statutory duties to further the interests of citizens and consumers.

We invite the views of interested parties and will consider responses before reaching a final decision.

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Section 1

Executive Summary

1.1 This consultation sets out a proposal to agree to a request to extend for an indefinite period the duration of the wireless telegraphy licence held by UK Broadband Limited ('UK Broadband') within the 3.4 GHz frequency band. UK Broadband holds 40 MHz of spectrum in two separate 20 MHz blocks at 3480-3500 MHz and at 3580-3600 MHz.

1.2 A request was submitted by UK Broadband to Ofcom in March 2013 asking for the licence to be varied to extend its duration beyond the current expiry date of July 2018. We have now considered this request in light of our statutory duties and propose to grant the requested variation, subject to consultation responses. The licence will be subject to an annual fee from the current expiry date.

1.3 In its submission in support of a licence extension, UK Broadband says it intends to deploy a 3.4 GHz network focussing initially on fixed wireless broadband and on mobile broadband services in major urban areas. The services will reach an estimated 45% of the UK's population. Before committing to the necessary investment the company says it requires long-term certainty over the 40 MHz of spectrum it holds in the 3.4 GHz band.

Background

1.4 Ofcom intends to award an additional 150 MHz of spectrum in the same 3.4 GHz band (3410 to 3600 MHz) in which UK Broadband has its current holding. This additional spectrum is being released by the Ministry of Defence (MOD) as part of a Government commitment to make 500 MHz of public sector spectrum available for civil use by 2020.

1.5 In connection with this award, we published on 16 October 2013 a consultation[1] on a proposal to vary UK Broadband's existing licence so that its 40 MHz of spectrum could be consolidated into a single contiguous 40 MHz block between 3560 and 3600 MHz. We said such a change would make it easier to accommodate a wider range of demands within the spectrum to be awarded, and reduce the number of inter-operator frequency boundaries.

1.6 This new consultation sets out the reasons we are not proceeding with that proposal at this stage.

Our consideration of UK Broadband's request

1.7 We have considered UK Broadband's request for a licence extension against our statutory duties under the Communications Act 2003 and the Wireless Telegraphy Act 2006. In particular, we have taken account of our duties:

- to further the interests of citizens and consumers in relation to communications matters;
- to promote competition to further the interests of consumers; and

[1] http://stakeholders.ofcom.org.uk/binaries/consultations/2.3-3.4-ghz/summary/2.3-3.4-ghz.pdf

- to ensure the optimal use of the radio spectrum.

1.8 We considered two alternatives for dealing with UK Broadband's request: either by refusing the request or by extending the licence as requested. Under the first option, UK Broadband's licence would be allowed to expire and we would conduct a fresh award - either as part of the planned 3.4 GHz award (expected to be held in the financial year 2015/16) or in a subsequent award for the spectrum.

1.9 In considering the options, we took account of evidence provided by UK Broadband that it intends to go ahead rapidly with investment in a new network - bringing the prospect of consumer benefits through keenly priced new services and increased competition. This will initially be in the fixed wireless broadband market but also includes mobile broadband. The company says its investment is unlikely to proceed unless the company can secure on-going access to spectrum.

1.10 The option of licence extension offers the potential for benefits to citizens and consumers due to earlier investment by UK Broadband than is likely to occur under the option of allowing the licence to expire – although those benefits could still occur subsequent to expiry. Such an investment will increase competition in the broadband sector.

1.11 However, there is also a potential cost from less efficient use of spectrum than might otherwise be possible. This is because the current UK Broadband holding is split into two blocks, which means there are more boundaries with other users than would exist if there was a single contiguous block.

1.12 We consider that granting an extension is consistent with our statutory duties in that it will further the interests of citizens and consumers, including through the promotion of competition, and will encourage investment and innovation.

1.13 Although there may be some risk of spectrum inefficiency we believe there may be mechanisms available to address this issue in the future.

Our proposal

1.14 Having considered the two options we propose, subject to this consultation, to grant UK Broadband's request for an indefinite extension to its 3.4 GHz licence.

1.15 We further propose that the licence extension will be subject to the application of an annual spectrum fee. This will be subject to further consultation, but we expect the fee to be set in accordance with the principles of Administered Incentive Pricing (AIP). Until now, no such fee has been applicable because the original spectrum award was made through an auction, which therefore determined the fee.

Potential consolidation of UK Broadband's spectrum holding

1.16 Some responses to our 16 October consultation set out arguments disagreeing with our proposal to vary UK Broadband's existing licence in order to consolidate its two 20 MHz holdings of 3.4 GHz spectrum into a single contiguous 40 MHz block. In particular, it was suggested that the proposal to relocate UK Broadband's holding at 3480-3500 MHz to 3560-3580 amounted to a new award of spectrum and should be subject to a competitive process.

1.17 In light of this we have decided not to proceed with our proposal to consolidate the spectrum holding at this stage. This consultation is therefore limited to the single issue of licence extension.

1.18 Nevertheless, as indicated in our earlier consultation, we believe that consolidation may lead to more efficient use of spectrum in the 3.4 GHz band in the long-term. Consolidation would capture the consumer benefits achieved from extending the UK Broadband licence whilst mitigating the potential loss in spectrum efficiency arising from the existing non-consolidated holding (but with costs incurred by UK Broadband to relocate to new frequencies).

1.19 It is possible that such an outcome could be achieved after the planned 3.4 GHz auction through spectrum trading. However, we are also interested in exploring the potential for this to be addressed through the design of the PSSR award process. We will consult on the design for the PSSR 3.4 GHz auction in the autumn of 2014.

Next steps

1.20 We invite the views of stakeholders on our proposal to extend UK Broadband's licence for an indefinite period and to charge an annual licence fee. Our consultation closes on 25 July 2014.

Section 2

Introduction

2.1 This consultation sets out our assessment of a request by UK Broadband Limited for us to make a change to the terms and conditions of a licence it holds. The licence was granted by Ofcom to the company under the Wireless Telegraphy Act 2006. It authorises use of certain radio frequencies in the 3.4 GHz band.

2.2 The licence is due to expire in July 2018. UK Broadband has requested that we amend the licence to change that expiry date. The company has asked that the licence runs for an indefinite period of time, but subject to terms enabling revocation by Ofcom in particular circumstances (which are common to a large number of wireless telegraphy licences).

2.3 UK Broadband's licence authorises the use of 40 MHz of radio spectrum in two separate 20 MHz blocks at 3480-3500 MHz and at 3580-3600 MHz.

2.4 The licence has been held since 2003 following an auction. The request for a licence variation extending the existing licence beyond July 2018 was submitted to Ofcom in March 2013.

2.5 The remainder of this document is set out as follows:

- **Section 3** describes the history and background to UK Broadband's 3.4 GHz spectrum holding and the context for its request for a licence extension;
- **Section 4** sets out the legal and regulatory framework in which Ofcom must make its decisions;
- **Section 5** sets out our options in considering UK Broadband's request;
- **Section 6** outlines the practical consequences of granting an extension to UK Broadband's licence, namely the implications for licence conditions and annual fees;
- **Section 7** discusses the responses to our earlier consultation on consolidating UK Broadband's two 20 MHz spectrum holdings into a single contiguous block. It explores alternative ways in which the possible inefficiency costs of fragmentation might be addressed, and invites input from stakeholders.

Section 3

Background on UK Broadband's licence and the 3.4 GHz band

3.1 This section sets out the background to UK Broadband's use of radio frequencies in the 3.4 GHz band and the context for its request for a variation to its licence to allow an extension for an idefinite period.

3.2 As already identified, UK Broadband is authorised to use 40 MHz of radio frequency in two separate 20 MHz blocks at 3480-3500 MHz and at 3580-3600 MHz. These radio frequencies sit within a larger block of spectrum being released by the Ministry of Defence (MOD) for civil use (see Fig 2.1 below).

History of UK Broadband's licence

3.3 In 2001, the MOD agreed to release 40 MHz of spectrum in the 3.4 GHz band to the Radiocommunications Agency (RA) and it was awarded via an auction. The spectrum was made available for use on a technology neutral basis, but was awarded as two separate 20 MHz blocks, which allowed for the possibility of an FDD option for fixed wireless operations.

3.4 The RA auctioned 15 regional 3.4 GHz Public Fixed Wireless Access Operator licences in June 2003 (the '2003 auction'). The 15 regions together comprised the whole of the UK. Following the auction Pound Radio was awarded on 17 July 2003 a licence for 13 of the regions. Shortly afterwards this company changed its name to UK Broadband. It also purchased the companies that had won the other two licences. The licences authorised UK Broadband to operate radio equipment in the frequency ranges 3480-3500 MHz and 3580-3600 MHz.

3.5 In December 2006 UK Broadband asked Ofcom to vary its three licences so that all 15 regions were covered by a single licence. On 19 March 2007 Ofcom agreed to the replacement of these three licences with a single UK licence and subsequently issued a revised licence. Apart from some updating of the licence, for example to reflect the replacement of the Wireless Telegraphy Act 1949 by the Wireless Telegraphy Act 2006, the licence conditions were effectively identical to those in the licences granted in July 2003.

3.6 UK Broadband's licence authorised the establishment, installation and use of Public Fixed Wireless Access transceivers. The end user terminals included in this term were limited to customer premises equipment. The licence also stipulated maximum power limits but did not impose any limitation on the technology that UK Broadband may use.

3.7 In 2007 UK Broadband successfully requested a variation to alter its licence in two ways:

- to allow technology and application neutrality to remove the limitation to fixed applications;
- to increase the permitted power limits.

3.8 In the absence of widely available equipment able to use the 3.4 GHz band the rights to use the radio frequencies were not successfully exploited immediately. However, UK Broadband has invested subsequently in establishing a pilot network using its 3.4 GHz spectrum holdings in central London to offer wireless broadband services. Its fixed consumer service was launched on 4 June 2014[2]. The new services use a TDD arrangement.

3.9 The company now intends to deploy a national 3.4 GHz network focusing on major urban areas and reaching an estimated 45% of the UK's population. It plans to make a substantial investment before 2018 with a view to establishing wireless broadband services to homes/offices in major urban areas, and in 'not spots'. It also plans to offer national mobile coverage through a Mobile Virtual Network Operator (MVNO) arrangement,

3.10 However, in its submission to Ofcom, the company has indicated that it requires long term business certainty about licence holdings which authorise access to radio frequencies before such a significant financial outlay can be justified and says, therefore, that a licence extension is vital.

3.11 Our assessment of UK Broadband's future investment plans in relation to the request for licence extension is considered in detail in section 5.

The Public Sector Spectrum Release programme

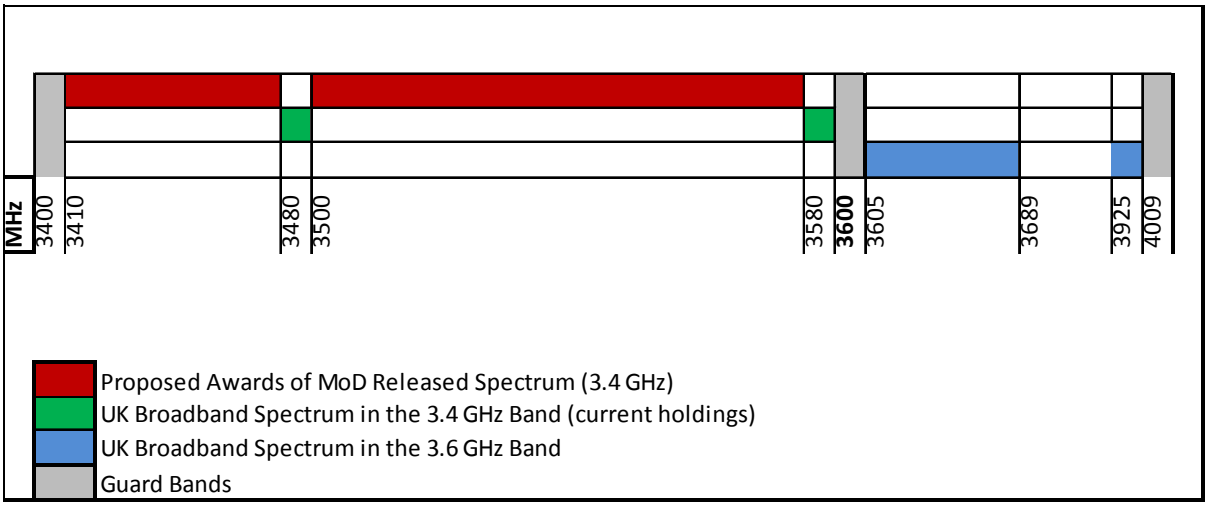
3.12 A total of 150 MHz of radio spectrum within the 3.4 GHz band is being released by the MOD to Ofcom for licensing. This released spectrum comprises frequencies in the range 3410-3600 MHz (excluding the 40 MHz held by UK Broadband). This additional 3.4 GHz spectrum forms part of the Public Sector Spectrum Release (PSSR) programme, which aims to free up 500 MHz of public sector spectrum for civil use by 2020.

3.13 The 3.4 GHz award is likely to be attractive to mobile network operators looking to use the spectrum for high power applications such as Long Term Evolution (LTE) mobile broadband. The MOD has asked Ofcom to award licences to use these radio frequencies in 2015/16. We intend to conduct a market led award by use of an auction process.

3.14 Figure 2.1 below illustrates UK Broadband's holdings in the 3.4 GHz band in relation to the additional spectrum being released by the MOD. The figure also shows UK Broadband's further spectrum holdings in the neighbouring 3.6 GHz band (N.B this is a separate holding and is not part of this consultation).

[2] http://www.ukbroadband.com/Relish

Figure 2.1 - UKB's Position in 3.4 GHz (and Adjacent Bands)



3.4 GHz band – band plan and international framework

3.15 There have been a number of developments affecting the 3.4 GHz band during the period of UK Broadband's licence holding.

3.16 At an international level, the 3.4 GHz band is allocated by the International Telecommunication Union (ITU) for fixed, mobile, fixed satellite (space to Earth) and radiolocation services. The ITU has also identified this band as suitable for International Mobile Telecommunications (IMT) for a defined grouping of countries. In 2007 CEPT issued a decision (ECC/DEC(07)02) aimed at harmonising the radio frequencies between 3400 and 3800 MHz for the implementation of broadband wireless access systems.

3.17 The 3.4 GHz band is already used for wireless broadband in a number of countries. In Europe there have been authorisations in Estonia, Germany, Ireland, Italy, Latvia, Macedonia, Norway, Spain, Sweden, Switzerland, Portugal and the UK (by UK Broadband). More widely, countries using or testing the band for wireless broadband include Nigeria, Hong Kong, New Zealand, Australia and Japan.

3.18 The USA is considering allowing shared access to the 3550-3650 MHz frequencies via a managed database system. This would be based on small cell use of the spectrum, to protect incumbent users.

3.19 The European Commission has sought to harmonise the 3400-3800 MHz band for terrestrial systems capable of providing 'electronic communications services' - for example mobile or fixed broadband - across the EU[3]. In relation to the 3.4-3.6 GHz band, the decision provided that member states should designate, by 21 November 2008, the band, on a non-exclusive basis, for terrestrial electronic communications networks in compliance with the parameters set out in the annex to the decision. Subsequently, CEPT developed channelling arrangements for the band in Decision ECC/DEC/(11)06. These included paired and unpaired band plans for 3400-3600 MHz, and an unpaired-only band plan for 3600-3800 MHz.

3.20 In 2012 the Commission issued a mandate to CEPT to undertake studies on amending the technical conditions in Decision 2008/411/EC to make them suitable

[3] European Commission Decision 2008/411/EC

for wide bandwidth wireless broadband systems and to include a harmonised band plan. The CEPT work in response initially resulted in two choices for harmonised band plans in the 3400-3600 MHz band: a paired (FDD[4]) option; or an unpaired (TDD[5]) option.

3.21 Ofcom consulted stakeholders on which of these two options should be applied to the 3.4 GHz award[6], proposing that TDD would lead to a more efficient use of spectrum and a greater level of benefits. A majority of CEPT administrations have since reached the same conclusion and have agreed that the preferred band plan should be TDD.

3.22 This conclusion was reflected in CEPT Report 49[7], which was delivered to the European Commission on 5-8 November 2013. The European Commission's Radio Spectrum Committee considered the CEPT report on 11-12 December 2013.

3.23 The Commission Implementing Decision was adopted on 2 May 2014 amending Decision 2008/411/EC on the harmonisation of 3.4–3.8GHz in accordance with the opinion of the Radio Spectrum Committee.[8] The amended Decision primarily revised the technical conditions set out in the annex, in compliance with which the band needs to be made available. It stated that the preferred duplex mode of operation in the 3.4-3.6 GHz sub-band shall be Time Division Duplex (TDD). We made a statement indicating that we will adopt a TDD-only band plan in February 2014.

3.24 The Decision sets a deadline of 30 June 2015 for Member States to apply the technical conditions. (The decision is set out in section 4 of this document in relation to the legal framework.)

[4] Frequency division duplex is used to transmit the outward and return signals in different frequency channels, so both signals can be transmitted and received at the same time
[5] Time division duplex is used to separate the outward and return signals in the same frequency channel by time
[6] Within our October 2013 consultation: http://stakeholders.ofcom.org.uk/binaries/consultations/2.3-3.4-ghz/summary/2.3-3.4-ghz.pdf
[7] http://www.erodocdb.dk/Docs/doc98/official/Word/CEPTREP049.DOCX
[8] Decision 2014/276/EU of 14 May 2014, OJ L139/18.

Section 4

Ofcom's duties and functions

4.1 This section provides an overview of the main European and UK legislative provisions relevant to wireless telegraphy licensing and the requested variation. It is not a full statement of all the legal provisions which may be relevant to Ofcom's functions and to wireless telegraphy licensing.

