



SRSP: The revised Framework for Spectrum Pricing

Our policy and practice of setting AIP spectrum fees

Statement

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Section 1

Executive Summary

- 1.1 The purpose of this document is to set out our conclusions on our revised Framework for spectrum pricing. This Framework will be used in future as a guide to setting AIP fees (based on the opportunity cost of the spectrum used) and will inform how we develop AIP fee proposals in future, as well as to how we will determine when a fee review is appropriate and how we will undertake post-review evaluations. We undertook this review because some of the principles and practices discussed in our consultation document have evolved over time in relation to specific licence sectors and classes. As a result not all of our principles or methodologies have been implemented, in full, for all licence sectors. We have now concluded that we will continue to apply these refinements systematically in future and in a way that takes full account of the specific characteristics and circumstances of each sector.
- 1.2 We will apply this Framework recognising that we need to take account of the particular circumstances of the frequency bands and licence types under review. It is likely therefore that in any specific fee review that some principles and methodologies will have more bearing on our proposals than others, and that in some circumstances we may need to diverge, for specific reasons, from these principles and methodologies. In general where we propose to do this we will set out our reasoning and consult.
- 1.3 This document presents high level AIP principles and methodologies and as such, it does not make specific fee proposals for individual licence sectors. We will consult further on fees for specific licence sectors as and when we consider it necessary to review these. When we do so, we will in all cases explain the various factors that we have taken into account in our proposals and, following consultation, the reasons for our decisions.

Decisions by users are more likely to secure optimal use

- 1.4 As the independent regulator for communications, we have a duty to secure optimal use of the radio spectrum¹. We interpret 'optimal use' to mean that the spectrum is used in a way that maximises the value that citizens and consumers derive from it, including the wider social value of spectrum use, and taking into account the specific consumer and citizen interests, including the interests of particular groups within society.
- 1.5 We believe that objective is, as a general rule, more likely to be achieved if detailed decisions on how spectrum is used are left to those directly engaged in its use rather than dictated centrally by a regulator. We have therefore adopted a range of complementary regulatory instruments to manage the spectrum with less central direction by Ofcom while recognising that regulation continues to play an important role in managing interference, negotiating international agreements to enable the better exploitation of the use of spectrum for the UK, securing compliance with

¹ See section 3(2)(a) of the Communications Act 2003, which requires Ofcom to secure (among other things) in the carrying out of its functions, the "optimal use for wireless telegraphy of the electro-magnetic spectrum".

international obligations and addressing market failures. These regulatory instruments include AIP fees set at levels that provide incentives for its optimal use.

The role of AIP as a complement to other regulatory instruments

1.6 In our consultation document we presented our analysis of the implications for pricing policy of the development of the spectrum market² since trading was introduced at the end of 2004. In summary, we conclude that, in general:

- There is no single spectrum market but rather a set of separate markets across the various frequency bands;
- Spectrum markets remain immature, with limited liquidity and an absence of developed market institutions and price information that would make them more effective;
- Trading and liberalisation alone may not be sufficient to promote efficient use in certain spectrum markets and so AIP may have a more important role in such markets;
- In markets where trading and liberalisation have a stronger role to play in the promotion of the efficient use of spectrum, the role of AIP may be less critical, but it can still provide an important complementary incentive.

1.7 We conclude that AIP is a valuable complement to spectrum auctions, trading and liberalisation and can usefully reinforce incentives from trading. However, this general conclusion will need to be assessed on a licence sector-specific basis in future fee reviews.

Our key AIP principles and methodologies

1.8 We have concluded on a set of eight principles and a methodology consisting of four methods that will be used to determine whether AIP should be applied and at what level the AIP fee should be set for any specific fee review of a licence sector in future. Having reviewed the comments from respondents to the consultation we have concluded that proposed principle 2 of the consultation document is not required going forward as while it sought to address an issue that has been of concern to stakeholders – that users of spectrum typically need time to respond to pricing signals - it does not add to the principles of when and how we approach a fee review. The way in which we take into account the fact that users cannot respond efficiently in the short term is through the methods by which we calculate opportunity cost (captured in methodology 2) and through our consideration of the impact of changes to fee levels in our impact assessment (captured in methodology 4). We discuss this in more detail under principle 2, in Section 4, at pages 35 – 40.

1.9 Having considered the comments we received at a series of stakeholder workshops, as well as the formal written responses, we have recognised that in the past, including in our consultation document, we have used the terms “spectrum value” and “opportunity cost” somewhat interchangeably. We have done this without necessarily always explaining what we mean by “value” as there are a number of

² For ease of reference we have used the term ‘market’ as convenient shorthand and this is not intended to refer to a relevant economic market.

ways in which this term can be interpreted. When discussing setting AIP fees to reflect the value of spectrum we have usually meant that these fees would be set at the price that would emerge in a well-functioning market. In a well-functioning market, the price of spectrum would be equal to the value of that spectrum in the next highest value use, rather than the value that the current user (for example, a company) might place on the spectrum. Given the possibility of continuing confusion about our meaning of the term “value” in the context of AIP fees we have redrafted our AIP principles and methodologies to clarify that we set AIP fees on the basis of opportunity cost.

- 1.10 We have, as a result, renumbered the AIP principles in the Table below and in the final spectrum pricing Framework. In the remaining document, however, for consistency with our consultation document and therefore ease of cross-reference, we have referred to the proposed principles by the number indicated in the consultation document.
- 1.11 The following two tables provide the text we have concluded on for these AIP principles and methodology. It also provides details of where in this Statement we provide our response to issues raised by respondents to the consultation and our rationale for concluding on these principles and methodologies.

AIP pricing principles	Page Numbers
<p>AIP principle 1: role of AIP</p> <p>AIP should continue to be used in combination with other spectrum management tools, in both the commercial and the public sectors, with the objective of securing optimal use of the radio spectrum in the long term. AIP’s role in securing optimal use is in providing long-term signals of the opportunity cost of spectrum.</p>	P. 25 - 36
<p>AIP principle 2: when AIP should be applied</p> <p>AIP should apply to spectrum that is expected to be in excess demand from existing and/or feasible alternative uses, in future, if cost-based fees were applied. In determining feasible alternative uses, we will consider over the relevant timeframe, any national or international regulatory constraints, the existence of equipment standards, and the availability and cost of equipment as well as other factors that may be appropriate.</p>	P. 42 - 48
<p>AIP principle 3: the ‘relevant timeframe’ to assess future demand of spectrum</p> <p>In general, we need to determine the time period over which we will seek to assess excess demand, congestion and feasible alternative use. We will do so over a timeframe that reflects the typical economic lifetime of existing users’ radio equipment.</p>	P. 48 - 53
<p>AIP principle 4: AIP and spectrum trading</p> <p>Many secondary markets are unlikely to be sufficiently effective to promote the optimal use of the spectrum without the additional signal from AIP. Therefore AIP will likely continue to be needed to play a role complementary to spectrum trading for most licence sectors.</p>	P. 53 - 57

<p>AIP principle 5: role of AIP in securing wider social value</p> <p>Uses of spectrum that deliver wider social value do not, as a general rule, justify AIP fee concessions, because direct subsidies and/or regulatory tools other than AIP are normally more likely to be efficient and effective.</p>	<p>P. 57 - 62</p>
<p>AIP principle 6: AIP concessions and the promotion of innovation</p> <p>It will generally not be appropriate to provide AIP concessions in order to promote innovation.</p>	<p>P. 62 - 65</p>
<p>AIP principle 7: use of market valuations</p> <p>We will take account of observed market valuations from auctions and trading alongside other evidence where available when setting reference rates and AIP fee levels. However, such market valuations will be interpreted with care and not applied mechanically to set reference rates and AIP fees.</p>	<p>P. 65 - 71</p>
<p>AIP principle 8: setting AIP fees to take account of uncertainty</p> <p>Where there is uncertainty in our estimate of opportunity cost, for example arising from uncertainty in the likelihood of demand for feasible alternative uses appearing, we will consider the risks from setting fees too high, or too low, in light of the specific circumstances. When spectrum is tradable we will consider the extent to which trading is expected to promote optimal use, and will also have particular regard to the risk of undermining the development of secondary markets.</p>	<p>P. 71 - 76</p>

AIP methodologies	Page Numbers
<p>AIP methodology 1: AIP and congestion</p> <p>In setting AIP fees, we will assess current and future congestion in existing use and demand for feasible alternative uses in the frequency band in question and at different geographic locations over the relevant timeframe, given technological, regulatory and international constraints and using readily available evidence.</p>	<p>P. 82 - 86</p>
<p>AIP methodology 2: reference rates</p> <p>Reference rates will be based on the estimated opportunity cost of spectrum use, considering both the current use and any feasible alternative uses. These estimates will be informed, where appropriate, by the available market information (if any), and economic studies of the value of spectrum in different uses.</p>	<p>P. 86 - 95</p>
<p>AIP methodology 3: calculating individual licence fees</p> <p>In converting reference rates to fees, we will take account of the opportunity cost and the amount of spectrum denied to others. This will generally be based on frequency, geographical location, bandwidth, geographical coverage or other measure that reflects the geographical extent of co-</p>	<p>P. 95 - 98</p>

ordination requirements and in some cases the exclusivity of an assignment.	
<p>AIP methodology 4: impact assessments</p> <p>We will undertake Impact Assessments on our fee proposals to identify any potential detrimental impacts to spectrum users, consumers and citizens. We will need to consider carefully the balance of benefits and risks of the implementation of all changes in fees.</p>	P. 98 - 103

1.12 In addition to the AIP principles and methods we have also concluded on a set of four principles to address how and when we will review AIP and cost-based fees and how we will evaluate the success of these fees in future. We have called these our four pricing review principles. These are summarised in the following Table where we also indicate where our response to issues raised by stakeholders on these issues are located in this Statement, along with our conclusions.

Pricing review principles	Page Numbers
<p>Pricing review principle 1: when to review fees</p> <p>If we think there is a case for a fee review we will generally seek views on the need for a review from stakeholders when we consult on Ofcom’s Annual Plan.</p> <p>We may still, however, on occasion undertake a fee review where there is a clear need without including this in the Annual Plan.</p> <p>We will propose to conduct a fee review only where the evidence suggests that a review would be justified, including evidence of a likely and sufficiently material misalignment between the current rates and the opportunity cost of the spectrum for fees based on AIP, or between the current rates and our spectrum management costs for cost-based fees.</p> <p>When we conclude on a review in future, we would also specify, where appropriate, a time period during which we would not normally expect to carry out a further review.</p>	P. 104 - 109
<p>Pricing review principle 2: Process for carrying out fee reviews</p> <ul style="list-style-type: none"> • Step 1 - Is there evidence to indicate that fees are out of line with opportunity cost or our costs of spectrum management? In order to decide whether or not a particular licence fee needs to be reviewed at a particular time, we will first look for evidence of a sufficiently material misalignment of the fee and the relevant opportunity or spectrum management cost. This is because severe misalignment may indicate that fees at the present level are unlikely to be achieving our objectives of promoting optimal use of spectrum or reflecting our spectrum management cost; • Step 2 - Is there evidence that a fee change would increase the efficiency of use more effectively than another spectrum management response? As noted before, spectrum pricing is only one of a range of regulatory approaches available to us. There may be other steps we could take such as identifying 	P. 109 - 114

<p>more spectrum that could be made available for the current use, initiating a planned programme to clear the band for an alternative use, or reviewing the regulations around the spectrum such as international or domestic technical constraints;</p> <ul style="list-style-type: none"> • Step 3 - Is this the right time to review? We will also be responsive to evidence of an urgent need to change a fee, for example that the existing fee level is causing serious detriment, such as a majority of users unexpectedly vacating a band without realistic prospect of new users taking up the available spectrum - or that a very valuable band is, or is likely to become, severely congested without a change in fee level. 	
<p>Pricing review principle 3: Post-review evaluations</p> <p>We will attempt to evaluate the effectiveness of fee rates based on AIP. We will do this by collecting and assessing evidence that:</p> <ul style="list-style-type: none"> • users (individually or collectively) are changing their spectrum requirements, or • congestion and demand in a band or location is worsening, or • spectrum is not used, or used only to a small extent, for a considerable time. 	<p>P. 114 - 117</p>

Future Fee reviews

- 1.13 We have concluded that we intend to undertake a review of the frequency bands used in UK for fixed links, subject to the availability of resources and consideration of our overall priorities for spectrum management, following the publication of this Statement. This review will encompass all services that share spectrum with fixed links to reflect our intention to price spectrum through consideration of feasible alternative uses, rather than licence sectors. We note that as part of this review it may be necessary to review the costs of managing this spectrum as this will inform the minimum fee or “floor” for such AIP-based fees.
- 1.14 We have also concluded that a wholesale review of our approach to cost-based fees is not a priority for stakeholders or Ofcom at this time, given the resource constraints that we face and our view of the priority for a review of fixed link fees. We may however review individual cost-based fees where we believe this should be a priority against our other spectrum management activities.

Section 2

Introduction

- 2.1 This document sets out our conclusions on our revised Framework for spectrum pricing. This Framework will be used in future as a guide to setting AIP fees (based on the opportunity cost of the spectrum used) and will inform how we develop specific AIP fee proposals in future as well as guide how we will determine when a fee review is appropriate and how we will undertake post-review evaluations. We will apply this Framework in future fee reviews, recognising that we need to take account of the particular circumstances of the frequency bands and licence types under review. It is likely therefore that in any specific fee review that some principles and methodologies will have more weight than others and in some circumstances that we may need to diverge, for specific reasons, from these principles and methodologies. In general where we propose to do this we will set out our reasoning and consult.
- 2.2 We published our proposals for the revised Framework on spectrum pricing in March 2010 in our consultation document available here <http://stakeholders.ofcom.org.uk/consultations/srsp/>.

Stakeholder responses

- 2.3 We received 30 consultation responses from licensees from most licence sectors³ as well as industry associations and other interested stakeholders, including six confidential responses.
- 2.4 A list of the non-confidential respondents to this consultation can be found in Annex 1 and the full text of the non-confidential responses is available at <http://stakeholders.ofcom.org.uk/consultations/srsp/?showResponses=true>.

Consultation questions

- 2.5 In our consultation document we proposed nine principles and four methodologies of spectrum pricing. We asked seven questions of stakeholders:

General principles

Question 1: Do you agree with our proposed core principles of setting AIP? Are there additional matters that it would be helpful to clarify?

Proposed principle 1: role of AIP

AIP should continue to be used in combination with other spectrum management tools, in both the commercial and the public sectors, with the objective of securing optimal use of the radio spectrum in the long term. AIP's role in securing optimal use is in providing long-term signals of the value of spectrum which can be indicated by its opportunity cost.

³ The term "licence sector" is used generically in this document and may include a single licence class or a number of licence classes used by a group of users.

Proposed principle 2: users can only respond in the long term

The purpose of AIP is to secure the optimal use of spectrum in the long term, so as to allow users to be able to respond to AIP as part of their normal investment cycle. Even where users have constraints imposed on their use of spectrum, in general, some if not all users have some ability to respond to AIP.

Proposed principle 3: when AIP should be applied

AIP should apply to spectrum that is expected to be in excess demand from existing and/or feasible alternative use, in future, if cost-based fees were applied. In determining *feasible* alternative uses, we will consider the relevant timeframe, any national or international regulatory constraints, the existence of equipment standards, and the availability and cost of equipment.

Proposed principle 4: the ‘relevant timeframe’ for AIP

In general, we seek to assess excess demand, congestion and feasible alternative use over a timeframe that reflects the length of existing users’ investment cycles.

Proposed principle 5: AIP and spectrum trading

Many secondary markets are unlikely to be sufficiently effective to promote the optimal use of the spectrum without the additional signal from AIP. Therefore AIP will likely continue to be needed to play a role complementary to spectrum trading for most licence sectors.

Proposed principle 6: AIP and wider policy objectives

Socially beneficial uses of spectrum do not, as a general rule, justify AIP fee concessions, because direct subsidies and/or regulatory tools other than AIP are normally more likely to be efficient and effective. For cost-based fees there might be some circumstances in which it could be appropriate to provide a concession.

Proposed principle 7: AIP and the promotion of innovation

It will generally not be appropriate to provide AIP concessions in order to promote innovation. We may consider whether cost-based fees should be set at a lower level in order to promote innovation.

Proposed principle 8: use of market valuations

We will take account of observed market valuations from auctions and trading alongside other evidence where available. However, such market valuations will be interpreted with care and not applied mechanically to set AIP fees.

Proposed principle 9: setting AIP fees to take account of uncertainty

Where there is uncertainty in our valuations and the likelihood of demand for feasible uses appearing we will consider the risks from setting fees too high, or too low, in light of the specific circumstances. When spectrum is tradable we will consider the extent to which trading is expected to promote optimal use, and will also have particular regard to the risk of undermining the development of secondary markets.

Fee-setting methodology

Question 2: Do you agree that we should charge cost-based fees where AIP is not appropriate or AIP would not cover our costs? How do you think we should set cost-based fees in future fee reviews? Are there particular factors you think we should take into account, for specific licences fees or cost-based fees in general?

Question 3: Do you agree with our proposed fee-setting methodology principles (set out below)? Are there additional matters that it would be helpful to clarify?

Proposed methodology 1: AIP and congestion

In setting AIP fees, we will assess current and future congestion in existing use and demand for feasible alternative uses in the frequency band in question and at different geographic locations over the relevant timeframe, given technological, regulatory and international constraints and using readily available evidence.

Proposed methodology 2: reference rates

Reference rates will be based on the estimated value of the spectrum in the current use and any feasible alternative uses. These estimates will be informed, where appropriate, by the available market information (if any), and economic studies of spectrum value.

Proposed methodology 3: calculating individual licence fees

In converting reference rates to fees, we will take account of the value of the amount of spectrum denied to others. This will generally be based on frequency, geographical location, bandwidth, geographical coverage or other measure that reflects the geographical extent of co-ordination requirements and in some cases the exclusivity of an assignment.

Proposed methodology 4: impact assessments

We will undertake Impact Assessments on our fee proposals to identify any potential detrimental impacts to spectrum users, consumers and citizens. We will need to consider carefully the balance of benefits and risks of the implementation of all changes in fees.

Plans and priorities for spectrum fee reviews

Question 4: Do you agree with our proposal to move away from regular full-scale reviews to reviewing in response to evidence, as set out in Option 5?

Question 5: Do you agree with our process for assessing the priority of future fee reviews? Are there other sources of evidence of misalignment between fees and spectrum value or spectrum management costs that you can think of, and what weight should we give them?

Question 6: Based on our proposed criteria, or other criteria you would propose we use, what do you think our priorities for future fee reviews should be? Please tell us your reasons for thinking these should be prioritised. Do you agree that we should prioritise a fixed link fee, as some stakeholders have suggested to us?

Question 7: Do you agree with our proposed approach to post-review evaluations?

The structure of this document

2.6 The rest of this document is structured as follows:

- Section 3 sets out the background to spectrum pricing
- Section 4 sets out our conclusions on our core policy principles in relation to AIP;
- Section 5 sets out our conclusions on the methodology for setting spectrum fees;
- Section 6 sets out our conclusions of the process and priorities for conducting specific fee rate reviews;
- Annex 1 provides a list of respondents;
- Annex 2 sets out responses addressing specific licence sectors or non-pricing issues; and
- Annex 3 provides a glossary.

Section 3

Background

The purpose of this document

- 3.1 This document sets out our conclusions on the overarching Framework of policy principles and methodology that we will apply in setting AIP fees for access to radio spectrum and on our approach to planning and evaluating future reviews of fees in specific licence sectors⁴. It is likely to be of interest to current and prospective users⁵ of the spectrum.
- 3.2 We undertook this review because some of the principles and practices discussed in our consultation document have evolved over time in relation to specific licence sectors and classes. As a result not all of our principles or methodologies have been implemented, in full, for all licence sectors. We have now concluded that we will continue to apply these refinements systematically in future and in a way that takes full account of the specific characteristics and circumstances of each sector. This document sets out our general approach to AIP fee policy, which is intended to accommodate all of the types of issues we need to consider in specific AIP fee reviews.
- 3.3 Any future AIP fee review will be conducted under the general principles and methodology outlined in this Statement. The detailed policy and AIP fees in each case will reflect the specifics of the use(s) and band(s) under consideration.
- 3.4 This section sets out the context for this Statement and the basis of our analysis, including the legal framework.

The legal framework

- 3.5 The legal framework within which we operate is set out in the Communications Act 2003 (the 'Act'), the Wireless Telegraphy Act 2006 (the 'WT Act') and applicable EU directives, including the Authorisation Directive⁶ and the Framework Directive⁷.

Spectrum fees and our duties concerning spectrum management

- 3.6 We currently employ three mechanisms for setting fees for rights to use spectrum: cost-based pricing, AIP and auctions. This document focuses on the first two of these. In July 2010 the Government laid a draft Direction before Parliament⁸ that would require us to employ a fourth mechanism – the setting of fees to reflect full market value. We do not discuss this fourth mechanism in this document.

⁴ The term "licence sector" is used generically in this document and may include a single licence class or a number of licence classes used by a group of users.

⁵ The term "spectrum users" is used generically in this document to include existing and potential users of spectrum.

⁶ Directive 2002/20/EC on the authorisation of electronic communications networks and services, as amended by Directive 2009/140/EC.

⁷ Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services, as amended by Directive 2009/140/EC.

⁸ <http://www.legislation.gov.uk/ukdsi/2010/9780111500767/data.pdf>

- 3.7 We apply AIP where appropriate to secure optimal use of the radio spectrum⁹ and set fees for licences¹⁰ and grants of recognised spectrum access (RSA)¹¹ with that objective in mind. The following section discusses our general approach to deciding when to apply AIP as opposed to charging cost-based fees.
- 3.8 The Authorisation Directive states in Article 13 that Member States may impose fees for the rights of use of radio frequencies which reflect the need to ensure the optimal use of that resource. The WT Act, therefore, permits us to recover sums greater than those necessary to recover the costs incurred in connection with our radio spectrum functions. If we do so, we are required to have regard, in particular, to:
- the extent to which the spectrum is available;
 - present and likely future demand;
 - the desirability of promoting:
 - efficient management and use of the spectrum;
 - economic and other benefits;
 - innovation; and
 - competition¹².
- 3.9 We are also required to have regard to our general duties and the Community requirements set out in sections 3 and 4 of the Act respectively¹³. Our primary duties are to further the interests of citizens in relation to communications matters, as well as the interests of consumers in relevant markets, where appropriate by promoting competition. Section 3(2)(a) of the Act requires Ofcom to secure the optimal use for wireless telegraphy of the electro-magnetic spectrum.

⁹ Under Section 3(2)(a) of the Act, we have a duty to secure, among other things, the optimal use for wireless telegraphy of the electro-magnetic spectrum.

¹⁰ Installation or use of radio equipment is unlawful unless under, and in accordance with, a licence granted by Ofcom (see s. 8(1) of the WT Act). This does not apply to Crown bodies, which do not require a licence from us for their use of spectrum. However, the Secretary of State may make payments to Ofcom in respect of the use of spectrum by Crown bodies (s. 28 of the WT Act). Additionally, a licence is not required also where the use of spectrum is exempted from this requirement by regulations. Equipment that is unlikely to cause interference, such as short-range devices or receivers, must be exempted from licensing under s. 8(4) of the WT Act. Therefore, no fee is payable to access the spectrum by means of such equipment, unless under a grant of recognised spectrum access, as explained in the following footnote.

¹¹ Subject to Ofcom making the necessary regulations, Crown bodies and operators of equipment that can receive but not transmit (referred to as 'receive-only') may apply for recognised spectrum access if they wish their spectrum use to be formally recognised (see s. 18 of the WT Act). Ofcom has a duty to take account of grants of RSA in the same way as of licences in carrying out its spectrum management functions (see s. 20 of the WT Act). RSA has so far been introduced for receive-only radio telescopes in certain radio astronomy bands and for Crown bodies in the 406.1-430 MHz band.

¹² Section 13 of the WT Act

¹³ In case of conflicting duties, priority must be given to the Community requirements over the general duties set out in section 3 of the Act and these latter take precedence over the duties set out in section 3 of the WT Act, which concern more specifically the management of the radio spectrum.

- 3.10 The Authorisation Directive¹⁴ also requires fees for rights to use spectrum to be objectively justified, transparent, non-discriminatory and proportionate.
- 3.11 The fees for most licences are set out in specific regulations. The current regulations are the Wireless Telegraphy (Licence Charges) Regulations 2005 (SI 2005/1378), as amended.
- 3.12 The new EU Framework for electronic communications networks and services¹⁵ and the Digital Economy Act 2010 have not introduced any changes to our high-level duty to secure the optimal use of spectrum, nor to the matters that we need to consider when we set fees under s.3 of the WT Act. The Digital Economy Act 2010 has granted us an express power to set fees in relation to licences that have been auctioned in the cases specified under section 12(6) (e.g. once the initial licence term has expired)¹⁶.

How we interpret our duty to secure the optimal use of spectrum

- 3.13 In response to requests by stakeholders, we have sought to clarify how we interpret our general duty to secure the optimal use of spectrum.

What we mean by ‘optimal use’

- 3.14 In practice, subject to the considerations given in paragraphs 3.19 – 3.20, we consider that optimal use is more likely to be secured for society if spectrum is used efficiently, that is to produce the maximum benefits for society. We consider that efficient use of spectrum means that:
- spectrum is allocated and assigned to those uses and users that will provide the greatest benefits to society as a whole;
 - individual spectrum users economise on their use of spectrum so there is no ‘wasteful’ use or underutilisation of spectrum; and
 - spectrum becomes available over time for new and innovative services, where these are of sufficient value to society, and more generally to accommodate changes in technologies and consumer demand for services that rely on spectrum.
- 3.15 If these conditions are met, society will obtain the maximum possible output (measured by value) from the limited spectrum resource. The value that society derives from spectrum encompasses both the value that individual consumers gain from the goods or services that they obtain commercially and wider social, cultural or economic benefits.
- 3.16 In the commercial sector, the users and uses that can generate the greatest benefit to society are normally those who value spectrum more highly. The fact that they are prepared to pay the highest price for spectrum normally indicates their ability to use it more productively in order to satisfy commercial demand for downstream services.

¹⁴ Article 13 of the Authorisation Directive, which also specifies that Member States shall take into account the objectives set out in Article 8 of the Framework Directive 2002/21/EC (the Framework Directive) in setting fees.

¹⁵ http://ec.europa.eu/information_society/policy/ecomm/tomorrow/index_en.htm.

¹⁶ See section 12(6) of the WT Act, as amended by the Digital Economy Act 2010.

Consequently, their decisions are, in general, more likely to lead to highest benefits for society.

- 3.17 In the public sector, similar principles apply. The providers of public services buy their inputs such as property, energy, equipment and labour from markets, in competition with commercial operators. How much they are prepared to spend on particular inputs can be taken to indicate the value they expect to generate for society from those inputs.
- 3.18 We discuss the particular case of wider social benefits which are not reflected in, or proportionate to, individual users' value of spectrum in principle 6, from paragraph 4.213 to 4.240.

Cases where securing efficient use may not always be optimal

- 3.19 Given our belief that efficient use will promote maximum benefits for society from the use of spectrum, we aim to identify fee levels that will promote efficient use. However, we also need to consider the interests of particular groups in society, as set out in our general duties (and as required under our duty to conduct an Impact Assessment including an Equality Assessment). Put simply, if efficient use can only be secured at a significant cost to a particular group of citizens or consumers, then while securing that increase might be efficient, it may not be optimal.
- 3.20 We would therefore consider the potential impacts on particular groups of citizens and consumers (as required by our general duties) before making fee proposals for consultation.

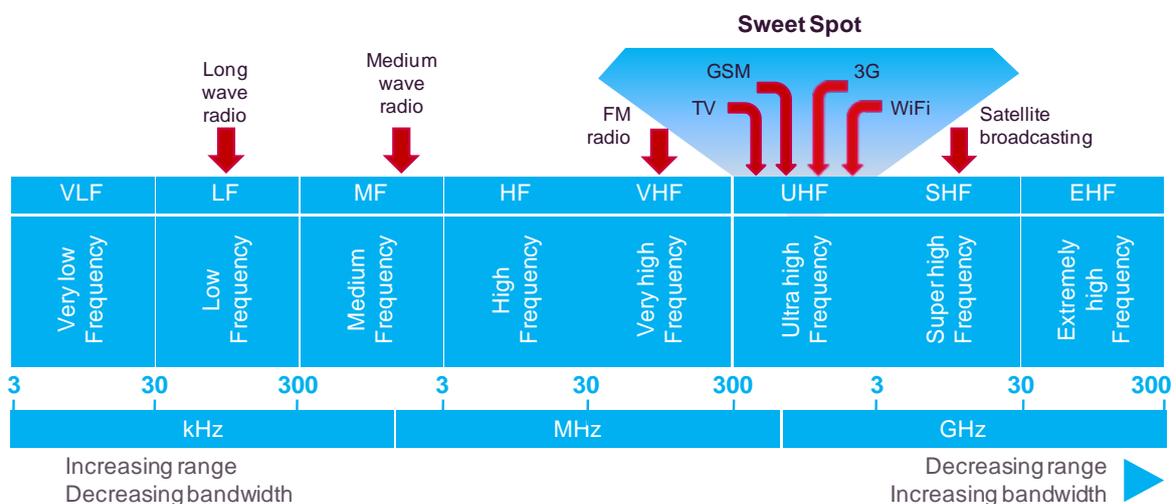
The radio spectrum and its value

- 3.21 Radio spectrum is a valuable resource. Television and radio broadcasting, mobile telephone networks, emergency services, radar and many other services and applications all depend on access to it.
- 3.22 The radio spectrum is finite in that use of spectrum for one purpose or by one user will generally exclude or limit its use by others. This means that use of spectrum imposes a cost on society where there is insufficient spectrum available to meet demand for it, whether for the existing or an alternative use. That cost is referred to as the 'opportunity cost'. It represents the value to society of the most valuable alternative use of the spectrum that is forgone and is a key concept in relation to spectrum pricing as explained in paragraph 3.41 to 3.44 below.
- 3.23 Unless spectrum use is appropriately managed and planned, it is highly likely that interference between different users will greatly diminish its value for communications and other purposes. This is the reason why the use of spectrum is coordinated between different services and different users nationally and internationally. This is not intended to imply that Ofcom has to direct, or regulate every aspect of spectrum use; we are required to be proportionate in our approach. Our aim in planning and managing spectrum use is to provide sufficient clarity for users to understand the value of spectrum to others and the flexibility they have in their use of spectrum which is limited by the risk they have of causing harmful interference to others.

Spectrum value is influenced by its physical properties

- 3.24 Spectrum is not homogeneous. The laws of physics mean that different frequencies are more suitable for different applications depending on factors such as the distance the signals have to travel and the amount of information to be carried. Lower frequencies tend to travel further and penetrate buildings better than higher frequencies but have limited bandwidth that may not be sufficient for high-data uses. In addition, the relationship between size of antenna and frequency means that lower frequencies may not be practical for some compact portable equipment, although technological solutions may be deployed extending the usable range of spectrum for this purpose.
- 3.25 Conversely, higher frequencies can carry much more data although the suitability of frequencies much above 3 GHz for mobile applications depends on ongoing developments in technology (deployment in 4-5 GHz may become technically and economically feasible in the foreseeable future).
- 3.26 The figure below illustrates how the radio spectrum is used and shows the 'sweet spot' that is often considered the most attractive frequency range for commercial exploitation because it can be used for mobile applications and has sufficient capacity to carry broadband and video broadcasting. Everything else being equal, spectrum in the 'sweet spot' is likely to be in greater demand and therefore more valuable than other parts of the radio spectrum.