Ofcom's general duties

4.2 Section 3 of the Communications Act 2003 states the general duties of Ofcom. Under section 3(1) it is the principal duty of Ofcom in carrying out its functions:

- to further the interests of citizens in relation to communications matters; and
- to further the interests of consumers in relevant markets, where appropriate by promoting competition.

4.3 In doing so, Ofcom is required to secure, amongst others (under section 3(2)):

- the optimal use for wireless telegraphy of the electro-magnetic spectrum; and
- the availability throughout the UK of a wide range of electronic communications services.

4.4 In performing the duties referred to in paragraph 3.2, Ofcom must have regard to, amongst others, the following matters:

- the desirability of promoting competition (section 3(4)(b));
- the desirability of encouraging investment and innovation (section 3(4)(d));
- the desirability of encouraging availability and use of high speed data transfer services throughout the UK (section 3(4)(e)); and
- the different needs and interests of persons in different parts of the UK (section 3(4)(l)).

4.5 The management of the UK radio spectrum is governed by the European Communications Directives, which aims to harmonise the regulation of electronic communications networks and services throughout the European Union. Related to that, Section 4 of the 2003 Act requires Ofcom when carrying out its spectrum functions to act in accordance with "six community requirements" when managing the wireless spectrum within the UK. These include:

- the requirement to promote competition (section 4(3));
- the requirement to secure that Ofcom's activities contribute to the development of the European internal market (section 4(4));
- the requirement to promote the interests of all persons who are citizens of the European Union (section 4(5));

Ofcom's duties when carrying out spectrum functions

4.6 In carrying out its spectrum functions it is the duty of Ofcom (under section 3 of the 2006 Act) to have regard in particular to:

- the extent to which the spectrum is available for use or further use, for wireless telegraphy;
- the demand for use of that spectrum for wireless telegraphy; and
- the demand that is likely to arise in future for the use of that spectrum for wireless telegraphy.

4.7 It is also the duty of Ofcom to have regard, in particular, to the desirability of promoting:

- the efficient management and use of the spectrum for wireless telegraphy;
- the economic and other benefits that may arise from the use of wireless telegraphy;
- the development of innovative services; and
- competition in the provision of electronic communications services.

4.8 Where it appears to Ofcom that any of its duties in section 3 of the 2006 Act conflict with one or more of its general duties under sections 3 to 6 of the 2003 Act, priority must be given to its duties under the 2003 Act.

Ofcom's spectrum functions

4.9 Ofcom's powers to carry out its spectrum functions are set out in the Wireless Telegraphy Act 2006. Such powers include, under Schedule 1(6) of the 2006 Act, the general discretion to revoke or vary any wireless telegraphy licences by serving a notice in writing on the licence holder or by way of general notice to licensees in a class.

4.10 Ofcom also has a duty (set out section 9(7) of the 2006 Act, reflecting Article 6 of the EU Authorisation Directive 2002/20/EC) to ensure that wireless telegraphy licence conditions are objectively justified in relation to networks and services to which they relate, non-discriminatory, proportionate and transparent. Ofcom considers that this obligation is ongoing and must be assessed against market circumstances and the state of technology development at the time.

4.11 Ofcom therefore has a broad discretion under Schedule 1(6) of the 2006 Act to agree to vary licences, but legal rules operate to limit that discretion. These legal rules on licence variation include the following:

4.12 UK obligations under European law or international agreements where use of spectrum has been harmonised: Ofcom will not agree to changes that would conflict with the UK's obligations under international law. This includes changes that would contravene binding Community measures, such as directives or harmonisation measures adopted under the Radio Spectrum Decision (676/2002/EC) and ITU Radio Regulations.

- Ofcom must act in accordance with its statutory duties, as set out above.
- Ofcom must act in accordance with its obligations under the European Authorisation Directive (2002/20/EC).
- General legal principles, which include the duties to act reasonably and rationally when making decisions and to take account of legitimate expectations.

Commission Decision 2008/411/EC on the harmonisation of the 3400-3800 MHz frequency band and Commission Decision 2014/276/EU amending Decision 2008/411/EC

4.13 On 21 May 2008, the European Commission adopted a decision which sought to harmonise the technical conditions for using the spectrum in the 3400-3800 MHz frequency band for the terrestrial provision of electronic communications services throughout the EU, mainly targeting wireless broadband services[9]. The parameters identified block-edge masks as the means to ensure coexistence between neighbouring networks.

4.14 The Commission Decision was implemented in the UK by way of the 3400-3800 MHz Frequency Band (Management) Regulations 2008[10], which required Ofcom to exercise its functions under the WTA so as to give effect to the obligations of the United Kingdom under the Commission Decision.

4.15 On 2 May 2014, the Commission adopted a decision amending Decision 2008/411/EC, in particular in relation to the technical conditions for using the spectrum. The decision reflects CEPT[11] Report 49 of 8 November 2013, which includes the results of studies on the least restrictive technical conditions (such as block edge masks), frequency arrangements and principles for coexistence and coordination between wireless broadband and existing spectrum uses.

4.16 The decision also provides that while it is without prejudice to the protection and continued operation of other existing use in the bands, the new harmonised technical conditions should also apply, to the extent necessary, to existing spectrum usage rights in the 3400-3800 MHz frequency band so as to ensure technical compatibility between existing and new users of the band, efficient spectrum use and avoidance of harmful interference.

4.17 This affects UK Broadband's licence because the decision applies to the 3.4 GHz frequencies licensed to the company.

Impact assessment

4.18 This consultation as a whole, including its annexes, comprises an impact assessment as defined in Section 7 of the Communications Act.

4.19 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in Section 7 of the Act, which means that generally we have to carry out impact assessments where our proposals would be

[9] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:144:0077:0081:EN:PDF
[10] S.I. 2008/2794; http://www.legislation.gov.uk/uksi/2008/2794/pdfs/uksi_20082794_en.pdf
[11] CEPT: European Conference of Postal and Telecommunications Administrations

likely to have a significant impact on businesses or the general public, or when there is a major change in Ofcom's activities.

4.20 The following sections and annexes contain analysis of policy options relating to the question of extending UK Broadband's 3.4 GHz licence, and the potential impact of our proposals. In particular, we have considered the citizen and consumer interests in relation to our policy objectives.

4.21 Ofcom is an evidence based organisation and welcomes responses to this consultation. Any comments about our assessment of the impact of our proposals should be sent to us by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals. For further information about our approach to impact assessments, see the guidelines, Better policy-making: Ofcom's approach to impact assessment, which are on our website: http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf

Equality Impact Assessment

4.22 Ofcom is separately required by statute to assess the potential impact of all our functions, policies, projects and practices on race, disability and gender equality. Equality Impact Assessments (EIAs) also assist us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers regardless of their background or identity.

4.23 We do not consider that our proposals in respect to UK broadband's licence extension are likely to have a particular impact on one group of stakeholders as opposed to another.

4.24 Additionally, we do not believe any aspect of the question of whether or not to extend UK broadband's licence raises issues requiring separate EIAs in relation to race or gender equality or equality schemes under the Northern Ireland and Disability Equality Schemes.

Section 5

Assessment of UK Broadband's Licence Variation Request

Introduction

5.1 This section of the consultation assesses the pros and cons of granting UK Broadband's request for an extension of the duration of its wireless telegraphy licence in the 3.4 GHz band. We have considered two main options:

- Option 1: the request for a licence variation is refused. Under this option, the existing licence would terminate automatically in July 2018, and the 40 MHz of spectrum covered by the current UK Broadband licence would either be auctioned alongside the additional 150 MHz of spectrum in the 3.4 GHz band being released by the MOD; or auctioned separately in a subsequent award. In either case, full rights would only be available after UK Broadband's current licence expires in July 2018.

- Option 2: the request for a licence variation which would change the licence duration is granted. Under this option, the existing UK Broadband 3.4 GHz licence would be extended for an indefinite period. The newly varied licence would be subject to an annual licence fee from 2018.

Framework for our analysis

5.2 We have considered our two options in light of our statutory duties as identified in section 4. We set out how we have taken account of the key relevant duties in some detail below, and follow this same structure in our subsequent assessment of costs and benefits. However, it is important first to identify the overall framework within which we have conducted our analysis. Our assessment of the options takes place against the background of our duties as a whole.

5.3 We have noted and considered the evidence that UK Broadband has provided in support of its request for a licence extension. Namely, the evidence behind the assertion that the company will proceed rapidly with investment in a new network - bringing the consumer benefits from new services and the potential for benefits from competition in the broadband market.

5.4 In considering UK Broadband's request, we have noted the potential benefits in light of our duties to promote competition; to support innovation; and to promote investment. We have balanced this against the potential for any spectrum inefficiency which might arise from more fragmented use of the band as a whole if the variation were granted. We currently consider that the appropriate proposed decision is to agree to the licence variation request. We are seeking views on this proposal.

5.5 In relation to spectrum efficiency we would note at the outset of this discussion that this variation request does not necessitate any change to the parameters for transmission which are authorised under the licence. So there will be no additional risk of harmful radio interference to third parties.

The interests of citizens and consumers

5.6 As described above, the Communications Act 2003 provides that it shall be the principal duty of Ofcom, in carrying out its functions, to further the interests of citizens in communications matters; and to further the interests of consumers in relevant markets, where appropriate by promoting competition. In general, the interests of citizens and consumers are furthered by:

- the introduction of new services;
- reductions in prices;
- improvements in quality;
- widening consumer choice; and
- bringing these benefits forward in time.[12]

5.7 We have considered whether such benefits would arise in this context. We have considered both benefits to fixed and to mobile broadband consumers. In addition we have undertaken some quantified analayis. This has focussed on the benefits to UK Broadband's fixed broadband customers, because UK Broadband's fixed service is being launched before its mobile service, and the product and commercial features are clearer at this stage.

Promoting competition

5.8 As noted, the statutory regime requires that we further the interests of consumers in relation to communications matter, where appropriate by promoting competition.

5.9 Although regulation may be needed to protect consumers - for example where there is market failure - it is not a cost-free or a risk-free activity. We consider that it is generally better for consumers if markets themselves work effectively, and this usually requires markets to be competitive.

5.10 We believe that competitive markets tend to be better than regulators at responding to changes in consumer needs, developing new products, and at identifying ways of doing things more efficiently, including by saving costs. Where effective and sustainable competition can be established, regulation can be withdrawn.

5.11 In the light of this, we have considered the benefits that Option 2 could bring to consumers through promoting competition in the provision of fixed and mobile broadband services.

Optimal use of spectrum

5.12 The Communications Act provides that Ofcom is required to secure a number of things which would further Ofcom's principal duties with respect to the interests of citizens and consumers. This includes securing the optimal use for wireless telegraphy of the electro-magnetic spectrum. Under the Wireless Telegraphy Act, Ofcom must also have regard to the desirability of promoting the efficient

[12] Other things equal, consumers prefer £1 today to £1 tomorrow or in ten years time. We take account of this preference in our quantitative analysis by discounting future costs and benefits at the Social Time Preference Rate. We describe our approach to discounting more fully in Annex 5.

management and use of the part of the electro-magnetic spectrum available for wireless telegraphy.

5.13 We have considered in particular the costs in terms of spectrum efficiency which are likely to arise from the fact that UK Broadband's spectrum holdings are not contiguous. Having two separate blocks of spectrum increases the scope for interference with users in neighbouring parts of the band, and means extra costs may need to be incurred to avoid it i.e. the use of spectrum is likely to be less efficient.

5.14 Although clearly relevant, this is only one aspect of efficiency and the concept of economic efficiency is a broader one. Ensuring that spectrum is used optimally means that account must be taken of the value provided to consumers by the use of spectrum.

5.15 In addition, determining what is optimal may require us to take a long-term perspective. For example, competition often leads to increased costs in the short-term if entrants duplicate an incumbent's existing network and economies of scale are lost. But such losses of 'static efficiency' may in the longer term be outweighed by gains in 'dynamic efficiency'. Dynamic efficiency refers to the improvements in efficiency that occur over time as innovation and investment leads to lower costs and the introduction of new services, often as a result of competitive pressure.

Investment and innovation

5.16 Under the Communications Act, Ofcom must have regard to the desirability of encouraging investment and innovation in relevant markets. We also have a duty to secure the availability throughout the UK of a wide range of electronic communications services. The Wireless Telegraphy Act provides that Ofcom must have regard to the desirability of promoting the development of innovative services.

5.17 Creating a telecommunications network, whether based on copper, fibre or wireless technology, requires a great deal of investment. Without capital expenditure on a large scale, consumers would not be able to benefit from competition from operators of new networks, or from new services which also often require substantial new investment. When Ofcom carried out its *"Strategic Review of Telecommunications"* in 2004/05, we noted that many respondents to our consultations emphasised "the increasing importance of timely investment in leading-edge telecoms services to the competitiveness of the UK economy".[13] We believe that point is as relevant today.

5.18 Product innovation enables consumers to benefit from higher quality, greater functionality, speed or flexibility from the products they purchase. Other innovations may lower the costs of providing services, enabling prices to be reduced, again to the benefit of consumers.

5.19 We have considered whether extending UK Broadband's licence could enable its customers to benefit from its past investment and innovation and encourage further investment and innovation in future. We have also considered whether UK Broadband's investment could create the conditions for technological "spillovers" to the rest of the 3.4 GHz band, allowing later users of the spectrum to deploy broadband services in the band more quickly and/or at lower cost.

[13] Ofcom, "*Strategic Review of Telecommunications, Phase 2 consultation document",* 18 November 2004, paragraph 1.7, http://stakeholders.ofcom.org.uk/binaries/consultations/telecoms_p2/summary/maincondoc.pdf.

Our assessment in detail

5.20 In the rest of this section, we set out our more detailed assessment of the options. In particular the application of the statutory framework (about competition, spectrum efficiency, consumer benefits and investment and innovation) leads us to consider three key issues:

- Firstly, would extending the duration of UK Broadband's licence term increase investment by UK Broadband? Extension is only likely to result in benefits if it brings about an increase in investment as UK Broadband claims.

- Secondly, would the investment be sustainable? For sustainable benefits we believe UK Broadband should be able to compete in the long-term without regulatory support.[14]

- Thirdly, would the benefits for citizens and consumers which could flow from UK Broadband's investment be sufficiently likely to exceed any costs arising from any loss of overall spectrum efficiency in the 3.4 GHz band?

5.21 Both costs and benefits are subject to uncertainties. For example, we cannot be certain that UK Broadband will succeed in attracting customers in the numbers it expects and which we have reflected in our quantified analysis. This is captured in our approach to evaluating both costs and benefits. We ask under what circumstances the benefits are likely to exceed the costs we have identified. In particular, we consider whether, on balance, the benefits to consumers of lower fixed broadband prices and faster broadband, together with other potential benefits, will outweigh any future disbenefits (or costs) which might be associated with fragmented spectrum holdings. Hence, whilst we have not sought to second-guess UK Broadband's business plan, our assessment does not depend on UK Broadband achieving its business plan in full if it goes ahead. Moreover, we focus on benefits and costs which might be borne by consumers rather than on the costs, revenues and profits in UK Broadband's business plan.

5.22 More detail of the methods we have used to estimate the value of the benefits and costs which we have been able to quantify is set out in Annex 5.

Will extending the duration of UK Broadband's licence result in increased investment by UK Broadband?

5.23 We asked UK Broadband for a copy of its business plan as signed off by the UK Broadband board in London and/or the PCCW board in Hong Kong, together with supporting documentation (such as market research reports), in order to show that it would indeed make the proposed investment if its licence were extended. We also asked UK Broadband to supply a copy of any independent review of its business plan which had been undertaken.[15]

5.24 UK Broadband said that the business plan which it submitted to Ofcom in July 2013 had been signed off by both the London and Hong Kong boards in June 2013. It also

[14] Our section 4 duties (duties for the purpose of fulfilling EU obligations) refer to "securing sustainable competition". Similarly, in our Strategic Review of Telecommunications we said "*The objective is sustainable competition"* Strategic Review of Telecommunications, Phase 2 consultation document, November 2004, page 6.

[15] In this section, we draw on The February submission: UK Broadband, Responses to Ofcom's request for further information dated 28 January 2014, questions 1 - 3.

said that it had subsequently revised this plan to include expansion into additional markets and that the revised plan was signed off, again by both the parent company and the UK Broadband board, in December 2013. UK Broadband also supplied a copy of an independent review of the plan by Deloitte.

5.25 UK Broadband also explained that the development of LTE technology meant the time was now right for it to proceed with its investment. It said the technology had caught up with its own business vision.[16]

5.26 In the light of the above, we consider that UK Broadband has taken the actions we would expect of a company seriously appraising a significant investment. We believe that the business plan, with independent review and high-level sign-off by the parent company, indicates that it will go ahead with the planned investment if its licence is extended. We also note that the financial projections supplied, which were extracted from the plan, showed that the investment was expected to earn internal rates of return above the company's minimum requirement, and that this suggests that UK Broadband believes that it has a financial incentive to undertake the planned investment.

5.27 We also asked UK Broadband for information to demonstrate that extension was a critical and necessary condition for its planned investment to go ahead.

5.28 UK Broadband explained that its business plan is dependent on the extension of the current spectrum licence. Specifically, it states that "..if the licence extension were not to be granted, UK Broadband's investors would abandon the current business plan and, instead seek to maximise all possible returns with the existing assets within the time period available". The company also notes: "If this window is missed, there is no guarantee that the same opportunity or appetite for investment will exist in the future".[17]

5.29 UK Broadband said that it would support existing contracts to 2018 and beyond where possible. However, without an extension, the company said there would be nothing to encourage further real investment by PCCW in the UK."

5.30 UK Broadband's view therefore was that delay to the investment would lead to crucial opportunities being missed which would undermine the investment case.