Figure 1: the spectrum 'sweet spot'

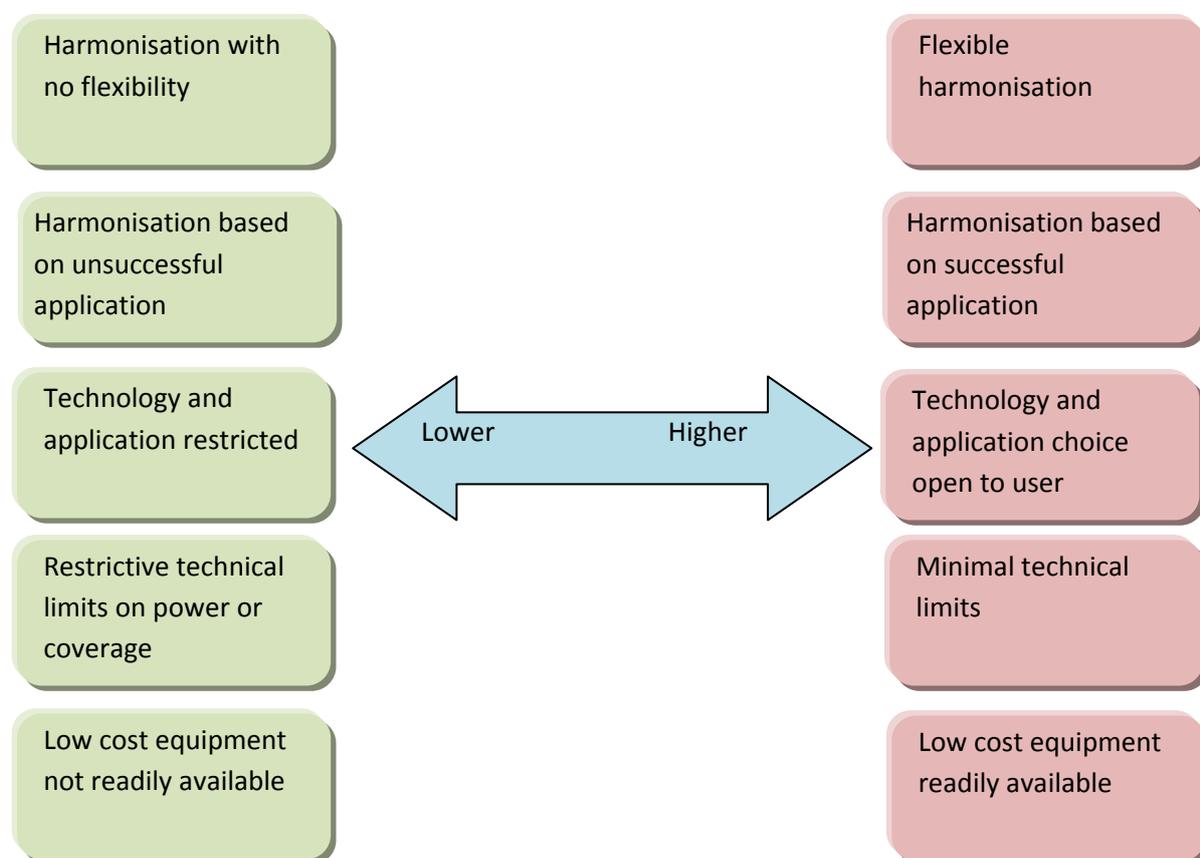


Spectrum value is affected by a range of factors

- 3.27 Spectrum value can however be significantly affected by factors other than intrinsic physical properties of propagation and bandwidth. These exogenous factors, illustrated in Figure 2 below, include the following:
- *International harmonisation.* The existence of international agreements to make spectrum available for particular services within Europe or globally, known as 'harmonisation', can create multinational markets for equipment and services including enabling roaming of consumer devices between countries. The resulting economies of scale in equipment manufacture may reduce the price of equipment and so tend to increase the value of the spectrum for downstream services.

Harmonisation is often supported by substantial effort to design systems and develop technical standards and the time needed for this activity can be considerable. On the other hand, if harmonisation works as a constraint by being inflexible and reserving spectrum for services that are not commercially successful, or reserves more spectrum than the intended use requires, it can depress the value society gains from the spectrum by excluding higher value alternative uses;

- *Demand from consumers/value of services to citizens.* The technological developments in recent years which have tended to enable uses like mobile broadband in more frequencies have been substantially driven by the observed high value placed on such services by consumers. As a result, the potential value of affected bands – both the value to individual consumers and the wider social value produced by the existence of these services – has increased. Similarly, developments in technology which allow more information to be transmitted for the purposes of national security or public safety have increased the benefits that society gains from the spectrum used in those services;
- *National frequency policy.* National restrictions on how spectrum may be used or licence conditions that effectively lock in current use can directly affect spectrum value. Parts of the spectrum may be reserved for particular services or technologies or for unspecified uses with a particular purpose, such as defence and national security. The need to protect other services from undue interference may require us to impose technical restrictions, such as power limits on other users of spectrum. Such restrictions may be of value to the existing users because they provide added certainty about the condition of the spectrum that they access. However, if they inhibit or prevent user-led change, they may depress the value that society could gain from the spectrum over the long term. In general, in managing the spectrum, we aim to keep restrictions on use to the minimum necessary so as to minimise the risk that such costs will arise.
- *Availability of equipment.* If equipment is not readily available or is unduly expensive to purchase compared with the benefits it is likely to generate, this will make the spectrum less attractive for commercial or non-commercial services. Lead times for new technology can be considerable, especially if new technical standards need to be developed;

Figure 2: non-physical factors affecting potential value realised from spectrum

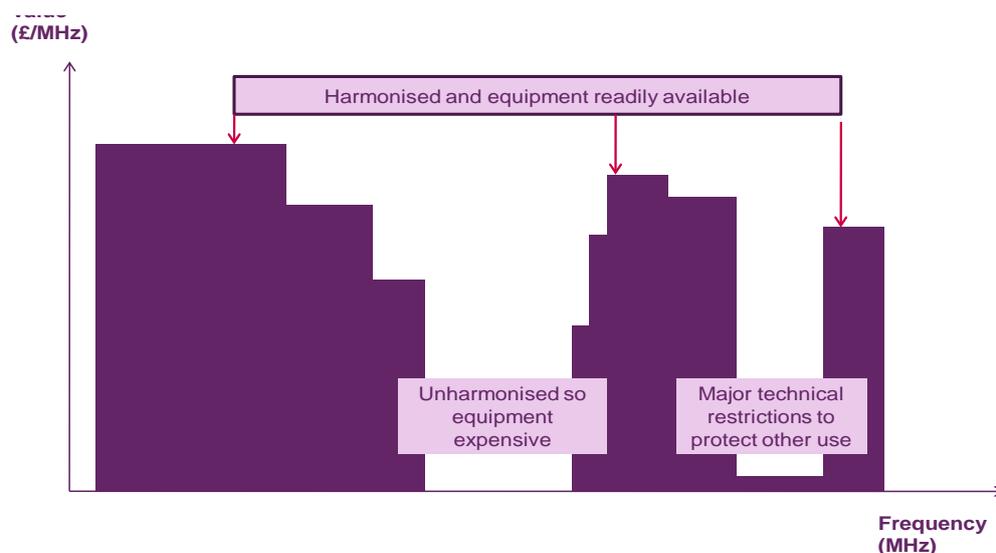
3.28 These factors are capable of being changed in the medium and long term but altering them may take considerable time or cost.

The spectrum frequency-value curve is likely to exhibit marked discontinuities

3.29 The value of spectrum may therefore be expected to vary considerably with frequency, depending not just on its physical properties of bandwidth and propagation but also on factors such as those discussed above. Consequently, spectrum at one frequency will not necessarily be a substitute for spectrum at another frequency, even if those frequencies are relatively close and have similar physical characteristics. The 'frequency-value' relationship will not follow a predictable, smoothly rising then falling curve that might be expected if value simply reflected the physics of radio propagation and bandwidth availability. Instead, the relationship can be expected to exhibit numerous discontinuities.

3.30 As discussed in the following sections, this has important implications for how we charge for spectrum access. Although, as a rough guide, frequencies that are suitable for mobile services are likely to be more valuable than those that are not, the relationship between frequency and value is more complex as illustrated in Figure 3 below, and not all spectrum potentially usable by mobile applications is equally valuable for all uses. This illustrates how the value across a range of spectrum might vary with frequency.

Figure 3: illustrative spectrum values



Demand for radio spectrum is growing and shortages have been forecast

- 3.31 Demand for radio spectrum has grown substantially over the last decade driven by the rise in demand for mobile broadband communications and a range of other applications and certain frequency bands are already congested in some areas¹⁷. It was forecast by consultants in 2005¹⁸ that demand will exceed supply by around 2.5 GHz below 15 GHz by 2025 and that spectrum shortages could constrain optimal deployment and growth in future; and a later study¹⁹ found that growth in cellular and short-range wireless could generate significant pressure on spectrum over the next 3-4 years.
- 3.32 Such predictions, however, are subject to a number of caveats. Forecasts of demand looking much more than 5 years ahead are inevitably speculative as there is substantial uncertainty about the emergence of new technologies and consumer demand. In addition, new releases of spectrum and the fact that users' have incentives to deploy technologies that can make more use of what is available will both tend to counteract the simple effect of demand growth. However these changes are not continuous but themselves take time, during which high value spectrum may not be in sufficient supply to accommodate demand.

The purpose of and rationale for AIP

- 3.33 The purpose of AIP is to provide users with a sustained long-term signal of the value of the spectrum as indicated by its opportunity cost in the next highest use and, as a result, to give them incentives to use it in a way that maximises benefits for society over time.

¹⁷ The 165-173 MHz band even had to be closed to new business radio assignments in London in 1990 (i.e. before AIP was introduced) because it was too congested.

¹⁸ *Spectrum Demand for Non-Government Services 2005-2025*, 1 September 2005 by Analysys and Mason, http://www.spectrumbaudit.org.uk/pdf/spectrum_demand.pdf

¹⁹ *Predicting Areas of Spectrum Shortage* by PA Consulting, 7 April 2009 at http://www.ofcom.org.uk/research/technology/research/spec_future/predicting/shortage.pdf

- 3.34 The rationale for AIP may be simply stated. If the price charged for any limited resource, whether it is energy, raw materials, land or spectrum, does not reflect its opportunity cost, there will be less incentive to use it efficiently, it will be not be available for alternative uses or other users that could produce additional value and society will be worse off. For example, faced with a choice between investing in more advanced equipment and using more spectrum businesses will naturally tend to choose the option with lower costs. If the cost of spectrum reflects its true opportunity cost, and the cost of equipment also reflects its true value (as would be expected in a well-functioning market for equipment) then business will make the trade-off between investment in spectrum and equipment in a way that maximises benefits generated from their use.
- 3.35 If spectrum appears cheaper than its true opportunity cost, businesses will rationally use more spectrum, and invest less in equipment than the efficient balance. The result of this would be that fewer users overall will be able to access spectrum to generate benefits for society.
- 3.36 On the other hand, if spectrum appears more expensive than its true opportunity cost, businesses will be incentivised to over-economise in spectrum, leading either to users:
- using more complex (and therefore expensive) equipment, or alternatives to spectrum that are more costly than spectrum would be if charged at its “true” opportunity cost and which might translate into higher costs for consumers, or
 - reducing, or ceasing altogether services they provided, resulting in reduced benefits to consumers and citizens and unused spectrum.
- 3.37 Users face various choices in relation to spectrum. These include:
- *whether to use radio* or some other form of technology such as cable, where this would be possible;
 - *which frequency band to use*. For example, for point-to-point fixed links, there might be a choice between using a lower frequency, which requires fewer links to cover the distance but possibly denies spectrum to a higher value use or user, and using a higher frequency requiring more infrastructure investment (where this is practically feasible) but imposing a lower opportunity cost;
 - *which radio technology to employ*. For example, it might be possible to reduce the spectrum bandwidth needed to carry a given amount of information by investing in more sophisticated modulation or coding schemes;
 - *what network architecture to employ*. For example, to accommodate a given level of traffic in a cellular network, there are trade-offs between the number of base stations and the amount of spectrum used. Installing more base stations requires additional investment in equipment but enables spectrum to be re-used more intensively so that more traffic may be accommodated in a given bandwidth.
- 3.38 Users may, in addition or instead, choose to make adjustments to other elements of their business or service, for example by reducing non-spectrum costs.

- 3.39 We recognise that some of these choices might be constrained in practice, for example by regulatory requirements, equipment availability or the time taken to respond in an efficient manner; and that the time needed to respond to price signals might be lengthy if significant investment is required to upgrade or replace existing systems. AIP is therefore intended to provide an incentive for longer term investment decisions, recognising that choices may be limited in the short to medium term. We discuss this further in the following section.
- 3.40 However, subject to these caveats, we would expect, and experience tends to confirm, that spectrum, like other scarce resources, is likely to be used sub-optimally over time if those making decisions on its use do not face a price that reflects its value to society.

Setting fees to reflect opportunity cost provides the right incentives to maximise benefits for society

- 3.41 In general terms, benefits to society will be maximised over time if spectrum is priced to reflect opportunity cost. The opportunity cost is the price that would emerge in a well functioning market and reflects the value of spectrum to the best alternative use or user that is denied access to it²⁰. When AIP fees are charged, users will hold scarce spectrum if they value it more than the AIP fee. If AIP fees reflect opportunity costs, users have an incentive to hold only the spectrum that they value as highly as the best alternative user or use. In this way, AIP fees have an effect similar to the prices that would emerge in a well functioning spectrum market.
- 3.42 One user's use of spectrum may deny another's use in two ways²¹:
- i) Transmissions may 'sterilise' an area around the transmitter site because the emitted signals swamp reception of incoming signals from other transmitters;
 - ii) It might also be necessary to exclude other transmitters from an area around the system receiver in order to prevent harmful interference to reception²².
- 3.43 In either case, our duty to secure optimal use would lead us not to permit some users access to the affected spectrum, where the existence of harmful interference²³ would rule out efficient use by one or more users.
- 3.44 In deciding to apply AIP, we do not claim to be able to predict exactly how users will respond to a particular level of fees. Over time, users can be expected to adapt their use of spectrum and other inputs and the services they offer in response to a wide

²⁰ Even if the band is already in the highest value use, there will still be an opportunity cost if prospective new users, in that use, are denied access. In that case, the opportunity cost would correspond to the benefits that those users would have generated had they been able to access spectrum.

²¹ For a fuller discussion of interference and how it arises, see our June 2008 *Guide to Spectrum Usage Rights* at <http://www.ofcom.org.uk/radiocomms/isu/sursguide/>.

²² The exclusion might extend beyond the frequencies assigned to the system (so-called 'out-of-band' protection), possibly extending hundreds of MHz beyond the designated frequency limits of the assignment if receivers are not selective, resulting in large 'guard bands' that may rule out significant beneficial uses of spectrum

²³ In some uses, users can tolerate higher levels of interference and so it is possible to make more assignments in a given portion of spectrum. Interference that users tolerate is not considered 'harmful'. Everything else being equal, a licence for this sort of use would be expected to have a lower opportunity cost, because the denial effects on other users are reduced.

range of factors that it is not possible to predict with any certainty. However, by charging users AIP fees that correspond to the opportunity cost of spectrum, individual users should be incentivised to make decisions appropriate to their circumstances that are likely to generate greater benefits to society than charging cost-based fees that do not reflect this opportunity cost in that it will incentivise them to use more spectrum efficiently.

Application of spectrum pricing in the public sector

- 3.45 Crown bodies²⁴ are a major user of spectrum (most notably the Ministry of Defence (MoD) which as shown in Figure 4, below holds around 30%, of the spectrum²⁵). It is therefore important that Crown bodies, as well as commercial users, have effective incentives to use spectrum efficiently²⁶.
- 3.46 Ofcom cannot require the Crown to pay licence fees for the use of spectrum as Crown bodies, such as the MoD and some other government departments and agencies, do not need a licence to use spectrum.
- 3.47 The *Independent Audit of Spectrum Holdings* recommended that the public sector, including the Crown, should face the same incentives and signals as private sector users of spectrum. This principle, and the explicit principle that the public sector should pay for spectrum on a comparable basis to the private sector, was adopted by the Government in its response²⁷.

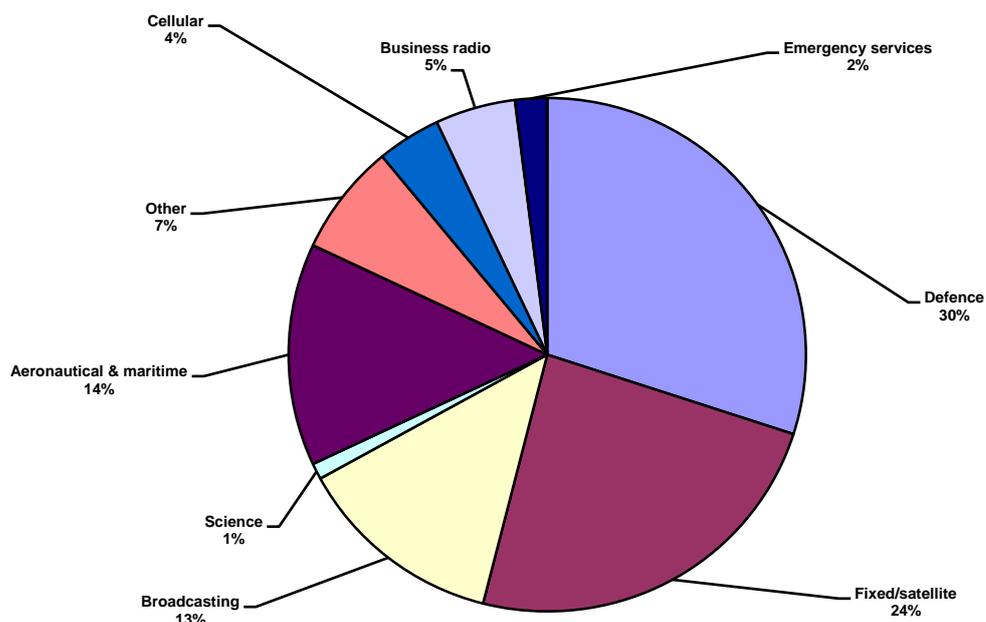
²⁴ There is no general legal definition of a Crown body but central government departments reporting to ministers such as the MoD, Home Office and Treasury are generally considered to be Crown bodies.

²⁵ Although MoD has permitted access to parts of the spectrum it holds for other public sector (such as the emergency services) and commercial use, much of which access is managed and charged for by Ofcom through WT Act licences.

²⁶ Non-military 'Aeronautical & maritime' users are generally commercial but were included in the *Independent Audit* as 'public sector' reflecting the extensive public policy (safety) interest and regulatory involvement in their use of wireless communications, and the fact that many technologies and spectrum bands are shared with defence uses.

²⁷ www.spectrumbaudit.org.uk

Figure 4: weighted use of spectrum below 60 GHz²⁸



- 3.48 Any future fee reviews that follow this consultation will therefore have implications for the amounts the Crown pays under this comparability principle.
- 3.49 Other public bodies that are not Crown bodies require a licence from Ofcom in the same way as commercial users and pay licence fees set by Ofcom. They will therefore be directly affected by any future fee reviews relating to their licences or to spectrum that they may wish to use in future and which will be based on the application of the general principles and methodology set out in this document.

Other pricing related activities

- 3.50 We are currently undertaking, or have recently concluded, a number of specific fee rate reviews and some stakeholders have asked us to clarify how the SRSP relates to this separate series of consultations, particularly those for use of spectrum by the aeronautical and maritime sectors, but also other work we are undertaking in which fees are a core or key element.
- 3.51 This Statement concludes on a Framework for spectrum pricing that we will apply to future AIP fee rate reviews, but does not conclude on any specific changes to fee rates. The aeronautical and maritime fee reviews made detailed proposals for fee rate changes, specific to those uses and users. In concluding on the principles and methodologies for this Framework we worked closely with the teams responsible for the specific aeronautical and maritime proposals and conclusions, as well as the PMSE proposals and therefore anticipate no inconsistency in the overall principles and methodologies incorporated in any of the proposals.

²⁸ Bandwidth is weighted according to frequency to provide comparability between the amounts of spectrum allocated at different frequencies. At lower (typically more valuable) frequencies a smaller amount of spectrum is available compared to at higher frequencies so that a 1 MHz assigned at 100 MHz represents a similar percentage of available spectrum to 10 MHz assigned at 1 GHz.

- 3.52 Stakeholders should also note that the Government has recently laid a draft direction in Parliament which, if made, would require us to revise the level of annual licence fees applying to existing 900MHz and 1800MHz mobile licences to reflect the full market value of the frequencies in those bands. If the direction is made we would expect to consult, in due course, on our proposed approach to the implementation of this element of the direction. We would expect the details of our methodology to set annual licence fees to be specific to the requirements of the Government's direction, which could differ from some of the approaches set out in this statement for AIP.
- 3.53 We have also previously concluded that we will consult nearer the time on any fees that we propose for digital terrestrial broadcasting and will not implement these before the end of 2014 and that Ships' and Amateurs' licences will be free when issued on-line. We do not intend this Statement to reopen either of these decisions.

Section 4

Core AIP pricing policy principles

Introduction

4.1 In our consultation document we set out nine spectrum pricing principles that we proposed to use to decide whether to apply AIP to particular licence sectors and how we should set spectrum fees. Most of these proposed principles are already applied to all licence sectors while others represented refinements and clarification in light of our experience to date.

4.2 In this section we present our conclusions, modified as appropriate in light of the responses to question 1 of our consultation that addressed our pricing principles:

Question 1: Do you agree with our proposed core principles of setting AIP? Are there additional matters that it would be helpful to clarify?

4.3 These principles will now form part of our overall Framework for spectrum pricing and inform how we develop specific fee proposals in future. We will apply these principles in future fee reviews, recognising that we need to take account of the particular circumstances of the frequency bands and licence types under review. Each of these principles will have a greater or lesser relevance in specific reviews and in some cases we might need to diverge from these principles for particular reasons.

4.4 As normal, we will consult on how we propose to take account of the specific circumstances of any fee review including any proposal to diverge from these principles and give reasons for our decisions, when we carry-out future licence sector-specific fee reviews.

4.5 In our consultation document we discussed cost-based fees as well as AIP fees in some of these principles. For greater clarity we have decided to remove discussion of cost-based fees from all of these principles and have instead included this discussion under Question 2 which addresses cost-based fees. We have now therefore decided to term these nine principles – “AIP principles”.

4.6 The remainder of this section summarises in turn:

- Our impact assessment of our proposals;
- Principle 1: the role of AIP;
- Principle 2: users can only respond in the long term;
- Principle 4: the “relevant timeframe” for AIP (addressed out of numerical order for clarity of argument);
- Principle 3: when AIP should be applied;
- Principle 5: AIP and spectrum trading;
- Principle 6: AIP and wider policy objectives;

- Principle 7: AIP and the promotion of innovation;
- Principle 8: use of market valuations;
- Principle 9: setting AIP fees to take account of uncertainty

Impact Assessment

- 4.7 Impact Assessments (IAs) provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice in policy-making. This is reflected in Section 7 of the Communications Act 2003, which states that we generally need to carry out IAs where our proposals would be likely to have a significant effect on businesses or the general public or when there is a major change in Ofcom's activities. As a matter of policy, Ofcom is committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions. For further information about our approach to IAs, see the guidelines *Better Policy-Making: Ofcom's Approach to Impact Assessment* at http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf.
- 4.8 The analysis presented in this document constitutes an IA for our decision to refine our spectrum pricing policy and methodology. Because it outlines a general approach rather than specific fee proposals, it is not possible to provide quantitative estimates of its effects: to the extent that we are able to provide these, they will be included in the IAs that we will produce when consulting in due course on specific fee revision proposals. Those IAs will include, where appropriate and proportionate to do so our best estimates on the available information of the financial and commercial implications of our proposals for current users and their customers.
- 4.9 As part of our Impact Assessments we conduct an Equality Impact Assessment to identify whether our proposals would have particular effects on specific groups within society. We have therefore considered whether we were required to undertake a full Equality Impact Assessment for this review. On the basis of our Initial Equality Impact Assessment Screening we determined that this was not required, because the changes to our pricing methodology do not raise specific equality issues; they will affect spectrum users, consumers and citizens equally, regardless of race, gender or disability. As we are not making changes to any specific fees, at this stage, there would be no immediate impacts, and so no impacts that we would need to consider for potential differential effects between groups. Equality Impact Assessments will form an integral part of any future fees review.

Principle 1: the role of AIP

- 4.10 In our consultation document we said that AIP's role is to help secure the optimal use of spectrum by providing a sustained long-term signal of spectrum value to inform users' investment decisions (both new users and existing users) for spectrum that is scarce.
- 4.11 We proposed therefore that we should, where appropriate, continue to use AIP as one element of our spectrum management approach.
- 4.12 We also said that we expected in future to propose AIP-based fees, for consultation, where our analysis of the evidence indicates that this is more likely to promote the optimal use of spectrum than the alternatives of charging cost-based fees or no fee.

4.13 We proposed principle 1 to address the issue of the role of AIP.

Proposed principle 1: role of AIP

AIP should continue to be used in combination with other spectrum management tools, in both the commercial and the public sectors, with the objective of securing optimal use of the radio spectrum in the long term. AIP's role in securing optimal use is in providing long-term signals of the value of spectrum which can be indicated by its opportunity cost.

The majority of responses agreed in general with principle 1, although most additionally argued that AIP was not relevant to their specific use of spectrum

- 4.14 Ministry of Defence (MoD), Arqiva, "Three", NATS, CAA, Telecommunications Association of the UK Water industry (TAUWI), STFC Rutherford Appleton Laboratory (STFC), British Ports Association and UK Major Ports Group (BPA/UKMPG), Met Office, Scottish Government and 5 confidential responses agreed generally with principle 1 and the core principles of spectrum pricing.
- 4.15 Cable & Wireless Worldwide (C&W Worldwide) and Intellect agreed that the general principles set out in the consultation may be suitable for some uses of spectrum.
- 4.16 Vodafone, IATA, Inmarsat and ESOA/SAP REG/GVF²⁹ did not address the appropriateness of the core principles to a licence sector other than their own.
- 4.17 A confidential response argued that as the consultation document presented only general principles for deriving AIP and it will be the specifics of each market that determines the fee rates set, it was difficult for the respondent to conclude on the generalities.
- 4.18 Examples of some of the comments in support of the core pricing principles included:
- support for Ofcom's market-based approach to spectrum management and strong belief that spectrum fees paid for the use of spectrum managed by Ofcom or bodies authorised by Ofcom should be based on the economic value of that spectrum;
 - recognition of the potential of AIP to further the efficient use of spectrum and support for the principles proposed by Ofcom in respect of AIP and setting fees to reflect opportunity cost;
 - strong agreement that AIP should be used in combination with other spectrum management tools with the objective of securing optimal use of spectrum in the long term;
 - support for the general principles behind the use of market mechanisms as a means to deliver efficiency improvements where there are competing demands for the use of a scarce resource and support for the need to deliver spectrum efficiency;
 - comment that the proposals are based upon the economically sound premise of price being used as a tool to control commercial demand for radio spectrum;

²⁹ Referred to as the ESOA response in following sections.

- agreement that where demand outstrips supply AIP can ensure the spectrum is used in the most efficient manner;
- agreement that the proposed principles for setting AIP would appear to be appropriate for non-aeronautical mobile and fixed link systems.

4.19 Of those that agreed in principle, however, many argued either that the principles were not applicable to their sector, or that there were features of use or demand in certain circumstances that would make AIP problematic in its effects, or ineffective:

- CAA added that it is not convinced of the argument for aviation;
- BPA/UKMPG said in their opinion some of the issues discussed in the principles were "unsatisfactorily prescriptive";
- NATS and CAA stated reservations on the use of AIP to spectrum used by aviation;
- C&W Worldwide argued that satellite services have a unique international dimension that raises serious doubts about the suitability of AIP for managing efficient use of spectrum for satellite services;
- The Met Office expressed concern about using market valuations of spectrum to set AIP for publicly funded or internationally agreed activities arguing that appropriate management tools need to be fully considered in the case of services providing wider socioeconomic value;
- STFC said science will suffer if the costs of AIP are not fully compensated by increases in grants.
- The Scottish Government said that the existence of excess demand for services may well be different in Scotland from other parts of the UK.

Ofcom view

It is not possible to consider all circumstances that might arise in a specific fee review in a general Framework and thus there will be substantive issues that can only be determined on a case-by-case basis

4.20 As the objective of this Review is to develop a general Framework for spectrum pricing we are not in a position to answer many of the arguments made in relation to the application of AIP to specific licence sectors; in any specific fee consultations we would need to consider these and other arguments in some detail, in the context of the specific circumstances at the time. We therefore only note these objections above to make clear that agreement on this general principle was widely caveated by respondents, in relation to specific spectrum uses.

4.21 Equally in any general Framework, such as this, it is necessary to provide general principles which capture how an issue would normally be determined, but we cannot rule out that in some circumstances we will need to diverge from these principles for specific circumstances in individual fee reviews. As such they should not be considered as prescriptive, rather providing general guidance on how we would seek to consider the issues.

- 4.22 Annex 1 provides further detail on the comments received that are specific to a licence sector. These comments are not addressed in this document, but have been passed to the relevant business units in the Spectrum Policy Group of Ofcom and will be considered, as appropriate, as and when a fee review for that licence sector is undertaken.
- 4.23 We address arguments made by respondents of a more general nature about why we should not apply AIP under principle 3.

Some responses imply that we did not explain our thinking as well as we could have, and it would be helpful to clarify some points

- 4.24 The Joint Radio Company Ltd (JRC) stated their belief that the problem with AIP is that it is based on the assumption that there is a market for spectrum, which they argued is not the case for many spectrum applications. They argued that there is no spectrum market because there are no spectrum trades (stating their belief that most trades in the spectrum trading register are in fact changes of name or administrative adjustments). They made a specific point that in many cases there are no sellers of spectrum (as shown they said by the Government having to coercively acquire spectrum for the 2012 Olympics instead of acquiring it via the market).
- 4.25 JRC further argued that spectrum is not a substitutable product in the economic sense. Therefore, they concluded the use of classical economic market theory to determine prices of spectrum, which does not exhibit classic market features, will not result in a rational outcome.
- 4.26 London Bus Services Ltd and London Underground (LBS and LU) said that they understood from the consultation that Ofcom's argument was that for commercial services those who will be willing to pay most for spectrum will generate most benefits and efficiency will come as the commercial organisation seeks to address markets in pursuit of income. For this to be true, they argued, there must be a causal link between the value placed on the spectrum and the income generated. They then said that the consultation document seems to extend this logic to the public sector, which they said that they do not agree with. They argued that spectrum used by the transport sector is only an enabler and not part of the service itself, and as such it does not drive revenues. They argued that as a result there is no causal link between the investment decisions made by transport in spectrum and the revenue it derives from the use of this spectrum.
- 4.27 The UK Chamber of Shipping added in particular, that safety and uses for complying with mandatory radio regulations governed through International treaties are not a choice and therefore should not be charged for.
- 4.28 A confidential response stated that it was unclear whether all principles or just a subset of them would be applied when considering AIP.

Ofcom view

AIP fees serve to mimic, broadly, the incentives for efficient use of spectrum that result from well-functioning markets. A market is not needed for AIP to be a useful regulatory tool

- 4.29 Rather than a reason for abandoning the concept of AIP, the fact that there is not currently a well-functioning market for spectrum is a rationale for applying AIP. By

applying AIP fees, to reflect the opportunity cost of spectrum used by licensees, we anticipate achieving some of the efficiency improvements that well-functioning markets would be expected to deliver.

- 4.30 As discussed in our consultation document, because spectrum is a scarce and finite resource, its use involves an opportunity cost. This opportunity cost is the value to society that is forgone when a block of spectrum is employed for one particular use (or by one user) rather than the next best alternative. If the value of spectrum to a particular user is less than this opportunity cost, then the spectrum is, by definition, valued more by someone else. If spectrum were reassigned to that alternative use or user then we would expect that user to generate greater benefits to consumers and therefore increase the efficiency of the spectrum use. We consider the case where spectrum use generates a wider social value that is not reflected in the price users' are willing to pay under principle 6.
- 4.31 In a well-functioning spectrum market:
- spectrum would be a freely and efficiently traded good, with sufficient liquidity and transparency that there was good information in the market about prices;
 - all users of spectrum would have to acquire the spectrum that they wanted through the market.
- 4.32 In these circumstances the "market price" for a marginal block of spectrum would be expected to reflect the valuation of the best alternative use of the spectrum i.e. the opportunity cost of the use of the spectrum. This reflects the fact that the current holder of the spectrum could sell the spectrum at a price that reflects the next highest valuation as it knows that it will not find a higher price for this spectrum. Through this mechanism, prices in well-functioning markets can be expected to reflect the opportunity cost or the value of the best alternative user that is denied access to the spectrum. This promotes the efficient use of spectrum since there is an incentive for users to sell spectrum to alternative users where the next best alternative is more valuable than the current use.
- 4.33 However, where markets do not exist, are immature or for other reasons do not function well then spectrum users may not be aware of the opportunity cost of their use of spectrum and hence may have limited economic incentive to use spectrum efficiently. For example, if spectrum is not tradable and is made freely available at no charge, there is no economic incentive to encourage spectrum users to economise on their use of spectrum. In these circumstances, we consider that AIP can play a role in signalling the opportunity cost of scarce spectrum and ensuring that there is an incentive for spectrum to move from lower value to higher value uses. We note however, that pricing is not expected or intended to lead to specific changes in spectrum use for all users – since some users may value their use of spectrum at the same or higher level than its opportunity cost.
- 4.34 On the issue of the spectrum needed to support the Olympics, our overall approach to the spectrum plan to meet the UK Government's spectrum guarantees with minimum disruption to other (day-to-day) users was set out in section 3 of the Statement published on 19 October 2009³⁰. Our overall approach remains that we

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<http://stakeholders.ofcom.org.uk/binaries/consultations/london2012/statement/london2010Update.pdf>

have first sought to make use of unencumbered spectrum, and then spectrum that will require specific measures to facilitate shared access with existing users. Only in the last resort would we temporarily remove or restrict existing users from spectrum for the duration of the London 2012 Games requirement.

- 4.35 Through the efforts and cooperation of the NPIA, the Department for Health, the MOD, Airwave Solutions Ltd and Arqiva, spectrum for the Airwave Emergency Services network has been secured through the transfer of spectrum rights (i.e. spectrum trades).

We agree there is currently no single, homogeneous spectrum market³¹ but there is a collection of separate markets across the various frequency bands

- 4.36 As discussed in greater detail in Annex 6 of the consultation document we agree that spectrum is not homogeneous. The physical properties of the spectrum along with historical allocations, limitations in technology, differences in equipment availability and cost as well as other factors limit the substitutability of different bands. This means that there is currently no single, homogeneous spectrum market but rather a collection of separate markets across the various frequency bands, and we expect this state of fragmentation to continue in the foreseeable timeframe.
- 4.37 To illustrate this point, we quoted the example of business radio and fixed links which operate in different parts of the spectrum³², and are widely separated by non tradable spectrum allocated to broadcasting and aeronautical uses. As a result, business radio and fixed link users do not consider each other's frequencies substitutable or compete for the same spectrum, creating separate markets for each group of bands. However, within each of the business radio frequency bands and the fixed links frequency bands spectrum is substitutable and therefore pricing can incentivise users to migrate within these bands and can be used to facilitate access to some of these bands for higher value alternative uses.

Spectrum is a valuable resource regardless of how it is used in delivering a service

- 4.38 Businesses that use spectrum require a variety of resources to produce the goods and services they sell. Some use resources such as spectrum directly in the production of the goods or services. Others use spectrum only indirectly to support the production of the good or service. This does not however mean that one user values spectrum in a different way to the other – both will consider the loss of revenue, or increase in costs that would result from a loss of spectrum in their specific case.
- 4.39 For users of spectrum, such as the LBS and LU which are required by regulation to have radio available to meet safety requirements, spectrum is a key input to their business. In the extreme, if sufficient spectrum were not available for their needs, in some areas they would be prevented from offering a service at all and therefore would be unable to generate revenue. If spectrum was available through the market,

³¹ For ease of reference we have used the term 'market' as convenient shorthand and this is not intended to pre-judge the way in which we might define a market for the purposes of a competition investigation.

³² Business Radio operates between 26MHz and 466MHz, with most activity in the UHF1 (425-449MHz) and UHF2 (453-466MHz) bands. Fixed links operate between 1.35GHz and 57 GHz or in higher frequencies where they are self-coordinated. The small exception is scanning telemetry, a fixed service that operates at around 460MHz.

therefore, they would be expected to value spectrum highly and where scarce might need to pay a higher price than other users to ensure access to it.

- 4.40 Similarly, depending on the specifics of the market for the services that spectrum is used to support, other users would be expected to react to an increase in fees through actions such as passing on the cost of spectrum to their consumers, reducing their investment or reducing their profit. Those that are mandated in their use of spectrum will need to make similar business decisions in response to pricing signals and are equally able to react.
- 4.41 Where there is insufficient supply of spectrum (at a cost-based price) setting fees at the level of the opportunity cost of the spectrum will therefore ensure that those who value it higher than this opportunity cost gain access to it, whilst those who do not will look for other alternatives.

In future fee reviews we will need to consider all of these principles, recognising in specific circumstances not all principles will have the same weight or relevance

- 4.42 We confirm we will consider all these principles in all future reviews of whether to apply or revise AIP fees, while recognising that we need to take account of the particular circumstances of the frequency bands and licence types under review and this might require us to modify them in particular cases. Equally some principles are likely to have greater relevance in some circumstances than others and will therefore be considered in more detail than others in individual fee reviews. We will consult on how we propose to take account of the specific circumstances of any specific fee review and will give reasons for our proposals.

Some responses argued that spectrum management tools other than AIP and pricing should be used to achieve the efficient use of spectrum

- 4.43 Arqiva added that AIP was not a panacea but must be used alongside other spectrum management tools as indicated by Ofcom in its consultation document.
- 4.44 UK Chamber of Shipping and BPA/UKMPG were both unconvinced of the need to move away from “command and control” and to a more market led approach such as pricing. They expressed concern that Ofcom did not appear to give equal consideration to other spectrum management options.
- 4.45 LBS and LU expressed their belief that the efficient use of spectrum is in reality driven by technology evolution rather than through pricing of spectrum. Similarly, FCS argued that the optimal use of spectrum might be achieved more effectively and in a timelier manner through technical developments rather than through what they termed “AIP constraints” imposed by the regulator. David Hall Systems Ltd and C&W Worldwide also argued that AIP should be used in combination with other spectrum management tools, including technical methods of allaying congestion and should only be used as a last resort.
- 4.46 C&W Worldwide argued that Ofcom's proposals were made purely on the basis of economic rationale and failed to take sufficient account of other means to ensure optimal use of spectrum. They did not believe the discussion around AIP has been sufficiently progressed since AIP was first debated, certainly with reference to satellite services.

- 4.47 Transfinite argued that the Review did not consider other options for providing pricing information to spectrum users. In particular, they noted the consultation did not consider overlay auctions³³ for services such as Business Radio and Fixed Links that would enable a private Spectrum Management Organisation (SMO)³⁴ market to emerge.
- 4.48 C&W Worldwide also argued that, rather than mechanically applying AIP, Ofcom should consider whether to take action to ensure the release of spectrum where operators have purchased spectrum but have failed to deploy services to ensure the release of such spectrum where this behaviour is artificially creating scarcity, rather than mechanically applying AIP.

Ofcom view

We agree that spectrum pricing should be used in combination with other spectrum management tools and is not a panacea for all spectrum issues

- 4.49 As we discussed in some detail in our consultation document, faced with actual and potential spectrum shortfalls, we consider that the mechanism by which frequencies are allocated and assigned plays a key role in securing optimal use of spectrum. Changes in technology and also in consumer preferences either leading or responding to technological advances have become more frequent in recent years. As a result, it has become increasingly unlikely that any regulator can have sufficient information or foresight to predict which technology or service will generate greatest benefits for society. Moreover, regulation often takes a long time to change, and as a result cannot always keep up with the pace of change.
- 4.50 Following on from the start made by the Radiocommunications Agency, Ofcom has progressively moved therefore from a wholly ‘command and control’ approach towards a more market-led approach, in which spectrum users are given greater flexibility to decide how best to use spectrum.
- 4.51 We also agree with the proposition that efficient use of spectrum is driven in part by improvements in technology. However, there is then the question of what might prompt such improvements. In our view, a clear signal of spectrum value can inform equipment manufacturers’ thinking on the timing of the major investments needed to develop technology. If spectrum were free, then while there would be incentives to develop technology that would deliver better (or more) services over the same spectrum, there would be little incentive to develop technology that would, additionally or alternatively, reduce each user’s spectrum requirement. Both of these changes can increase efficiency – the first by letting users generate more benefits from the same amount of spectrum and the second by allowing additional users to access spectrum.

³³ By “overlay auctions” we understand Transfinite to mean an auction of spectrum in which there are incumbent licensees that will retain explicit rights to use the spectrum post-auction for some period.

³⁴ By “private spectrum management organisation” we understand Transfinite to mean a private company that provides access to spectrum to third parties for payment

Recognising that price is just one regulatory tool available to us, in reviewing fee levels in future we intend to assess whether the current spectrum management arrangements remain appropriate

- 4.52 We agree that AIP is based on economic rationale and there will be certain circumstances where AIP may either not be the right regulatory tool to use, or where AIP needs to be used in conjunction with other regulatory actions.
- 4.53 As noted above, we agree it is important to consider for each sector the mix of regulatory tools that is likely to promote the best outcome in terms of the optimal use of spectrum, which may differ from sector to sector.
- 4.54 We intend therefore in future, when carrying out fee reviews, to consider and consult, where appropriate, on alternative options for managing the spectrum under review.

AIP has an important role to play in encouraging the efficient use of spectrum, but AIP may not be effective at preventing anti-competitive hoarding

- 4.55 On the issue of hoarding that one stakeholder raised we consider that AIP can play an important role in incentivising spectrum users to consider giving up unused or unwanted spectrum (at the fee charged) and that it may therefore be effective at discouraging certain types of hoarding. It is unclear, however, that AIP would be effective at deterring anti-competitive hoarding if the potential benefits to a licensee of such behaviour exceed the cost given the level of AIP fee charged.
- 4.56 If, however, we became aware that there was a possibility that a user was holding unused spectrum for anti-competitive reasons, we would consider whether it is appropriate for us to use our powers in order to address this problem.

Some responses argued that AIP has a role in generating income for government or providing a fair rate of return of a state resource, two asked for greater transparency over the use of the funds raised

- 4.57 "Three" argued a role of AIP should be to secure a fair return to taxpayers of a state resource.
- 4.58 BPA/UKMPG questioned why Ofcom had not taken up a suggested initiative from them³⁵ which they say would "offer an income generation opportunity for government, as being an Ofcom role".
- 4.59 Intellect said when AIP is charged and is significantly higher than the cost of managing it the AIP fees are given to Treasury. In their view this implies an additional de facto purpose of AIP as a revenue raising measure for HMT. They argued therefore that the fact HM Treasury's remit is to maximise revenue for the UK Exchequer calls into question the credibility of AIP as a purely regulatory tool designed to cover costs and induce appropriate behaviour.
- 4.60 Intellect and C&W Worldwide also argued that greater transparency should be provided regarding what happens to AIP funds. C&W added that it should be clear

³⁵ They proposed initiating and awaiting for changes in international agreements (which are likely to take a very long time) to allow spectrum to be freed up for subsequent award, rather than managing existing congestion through AIP

whether a proportion of those funds are redeployed into the industry for example for research into the sector.

Ofcom view

Ofcom does not have a duty to generate revenue from spectrum use

- 4.61 Our main objective in exercising our power to set licence fees under section 12 of the WT Act is to promote the optimal use of spectrum. While it is true that we pass receipts from spectrum licence fees to the UK Exchequer we do not have a duty to raise revenues. This is not a consideration that we take into account when setting fees, neither do we aim to deliver a “fair rate of return” of a state resource as suggested by “Three”.
- 4.62 Decisions on any proposal to change spectrum use, as suggested by BPA/UKMP, will be taken by us in the context of whether such action will promote the optimal use of spectrum, what the overall benefit to society might be and any existing constraints on our doing so.

There is transparency over the fees that Ofcom collects from WT Act fees, once passed to the UK Exchequer the responsibility for these funds is not with Ofcom

- 4.63 Ofcom is required to pay government the fees collected from licensees and holders of grants of RSA issued under the WT Act.
- 4.64 Under Section 400(4) of the Act, Ofcom is required to prepare a statement of accounts for each financial year in respect of licence fees collected from stakeholders under the Act and is subject to a statutory auditing procedure³⁶.
- 4.65 This auditing procedure ensures transparency in relation to the fees paid to Ofcom by stakeholders under the WT Act. Once these monies are passed to the UK Exchequer, the Government (and not Ofcom) becomes responsible and accountable for the use of such funds.

Some responses raised concerns about state aid and whether we should ensure AIP does not distort competition between users

- 4.66 “Three” argued that the role of AIP should also include consideration of the impact on competition. BT’s response, and a confidential response, also cited concerns that AIP does distort competition between operators using spectrum purchased in an auction and those charged AIP.
- 4.67 “Three” also argued that Ofcom should consider whether AIP represented unfair State Aid for those operators holding administratively assigned spectrum.

³⁶ In particular, s. 400(6) of the Act provides that: “*The Comptroller and Auditor General must examine, certify and report on the account and lay copies of it, together with his report, before each House of Parliament*”. The certified statement is made publicly available, being published on Ofcom’s website (see, for instance: <http://www.ofcom.org.uk/files/2010/07/Ofcom-S400-2009-10-accounts.pdf>).

Ofcom view

Normally, AIP is not the most effective tool to address competition problems, but we will consider any potential effect of AIP on competition on a case-by-case basis

- 4.68 In general, we do not believe that AIP is the appropriate regulatory tool to deal with competition concerns in downstream markets. Similarly, we think it is unlikely that AIP could introduce distortions to competition in downstream markets when it reflects the opportunity cost of spectrum.
- 4.69 However, there might be particular cases where we are considering changes to fees where it is necessary to take account of downstream competition effects, including the possibility of the existence of windfall gains. Therefore, we remain of the view that it is appropriate for us to consider any potential effect of AIP on competition on a case-by-case basis using the results of our impact assessment in order to better inform our decisions. We address this issue further in methodology 4 later on in this document.
- 4.70 We do not consider it necessary to adopt an additional principle specifying that the purpose of AIP is also to ensure that the holders of administratively assigned spectrum do not enjoy unfair state aid as a result of their spectrum holding, as suggested by “Three”. We are mindful that the grant of licences for the use of spectrum may have an economic value and constitute a State resource, such that they could potentially constitute a state aid under Article 107 of the EC Treaty if the granting of such licences confers an advantage to the licensee which could distort competition and affect trade between Member States. However, given that a state aid can only arise where there is a distortion of competition, which we would consider, where appropriate, as part of our impact assessment, we see no need to specify that compliance with EC rules on state aid is a specific objective of AIP

Conclusion on principle 1: the role of AIP

- 4.71 Having carefully considered the responses to this issue we agree with respondents that there is a limit to the extent that pricing can solve all issues of allocation, assignment and management of demand and that on occasion the best approach to a particular issue will be to use our other regulatory tools including regulatory interventions such as clearance. As a result, we conclude that in reviewing fees in future we should consider first whether the existing spectrum management arrangements are appropriate.
- 4.72 However, in general we still believe that for many uses of spectrum, pricing can be an effective method for promoting the optimal use of spectrum because it can signal the long-term value of spectrum through an estimate of its opportunity cost.
- 4.73 Having also considered the comments we received at a series of stakeholder workshops, as well as the formal written responses, we have recognised that in the past, including in our consultation document, we have used the terms “spectrum value” and “opportunity cost” somewhat interchangeably. We have done this without necessarily always explaining what we mean by “value” as there are a number of ways in which this term can be interpreted. When discussing setting AIP fees to reflect the value of spectrum we have usually meant that these fees would be set at the price that would emerge in a well-functioning market. In a well-functioning market, the price of spectrum would be equal to the value of that spectrum in the next highest value use, rather than the value that the current user (for example, a

company) might place on the spectrum. Given the possibility of continuing confusion about our meaning of the term “value” in the context of AIP fees we have redrafted our AIP principles and methodologies to clarify that we set AIP fees on the basis of opportunity cost.

- 4.74 We conclude therefore that we should, where appropriate, continue to use AIP as one element of our spectrum management approach and we will in future propose AIP-based fees, for consultation, where our analysis of the evidence indicates that this is more likely to promote the optimal use of spectrum than the alternatives of charging cost-based fees or no fee, or any other regulatory intervention.
- 4.75 We conclude therefore that principle 1 be adopted as one of our AIP pricing principles:

AIP principle 1: role of AIP

AIP should continue to be used in combination with other spectrum management tools, in both the commercial and the public sectors, with the objective of securing optimal use of the radio spectrum in the long term. AIP’s role in securing optimal use is in providing long-term signals of the opportunity cost of spectrum.

Principle 2: users can only respond in the long term

- 4.76 In our consultation document we discussed the need for AIP to be a long term signal. We said that in order for AIP to incentivise efficient responses from spectrum users (rather than potentially inefficient short term responses) AIP needed to be a long term signal that would permit all possible responses to spectrum users, many of which are only available in the long term due to the need to reinvest in radio equipment.
- 4.77 We also said that where users’ responses are constrained, for example by regulation, that we did not think this necessarily meant that no response was available to them. However, in these circumstances we said we believed that we should consider the specifics of each case before determining whether AIP has a role to play.
- 4.78 We therefore proposed principle 2 to address the issue of why AIP needs to be a long-term signal.

Proposed principle 2: users can only respond in the long term

The purpose of AIP is to secure the optimal use of spectrum in the long term, so as to allow users to be able to respond to AIP as part of their normal investment cycle. Even where users have constraints imposed on their use of spectrum, in general, some if not all users have some ability to respond to AIP.

Some responses agreed with principle 2 but some argued that short term responses to pricing signals were also possible

- 4.79 A confidential response supported the long-term view of setting AIP to encourage optimal use of spectrum, whilst Telefónica O2 (O2) agreed that the time required to respond to price signals might be lengthy and that AIP must provide incentives for investment in the long term. The Met Office supported the principle that AIP should reflect long-term procurement cycles
- 4.80 Arqiva, Intellect and BT said that some spectrum users may be able to respond to changes in AIP in the short term.

- 4.81 Arqiva agreed with us that AIP should not generally seek sudden changes in use or investment decisions but should aim to contribute towards optimal use of spectrum over the long term.
- 4.82 BT argued that principle 2 should not be an “un-erring rule”, citing spectrum trading of unused spectrum and spectrum sharing as examples of situations where much shorter term responses were possible.
- 4.83 BT and Intellect also argued that only in cases where the use is apparatus based (e.g. fixed links) it is the equipment lifecycle that drives the timing of opportunities to improve efficiency. Conversely, for applications such as mobile networks, they argued that more short term responses are possible, for example, by adding cells and reconfiguring the network rather than investing in new equipment. Therefore in these cases, they argued, a response to a spectrum pricing stimulus could happen in the short term.

Ofcom view

Whilst some users of spectrum can respond to price signals in the short term many may only be able to respond efficiently in the long-term

- 4.84 We agree with responses that argue that some users can respond in timescales that are shorter than others and that for some this timescale is not related to the economic life of the radio equipment they use.
- 4.85 In considering the arguments presented by respondents and reviewing what we said in our consultation document we have realised that we somewhat confused two key issues relating to timing and did not explain the differences between them clearly enough. These are:
- The time that it takes spectrum users to respond efficiently to a price signal; and
 - The timeframe over which users are planning to make investments in radio equipment and therefore the long term value of spectrum that we want to signal to users to inform these investment decisions.
- 4.86 The first of these is what we discuss under principle 2 and the second is the issue we discuss under principle 4. We should also be conscious of the fact that the discussions under each of these principles apply once we have decided that pricing is the appropriate regulatory tool and that AIP in particular may be appropriate. We may consider different timescales relevant when considering the use of other regulatory tools.
- 4.87 We also take these two issues of timing into account in different ways when setting fees:
- The first is taken into account when we estimate the existing value of spectrum when setting reference rates – for example with the Least Cost Alternative (LCA) approach we do not limit the options available to users. This is regardless of how long it might take for these options to be implemented, or more specifically for them to be implemented efficiently as discussed under methodology 2.
 - The first may also be relevant to our assessment of the impact of proposed fee changes, as it may constrain the scope for users to adjust to a new fee level

within a shorter time. In certain cases this or other factors may lead us to propose phasing in a change over time. We discuss impact assessments later in the next section under methodology 4.

- The second is accounted for when we consider the likelihood of congestion, excess demand, and feasible alternative use over the “relevant timeframe” that we discuss in more detail under principle 4. This informs both how we value the “existing use” – including whether or not there is likely to be congestion and therefore whether AIP should apply, and how we value any “alternative use” – in terms of what alternative uses and which of their values we should take into account.

4.88 For many spectrum users these timeframes are the same: the economic lifetime of the radio equipment they use. However, as responses have pointed out these can, for some uses of spectrum, be different. That is, if there is already an equipment base such as a network and the efficient response for a user would be to make marginal changes, these could be implemented in a relatively short time, say within a year; but the investment in the new equipment installed to deliver those marginal changes would normally be expected by the user to have a longer economic life.

Other responses argued that some spectrum users cannot respond to AIP because of regulatory constraints or long investment cycles

- 4.89 A confidential response argued that spectrum fees may act to influence their spectrum usage at system concept stage, and to encourage un-used spectrum to be released at end of life, but will have no impact in the extended interim and therefore should not be applied during that period.
- 4.90 FCS argued that in their view, where users have investment cycles of more than 15 years the market will be almost completely inelastic unless extortionate fees are charged.
- 4.91 CAA, UK Chamber of shipping, BPA/UKMPG and a confidential response argued that where users face very long investment cycles and/or have regulatory constraints that directly impact on their choice of radio technology and spectrum that individual users cannot respond as there needs to be industry-wide agreement.
- 4.92 LBS and LU argued that as spectrum is a regulatory requirement for delivering transport and transport companies must pay the spectrum fee regardless and either:
- pass the cost onto the ticket payers, or
 - reduce investment in infrastructure.
- 4.93 Therefore, LBS and LU contend that no spectrum efficiency will result from charging the transport sector for spectrum.

Ofcom view

We agree that spectrum users will respond in different timeframes but this does not mean that the AIP signal is not effective in informing users' decisions on spectrum use

- 4.94 As we explain above and in more detail under principle 4 the reason that we signal the value of spectrum to users of spectrum is so that they take these into account when making their investment decisions. Investment decisions take account of all costs and revenues that arise from it *over the lifetime of these investments*.
- 4.95 We agree with the response that said users will respond as and when it is efficient for them to do so, such as when they come to reinvest in equipment. That some users are only able to make these decisions at particular points in time is not, however, an argument for not applying AIP during the remainder of the period.
- 4.96 Even if it were practical to know when these investment decisions occurred for specific licensees we would still need to signal the opportunity cost of their spectrum use *over the economic life of these investments*. The amount we would need to charge would therefore be equivalent to an annual fee over the lifetime of the investment, but would be charged in a single upfront payment. Such an approach would offer no significant benefits to licensees or us, but would present very real practical difficulties for us (for example, understanding the timing in which users are likely to make these investment decisions).
- 4.97 We also therefore disagree that AIP has a limited impact where there are long-term investment cycles, but recognise that these benefits may take longer to achieve. In fact we expect that many of the efficiency gains from AIP will come in the form of long term changes in investment decisions.
- 4.98 We should also note that just because users' investment decisions are long term this does not mean that no efficiency in spectrum use can be achieved quickly following a revision of AIP fee levels. For example, there may be some users who have more spectrum than they want (at this revised fee level) and who can therefore quickly trade or return spectrum to us. In addition, in any specific band there are likely to be individual users that are at different stages in their radio equipment investment cycles. If some are at the beginning of a new investment cycle then spectrum fees could influence their investment decisions immediately and improve the efficiency with which the spectrum can be used.

It may also be appropriate to apply AIP to uses of spectrum that are mandated by regulation, for example where there is excess demand in its existing use

- 4.99 We recognise that there are uses of spectrum that are mandated by other regulators and/or government departments to ensure that specific public policy benefits are secured. In many such cases users have little or no choice over what spectrum they use, or how they use it, to meet these requirements.
- 4.100 However, as discussed in paragraphs 3.23 to 3.29 of our consultation document where spectrum use is mandated by regulation there may still be instances where pricing has a role to play in ensuring the optimal use of spectrum. This includes circumstances where there is congestion in the existing use.

4.101 Additionally, some (though by no means all) users who are mandated to use spectrum have some flexibility about how they fulfil that requirement. For example, some regulations require the use of wireless technology to deliver certain capabilities (such as to support safety services) but do not specify bands or standards except broadly. Therefore, for example, a requirement on an important infrastructure installation (a power plant, or power distribution network) to maintain a standard of wireless communication to allow for response to certain events, may leave the choice of equipment and of spectrum used up to the individual user. As a result, provided there is a range of substitutable spectrum available users may respond efficiently to a price signal by changing the band they use or the type of equipment they deploy.

A number of responses argued that as they can only respond in the long term, security of tenure and security of fee levels should reflect this timescale

4.102 Inmarsat, Met Office, one confidential response, STFC and ESOA argued that long term certainty on fee rates and security of tenure for the use of the spectrum should be linked to their ability to respond to pricing signals.

Ofcom view

We disagree with the suggestion that security of tenure or the timing of changes to fee levels should be linked to users' ability to respond to price signals

4.103 We have explained that the reason that AIP is a long term signal is that we are looking to encourage efficient responses to this price signal from spectrum users. However, for the timing of changes to fee levels and any security of tenure the issues are very different. If we were to set fee levels for a long period of time it is possible, if not probable, that the fee level would become materially out of line with the true opportunity cost of the spectrum (either up or down) and would therefore be providing similarly misaligned incentives for investment in the band. This might take the form of either:

- pricing out users who, had the fee been set at the appropriate level, could have made use of the spectrum, or conversely
- creating congestion because there are no incentives for lower value uses to make more efficient use of the spectrum or to consider alternative options, which could keep higher value alternative users and uses out of the spectrum.

4.104 In either case this would be to the detriment of the optimal use of spectrum. The issue of what factors we should take into account when deciding when to review fee rates is addressed in more detail under Question 4.

4.105 The issue of the security of tenure of access that a specific use of spectrum should be given is not a subject for this consultation. However, it does have implications for the value licensees place on spectrum. It is our policy, in general, to provide administratively assigned licences on a rolling annual basis. In accordance with our general licence conditions³⁷, our power to revoke the licence for reasons related to the management of the radio spectrum may generally only be exercised after we give

³⁷ See Condition 1.2(f): http://licensing.ofcom.org.uk/binaries/spectrum/regulations-technical-reference/General_Licence_Conditions.pdf.

five years' notice in writing to the licensee. In general therefore most licensees that are charged on the basis of AIP can expect to have reasonable security of tenure.

4.106 This is not to say that we do not recognise the importance of a level of stability in fee levels to licensees. In Section 6 we have concluded that we will only undertake AIP fee reviews in future where we have evidence that the current fees are materially out of line with the opportunity cost of the spectrum in a direct response to the request for greater certainty on fees from stakeholder. We have also concluded that we will, specify, where appropriate, a minimum time period during which we would not normally expect to carry-out a further fee review.

Conclusion on principle 2: users can only respond in the long term

4.107 Principle 2 was included in our consultation to address stakeholders' concerns about how we take their ability to respond to price signals into account when deciding whether and how to apply AIP. From the responses we received we have realised that our original consultation document blurred the distinction between two timeframes that we take into account when setting AIP fees:

- The time it takes for users to respond to a price signal, including whether or not a response is possible, and therefore the range of responses to these signals that we should consider when assessing opportunity cost; and
- The timeframe over which we consider the likely value of spectrum that we wish to signal – the “relevant timeframe” addressed under principle 4.

4.108 Discussions with stakeholders have therefore enabled us to clarify this distinction, and we hope to explain more clearly to stakeholders why and in what way we take into account users' ability to respond to AIP.

4.109 However, given that the purpose of the AIP principles is to set out the factors that need to be considered when setting AIP fees we believe that principle 2 is no longer required as a separate principle as it is taken into account in methodology 2. Methodology 2 deals with how we calculate the reference rate for spectrum to reflect the opportunity cost of the spectrum. In general, we estimate reference rates using the Least Cost Alternative (LCA) method in which we start by identifying the range of potential options available to spectrum users in response to a price signal. When identifying these options we therefore allow for all possible responses, regardless of how long it might take before such options can be practically implemented. If we limited the alternatives we considered to those which a user might deploy within a fixed deadline we risk looking only at short-term responses which may well be more expensive.

4.110 This is not in any way intended to imply that this diminishes the importance of this issue in our consideration of whether and how AIP fees should be set, but rather to ensure that each of the timing issues is considered in the correct context.

4.111 We also note here that by excluding principle 2 we now have 8 AIP principles and that these will need to be re-numbered, as presented in our Executive Summary. However, for ease of reference with our consultation document for the remainder of this section we continue to refer to them with the numbering indicated in the consultation document.

Principle 3: when AIP should be applied

- 4.112 In our consultation document we said that the prospect of current or expected future³⁸ excess demand in a band is central to our decision to charge AIP-based fees and to setting those fees. This, we explained, is because it indicates that there is a risk that potentially higher value users and uses could be denied access to spectrum; and more generally, that the current use of spectrum imposes an opportunity cost on society.
- 4.113 We explained that if sufficient spectrum is available to meet current and expected future demand at a cost-based level of fee, there will generally be no spectrum management need to set fees above a level that reflects our spectrum management costs.
- 4.114 We argued that in assessing the balance between supply and demand for a particular frequency band and location, we need to take account of:
- demand for spectrum from the existing uses of the band over the ‘relevant timeframe’, which is discussed under principle 4 below; and
 - demand for spectrum from *feasible alternative* uses over the relevant timeframe, taking into account relevant constraints as discussed below.
- 4.115 In identifying the feasible alternative uses, we proposed to take account of various factors, including the physical properties of the band and its suitability for other applications/services, evidence of national and international regulatory constraints that may restrict the alternative uses that may be permitted in the band, the existence (or active development) of equipment standards and the availability and cost of equipment.
- 4.116 We therefore proposed principle 3 to address the issue of when AIP should be applied.

Proposed principle 3: when AIP should be applied

AIP should apply to spectrum that is expected to be in excess demand from existing and/or feasible alternative use, in future, if cost-based fees were applied. In determining feasible alternative uses, we will consider the relevant timeframe, any national or international regulatory constraints, the existence of equipment standards, and the availability and cost of equipment.

A number of responses agreed with proposed principle 3

- 4.117 BT and Arqiva agreed with the principle and Intellect agreed with this principle in some cases.
- 4.118 MoD agreed that a good understanding of demand is needed to identify the true opportunity cost of spectrum.

³⁸ We make a forward-looking assessment of spectrum availability and demand, as required by Section 3 of the WT Act 2006, in order to ensure that AIP provides a suitably long-term signal to inform future decisions on investment and spectrum use.

- 4.119 The Met Office agreed that evidence of congestion seems in principle a logical rationale for applying AIP although they argued that if congestion leads to increased interference this may reduce the value of spectrum.

Ofcom view

Congestion does not cause harmful interference to licensees as we operate to strict technical planning rules to ensure that interference is kept to acceptable levels

- 4.120 We operate to strict technical planning rules that are designed to ensure that all licensees are provided, as far as possible, with protection from harmful interference from other licensees. Congestion therefore will not result in increased interference to a detrimental level to other licensees.
- 4.121 Congestion in spectrum which is shared by a number of licensees (such as business radio) is therefore often not visible to existing users unless and until they request additional spectrum. At that point, in order to maintain protection to other licensees, we may be unable to meet the request, in full or in part. For example, if the coverage requested would cause harmful interference to existing licensees we may only be able to offer a smaller coverage area, or offer the coverage area requested in a different frequency band.

A few responses had concerns about the general approach proposed by principle 3

- 4.122 David Hall Systems Ltd argued that Ofcom needs to better understand the implications of sending a pricing signal now in bands that may become congested in future. They argued that this might dampen demand, reduce investment in a band, or have no effect at all.
- 4.123 FCS argued that whether or not spectrum is congested is a function of historical allocation decisions rather than current usage. They added their belief that other sectors have traditionally been allocated large amounts of spectrum compared with mobile and therefore don't suffer the same amount of congestion.
- 4.124 The Met Office and STFC argued that Ofcom should consider whether there are substitute frequency bands for alternative uses of spectrum, as some commercial services have a number of potentially substitutable frequency bands, whereas for some science uses no other substitute might exist (such as for passive monitoring). They also argued that we should take particular account of international agreements.
- 4.125 Inmarsat argued that leaving the word "feasible" largely undefined brings significant uncertainty into business planning and fund raising and does not allow for risks to be fully accounted for. They also argued that considering alternative uses of spectrum in setting fees could undermine the international harmonisation of spectrum.

Ofcom view

We reflect future demand from existing and alternative uses when setting fees to ensure users' investment decisions take the future value of spectrum into account

- 4.126 We make a forward-looking assessment of spectrum availability and demand to ensure that AIP provides a suitably long-term signal to inform future decisions on investment and spectrum use.

- 4.127 We agree that by sending a signal now of future increases in spectrum value we are likely to dampen demand and that it is a fine balancing act to ensure that we do not dampen demand too early or by too much with resultant unutilised spectrum. Equally, however, we do not want to encourage continued use of the band by lower value uses when a higher value use has emerged and is looking for access to the spectrum. We will, therefore, need to undertake a case-by-case analysis of the pros and cons of setting fees too high or too low, as addressed under principle 9 dependent on the specifics of each case.