5.31 However, we were also concerned to understand why UK Broadband would not go ahead with the investment without delay, on the basis that, if its licence were not extended, it would have the option of taking part in the planned auction of the 3.4GHz band. If UK Broadband were to go ahead with its plan on this basis, it would then have to pay whatever price was necessary to obtain spectrum in the auction. On the other hand, if its licence is extended UK Broadband will expect to pay an annual fee from 2018.

5.32 Bids and prices in the PSSR award for 3.4 GHz spectrum are expected to provide a good indication of the opportunity cost of spectrum in the band at the time of the auction. This will be relevant for us to take into account, along with any other relevant evidence, when we consider the appropriate level of annual fees to apply in 2018. In principle therefore, the costs to UK Broadband of obtaining spectrum through the auction or through extension of its existing licence are likely to have some similarity.

[16] The July 2013 submission, paragraph 1.3.
[17] The February submission UK Broadband, Responses to Ofcom's request for further information dated 28 January 2014, questions 5 and question 3.

5.33 We have therefore asked UK Broadband to explain why it regards uncertainty about the outcome of the auction as fundamentally different from uncertainty about annual fees, to an extent that it would not invest unless its licence is extended.

5.34 In submissions to Ofcom, UK Broadband assured us there were a number of reasons why it regarded uncertainty about the auction outcome as fundamentally different from the uncertainty around the level of annual fees - and which meant that its parent company would not invest substantial sums in advance of an auction which UK Broadband might not win.[18] One reason was that some of UK Broadband's large potential customers themselves saw the two types of uncertainty as different. For example, assured access to spectrum might be a pre-condition for being able to bid for certain contracts. UK Broadband was also concerned that it might be the target for strategic bidding in the auction.

5.35 As to why it was unconcerned about the exact level of the annual fee, it said that this was because its business case was sufficiently robust to cater for different reasonable assumptions about the scale of the fee. It also noted that it could be possible to trade the rights to use radio frequencies under a licence to a third party, though it considered that it would be unlikely to wish to do so.[19]

5.36 In the circumstances, we consider that it is more likely that UK Broadband's investment will go ahead as planned if the licence is extended than if it is not. In our quantified analysis, we have allowed for the possibility that another operator could invest, with similar benefits (we assume) if UK Broadband leaves the market, but only with a significant delay. Alternatively, if its licence is not extended, UK Broadband could (if it were successful in bidding at the auction) obtain righst to use radio frequencies through the auction, again resulting in a time delay (though a shorter one) to its investment and achievement of the resulting benefits.

Is UK Broadband's Business Plan consistent with sustainable investment?

5.37 UK Broadband has stated to Ofcom that it intends to use its 40 MHz of 3.4 GHz spectrum along with other spectrum it holds to build a dual LTE and Microwave Ethernet network to cover 45% of the UK's population and create a new national wholesale network. For this investment to be sustainable in the longer term, it will need to be commercially viable without regulatory support.

5.38 As noted above, UK Broadband has also submitted a business plan including financial projections which show that its planned investments would generate an internal rate of return above the company's required rate, if the plan was achieved. It also told us this plan was signed off by UK Broadband's Board on 3rd December 2013 following an independent evaluation by Deloitte in June 2013.[20]

5.39 UK Broadband's business plan shows that it is planning to use its network to offer a home broadband product which will provide an unlimited usage broadband package with a speeds up to 65Mbps for a total charge of £20 per month, and £25 + VAT per month for business customers. [21] UK Broadband's product does not include a voice

[18] See, in particular, 'The February Submission', pages 7 – 8 and 'The March Submission', page 5.
[19] 'The March Submission', page 5.
[20] UK Broadband, Responses to Ofcom's request for further information dated 28 January 2014 in connection with the proposed variation of UK Broadband's 380MHz-3500MHz and 3580MHz-3600MHz spectrum licences, 12 February 2014 (The February submission).
[21] Prices inclusive of VAT. UK Broadband, Proposed variation of UK Broadband's 380MHz-3500MHZ and 3480MHz-3600MHz spectrum licences, 22 April 2014, page 2.

landline, so customers that switch to UK Broadband are assumed to rely on VOIP or mobile voice.

5.40 UK Broadband told us that, for planning purposes, it had assumed that on average over ten years, 30% of its customers would take its fixed service and 70% its mobile service.[22] However, it said that it planned to launch the mobile service slightly later than the fixed service, and it expected the share of its customers which take the mobile service to increase over time.

5.41 UK Broadband also plans to offer large enterprise products using a combination of LTE and microwave technologies. They describe this product as offering flexible speed options, faster installation times and portability as well as a potential use as a secondary resilient path.

5.42 The financial projections allow for spectrum fees to be paid at rates that reflect the (expected) opportunity cost of the spectrum, that is, its value to the highest-value alternative user (or use). Moreover, the projections indicate that the investment could still be viable if the cost of spectrum turns out to be higher than assumed. In its submission to Ofcom, UK Broadband states that under Option 2 it is prepared to undertake long term investment in the face of uncertainty over the level of annual fees post 2018, on the basis that this annual fee is linked to the 3.4 GHz auction price.

5.43 In addition, we have considered whether it may be technically possible to use 3.4 GHz spectrum to deliver the services proposed to the customer numbers expected, and whether the business plan is consistent with the broad trends that we expect to observe in the market. We note that broadly similar technology is already in use in Japan. Regarding market trends, we expect the demand for high-speed broadband to keep growing, and we see that some customers are willing to give up the fixed access line for voice services. We are also aware of other examples of plans for entry in broadband markets. This indicates there is a market opportunity and suggests the proposed service is commercially sustainable. On the other hand, it could also mean competition for UK Broadband and the capture by rivals of some of the benefits sought by the company.

5.44 We have not sought to second-guess the business plan made by UK Broadband. The company is better placed than we are to take a view on the available market opportunity and has better knowledge of the costs. But, as we noted above, we believe that the business plan, with independent review and high-level sign-off by the parent company, is consistent with the company having carefully appraised a significant investment, and believing it to be commercially sustainable in the market environment it expects to face.

5.45 In particular, we note that UK Broadband expects to earn more than a minimum commercial rate of return on its investment, whilst paying annual fees which reflect its expectation of the opportunity cost of spectrum, and that its parent company appears willing to commit the necessary funds on this basis. These factors are consistent with the proposed service being commercially sustainable. But we also recognise that the business plan may not be achieved in reality or may change during its execution. Our assessment does not depend on the plan being achieved in full.

5.46 With this caveat, we have used information from the plan to inform our quantitative assessment of costs and benefits because we consider it provides the best

[22] Letter from Nicholas James to Andrew Hudson, 19th May 2014

information available about the services UK Broadband would offer, the prices, and likely customer numbers if its licence were extended (and if it successfully implemented its business plan).

Assessment of benefits for citizens and consumers

5.47 The types of benefits which could arise, which we discuss in this section, are:

- Lower prices:
- Faster download speeds:
- Reaching new customers:
- Innovative new services
- Potential dynamic benefits from increased competition;
- More favourable terms and conditions;
- Improved functionality for emergency services; and
- Benefits to other users of the band from earlier development of the 3.4GHz ecosystem.

5.48 If UK Broadband introduces the new service it proposes in its business plan it could create benefits for consumers who take up the service. The precise way in which customers will benefit will depend on what they would have done in the absence of the service.

5.49 A customer who would not have used a fixed broadband service at all will get different benefits to one who would have used a lower speed service or a more expensive service of a similar speed. But in each case, consumers will benefit if the service is better than existing offers, e.g. if it is available at a lower price or better quality.

5.50 As noted, we focus on benefits to UK Broadband's fixed broadband customers because the fixed service is being launched in advance of the mobile service. Reflecting this, planned mobile service prices and service characteristics are less clear than those of the fixed service, and other mobile offers may also be expected to develop by the time UK Broadband launches its mobile service. However UK Broadband says that its mobile service *"will be competitive on both price and amount of data offered"*[23]. There may therefore be some additional benefit to users of UK Broadband's mobile service which we have not quantified.

5.51 By contrast, the fixed service is ready to launch, we know launch prices and service characteristics and these appear to offer some potentially significant and quantifiable advantages over other fixed offers. However, as the fixed service is only expected to account for some 30% of subscribers on average over the plan period, it could be misleading to compare the benefits of the fixed service to the entirety of the costs associated with licence extension.

[23] Email from Nicholas James to Andrew Hudson of 25th May.

5.52 As we have not quantified any of the other possible benefits listed above, the approach we adopt is to identify a reasonable proportion of the costs to compare to the quantified benefits of the fixed service, in a range of different scenarios.

Benefits from lower prices

5.53 The launch of UK Broadband's new services could provide lower prices for its customers. UK Broadband expects its fixed broadband product to compare favourably with its competitors in terms of price. Lower prices will clearly benefit the consumers who take the service and save money as a result. The price saving itself is a good measure of the value to existing consumers of lower prices, and this is important because of our duty to further consumers' interests.

5.54 However, in the long-term, the scale of the benefit for consumers may depend on whether UK Broadband's prices are lower because of lower costs than competitors, or whether a lower price is offered with similar costs, or in spite of higher costs. In the long-term, higher costs are unlikely to be in consumers' best interests as they are likely to borne by customers. In addition, sustainable prices need to be sufficient to allow recovery of efficiently incurred costs including the cost of capital.

5.55 UK Broadband's lower prices do not necessarily imply similarly lower costs and higher efficiency than for other network operators. One reason is that any cost advantage possessed by UK Broadband may derive from operating only in a limited area, where the average cost of serving customers is relatively low. Another reason may be that other operators' prices are typically set to recover both forward-looking and sunk costs.[24]

5.56 A large part of the price saving for UK Broadband's fixed customers comes from avoiding the need for a fixed access line. However, when a customer of another fixed operator switches to UK Broadband, some of the costs of providing the now redundant line will not be avoided.

5.57 This is because a large part of the fixed line rental goes to recover the costs incurred in the past to dig and install 'copper in duct', and these cannot be avoided even if the customer ceases to take a fixed-line service.[25] Hence, although the different and innovative technology that UK Broadband proposes to use means that no new costs of digging duct and installing fibre are incurred, the costs which have already been sunk in access lines which are no longer needed will not be saved.

5.58 However, where there is no fixed network and no costs are sunk, then UK Broadband's lower prices are more likely to reflect an increase in economic efficiency, to the extent that UK Broadband has lower forward looking costs than providers of alternative services. Indeed, UK Broadband's pricing plans suggest that it believes that its technology might then be more efficient than a traditional fixed network, at least given the services it plans to provide and its geographic coverage.

[24] Sunk costs are costs which do not need to be incurred in future over the relevant time horizon and which cannot be recovered on exit. A sunk asset is one which will not require replacement for the firm to stay in the market, even in the long-term. It is usually considered appropriate for regulated prices to allow recovery of sunk costs in order to provide incentives for investment: if investors thought that their investments, once sunk, would be regarded as irrelevant for pricing purposes, they would be reluctant to make investments in future.

[25] Fixed line assets that are long lived (duct is the obvious example) may have low forward looking costs relative to their replacement value.

5.59 It is therefore possible in principle to distinguish between consumer benefits from lower prices which reflect savings in forward-looking costs and greater efficiency – these are a benefit to the economy as a whole; and consumer benefits which are not matched by savings in forward-looking costs – these benefit consumers but in themselves are not a gain to the economy.

5.60 The precise balance between the two is uncertain. However, the extent by which UK Broadband plans to undercut other operators' prices and the returns it anticipates suggest that it expects to be a relatively low-cost operator. This indicates that UK Broadband could be an efficient entrant and benefits from lower prices are therefore likely to be at least in part a reflection of this. In our quantitative analysis, we have not attempted to differentiate between price savings which are matched by cost savings, and any which are not.

5.61 The size of the aggregate benefit from price savings depends on the price discount that UK Broadband's customers will gain, and this in turn will depend on the service they were taking before switching to UK Broadband, if any. Given the characteristics of the UK Broadband service we consider that some customers are likely to switch from other fixed broadband providers.

5.62 The aggregate benefits to these customers from lower prices are potentially large, with average broadband prices £12 per month higher[26] than UK Broadband's proposed tariff of £20 for residential customers. However, as noted above, the size of this benefit depends on the product UK Broadband's customers were using prior to joining UK Broadband. Standard broadband users will save less than existing superfast broadband (SFBB)[27] users, for example (as discussed below, they will additionally benefit from the higher-speed of the service). The size of the benefit also depends on how long the UK Broadband price discount will persist over time, and on the amount of time that UK Broadband's investment would be stalled without a licence extension. The benefits of extension are a lot higher if investment would otherwise be stalled for longer.

5.63 In addition, some of the price saving benefits could be offset if there are disadvantages for customers, such as any deterioration in consumer experience from relying for voice services on VOIP or mobile. However, these disadvantages may be small for the customers that join UK Broadband if they do not require or want a fixed voice service.

5.64 As a result of these uncertainties, we do not attempt to produce a'"preferred estimate" of total benefits to consumers. However, a conclusion that there is likely to be some benefit to consumers is not sufficient for our purposes. It is also important to know whether such benefits are likely to exceed any costs arising from less efficient

[26] We assume an average charge of £32 including line rental. This is consistent with data from Ofcom, "*The Consumer Experience of 2013*": January 2014, pages 104 and 111 at http://stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-13/TCE_Research_final.pdf (the CER 2013). The CER 2013 data include both standard and SFBB packages but, on the other hand, also include legacy packages which may no longer be marketed to new customers and which may have higher prices than current offers. We also note that a price of £32 is comparable to the mid-point of the range of SFBB prices shown in Figure 3.1 of Ofcom "*Review of the wholesale broadband access markets: Draft statement on market definition, market power determinations and remedies*" 19 May 2014 at http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/statement/WBA-draft-statement.pdf

[27] Superfast Broadband (SFBB) is a broadband connection that can support a maximum download speed of 30Mbps or greater.

spectrum use, and which could also be borne by consumers. We have therefore adopted an approach to this question which does not require us to make a "preferred" estimate of benefits. We calculate a "threshold price" for UK Broadband's fixed broadband service at which the benefits to consumers from lower prices (which, naturally, are greater the lower the price), combined with the benefits of faster broadband speeds, just equal the estimated additional costs which might arise from any reduction in spectrum efficiency. We calculate different values for this "threshold price" for a range of different assumptions which affect costs and benefits. Where the threshold price is above the price that UK Broadband actually plans to charge (£20 at launch), we regard this as evidence that, at the prices actually charged, benefits to UK Broadband's fixed broadband customers are likely to be sufficient to offset an appropriate proportion of the costs associated with extending the licence net of the benefits of faster broadband speeds and given the other assumptions made (see Annex 5 for further details). We have not attempted to quantify this benefit.

5.65 The price which UK Broadband would need to offer its fixed broadband customers in order to fully offset an appropriate proportion of the net costs of licence extension depends on the length of the delay to investment which would be caused by not extending its licence. The longer the delay, the higher the UK Broadband price that is consistent with licence extension producing a net benefit. For example, if the delay is four years, a UK Broadband price of £28 per month would be sufficient for quantified benefits to just equal an appropriate share of quantified costs if costs are at the low end of the range we consider reasonable - whilst if costs are at the high end of the reasonable range the UK Broadband price would need to be £23 or lower.[28] See Annex 5 for a full discussion of the quantified costs and benefits.

5.66 In either case, this is significantly above UK Broadband's proposed residential price of £20 per month, indicating that licence extension is likely to be beneficial in this scenario on the basis of quantified costs and benefits if UK Broadband's proposed price is sustained.

5.67 On the other hand, a short delay of, say one year, could mean that net quantified benefits would only arise if UK Broadband priced at £24 even if costs are at the low end of the range we consider reasonable. If costs are at the high end of the reasonable range, a net quantified benefit might only arise if UK Broadband were to price below its planned level of £20, indicating that licence extension is less likely to be beneficial if the amount of time by which it brings forward investment is short.

Quality improvement - Benefits from faster download speeds

5.68 The launch of UK Broadband's new services could provide faster speeds for its customers. This would apply to all users who switch to UK Broadband from a standard broadband product (or potentially no fixed broadband product). Furthermore, some of these customers may currently be in areas where high speed broadband is not available; these users are likely to benefit most (on average) from taking up the UK Broadband product.

5.69 Indeed, UK Broadband has told us that its initial launch programme will include a significant number of areas that currently do not get high speed internet, including the

[28] This represents a saving of between £4 and £9 per month on the assumed average residential broadband price of £32 per month including the line rental.

Docklands and Canary Wharf in London, although it acknowledges that fixed line speeds may be upgraded over time.[29]

5.70 In order to evaluate the benefits to customers of higher speeds we need to understand the type of customers who are likely to use UK Broadband's fixed service. This affects the value they are likely to place on the service, and the choices open to them. However, in its market research into potential users of its service, UK Broadband did not identify the product currently used.

5.71 In assessing the size of these benefits we have assumed that some level of benefit accrues to each UK Broadband customer that obtains the advantage of faster fixed broadband speed. One way of measuring the value consumers place on a service is 'consumer surplus' i.e. the difference between the maximum amount a consumer would be willing to pay for a service and the price they are actually required to pay. We have independent estimates of consumers' willingness to pay for SFBB from work undertaken by Enders Analysis in 2011. We can use this to assess the value to consumers of higher broadband speeds provided by UK Broadband.[30]

5.72 We assume that those customers that do not currently have access to high speed broadband benefit most (by on average £3.50 per month). Those that currently have such access, but currently choose not to take a SFBB product, are assumed to benefit by (on average) £2 per month.[31] Based on these assumptions the net consumer benefits of faster download speeds under Option 2 (granting the extension) we estimate may be around £5m-£18m in NPV terms.[32] The range reflects the amount of time that UK Broadband's investment is stalled without a licence extension. The benefits of extension would be at the high end of the range if investment would otherwise be stalled for longer but at the low end if investment would proceed relatively quickly in any case.[33]

More favourable terms and conditions

5.73 UK Broadband claims that its customers will also benefit from more favourable terms and conditions, in particular faster installation times and shorter-term contracts than other fixed operators provide. There is evidence on the potential scale of these benefits from Ofcom's Fixed Line Installation and Fault Repair Summary Report.

5.74 Ofcom surveyed private fixed-line users and SMEs about their willingness to pay (WTP) for earlier installation. 73% of private consumers and 55% of business users stated that their WTP for early installation is £0 - but those that *were* willing to pay

[29] UK Broadband, The February submission, Question 9.
[30] The willingness to pay figures are based on: Enders Analysis, "*UK residential high speed broadband outlook: leading the horse to water",* 20 July 2011, page 6. Clearly these figures must be considered approximate.
[31] In other words, the average willingness to pay across all consumers is assumed to be £3.50 per month above the standard broadband price. The average among those who currently have access to superfast broadband but choose not to take it is assumed to be lower at £2 per month above standard broadband. The derivation of these assumptions is explained in Annex 5. It is not possible to determine the WTP specific to the mix of customers UK Broadband is likely to gain. In our quantitative analysis we reflect the distribution of UK Broadband customers among these three categories based on market-level averages.
[32] We consider consumer benefits that would accrue in NPV terms over the period of UK Broadband's business plan which runs to 2022/23.
[33] See Annex 5 for a full discussion of the size of costs and benefits.

had relatively high valuations.[34] Overall the scale of these benefits is likely to be small, though they might be material to some customers. We have not included these benefits in our quantified assessment.

Improved functionality for emergency services

5.75 UK Broadband has also stated that it is actively involved in the stages to date of the ESMCP programme for emergency services. [35] UK Broadband says that it could provide full functionality for a new Emergency Services Network by deploying an eLTE solution. If this is correct, then extending UK Broadband's licence to allow the company to have an opportunity to compete for this business could lead to benefits for the emergency services and other large users. However, we have not tested whether UK Broadband would be able to offer a better service than potential alternative suppliers, and nor have we attempted to place a value on these benefits.[36]

Reaching New Customers

5.76 Another way in which lower prices can increase consumer welfare is by expanding the market. Expanding the market through price reductions is a benefit to the economy as a whole, as long as the price is not less than the extra costs incurred - that is the (forward-looking) incremental cost. The prices of telecommunications services are almost always above incremental costs because firms also need to recover common costs and sunk costs, which in telecoms are generally significant. However, reducing prices towards incremental costs will mean that more customers who have a willingness to pay above the incremental cost will be able to consume the service, and this will add to total consumer welfare.[37]

5.77 UK Broadband has also told us that it is planning to target customers who who either cannot get sufficiently fast broadband or who do not choose to have a landline. These may be customers who are not currently able to find a service which meets their needs e.g. those in temporary accommodation. [38] In addition, it plans to serve areas where broadband speeds are slow or SFBB is not available.

5.78 If UK Broadband succeeds in its aim of attracting customers who do not currently take a (fixed) broadband service, it will expand the market through price reductions

[34] The median amount private and business consumers are willing to pay for early installation is £19 and £44 respectively.
[35] Letter from Nicholas James to Andrew Hudson, 19th May 2014.
[36] In addition, deployment of the ESN may require additional base station sites and hence additional filter and RRU costs. For consistency we have included neither benefits nor costs related to the ESN in our quantified analysis.
[37] Strictly, any price above marginal cost could increase economic efficiency. Marginal cost is a special case of incremental cost where the increment is one unit of output. A large proportion of the costs of telecoms networks are fixed in the short run, and short run marginal costs can be very low. Setting prices in relation to short run marginal costs would therefore generally understate the costs of telecoms services and incremental cost is generally considered to be a more appropriate benchmark in telecoms networks for this reason. For a discussion of cost concepts, see "*Fixed access market reviews: Approach to setting LLU and WLR charge controls",* 11 July 2013, paragraphs 3.13 – 3.15 at: http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/summary/LLU_WLR_CC_2014.pdf
[38] For data on non-ownership of communication services, including internet access, see "The Consumer Experience of 2013" http://stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-13/TCE_Research_final.pdf, Ofcom, January 2014, Section 6.6

which enable more consumers to purchase the service. The result is likely to be increases in total consumer welfare and gains in economic efficiency.

5.79 New consumers' willingness to pay for UK Broadband's services will in part be reflected in a net gain in consumer surplus. If these customers had the same willingness to pay for SFBB as other customers (we assume this to be £3.50 per month plus the standard broadband price on average), then the welfare gains from serving such customers could be large.

5.80 The value new consumers place on the service will also in part be captured by UK Broadband itself and reflected in the revenues and returns projected in its business plan. The profits that UK Broadband expects to earn (over and above the cost of capital) are another component of value, even if they do not immediately benefit consumers.

5.81 On the other hand, the fact that no fixed broadband service is currently taken suggests that these customers' willingness to pay might be lower than the average. We also understand that UK Broadband's planned, and relatively low, price was informed by market research which included questions on willingness to pay.

5.82 There is some uncertainty about the value of the benefits created by serving these customers therefore.[39] However, we can say that, if they become UK Broadband customers they would have voluntarily purchased a product that was not available before. As such, it is reasonable to expect they would be made better off as a result of the introduction of the UK Broadband product, at the prices charged.

5.83 In addition, if bringing high speed broadband to customers who do not have access to such services at present also benefited other users, additional benefits over and above the consumers' own willingness to pay for higher speeds could be created. These are more likely to be relevant if the increase in speed is significant enough to enable a step change in the type of service which customers are able to use and if this step change enables users to participate in a wider range of activities.[40] We have not attempted to quantify this benefit.

Innovation and new services

5.84 UK Broadband has been present in the UK since March 2003. Initial efforts to market fixed wireless broadband services using TDD-CDMA technology were ultimately not successful but, since then, the spectrum UK Broadband holds has been included in Release 10 of the 3GPP LTE standards. UK Broadband now aims to invest in a new network in order to bring the new technology to market and obtain the rewards of its earlier innovation.

5.85 Extending UK Broadband's licence could, by enabling UK Broadband (and its customers) to benefit from its past investment and innovation, encourage further investment and innovation in future. A rapid implementation of its business plan could enable UK Broadband to introduce further new services as they become technically

[39] Given the difficulties in quantifying this potential market expansion benefit, we have not attempted to do so. Instead, in the quantitative analysis, all UK Broadband customers are assumed to take either a standard or an SFBB product, and we do not identify or treat separately customers who might not previously have taken a fixed broadband service. For a given level of willingness to pay, this affects the distribution of benefits between "price cuts" and "faster speeds".

[40] For a discussion of the circumstances in which "broader social value" may arise, see for example Ofcom, "*Digital Dividend Review*", 19 December 2006 at http://stakeholders.ofcom.org.uk/binaries/consultations/ddr/summary/ddrmain.pdf

and commercially feasible - utilising its new infrastructure to provide services such as microwave Ethernet backhaul networks. UK Broadband has stated it would be in a good position to bring innovative services to the market.

Benefits from earlier development of the 3.4 GHz ecosystem

5.86 Early development and marketing of products and services is likely to create the conditions for technological spillovers to the rest of the 3.4 GHz band. These could permit faster development of the ecosystem for broadband services in the band, which may enable deployment by later users more quickly and/or at lower cost.

5.87 We consider that extending UK Broadband's licence could encourage investment and innovation, consistent with Ofcom's duties. We have not attempted to quantify this benefit.

Promoting competition

5.88 In economic efficiency terms, the introduction of competition very often involves a trade-off between dynamic and static efficiency. Where static inefficiency arises, it is often because of duplication by a competitor of the incumbent's assets, the costs of which may be sunk. This may mean that total costs increase in the short-term but, in the longer term, competitive pressure leads to bigger cost reductions and dynamic efficiency gains which more than offset the initial static efficiency losses.

5.89 If the markets in which entry occurs are already competitive then the extent of further dynamic gains are likely to be more limited. But if entry occurs in markets where there is less competition then they can be much larger.

5.90 UK Broadband proposes to offer a wireless broadband service that will provide both fixed home broadband services and mobile broadband services. This suggests that it will be competing initially in the retail market for fixed broadband access alongside BT, Virgin and LLU operators such as Sky and TalkTalk. However, UK Broadband itself says it is not aiming to go head to head with the larger operators but seeking to fill perceived gaps in the market. [41]

5.91 A first step in an analysis of competition effects is normally a careful definition of the relevant economic market. However, firms often use the term market in a different way to economists or competition authorities, and often define markets more narrowly than an economist would. Hence, there is no necessary inconsistency between UK Broadband's view that it is not intending to compete 'head-to-head' with other fixed operators and a conclusion that it will operate in the same economic market.

5.92 Whilst it is also true that Ofcom has generally not placed services provided by fixed wireless access (FWA) in the same market as other cable and copper-based broadband products, this is because existing FWA services have not become a real alternative to fixed broadband products. This in turn is likely to be a reflection of the characteristics of the current generation of FWA services which have now been available for several years.

5.93 These FWA products have sometimes been considered as an 'in-fill' technology that can be used to provide services in 'not-spots' (areas where cable and ADSL technologies cannot provide satisfactory services for technical and/or economic

[41] UK Broadband, Letter to Andrew Hudson from Nicholas James, 22nd April 2014.

reasons). Alternatively, FWA services via WiFi in urban areas have generally had a lower quality to that of fixed broadband and as a result are positioned as complementary to fixed broadband offerings rather than a substitute.[42]

5.94 However, this does not necessarily mean that UK Broadband will not attract customers from fixed network providers. UK Broadband's new service is likely to have advantages over earlier FWA products and to offer quality and prices which compare more favourably to fixed line services. UK Broadband has told us that its home broadband product differs from most existing FWA services and will enable more applications. The fixed broadband service will also be very keenly priced. This suggests that it could have an impact greater than earlier FWA products if it is successful.[43] Moreover, products which are 'just outside' a market can also have a constraining effect on prices within it.[44]

5.95 We therefore think that, if it is successful, UK Broadband's offer of a high-speed broadband service at a competitive price is likely to attract users of existing broadband services, even if these are outside its particular prime targets. Indeed, UK Broadband itself refers to fixed-line providers as "our competitors" in its business plan, and illustrates a claim that "we can price very favourably with competitors" by comparison of its own prices with the prices of comparable high-speed broadband services with unlimited usage offered by Virgin, TalkTalk, Sky, and BT.

5.96 UK Broadband's new service could therefore create 'spillover' benefits to customers who remain with other operators but receive price reductions which their existing suppliers make as a competitive response to UK Broadband. However, we have not attempted to quantify these benefits. This is because the magnitude of any such benefits is highly uncertain. In particular:

- As with UK Broadband's own price reductions, the price cut itself is not a gain in economic efficiency unless it results from a cost reduction or to the extent that it results in market expansion;
- UK Broadband intends to operate in a geographically limited area which may mean that national operators do not match UK Broadband prices or, if they do, it may be by "de-averaging" prices which could mean that customers in other areas pay more; and
- UK Broadband says that it does not intend to compete head on with existing broadband providers but is seeking incremental broadband users.

5.97 However, there are also reasons for thinking that, if UK Broadband does induce a competitive response, then its impact could be significant in relation to its size. In particular UK Broadband would be a full infrastructure competitor – unlike LLU

[42] See pages 72 - 73, Ofcom, Review of the wholesale broadband access markets: Draft statement on market definition, market power determinations and remedies, 19 May 2014 at http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/statement/WBA-draft-statement.pdf.

[43] UK Broadband projects a total of 1.7m (fixed and mobile) subscribers by 2022. See 'The February Submission', page 7.

[44] Market boundaries are usually defined on the basis of the ability of substitution between products in the market to make a "small but significant non-transitory increase in price" unprofitable. This does not mean that other services can have no constraining effect on the prices of services within the market. For example, such "external constraints" were taken into account explicitly in the SMP assessment in Ofcom's February 2013 "Business connectivity market review", http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/statement

operators such as Sky and TalkTalk for example – and with a different cost structure to other suppliers of broadband services.

5.98 Competition for customers at the retail level between full-infrastructure operators can impose pressure to reduce costs at all levels in the value chain. This means that UK Broadband would, in effect, have the ability to compete at the infrastructure level, in a market in which BT has entrenched market power and entry is generally considered unlikely.[45] Hence, if UK Broadband were to be seen as a competitor to BT, even on a small scale or in certain geographical areas, there is the potential for dynamic benefits (innovation and cost reductions over time) from any increased competition it provides.

5.99 Entry by UK Broadband could also encourage future rollout of SFBB into the same areas by BT or others, adding to consumer choice and competition and bringing additional benefits. Moreover, the threat of entry by UK Broadband could encourage BT and other operators to roll out into other areas not yet served by any SFBB provider.[46]

Ensuring the optimal use of the radio spectrum

5.100 The foregoing discussion of consumer and competition benefits is also relevant to the consideration in this section of whether extending UK Broadband's licence is likely to lead to optimal use. But to avoid repetition, we focus here on the impact of extension on efficient spectrum use. There will no harmful interference arising from this decision as it concerns only licence extension, and there is to be no relaxation of transmission parameters. However, licence extension may, in some circumstances, mean that additional costs are incurred to prevent interference (compared to Option 1) because UK Broadband holds its spectrum in two non-contiguous blocks.

5.101 In the light of our duties, we consider it appropriate to take account of costs which are likely to be borne by consumers (though perhaps in the longer term), even if initially they fall on UK Broadband or other operators. If a cost is likely to be passed on, we also need to identify an appropriate proportion of costs in our quantified analysis to compare with our estimates of the potential benefits to fixed broadband customers, because the quantitative analysis only includes benefits to fixed customers. In particular, we need to take account of the fact that fixed broadband customers make up only 30% of UK Broadband's projected customer base in its business plan.

5.102 This means that, if a cost is passed on by UK Broadband to its customers, users of UK Broadband's fixed service are unlikely to bear all of it, and might only bear a relatively small proportion, with the rest borne by users of UK Broadband's mobile service or other customers which are not included in our quantitative assessment of

[45] This market is termed the "Wholesale Local Access Market". On 20 May 2014, Ofcom published the draft conclusions of its "Fixed Access Market Review", including draft findings on the competitivess of the wholesale local access market. See Ofcom "*Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 Volume 1: Draft statement on the markets, market power determinations and remedies*."
http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/volume1.pdf

[46] Competitive interactions of this kind have been noted elsewhere: see for example, Charles River Associates report for DG Information Society and Media, "*Costing methodologies and incentives to invest in fibre*", July 2012,
http://www.crai.com/ecp/assets/20120705_finalreport_costing_cra.pdf. CRA were commissioned by the EC to advise it on setting access prices to encourage investment in fibre networks.

benefits. For the purposes of the quantitative analysis, we have assumed that 30% of UK Broadband's additional costs which are passed on are borne by its fixed-service customers, in line with the proportion of UK Broadband's customers which are expected to take the fixed service.

Impact of licence extension on spectrum efficiency

5.103 UK Broadband currently holds two blocks of 20 MHz of spectrum which are non-contiguously located in the 3.4 GHz band. Following the PSSR award we expect other users to occupy the remainder of this band. If the licence variation is granted it is therefore possible that there may be a more fragmented set of spectrum holdings across the entire band, which entails slightly less efficient use as whole. This is because any non-contiguous holding increases the number of boundaries between operators and so means additional guard bands may be needed to prevent interference between users of adjacent parts of the spectrum. Some additional equipment costs may also then be incurred where holdings are not contiguous..

5.104 In comparing the costs, we assume that these are not incurred if UK Broadband's licence is not extended and the spectrum is re-assigned in 2018.[47] This is because, in this case, we assume that all licensees in the band would be able to have a contiguous spectrum holding. If UK Broadband's licence were extended with its current non-contiguous frequencies, costs (in excess of costs under Option 1) would include: reductions in the amount of spectrum which is usable due to the need for additional guard bands, costs of additional equipment, and the prevention of some auction outcomes. [48]

Less usable spectrum in 3.4 GHz band

5.105 Following the PSSR auction, users will have to operate alongside other users in the band. As we explain below, the risk of interference between neighbouring users means that users will need to reach synchronisation agreements or, if not, they will need to apply internal guard bands at any boundary between different operators, which would reduce the amount of usable spectrum.

5.106 The PSSR auction is currently in the design phase and there are a number of options for the packaging of the award. These packaging options, and the outcome of the auction, will determine the number of such boundaries under Option 1 (no licence extension) and Option 2 (licence extension).

5.107 If there are additional boundaries in the 3.4 GHz spectrum band under Option 2, this could mean that there are additional internal guard bands which reduce the amount of spectrum which can be used in practice compared to under Option 1. In the absence of synchronisation, guard bands would be needed at each boundary between operators and, the greater the number of boundaries, the more spectrum needed for this purpose and the less which could be used to provide services to consumers.

5.108 For example, if we assume that extending UK Broadband's licence creates two additional boundaries in the 3.4 GHz band then, given our proxy estimate of the value of this band, we find that there could be a total cost of £14m-£28m in NPV

[47] If UK Broadband's licence were not extended and it then participated and won spectrum in the PSSR award it would incur some relocation costs in relation to the small number of existing sites in this scenario.
[48] In Section 7 we consider ways of addressing non-contiguous holdings.

terms depending on whether an additional boundary affects 5 MHz or 10 MHz per boundary.

5.109 The costs of less usable spectrum due to additional boundaries would fall on both UK Broadband and a new acquirer of 3.4 GHz spectrum in the PSSR award adjacent to UK Broadband. We include in our quantified estimates all of the costs to the adjacent operator as such costs may adversely affect the services the operator may offer to consumers in Option 2 compared to Option 1, for example by reducing peak speeds.

5.110 As regards the cost to UK Broadband, we consider that the loss of usable spectrum could affect customers through reductions in service quality and so it is appropriate to include a share of these costs in our quantitative assessment. We have assumed that the effects of any reduction in the amount of UK Broadband's holding which is usable are borne proportionately by its fixed and mobile customers.