We agree we have a role in some cases to seek to allocate additional spectrum to specific uses, although pricing also has a role in promoting the optimal use of the available spectrum

- 4.128 We acknowledge that historical allocations of spectrum have an influence on congestion. These historical allocations were determined based on the priorities and national spectrum management policy of the time, which will have included consideration of the demand for spectrum from individual services. We also recognise that as well as pricing, there are other regulatory tools that we may need to employ to manage congestion in future and this includes seeking the international allocation of more spectrum to some services. In general, however, this requires us to negotiate internationally, may require mandatory closure and clearance of bands to other services, and therefore can take considerable time to achieve. In the meanwhile pricing remains a useful tool in managing existing and future excess demand.

We agree that in measuring and predicting excess demand it is important to take account of substitutable spectrum, although we recognise the difficulties in doing so

- 4.129 We agree that some uses of spectrum have a range of substitutable or partially substitutable frequency bands in which they could operate, whereas for other uses no other options may exist. This is particularly true where the use is dictated by the physical characteristics of the band. When determining excess demand it is necessary therefore to consider both supply (including the substitutable frequency bands) as well as demand.
- 4.130 However, this can be a complex issue, particularly where the assessment of the supply of spectrum is intimately bound up with its use, for example in fixed links where it is difficult to try and assess the number of fixed links that could be accommodated in any specific band without making a number of highly subjective assumptions on the path length, required availability and bandwidth as well as the physical location of each end of the links.
- 4.131 We will, therefore, on a case-by-case basis determine to what extent we need to, and can, take into account substitutable and partially substitutable spectrum when deciding whether frequency bands are in excess demand.

We agree that understanding what factors we will take into account when deciding the feasibility of alternative use is important

- 4.132 We agree that the definition of what factors we should take into account when deciding whether a use is feasible is important for this spectrum pricing Framework and therefore we have included some discussion of this under principle 3 in our consultation document.

4.133 In particular in our consultation document we proposed that when identifying feasible alternative uses, we will take account of various factors, including:

- the physical properties of the band,
- the band's suitability for other applications/services,
- any national and international regulatory constraints that may restrict the alternative uses that may be permitted in the band,
- the existence (or active development) of equipment standards, and
- the availability and cost of equipment for use in the band.

4.134 It is not possible within a general Framework such as this to provide additional detail on how we might take account of these factors in specific circumstances, nor set out an exhaustive list of factors. However, before revising fees in light of any identified feasible alternative uses we will consult fully with stakeholders and set out clearly our reason for why we believe specific alternative uses are feasible or not.

4.135 On the issue of whether taking account of alternative uses when setting fees could undermine the international harmonisation of spectrum, we note that we have already said that we will take international regulatory agreements, along with other relevant factors, into account when determining whether an alternative use is feasible. In authorising uses of spectrum we remain cognisant of the terms of all relevant international obligations and we would not act in a manner that was incompatible with such obligations under, for example, the ITU Radio Regulations or EC Decisions.

Most responses argued that AIP was not appropriate for, or had been incorrectly applied to, their specific use of spectrum

4.136 LBS and LU argued that AIP should not be applied in sectors (for example transport) where the cost of spectrum is insignificant relative to the costs of the core business as they argued it would not achieve its stated objective of incentivising changes in spectrum use.

4.137 C&W Worldwide and Inmarsat argued that AIP fees set to reflect feasible alternative uses should not be applied where doing so would lead to fees that cannot be borne by some existing users.

4.138 Both of these arguments invoke circumstances that could apply to a number of spectrum uses: that the price of spectrum may not be significant in comparison with operating investment costs, and that not all users may be able to bear fees set by reference to feasible alternative use values. We therefore discuss them, as general points, in this Statement, while not prejudging any future proposals we may make in relation to fees applying to the spectrum used by these specific responses.

4.139 In addition to these responses there were a large number of responses that were so specific to a licence sector that we are unable to address them within this general Framework. These comments are summarised in Annex 1 and will be considered, as and when, the relevant fees for a sector or band are next reviewed.

Ofcom view

Fees that reflect the opportunity cost of spectrum are likely to incentivise an optimal use of spectrum regardless of the relative size of the costs

- 4.140 We recognise that in some cases spectrum fees may be so low (when compared to other costs of the business) that they may not be the main determinant of spectrum users' behaviour. However, in setting AIP fees we do not expect or intend that all spectrum users will be incentivised to change their use of spectrum. Many will consider the value they gain from its use is equal to or greater than its opportunity cost and potentially by a very significant margin where spectrum fees are a low proportion of the overall costs and so continue using it. Our aim is rather to incentivise those who do not value the spectrum at or above its opportunity cost to seek alternatives.
- 4.141 Therefore while spectrum fees may be small compared to the overall investment of a business, it is to be expected that an efficient business would still review its overall costs and if the value it gains from its spectrum use is materially less than it costs then it will respond accordingly.

The role of pricing is to incentivise those who value spectrum the least to seek alternatives that will include some choosing to exit a specific frequency band

- 4.142 We recognise and accept the concerns raised by some responses that there is a risk in over-valuing spectrum, particularly as a result of reflecting alternative uses that are not truly feasible in the band, leading to existing licensees vacating spectrum that is not subsequently taken up by alternative uses.
- 4.143 We also agree that when deciding fee levels, particularly those that reflect new and unproven alternative uses, we need to balance the risks of over-charging with those of under-charging and we address this in more detail under principle 9.
- 4.144 However, we do not agree that fees should always be set to ensure that all existing users should be able to bear them. The reason for introducing AIP-based pricing is to ensure that spectrum is available to those who value it the highest, which inevitably means that some existing users might be unable to bear the fee levels and will need to consider other less costly options.
- 4.145 If other users can make better use of the released spectrum, reflecting this through their willingness to pay a higher fee, then society as a whole will benefit. We do however have a duty to consider the impact of any proposed fees, as discussed in more detail under methodology 4, and we would consider the specific circumstances of any fee review, including whether the effect of any loss of services to society, as a result of the proposed fee level, would be sub-optimal.

A number of responses argued that AIP is not appropriate for public sector uses of spectrum, publicly funded uses of spectrum or where spectrum's use is mandated by regulation

- 4.146 FCS argued that AIP might have application to the commercial and public telephony sector but not for the public sector.

- 4.147 A confidential response noted that in practice, any large increases to spectrum pricing during the life of the equipment are likely to be referred back to government as a requirement for additional funding.
- 4.148 The Met Office cautioned against applying AIP for publicly funded or internationally co-ordinated uses of spectrum, which have a wider socioeconomic value, and urged Ofcom to fully consider all appropriate management tools before possibly jeopardising the provision of such services.
- 4.149 STFC added that this principle should not be universal as it will be impossible for some publicly funded users (in particular scientists) to compete against some commercial applications.

Ofcom view

It is appropriate to apply AIP to public sector uses of spectrum as it is Government policy that the public sector should face comparable costs to the private sector

- 4.150 The Government's response to the Independent Audit of spectrum Holdings 2006³⁹ stated:

"The Government supports the principle that pricing for public sector spectrum should be set on a comparable basis to the private sector"

- 4.151 We also agree that generally providing concession for spectrum uses that deliver wider social value, such as public services are unlikely to secure the optimal use of spectrum. The rationale for this position is discussed in greater detail under principle 6, which deals with the role of AIP in securing wider social value.

One response argued that care should be taken where pricing was being used to promote changes in spectrum use

- 4.152 David Hall Systems Ltd expressed the opinion that attempting to predict alternative higher value alternative uses is an invalid approach and that a better approach would be to develop a system that allows for significantly more flexibility in the use of spectrum to meet changing requirements. Mr Hall argued that changing technology and the way end users use spectrum based applications are likely to have an influence on long term spectrum usage and that this needs to be taken into account, but was difficult to predict. He considered that AIP will not be effective in influencing these trends.

We agree with the aim of relaxing constraints on the use of spectrum to enable users of spectrum to more readily change the use they make of it, but achieving this would not, by itself, automatically remove any role for AIP

- 4.153 We agree that we should create as much flexibility as we can in the way that licensees can use the spectrum they hold, and have worked towards this goal where possible. However, there are very difficult technical issues to overcome, particularly in the complex interference and sharing environments of most licence classes for which we charge AIP (e.g. fixed links, business radio, PES) before we could further

³⁹ <http://www.spectrumbauidit.org.uk/pdf/governmentresponse.pdf>

relax licence conditions. Given this we therefore believe that AIP continues to have a role in incentivising optimal use in these licence classes.

- 4.154 However, were licensees to have the maximum flexibility over their spectrum use, it remains the case that in most uses, one licensee's access to spectrum excludes another potential user's access. There is, therefore, still an opportunity cost associated with each licence, and where markets are not well functioning in order to increase the chance that the highest value uses are made of the spectrum, a price signal based on this opportunity cost remains useful.
- 4.155 If technology and other developments were to make it possible for all permitted users to co-exist without the need for explicit technical licence conditions to avoid harmful interference, we would first consider whether the new technology was such that we could exempt the use from licensing altogether: this would be a prior consideration before we considered the applicability of any fees. If we concluded that licensing was still required, in setting fees we would need to consider the demand and nature of feasible alternative uses.

Conclusion on principle 3: when to apply AIP

- 4.156 In light of the responses we received relating to principle 3, we have concluded that when assessing demand from feasible alternative uses that we should, where proportionate and appropriate, also assess the availability of substitutable spectrum for alternative uses.
- 4.157 Having considered all of the responses to this issue we have also concluded that AIP should continue to be applied when spectrum is, or is likely to be, in excess demand in the future from existing or feasible alternative uses, as it is likely to promote the optimal use of spectrum.
- 4.158 We therefore conclude that we will adopt principle 3 as one of our AIP pricing principles.

AIP principle 3: when AIP should be applied

AIP should apply to spectrum that is expected to be in excess demand from existing and/or feasible alternative uses, in future, if cost-based fees were applied. In determining feasible alternative uses, we will consider over the relevant timeframe, any national or international regulatory constraints, the existence of equipment standards, and the availability and cost of equipment as well as other factors that may be appropriate.

Principle 4: the "relevant timeframe" for AIP

- 4.159 In our consultation document we said that it is important to set our decisions relating to AIP within the context of the "relevant timeframe", particularly in relation to the assessment of excess demand, congestion, and feasible alternative uses. We proposed that the relevant timeframe should reflect users' investment cycles in order to ensure that investment decisions can be informed by a forward-looking assessment of potential spectrum availability.
- 4.160 In our consultation document we therefore proposed the following principle to address the issue of what the "relevant timeframe" should be.

Proposed principle 4: the "relevant timeframe" for AIP

In general, we seek to assess excess demand, congestion and feasible alternative use over a timeframe that reflects the length of existing users' investment cycles.

Some responses agreed with this principle

- 4.161 BPA/UKMPG, STFC and ESOA agreed that investment cycles need to be considered when deciding what the relevant timeframe should be.
- 4.162 A confidential response agreed there is value in using AIP to provide an incentive for longer term investment decisions.

Some responses disagreed with the principle or argued that the relevant timeframe should consider other factors than simply investment lifecycles

- 4.163 A confidential response argued that the long term should also take into account the implementation of networks citing that one specific system took 11 years to roll-out, which they argued means it is essential for them to have substantive notice of significant changes to fees.
- 4.164 The Met Office argued investment cycles should not be the only consideration citing lead times for planning, procurement and deployment of satellite systems.
- 4.165 David Hall Systems Ltd went on to state its opinion that if there is a higher value alternative use, then it might be appropriate to consider reducing "the relevant timeframe" to make the spectrum available earlier.
- 4.166 BPA/UKMPG argued that the time taken to change international agreements should also be taken into account when assessing the relevant timeframe.

Ofcom view

The relevant timeframe is generally the economic lifetime of the radio equipment used with spectrum but on occasion it may be appropriate to consider other factors

- 4.167 In the following consideration of the issues around principle 4, it is important to remember that these issues are discussed within the context of spectrum pricing and that there may be different considerations for timescales when we are considering the use of other regulatory tools, such as clearance.
- 4.168 In deciding whether to apply AIP we need to form a forward-looking view of congestion from current uses and excess demand from alternative uses, as well as whether there are likely to be any alternative uses that we should take into account when setting fees. The rationale for this is to ensure the investment decisions in long-lived assets take into account likely future spectrum value. As highlighted in our consultation document in paragraphs 3.64 to 3.67, if we did not reflect the potential future demand for spectrum in AIP fees, this could result in distorted investment decisions which are not consistent with the optimal use of spectrum. In particular, if AIP fees are not based on a forward-looking assessment of spectrum demand, there is a risk that this may encourage users to invest more than they would otherwise in equipment in spectrum bands for which a higher value use is expected to emerge within the lifetime of this equipment. At this time, we would have to either:
- Increase fees to reflect the increased value of the spectrum, potentially resulting in existing users stranding assets; or

- Leave fees at the existing low levels and lock out higher value uses or users.
- 4.169 As noted in paragraph 3.65 of the consultation document, both of these options are undesirable, and we consider that in general efficiency is more likely to be promoted if AIP provides a signal of likely future spectrum scarcity.
- 4.170 Take as an example the hypothetical case of a band for which we anticipate a much higher value feasible alternative use becoming possible in five years. If the typical economic life of the equipment used by existing users of the band is ten years, then we would wish to signal to these users that the value of the spectrum they use is likely to increase significantly during the lifetime of their investment (i.e. before the period over which they expect to obtain the returns on their investment ends). Conversely, if the lifetime of the investment of the existing users is only two years we would not need to signal this future higher value use as it would not materialise before the end of the current users' investment cycle.
- 4.171 Because one of our objectives of AIP is to inform, as far as we are able, the investment decisions of existing spectrum users, in principle the relevant timeframe should be based on the frequency with which users in the band make investment decisions. In general, we would expect this to reflect the asset lives of relevant spectrum-related equipment. As highlighted by stakeholders, however we agree that when assessing the relevant timeframe we may need on a case-by-case basis to consider other factors such as the time needed for the planning and procurement of networks and systems. We do not believe that it would be appropriate, however, to consider the time taken to roll-out networks as it can be argued that some networks are never completed as they grow in both geography and capacity dependent on demand.
- 4.172 However, as noted in paragraph 3.67 of the consultation document, there may be practical constraints on our ability to forecast future demand, particularly from alternative uses, with any certainty over a long period of time, and this may constrain the length of the relevant timeframe that we can consider in practice. We should also acknowledge that the further that we look into the future the greater the level of uncertainty inherent in these forecasts and therefore the more care we need to employ in their use. Uncertainty is a key issue when setting AIP fees and is the subject of a separate principle (principle 9) that we discuss later in this Section.
- 4.173 We would not look to reduce the relevant timeframe, as suggested by one response in the event that a higher value use was expected to emerge, as this would lead to distortions in users' investment decisions. The relevant timeframe is not a reflection of any desire on our part to introduce specific changes in spectrum use, but rather is set to enable us to reflect likely changes in future spectrum value that are likely during the life of investment decisions being made by spectrum users, to better inform these decisions.

International agreements may limit both users' ability to respond and the potential for other uses of the spectrum within the relevant timeframe, but do not bear directly on the timeframe over which we wish to influence investment decisions

- 4.174 On the issue of the time taken to change international agreements, as we discussed in paragraphs 3.23 to 3.29 of our consultation document and under principle 2 of this Statement it is necessary to consider the specifics of any International agreement on a case-by-case basis before it is possible to determine how this might impact users' ability to change their use of spectrum as a result of a pricing signal, or whether other

uses are feasible in the relevant timeframe. However, such international agreements do not themselves alter the “relevant timeframe” over which we would look to assess congestion, excess demand and the future value of spectrum. Therefore we would still wish to inform spectrum users’ investment decisions by providing an indication of the future demand and value of spectrum over the economic life of the equipment being used.

Other responses argued that some operators are able to make shorter term responses to price signals than indicated by their investment cycles

4.175 BT and Intellect agreed with this principle only in some circumstances, arguing that equipment lifetimes and associated investment cycles are not the only consideration. They argued that only in cases where the use is apparatus-based (e.g. fixed links) is it the equipment lifecycle that drives the timing of opportunities to improve efficiency. For uses where use is more spectrum based e.g. mobile networks they argued that more short term responses are possible, for example, by adding cells and reconfiguring the network rather than investing in new equipment. Therefore in these cases, they argued, a response to a spectrum pricing stimulus could happen in the short term.

Ofcom view

AIP seeks to inform investment decisions, therefore the relevant timeframe should reflect the lifetime of the asset, and is not related to the ability of users to respond

4.176 We agree that some spectrum users have the ability to respond more quickly to pricing signals than indicated by the economic lifetime of their equipment. However, when assessing the relevant timeframe and the future demand and therefore value of spectrum the important issue to consider is the lifetime of the investment decisions being made in light of the fees that we charge for spectrum, rather than the responses available to spectrum users. Therefore, the relevant timeframe will generally be determined by be the economic lifetime of the radio equipment deployed to use the spectrum.

4.177 As we explained in principle 2 in paragraphs 4.85 to 4.88, users’ ability to respond is a factor we need to take account of in estimating the opportunity cost of spectrum in the LCA method.

A number of responses questioned how we would assess the relevant timeframe if licensees in a band have very different investment lifecycles

4.178 The Met Office, Intellect, C&W Worldwide and David Hall Systems Ltd questioned whether and how “the relevant timeframe” could be assessed in a band where there are different investment cycles for existing and/or feasible alternative users and that a more refined approach might be needed.

4.179 Intellect expressed the opinion that the term "investment cycle" has different meanings to different users depending on the size of the investment and whether it includes infrastructure and consumer equipment.

Ofcom view

When considering the relevant timeframe we will not always need, nor will it be helpful to determine a specific timeframe, rather we will need to take a balanced view of all factors that should influence the level at which we set fees

- 4.180 We recognise that the decision on what relevant timeframe to use could have important implications on the level of spectrum fees and, ultimately, on the allocation of spectrum to different users. For example, in a situation where the demand for spectrum is expected to grow, and technological and regulatory developments are expected to result in more feasible alternative uses then the further we look into the future the higher the demand for spectrum is likely to be (albeit such forecasts will suffer from an increasing level of uncertainty, as discussed under principle 9 in this Statement). Therefore, in some circumstances the longer the relevant timeframe over which we look to set AIP fees, the higher the AIP fee rate is likely to be (tempered by the level of uncertainty). As previously discussed in paragraph 4.172, above, the issue of uncertainty is addressed under principle 9 later in this Section.
- 4.181 As discussed above, there is equally a risk that if we take the shorter equipment lifecycle into account we would fail to recognise higher value alternative uses that may emerge in future. This would encourage lower value users to continue using the spectrum, while other more valuable users and uses are locked out.
- 4.182 Where users with very different equipment lifetimes use the same spectrum this principle appears to imply that we will have to decide which of these should be used as the 'relevant timeframe' over which to assess excess demand, congestion and the feasible alternative uses.
- 4.183 In practice, however, the relevant timeframe is just one element we consider when determining whether AIP is appropriate and, if it is, at what level it should be set. Given the practical limitations on our ability to forecast demand and the inherent uncertainty in forecasts made over long periods we believe that this is unlikely to be a material issue in most cases. We would, therefore look to make a rounded judgment on how best to set the AIP fees based on our consideration of all the relevant principles and methodologies and all the available evidence, as well as through consultation with stakeholders in our normal manner.
- 4.184 We agree that it would appear that our using the term "investment cycle" has been interpreted in different ways by some responses. Some have assumed that we are referring to the overall business investment cycles of their organisations rather than, as we meant, the typical economic lifetime of the radio equipment used in the specific band in question. We hope that this statement has made this distinction clear.

Conclusion on principle 4: the "relevant timeframe"

- 4.185 In light of responses made on how we will determine the relevant timeframe in specific circumstances, such as when there are users with very different investment cycles, as discussed above we need to recognise that it will not be possible, nor necessarily helpful, to determine a specific relevant timeframe in each specific fee review. As we have said previously in this Statement, this spectrum pricing Framework sets out outline considerations that may be relevant to a greater or lesser extent in any specific fee review, and it should be used as guidance on how we would expect to address these issues. It is not intended to provide a fixed "recipe-book" on how to set fees and therefore it is not necessary, or right, to provide a single

stand-alone answer to the consideration of each and every principle. In particular in some cases we would need to consider the risks and benefits of taking different relevant timeframes into account, along with all the other considerations before forming a balanced judgment on the fee level to set. We would expect to explain our reasons for the proposals that we put forward in any fee proposal, and consult with stakeholders, before making a final decision.

- 4.186 Given some of the responses we received on this principle and principle 2 above, it would appear that the term “investment cycle” has been interpreted in different ways by some responses. Some have assumed that we are referring to the overall business investment cycles of their organisations, rather than as we meant the typical economic lifetime of the radio equipment used in the specific band in question. We have sought to clarify this clearly in this Statement and have also sought to clarify this in an amendment to the text of principle 4. We have also sought to clarify in the text of the principle how the relevant timeframe is used in our Framework as the original text caused some confusion to stakeholders.
- 4.187 Having considered all of the responses to this issue, therefore, we remain of the view that AIP is set to influence investment decisions over the long term (the ‘relevant timeframe’). This timeframe, in general, is likely to reflect the radio equipment investment cycles of the existing users, although we recognise as highlighted by stakeholders in their responses that there may be other factors that we will need to take into account on a case-by-case basis and have amended principle 4 to reflect this.
- 4.188 We therefore conclude that we will adopt principle 4 as part of our Framework for spectrum pricing.

AIP principle 4: the ‘relevant timeframe’ to assess future demand of spectrum
In general, we need to determine the time period over which we will seek to assess excess demand, congestion and feasible alternative use. We will do so over a timeframe that reflects the typical economic lifetime of existing users’ radio equipment.

Principle 5: AIP and spectrum trading

- 4.189 In our consultation document we said that we remain of the view that:
- there is currently no single spectrum market but rather a set of separate markets across the various frequency bands, and this is likely to continue in the foreseeable future. This points to the need for a separate analysis of each market in future fee rate reviews, and means that the role of AIP as a complement to other market mechanisms may well differ in each individual market;
 - trading volumes in individual markets have proven insufficient to provide the market with the depth and liquidity required to attract those market intermediaries that would enable markets to operate more efficiently;
 - in addition, trading and liberalisation alone may not be sufficient to promote efficient use in certain spectrum markets, particularly where spectrum use is highly co-ordinated under the current licensing regime – therefore, AIP may need to perform a more important role in such markets;

- in markets where trading and liberalisation have a stronger role to play in the promotion of the efficient use of spectrum, the role of AIP may correspondingly be less critical, but may remain an important complementary regulatory tool to promote the optimal use of spectrum where those markets continue to be imperfect.

4.190 We therefore initially concluded that it is likely to be premature to dispense with AIP altogether as a complementary tool for securing optimal use of spectrum as spectrum trading markets are not sufficiently effective, as a general rule, to supplant AIP in promoting optimal use. Consequently, we considered that in most circumstances AIP will continue to be needed in those bands where there is excess demand, even if licences are tradable. We proposed to assess the roles of trading and AIP for each licence sector-specific fee review in order to reach a decision appropriate to the circumstances of the individual market.

4.191 In our consultation document we therefore proposed the following principle to address the issue of whether AIP is needed for tradable licences:

Proposed principle 5: AIP and spectrum trading

Many secondary markets are unlikely to be sufficiently effective to promote the optimal use of the spectrum without the additional signal from AIP. Therefore AIP will likely continue to be needed to play a role complementary to spectrum trading for most licence sectors.

Some responses agreed in general with principle 5

- 4.192 Arqiva, BT and “Three” agreed with this principle. Intellect agreed in some cases, but did not expand on which cases they would not agree or why.
- 4.193 BT added that it agreed with this principle at least while market mechanisms are not well established and where competition considerations might provide a significant disincentive to trade.
- 4.194 Arqiva added that trading is still in its infancy and that it looked forward to the release of public sector spectrum holdings.

Ofcom view

4.195 We agree that issues of competition can impact the effectiveness of secondary markets to promote the optimal use of spectrum.

Other responses disagreed with principle 5, arguing AIP was incompatible with tradable licences

- 4.196 O2 disagreed with AIP applied to tradable licences because AIP and trading share the same objective: efficient use of spectrum.
- 4.197 Vodafone argued strongly against this principle and in particular argued against AIP applied to mobile spectrum that was tradable (and liberalised) and expressed their opinion that the arguments put forward by Ofcom justifying when AIP should be applied are unconvincing. They presented, verbatim, the arguments they presented in their responses to Ofcom’s 2004 Spectrum Trading consultation. This commented on each of the six arguments Ofcom gave in this earlier consultation for why AIP might have an efficiency role when spectrum is tradable.

4.198 However, since 2004, when we consulted on the introduction of spectrum trading, we have gained experience of the spectrum trading market in the UK and our thinking has evolved accordingly. For this reason, our consultation did not put forward, and our rationale for this principle did not rely on some of the 6 arguments to which Vodafone's response to the consultation on the introduction of spectrum trading referred. We will not therefore address those arguments that we did not present in our consultation document in this Statement. We note, however, that some of these arguments may well have validity in some specific circumstances.

4.199 Instead, here we will only consider the two circumstances that we put forward in our consultation document in paragraphs A6.48 to A6.60 addressing when we believe secondary markets may not provide sufficient incentives for optimal spectrum use, namely, when:

- trading is limited by barriers like transaction costs, coordination problems and/or lack of price information; and,
- licensees are more responsive to AIP than to the possibilities offered by trading.

Ofcom view

Making licences tradable does not of itself ensure a well-functioning market and so AIP and trading can complement each other in achieving our objective

4.200 In our consultation document we identified and discussed in Annex 6, paragraphs A6.48 to A6.60 the criteria that would have to be met before deciding to remove AIP. Overall we proposed that the key question enabling us to reduce the need for AIP would be the existence of a sufficiently effective secondary market. However, our analysis of the UK spectrum market showed that many secondary markets are not sufficiently effective to promote the efficient use of spectrum. We therefore proposed that due to the specific characteristics of individual spectrum markets, we would need to assess this on a case-by-case basis. Having considered the responses to this issue we remain of this view.

AIP can improve spectrum efficiency where there are high transaction costs, lack of price information and co-ordination problems

4.201 Trading volumes and market liquidity in individual sub-markets have not enabled the development of market institutions that would facilitate low-cost, efficient trading activity, such as spectrum brokers or other market intermediaries. There is some evidence that they are beginning to emerge in the USA but they have yet to gain a foothold here. For the most part, trading continues to be bilateral and traders must find each other via private contacts, advertising or other ad hoc means. In addition, market price information is virtually non-existent outside the small number of auctions held to date. As a result, transaction costs may be too high and may be deterring efficient trades.

4.202 Transaction costs are also increased due to licence conditions that enable fragmented and highly technically co-ordinated sharing of spectrum e.g. for business radio technically assigned licences. In these cases, existing assignments may have a relatively localised coverage area and a potential buyer may need to locate a potentially large number of licensees to purchase the spectrum rights needed for his service. These search costs may make it unviable to acquire licensed access to the entire geographical areas or to subsets of the band through the market. In such

circumstances, AIP can facilitate the transfer of spectrum from lower to higher-value users through the handing back of licences to Ofcom and their reassignment to other users.

Some licensees might be more responsive to a direct cost such as AIP than to forgone revenue that they might achieve through trading

- 4.203 We also note that some commercial and public spectrum users may be less responsive to trading than to AIP. This may be the case, for example, where public sector users will not retain the proceeds from spectrum sales, or will retain only part of them. More generally, when strong pressures are put on managers to reduce or contain their operating budgets, but less importance is placed on realising untapped revenue sources such as might arise from selling spectrum, AIP can provide a more powerful incentive for licensees to use spectrum efficiently than the possibility of selling unwanted spectrum.
- 4.204 There may be other reasons, specific to an individual licence sector, which means that trading is not yet, and may not be in future, effective.

Other responses disagreed with principle 5 arguing that Ofcom's focus should be greater liberalisation of spectrum rather than pricing

- 4.205 David Hall Systems Ltd said it believed that the lack of trading was due to too many constraints and barriers on licensed spectrum use. Mr Hall added that they think that Ofcom should put more effort into establishing a freely functioning non-fragmented spectrum market – thereby reducing the need for AIP.
- 4.206 BPA/UKMPG argued that this principle assumes trading between commercial organisations and our discussion omitted the concept of "liberalisation" that appears in the principle's title but is not developed further in the consultation document.
- 4.207 STFC argued that Science is not a market, as such, so it is unclear how trading is intended to work for the science community. It added that trading will only benefit the science community if the research councils are allowed to re-invest any money obtained from the spectrum they release.

We agree that liberalisation will strengthen the ability of trading to promote spectrum efficiency and that limitations on our ability to relax technical conditions will inhibit the ability of trading to encourage optimal use of the spectrum

- 4.208 We recognise that liberalisation - the inclusion of less constraining technical licence conditions - is one of the key mechanisms promoting the efficient use of spectrum. However, liberalisation (i.e. permitting greater flexibility in the way that a licensee can use their spectrum) is not an absolute – it requires the application of judgement on the trade-off between the benefits of increased flexibility for one licensee and the risk of increased interference to neighbouring licensees. This trade off will differ between bands. We note that AIP is applied in many cases to congested licence classes, which are closely co-ordinated to avoid interference (with many individual licensees sharing the use of the frequency band). It is not immediately apparent to us how much further we can remove or relax the current technical constraints in the licences without increasing the probability that harmful interference would reach unacceptable levels for all licensees. We remain open, however, to any suggestions as to how we could introduce more flexibility into these licence classes.

- 4.209 We agree that in our discussion on AIP and tradable licences we did not directly refer to liberalisation. The relevance of this to the overall discussion, however, is that in some licence sectors the effectiveness of trading is diminished by constraints on the ability of users to change their use of spectrum or on a trading partner to change the use. As discussed above in some licence sectors it would be necessary to purchase a very large number of existing licences in order to create an interference environment where they could change the use of spectrum without causing unacceptable interference to other licensees.

We do not expect trading to be limited to commercial organisations

- 4.210 On the issue that Science is not a market we were not intending to imply that it is, rather that a resource such as spectrum needed by science or any other public sector user can be obtained through trading as well as by direct request to us. We anticipate, therefore, that there will be trading between commercial as well as non-commercial organisations, including the public sector. Indeed a key objective of the Cave programme is for public sector holders of spectrum to procure additional spectrum requirements from the market (i.e. directly from other holders of spectrum or at auction) and to release unwanted spectrum back to the market, through auctions and/or trading.

Conclusion on principle 5: AIP and tradable licences

- 4.211 Having carefully considered the responses to this issue we remain of the view that AIP is compatible with tradable licences and that, for the present at least, while spectrum trading is proving useful and effective for growing numbers of spectrum users, spectrum trading markets are not sufficiently effective, as a general rule, to undermine the role of AIP in promoting optimal use. Consequently, we conclude that in most circumstances AIP will continue to be needed in those bands where there is excess demand, even if licences are tradable. In order to reach a decision appropriate to the circumstances of the individual markets, we intend to assess the roles of trading and AIP in each sector-specific fee review on a case-by-case basis.
- 4.212 We conclude therefore that we will adopt principle 5 as one of our AIP pricing principles.

AIP principle 5: AIP and spectrum trading

Many secondary markets are unlikely to be sufficiently effective to promote the optimal use of the spectrum without the additional signal from AIP. Therefore AIP will likely continue to be needed to play a role complementary to spectrum trading for most licence sectors.

Principle 6: AIP and wider policy objectives

- 4.213 In our consultation document we acknowledged that there will be some goods or services that the market, left to itself, could fail to provide in sufficient quantity and that options for ensuring the provision of these goods include public provision funded from taxation, and regulation to mandate operators to provide particular benefits. We explained that, in general, we consider direct subsidies and/or regulatory tools are normally more likely to be efficient and effective in securing the desired policy objectives and associated wider social benefits, rather than concessions on AIP fees.
- 4.214 This was because:

- subsidising one input such as spectrum creates the risk that investment choices will be distorted, such that the users provided with a subsidy will tend, over time, to retain more spectrum than they need, increasing the opportunity cost resulting from excluding other uses and users;
- an input subsidy on its own does not guarantee that the input will be used, nor that the desired outputs will be delivered using it. Direct subsidies and/or regulations can be targeted at the desired outputs and so are normally more likely to be effective, and proportionate.

4.215 In our consultation document we therefore proposed the following principle to address the issue of whether concessions on AIP fee levels should be given to uses of spectrum to deliver wider policy objectives.

Proposed principle 6: AIP and wider policy objectives

Socially beneficial uses of spectrum do not, as a general rule, justify AIP fee concessions, because direct subsidies and/or regulatory tools other than AIP are normally more likely to be efficient and effective. For cost-based fees there might be some circumstances in which it could be appropriate to provide a concession.

4.216 This issue caused considerable debate at the stakeholder workshops and was the principal subject of a number of responses.