5.111 We do not know the value consumers would place on any resulting loss of quality, so as a proxy we use an estimate of the value of the unusable spectrum (which also represents the cost of avoiding a quality reduction by hypothetically obtaining more spectrum).

5.112 UK Broadband has noted that it hopes to reach synchronisation agreements with its 3.4 GHz neighbours (i.e. through permissive masks). Synchronisation has the benefits of avoiding some spectral inefficiencies which would otherwise arise from the need to accommodate filter roll-off or guard bands. In theory these savings could create an incentive for operators to agree synchronisation where possible.

5.113 However, a disadvantage of synchronisation is that all operators need to agree the proportion and timing of uplink and downlink traffic and co-operate to make it happen. A difficulty could be that operators have very different business models and timescales for implementing the business models, so they may find it difficult to come to an agreement to synchronise. If synchronisation were agreed, it could significantly reduce the costs of spectrum loss.

Costs of additional remote radio unit (RRU) and filter equipment

5.114 Holding spectrum in two separate blocks rather than as a single contiguous block may, in some circumstances, also result in UK Broadband incurring costs of additional RRU and filter equipment as it deploys base stations in order to prevent interference with neighbouring operators. We estimate that the additional cost to UK Broadband would be approximately £83m in NPV terms.

5.115 UK Broadband's 20 MHz holding in the middle of the 3.4 GHz band may mean a winning bidder in the PSSR auction also receives an assignment of two non-contiguous blocks, depending on the spectrum packages which other bidders want. Some packages may be compatible with UK Broadband's split holding without requiring another assignment to be non-contiguous, but others may not be. If another operator is assigned a non-contiguous holding, and there is no synchronisation, we estimate that the additional costs to that operator would be between approximately £12m if it has 1,000 sites and approximately £56m for 5,000 sites.

5.116 We have included these additional RRU and filter costs imposed on other operators, as there is a clear possibility that these could be passed on to consumers in the form of higher prices or lower quality services.

5.117 It is less clear that any additional costs borne by UK Broadband itself will necessarily be passed on. On one hand, the scale of the profits projected by UK Broadband suggests they could be borne by the company without affecting the planned prices or quality of service. On the other, we understand that they have not been included in UK Broadband financial projections, and so there could be the possibility of some adjustment to prices or services. In the light of this we included UK Broadband RRU and filter costs in our 'high case' estimate of costs[49] but excluded them in our 'low case' estimate of costs.

5.118 The combined total of UK Broadband's and other operators' RRU and filter costs which we have included in our quantitative analysis is between £12m and £80m in NPV terms.

The prevention of some auction outcomes which may be efficient

5.119 UK Broadband's 20 MHz holding in the middle of the band may prevent some auction outcomes which may be efficient. For example, should any potential bidder wish to acquire a contiguous holding of more than 80 MHz, it would not be able to do so due to UK Broadband's position in the middle of the band. A potential bidder for a holding of more than 80 MHz of spectrum in the band might face additional costs if such a holding would have to be non-contiguous.[50]

5.120 Another potential example of an efficient auction outcome being prevented is if a new acquirer of 3.4 GHz spectrum in the PSSR award might have to be assigned non-contiguous spectrum (see Figure A5.3 in Annex 5 for an illustration). This could have an adverse impact on the nature or quality of services that a new acquirer might be able to offer to consumers (e.g. see paragraph 7.14).

5.121 We have not been able to quantify these costs, but we take them into account in our overall assessment (as well as the types of benefit we have not quantified).

Spectrum trading

5.122 If synchronisation is not agreed, there may still be other ways of mitigating the disadvantages resulting from a non-contiguous UK Broadband holding. A possible solution to address this issue is a set of spectrum trades after the PSSR award.[51]

5.123 Cost savings from achieving contiguous holdings would be offset to some degree by the costs to UK Broadband of reconfiguring equipment at existing sites to accommodate new frequency locations. Furthermore, while the prospect of cost savings and more efficient spectrum usage may create incentives for trading to take place, the required set of trades may be complex.

5.124 For example, there may well need to be a set of trades between (say) three operators (i.e. UK Broadband and two others) rather than a bilateral trade between

[49] We included a reasonable proportion of these costs, reflecting UK Broadband's expected proportion of customers taking it fixed broadband service.
[50] In its response to our 2013 Call For Inputs on the PSSR award, BT suggested that it might be interested in a single holding of as much as 120MHz: BT response to the CfI, page 5.
[51] Another possible solution, discussed in Section 7, is consolidation of spectrum holdings through the PSSR award. However, we do not consider that in our assessment of Option 1 and Option 2, as the design of the PSSR will only be considered after we have made this decision.

UK Broadband and one other operator.[52] This additional complication may make it less likely that an efficient allocation would be achieved. The required set of trades might need to be completed in a specific time window shortly after the auction before new acquirers incur sunk costs to use the specific frequencies they acquired (otherwise the costs of changing frequencies to one or more of the participants to the trades might increase, and so reduce the gains from trade). It is also possible that some operators may have a strategic motive to block potential trades (e.g. to prevent competitors obtaining contiguous spectrum).

Is there a higher value use for UK Broadband's spectrum?

5.125 It is possible that another potential acquirer of UK Broadband's spectrum would be able to create more consumer benefits at a lower cost and that extending UK Broadband's licence will prevent them from doing so.

5.126 If UK Broadband is not the highest-value user for its spectrum after 2018, extending its licence is likely to mean that the use of the spectrum will not be as efficient as it could be - unless UK Broadband trades the spectrum to a higher-value user. The advantage of auctioning UK Broadband's spectrum would be that the auction would discover the higher value user and allow spectrum to be assigned to it.

5.127 We are not in a position to say whether UK Broadband will or will not be the highest-value user of its spectrum after 2018. However, this potential cost of any overall efficiency in terms of use of the entire 3.4 GHz band will be mitigated by charging UK Broadband appropriate annual fees post-2018 and by the the opportunity for UK Broadband to trade the spectrum to a higher-value user, provided that there are no practical constraints on doing so.

5.128 Which Option is most likely to lead to the optimal allocation of post 2018 spectrum rights depends on whether or not UK Broadband is the highest value user of these rights. If UK Broadband is the highest value user, then Option 2 avoids a delay in UK Broadband implementing its business plan. If UK Broadband is not the highest value user then auctioning the spectrum (Option 1) is more likely to deliver the most efficient allocation.

5.129 This allocation could also be achieved under the licence extension option through trading the post 2018 rights - although there is no certainty that it would, particularly if trades between UK Broadband and more than one other party would be needed. In addition, there is a possible loss of benefit if, in the auction, the highest value user was not assigned the spectrum immediately adjacent to UK Broadband. This is because the highest-value user could not then obtain a contiguous assignment through trading with UK Broadband alone, whereas if the highest value user acquired all its spectrum in the auction, it would be likely to do so as part of a larger contiguous block.

Summary and conclusion

5.130 In considering UK Broadband's request, we have noted the potential benefits in light of our duties to promote competition; to support innovation; and to promote investment. We have balanced this against the potential for spectrum inefficiency which might arise from slightly more fragmented use of the band as a whole if the

[52] Fully contiguous holdings may be achievable through bilateral trading if a single operator holds the rights to use all the 80MHz of spectrum in the 3.4GHz band between the two UK Broadband holdings. But many other auction outcomes are feasible

variation were granted. We currently consider that when all of these factors are taken into account and in light of our statutory duties, the appropriate proposed decision is to agree to the licence variation request.

5.131 Our proposal is informed by the analysis in this section of the costs and benefits which might flow from licence extension. In summary, the costs and benefits that we have identified are shown in Table 5.1 below. Where we have made quantified estimates of costs and benefits, we have shown these as ranges. The ranges reflect the range of assumptions and outputs we have modelled for the purposes of our quantified analysis. However, we emphasise the difficulties associated with making quantified estimates, and actual outturn costs and benefits could be outside those ranges. Significant weight should also be given to benefits and costs which we have not quantified.

Table 5.1: Summary of Consumer Benefits and Costs of Option 2 relative to Option 1[1]

Type of cost or benefit		Included in quantified analysis
Benefits		
Consumer benefits of faster fixed broadband speeds	✓	£5m-£18m
Consumer benefits of lower fixed broadband prices	✓	Up to £136m
Benefits to mobile subscribers	✓	
Dynamic gains from competition and spillover effects	✓	
Consumer benefits from faster installation times	✓	
Improved functionality for emergency services	✓	
Technological spillovers to rest of 3.4GHz band	✓	
Reaching new customers	✓	
Innovative new services	✓	
Costs		
Less usable spectrum in 3.4GHz band (without synchronisation)	£14m-£28m	£9m - £18m
Costs of additional RRU and filter equipment if holdings are not contiguous (without synchronisation)	To other operators: £12m-£56m To UK Broadband: £83m	To other operators: £12m-£56m To UK Broadband: £0 - £25m
UK Broadband being awarded the spectrum even when it is not the most efficient user	✓	

[1] The red ticks show which potential benefits and costs could apply even if we have not quantified them.

5.132 It should be borne in mind that even the lower estimates of costs in Table 5.1 are in some respects conservative and may not represent the lowest possible costs. If no winner in the PSSR auction receives a split assignment, then the other operator's additional RRU and filter costs would be zero, whilst if operators agree synchronisation, more of the spectrum would be usable and most of the costs

associated with the loss of usable spectrum would be avoided. All the cost estimates above assume that at least some spectrum is rendered unusable and some additional equipment costs are incurred as a result of non-contiguous holdings.

5.133 Depending on the following factors we consider that benefits are more likely to exceed costs:

- the longer the delay to investment in the absence of extension. A long delay before UK Broadband's spectrum would be used if its licence is not extended means any consumer benefits would be pushed well into the future in this case (and consequently would be of lower present value);
- the larger the price saving. The lower UK Broadband's prices relative to other operators, the greater the benefit to consumers;
- the larger the number of customers who would take SFBB from UK Broadband but who would otherwise take a standard speed service from another operator or no fixed broadband service. Consumers on average place a higher value on SFBB than on standard broadband access;
- the greater the degree to which the price saving represents a cost saving. If UK Broadband's costs are lower than other operators, it is more likely that price savings for consumers will be sustained in the longer term;
- the greater the extent to which competition from UK Broadband leads to other operators cutting prices, reducing costs or investing in higher speed services;
- the greater the extent of other unquantified benefits, for example, benefits to mobile subscribers, more favourable terms and conditions, technological spillovers and gains from better meeting the needs of the Emergency Services and other large users;
- the smaller the loss of usable spectrum, for example, if operators in adjacent spectrum are able to agree synchronisation;
- the lower the costs of additional equipment caused by additional adjacencies or non-contiguous assignments;
- the smaller the loss of efficiencies from the prevention of some auction outcomes such as a contiguous block larger than 80 MHz; and
- the higher the value UK Broadband places on the spectrum, relative to other potential users.

5.134 Having considered the two options, we believe that licence extension is appropriate. In particular, we consider that, if its licence is extended:

- UK Broadband is likely to offer fixed SFBB at lower prices than are currently offered, and in some areas where SFBB is not currently available from other operators. It may also appeal to customers who find that their specific needs are not met by other fixed or mobile operators. This will further the interests of citizens and consumers, consistent with our principal duty; and
- UK Broadband is potentially an additional competitor for existing suppliers of fixed broadband services. Unlike LLU operators, UK Broadband will not be reliant

on using BT's access line and, albeit on a small scale, will be able to apply competitive pressure throughout the value chain. This is consistent with promoting competition, where appropriate, and hence with our principal duty.

5.135 Although UK Broadband's split holding may mean that there is some loss of spectrum efficiency in the band, this could largely be avoided if operators reach synchronisation agreements. If such agreements are not reached, our analysis shows that, on reasonable assumptions, the quantified costs of this may well still be outweighed by the quantified benefits to consumers of bringing forward UK Broadband's investment, even if UK Broadband is less commercially successful than its business plan envisages.

5.136 There are both further costs and further benefits that we have not attempted to quantify. The unquantified benefits (such as benefits to mobile subscibers and from additional competition in fixed broadband markets) may exceed the unquantified costs (such as the prevention of some auction outcomes). At the least, we do not consider it is clear that unquantified costs would exceed unquantified benefits.

5.137 UK Broadband's service is innovative: extending the licence would enable this service to be brought to market and encourage further investment and innovation in future. This is consistent with the requirement for Ofcom to have regard to the desirability of encouraging investment and innovation

5.138 We therefore are seeking views on our proposal to grant UK Broadband's request for an indefinite extension to its 3.4 GHz licence.

Questions

Q1: Do you agree with our proposal to approve UK Broadband's Licence Variation request to extend the term of its licence indefinitely from 2018? Do you have any other comments you wish to make?

Section 6

Consequences of extending UK Broadband's licence

6.1 This section of the consultation looks at some consequences arising from an extension of UK Broadband's licence, as we propose.

6.2 It sets out first how the licence will be amended to reflect the extension; it then, considers the question of licence fees; and finally addresses the question of aligning the licence conditions of an extended UK Broadband 3.4 GHz licence with those of other future licences in the same band,

Licence term

6.3 In order to reflect the extension of UK Broadband's licence, we propose to amend the licence term provisions of the licence so they read as follows:

> *"This Licence shall continue in force until revoked by Ofcom or surrendered by the Licensee."*

Licence fees

6.4 Until now, the 3.4 GHz spectrum held by UK Broadband has not attracted annual licence fees because it was awarded through an auction. Spectrum access rights granted via auctions are subject to payment of a sum determined through the award process itself. They are not subject to additional fees until after the end of the initial licence term. We consider what fee level to apply at that time, and once we impose a fee, payment is usually required annually.

6.5 Our spectrum pricing policy was set out in our revised Framework for Spectrum Pricing[53] in 2010 (the SRSP 2010). This notes that where we license spectrum, we employ one of three mechanisms for setting fees for rights to use the frequencies: cost based pricing, administered incentive pricing (AIP) and auctions.

6.6 If we proceed with our proposal to extend the UK Broadband 3.4 GHz licence beyond the initial term it will become subject to payment of an annual fee that has yet to be determined. As set out in the SRSP 2010 document, we consider that we will typically achieve the optimal use of spectrum by setting charges at a level that reflects the opportunity cost of spectrum i.e. at a level consistent with the principles of AIP.

6.7 As the fee will apply from 2018, we will look at the opportunity cost of the spectrum closer to the time and consult on our proposals before setting the fee (see also paragraph 5.32).

6.8 In light of the above, we propose to amend the licence fee provisions of UK Broadband's licence so they read as follows:

[53] http://stakeholders.ofcom.org.uk/binaries/consultations/srsp/statement/srsp-statement.pdf

"From 17 July 2018, the Licensee shall each year pay to Ofcom the relevant fee as provided in section 12 of the Act and the Regulations made thereunder on or before the fee payment date, or on or before such dates as shall be notified in writing to the Licensee, failing which Ofcom may revoke this Licence."

Licence conditions

6.9 This consultation is limited to consideration only of the question of extending – or not – UK Broadband's 3.4 GHz licence.

6.10 However, as noted, the UK Broadband spectrum holding sits within the additional 150 MHz of 3.4 GHz spectrum being released by the MOD under the PSSR programme. We believe it is appropriate that licence conditions should be consistent across the whole band.

6.11 To date, we have not concluded our consideration of the technical and non-technical licence conditions to be applied to that part of the 3.4 GHz spectrum band to be awarded through the PSSR auction. Nevertheless we believe it would be appropriate to align the UK Broadband licence with those of new licensees within a reasonable period from the date of the PSSR award. We note that UK Broadband has indicated a willingness for its licence to be aligned with other 3.4 GHz licensees.

Question

Q2: Do you agree that if the variation to UK Broadband's 3.4 GHz spectrum licence is approved then fees should be charged on an annual AIP basis?

Section 7

Achieving spectrum efficiency

7.1 Although we believe our proposal to extend UK Broadband's licence provides the best overall outcome - when considered against the alternative of not extending the licence - we have noted the potential spectrum inefficiency costs arising from the fact that UK Broadband's 40 GHz of spectrum in the 3.4 GHz band comprises two separate 20 MHz blocks.

7.2 We believe there may be opportunities to address this once the licence has been extended. However, for the avoidance of doubt, our proposal to extend the licence is entirely independent of any potential reallocation of spectrum to avoid fragmentation.

7.3 The original award of two 20 MHz blocks allowed for the possibility of fixed wireless services being established using an FDD arrangement, with one block used for uplink and the other for downlink. The subsequent European harmomnisation of the band with TDD as the preferred band plan – and with UK Broadband now adopting TDD for its newly launched network in any case – means this is no longer relevant.

Options

7.4 One opportunity to avoid or reduce the additional spectrum costs we have identified is if UK Broadband and other operators are able to reach synchronisation agreements. Synchronisation between adjacent operators would, make the achievement of net benefits more likely.

7.5 A further option for reducing the costs of spectrum inefficiencies is if UK Broadband were to relocate some or all of its spectrum to another part of the band i.e. into one contiguous block. There are two ways in which this could be achieved:

- via a spectrum trade; or
- through the PSSR award.

7.6 Extending UK Broadband's licence removes one practical constraint in relation to spectrum trading, namely the uncertainty about spectrum rights post 2018. Trading provides an opportunity to achieve contiguous spectrum after the award, which we discuss in Section 5.

7.7 The alternative to consolidation through trading is to consolidate through the PSSR award itself. Consolidation would capture the consumer benefits achieved from extending the UK Broadband licence whilst mitigating the potential loss in spectrum efficiency arising from the existing non-consolidated holding (but with costs incurred by UK Broadband to relocate to new frequencies).

7.8 We first discuss our previous proposal to consolidate UK Broadband's 3.4 GHz spectrum.

Summary of our earlier consultation

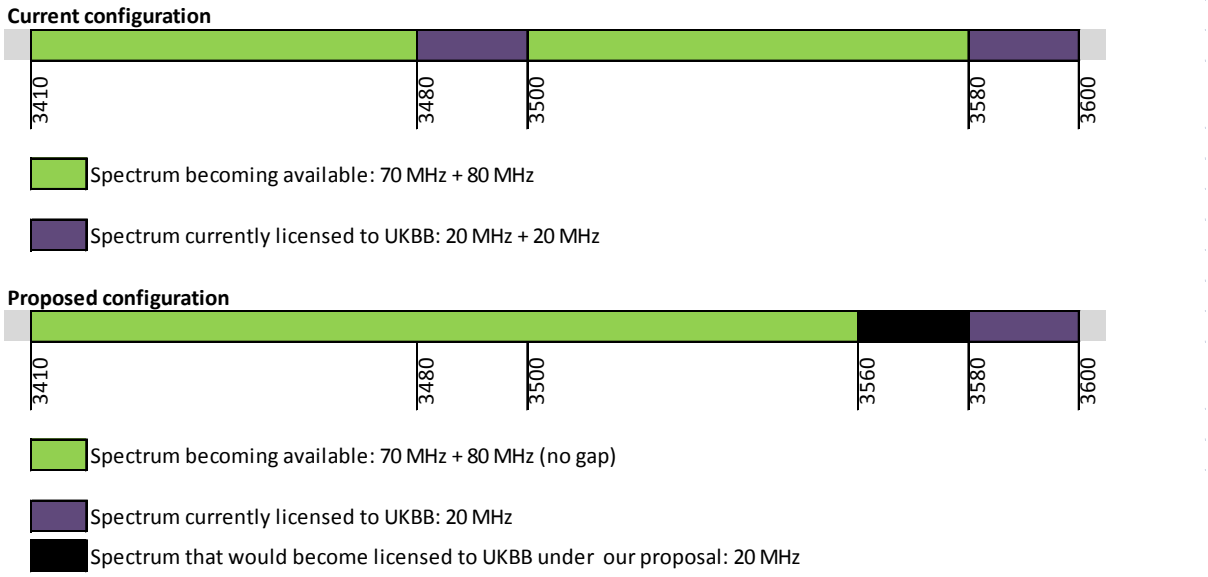
7.9 In our consultation of October 2013 we proposed that there would be spectrum efficiency gains if we were to consolidate UK Broadband's two 20 MHz spectrum

holdings into a single block of contiguous spectrum. We proposed to vary the licence to form a single block of 40 MHz at the top of the 3.4 GHz award band (3560-3600 MHz), as illustrated in Figure 7.1 below. This would allow the remainder of the spectrum in the 3.4 GHz band to be offered in a contiguous block as well. We felt this would:

- make it easier to accommodate a range of different demands within the spectrum to be awarded, in particular the potential for larger contiguous assignments that could in turn give operators the flexibility to deploy larger channel sizes; and

- reduce the number of inter-operator frequency boundaries which results from the spectrum award process, thereby reducing the technical constraints arising from the need to manage a higher number of spectrum boundaries between licensees.

Fig 7.1: current and proposed spectrum configurations



7.10 The earlier consultation noted that the current configuration of UK Broadband's spectrum blocks means that we would need to manage three adjacencies with new licensees. This leaves the 150 MHz available for award fragmented, with a 70 MHz block available between 3410–3480 and an 80 MHz block available between 3500–3580 MHz. We said this represented a potentially inefficient use of the spectrum. The proposed relocation would leave only one boundary between the UK Broadband holding and the rest of the band.

7.11 In proposing that the UK Broadband spectrum holding be consolidated at the top of the 3.4 GHz band, we set out our understanding that spectrum right across the 3.4 GHz award band was similar. In particular, we suggested all contiguous spectrum assignments of a given size within the 3410-3560 MHz frequency range are likely to be broadly similar in value, irrespective of their location. We noted that the whole band is included within the relevant LTE standard and we expect equipment to be designed to operate in all the 3.4 GHz frequencies.

7.12 Under the EU Authorisation Directive (2002/20/EC) Member States must make new grants of rights of use of radio frequencies through open, objective, transparent and non-discriminatory procedures. We therefore sought views on whether there is any demand or interest in the market for acquiring the 3560 to 3580 MHz assignment -

which we proposed to include in the UK Broadband licence - over and above any demand or interest that there might be in acquiring the 3480-3500 MHz spectrum that would become available as a result.

Consultation responses

7.13 Most of the responses to our consultation were confidential. However, almost all of those who expressed an opinion on our proposal to consolidate UK Broadband's spectrum holding recognised the advantages of us being able to award contiguous spectrum in the 3.4 GHz award – although a few respondents added caveats.

7.14 Nokia noted that consolidation would provide technical advantages to minimise inter-operator boundaries within the band. LTE Advanced intra-band carrier aggregation does not exclusively rely on contiguous spectrum assignments, but many implementation and operational aspects of networks can benefit from contiguous assignments.

7.15 The majority of the remaining respondents were either neutral on the issue of consolidation or favourable, dependent on specific conditions. For example, UK Broadband was supportive of a re-location in principle, but would only regard this as beneficial to any business plans if it obtained a post-2018 licence extension.

7.16 The most significant argument opposing the proposal was submitted by BT. In a non-confidential response, BT challenged our suggestion that the whole of the 3.4 GHz band was of broadly equal value. The company said the new frequencies that Ofcom proposed to make available to UK Broadband coincided with spectrum being harmonised for shared use and small cells in the USA. These frequencies were of particular interest to BT, and potentially to other parties.

7.17 BT said it would be *"improper"* to award this spectrum to another party without *"proper process".* Further, it said that Ofcom should include all the frequencies held by UK Broadband in the planned auction, for availability in 2018 (or earlier if traded to a new buyer). It was unclear to BT why Ofcom was consulting on changing the UK Broadband frequencies without addressing what happens to them when the licence expires in 2018.

7.18 Even though consolidation of the UK Broadband holding might simplify the auction arrangements for the remainder of the band and confer advantages for future use, BT said this was not the only relevant consideration.

7.19 Another respondent said Ofcom should consider the possibility of an unintended windfall gain for UK Broadband, and that there may be negative competitive aspects for third parties. UK Broadband could offer higher bit rate services more easily compared to when the spectrum was originally assigned to the company.

Ofcom's response

7.20 We note BT's view on the relative value of different frequencies in the 3.4 GHz band. However, we cannot say for sure whether the proposed harmonisation process in the USA will make the higher 3.4 GHz frequencies more valuable than the lower frequencies. The US plans are not yet finalised.

7.21 If the USA decides in the end that it would prefer to use existing band plans rather than a separate band designation, this would be compatible with the European

Decision. This in turn would mean there are unlikely to be different equipment availabilities in this part of the band compared to other parts.

7.22 Under alternative scenarios, the lower frequencies may be as valuable – we note in particular the deployment of services in Japan using lower frequencies. Finally, we note that no other respondent other than BT expressed specific interest in the higher frequencies in preference to other 3.4 GHz spectrum.

7.23 However, having carefully considered all the responses to our consultation, we believe it is appropriate for us to separate the issues of licence extension for UK Broadband from the additional question of whether the spectrum should be consolidated.

7.24 In light of this, and of our own further considerations, we are not proceeding with our proposal to consolidate the UK Broadband spectrum in advance of the 3.4 GHz spectrum auction.

UK Broadband and the PSSR award

7.25 We are keen to explore further ways to reduce any spectrum inefficiencies arising from the fragmented holdings. We have already indicated that this could be resolved through spectrum trading. However, we are also interested in exploring the potential for this to be addressed through the design of the PSSR award process (and our current thinking is around the assignment stage in particular).

7.26 We will consult on the design for the PSSR 3.4 GHz auction in the autumn of 2014.

Annex 1

Responding to this consultation

How to respond

A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made by 5pm on Friday 25 July 2014.

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://stakeholders.ofcom.org.uk/consultations/uk-broadband-licence/howtorespond/form, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.

A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email 3.4GHzlicence@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Chenab Mangat
Floor 3
Spectrum Policy Group
Riverside House
2A Southwark Bridge Road
London SE1 9HA.

Fax: 020 7981 3333

A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Chenab Mangat on 020 7981 3796 or the email above.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your

response should be kept confidential, can you please specify what part or whether all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/about/accoun/disclaimer/

Next steps

A1.11 Following the end of the consultation period, Ofcom intends to publish a statement.

A1.12 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/static/subscribe/select_list.htm

Ofcom's consultation processes

A1.13 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.14 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A1.15 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Graham Howell, Secretary to the Corporation, who is Ofcom's consultation champion:

Graham Howell
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA

Tel: 020 7981 3601

Email Graham.Howell@ofcom.org.uk

Annex 2

Ofcom's consultation principles

A2.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

A2.3 We will be clear about who we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Ofcom's 'Consultation Champion' will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We would usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website, www.ofcom.org.uk.

A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.

A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.

A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at www.ofcom.org.uk/consult/.

A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing ☐

Whole response ☐

Part of the response ☐

Name/contact details/job title ☐

Organisation ☐

If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here. ☐

Name

Signed (if hard copy)

Annex 4

Consultation questions

Question 1: Do you agree with our proposal to approve UK Broadband's Licence Variation request to extend the term of its licence indefinitely from 2018? Do you have any other comments you wish to make?

Question 2: Do you agree that if the variation to UK Broadband's 3.4 GHz spectrum licence is approved then fees should be charged on an annual AIP basis?

Annex 5

Quantified estimates of the costs and benefits of extending UK Broadband's licence

Introduction

A5.1 In order to inform our decision on whether to extend UK Broadband's licence, we want to identify and, where possible and useful, quantify the costs and benefits which could result from a licence extension. However, amongst the different types of costs and benefits we have identified, some are less amenable to quantification. We set out our assessment of the costs and benefits of extending UK Broadband's current licence in Section 5, which takes into account these unquantified costs and benefits as well as those we have been able to quantify.

A5.2 In this annex we focus in more detail on the quantified estimates we are able to make. First, we outline our approach to quantifying costs and benefits. Then we summarise the different types of costs and benefits, indicating which we have quantified. Thereafter, we discuss how we derived our quantified estimates.

Our approach to quantifying costs and benefits

A5.3 It is important to define the counterfactual against which costs and benefits are assessed. In this case we treat Option 1, turning down UK Broadband's request for a licence extension, as the counterfactual against which Option 2, licence extension, is compared.

A5.4 In assessing the options, we only consider changes in benefits and costs which are causally related to the option being appraised, that is, the additional benefits and costs incurred as a result. In other words, we have only taken 'forward-looking' costs and benefits into account. Costs incurred in the past cannot be influenced by current or future consumption and production and so are excluded.

A5.5 We assume in our quantification of costs and benefits that UK Broadband brings forward its investment if its licence is extended but otherwise does not do so. We assume that consumer and other benefits are dependent on investment being brought forward.

A5.6 It is often the case that costs and benefits occur at different times. Investment, for example in equipment or systems development may be needed before benefits can be realised, and the timing of costs and benefits may differ between options. The standard method of assessing whether future benefits are sufficient to outweigh an initial investment is a discounted cash-flow ("DCF") analysis. In a DCF analysis, future cash flows are discounted at a rate which reflects the opportunity cost of the funds initially invested. The sum of discounted future cash-flows is the Net Present Value (NPV) of the project or option under appraisal.

A5.7 As part of our analysis, we have considered the appropriate rate at which to discount future costs and benefits. For consumer benefits and costs other than privately-financed capital costs, the discount rate used is the Social Time

Preference Rate (STPR). Capital costs financed by private capital are discounted using an approach known as the Spackman method. [54]

A5.8 The Spackman approach is a two-step method:

i. First, we convert any capital costs incurred by private firms into annual costs at the company's cost of capital (WACC). The annual cost can be calculated in a number of ways, but the approach we have used is a simple flat annuity formula. This spreads the capital costs incurred by private firms plus financing costs over a number of years, the annualisation period.

ii. Second, we discount the annualised costs, any non-capital costs and benefits back to 2014 using the rate of social time preference.

A5.9 We identify the specific costs to which the Spackman method is applied later in this annex.

A5.10 It may not be possible to quantify all costs and benefits. Where it is not possible to quantify costs or benefits, it may still be possible to rank options according to their likely level. In addition it may be possible to take them into account, for example, by considering whether a quantified cost could be worth paying to secure an unquantified benefit.

A5.11 The quantified costs and benefits are based on UK Broadband's business plan for its 3.4 GHz network which it submitted to Ofcom in February 2014.[55] This submission sets out what UK Broadband has told us it will do if it is able to implement its business plan and the investments which it proposes to make.

A5.12 For the purposes of the quantified analysis, we generally assume that UK Broadband achieves its business plan. However, we recognise that the business plan may not be achieved in reality or may change during its execution. Our quantification focuses on the plan because we consider it provides the best information available on what would happen if UK Broadband's licence were extended and UK Broadband achieved its business plan in full. But in our overall assessment, we take account of the fact that UK Broadband may fail to achieve its objectives, and that customer numbers, prices and quality of service may all differ from those assumed.

A5.13 UK Broadband is planning to use its 3.4 GHz network to offer a broadband product which will provide an unlimited usage broadband package with a speed of up to 65Mbps (although the actual speed may be less) for a total monthly charge of £20 per month for the residential product and £25 plus VAT per month for the SME product.[56] In the earlier years of its business plan we believe UK Broadband

[54] This approach is set out in Spackman (2004), "*Time Discounting and of the Cost of Capital in Government*", Fiscal Studies (2004), vol. 25, no.4, pp.467-518. The Joint Regulatory Group (JRG), of which Ofcom is a member has concluded that in most cases where there are private costs but public benefits the Spackman approach is appropriate: see Joint Regulators Group, July 2012, *Discounting for CBAs involving private investment, but public benefit*
http://stakeholders.ofcom.org.uk/consultations/discounting-for-cbas/statement

[55] UK Broadband, Responses to Ofcom's request for further information dated 28 January 2014 in connection with the proposed variation of UK Broadband's 3480MHz-3500MHZ and 3580MHz-3600MHz spectrum licences, 12 February 2014 (The February submission).

[56] Prices inclusive of VAT. UK Broadband, Proposed variation of UK Broadband's 380MHz-3500MHZ and 3580MHz-3600MHz spectrum licences, 22 April 2014, page 2.

intends to market the service as an alternative to a fixed broadband access service.[57] UK Broadband's product does not include a voice landline service.

A5.14 UK Broadband also told us that it plans to market a mobile service, though later than the fixed service, and that it expects the share of its customers which take the mobile service to increase over time. It had assumed that, on average over ten years, 30% of its customers would take its fixed service and 70% its mobile service.[58]

A5.15 The benefits of licence extension derive from the impact it would have on the speed with which investment takes place.

A5.16 In the next section we describe the potential costs and benefits of extending UK Broadband's licence.

Potential Costs and Benefits

A5.17 Extending UK Broadband's licence could have impacts on consumers, UK Broadband itself, other providers of broadband services and other users of spectrum. Because our principal duty is to further the interests of consumers, we focus in our assessment on those costs and benefits which affect consumers. However, we include some costs or benefits which, although initially borne by firms, might affect consumers in the longer run, either through changes in the quality of service provided or as a result of being passed on in changes in prices. In the longer term, consumers can benefit from increases in actual or potential competition, but there could also be additional longer-term costs to consumers, for example, if incentives were distorted by inappropriate regulation or by market failures which were not addressed. Charging annual licence fees for spectrum use and setting them at an appropriate level based on opportunity cost is one way of avoiding distortions of this kind.

A5.18 In our quantified analysis, we have focused on the costs and benefits that are most relevant in terms of our assessment criteria and duties and which we can quantify. These are, foremost, benefits to consumers and implications for the efficiency with which spectrum is used. We also consider whether UK Broadband would incur additional costs as a direct result of either option.

A5.19 We focus on benefits to UK Broadband's fixed broadband customers because we know the planned launch prices and service characteristics of the fixed service and these appear to offer some potentially significant and quantifiable advantages over other fixed offers. As the full mobile service is to be launched slightly later, the details of future mobile service prices and service characteristics are more likely to change before launch, as may those of other mobile broadband suppliers. But as the fixed service is only expected to account for some 30% of subscribers on average over the period covered by UK Broadband's business plan, it could be misleading to compare the benefits of the fixed service to the entirety of the costs associated with licence extension. This is because a significant proportion of UK Broadband's costs could be borne by mobile or other customers which are not included in our quantitative assessment of benefits. We have therefore identified a reasonable proportion of UK Broadband's additional costs to include in our

[57] UK Broadband's plans for a mobile broadband service are therefore less relevant to the comparison between the options.
[58] Letter from Nicholas James to Andrew Hudson, 19th May 2014

comparison to the quantified benefits of the fixed service, in a range of different scenarios.

Potential costs

A5.20 We assume that the costs discussed below are not incurred if UK Broadband's licence is not extended and the spectrum is re-assigned in 2018 in contiguous blocks.[59] If UK Broadband's licence were extended with its current non-contiguous frequencies, costs (in excess of costs under Option 1) could include:

- **Less usable spectrum in the 3.4 GHz band;**
- **Costs of additional remote radio unit (RRU) and filter equipment;**
- **The prevention of some auction outcomes which may be efficient;** and
- **Welfare losses if UK Broadband is not the highest-value user of the spectrum**.

A5.21 Other costs could arise if licence extension resulted in UK Broadband being awarded the spectrum even when it is not the most efficient user of the 40 MHz of specific 3.4 GHz frequencies.

A5.22 We do not know how any of the above costs might be reflected in fixed or mobile broadband prices, if at all. For the purposes of our quantitative assessment, we consider that it is reasonable to assume that, where costs are passed to UK Broadband's customers in prices, this is in proportion to the expected numbers of fixed and mobile customers. As noted above, on average over the business plan period, fixed customers are expected to make up 30% of the total and mobile customers the remaining 70%. However, we include in full our estimates of costs borne by other operators, which might be passed on to their customers.