Some responses agreed with the principle, but with a reservation on the likely availability of government funding

- 4.217 Arqiva, UK Major Ports and British Ports Association, Intellect and STFC agreed in principle with the proposal.
- 4.218 LBS and LU acknowledged that public sector investment decisions are made not just in terms of return on investment but also in non-monetary terms e.g. wider social benefits including environmental matters; notional monetary terms e.g. for transport the notional value of time in waiting for transport beyond normal waiting times; and by fulfilling its obligations to various statutory/mandated responsibilities. I.e. they agreed there was a role to be fulfilled by publicly funded organisations in monetising some of the wider social benefits (for which they are responsible).
- 4.219 Arqiva, ESOA and Intellect, however, questioned whether such direct subsidies would be made available, particularly in the current economic climate.
- 4.220 ESOA, the Met Office and a confidential response argued that without concessions there was a danger that socially beneficial services, and even essential safety-related services, could be “priced out of spectrum”.
- 4.221 STCF cautioned, in particular, that the diversity of the science community may make the collection of AIP fees impractical or at least administratively costly for it to implement and that, therefore, they may also be unable to meet the cost of spectrum.

Ofcom view

Although we acknowledge the current scrutiny on public funding, it is not appropriate for us to distort public sector investment decisions by providing concessions on AIP fees

4.222 A major concern for many responses was the practical realities of a squeeze on public funding and how this might manifest itself in terms of funding for public uses of spectrum. We agree that public expenditure on wireless communications, such as on spectrum and on equipment, will come under the general scrutiny required of public bodies in assessing their priorities in the current climate. In general, however, we do not think that this would justify reducing or waiving spectrum licence fees because that would risk distorting each public body's decision between different inputs. That is, if spectrum were artificially cheaper a public body seeking to reduce its overall costs may continue to use more spectrum than was efficient to deliver its priorities, reducing the amount available for other users in both the private and public sectors and therefore reducing the benefits gained by citizens and consumers from the use of spectrum.

If government collectively thought the impact of any proposed fees would have an unacceptable impact on a public service it has the power to direct us

4.223 In an extreme case, an inability to pay for spectrum could conceivably lead to an unacceptable cessation or reduction in a key public service if public funding were not made available to cover the spectrum fees. We consider that our duty to consider the impacts of any spectrum policies, as described in methodology 4, would provide a mechanism by which this would be avoided. But there is an additional safeguard against unacceptable effects on public services, because if Government collectively thought that the impact of a spectrum management proposal (such as the form of an award, or the level of licence fees) would have unacceptable effects on the provision and availability of a public service, then it could decide to direct us to take steps to ensure that this could be avoided. This safeguard could also be considered in the case of a wider social benefit delivered by a commercial service.

Other responses argued robustly for concessions to be granted for some uses of spectrum that deliver social benefit

4.224 ESOA, the Met Office, FCS, Scottish Government and a confidential response argued for the wider social benefits of spectrum use to be taken into account when setting fee levels and that either concessions on AIP fees should be made or that a cost based fee should be charged.

4.225 ESOA also said that they had serious concerns that the consultation document did not give sufficient weight to these considerations.

4.226 David Hall System stated their belief that spectrum value, as expressed in AIP fees, should be based on a combination of:

- the opportunity cost of spectrum;
- the contribution that a specific spectrum usage makes to GDP; and
- the wider benefits to society resulting from that specific spectrum usage.

- 4.227 This they argued was because Ofcom's statutory obligation includes taking into account the interests of citizens, which they claim doesn't seem to have been fully taken into account in the current proposals.
- 4.228 ESOA disagreed with what they saw as a simplistic assertion that spectrum fee policy can be divorced from other public policy objectives and expressed their view that principle 6 appears to contradict the requirement expressed in the consultation document that "spectrum is allocated and assigned to those that will provide the greatest benefits to society as a whole". They further argued that (public) policy goals should be facilitated not frustrated by spectrum fees policies.
- 4.229 The Met Office further argued that services which provide wider social benefits should be defined as non-commercial services relating to civil contingencies or public safety including weather radar or irreplaceable internationally agreed remote sensing.

Ofcom view

We should not generally use concessions on AIP fees to try to support wider policy objectives, as they risk incentivising inefficient use of spectrum

- 4.230 In general, as discussed in paragraphs 4.213 to 4.215, we believe that if it is considered that a subsidy should be provided to support wider policy objectives, it is more efficient for those services to be explicitly subsidised by government from general taxation, leaving those providing them to have the same incentives to use resources, such as spectrum, efficiently, rather than to seeking to provide such services through concessions on the fee charged.
- 4.231 For these reasons, socially beneficial but un-commercial services do not generally receive goods, services or resources at a concession but, as a general rule, pay the market price.
- 4.232 This view is endorsed by government in relation to the public use of spectrum, as it is government policy that public sector users should pay comparable rate to commercial users. We recognise there are wider issues for public sector bodies' engagement with the market, including in relation to their participation in auctions. In terms of spectrum pricing however, it is clear that the public sector should be treated comparably to the commercial sector.
- 4.233 The wider social benefits provided by other services are often secured by mandating their delivery through regulation, such as those protecting health & safety in the workplace and safety of life more generally. Similar to public subsidy, the imposition of regulatory costs is required to be justified by the relevant regulator in terms of the benefits to society. Delivery of these services are not usually subsidised or compensated for by the relevant regulator.
- 4.234 However, while we do not think that subsidising spectrum, by means of AIP concessions, is normally a focused or effective way of promoting wider policy objectives, when making decisions on fee levels, we also have regard to those matters set out in section 3 of the Act which appear relevant in the circumstances. These may include for example the needs of persons with disabilities, of the elderly and those on low incomes. When efficient use of spectrum can only be secured at a significant cost to a particular group of citizens or consumers for which we have regard, we may need to consider whether this outcome would be optimal (see section 3 paragraphs 3.13 to 3.20 for a further explanation of our views on efficient

versus optimal use of spectrum). Therefore we will continue to have regard to the impact of spectrum fees on certain policy goals on a case-by-case basis.

- 4.235 Equally, when considering the impact of fees in a specific fee review, we will carefully consider any potential impact on wider social policies in our decisions on whether and how to apply AIP in individual sectors.

Conclusion on principle 6: AIP and wider policy objectives

- 4.236 Having considered carefully the responses to this issue, we recognise that the main concern of respondents was the potential loss of services that provide substantial societal benefits, whether provided by the public or private sector. As discussed above we recognise that there is particular scrutiny at this time on public finances and that this will include scrutiny on expenditure on wireless communications. However, we do not believe that this is sufficient reason for us to change our view that in general concessions on AIP fees for services that provide wider social benefit are neither appropriate nor guaranteed to achieve the objective of ensuring such benefits are delivered.
- 4.237 As discussed above and in section 3, however, we have specific duties under section 3 of the Act which may require us to consider whether whilst efficient, a specific outcome of a fee proposal may not be optimal (see paragraphs 3.13 to 3.20 for an explanation of how we interpret efficient and optimal use of spectrum).
- 4.238 We recognise, as some respondents argued, that there are some commercial services that whilst not delivering on stated public policy do also provide wider social benefits. To reflect this in our AIP principles going forward therefore we have revised the text of principle 6 to refer to wider social value, rather than limiting its scope to wider public policy objectives as in our original formulation of principle 6.
- 4.239 We conclude, therefore, that in setting AIP fees, in general, AIP concessions are unlikely to be the most efficient and effective way to promote wider social benefits. However, in setting AIP fees, we will continue to have regard (among other things) to the desirability of promoting economic and other benefits that may arise from the use of spectrum, including wider policy objectives⁴⁰, making a case-by-case assessment and therefore that we will adopt principle 6, below, as one of our AIP pricing principles.

AIP principle 6: role of AIP in securing wider social value

Uses of spectrum that deliver wider social value do not, as a general rule, justify AIP fee concessions, because direct subsidies and/or regulatory tools other than AIP are normally more likely to be efficient and effective.

- 4.240 Principle 6 as set-out in our consultation document also addressed whether we should provide concessions to cost-based fees in order to secure wider social value. For clarity this discussion is now in Section 5 under Question 2 which addresses cost-based fees and not included in principle 6 which is now restricted to consideration of AIP fee.

⁴⁰ In line with s.3(2)(b) of the WT Act

Principle 7: AIP and the promotion of innovation

- 4.241 In our consultation document we said that in general, we do not consider that it would be appropriate to give concessions on AIP fees to users wishing to provide innovative commercial services via access to scarce spectrum on the same terms, including security of tenure, as other operators paying the full fee rate. The reason for this presumption, we explained, is that AIP only applies to spectrum that is scarce and if we give some users concessions on AIP fees then they may use more spectrum than they would have if faced with the full opportunity cost of the spectrum. As a consequence, we argued, this may exclude users who would have been willing to pay the full fee, and who might therefore be expected to have generated more value from the spectrum. We therefore said that we thought it could run counter to our objective to secure optimal use of spectrum to offer scarce spectrum to some users for a reduced fee and that it could provide incentives that could distort investment decisions by new operators.
- 4.242 In our consultation document we therefore proposed the following principle to address the issue of whether concessions to AIP fees should be given in order to promote innovation:

Proposed principle 7: AIP and the promotion of innovation

It will generally not be appropriate to provide AIP concessions in order to promote innovation. We may consider whether cost-based fees should be set at a lower level in order to promote innovation

Many of the responses that addressed this principle broadly agreed with it

- 4.243 Arqiva, BT and BPA/UKMPG agreed with the principle as drafted. STFC agreed in general with the proposed principle. Intellect agreed in some cases, but did not expand on when they would not agree.

Some responses disagreed with proposed principle 7 either because they believe that AIP will inhibit innovation, or that AIP should actively incentivise innovation

- 4.244 The MetOffice commented that the general approach is probably quite equitable, but they raised an issue as to whether the application of this principle could stifle innovation to some extent. They therefore indicated that they believed there is a justification for some element of broader consideration, rather than just applying market values for innovative services.
- 4.245 ESOA disagreed with the proposed principle as it believes that AIP will stifle rather than encourage innovation.
- 4.246 Scottish Government expressed the opinion that in order to promote innovation spectrum pricing should be seen to incentivise and not just "penalise".
- 4.247 A confidential response stated that it supported proposals for AIP concessions for the promotion of innovation which were technically more spectrally efficient. However, they commented that the mechanism by which this should be applied would require further investigation - especially in harmonised bands supporting a common technology.

- 4.248 David Hall Systems Ltd considered that more flexibility in the way users are permitted to use spectrum is a more appropriate means of promoting innovation, but added that discounted cost-based fees could provide additional benefits.
- 4.249 ESOA also said that there is no evidence that AIP has led to any substantial innovation.

Ofcom view

We remain of the opinion that AIP concessions are not normally the most effective way to promote innovation, and could reduce the benefits to society of spectrum use

- 4.250 One of the matters we are required to have regard to in particular in setting AIP is the promotion of innovation⁴¹. As discussed in the consultation document the primary aim of AIP is to promote the optimal use of spectrum by promoting greater efficiency in the way that spectrum is used, as AIP can be expected to provide incentives for spectrum to be released for more valuable uses where it is scarce.
- 4.251 We believe that relieving spectrum scarcity will normally promote innovation in electronic communications by making it easier and faster for new and existing providers to access spectrum and develop new services. In other words, by achieving its main objective – more efficient use of spectrum – AIP can be expected as a consequence to increase opportunities for innovative uses.
- 4.252 However, as a general rule we do not believe that we are best placed to promote specific innovative uses of spectrum by providing AIP concessions. Instead, we think the market will be better in selecting the innovative services that are likely to provide the greatest future value for society from scarce spectrum.
- 4.253 For test & development and academic research, we also make available “non-operational licences”, for which we charge a cost-based fee set at a level so as not to discourage innovation.
- 4.254 We do not agree that AIP applied consistently to users of scarce spectrum, innovative or established, could be characterised as stifling or “penalising” innovative uses, but simply maintaining a consistent price signal independent of the decisions users make as to what to do with the spectrum they access. In our opinion, granting AIP concessions could give rise to distortions in the investment decisions of new operators because those benefiting from concessionary rates may use more spectrum than they would have if faced with the full opportunity cost of the spectrum. This might exclude other potential users that could otherwise generate greater benefits for society and, by excluding them, lead to a non-optimal use of spectrum.
- 4.255 On the suggestion of one response that we provide concessions to innovation that is spectrally more efficient, we note that the methodology that we adopt when deciding what fees to charge for individual licences includes a “bandwidth factor” that takes account of how much spectrum any licensee uses. Therefore, a more spectrally efficient use will pay proportionately less fees than a use that is less spectrally efficient, which should act as an incentive for spectrum users to seek and for manufacturers to develop more spectrally efficient equipment. We do not, however,

⁴¹ Sections 3(2)(c) and 3(2)(d) of the WT Act

believe that it is appropriate to provide AIP concessions based on the extent to which a use might be judged by us to be “innovative” in its technical use of spectrum.

- 4.256 We do agree that introducing greater flexibility in how spectrum can be used (taking account of the potential for harmful interference to other users) is important in promoting innovation and we will continue to be open to suggestions on where and how we can increase such flexibility.
- 4.257 We do not expect pricing to be a specific driver of innovation, but rather provide the right environment for it to occur, through ensuring spectrum is available as when such innovations have need to access it.

Conclusion on principle 7: AIP and the promotion of innovation

- 4.258 Many responses agreed with this principle, whilst some of those that did not felt that AIP could inhibit innovation, particularly in respect of technical innovation allowing more spectrally efficient use of spectrum. Having considered these responses we believe that our existing approach to charging for individual licences (see section 5, methodology 3 for greater detail) provides sufficient incentives for users and manufacturers to produce more spectrally efficient technology, given that users are charged only for the bandwidth they use.
- 4.259 We remain of the view that in general it is not appropriate for us to provide concessions on AIP fees in order to promote innovation as we believe that this would run counter to our primary duty to secure the optimal use of spectrum. Users provided with access to scarce spectrum at a reduced level of fee are likely to use more spectrum than they would if they were charged the full fee level and thus are likely to prevent others from gaining access to scarce spectrum.
- 4.260 We recognise, however, that innovation plays a very important role in increasing the value of services for citizens and consumers produced from spectrum by, for example, creating new uses of spectrum. Where innovation creates additional value for society it may also increase the opportunity cost of spectrum. If we were to reflect this increase in opportunity cost in our fees as soon as the increase becomes apparent, we might reduce the rewards of innovation and as a result reduce incentives to innovate. This has specific implications for when and how we should undertake fee reviews in response to increases in opportunity cost of spectrum. Specifically, when the increased opportunity cost results from innovation this would be a consideration in deciding whether and how to reflect the increase in fees. This is reflected in our discussions in Section 6 on when we would undertake a fee review in future.
- 4.261 Principle 7 as set-out in our consultation document also addressed whether we should provide concessions to cost-based fees in order to promote innovation. For clarity this discussion is now in Section 4 under Question 2 which addresses cost-based fees and not included in principle 7 which is now restricted to consideration of AIP fee.
- 4.262 We conclude therefore that we will adopt principle 7, as amended below, as one of our AIP pricing principles.

AIP principle 7: AIP and the promotion of innovation

It will generally not be appropriate to provide AIP concessions in order to promote innovation.

Principle 8: use of market valuations

4.263 In our consultation document we said that, in principle, we agree that direct observations of market prices⁴² are relevant as indicators of spectrum value and that the advent of auctions and spectrum trades makes it timely to consider whether we should take greater account of such market observations in setting fees if and when they are available. However, we identified a number of reasons why this will need to be done with care, and should not be done in a mechanistic manner or to the exclusion of other considerations. Subject to that significant caveat, we proposed to make greater use of observed market valuations in setting AIP in future.

4.264 Our main concerns on using market valuations in setting fees were:

- our ability to find, or reliably determine, like-for like comparisons – that is, whether traded spectrum is comparable to the spectrum for which reference rates are sought, and for which we intend to set fees, and whether the circumstances surrounding a specific trade or auction at a particular point in time are representative of the general position going forward;
- whether it is possible to link AIP to observed market prices without distorting bidding or trading incentives. But care is needed in some cases. For example, if bidders expect the AIP fees they pay on some of their spectrum to be revised in light of the auction price of spectrum they are bidding for, they may have an incentive to bid less aggressively. Or if a trade occurs in the knowledge that the trading price will be used to set AIP fees for similar spectrum, it could deter the trade from occurring or create a risk of circularity (i.e. the trading price depends on expectations of the future level of AIP, but the trade price itself affects that future level).

4.265 In particular, we argued that auction valuations are in practice affected significantly by the specific circumstances of the award, including:

- how much spectrum is available, and how it is packaged;
- whether it is adjacent to an incumbent's holding or harmonised;
- the timing of the award relative to other spectrum market developments (e.g. availability of complementary spectrum elsewhere in Europe);
- the degree of harmonisation and equipment availability at that frequency;
- the nature of the technical limitations imposed in the licence, for example to protect incumbents in the same or neighbouring bands;
- any non-technical conditions, for example on network roll-out.

4.266 This, we said, can make it difficult to establish valid like-for-like comparisons from the relatively small number of auctions held to date. We also said that we thought

⁴² For the avoidance of doubt where we refer to “observed market value/valuation” in this Framework we mean the value placed by individual companies on spectrum acquired either by auction or by trading.

auction outcomes will reflect wider service market conditions and expectations at the time of the auction, which may no longer apply when we come to set AIP fees.

- 4.267 However, we said that we still saw observed market valuations as relevant and instructive evidence of the opportunity cost of spectrum and that we would look to take such valuations into account when setting AIP fees. We therefore proposed principle 8 to address the issue of whether we should make greater use of observed market valuations in setting AIP fees.

Proposed principle 8: use of market valuations

We will take account of observed market valuations from auctions and trading alongside other evidence where available. However, such market valuations will be interpreted with care and not applied mechanically to set AIP fees.

The majority of responses that addressed this issue agreed that market valuations should be taken into account, where possible, when setting AIP fees

- 4.268 Arqiva agreed that prices achieved in auctions and any other indicators of market values for spectrum may well have a role to play in determining the appropriate level of AIP and C&W Worldwide remarked that it is clear that in setting AIP fee levels estimates of market value are a key input.
- 4.269 Vodafone said that it would not rule out the use of auction outcomes to calibrate AIP and BT believed a suitably designed auction will reveal the market value of spectrum.
- 4.270 A confidential response was very much in support of the use of market valuations in setting AIP fees as proposed in the Consultation. They agreed that operators engaged in the commercial use of spectrum are best placed to correctly value spectrum to ensure that an adequate return is achievable from spectrum investments.
- 4.271 The MetOffice said that they had difficulty in understanding how AIP could reflect the value of spectrum if no market mechanism is used to determine the fee level. They added that they believe that testing the market must be imperative to realising the true value by which AIP "rental" fees are determined. They also remarked that the fact that trading values need not be revealed to Ofcom seems to be a lost opportunity.
- 4.272 The Scottish Government expressed the view that if market valuations are to be used to inform estimates of spectrum values then Ofcom must accept that these valuations may result in lower values than may have been applied through AIP.
- 4.273 BT & Intellect agreed with the proposed principle and remarked that they view this as a significant area of change.
- 4.274 BT argued that one effect of aligning AIP more closely with auction values will be that auction prices will not only reflect the value of that part of the spectrum being purchased but will also reflect how that market transaction will influence the cost of all the spectrum available to that bidder (if this is similar spectrum and AIP is applied). As a consequence they said spectrum costs to all parties will converge in the longer term. This they argued may assist in promoting long term competition at a platform level that could benefit consumers. Intellect also argued that if there is a direct connection between AIP and auction prices then spectrum users may consider

either option as a supply of spectrum and costs may tend to even out between the two sources of supply of similar spectrum.

4.275 Intellect and C&W Worldwide also agreed with this principle. They argued that if AIP spectrum costs are significantly out-of-line with auction prices paid for similar spectrum then AIP may be either:

- a tax, or
- may result in lower incentives for more efficient use and/or competitive distortions.

4.276 A confidential response agreed that the use of market valuations to determine the appropriate levels of AIP is reasonable, but argued that this information alone may not be all that needs to be considered. In particular they re-iterated their belief that wider societal values must be taken into account when setting AIP fee levels.

4.277 STFC remarked that they are pleased to note that principle 8 states that the auction value of nearby spectrum will not be directly used to determine AIP fees.

Ofcom view

Given the general support for this proposal to take greater account of market valuations when setting AIP fees we intend to proceed with this approach

4.278 We are encouraged by the positive response from stakeholders to this proposal. Subject to the not insignificant caveats provided in our consultation document and expanded on by stakeholders in their responses to this principle, we intend to proceed with taking greater account of observed market transactions when setting fees. In particular, we will look to scrutinise auction outcomes and other market valuations available in order to determine the extent to which they may inform our view of the opportunity cost of spectrum. We also note that the impact of strategic bidding incentives can be minimised by good auction design which is one of the factors we take into account when designing our spectrum auctions.

4.279 We also confirm that AIP fee levels should be expected to go down as well as up, reflecting changes in demand for existing and feasible alternative uses and in the supply of spectrum regardless of the sources of evidence of such changes and would not expect the greater use of market valuations, as a specific source of evidence, to change this.

4.280 We also agree that, assuming like-for-like comparisons can be identified, and through the considered use of market valuations to inform our AIP fees (to take account of the factors discussed in paragraphs 3.103 to 3.110 of our consultation document) we are likely to set fees that better reflect a market price.

4.281 On the issue of taking wider societal benefits into account when setting AIP, this is discussed under principle 6 earlier in this section.

4.282 We would also like to address a potential misconception that came to light in a response to this issue. As we discuss in the section below, we would not look to mechanistically apply the result of an auction to adjacent spectrum. There may, however, be occasions when such an approach would be appropriate because the

two bands of spectrum are substitutable. Therefore, in some circumstances we may use the auction value of nearby spectrum to directly determine AIP.

Many expanded on Ofcom's caution against applying market valuations mechanically to apparently similar spectrum

4.283 Vodafone, BT, O2, Arqiva and C&W Worldwide warned that Ofcom needs to exercise a high degree of care in interpreting spectrum valuations from one spectrum band to another as auction outcomes can be affected significantly by the specific circumstances of the award.

4.284 Vodafone highlighted the need to take a high degree of care when relating spectrum valuations between different spectrum bands.

4.285 BT warned auction outcomes will be influenced by a variety of factors such as:

- how much spectrum is made available, relative to demand;
- the level of any caps on holdings;
- how high the barriers to entry are; as well as
- more topical factors.

4.286 O2 added that given the regulatory risk of setting the fee too high compared to the market value Ofcom should be cautious when using market outcomes to set AIP.

4.287 O2 proposed adding to the non-exhaustive list given in our consultation:

- the rules of the auction,
- the number of players versus the spectrum lots,
- spectrum coming on to the market in future,
- existing holdings of licensees,
- caps on purchased spectrum,
- level of substitutability between spectrum blocks,
- ability to switch between different spectrum types in a multi-band auction.

4.288 Arqiva expressed their view that those circumstances include:

- prevailing competitive and general economic situations,
- the characteristics of the spectrum awarded, and
- the auction design adopted, which influences bidding.

4.289 Arqiva also agreed with our concern that linking auction outcomes too deterministically may distort bidding incentives, assuming like-for-like spectrum comparisons could even be made.

- 4.290 Arqiva also said that Ofcom needs to be wary of companies complaining in cases where auction outcomes which they perceive to be cheap have not fed into lower AIP, but may be happy to claim that any apparent auction over-payments simply reflect unique circumstances or the irrational bidding which auctions can easily engender.
- 4.291 FCS remarked that the value of auctioned spectrum in £/MHz appears to vary widely, even for similar spectrum and argued that some auction information was too old to be relied on for estimating AIP fees today.
- 4.292 C&W Worldwide also argued that market valuation needs to be assessed over time and not via a snap shot view of the market (e.g. UK 3G auctions) and that failure to do so could result in a distorted market valuation.
- 4.293 BT and FCS believed that auction information from outside UK can be illuminating noting however that this needs to be tempered with consideration of UK specific market, regulatory, policy and legal attributes.
- 4.294 Arqiva and Vodafone argued against the use of international auction results, commenting that even setting aside exchange rate variations, prices paid in international auctions may reflect local conditions (e.g. licence obligations, recent competition authority judgements, political pressure and the specific situations of network operators in the specific markets) which have little or no equivalent in the UK at that time.
- 4.295 Vodafone also argued it was necessary to take a high degree of care when relating spectrum valuations between economic, demographic and topological conditions in different countries.
- 4.296 Vodafone cited a specific example of two German auctions of similar spectrum (1800 MHz and 800 MHz) that had very different values placed on them that they claimed could not be explained by the different spectrum ranges and remarked that which of the two auction outcomes represents the “true” economic valuation is unclear.

Ofcom view

We agree that caution needs to be exercised when using spectrum auction outcomes to help set AIP fee levels

- 4.297 We agree with the responses that highlighted the difficulties of interpreting auction outcomes.
- 4.298 In particular, we agree that auction valuations are in practice affected significantly by the specific circumstances of the award, particularly by the design of any auctions, which means that there are difficulties in finding, or reliably determining, like-for like-comparisons and that it is important that we find methods of using evidence from observed auction outcomes to inform AIP decisions without distorting bidding or trading incentives.
- 4.299 On the issue of the risk of us setting AIP too high if based on market valuations, we would expect that, subject to being able to identify an appropriate comparison and being able to mitigate the risk of distorting bidding incentives, the market valuation would be more likely to reflect the “true” market price than any estimate made by us.

We address the issue of the risk of setting AIP too high and too low further under principle 9 below.

- 4.300 We also recognise that specific licensees may be more likely to favour the use of market valuations when they indicate that spectrum fees should be reduced rather than increased. However, we will ensure that due weight is given to market valuations regardless of the implication for fee levels.
- 4.301 We also agree that for any market valuation to be relevant it must have been undertaken in a similar market environment as today. Therefore, the more time that has elapsed between an auction and a fees review the greater the degree of caution required when interpreting it.
- 4.302 On the issue of the need to value spectrum over time and not on the basis of a “snap-shot” view provided, for example, by an auction, it is difficult to see how this can be accomplished through the use of market valuations, as by their nature they reflect the market’s (or individual company’s) view at that point in time of the value of the spectrum over the period that they have assessed the business case for acquiring it, e.g. in an auction. We agree that it is important to understand what factors might be specific to the circumstances of any award or trade, and to account for these, where possible and appropriate, when setting AIP fees. The mechanism by which we would anticipate reflecting changes to the value of spectrum over time would be to undertake fee reviews as and when it became evident that fees are not well aligned with the market price or opportunity cost of the spectrum, as discussed further under Question 5 below.
- 4.303 We agree that interpreting auction results from other countries also presents specific issues of interpretation and that the increased use of market transactions generally may sometimes, but not always, add complexity to fee reviews. However, we still believe that such evidence may be worthy of analysis on a case-by-case basis and that we should not rule its use out completely, whilst acknowledging the difficulties of doing so.

One response was concerned about the complexity of analysis needed and the level of certainty that such analysis would provide and was against the use of market valuations

- 4.304 O2 argued that the use of auctions or trades as benchmarks is likely to involve significant and complex work, which may not necessarily result in the level of confidence that Ofcom suggests in its consultation document. They further argued that Ofcom’s duty to act consistently places a burden of proof on Ofcom to clearly explain why these new factors are more relevant to the setting of AIP than the calculated opportunity cost of spectrum. O2 also recommended that given the complexity of any review of market evidence that a go/no go decision is built into the process before any significant piece of work is undertaken.
- 4.305 O2 concluded that they strongly supported an assessment of the opportunity cost of the current use of the spectrum concerned to set reference rates, rather than the use of market valuations.

Ofcom view

Taking market valuations into account may in some cases result in the need for additional analysis, we will assess the cost and potential benefits of doing so on a case-by-case basis

- 4.306 We recognise that in some circumstances it may be necessary to undertake some additional analysis to identify and account for some specific circumstances of an auction or trade, but we do not agree that the use of observed market valuations necessarily involves extensive and complex analysis. Whilst in principle we could base AIP reference rates directly on observed values, with or without adjustments to reflect differences in the specific circumstances, we could also use market valuations as a cross-check on our own estimates. The extent to which any specific market transaction needs complex analysis will be heavily dependent on the specifics of each case and we would only anticipate undertaking extensive additional analysis if we could see a clear benefit from doing so.
- 4.307 On the related proposal that we have a go/no-go decision before carrying out any complex work in this area, our existing governance procedures for agreeing the terms of reference for projects already include full consideration of the effort required to undertake any required analysis, including the need for any external consultancy support. Therefore resource and timing implications of important elements of complex analysis will be taken into account in assessing both the priority and the scope of future fee reviews.

Conclusion on principle 8: use of market valuations in setting AIP fees

- 4.308 We agree with those responses that advised caution when looking at observed market valuations for an indication of spectrum opportunity cost of “similar spectrum” and agree that the list of factors that could affect auction valuations that we provided in our consultation document is not exhaustive and will have to be determined on a case-by-case basis.
- 4.309 We agree also with the many responses who believe that suitably caveated, the use of observed market transaction could be relevant and useful when setting reference rates on which to base fee levels.
- 4.310 We therefore conclude that we will adopt principle 8, as outlined in the consultation document with some minor changes to the text as one of our AIP pricing principles. These changes are to make it clear that we will use observed market valuations when setting reference rates and AIP fees.

AIP principle 8: use of market valuations in setting AIP fee levels

We will take account of observed market valuations from auctions and trading alongside other evidence where available when setting reference rates and AIP fee levels. However, such market valuations will be interpreted with care and not applied mechanically to set reference rates and AIP fees.

Principle 9: setting AIP fees to take account of uncertainty

- 4.311 In our consultation document we said that when deciding at what level within a range of estimates we should set an AIP fee level, we proposed to assess the relative risks of setting AIP too high or too low on a case-by-case basis. We considered the following factors to be key to such an assessment:

- the difference between the current and any alternative use opportunity costs;
- our confidence in our estimates of opportunity costs of existing and alternative uses, whether the demand from alternative uses is proven, for example because they are already using the band, or whether the use is feasible but demand for the specific band uncertain;
- whether licences are tradable and the extent to which trading could be expected to promote optimal use.

4.312 In view of the inherent trade-off between setting AIP fees too high and too low, we also proposed in future we should move away from an overriding presumption that fees should always be set conservatively, and instead we should consider the specifics of each case to determine the appropriate fee level given the available evidence on the factors indicated above.

4.313 In our consultation document, therefore, we proposed principle 9 to address the issue of how to take uncertainties into account when setting AIP fees:

Proposed principle 9: setting AIP fees to take account of uncertainty

Where there is uncertainty in our valuations, and the likelihood of demand for feasible uses appearing, we will consider the risks from setting fees too high, or too low, in light of the specific circumstances. When spectrum is tradable we will consider the extent to which trading is expected to promote optimal use, and will also have particular regard to the risk of undermining the development of secondary markets.

A number of responses agreed with principle 9 and expanded on the uncertainties around estimating opportunity cost and setting fee levels

4.314 Arqiva, BT and Intellect agreed that Ofcom should consider, on a case-by-case basis, the risks of setting prices too high or too low.

4.315 David Hall Systems Ltd agreed that uncertainty needs to be taken into account and expressed its opinion that the extent of uncertainty may have previously been understated.

4.316 Arqiva agreed that when determining the future availability of alternative equipment to operate in a band it is necessary to take account of the uncertainty around the availability of such equipment within the timeframe. They argued, however, even where equipment for alternative uses became available within the forecast timeframe, its actual performance may differ markedly from what was assumed when the forward-looking assessment of spectrum availability and demand was undertaken and this they argued should also be taken into account when setting fees.

Ofcom view

We agree that there are a number of uncertainties that we might need to take into account in a fee review, dependent on the specifics of the licence sector

4.317 We agree that there are a range of uncertainties that will affect our estimates of reference rates and therefore fees. These include uncertainty over the likelihood of future congestion from current and alternative uses and the likelihood that a feasible use may emerge in the future and the value of this use of spectrum. There may also be uncertainty on the timing of when a particular alternative use might be practically

able to use a frequency band and, therefore, how early it would be right to signal this higher value in AIP fees.

- 4.318 We also agree that where a feasible alternative use does not currently exist, or is not currently capable of using the specific frequency band under review that there are even greater uncertainties around its feasibility and we will need to assess the associated implications, in consultation with stakeholders, very carefully.