Potential benefits

A5.23 Licence extension and the resulting investment that UK Broadband say it will make would bring the prospect of consumer benefits from new services and increasing competition in the fixed broadband market and also in mobile broadband.[60]

A5.24 UK Broadband's business plan could create benefits for consumers if UK Broadband's product is perceived as better than existing offerings. In particular, there could be benefits from:

- **Lower prices**: UK Broadband's planned prices would generally represent a significant potential saving for customers when compared to other fixed

[59] If UK Broadband's licence were not extended and it then participated and won spectrum in the PSSR auction, we assume that it would incur some relocation costs in order to move to a new contiguous holding. Though these costs are small, because UK Broadband would have only a small number of operational sites at the time of the auction in this scenario, we have allowed for these costs in our quantitative assessment.

[60] We are aware that UK Broadband launched its fixed broadband service for consumers in London on 4 June 2014. We understand that this launch formed part of UK Broadband's business plan submitted to us and does not constitute a change to their plans should Ofcom not extend the licence.

broadband packages of similar speeds. We use the price saving itself as a measure of the value to existing consumers of lower prices;[61]

- **Faster download speeds**: UK Broadband customers who don't already have SFBB will benefit from increased download speeds. We use consumer surplus as a measure of the benefit of faster speeds. Consumer surplus is the difference between the maximum amount a consumer would be willing to pay for a service and the amount they actually have to pay;
- **Reaching new customers**: The benefit to new consumers will depend on their willingness to pay for UK Broadband's services. The difference between their willingness to pay and the price will be reflected in a net gain in consumer surplus;
- **Innovative new services**
- **Potential dynamic benefits from increased competition;**
- **More favourable terms and conditions;**
- **Improved functionality for emergency services;**
- **Benefits to other users of the band from earlier development of the 3.4GHz ecosystem.**

Quantified Costs and Benefits

A5.25 In order to facilitate a comparison of the costs and benefits of licence extension we have attempted to quantify the costs and benefits which are amenable to quantification and which are likely to be most relevant to our assessment. Figure A5.1 summarises the types of costs and benefits we have identified for Option 2 (compared to Option 1) and which we have quantified. For costs we have focused on the impact on spectrum efficiency and equipment costs. For benefits we have focused on the impact of faster download speeds for consumers and benefits of lower fixed broadband prices.

Figure A5.1: Summary of types of costs and benefits and which have been quantified

Type of cost or benefit	What we have quantified
Costs	
Less usable spectrum in 3.4 GHz band	Quantification of cost to: (i) UK Broadband; and (ii) new acquirers
Costs of additional RRU and filter equipment	Quantification of cost to: (i) UK Broadband; and (ii) new acquirers
Prevention of some auction outcomes	Not quantified
UK Broadband is not most efficient user of the spectrum	Not quantified

[61] The benefit may to some extent be offset by any loss of value from giving up the fixed access line.

Benefits	
Faster download speeds for fixed broadband customers	Quantification is based on UK Broadband's proposed speeds and customer volumes in its business plan
Lower prices to consumers of fixed broadband services	Quantification is based on UK Broadband's proposed prices and customer volumes in its business plan
Reaching new fixed broadband customers	This benefit is included as part of the quantified benefits of faster download speeds and lower prices to consumers described above.
Benefits for mobile customers	Not quantified
Dynamic benefits from increased competition	Not quantified
More favourable terms and conditions	Not quantified
Improved functionality for emergency services	Not quantified
Technological spillovers	Not quantified

A5.26 We compare the size of costs and benefits in a scenario where UK Broadband's licence is extended at current frequencies (Option 2) against an option where the licence is not extended (Option 1). Costs and benefits depend on how UK Broadband acts under both Options. For the purpose of the quantification, we initially assume for Option 2 that UK Broadband implements its business plan in full, gaining 1.7m customers by the end of 2022 (and then we also take account of the potential for UK Broadband to deviate from the business plan).

A5.27 We assume that 30% of UK Broadband's total customers are fixed broadband consumers for consistency with UK Broadband's business plan. As noted, UK Broadband told us that, for planning purposes, it had assumed that 30% of its customers would take its fixed service and 70% its mobile service in each year of the plan. However, it said that, whilst it was a reasonable assumption on average over ten years, this was not a reflection of what it expected to happen in practice in each year. It planned to launch the mobile service slightly later than the fixed service, and it expected the share of its customers which take the mobile service to increase over time.

A5.28 Despite the limitations, as the best information available to us, we have used a consistent 30% to derive the assumption on the number of fixed customers for UK Broadband. This could mean that the numbers of customers for UK Broadband's fixed service are understated in the early years of the plan and hence in our quantitative assessment (and overstated in later years). If UK Broadband does get more customers for its fixed services in the early years than we have assumed, then the benefits to customers could also be greater than we have calculated.

A5.29 For Option 1 we consider two scenarios:

1. UK Broadband licence expires in mid-2018 and an alternative operator provides a similar service from mid-2018 creating the same benefits as UK Broadband would have done but with a four year lag.

2. UK Broadband's licence expires in mid-2018 but it wins spectrum at auction in 2015 and resumes its business plan in the first half of 2016. It then achieves its business plan forecasts with a one year lag but is required to relocate within the band.[62]

Quantified costs

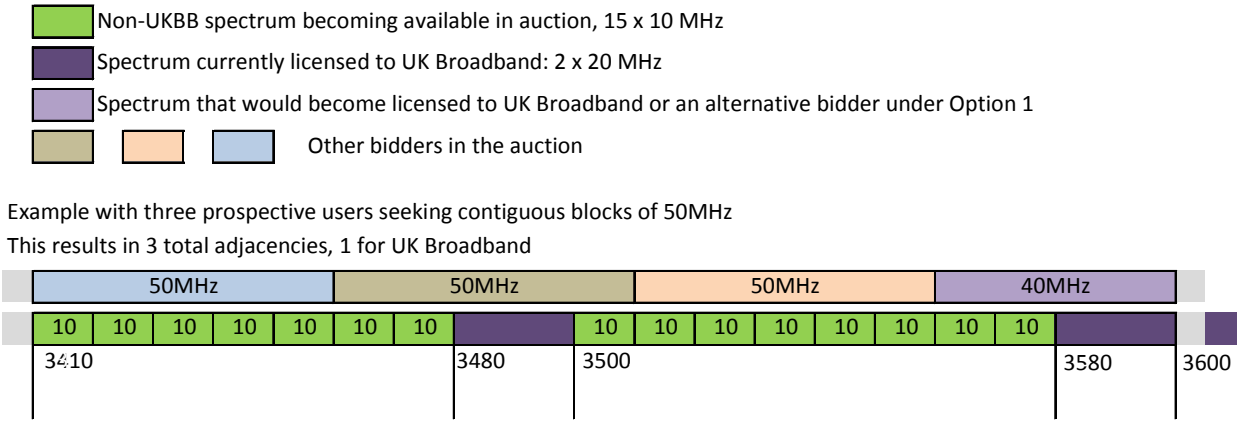
A5.30 UK Broadband has provided us with an investment plan which sets out the number of sites it expects to deploy in order to deliver its business plan. We have used this information as well as estimates of expected equipment costs to assess the extra costs that could be incurred in Option 2. We have also assessed the impact on usable spectrum in the band.

Costs of less usable spectrum in 3.4GHz band

A5.31 If Ofcom extends UK Broadband's licence in its current non-contiguous locations, the amount of usable spectrum in the band could be reduced. This is because the non-contiguous holdings increase the number of boundaries or adjacencies between operators and this increases the scope for interference between transmissions by neighbouring operators.

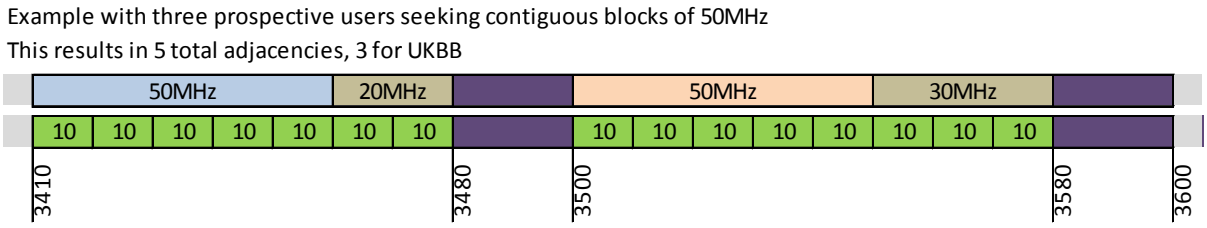
A5.32 The number of adjacencies if UK Broadband's licence is extended will depend on the outcome of the PSSR auction. However, we consider an illustrative example of the potential impact of adjacencies below.

Figure A5.2: 3.4 GHz band pre-assignment under Option 1 (post 2018)



[62] This scenario could also approximate the range of benefits in the case where another operator was able to provide consumer benefits in line with UK Broadband's business plan from the first half of 2016. The model includes the costs of relocation, though they are small because of the limited number of sites in Option 1.

Figure A5.3: 3.4 GHz band pre-assignment under Option 2



A5.33 Figure A5.2 shows the 3.4 GHz band before the PSSR auction assignment under Option 1 (without extension) and Figure A5.3 shows the band under Option 2 (with extension). In our example we assume that the result of the auction is that three operators win an assignment of 50 MHz and one operator wins an assignment of 40 MHz.

A5.34 In Figure A5.2 (Option 1) each of the four assignments could be awarded in contiguous blocks creating three adjacencies (boundaries between operators). However, in Figure A5.3 (Option 2) UK Broadband's existing split 40 MHz holding would prevent these assignments from being awarded in contiguous blocks, creating five adjacencies if one assignment was split.

A5.35 To show the potential cost of these additional adjacencies in Option 2 we have estimated the potential spectrum affected per adjacency and, using a proxy, we identify a figure for the cost of the affected spectrum.[63] This is illustrated in Figure A5.4 below which shows a cost of £15m-£30m as a result of the additional adjacencies in Option 2, depending on whether 5 MHz or 10 MHz per additional adjacency is affected by the need to comply with the restrictive unsynchronised emission limit at the boundary edge of UK Broadband's spectrum holding. For the purposes of the calculation we assume that the affected spectrum is in effect rendered unusable. In practice, some restricted use of the affected spectrum may remain possible and this may reduce the estimated costs of Option 2. Additionally if, operators synchronise with each other, then no internal guard bands are needed. In the scenario of operators synchronising with each other it is assumed that the cost of additional boundaries is negligible.

[63] We use a proxy of £1.5m/MHz which would equate to a total of £285m for the entire 3.4 GHz band. The £1.5m/MHz proxy is the value of the unpaired 2.6GHz band estimated for Ofcom using the "linear reference price" method: see "*Annual licence fees for 900 MHz and 1800 MHz spectrum*", consultation document, 10 October 2013, paragraph 4.20 at: http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800-mhz-fees/summary/900-1800-fees.pdf. This proxy could be too high or too low for the value of spectrum in the 3.4 GHz band, but we consider it provides the best available information at this time.

Figure A5.4: Impact of Option 2 on usable spectrum in 3.4 GHz band

Block Edge mask	Filter performance assumption	Per adjacency spectrum affected (impact on both operators)	Number of additional adjacencies (Option 2)	Total MHz lost	Total Cost (£m)
Restrictive, i.e. no synchronisation	50 dB in 5 MHz	10 MHz	2	20 MHz	30
	50 dB in 2.5 MHz or operators share 50 dB in 5 MHz	5 MHz	2	10 MHz	15

Source: Ofcom analysis
Note: the numbers are undiscounted and may for this reason differ from numbers elsewhere in the statement which are in NPV terms

Costs of additional RRU and filter equipment

A5.36 Possession of two non-contiguous blocks of spectrum can create the need for additional filters to prevent interference between neighbouring operators if they do not reach synchronisation agreements, compared to the case where all spectrum is held as a single contiguous block. We assume that under Option 2, UK Broadband would need to install an RRU with a built-in filter for each sector of a three sectored site as a result of its non-contiguous holdings. We have estimated the cost of installing replacement filters at £14k per site. For new sites we assume that installation can be done at the same time as site-build, which reduces this cost to £10.5k per site for the additional adjacencies.[64]

A5.37 If UK Broadband's 20 MHz holding in the middle of the 3.4 GHz band means that another operator (an acquirer of spectrum in the PSSR auction) also receives a split assignment, that operator may also need to install an additional three RRUs with built-in filters per site, at similar cost per site. The operator is assumed to have 5,000 macro sites, built between 2016 and 2018. This figure is however dependent on a number of factors relating to the use the other operator makes of the spectrum, and we have also estimated the other operator's costs assuming it has only 1,000 sites.

A5.38 On this basis, the additional cost to UK Broadband would be approximately £83m in NPV terms.[65] If there is another split assignment, the additional costs to the other operator(s) would be between approximately £12m for 1000 sites and approximately £56m for 5000 sites. If there is no other split assignment or the operators reach synchronisation agreements, these costs would be zero.

[64] We estimate, based on information from manufacturers, that the combined cost of filters and RRU equipment together would be about £3.5k per sector for a three sector site giving a total of £10.5k per site. If installation did not occur at the same time as site build, additional, predominantly labour, costs would be incurred, which we estimate at £3.5k per site, giving a total of £14k per site in that case.
[65] We use the Spackman method to calculate the NPV of RRU and filter costs. We assume that UK Broadband starts building its network immediately and starts installing filter equipment at new sites in 2015.

A5.39 In our "low case" costs, we assume that UK Broadband's additional filter costs are borne by the company with no impact on consumers. However, because our understanding is that UK Broadband may not have included these costs in its business plan, it is also possible that there could be an adjustment to prices at some time and so we include a proportion of these costs in our "high case" costs. We assume that these costs are then borne proportionately by UK Broadband's fixed and mobile customers. The combined total of UK Broadband's and other operators' RRU and filter costs which we have included in our quantitative analysis is between £12m and £80m in NPV terms. As noted above, the other operator's costs will also be zero if all the winning bidders in the PSSR auction receive contiguous assignments and so our approach, even in the low case, may be conservative.

A5.40 There could be an incentive for holdings to be consolidated through trading after the auction in order to avoid these costs. If this happened, these costs would be avoided but UK Broadband would incur costs of reconfiguring equipment to accommodate new frequency locations.[66] However, as noted in Section 5, the required set of trades may be complex and time-sensitive and could be affected by strategic behaviour. Therefore, whilst we recognise the potential for a set of trades to avoid the costs of additional adjacencies, we adopt a more conservative approach in our cost estimates which assume such trades do not occur.

Summary of quantified costs

A5.41 We combine the above cost estimates into a "high case" and a "low case". The assumptions applied in each case are shown in Figure A5.5 below:

Figure A5.5: Costs included in our "low case" and "high case" assumptions

	Low case	High case
Adjacent operator's RRU and filter costs	All included £12m	All included £56m
Adjacent operator's loss of usable spectrum[1]	5 MHz, All included £7m	10 MHz, All included £14m
Adjacent operator's site numbers	1000	5000
UK Broadband's RRU and filter costs	Excluded £0	30% included £25m
UK Broadband's loss of usable spectrum[1]	5 MHz, 30% included £2m	10 MHz, 30% included £4m
Total	£21m	£99m

[66] We estimate that these costs will equate to £14,000 per site and will apply to the number of sites where a change is required. As a result the total costs of this change depend on the number of UK Broadband sites when UK Broadband spectrum is consolidated.

[1] The figures here differ from those in Figure A5.4 in being shown in NPV terms for comparison with other costs and benefits.

A5.42 It should be borne in mind that even the "low case" costs is in some respects conservative and may not represent the lowest possible costs. If no winner in the PSSR auction receives a split assignment, then the other operator's additional RRU and filter costs would be zero, whilst if operators agree synchronisation, more of the spectrum would be usable and most of the costs associated with the loss of usable spectrum would be avoided.

Quantified Benefits

A5.43 We have focused on two types of benefits in our quantitative assessment. These are the benefits from faster download speeds and the potential for consumer benefits from lower fixed broadband prices.

A5.44 The benefit which consumers gain by taking UK Broadband's service will depend on whether it would otherwise:

5.44.1 not have used a broadband service at all; or

5.44.2 used a lower speed service; or

5.44.3 used a more expensive service of a similar speed.

A5.45 There are some indications that the first category could be material. In its submission, UK Broadband indicates that it is looking for incremental, rather than substitutional, broadband usage and that it is not looking to compete head on with existing broadband services. This could indicate that UK Broadband expects to win customers who do not currently take up any broadband service. We discuss our approach to those UK Broadband customers in the first category in section 5, including why we have not sought to quantify these benefits separately.

A5.46 The extent to which new consumers benefit from UK Broadband's services will depend on their willingness to pay for it. However, we are not able to estimate the willingness to pay of this group specifically. For the purposes of the quantitative analysis, we assume these customers have the same willingness to pay for SFBB as other customers (we assume this to be £3.50 plus the standard broadband price on average).

A5.47 This also enables the quantitative analysis to be simplified. For these purposes, all UK Broadband customers are assumed to take either a standard or an SFBB product, and we do not identify or treat separately customers who might not previously have taken a fixed broadband service. For a given level of willingness to pay, this affects the distribution of benefits between "price cuts" and "faster speeds".

A5.48 As noted above, we focus on benefits to UK Broadband's fixed broadband customers in the quantitative assessment. There may therefore be some additional benefit to users of UK Broadband's mobile service which we have not quantified.

A5.49 We have distinguished between three categories of fixed broadband user. The main reason for doing so is that, in order to evaluate the benefits to customers of higher speeds provided by UK Broadband, we need to make an assumption about the service that its customers would have used instead. This is because this affects the additional value consumers would get by switching to UK Broadband. In its market

research into potential users of its service, UK Broadband did not identify the product currently used, so we have made assumptions based on average figures for SFBB rollout and take-up

A5.50 On this basis, we identify three customer groups:

- those who currently take SFBB;
- those who currently have access to SFBB in their area but take a standard speed broadband package; and
- those who do not currently have access to SFBB in their area and take a standard speed broadband package.

A5.51 The proportions of customers which we assume fall into each group are based on national averages but in our modelling we have allowed for these to change over time in line with current trends. Hence we assume that SFBB rollout and take-up increases over time, which tends to reduce the additional benefits from switching to UK Broadband over time.

A5.52 In addition to customer volumes, there are a number of key assumptions that drive the size of these benefits which are also subject to uncertainty. These include the price saving that UK Broadband's customers will gain. As well as the uncertainty about how UK Broadband's price may change over time, we do not have any information on the price UK Broadband's prospective customers are currently paying for broadband. We look at consumer benefits based on average prices paid by broadband consumers but, if UK Broadband attracts customers who would otherwise have paid a lower (or higher) than average price, the benefit to them could differ from our estimate.

A5.53 We assume that download speeds provided by the UK Broadband fixed product are equivalent to an SFBB product.[67] However, if the number of customers using UK Broadband's network are higher than expected performance could be affected. In addition, capacity and peak speed could also be negatively affected by the reduction in the amount of usable spectrum if UK Broadband stays in its existing locations without synchronisation.

A5.54 Finally, the key driver of size of benefits is the extent to which our decision on licence extension affects the rollout of UK Broadband's business plan. We have considered two scenarios which give a wide range of impacts (see paragraph A5.29). If not extending UK Broadband's licence leads to investment being delayed until 2018, the benefits of extension are larger. However, if UK Broadband is able to replace the spectrum from its licence with an award in the upcoming PSSR auction the benefits of extension are much smaller.

A5.55 UK Broadband expects to market its residential product at £20 per month.[68] We assume these prices in our quantification.[69]

[67] UK Broadband have stated that its fixed broadband access product will provide speeds of 30Mbps to 65 Mbps. See February submission.
[68] Prices inclusive of VAT. UK Broadband, April submission, page 2.
[69] In the quantitative analysis we do not distinguish between residential customers and SME customers. In our "Review of the wholesale broadband access markets: Draft statement on market definition, market power determinations and remedies" 19 May 2014, paragraph 3.49 at: http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/statement/WBA-draft-

Faster download speeds

A5.56 Those who switch from their current fixed broadband provider to become UK Broadband customers and do not already have SFBB will benefit from faster speeds according to the UK Broadband business plan.

A5.57 In order to quantify the numbers of different consumers and consumer types that may benefit from UK Broadband's service, we assume that UK Broadband's service would cover a group of consumers that has similar standard broadband and SFBB take-up and availability as in the general UK population. The most recent evidence shows that 25% of broadband connections are super-fast,[70] and that SFBB is available to 73% of UK premises.[71]

A5.58 For the purposes of our assessment, we assume that consumers that already have SFBB will not benefit from faster speeds by switching to UK Broadband's product but consumers that currently have standard broadband will. The benefit the latter group gets depends on how much they would be willing to pay for SFBB over and above the price of standard broadband (their "willingness-to-pay" or WTP). However we differentiate between standard broadband customers who already live in an area where SFBB is available, but have chosen not to take-up SFBB so far, and consumers who do not currently have access to SFBB. We assume the former subgroup has a lower willingness to pay, on average, for SFBB than the latter subgroup.

A5.59 We assume that each UK Broadband customer that obtains the advantage of faster broadband speed benefits by on average £2 per month if they live in an area where SFBB is already available and £3.50 per month if they live in an area where SFBB is not currently available.[72]

A5.60 We consider that this is a reasonable assumption for UK Broadband's customer base because UK Broadband's proposed prices suggest that it will gain customers whose willingness to pay for high-speed broadband is well below that of current high-speed broadband users.

A5.61 Based on these assumptions we found that:

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statement.pdf, we state that "comparisons of business services are more complicated. Business services can be more differentiated than residential services and often include a greater variety of add-on services and features. This can result in a wide range of prices for business broadband at a given headline speed, and make it difficult to compare services on a like for like basis." However, Figures 3.2 and 3.5 of the WBAMR draft statement suggest that average differences between the prices of residential and business products are likely to be larger than the difference between UK Broadband's residential and business services. If so, this could mean that our quantitative analysis produces a conservative assessment of total benefits.

[70] See Broadband performance report, November 2013, page 8.

[71] See 2013 CER, page 57. We have adjusted this numbers to change over time such that broadband availability increase by 4% of premises each year and SFBB take-up rate increases by 5% each year.

[72] Based on an £8 per month premium to upgrade from broadband to superfast broadband at the currently existing offers and take-up rates: see p. 105, 2013 CER. The estimate of average willingness to pay is based on work by Enders analysis, see: "*UK residential high speed broadband outlook: leading the horse to water*", 20.07.2011, p. 6. Based on this work we assume an average (for all customers) willingness to pay of £3.50 per month above the standard broadband price. We then derive a lower figure (£2) for non-SFBB customers in areas where SFBB is available. The figure is lower because those with the highest WTP are assumed to take SFBB already. We derive the £2 figure on the basis of an assumption that 25% of customers currently take SFBB and so have a WTP of (at least) £8 above the standard speed price, and that the all-customer weighted average WTP is £3.50 above the standard price (25%*£8 + 75%*£2 = £3.50).

- Under Option 2 the benefits of faster download speeds over Option 1 scenario 1 would be circa. £18m.

- Under Option 2 the benefits of faster download speeds over Option 1 scenario 2 would be circa. £5m.

A5.62 The large difference in benefits between scenarios 1 and 2 reflects the uncertainty about what would happen under Option 1 and may be seen as polar cases. If UK Broadband's licence is not extended there are a number of possible outcomes including UK Broadband or other operators using spectrum awarded in the PSSR licence to introduce a similar product at any time after the auction. Furthermore, another operator could create larger or smaller consumer benefits depending on their own business plan.

A5.63 In the light of this, we consider a reasonable estimate of the benefits of faster download speeds to be in the range of £5m - £18m. By themselves, the benefits from faster speeds would not be sufficient to offset the estimated reasonable proportion of costs of £21m-£99m.

Lower prices

A5.64 UK Broadband expects to market its residential broadband product at £20 per month for residential customers.[73] This compares to an average price for residential broadband of £32 per month.[74] We consider an average broadband price of £32 as a reasonable proxy for the average alternative operator's price for our purposes. [75]

A5.65 We estimate the maximum price that UK Broadband could charge whilst generating sufficient customer benefits to offset a proportionate share of the net costs of licence extension in scenarios 1 and 2 (i.e. net of the benefits of faster download speeds). We then compare this price to UK Broadband's proposed price for its fixed line broadband product.

A5.66 We found that (on the assumption that UK Broadband fully achieves its business plan):

- If the counterfactual is Option 1 scenario 1 UK Broadband would need to offer its fixed broadband customers:

[73] Prices inclusive of VAT. UK Broadband, April submission, page 2.
[74] We assume an average charge of £32 including line rental. This is consistent with data from Ofcom, "*The Consumer Experience of 2013*": January 2014, pages 104 and 111 at http://stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-13/TCE_Research_final.pdf (the CER 2013). The CER 2013 data include both standard and SFBB packages but, on the other hand, also include legacy packages which may no longer be marketed to new customers and which may have higher prices than current offers. If customers on legacy tariffs already have the option to switch to a newer cheaper tariff, the fact that they do not do so may mean there are switching costs.
[75] We also note that a price of £32 is comparable to the mid-point of the range of SFBB prices shown in Figure 3.1 of Ofcom "*Review of the wholesale broadband access markets: Draft statement on market definition, market power determinations and remedies*" 19 May 2014 at http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/statement/WBA-draft-statement.pdf Prices include line rental where necessary for the provision of broadband.

- an average price of £23 (or less) in the "high cost" case;[76] or
- £28 (or less) in the "low cost" case[77]

in order to fully offset a reasonable proportion of the net costs of licence extension. These prices would represent a saving of some £4 to £9 against an average price of £32. This indicates that UK Broadband's proposed price of £20 is consistent with the creation of consumer benefits which would more than offset a reasonable proportion of the costs of licence extension.

- If the counterfactual is Option 1 scenario 2 UK Broadband would need to offer its customers:
  - an average price lower than the price it plans to charge in order for customer benefits to fully offset a reasonable proportion of the net costs of licence extension in the high cost case. This indicates that UK Broadband's proposed price of £20 would not create consumer benefits of lower prices and faster download speeds sufficient to offset the costs of licence extension in this case.
  - In the low cost case, a price of £24 (or less) would be sufficient for the benefits to UK Broadband's fixed broadband customers to offset a reasonable proportion of the costs of licence extension.

A5.67 The benefit of lower prices depends on the gap between UK Broadband's price and the price of the customer's alternative broadband service. Our analysis is based on a 10 year investment period and during that period we assume that UK Broadband's prices remain steady (as shown in its business plan). However, we acknowledge significant uncertainties around this assumption. For instance the price of equipment may reduce over time, which could allow UK Broadband to lower its prices. On the other hand, this may be cancelled out by increased difficulty in supplying higher speeds to meet growing demand. More generally, if UK Broadband's performance differs from the forecasts in its business plan, or if there is an unexpected change in costs or market circumstances, UK Broadband may revise its prices.

A5.68 We also assume that the average price of broadband remains steady over time. This is consistent with recent trends. However, if the relative prices of UK Broadband and other fixed line operators change, this would affect the consumer benefits that would be created from lower prices.

[76] Here we include all the adjacent operator's additional filter and RRU costs and the upper estimate of its spectrum inefficiency costs, and 30% of UK Broadband's additional filter, RRU and spectrum inefficiency costs (upper estimate), and assume that the adjacent operator has 5000 sites.
[77] Here we include all the adjacent operator's additional filter and RRU costs and the lower estimate of spectrum inefficiency costs, and 0% of UK Broadband's additional filter and RRU costs and 30% of its spectrum inefficiency costs (lower estimate), and assume that the adjacent operator has 1000 sites.

Annex 6

Glossary

Access Network - The part of a fixed telecommunications network that connects directly to customers from the local telephone exchange.

Assignment - Authorisation given by licensing authority (such as Ofcom) to use a specific radio frequency or channel under specified conditions.

Asymmetric Digital Subscriber Line (ADSL) - A digital technology that allows the local loop to send a large quantity of data in one direction and a lesser quantity in the other. See also DSL (Digital Subscriber Line).

Band - A recognised frequency range or a recognised group of frequency ranges where each range has a defined start and end frequency.

Bandwidth - This describes the maximum data transfer rate of a network or Internet connection. It measures how much data can be sent over a specific connection in a given amount of time. As well as referring to data, the term can also apply to spectrum bandwidth (i.e. the amount of spectrum in the channel).

Base station - A radio transmitter and receiver installed by an operator to provide a communications service.

Block Edge Mask (BEM) - A block edge mask is a transmitter spectrum mask that applies at the edge of a licensed block of spectrum and is designed to offer sufficient protection from interference to any anticipated receiving system in an adjacent frequency block. The emissions of all transmitters operating within a licensed block must comply with this block edge mask, regardless of the bandwidth of such transmitters.

British Sky Broadcasting Ltd (BskyB or Sky) - A UK based satellite broadcasting, broadband and telephone services company.

BT Group plc (BT) - A UK based multinational telecommunications services company.

European Conference of Postal and Telecommunications Administrations (CEPT) - The European Commission can mandate the European Conference on Postal and Telecommunications (CEPT) to carry out studies and other preparatory activities to harmonise the use of the radio spectrum in Europe (current membership stands at 48).

Commission (EU) - The European Commission is the EU's executive body. The term 'Commission' refers to both the college of commissioners and the institution and its officials.

Communications Act - The Communications Act 2003, which came into force in December 2003.

Consumer surplus - The difference between the maximum price a consumer would be willing to pay for a good or service and the actual price they do pay.

Cost of Capital - See “weighted average cost of capital.”

Downlink - The downlink part of a network connection on a mobile device is used to receive, or download, data to the mobile device from the base station. The uplink connection is used to send data from the mobile device back to the base station.

Digital Subscriber Line (DSL) - A family of technologies generically referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as "twisted copper pairs") into high-speed digital lines, capable of supporting advanced services such as fast internet access and video-on-demand.

Duplex Mode - Both Frequency Division Duplex or Time Division Duplex are types of duplex made, see 'FDD' and 'TDD'.

Fixed Links - Communications links between fixed points. Such links may be unidirectional or bidirectional, and may be point-to-point or point-to-multipoint.

Fixed Satellite - A service between mobile earth stations and one or more space stations, possibly including feeder links in operation.

Frequency-Division Duplex (FDD) – Operations that require the outward and return signals to operate on different carrier frequencies.

Frequency Range - Any formally recognised division of the radio spectrum defined in terms of a start and end frequency (or centre frequency and bandwidth).

Fixed Wireless Access (FWA) - A wireless link to the home or the office from a cell site or base station.

Gigahertz (GHz) - A unit of frequency of one thousand million Hertz (cycles per second).

Incremental costs – Those costs which are directly caused by the provision of a service in addition to the other services which the firm also produces. Another way of expressing this is that the incremental costs of a service are the difference between the total costs in a situation where the service is provided and the costs in another situation where the service is not provided.

International Telecommunications Union (ITU) - Global decision making body on some spectrum matters. Part of the United Nations with a membership of 193 countries and over 700 private-sector entities and academic institutions.

Licence - A formal authorisation under section 1 of the Wireless Telegraphy Act 1949 for a customer to use radio equipment under certain restrictions

Local loop – The access network connection between the customer's premises and the local serving exchange, usually comprised of two copper wires twisted together.

Local Loop Unbundling (LLU) – A process by which a dominant provider's local loops are physically disconnected from its network and connected to a competing provider's networks. This enables operators other than the incumbent to use the local loop to provide services directly to customers.

Long Run Incremental Cost (LRIC) – The cost caused by the provision of a defined increment of output given that costs can, if necessary, be varied and that some level of output is already produced.

Long Term Evolution (LTE) – Part of the development of 4G mobile systems that started with 2G and 3G networks. Aims to achieve an upgraded version of 3G services having up to 100 Mbps downlink speeds and 50 Mbps uplink speeds.

Microwave Ethernet network - A family of computer networking technologies for local area networks (LANs) based on fixed wireless links.

Megahertz (MHz) - A unit of frequency of one million Hertz (cycles per second).

Ministry of Defence (MOD) – The British government department responsible for implementing defence policy. As part of this the MoD also holds spectrum.

Not Spots - An area that has no broadband Internet, or no (or limited) mobile phone coverage.

Net Present Value (NPV) - The difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyse the profitability of an investment or project.

Ofcom - The Office of Communications - Ofcom is the regulator for the UK communications industries, with responsibilities across television, radio, telecommunications and wireless communications services.

Opportunity Cost – The benefit foregone by not using a resource in its best alternative use.

PCCW - UK Broadband's Hong Kong based parent company.

Permissive mask - Block edge masks specifying allowed emissions from a communications signal in the 3.4 GHz band when there is a bilateral agreement around network synchronisation in place between operators.

Public Sector Spectrum Release (PSSR) - A release programme for public sector held spectrum which includes MOD spectrum in the 2.3 and 3.4 GHz bands.

Rate of Return (RoR) - The ratio of money gained or lost (whether realised or unrealised) on an investment relative to the amount of money invested.

Radio Spectrum Committee (RSC) - A specialist EU body responsible for specific technical measures required to implement the broader Radio Spectrum Policy. The RSC is composed of Member State representatives and chaired by the European Commission.

Remote Radio Unit (RRU) - A unit that contains the radio transceiver for a sector on a base station, it may also contain an inbuilt filter to meet Block Edge Mask (BEM) requirements.

Restrictive masks - Block edge masks specifying allowed emissions from a communications signal in the 3.4 GHz band when there is no bilateral agreement around network synchronisation in place.

Satellite Earth Stations - A transceiver at a particular location used for communicating by radio with a space satellite.

Significant Market Power (SMP) - The significant market power test is set out in European Directives. It is used by National Regulatory Authorities (NRAs), such as Ofcom, to identify those CPs which must meet additional obligations under the relevant Directives.

Superfast broadband – A broadband connection that can support a maximum download speed of 30Mbps or greater.

TalkTalk Telecom Group plc (TalkTalk) – A UK based company which provides pay television, telecommunications, internet access, and mobile network services.

Third Generation/3G - Refers to the third generation of mobile telecommunications technology.

Time-Division Duplex (TDD) - Time-division duplexing is the application of time-division multiplexing to separate outward and return signals.

Time-division duplex-Code Division Multiple Access (TDD-CDMA) - This is a channel access method based on using spread spectrum multiple access (CDMA) across multiple time slots (TDMA).

Spectrum - A range of frequencies of electro-magnetic radiation (for example, radio waves).

Tradable - The ability to transfer the rights and obligations held by the licensee to a third party.

Technical Licence Conditions (TLCs) - A series of engineering and related conditions a spectrum licencee has to adhere to.

UK Broadband Limited (UKB) - A UK based company provides wireless data capacity, equipment and services.

Uplink - The uplink part of a network connection is used to send, or upload, data from a mobile device to a base station. The downlink connection on a mobile device is used receive data from the base station.

Virgin Media Inc. (Virgin) – A company which provides fixed and mobile telephone, television and broadband internet services in the UK.

Weighted Average Cost of Capital (WACC) - The rate that a company is expected to pay on average to all its security holders to finance its assets.

Wholesale Local Access (WLA) - Covers fixed telecommunications infrastructure, specifically the physical connection between end users' premises and a local exchange.

Willingness to pay (WTP) - The maximum amount an individual would be willing to pay for a good or service.