However, others argued that Ofcom should retain its bias of setting fees conservatively (low) with one arguing for rebates to be provided

- 4.319 The Met Office, O2, Vodafone and C&W Worldwide cited the regulatory risk that setting fees too high relative to the actual market value of spectrum could have on the use of spectrum.
- 4.320 Vodafone argued in particular, in their view, in the case of mobile cellular spectrum the risk of setting AIP too high outweighs the risk of sub-optimal allocation of spectrum when AIP is too low because any feasible alternative use is likely to have a much lower value.
- 4.321 C&W Worldwide argued that in the long run over-estimating the value of spectrum in AIP fees can damage investment and competition.
- 4.322 STFC expressed the view that it did not believe that this principle should apply to non-commercial use of spectrum.
- 4.323 BPA/UKMPG argued that this principle obscured the discussion in the document that AIP fees have generally been set below estimates because over-estimating the market price poses greater risk. They considered that the inference was clear that fees are more likely to be increased than reduced at any subsequent fee review.
- 4.324 Arqiva suggested a cautious approach to setting fee levels and additionally suggested an appeal process and rebates where assumptions made in setting AIP levels were not borne out over the indicated timeframe. Arqiva also recommended there be an appeals process in relation to estimating the value of spectrum and determining feasible alternative uses, as well as the assessment of existing or future congestion.

Ofcom view

We remain of the view that there are risks in setting AIP too low as well as too high

- 4.325 We will attempt to estimate the opportunity cost of spectrum as closely as possible, aided by consultation with stakeholders. However, given the range of uncertainties that we may need to consider in doing so, it is probable that in many cases this will result in a range of estimates that might be quite large. We will therefore need to decide where within this range we set the actual fee levels.
- 4.326 As we discussed in our consultation document in paragraphs 3.114 – 3.125, in general, whether we set AIP fees above or below the true opportunity cost this will result in losses for citizens and consumers. In addition, both cases also have implications for current users.

4.327 In particular, if we set fees that are materially lower than the long-term opportunity cost of the spectrum:

- There may be new or continued difficulty in making assignments to meet demand from existing uses;
- If there is a feasible alternative use that is of higher value than the current use, then that use may be delayed or may never gain access to the spectrum;
- These adverse effects may be mitigated to some extent if licences are tradable. This is because trading will facilitate the movement of spectrum from lower value users and uses to higher value users and uses depending on the extent to which secondary markets are efficient.

4.328 When setting fees we must therefore consider whether, if we set fees too high, the benefits lost from existing uses no longer being able to afford the spectrum outweighs the potential additional benefits that could be provided by alternative high value uses and users in aggregate.

4.329 In order to ensure optimal use of spectrum that is in excess demand, we obviously aim to promote high aggregate value for society by ensuring spectrum is used as fully as possible by those who will individually provide the highest value for society.

4.330 However, we recognise that if there is uncertainty about the true market value then we need to balance the risk of lower value users continuing to use spectrum (in the event that AIP is too low) and reduced spectrum utilisation (in the event that AIP is too high). We note that this trade-off will depend, to some extent, on the difference in value between the existing and feasible alternative use (where relevant). We need to decide whether it would be better overall for society if we:

- Set a high AIP with the risk that spectrum utilisation is reduced, but that licensees with a higher value alternative use can obtain access to the spectrum. or
- Set a low AIP, which reduces the risk that spectrum will not be fully utilised, but gives rise to the risk that higher value users may be prevented from obtaining access to spectrum because the fee level is too low to encourage existing users to consider other options.

4.331 In general, through the use of our impact assessments, we would try for a reasonable balance between these two extremes in order to minimise any loss of benefits to society, but we conclude that it would not be appropriate to always err on the side of a lower fee level.

4.332 In some cases, spectrum pricing might not be the most appropriate regulatory tool to ensure such a balance is achieved and we may need to take additional positive regulatory action, complemented by pricing. For example, where there is a clear case for re-allocating spectrum quickly from a low value use to a higher value use, because we have a high confidence that the benefits to society of such a change will be high, we would normally look to intervene and clear the band in a planned manner rather than looking to spectrum pricing to effect such a change. Once the change is effected, however, we would normally look to pricing to manage the ongoing demand for spectrum in the new use.

- 4.333 To the extent that spectrum pricing is the appropriate regulatory tool, however, we conclude that whilst in many circumstances a conservative approach may well be correct, in some circumstances, for AIP to be effective, such an approach might not be appropriate.
- 4.334 On the issue raised by Vodafone that if the spectrum is already allocated to the highest value use then the risks of setting it too high are greater than too low, we reiterate that pricing is not just to promote the use of spectrum in its highest value use but also to ensure that the most efficient users of spectrum in any specific use have access to it and that they economise on their use of spectrum so that there is no “wasteful” or underutilisation of spectrum.
- 4.335 We agree, however, that there are also risks in setting AIP fees too high and that this could act as a disincentive to investment. We will therefore need to take all the specifics of each case into account when making this determination on a case-by-case basis.

We agree there are substantive risks in over-pricing spectrum consistently over the long term and confirm that this principle is not meant to imply we wish to increase all fees

- 4.336 We agree that over pricing spectrum consistently over the long term will lead to inefficient and non-optimal use of spectrum as this will deny access to spectrum to those who could deliver additional benefits to society were fees at the right level. We will consider this risk as and when we review fees. For this reason, we will also be looking closely at how we might monitor the utilisation of spectrum as part of our process for post-review evaluations, as discussed under Question 6 in section 5 of this document. We would also look to react promptly where we have evidence that spectrum fees are either over or under priced, as discussed in more detail under Question 5 in section 5.
- 4.337 We disagree that this principle should not apply to non-commercial uses of spectrum. As we outlined in principle 1, the role of AIP for commercial and non-commercial uses of spectrum is the same – to reflect the value that others place on access to specific spectrum bands in order to inform all spectrum users’ decisions on its use, thereby ensuring those who value spectrum the most (and we therefore believe in general will deliver greatest benefits for society) have access to it. This principle therefore applies equally to all uses of spectrum, whether commercial or not and whether it is a direct driver of revenue for the licensee, or is an enabler of the service.
- 4.338 On the issue of whether this principle effectively indicates that in future fees are more likely to increase than decrease we would like to emphasise that this principle is intended to ensure proper consideration of the risks attendant on setting fee levels, both in setting fees too high as well as too low. It is not intended that as a consequence of this principle that fees should be set, in general, at the higher end of the range of opportunity cost estimates, but rather that we need to consider the specific risks on a case-by-case basis, which we will set out in the consultation that precedes any changes to spectrum fees.

We set fees based on all available information, which can include commissioned external research, and after consulting with stakeholders on our fee proposals

- 4.339 On the suggestion that we provide “rebates” on AIP fees if the fees levels are subsequently discovered to be higher than the market price, we note first that we

make every effort to estimate fee levels based on all relevant information available at the time, including consulting with stakeholders and commissioning external research, if appropriate. In making these estimates, as discussed under methodology 2 in section 4 we need to make a variety of forecasts based on assumptions of the development of technology and markets, which may or may not be borne out in due course. If subsequently we believe that spectrum value has changed substantially in either direction (up or down) compared to the fee set, we believe the appropriate regulatory response is to identify this in a timely fashion and revise the fee levels up or down as appropriate, as discussed further under Question 5 in section 5.

- 4.340 Secondly, given the role of AIP is to provide long term signals of the future value of spectrum, setting AIP fees by nature involves forward looking assessments that are subject to uncertainty. In general, we believe that licensees value certainty and stability where possible in the fee levels we set. If, as suggested, we were, in future, to take a backwards looking review we would need to consider additional payments where the value of spectrum were higher than indicated by the AIP fee, as well as any “rebate” where it was lower. This would introduce additional uncertainty and risk to spectrum users’ investment decisions and is therefore more liable to be to the detriment of the optimal use of spectrum.
- 4.341 On the suggestion of an appeals process on our assessments at the various stages of determining appropriate fee levels, we note that stakeholders are normally given an opportunity to provide representations on Ofcom’s proposals to set fees under the WT Act⁴³. They can also challenge the statutory instruments giving effect to our decisions by judicial review, if they consider that our decisions are unlawful.

Conclusion on principle 9: setting fees to take account of uncertainty

- 4.342 Having considered the responses to this issue, whilst we recognise that there are risks in setting AIP fees too high, which we will continue to assess carefully in any future fee reviews, we believe that there are different but also material risks to the optimal use of spectrum in our setting AIP fee levels too low.
- 4.343 In addition, as previously explained in paragraph 4.73 we have decided to be clearer about what we mean when we refer to spectrum value in relation to setting fees based on AIP and have amended the text of principle 9 to reflect this.
- 4.344 We therefore conclude that we will adopt principle 9 as the last of our AIP pricing principles.

AIP principle 9: setting AIP fees to take account of uncertainty

Where there is uncertainty in our estimates of opportunity cost, for example, arising from uncertainty in the likelihood of demand for feasible alternative uses appearing we will consider the risks from setting fees too high, or too low, in light of the specific circumstances. When spectrum is tradable we will consider the extent to which trading is expected to promote optimal use, and will also have particular regard to the risk of undermining the development of secondary markets.

⁴³ See section 122(4) of the WT Act.

Section 5

Our methodology for setting levels of spectrum fees

- 5.1 The previous section concluded on our AIP principles for spectrum pricing, part of our Framework for spectrum pricing. This section sets out our conclusions on our general methodology within that Framework for determining the level of fees.
- 5.2 The remainder of this section concludes in turn on:
- Cost-based fees;
 - AIP method 1: AIP and congestion;
 - AIP method 2: reference rates;
 - AIP method 3: calculating individual licence fees; and
 - AIP method 4: impact assessments.

Cost-based fees

- 5.3 In our consultation we discussed whether or not we should prioritise a wholesale review of cost-based fees and asked the specific question:

Question 2: Do you agree that we should charge cost-based fees where AIP is not appropriate or AIP would not cover our costs? How do you think we should set cost-based fees in future fee reviews? Are there particular factors you think we should take into account, for specific licences fees or cost-based fees in general?

Most responses agreed that where AIP was not appropriate we should charge a cost-based fee, but only one saw cost-based fees as a priority for review

- 5.4 The MoD, David Hall Systems Ltd, BT, Intellect, ESOA, FCS, BPA/UKMPG, C&W Worldwide, UK Chamber of Shipping, STFC, NATS, TAUWI, “Three”, the Scottish Government and four confidential responses agreed we should charge a cost-based fee where AIP is not appropriate.
- 5.5 BT and Intellect added that it was reasonable that Ofcom covers its costs and these costs are met by those who stand to benefit from the work Ofcom undertakes.
- 5.6 BT, however, raised a concern as to whether Ofcom has sufficient incentives to reduce its costs given they are passed on to licensees.
- 5.7 ESOA said that they find it fundamentally inappropriate to consider AIP as a means for Ofcom to partially or wholly recover its administrative costs.
- 5.8 Arqiva remarked that they could see why recovering costs might be attractive to Ofcom, but argued that they would be concerned if companies awarded spectrum always contributed at least the avoidable costs but Ofcom did not recover the equivalent avoidable costs from other forms of authorisation. They added that where

costs are to be recovered that averaging those costs over a 3-5 year period would be preferable to wide fluctuations over time.

- 5.9 FCS agreed that there may be a case for lower cost based fees to incentivise new technology such as 6.5 kHz business radio services.
- 5.10 Transfinite argued that cost-based fees should be reviewed as soon as feasible. No other response proposed cost-based fees as a priority for review.
- 5.11 David Hall Systems Ltd agreed that at present a cost-based fee is needed where AIP is not appropriate. In future, however, they argued that cost-based fees would no longer be appropriate as the market plays a bigger role through trading. In such an environment they argued that an authorisation process permitting trades could be preferable. A one-off authorisation charge could be charged for this replacing the current cost-based fees.

Ofcom view

We conclude that it is not a priority to undertake a wholesale review of our cost-based fees

- 5.12 Only one response indicated that there was a pressing need for us to review our cost-based fees and this was made by a company seeking to offer services as a SMO who argued that Ofcom should reflect the costs that a small scale band manager would face rather than the cost we actually incur.
- 5.13 We therefore conclude that we will not undertake a wholesale review of cost-based fees as a priority and therefore do not intend to address the more detailed proposals and issues raised by stakeholders on what costs we should seek to reflect in cost-based fees in this document.
- 5.14 In the following sections therefore we address those issues that can be addressed outside a wholesale review of all cost-based fees but only note the more detailed comments.

In general we would normally look to charge a cost-based fee where it is not appropriate to charge AIP

- 5.15 We agree with the view that where spectrum is not scarce or in excess demand and therefore AIP is not appropriate it is generally right to charge the costs of spectrum management to those who benefit from it. We also agree that where there would likely be significant fluctuations in the attribution of costs between the licence classes year on year that it might be appropriate to consider smoothing these peaks and troughs by averaging over an appropriate period of time.
- 5.16 On the issue of whether we face sufficient incentives to reduce the costs of our spectrum management functions, we take the need to reduce our burden on stakeholders and taxpayers very seriously. A reflection of how mindful we are of this burden is the fact that since our inception we have achieved a cut in our underlying operating budget every year. In addition, looking forward, the Government has set out its plans in the Comprehensive Spending Review to address the UK's public finances and a substantial reduction in the Ofcom budget is expected to be achieved. Our target is to reduce our spending over the next four years. The majority of the

savings, however, will be made in the first year and by 2014/15 this will deliver a 28.2% real terms saving on Ofcom's current annual funding cap of £143m.

- 5.17 It should also be noted that our spectrum management activities are funded by Government through a Grant-in-Aid payment and not by the fees we collect from WT Act licences and therefore none of the fees we charge are used to wholly or partially recover our administrative costs.
- 5.18 On the suggestion that all forms of spectrum authorisation should be charged at least a cost-based fee, we note that there are some specific circumstances where we believe charging a fee, of any kind, or at the level that our costs of spectrum management might indicate, would not be appropriate. In particular, licence exempt uses of spectrum do not attract a fee and nor do uses where the cost of collection of the fee would form a material and disproportionate part of the fee.
- 5.19 We discussed in our consultation document in paragraphs 4.46 to 4.47 that in contrast with fees based on AIP there might be circumstances where we might set cost-based fees lower than our full costs for innovative uses of spectrum. This is because in contrast to spectrum for which AIP fees are charged, spectrum charged on a cost basis not in excess demand and therefore use of such spectrum would not be expected to deny others access to the spectrum. However, we would need to consider carefully what types of innovative use warranted such concessions. Equally, as we said in our consultation document we believe that for spectrum charged on a cost based fee there may be circumstances where it would be appropriate to provide a concession to support wider social benefits where fully cost-based fees would risk damaging the delivery of these.
- 5.20 In particular, as we explained in our consultation document, however, when considering whether to set fees at a lower level than our full costs, we would normally take into account:
- whether the cost of collection of the fees would form a material proportion of the overall fee;
 - whether the benefits of the use to society overall were greater than our costs and no other funding was available for users to support their spectrum use;
 - whether the benefits of the use in promoting innovation could be justified; and
 - whether any particular group of citizens or consumers would be unfairly and adversely affected by fee levels that reflected our costs.
- 5.21 This should not, however, be taken to imply that if we do determine that fees for a specific licence class should be less than our full costs that this cost needs to be recovered through a higher fee for another licence class. We do not have a duty to recover all of our costs through cost-based fees and would not look to do so. When setting cost-based fees our consideration relates only to that specific licence class.
- 5.22 We believe that the proposal that we move away from annual licence fees to one-off charges at the point of a trade would be difficult in practice to implement. We currently have powers to recover our costs through annual fees and it is unclear how and why one-off transaction fees would better contribute to the promotion of the optimal use of spectrum.

Views on what costs and considerations should be reflected in such fees ranged significantly

- 5.23 Transfinite argued that if cost based fees were to be used it should reflect all of the costs and not just those listed in the consultation document in order to avoid giving some spectrum products a subsidy. Transfinite included a detailed list in their response of all the costs they argued should be taken into account when determining cost based licence fees. In addition to the costs that Ofcom incurs Transfinite proposed some additional “costs” that it argues need to be included in order to avoid the danger of Ofcom acting in an “anti-competitive” manner towards SMOs. These included:
- Return on investment: Transfinite argued that SMOs have to show a reasonable return on investment (ROI) e.g. purchase of spectrum block, procurement of suitable IT infrastructure, and provision of process support mechanisms and therefore a factor to reflect this should be included in the calculation of a cost based fee;
 - Significant market power cap: Transfinite argued that Ofcom has what would be defined as significant market power (SMP) in that it provides the majority of spectrum products at present. They argued therefore that averaging fixed costs over all assignments that Ofcom issues per year would result in lower average costs than any private band manager could match; as they would be capped at the percentage of the market they can provide to avoid anti-competitive behaviour. Therefore they propose that averaging of costs should not be over the full number of licences issued by Ofcom in a year, but over the maximum that could be issued by a private band manager that is just within the limit of market share it could gain before being accused of having SMP.
- 5.24 Transfinite made similar arguments that when setting fee levels Ofcom should take into account the impact of these fees on SMOs. They also argued that the impact of fees on SMOs should be considered when deciding when fee review should be initiated, as well as when undertaking post-fee review evaluations.
- 5.25 Transfinite also argued that in order to ensure transparency in the pricing mechanism used by Ofcom all the various items included in any cost based fee should be published as part of the justification for any modifications to the price algorithm.
- 5.26 UK Chamber of Shipping, whilst agreeing that one should be able to recover the cost of providing a service, added that one also needs to be mindful of the fact that use of spectrum in an international environment has to be competitive across the states. Citing the fact that as a port in Hamburg does not pay for spectrum, whilst those in UK do, UK Chamber of Shipping argued that this will make doing business in UK a more expensive proposition.
- 5.27 “Three” stated that they had no specific view on how cost-based fees should be set.
- 5.28 ESOA welcomed statements made to industry concerning Ofcom's intent to ensure that the cost of administration is kept under review. They also expressed the view that it is important that cost recovery fees are proportionate and relate directly to spectrum management costs.
- 5.29 One of the confidential responses added that they thought that the cost-based charging model should also consider the “avoidable cost” factor and any long term

signals that may significantly affect this model. They added that for clarity and to avoid market distortion that they believed that cost based and lower fees should be reviewed at least as often as related AIPs.

- 5.30 NATS expressed their view that cost-based fees should take into account everything associated with a particular sector but should as a minimum consider the cost of assigning frequencies, the cost of spectrum management including international representation and cost of rectifying interference that might occur to that sector.
- 5.31 The Scottish Government argued that cost-based fees should generally decrease over time as licensing, coverage predictions technology and web-based mechanisms reduce the cost of labour in issuing licences

Ofcom view

We disagree with suggestions we take account of the effect on UK competitiveness or impacts on specific SMOs when setting fees

- 5.32 As discussed in our consultation document, we are committed to facilitating the emergence of band managers where these are commercially viable. However we disagree with the suggestion that we should accommodate a particular band manager (who purchased spectrum at auction with the intention of offering it to the market alongside Ofcom) through an increase in spectrum fees in other bands. We see no spectrum management justification in deviating from our approach that when there is no excess demand, we set cost-based charges that are intended to reflect our administrative costs. As outlined in section 2 of this document, without a spectrum management justification for charging at a level greater than to cover our costs we do not have the power under the WT Act to charge fees at such a level. Equally for AIP-based fees we see no spectrum management justification for increasing fees beyond opportunity cost, and without such a justification we do not have the power to do so.
- 5.33 Similarly, we see no spectrum management justification in taking into account the impact on SMOs when setting AIP fees, or in deciding when to initiate a fee review, and nor when undertaking post-fee review evaluation.
- 5.34 On the suggestion that we should consider the fees charged by other national administrations and the effect this may have on the competitiveness of a specific UK sector (e.g. as the Ports example) when setting fees we note that our primary spectrum management objective is to ensure optimal use of spectrum for society as a whole, rather than the competitiveness of a specific UK sector.

Until we undertake a wholesale review of cost-based fees we are unable to address these specific issues raised by stakeholders

- 5.35 The remaining issues raised by stakeholders are too specific to be addressed outside a full review of our cost-based pricing approach and therefore we cannot address these at this time.

Conclusion on cost-based fees

- 5.36 Having considered the responses to this question we have concluded there is no immediate need to prioritise a wholesale review of all cost-based fees. Rather, as and when we have evidence that cost-based fees are materially out-of-line with our

costs we will look to review both the level of the fee and the basis of the fee. We will consult with stakeholders on any proposed changes to cost-based fees as and when they are reviewed.

- 5.37 We also conclude that there may be circumstances in which it is appropriate for us to provide concessions on cost-based fees for services in order to secure the consumer and citizen benefits of specific spectrum management objectives, such as the promotion of innovative services and our other wider policy objectives, such as our duties under section 3 of the Act.
- 5.38 Finally, we conclude that for all AIP fees, the costs we incur through our spectrum functions should act as a floor, or minimum fee. We therefore intend to review the costs of our spectrum functions for individual licence classes as and when we review the related AIP fees so that we understand at what level this AIP floor should be set.

Methodology for setting AIP fee levels

- 5.39 In our consultation document we proposed a set of 4 methodologies for setting AIP fees (in paragraphs 4.1 to 4.33 and 4.48 to 4.62) and posed the following question to stakeholders:

Question 3: Do you agree with our proposed fee-setting methodology principles? Are there additional matters that it would be helpful to clarify?

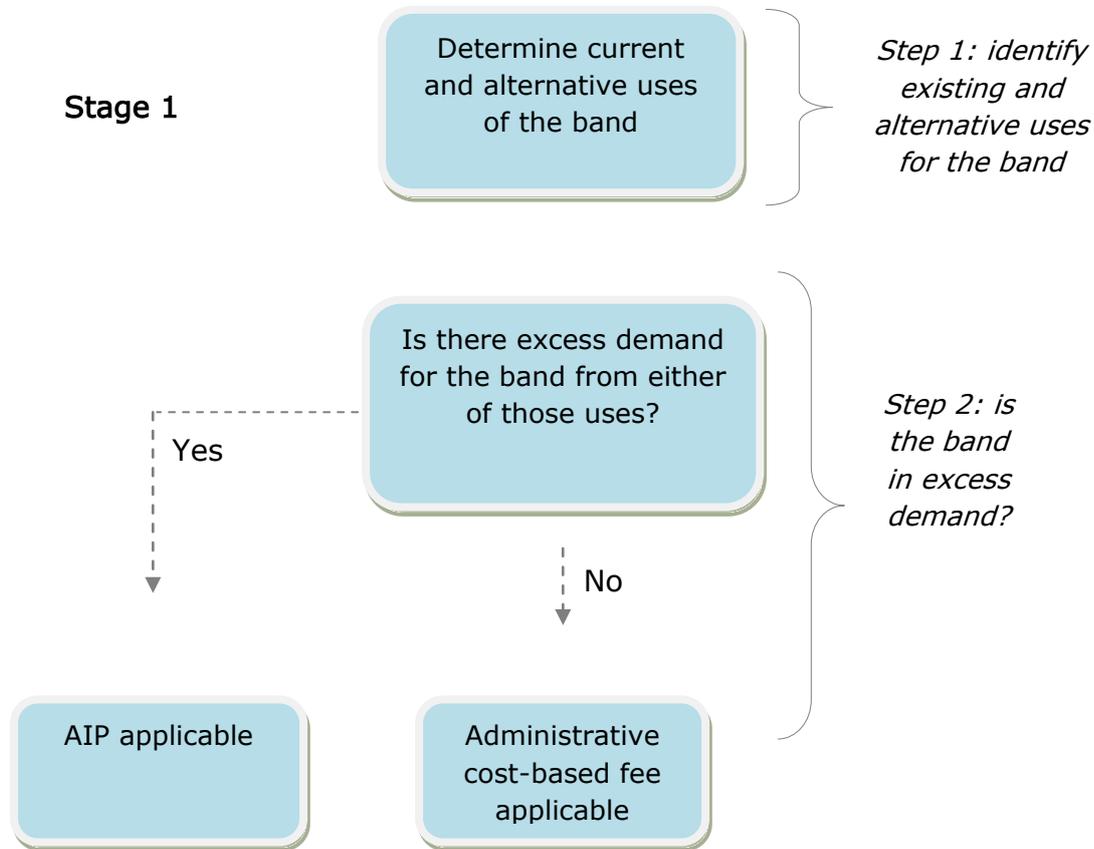
- 5.40 In the following sections we summarise the responses we have received against each of these, our position on these responses and our conclusions. To better reflect that these methodologies relate only to the setting of AIP fees, we have re-titled these AIP methodologies.

Methodology 1: AIP and congestion

- 5.41 In our consultation document we said that there were two stages in setting fees and that Figure 5 reproduced below, provides details of the first of two Stages in our methodology to set fees.
- 5.42 We said that having determined the existing and feasible alternative uses (over the relevant timeframe) in Step 1 it would then be necessary to assess whether there was likely to be excess demand in either of these uses. We also said that the way that we measured excess demand would likely depend on whether it was for an existing or alternative use:
- For existing use, we proposed to use congestion as an indicator for excess demand in the current use looking ahead over the relevant timeframe and noted that we have used a variety of methodologies to assess congestion that depend on the type of licence. These methodologies, we said, may need to be refined, depending on the available evidence at future fee reviews;
 - For *alternative use*, we said we would determine whether there is excess demand for the band in question from the alternative uses, taking account of whether there are other bands that are suitable and available which could be used to meet demand. To assess whether there is excess demand from alternative uses located in other bands, we proposed, to look at congestion in those bands as a proxy for excess demand in the band in question. If there is,

we argued, this suggests that it would be appropriate to apply AIP to the band in question.

Figure 5: Steps in setting AIP spectrum fees



5.43 In our consultation document we proposed methodology 1 to address the issue of how we should assess where there is excess demand for spectrum.

Proposed methodology 1: AIP and congestion

In setting AIP fees, we will assess current and future congestion in existing use and demand for feasible alternative uses in the frequency band in question and at different geographic locations over the relevant timeframe, given technological, regulatory and international constraints and using readily available evidence.

Most responses agreed in principle with the methodology, but argued that the methodology and evidence should be made more transparent to stakeholders

5.44 The Met Office, NATS, BT, Intellect, TAUWI, STFC, and “Three” agreed with this methodology.

5.45 David Hall Systems Ltd agreed that congestion can only provide information on current demand, whilst demand from some alternative uses of spectrum may not be visible because of existing constraints on the spectrum use.

5.46 BT, C&W Worldwide, Inmarsat, Arqiva and Intellect argued that transparency is important when assessing congestion. Some argued that the methodology and evidence Ofcom uses to assess congestion should be made available to

stakeholders so that they have an opportunity to provide their own counter-evidence. Others, including Inmarsat argued that a rigorous method for assessing congestion was needed.

- 5.47 Intellect and C&W Worldwide emphasised that Ofcom should consider the availability of alternative bands (for existing and feasible alternative uses) as part of the analysis of congestion.
- 5.48 The Scottish Government argued that demand in Scotland might be very different from the rest of the UK and that this should be recognised as appropriate in the fee levels.
- 5.49 The Met Office added however that it believes that there should be some consideration as to whether congestion can lead to decreased fees where spectrum use is non-exclusive or non-Primary and spectrum users suffer from a degraded quality of service, in the form of increased interference as a result.
- 5.50 BPA/UKMPG said in their opinion the discussion of congestion was "simplistic".
- 5.51 Vodafone did not understand our proposed methodology to account for alternative uses (e.g., how Ofcom will identify and weight them against existing uses and what information we will use to make our assessments).
- 5.52 A confidential response said that they were unclear how variables such as the current use of band, planned use of band, national and international regulatory conditions on use of band and how demand for the band is identified and quantified.

Ofcom view

This spectrum pricing Framework will help stakeholders understand the factors and evidence that we will take into account when setting fees

- 5.53 One key aim of this Review is to set out clearly our principles of pricing and the methodology by which we set fees so that in future fee reviews we can discuss each issue with stakeholders, including explaining if appropriate why we think any specific principle is not relevant to the licence sector under review. This we believe will improve the transparency by which we set fees including the factors we take into account. We also agree that it is important that we set out clearly the evidence that we use as the basis for our decisions and that we take account of representation on this evidence, or alternative evidence, from stakeholders.
- 5.54 As we have set-out in paragraphs 4.129 to 4.131 of this document we agree that it is important to consider what alternative substitutable spectrum is available for alternative uses as well as the demand, but recognise that this can be difficult in practice.
- 5.55 We acknowledged in our consultation document that there are geographical differences in demand that are not always reflected in our current fee structures and that when undertaking future fees we will specifically consider whether it is appropriate to reflect these differences in light of the complexity and costs of doing so. In particular in some cases we are aware of some very real practical problems with identifying appropriate metrics by which to reflect geographical demand for some licence sectors.

- 5.56 On the specific issue of demand in Scotland (or any other part of the UK) we would note that for many and possibly most services, the geographical distribution of demand is unlikely to follow strict geographic and political boundaries, and may well vary within them⁴⁴, and so we would not expect to see a single “Scottish” rate, but acknowledge that there may be areas of the UK where it might be appropriate to reflect a higher degree of differentiation in the demand for spectrum in the fees charged. We recognise in this regard that the existence of devolved executives with specific responsibilities for a range of public services could mean that in future, a public service in Scotland might have a different strategy in regard to its spectrum use from equivalent similar public service in England, Wales or Northern Ireland. However, to the extent that any of these services uses spectrum that is in excess demand, we would seek to set reference rate that the opportunity cost of this spectrum, which is not likely to be affected by the different choices made by devolved or local government in each country. However, as set out in our conclusion to Question 2 above, it should be noted that in future we will as a minimum set AIP fee levels that reflect the costs of our spectrum management functions and this will therefore set the minimum fee that a licence will be charged regardless of relative levels of congestion.
- 5.57 On the issue of whether degradation in service quality arising from congestion could result in reduced fees, in general our technical planning rules would not permit such degradation. However, where some users of a particular use of spectrum are able and willing to accept different levels of service quality, any reduction in service quality would be reflected in the fees paid as this would directly affect the spectrum denied to other users.
- 5.58 We do not agree that the discussion of this principle in our consultation document is overly simplistic or prescriptive. Where there is congestion in the use of spectrum some users are denied access to it. We have a first-come, first-served approach to the licensing of most administratively assigned spectrum for which we charge AIP (the main exception being Public Mobile Networks). Therefore users who may value the spectrum higher than the existing users are potentially unable to gain access to it unless existing users face the opportunity cost that their use imposes on society. This is true regardless of whether the congestion is in own or alternative use. In the absence of AIP-based pricing those who gained access to the spectrum historically would continue to retain this access regardless of whether they are making best use of it. Alternatively we as the regulator would have to make decisions as to which individual company should have access to the spectrum, a decision that we are unlikely to be best equipped to make.

We will make a detailed assessment to determine whether an identified alternative use is feasible or not

- 5.59 As we discussed in our consultation document when undertaking a fee review we would look at all available evidence of demand for similar spectrum from existing economic research and where necessary commissioning additional research.
- 5.60 We would look to identify alternative uses, with support from stakeholders through our consultation process, by identifying whether there is, or is anticipated to be excess demand for:

⁴⁴ For example between the cities of Glasgow and Edinburgh and the Highlands and Islands.

- Existing alternative uses already having access to the band;
- Existing services in other similar bands that could be addressed by providing access to the band;
- Existing services in bands dissimilar to the band, but where technological developments imply that they may be possible to provide in the band over the relevant timeframe (discussed under principle 4 above).
- New uses of spectrum being developed in standards and other bodies, which are likely to become available over the relevant timeframe.

5.61 We would also consider national and international regulations to identify any regulatory constraints as well as take into account the availability and cost of equipment to provide these alternative uses in this band. We would then make a judgment on whether or not the alternative use appeared to us to be feasible and would consult with stakeholders on our findings.

Conclusion on methodology 1: AIP and congestion

5.62 Having considered all the responses to methodology 1 we remain of the view that it is appropriate for us to assess congestion in own use as a proxy for excess demand and for us to assess excess demand and congestion on a geographical as well as frequency basis. We recognise that the specifics of how best to measure congestion and excess demand by nature are determined by the circumstances of the individual uses of spectrum, but still believe that conceptually the issue is a clear and valid one.

5.63 We therefore conclude that we will adopt AIP methodology 1 as one part of our spectrum pricing Framework.

AIP methodology 1: AIP and congestion

In setting AIP fees, we will assess current and future congestion in existing use and demand for feasible alternative uses in the frequency band in question and at different geographic locations over the relevant timeframe, given technological, regulatory and international constraints and using readily available evidence.

Methodology 2: reference rates

5.64 In our consultation document we explained the 'reference rate' denotes the value of a standard unit of spectrum that typically reflects the specific use made of the spectrum and the way in which we estimate the opportunity cost of this. We gave examples of reference rates, the current reference rate for cellular and business radio is £1.65 per MHz per km² and the rate for point-to-point fixed links between 1.35 GHz and 57 GHz is £88 per 2x1 MHz for each bi-directional link. We also provided the background to the adoption of these rates in a separate Appendix A.

5.65 We explained in paragraphs 4.23 to 4.33 of the consultation document that this reference rate is usually combined with a band factor to take account of variations in value between bands plus additional modifiers to take account of the specific technical details of the licence in question to set fees for individual licences.

5.66 We proposed to estimate the reference rate according to the following steps:

- a) calculate the value in the existing and the feasible alternative uses;

- b) if there is a higher value feasible alternative use, set the reference rate at a point between the two values, dependent on the perceived relative risks of setting the fee too high, or too low (see principle 9 in Section 4 for further detail);
- c) If there is no feasible higher value alternative use, set the rate at the value in existing use.
- 5.67 As set out in the consultation document, to estimate the value of spectrum and thus the opportunity cost of spectrum we currently primarily use the ‘least cost alternative’ (LCA) method. We explained, in the consultation document, that this involves estimating the value to an average user of a small additional block of spectrum in the band, in terms of avoided cost and this is generally based on a study of the cost of long-term alternative network designs or technology choices that would be made in response to a small reduction in spectrum held by a user. We noted that importantly the LCA method looks at the choices that would be made in the long-term, rather than the short-term. In the short-term, users’ responses would usually be more limited and more costly.
- 5.68 We also noted in the consultation document that external consultants have suggested that we adopt a second method for estimating the opportunity cost of spectrum, namely the discounted profit (DP) method. We explained that the DP method, unlike the LCA method, looks also at the revenues that would be lost if a user were to lose a small amount of spectrum, and therefore requires an understanding of the revenues as well as costs of the business of an “average user of spectrum” over time.
- 5.69 We assessed the advantages and disadvantages of each method in a Table that we have reproduced below.

Table 1: advantages and disadvantages of the LCA and DP methods

	Advantages	Disadvantages
LCA method	<ul style="list-style-type: none"> Information requirements are not demanding Easy to implement 	<ul style="list-style-type: none"> Not applicable if output cannot be assumed constant/ if revenue implications cannot be ignored Sensitive to assumptions, will produce a range of values Requires judgement to choose from range of values estimated
DP method	<ul style="list-style-type: none"> Method used by users to estimate 	<ul style="list-style-type: none"> Same as LCA

	<p>values in an auction</p> <ul style="list-style-type: none"> Is applicable if output cannot be assumed constant / if revenue implications cannot be ignored 	<p>(except first point)</p> <ul style="list-style-type: none"> Requires more cost information and uncertain revenue forecasts than LCA
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5.70 We said in the consultation document that we believed that the LCA method is generally fit for purpose and proposed to continue using it whilst acknowledging that the DP method offers a useful alternative in certain circumstances.

5.71 In our consultation document we therefore proposed methodology 2 to address the issue of how to set reference rates.

Proposed methodology 2: reference rates

Reference rates will be based on the estimated value of the spectrum in the current use and any feasible alternative uses. These estimates will be informed, where appropriate, by the available market information (if any), and economic studies of spectrum value.

Some responses agreed with this methodology, but argued for greater transparency in how reference rates are calculated and economic studies are used

5.72 BT, David Hall Systems Ltd, Intellect, STFC, Arqiva and NATS agreed with the methodology.

5.73 The Met Office and the Scottish Government wanted greater transparency on how we calculate and apply reference rates, including how market circumstances are taken into account.

5.74 Intellect and C&W Worldwide agreed that economic studies can provide a useful input into setting reference rates, but argued for transparency in the manner in which economic studies are commissioned and used. This they argued was essential so that stakeholders are provided with an opportunity to comment on the content of the reports and to agree or present a counterfactual to their conclusions.

5.75 Vodafone did not understand what Ofcom meant by “an increased focus on relevant market prices” when setting reference rates.

Ofcom view

We agree that transparency in how we set reference rates is important as is our use of evidence including external economic studies

5.76 As we have said in the previous section one key aim of this pricing Framework is to set out clearly our principles of pricing and the methodology by which we set fees

and thereby improve the transparency by which we set fees, including the type of evidence that we will use as the basis for our decisions.

- 5.77 Evidence can include economic studies, whether commissioned by us or others. Where we commission external studies, including economic studies, we follow a procurement policy which is aimed to ensure fairness, transparency, value for money and adherence to Ofcom and EU procurement rules⁴⁵.
- 5.78 For economic studies specifically commissioned to inform our proposals for fee rates we expect to commission, frame and scope these on the basis of the principles and methodologies previously consulted on and concluded on in this Statement. In some cases, however, where the issues to be addressed are complex and/or not well understood there may be merit in holding pre-consultation workshops with stakeholders to inform how we frame such studies in future.
- 5.79 We note that we normally publish the final report of any such studies alongside our consultation document unless it contains confidential information which we may not disclose. Therefore, stakeholders will normally be provided with an opportunity to comment on the results of these economic studies as part of the consultation process preceding Ofcom's decision to set licence fees.
- 5.80 We also note that if stakeholders wish to commission their own studies we would always be happy to consider this evidence as part of their response to our fee consultation.
- 5.81 On the specific issue of how we intend to have an increased focus on relevant market prices, we address this under principle 8. In simple terms we will as a minimum use relevant market transactions as a benchmark for comparison with any estimates of calculated opportunity cost, whether based on the LCA or DP method and, where appropriate, may base the reference rate directly on relevant market transactions.
- 5.82 On the more general issue of how we take market circumstances into account, in our consultation document we explained that we proposed to take into account feasible alternative use into account when setting fees, thereby taking into account potential developments in the market. As already indicated we address under principle 8 how we intend to take any available market transactions into account and under principle 9 how we take uncertainties in market circumstances into account.

Two responses supported the use of the Least Cost Alternative method for estimating the opportunity cost of spectrum and therefore reference rates

- 5.83 Vodafone and O2 indicated their support for the use of the Least Cost Alternative method.
- 5.84 Vodafone stated its opposition to the Discounted Profit (DP) methodology for mobile spectrum. They argued that future profits are more difficult to forecast than costs and that the DP method would appropriate all profits originating from the acquisition of spectrum. More generally, they argue that no regulator would have

⁴⁵ http://www.ofcom.org.uk/files/2010/06/Procurement_overview.pdf

sufficient/accurate information on which to calculate the opportunity cost using the DP method.

Ofcom view

We agree that the LCA method of estimating reference rates is most appropriate for most uses of spectrum, but believe that there is still a role for the DP method

- 5.85 As we discussed in our consultation document, we currently primarily use the ‘least cost alternative’ (LCA) method to estimate the opportunity cost of spectrum when setting AIP fees. The LCA method estimates the value to an average user of a small additional block of spectrum in the band, in terms of avoidable cost, based on the choices that are available in the long-term (e.g. when users look to reinvest in their networks and so have the full range of options available to them in response to pricing signals) rather than the short-term. In the short-term users’ responses would usually be more limited and more costly.
- 5.86 We also explained in the consultation document that consultants have previously suggested that we adopt a second method for estimating the opportunity cost of spectrum, namely the discount profit (DP) method. The DP method, unlike the LCA method, also looks at the revenues that would be lost if a user were to lose a small amount of spectrum, and therefore requires an understanding of the revenues as well as costs of the business of an “average user of spectrum”. This is a method that to date we have not used to estimate the opportunity cost of spectrum.
- 5.87 Table 1 above was provided in the consultation document, and provides a summary of the advantages and disadvantages that we see of each method. As the Table indicates we acknowledge that calculating the opportunity cost of spectrum using the DP method will require more information than using the LCA method and may therefore be subject to additional uncertainties, particularly, in relation to future revenue streams. However, we believe that the DP method is a valid approach to calculating the opportunity cost of spectrum and there is no reason to assume that we will face insurmountable difficulties in gathering the information needed to undertake the required analysis. We conclude therefore that the DP method remains a valid approach to calculate the opportunity cost of spectrum that we may have reason to use in future.
- 5.88 Overall, however, we remain of the opinion that the LCA method is generally fit for purpose and conclude that we will in general expect to continue using. However, we also conclude that the DP method offers a useful alternative in certain circumstances, in particular, if output cannot be assumed constant. In such circumstances it may be more appropriate to employ the DP method.
- 5.89 In making any future fee proposals, we will explain which method has been used, and the reasons for this in our consultation document.

A small number of responses raised specific issues on the definition of opportunity cost and the way in which reference rates should be presented

- 5.90 The Scottish Government argued that the Spectrum Tariff Unit⁴⁶ (STU) as devised by Smith-Nera may need to be replaced by something more recognisable to users.
- 5.91 A confidential response agreed that a case-by-case analysis of reference rates should be done each time, taking into account factors including:
- long lead infrastructure investments,
 - the fact that nearby frequency bands may have completely different opportunity costs, and
 - the fact that potential technology developments do not always lead to products being available within the estimated timeframe if at all.
- 5.92 A confidential response suggested that reference rates in shared bands should be the same for all types of service and technology.

Ofcom view

We intend to cease using the Smith-Nera approach to calculating opportunity cost based on own-use value only and take account of alternative use values as well

- 5.93 On the question of our continued use of Smith-Nera's STU concept, we proposed in our consultation document to move away from calculating reference rates based only on "own-use" opportunity cost (the "Smith-Nera" approach) and to also consider the opportunity cost of feasible alternative use (the "Indepen" approach). In addition, we proposed to take greater account of market transaction data to inform reference rates as well as retaining a preference for the use of the Least Cost Alternative (LCA) approach to estimating both "own-use" and "alternative-use" opportunity cost. We have now concluded that this is the approach that we will take in future fee reviews and as such we anticipate that the Smith-Nera STU concept will be superseded as and when fees are next reviewed.

We discussed in some detail the factors influencing spectrum value in our consultation document and gave due weight to the factors raised by ESOA

- 5.94 We agree that a key element of setting fees based on AIP is the calculation of the opportunity cost of spectrum and the setting of reference rates based on this. We provided extensive discussion of the factors that influence the value of spectrum, including methodologies for calculating opportunity cost, in our consultation document.
- 5.95 We also agree that there should be one reference rate for all spectrum users in a band and this is a direct consequence of using the Indepen method of estimating opportunity cost of both existing and alternative uses of spectrum.

⁴⁶ This was a specific way of representing a reference rate that was devised by Smith-Nera.

Other responses expressed concern that estimating spectrum opportunity cost is complex and that we need to be careful not to over-estimate its value

- 5.96 C&W Worldwide argued that there is a danger that spectrum value will be based on the value placed on it by those who are most able or willing to pay for it rather than with reference to the ability of the existing users to pay.
- 5.97 C&W Worldwide and Arqiva argued that there is a risk when assessing value based on the opportunity cost of uses that are not feasible and raised their concern that there is considerable scope for error in making such assessments.
- 5.98 O2 cautioned that previous experience indicated that LCA modelling is sensitive to the input assumptions and therefore there is a regulatory risk of charging too high a fee.
- 5.99 Vodafone expressed its opinion that no regulator can ever have enough information to calculate accurately the opportunity cost of spectrum.
- 5.100 Arqiva raised a concern that the effectiveness of AIP could easily be undermined if insufficient resources were available within Ofcom to ensure sufficient granularity of analysis.

Ofcom view

By setting fees to take account of the opportunity cost of alternative uses we implicitly accept some existing users and uses may not be able to bear this cost

- 5.101 We accept that in any pricing of spectrum based on opportunity cost, particularly where higher value feasible alternative uses are taken into account, it is likely that some existing users will not be able to afford these additional costs, as these users do not place as high a value on the spectrum as others. Indeed this is an intrinsic part of the role that we expect spectrum pricing to fulfil.
- 5.102 We also accept that taking into account higher value alternative uses poses a specific risk of pricing existing users out of the band, without certainty that the alternative use will take up the spectrum. We therefore have to assess very carefully, and consult with stakeholders on, the likelihood that such alternative use will materialise and in what time period as well as the opportunity cost of such an alternative use. We address how we should take account of such uncertainties under principle 9.
- 5.103 We have also discussed under principle 3 that it is important when identifying alternative uses that their feasibility is assessed carefully to ensure that we do not set fees too high compared to the feasible value that can be derived from using the spectrum.

We agree that estimating opportunity cost or market value is not an exact science and that we need to take care when setting fees based on this

- 5.104 We recognise that with any estimation of spectrum value, by whatever method, there is always a risk that we get it wrong. This is particularly the case where we are dealing with uncertainties in any feasible alternative use. We address the specific issue of dealing with uncertainties under principle 9.

- 5.105 On the issue that LCA modelling is sensitive to the input assumptions, we recognise that the LCA method requires us to make assumptions on the inputs used to calculate the opportunity cost of spectrum and that inevitably this means that there is a risk of error in our estimations. However, we believe that it is the best available method to estimate the price that would emerge in a well-functioning market. Additionally, we give the opportunity to stakeholders to comment on our specific fee proposals to mitigate the risk of erring when setting spectrum fees and improve the accuracy of our calculations.
- 5.106 On the issue of whether we can as the regulator have enough information to calculate accurately the opportunity cost of spectrum, we believe that the LCA method provides a relatively simple way of estimating the opportunity cost of spectrum as it only requires cost information that is generally publicly available. In the Annex to our consultation document we provided several examples of how we would estimate spectrum fees using the LCA method and the type of information that would be required. We acknowledge that calculating the opportunity cost of spectrum using the DP method will require a larger amount of information than using the LCA method and may be subject to greater uncertainties, particularly, in relation to future revenue streams. However, there may be occasions where the use of the DP method provides sufficient additional benefits to warrant our consideration of its use and therefore at this stage we do not wish to rule its use out completely, but will consider how to calculate opportunity cost on a case-by-case basis.
- 5.107 We also agree that sufficient resources need to be focused by us on estimating opportunity costs to the appropriate level of granularity. We will need to consider each case carefully when deciding what the appropriate and proportionate level of our resource to be focused on increasing this granularity based on the cost of doing so and the anticipated benefits to citizens and consumers.

One response argued that the step change between fixed and mobile reference rates needs to be addressed

- 5.108 The Scottish Government also argued that there are a number of discrepancies and inaccuracies that need to be addressed before setting future fee levels. As an example they quoted the step change between fixed and mobile that needs to be removed, they added that they believe that with bands being marketed on a technology agnostic basis there should be no distinction and therefore no vast step change in fee level between the bands.

Ofcom view

We agree that there are good arguments to increase the number of reference rates that we use, but sharp differences between values of neighbouring spectrum are likely to remain

- 5.109 As discussed in our consultation document, in our AIP methodology differences in spectrum value are captured through a combination of the reference rate and the band factor. It is possible to have different combinations of reference rates and band factors to set AIP fees. In general, the smaller the number of reference rates used the wider the range of value differences that the band factor needs to capture.
- 5.110 In our current approach the band factor has to capture variations in value caused by most or all key value drivers. For instance, bands used by the business radio and cellular 900 and 1800 MHz classes attract the same reference rate, so the band

factor has to capture value differences caused by different existing uses (e.g. between business radio at 138 MHz and cellular use at 900 MHz), propagation characteristics, degrees of harmonisation or equipment availability.

5.111 In general, this approach places a greater weight on the band factor and, in some circumstances may not capture variations in value with a sufficient degree of granularity. Reference rates will normally be able to capture the absolute opportunity cost of a particular use in order to arrive at an estimate of the fee across a range of bands. Reference rates can be based on market valuations and least-cost alternative calculations of opportunity cost. In contrast, the band factor can most readily be used to reflect relative differences in the opportunity cost between the bands and this might, for example, be indicated by relative levels of congestion in each band.

5.112 This suggests that in some circumstances there would be benefits in making greater use of reference rates in setting AIP fees. However, we need to strike the right balance between:

- on the one hand, reflecting variations in the value of different bands more closely and;
- on the other, the cost of obtaining greater granularity in our fees and the need to keep our pricing algorithms as simple as possible.

5.113 When setting AIP fees for licence sectors that operate over a large number of bands (such as fixed links or the business radio classes), it is not always proportionate to produce a large number of reference rates or, at the extreme, one rate per band. The cost of having greater granularity in our reference rate (in terms of the required resources to do so) may exceed the expected benefit.

5.114 All things considered, we agree that the use of two reference rates, as we do currently, may in some cases place undue weight on the band factor which may not sufficiently capture variations in market value (in the fixed/mobile frontier as well as in other parts of the spectrum).

5.115 As already summarised under principle 3, we will in future take account of feasible alternative uses where we do not currently do so, in order to move towards a pricing system that better reflects the variations in spectrum value. This will also help address the sharp 'cliff edge' in our pricing of mobile and fixed applications, although some discontinuities in AIP fees (caused by those inherent in spectrum values, as discussed in Section 2 of this document) will remain. As such, we will, in applying this principle, continue to aim to keep fee structures simple and transparent – our aim might for example be achieved with a small number of additional reference rates.

Conclusion methodology 2: reference rates

5.116 In addition to the issues discussed above one confidential response highlighted that there are occasions when we develop a new licence product in scarce spectrum and where we need to also determine an appropriate reference rate on which to base the AIP fee. In such cases we need to consider whether it is proportionate to undertake a full fee review from first principles as set out in this Framework or whether it would be more appropriate to use an existing reference rate as a proxy for the opportunity cost of the spectrum.

- 5.117 Where a reference rate exists for similar spectrum that can be broadly considered economically substitutable then in many cases this may be a more appropriate use of our resources when set against our other spectrum management priorities (see Section 6, paragraphs 6.31 – 6.44 for greater detail on how we intend to prioritise fee reviews in future). We have therefore amended AIP methodology 2 to reflect such cases.
- 5.118 Having also considered other responses to this methodology we accept, as suggested in stakeholder responses, that in estimating the opportunity cost of spectrum we need to take care and that it is important for us to be transparent with stakeholders on how we have made these estimates. We will continue to do so through our application of this pricing Framework and the consultation process.
- 5.119 We remain of the view that reference rates should seek to reflect the opportunity cost of spectrum in existing and alternative uses and, where appropriate, should be estimated through a mix of economic methods such as LCA as well as observed market transactions.
- 5.120 In addition, as previously explained in paragraph 4.73, we have decided to be clearer about what we mean when we refer to spectrum value in relation to setting fees based on AIP and have amended the text of principle 9 to reflect this.
- 5.121 We conclude therefore that we will adopt AIP methodology 2 as one part of our spectrum pricing Framework.

AIP Methodology 2: reference rates

Reference rates will be based on the estimated opportunity cost of the spectrum use, considering both the current use and any feasible alternative uses. These estimates will be informed, where appropriate, by the available market information (if any), and economic studies of spectrum value in different uses.

Methodology 3: calculating individual licence fees

- 5.122 In our consultation document we said the reference rate expresses the value of spectrum for a standard unit of spectrum in typical use. This can be expressed in a number of ways depending on how it is calculated e.g. in £s per MHz per square kilometre or per (fixed) link. We explained that in order to convert reference rates into fees for individual licences, it is necessary to capture variations in the value of the spectrum, driven by:
- the feasibility of alternative uses;
 - variations in demand by frequency and geography;
 - the spectrum denied to others.
- 5.123 We explained further that to capture variations in the value of spectrum by frequency and geography, we use two ‘factors’ or ‘modifiers’:
- *Frequency band factor*, which is intended to reflect differences in the value of bands subject to the same reference rate, as proxied by the degree of frequency congestion in those bands;

- *Location factor*, which captures the value of the spectrum where the licensee operates, as proxied by the degree of geographical congestion.

5.124 To measure the amount of spectrum denied to others we explained that we consider the following features of the assignment:

- the *bandwidth* denied to others measured in kHz, MHz or other units of frequency;
- the *area* denied to others measured in km²;
- the *degree of exclusivity*, a measure of the extent to which the individual assignment of spectrum is shared by others or is exclusive.

5.125 In our consultation document, therefore, we proposed methodology 3 to address the issue of how we calculate individual fee rates from the reference rate.

Proposed methodology 3: calculating individual licence fees

In converting reference rates to fees, we will take account of the value of the amount of spectrum denied to others. This will generally be based on frequency, geographical location, bandwidth, geographical coverage or other measure that reflects the geographical extent of co-ordination requirements and in some cases the exclusivity of an assignment.

Most responses did not address this methodology but those that did broadly agreed, with some proposing that we also consider receiver characteristics when setting fees

5.126 BT, STFC, Arqiva, NATS and David Hall Systems Ltd generally agreed with the methodology.

5.127 The Scottish Government thought that the calculation of individual licence fees from a reference rate should be more transparent.

5.128 Transfinite and a confidential response argued that pricing should consider the receiver as well as transmitter characteristics. For Transfinite the issue was one of principle. For the confidential respondent their key issue was that they perceived that there is little incentive for some operators to invest in techniques which would reduce the susceptibility of their systems to interference from other technologies, which imposed an opportunity cost on others.

5.129 David Hall Systems Ltd however argued that, when estimating the reference rate for spectrum, we should not only take into account the value denied to other spectrum users but should also include the value of wider social benefits resulting from the use of that spectrum.

Ofcom view

We intend to proceed with proposed methodology 3

5.130 Although we did receive specific comments from stakeholders on the existing fee structures, this methodology was the least contentious and therefore we intend to proceed on the basis of the method outlined in the consultation document and summarised below.

We may consider, following consultation, the possibility of reflecting the costs imposed on society by the receiver performance of some users when setting fees

- 5.131 The issue of the denial of spectrum because of the need to protect receivers, in addition to the spectrum denied by transmission, is one that has been raised a number of times in the past. Because of the nature of radio signals, protecting reception for one use will tend to create limits on other uses. However, this does not necessarily impose an additional cost to society given that the consumer and citizen benefits of spectrum use depend primarily on such protection. However, we recognise that in some cases existing receiver performance can be such that it imposes a higher cost in terms of limiting new services than is needed given the current state and cost of receiver technology. The balance of these costs and benefits will vary from case to case.
- 5.132 This is often a particular issue where services have very different technical characteristics, where a new service wishes access to a band and where our first-come first served regime places a requirement on them to protect existing users in adjacent bands.
- 5.133 However, we have no evidence to indicate that developing a pricing solution to these problems is an administrative priority or that it would justify the likely costs involved on our side, given that we do not understand what the scale of these problems is in practice, nor whether it would be proportionate to develop a “general” approach or to instead consider particular issues as they arise. Rolling out such a major change to our methodology for setting fees would need to be justified based on the additional benefits it would achieve over our current methodology. In addition, we have not consulted on how we might include consideration of receiver characteristics in fees and this would likely take some considerable analysis including potentially the commissioning of an independent technical study to develop a methodology.
- 5.134 Finally it is not clear whether pricing or some other spectrum management approach would be the most effective way of tackling these problems. This is however an issue that we may consider further, including the benefits that a change in our approach could offer in promoting the optimal use of spectrum. In such an event we would consult with stakeholders on specific proposals before implementing any change.

Setting reference rates that reflect the full value of wider social benefits of the services provided on top of the opportunity cost of spectrum is unlikely to improve the optimal use of spectrum

- 5.135 On the issue of charging for spectrum based on the value that such uses generate for society more widely, we do not believe that such an approach would promote the optimal use of spectrum. We take an approach that considers the opportunity cost of spectrum that reflects the value an alternative user would place on it. If, as suggested, we were to take into account the wider social benefits of the services provided, we would need to adjust prices downwards (instead of upwards, as suggested) but we do not believe this would be appropriate.

One response requested that Ofcom provided non-binding guidance as to how UK-wide AIP might be split between different geographical regions

- 5.136 Arqiva argued that in addition to the transfer of complete spectrum licences, trading is likely to increasingly involve the splitting of spectrum licences by geographic area.

They suggested that where such spectrum licences are subject to AIP, such trades would be aided if Ofcom made available non-binding guidance as to how UK-wide AIP might then be split between the successor licences and gave examples such as pro rata by population, or contribution to GDP.

Ofcom view

Spectrum value is determined by a wide range of factors and it is not possible for us to generalise on the geographic differences in value of nation-wide licences

5.137 On the request that we provide guidance on how UK-wide AIP rates might be reflected in geographically distinct licences arising out of a trade, we note that for some spectrum bands (such as those used by business radio) we do include a location factor to reflect the relative value of spectrum in different geographical areas that is indicative of differing levels of demand in these areas. We have considered whether we could make a similar, but more generalised, assessment of how we might split a UK-wide AIP fee across a set of geographically distinct licences. However, we note that the drivers of demand, and therefore value, are likely to be different depending on the specifics of the spectrum concerned. For example, demand for spectrum capable of providing mobile type applications might, in some cases, be expected to be driven primarily by population density, whilst spectrum that can only support more point-to-point services might be expected to be driven by other factors, such as major trunk routes, or locations with less cable infrastructure such as rural locations. We are therefore unable to generalise on how we might apportion a UK-wide AIP fee across geographic regions, without consideration of the specifics of the spectrum.

Conclusion on methodology 3: calculating individual licence fees

5.138 This methodology appeared to be one of the least contentious issues that we consulted on and those who responded to this agreed with it. Although some responses suggested that we should also consider receiver characteristics when setting individual fees, most who responded agreed with this methodology. Whilst we cannot conclude on the need for a definitive policy to taking into account receiver characteristics in fees at this time, we may consider this issue at a later date.

5.139 In addition, as previously explained in paragraph 4.73 we have decided to be clearer about what we mean when we refer to spectrum value in relation to setting fees based on AIP and have amended the text of principle 9 to reflect this.

5.140 We therefore conclude that we will adopt methodology 3 as part of our spectrum pricing Framework.

AIP methodology 3: calculating individual licence fees

In converting reference rates to fees, we will take account of the opportunity cost and the amount of spectrum denied to others. This will generally be based on frequency, geographical location, bandwidth, geographical coverage or other measure that reflects the geographical extent of co-ordination requirements and in some cases the exclusivity of an assignment.

Methodology 4: impact assessments

5.141 We said in our consultation document that once we have developed detailed proposals for changes to fee rates, we are required to undertake a formal Impact

Assessment that considers the impacts on affected parties and the consequent impact, if any, on citizens and consumers.

5.142 We said that if an initial assessment indicates that the proposed policy is likely to have detrimental effects, or not achieve its objective, we would then revisit these proposals to address such issues. We discussed two examples of where an initial IA might lead to us revising our proposals:

- Cases where the impact on licensees of increasing fees would be so great that we would consider phasing in of fees; and
- Cases where we are considering changes to fees where it might be necessary to take account of downstream competition effects, including the possibility of the existence of windfall gains.

5.143 In our consultation document we, therefore, proposed methodology 4 to address the issue of how to take account of the impact of our decisions on all affected parties including citizens and consumers.

Proposed methodology 4: impact assessments

We will undertake Impact Assessments on our fee proposals to identify any potential detrimental impacts to spectrum users, consumers and citizens. We will need to consider carefully the balance of benefits and risks of the implementation of all changes in fees.

Most responses agreed with the proposed methodology with some suggesting that Ofcom consider impacts on all stakeholders

5.144 BT, STFC, Arqiva, NATS, ESOA and Intellect agreed with the proposed approach. O2 agreed with the proposal that on occasion it may be necessary to consider the phasing of fee increases, for example where the increases might be disruptive to existing licensees.

5.145 ESOA added that detailed and diligent impact assessments taking all possible effects into account are critical for fee reviews.

5.146 David Hall Systems Ltd argued that when assessing the balance of risk/cost that they consider it important that impacts on different types of stakeholders are taken fully into account as they may each be impacted differently.

5.147 CAA argued that it is essential that any impact assessment of pricing demonstrates the feasibility of delivering benefits, taking into account the additional institutional costs of implementation.

5.148 Transfinite argued that impact assessments should include an analysis of the impact of any proposed changes to its fees on the ability commercial band managers to undertake their business.

Ofcom view

We agree that impact assessments are a critical part of any fee review and we will endeavour to provide clear explanations of all the considerations we think relevant

- 5.149 We agree that Impact Assessments (IAs) are a key part of best practice policy making, as highlighted in our Better Policy Making guidelines⁴⁷. They should show how a regulatory decision is designed to fulfil our statutory duties, bearing in mind that our principal duty is 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 competition⁴⁸.
- 5.150 IAs provide a framework for evaluating different regulatory options, including de-regulation. In carrying out IAs we will be guided by the principle of proportionality. This means that a decision which is likely to have a wide-ranging impact and/or impose substantial costs on stakeholders will have a more comprehensive IA than a decision which will have a less significant impact.
- 5.151 We agree with stakeholders that IAs can have a significant role to play in setting fee levels and in decisions on the need for phasing, as discussed in our consultation document. We also agree that they should attempt to identify possible material impacts and the scope for unintended consequences that our proposals could have on the relevant stakeholders, consumers and citizens.
- 5.152 We also accept that our IA should give due consideration to the possibility that increasing fees might result in higher prices to consumers. However, our duty to promote the optimal use of spectrum means that we would increase spectrum fees if this resulted in likely benefits that exceeded the costs of the increase in consumer prices. We believe this is likely to be the case when AIP is set to reflect the opportunity cost of the spectrum.
- 5.153 We do not agree that we should consider the impact of our fees levels on the business plans of licensees who have purchased spectrum at auction with the intention of offering it to the market alongside Ofcom. This is for the same reasons that we do not believe that we should consider the effect of our cost-based fees on such businesses and that we discuss under Question 2 (specifically at paragraphs 5.32 to 5.33).

A number of responses proposed that impact assessments could be used to identify and “protect” services due to the inability of existing users to pay the market value

- 5.154 The Met Office argued that, as Ofcom’s approach to setting fees was based on economic value perhaps at the expense of socioeconomic value, an impact assessment could be a crucial part of the proposed methodology on the assumption that this could be used as a means to redress imbalances brought in by market forces.

⁴⁷ Better Policy Making – Ofcom’s approach to Impact Assessment, see <http://stakeholders.ofcom.org.uk/consultations/better-policy-making/>

⁴⁸ Ofcom’s principal duty is set out in section 3(1) of the Act.

- 5.155 C&W Worldwide raised a concern that there is a risk of AIP being set higher than the commercial realities of the existing use of the spectrum and that companies will be put out of business. They also raised a concern that there is a risk that potential market entrants could be deterred if fees are significantly out of line with the commercial value of the services that can be offered.
- 5.156 Met Office and Inmarsat expressed concern that Ofcom's pricing approach might be followed by other administrations and that the impact of this should be considered in any impact assessment

Ofcom view

Impact assessments can allow us to address potentially unacceptable outcomes for key public and commercial services due to increased fees

- 5.157 Impact Assessments, in some cases, should help us to identify where an inability to pay for spectrum could lead to an unacceptable cessation or reduction in a key public or commercial service. This is most likely to be as a result of fee increases timed outside the periodic public spending reviews. As we have the option of phasing fees to reduce the shock of large increases, which we believe would mitigate the risk of such unacceptable outcomes.
- 5.158 There may, however, be rare cases where phasing alone would not suffice and we might need to consider carefully the balance of the potential gains to be had by reflecting the opportunity cost of spectrum against the potential loss of benefits to society that could result. We also might need, in such cases, to consider whether alternative spectrum management arrangements were appropriate.

We do not believe that it is appropriate for us to comment on the regulatory approach to the setting of fees taken by other Administrations

- 5.159 Some responses expressed concern that pan-European or international services could be made uneconomic if other administrations decided to start charging fees on the same basis as the UK. We do not believe that it is appropriate for us to comment on the approach to spectrum fee charges taken by other administrations since each administration has jurisdiction over its national resources and may therefore set fees according to their respective national pricing policies.
- 5.160 Companies need to take account of the specifics of each market when building their business plans and this includes the costs they incur as a result of their use of spectrum. We believe that to achieve the efficient use of spectrum it is necessary to reflect the value of spectrum denied to other uses to ensure that all users of spectrum have the same incentives to use it efficiently and that this will lead to those who deliver the greatest benefits to society gaining access to it, as discussed in more detail in principle 1.

On the issue of whether impact assessments should consider impacts on competition there were mixed responses

- 5.161 ESOA argued that AIP could raise competition concerns by distorting the competitive landscape for providing broadband and broadcast service via wire line and wireless means. They argued it could force certain operators to cease important services in UK or even withdraw from the UK market altogether. The implementation of AIP for satellite services they argued could lead to higher prices to consumers in the UK as

satellite operators would have to pass on these costs. They concluded that AIP would therefore act as a disincentive to optimal use over the long and short term and should not be applied to spectrum that is or can be used for satellite services.

- 5.162 David Hall Systems Ltd raised concerns about the possible use of AIP to address competition issues adding that they do not consider that AIP should be used in this way.
- 5.163 “Three”, BT and a confidential response raised concerns that AIP should consider the impact on competition and ensure that it did not distort competition between those who purchased spectrum at auction and those who pay AIP
- 5.164 BT argued that the most important consideration when setting fees is to avoid outcomes that create barriers to innovation or investment.

Ofcom view

We remain of the view that it may sometimes be necessary to consider the effect of AIP fees on downstream competition

- 5.165 On the impact of our fees on competition, in general, the effect of AIP should be positive in the service markets concerned. AIP will relieve spectrum scarcity and make it easier and faster for new market players to enter the market offering potentially new services and promoting competition in electronic communications. This will benefit consumers of such services by widening choice and reducing prices.
- 5.166 We discussed in the consultation document whether it would potentially be appropriate to use AIP to promote competition more generally, or to address existing competition problems in downstream markets. We considered for example, whether AIP should be reduced selectively for certain licences in order to encourage entry into a downstream market, or to offset the competitive advantages of a dominant firm.
- 5.167 We remain of the view that, depending on the circumstances of the case, pursuing such an objective could, in principle, be consistent with our duties to promote competition where appropriate. However, such a means to promote competition via changes in competitors’ relative input costs may not be the most effective approach. UK competition authorities, including Ofcom, already have powers to identify and address competition problems directly under the Communications Act 2003 and general competition law. Further, it would, in practice, need to be done in a manner that was consistent with our duty to ensure that fees are non-discriminatory and also with EU law on state aid.
- 5.168 There might also be particular cases where we are considering changes to fees in which it is necessary to take account of downstream competition effects, including the possibility of the existence of windfall gains.
- 5.169 If our analysis of the specific circumstances of any particular case indicates that it is appropriate to take downstream competition effects into account when setting AIP fees, we will make this explicit in our proposals and provide supporting evidence and reasoning when we consult on them.

Conclusion of methodology 4: impact assessments

5.170 Having considered all the responses to this issue we agree with the majority of responses that this methodology should only consider the impacts on spectrum users, consumers and citizens, as opposed to the impact on the ability of commercial band managers to undertake their commercial activities. We conclude therefore that we will adopt methodology 4 as one of our methods for setting fees based on AIP.

AIP methodology 4: undertaking impact assessments

We will undertake Impact Assessments on our fee proposals to identify any potential detrimental impacts to spectrum users, consumers and citizens. We will need to consider carefully the balance of benefits and risks of the implementation of all changes in fees.

Section 6

Pricing principles for the process of undertaking fee reviews

6.1 In this section we conclude on a set of pricing principles for the process of undertaking fee reviews. This concludes on a set of pricing review principles that indicates how we will decide:

- when to carry out fee reviews,
- the types of evidence we would use to make this decision,
- the current near-term priorities for fee reviews, and
- a process for evaluating fees following a review.

When should we review fee levels?

6.2 In our consultation document we identified 5 options for how we could decide when to review fees in future, and set-out the advantages and disadvantages, we had identified of each in Table 2, which we replicate below.

Table 2: Options for deciding when to review fees in future

Option	Stability and/or predictability for users	Aligning fees with market conditions	Other costs and benefits
1. Automatic review on a fixed cycle	Fees will be regularly and routinely reviewed even if there is no evidence that the value has changed introducing uncertainty to the market and consuming stakeholder and Ofcom resource.	Fees will be up to date with lags limited to a certain number of years (e.g. 3, 4 or 5 years).	Reviews triggered by the fixed term might not have been priorities on the evidence of demand and use.
2. Maximum term before next review	Uncertainty during maximum term as to whether or not fees will be changed.	Fees can be reviewed before the end of the period if circumstances suggest they should change. Lags will be limited to the maximum term	Reviews triggered by the maximum term might not have been priorities on the evidence of demand and use.
3. Minimum term before next review:	Fees could be assumed to be stable for the minimum term. If we did not provide additional clarity beyond that period, changes to fees would be uncertain	Changes in value or our costs would not be reflected during the minimum term.	If the minimum term is relatively long, will reduce Ofcom and stakeholders' resources focused on fees

Option	Stability and/or predictability for users	Aligning fees with market conditions	Other costs and benefits
4. Set priorities following possible consultation in the Annual Plan. Propose a review only when evidence it is justified	Fees could be assumed to be stable unless or until Ofcom consults on the justification for a review. When reviews are triggered by major changes stakeholders will usually have had notice of these changes for some time and will be consulted on the materiality of these changes.	Flexibility to reflect relevant changes in market values or our costs, where these are materially different from current fees. Small misalignments might not be reflected for a considerable time.	Ofcom and stakeholder effort limited to reviews that are material and a priority.
5. Set priorities following possible consultation in Annual Plan. Propose a review only when evidence justifies it and at conclusion of a review, set a minimum term before any further review.	Fees could be assumed to be stable unless or until Ofcom consults on the justification for a review. When reviews are triggered by major changes stakeholders will usually have had notice of these changes for some time and will be consulted on the materiality of these changes. Following a review, fees could be assumed to be stable for the minimum term.	Flexibility to reflect relevant changes in market values or our costs, where these are materially different from current fees. Small misalignments might not be reflected for a considerable time. Changes in value or our costs would not be reflected during the minimum term.	Ofcom and stakeholder effort limited to reviews that are material and a priority.

6.3 We proposed using option 5 and asked the following question:

Question 4: Do you agree with our proposal to move away from regular full-scale reviews to reviewing in response to evidence, as set out in Option 5?

Most responses agreed with the logic of moving to reviewing fee levels based on evidence as set out in Option 5 of our consultation document

- 6.4 Arqiva, BPA/UKMPG, BT, David Hall Systems Ltd, ESOA, Intellect, NATS, STFC, TAUWI, "Three", a confidential response, UK Chamber of Shipping, and Vodafone all agreed with this proposal.
- 6.5 Arqiva added further that neither technology nor regulatory restrictions develop in a linear manner. They agreed that reviewing only where there is evidence "makes more sense" than on a regular basis, but warned that users need to have a reasonable degree of notice of a review, particularly where this has not been signalled, in advance, in the Annual Plan.

- 6.6 BT added that it believes that the minimum term needs to be realistic and, where known, take into account known planned events that might provide additional evidence e.g. planned auctions of similar spectrum. It also indicated that its agreement was subject to the concerns that it had raised on principle 8, above.
- 6.7 David Hall Systems Ltd added that they believed that over time as the spectrum market becomes more effective the need for evidence based reviews should decrease.
- 6.8 ESOA added that long term regulatory certainty is essential to the continued provision of important services by the satellite sector in the UK.
- 6.9 The Met Office expressed no strong view, but believed that there may be some merit in having some element of periodic review. Their main concern was for stability in fee reviews and they stated that they would endorse a sensible long-term approach to any spectrum pricing and review process.
- 6.10 "Three" added that there should be an automatic review in the event of certain pre-defined events including any change of spectrum licence conditions.
- 6.11 NATS agreed that regular full-scale reviews are very time consuming and will not achieve anything if the market values or Ofcom costs are fairly static. They agreed that Option 5 appears to set out a good balance of achieving the desired results and stakeholders' stability in terms of costs and investment decisions by allowing a minimum term before any review takes place.
- 6.12 UK Chamber of Shipping agreed subject to this approach delivering efficiency and costing less to business in terms of bureaucracy, that it provides "value for money".

Ofcom view

We welcome stakeholders' strong support of our proposals and agree that we need to allow stakeholders time to consider any specific proposals in our consultation

- 6.13 Most stakeholders expressed their support for the greater stability of fee levels that is likely to result from our proposed approach. Some also commented that stakeholders should have notice of a review, which we agree is important and is the purpose of our consultation processes. We always consult on any proposals to vary fees and often hold pre-consultation meetings to inform our proposals and allow stakeholders time to respond. We will continue with this process, regardless of whether we discuss a future fee review as part of our priorities for activities on spectrum matters in our Annual Plan.
- 6.14 In particular, under Question 6 below, we indicate that we intend, subject to the availability of resources and consideration of our overall priorities for spectrum management, to undertake a review of the frequency bands used by fixed links following publication of this Statement. As part of this consultation we intend to hold some pre-consultation discussions with stakeholders.

Some public sector users expressed concern as to how this approach would fit in with government Spending Review cycles

- 6.15 The MoD accepted the reasoning behind the proposal but had concerns about how this approach would fit with government's periodic spending reviews and would

prefer to have the up to date view of spectrum values that regular reviews would give. They also indicated that they thought that option 5, (the proposed option) would put the onus on MoD to produce evidence before a review would be initiated and stated that the MoD sees this as Ofcom's responsibility as the UK regulator.

- 6.16 Two confidential responses argued that like all Government departments they are subject to regular spending reviews and therefore any changes to fees should match the long financial planning cycles in the public sector. One added that even if there is compelling evidence of a significant misalignment we must maintain financial stability as lead times for public sector are perhaps longer than for many sectors.
- 6.17 The Scottish Government argued that while it is important to keep accurate and transparent tariffs, users expect stability over the medium term and advance notice of at least 3 years of any proposed increase.
- 6.18 STFC argued that changes to satellite frequencies are not possible after the launch of a satellite and therefore in order to avoid science being held to ransom, any increase in spectrum cost or spectrum re-allocation should be postponed until the end of the life of the mission. They added that mission life post launch is typically up to 10 years.

Ofcom view

We understand the constraints that budgeting periods place on the public sector, but in general we would expect the public sector to respond to changes in fees as they do to changes in the prices of other inputs

- 6.19 We recognise that the public sector operates to a 3 year funding cycle with budgets set for the period. However, the public sector is expected to manage these budgets accepting that the costs of a wide variety of the resources they fund could increase or decrease over the period. Spectrum is no different in this respect and therefore unless a substantive increase in fee levels was proposed we would expect to implement any increase to the public sector at the same time as to the commercial sector. Spectrum fees are also, in general, a small proportion of most public sector budgets and therefore any increases are likely to have only a marginal effect on their overall funding position.
- 6.20 In addition, we also have the possibility of phasing in increases in fees for public sector users, as for commercial users of spectrum if they are substantive.

We agree that it is our responsibility to monitor indicators of changes to spectrum value and to react accordingly if we believe that our fees are materially out of line

- 6.21 In our consultation document and in the section below addressing the process for prioritising fee reviews it is clear that we hold a significant portion of the evidence that might indicate our fees are materially out of line with spectrum value. For example, if we find we are unable to meet requests for assignments this may indicate congestion is increasing. We therefore recognise that we need to play a major role in monitoring such indicators and would anticipate doing so periodically.
- 6.22 However, stakeholders may be expected to be more aware of commercial and technology advances than ourselves. As such we would encourage stakeholders to inform us if they think that there is evidence indicating a significant change in spectrum value that we should look to reflect in fee rates.

- 6.23 We therefore believe that while we can and should monitor indicators of changing spectrum demand and other evidence of changes in spectrum value we would still welcome stakeholders providing their own evidence if they believe that our fees are materially out of line with spectrum value.

We agree that equipment lifetimes are sometimes important when assessing the “relevant timeframe”, but not when deciding whether to review fees

- 6.24 Under principle 4, above, we discuss the “relevant timeframe” which is the time over which we need to assess congestion, excess demand and feasible alternative uses and why we do not believe that it is appropriate to set fee levels constant for the length of this relevant timeframe, as suggested by some stakeholders. The main reason for this is that spectrum value is likely, in many cases, to change over much shorter timeframes and it is important for AIP fees to reflect current (or recent) information on the value of spectrum.
- 6.25 We recognise that for some uses of spectrum once equipment is purchased a decision to change their use of spectrum is unlikely to be made for many years. However, by ensuring that we reflect current information on the value of spectrum in spectrum fees we will ensure that spectrum continues to be used by those who value it most highly. This might mean, for example, that because of an increase in the fee a user decides to invest in new equipment operating in a higher band, or more technically efficient equipment sooner than they might otherwise. We would therefore have secured more efficient use of spectrum sooner than if the fee had been set constant for many years.

Conclusion on Question 4: a move away from periodic fee reviews

- 6.26 Having considered the responses to this question we remain of the view that the timing of reviews should be determined by changes in spectrum value and should not be tied to external timescales such as the public sector spending review.
- 6.27 We therefore conclude, and as most responses agreed, that we will, in future, give explicit weight to the advantages of stability in promoting efficient investment decisions and in reducing potential inhibition of efficient trades.
- 6.28 We discuss the evidence that we might use to judge whether any potential misalignment between current fees and value, or between current fees and management costs, is sufficiently material to warrant a fee review in the next section below.
- 6.29 In addition, as previously explained in paragraph 4.73 we have decided to be clearer about what we mean when we refer to spectrum value in relation to setting fees based on AIP and have amended the text of principle 9 to reflect this.
- 6.30 We conclude therefore in future we will adopt the following new pricing review principle as part of our Framework for spectrum pricing:

Pricing review principle 1: when to review fees

If we think there is a case for a fee review we will generally seek views on the need for a review from stakeholders when we consult on Ofcom’s Annual Plan.

We may still, however, on occasion undertake a fee review where there is a clear need without including this in the Annual Plan.

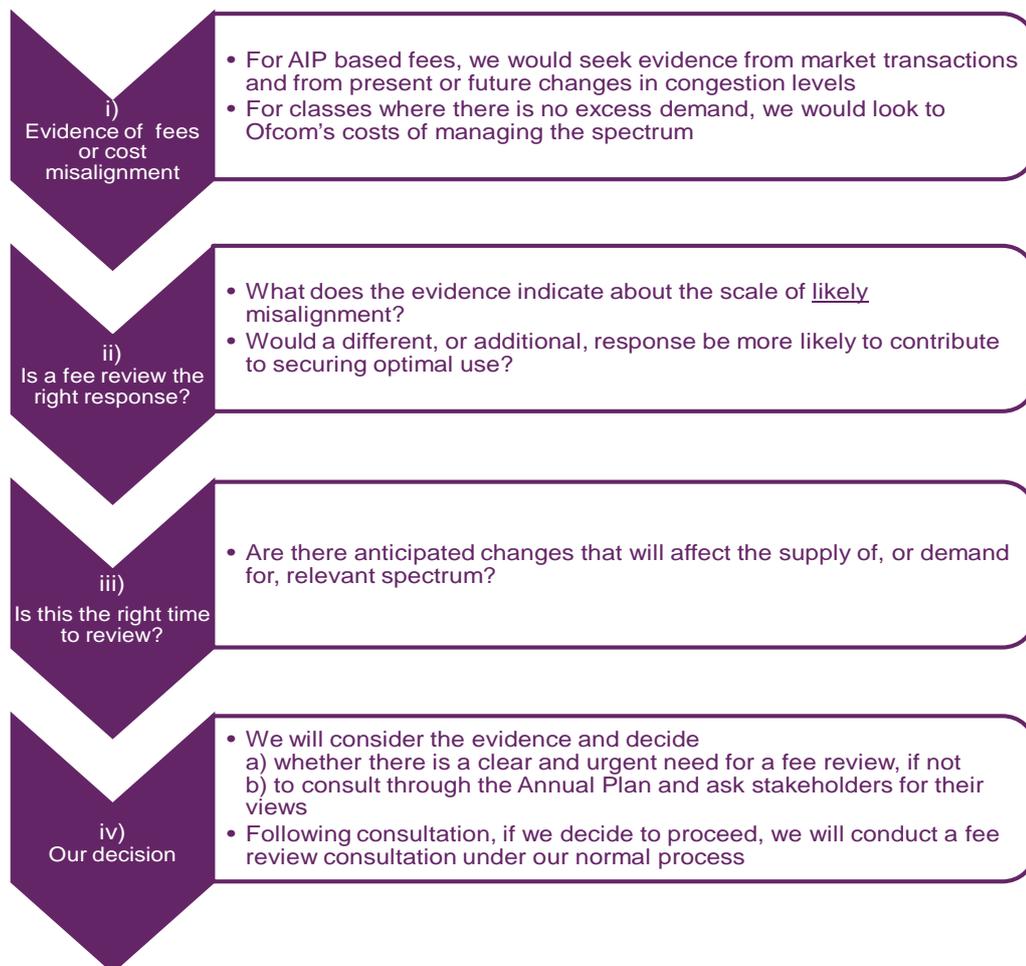
We will propose to conduct a fee review only where the evidence suggests that a review would be justified, including evidence of a likely and sufficiently material misalignment between the current rates and the opportunity cost of the spectrum for fees based on AIP, or between the current rates and our spectrum management costs for cost-based fees.

When we conclude a review in future, we would also specify, where appropriate, a time period during which we would not normally expect to carry out a further review.

How should we assess the priority of fee reviews?

6.31 In our consultation document we proposed a process for assessing the priority of fee reviews based on evidence of misalignment of fees with either opportunity cost or the costs of our spectrum management functions, dependent on whether the fees are AIP, or cost-based, which is presented below as Figure 6.

Figure 6: Proposed process for carrying out fee reviews



6.32 We also asked the following question of stakeholders:

Question 5: Do you agree with our process for assessing the priority of future fee reviews? Are there other sources of evidence of misalignment that you can think of and what weight should we give them?

There was general agreement for the proposed process for assessing the priority for fee reviews, although some asked for greater clarity on the evidence needed

- 6.33 BT, Intellect, BPA/UKMPG, Arqiva, NATS, STFC, “Three” and David Hall Systems Ltd agreed with the proposal.
- 6.34 A confidential response agreed that the process looks logical but said that in its view it is lacking in clarity on how evidence of misalignment is gathered. They asked whether this would be at agreed review dates or after a minimum stability period.
- 6.35 MoD were also unclear what evidence would be required to initiate a review and how detailed such evidence would need to be.
- 6.36 UK Chamber of Shipping agreed with the proposal to a certain extent but stressed that they think that Ofcom needs a good understanding and appreciation of the businesses to which it is applying fees before making changes, particularly in the maritime sector.
- 6.37 The Scottish Government argued that any change (particularly upwards) in fees is likely to have an adverse effect on users. They said that while they appreciate that reviews may be needed they would suggest full consultative processes before changes are made.

Ofcom view

There are a number of sources of evidence that we would expect to consider when assessing whether fees are materially out of line with spectrum value

- 6.38 As we discussed in the consultation document sources of evidence would include changes in:
- Congestion levels. The existence or expectation of potential congestion in existing use at existing fee levels over the relevant timeframe or, conversely, the expectation that congestion will fall away. In some cases, we will have good visibility of significant changes in congestion levels from the data collected through our licensing operations. An example of this could be an increase in the number of requested assignment that we cannot meet on first assessment, which would point to an increase in congestion. Conversely, low numbers of users in a band might indicate that demand was lower than we had expected when we set fees;
 - Information from spectrum auctions and trades. As discussed under principle 8, these may be highly relevant in assessing the demand for, and hence the value of, comparable spectrum;
 - Increased supply of substitutable spectrum. This could arise in several ways: directly by a major spectrum release, by Ofcom or another major spectrum holder

such as MoD or a large private sector user, or indirectly as a result of technological developments. Technological advances in a particular use may make it possible to extend the provision of applications to new frequency bands, increasing the effective supply of spectrum and so reducing congestion in that use, or alternatively to provide an existing or enhanced service using less spectrum;

- Expectation of a regulatory change that will affect the attractiveness of spectrum to commercial or public sector users.
 - New equipment standards may make a particular use of a frequency band more viable because of the expectation that equipment will become available;
 - Regulatory changes may also affect the value of the spectrum directly, through a new harmonisation measure for a particular use and potentially the value of other substitutable spectrum. We should recognise, however, that industry adoption of harmonisation tends to influence spectrum value more significantly than mere regulatory harmonisation; and
 - Bi-lateral agreements with neighbouring administrations on changes of use of spectrum can also make spectrum more or less valuable depending on the use agreed.

6.39 We would also expect that stakeholders would continue to be proactive in identifying evidence of some or all of this type if they feel their fees are out of line with the spectrum value. However, as previously indicated in the above section, we would expect the onus to collect this evidence to be primarily Ofcom's responsibility.

6.40 In the case of cost-based fees, if our cost base were to change materially from that on which we set fees this would indicate a need to review fee levels.

We normally consult with stakeholders on any proposed changes to licence fees to allow them to present evidence and to explain any relevant specifics of their sector

6.41 As indicated in the consultation document and provided below as Figure 6, our normal process for undertaking fee reviews always includes consulting with stakeholders on our proposals. During such consultations we encourage stakeholders to provide us with evidence and information that should be considered when making our decision.

Conclusion on Question 5: process to prioritise fee reviews

6.42 The majority of responses agreed with our proposals on prioritising fee reviews, although many were keen for us to be more transparent. We agree that we should be as transparent as possible when determining the priority of fee reviews.

6.43 In addition, as discussed in paragraph 4.260, we recognise that it is important that we have regard to the impact on the promotion of innovation of any fee increase that sought to quickly reflect the additional opportunity cost of spectrum created by such innovation. Therefore, we will also take this into account when deciding whether and how to review a specific fee level.

- 6.44 We have concluded that going forward we will decide what fee review should be prioritised on the basis of the decision process outlined in our consultation document and illustrated in figure 7 above.
- 6.45 We will therefore adopt pricing review principle 2 below as part of our Framework for spectrum pricing.

Pricing review principle 2: process to prioritise fee reviews

Step 1 - Is there evidence to indicate that fees are out of line with opportunity cost or our costs of spectrum management? In order to decide whether or not a particular licence fee needs to be reviewed at a particular time, we will first look for evidence of a sufficiently material misalignment of the fee and the relevant opportunity or spectrum management cost. This is because severe misalignment may indicate that fees at the present level are unlikely to be achieving our objectives of promoting optimal use of spectrum or reflecting our spectrum management cost;

Step 2 - Is there evidence that a fee change would increase the efficiency of use more effectively than another spectrum management response? As noted before, spectrum pricing is only one of a range of regulatory approaches available to us. There may be other steps we could take such as identifying more spectrum that could be made available for the current use, initiating a planned programme to clear the band for an alternative use, or reviewing the regulations around the spectrum such as international or domestic technical constraints;

Step 3 - Is this the right time to review? We will also be responsive to evidence of an urgent need to change a fee, for example that the existing fee level is causing serious detriment, such as a majority of users unexpectedly vacating a band without realistic prospect of new users taking up the available spectrum - or that a very valuable band is, or is likely to become, severely congested without a change in fee level.

What are our current priorities for fee reviews?

- 6.46 In our consultation document, using the process that we proposed and have now concluded on for prioritising fee reviews, given above, and the available evidence we discussed what licence sector(s) should be a priority for us to review and asked the following question of stakeholders:

Question 1: Based on our proposed criteria, or other criteria you would propose we use, what do you think our priorities for future fee reviews should be? Please tell us your reasons for thinking these should be prioritised. Do you agree that we should prioritise a fixed link fee review, as some stakeholders have suggested to us?

Most responses that addressed this question agreed that fixed links should be reviewed

- 6.47 BT, C&W Worldwide, David Hall Systems Ltd, a confidential response, and Intellect agreed that fixed links should be reviewed as a matter of priority and as soon as possible.
- 6.48 C&W Worldwide also stated their belief that the present fixed link fees are higher than appropriate given outcome of the 2008 “fixed link” spectrum auction.

- 6.49 A confidential response indicated their belief that the use of fixed links has changed considerably since fees were last reviewed and that the balance of demand and supply had changed significantly both in total and in individual frequency bands.
- 6.50 NATS said that although they had no strong views, the lack of any geographic variation in the fixed link algorithm would make it a candidate for review.

One response argued against a fixed link review as they disagreed that the auction results cited were evidence that fees were misaligned with market value

- 6.51 Arqiva disagreed the auction results indicate that there is a misalignment of the fixed link fees or that this needs to be address as a priority. They believed this misconception was probably down to the results of a single auction and that there are risks in attempting to read these across to AIP based licence fees. Instead they cited congestion in business radio and suggested this should be more of a target of a review, rather than fixed links.

Ofcom view

Given the support for a review of fixed link fees we intend to progress with such a review following this Statement

- 6.52 The majority of responses that addressed this question argued for a review of fixed link fees, citing an auction result of what they argued is substitutable spectrum to indicate that these fees are currently set too high compared with the market price.
- 6.53 One response opposing the fixed links review disagreed that the auction results indicated a misalignment of fees. Without undertaking the relevant analysis, as discussed under principle 8 of this Statement it is not possible for us to comment on this assertion.
- 6.54 Having considered all of the responses we decided to undertake a review of the fees of the spectrum bands used by fixed links, subject to the availability of resources and consideration of our overall priorities for spectrum management,

One response argued for a review of 2G

- 6.55 "Three" urged Ofcom to undertake an urgent fee review for un-liberalised 2G and prospective liberalised 2G spectrum, arguing the AIP fee level is materially out of line with the market valuation.

Ofcom view

It would be inappropriate for us to undertake a review of 2G spectrum given that Government has laid a Direction before Parliament on this subject

- 6.56 As we outlined in section 3, Government has a laid a Direction before Parliament to instruct Ofcom how to set fees for 900 and 1800 MHz spectrum. It would therefore be inappropriate for us to review these fees earlier.
- 6.57 As there were no suggestions to add to or change our proposed criteria for prioritising what fees should be reviewed, we conclude that we will proceed on the basis of our proposal.

Conclusion on Question 6: priorities for future fee reviews

- 6.58 Having considered the responses to this question, where the majority argued for a review of fixed links we conclude that we intend to undertake a review of the frequency bands used in UK for fixed links, subject to the availability of resources and consideration of our overall priorities for spectrum management, following the publication of this Statement. This review will encompass all services that share spectrum with fixed links to reflect our intention to price spectrum through consideration of feasible alternative uses, rather than licence sectors.
- 6.59 As outlined under principle 1 (specifically paragraphs 4.53 to 4.54), this review will not be restricted to pricing but will rather be a review of our overall approach to managing these frequency bands and licence sectors.
- 6.60 At this stage we have made no decision on the timing of any increases that might be indicated by this review. Any decreases that may be indicated will be implemented as soon as practicable, as previously discussed in the consultation document, to avoid the risk of pricing out efficient users of the spectrum.

Approach to post-fee review evaluations

- 6.61 In our consultation document we discussed the value of post-fee review evaluations and proposed that we would undertake such reviews in future. We said when we make regulatory decisions we should, as a matter of good practice, evaluate their effects to assess whether they had the effect intended.
- 6.62 In practice, however we argued, we will only be able to evaluate the effectiveness of AIP fees qualitatively and may not be able to draw definitive conclusions. We identified three main reasons why it may not be possible to assess the effectiveness of AIP fees:
- we cannot accurately predict users' reaction to fee changes. As we have already discussed, we do not attempt to predict these in setting fees, because fees are not set to secure specific responses from users but to inform their decisions over time without prejudice to what those decisions are. As a result, we would not have a direct and quantified measure of 'success' in terms of individual users' behaviour;
 - changes in behaviour might not be solely attributable to fees and it can be difficult to isolate the effects of spectrum pricing; and
 - responses to fee changes may take several years, or longer, to become apparent (see Section 3, principle 4).
- 6.63 Since these aspects of fees policy make direct measurement of achievement of objectives difficult, we proposed to approach monitoring in two ways:
- First we will collect and assess evidence that users (individually or collectively) are changing their spectrum requirements, for example by reducing their assignments or returning some altogether in highly congested bands. As discussed above it will not be possible to identify definitively the reasons for these changes but it may suggest that spectrum pricing has had some role in users' changing their use.

- Second, we proposed to identify some broad measures which would indicate that fees were **not** contributing to optimal spectrum use:
 - If congestion and demand in a band or location (from the existing and feasible alternative use) worsens, then our fees may not have been effective in ensuring the most efficient users have access to the spectrum. In considering whether this evidence indicates that a further fee review might be appropriate we would consider other regulatory responses (such as, where possible, making more spectrum available);
 - If, conversely, spectrum is not used, or used only to a small extent, for a considerable time, then our fees may be excluding efficient users. Similarly to the case above, we would consider, alongside a fee review, whether any relevant constraints on the use of the spectrum could be reduced or removed.

6.64 We then asked the following question of stakeholders

Question 7: Do you agree with our proposed approach to post-review evaluations?

Most responses agreed both that post-review evaluations are a good idea and with the general approach proposed in the consultation document

- 6.65 The Met Office, “Three”, David Hall Systems Ltd, Intellect, UK Chamber of Shipping, BPA/UKMPG, STFC, Arqiva, NATS and BT agreed the need for post-review evaluations and with our proposed approach to these evaluations. David Hall Systems Ltd also agreed that changes in behaviour might not be solely attributable to fees and that it can be difficult to isolate the effects of spectrum pricing. They said that this important issue needs to be addressed, but, however, did not provide any suggestions as to how we might address this issue.
- 6.66 ESOA agreed that post-review evaluations are useful.
- 6.67 The Scottish Government agreed with us that it is difficult to assess the effect of AIP on users as “the relevant timeframe” over which one would expect to see such changes in behaviour can be very long particularly for users that have systems installed which are expected to have a lengthy lifespan.
- 6.68 The Met Office added that that they thought that post-review evaluation should be performed as a matter of course and used where necessary to redress fees where valuable socioeconomic services have been restricted or priced out of bands by excessive pricing of spectrum.

Ofcom view

We would expect that before ceasing services that provide substantial wider social value as a result of spectrum pricing that licensees would approach us to discuss their concerns

- 6.69 We agree that post-review evaluations could be useful in identifying if services that are considered to be essential, or provide substantial wider social benefits have been priced out of a band. However, in practice, we would hope that were such services at risk that the licensees involved would discuss their specific issues with Ofcom, as well as with any relevant sponsoring Department or other authority before returning

their licences, including providing us with evidence of their inability to pay, so that we could assess whether there was any alternative action that could be taken.

Two responses argued there is no evidence that AIP achieves its objectives and one suggested that Ofcom should state clearly the circumstances under which AIP would be removed

- 6.70 C&W Worldwide argued that there is no evidence that AIP promotes investment or innovation. Vodafone also argued as there is no evidence of the effectiveness of AIP for mobile cellular spectrum they believe that it is unlikely that it will fulfil its role of securing optimal use.
- 6.71 Vodafone suggested that Ofcom should ask stakeholders to produce Board papers, strategy documents or meeting notes linking AIP to network investment or utilisation before we review mobile AIP. More generally, Vodafone suggested that we should state clearly under which circumstances we would consider that AIP has failed to meet its objectives and should be removed.

Ofcom view

Our proposals to undertake post-review evaluations of fees by monitoring spectrum use is less intrusive than that suggested by one response

- 6.72 We may require information on the impact of AIP on investment decisions to the extent that this information is needed for statistical purposes⁴⁹ and as long as such a request for information is proportionate to the use to which the information is to be put in the carrying out of Ofcom's functions⁵⁰.
- 6.73 Vodafone has suggested that we should require mobile operators to disclose board meeting notes, strategy documents and other meeting notes. We note, however, that we may inform our assessment of the impact of AIP on investment decisions by using less intrusive means, such as looking at the trend of the demand for spectrum over time, as we did for the first evaluation report.

We agree that post-review evaluations should consider the continuing role for AIP, but cannot provide here general indicators that AIP is no longer required

- 6.74 On the issue of providing clear guidance as to the circumstances in which we would consider removing AIP, as we discussed in some detail in Annex 6 of the consultation document, and we summarised in this document under principle 5, Ofcom has previously accepted that there would be no need for AIP to encourage efficient use if:
- spectrum were a freely and efficiently traded good, with sufficient liquidity and transparency that there was good information in the market about prices, and those prices were a good reflection of market value; and
 - all users of spectrum had to acquire the spectrum that they wanted through the market.

⁴⁹ See section 32 of the Wt Act.

⁵⁰ See section 32(3)(b) of the WT Act.

- 6.75 Under principle 5 we have also indicated our reasoning for why an assessment of whether or not spectrum markets are fully effective needs to be done on a case by case basis. Given the very different nature of each of the spectrum markets it is not possible within an overall spectrum pricing Framework to indicate the exact circumstances that would lead us to conclude that a market is fully functioning and therefore we should consider the removal of AIP.

Conclusion on Question 7: post-review evaluations

- 6.76 Given the positive stakeholders response we received to this proposal we intend to proceed to include this as one of our Pricing Process principles
- 6.77 We therefore conclude that we will adopt a new pricing review principle 3 given below as part of our Framework for spectrum pricing.

Pricing review principle 3: post-review evaluations

We will attempt to evaluate the effectiveness of fee rates based on AIP. We will do this by collecting and assessing evidence that:

- users (individually or collectively) are changing their spectrum requirements, or
- congestion and demand in a band or location is worsening, or
- spectrum is not used, or used only to a small extent, for a considerable time.

Annex 1

List of respondents to the consultation

Arqiva

British Ports Association and UK Major Ports Group (BPA/UKMPG)

British Telecommunications plc (BT)

CAA

Cable & Wireless Worldwide (C&W Worldwide)

David Hall Systems Ltd

European Satellite Operators Association (ESOA)/SAP REG/GVF

Federation of Communications Services (FCS)

Hutchison 3G UK Ltd ('Three')

Inmarsat

Intellect: The Trade Association for the UK

International Air Transport Association (IATA)

Joint Radio Company Ltd (JRC)

London Bus Services Ltd and London Underground (LBS and LU)

Met Office

Ministry of Defence (MoD)

NATS

Science and Technology Facilities Council Rutherford Appleton Laboratory (STFC)

Telecommunication Association of the UK Water Industry (TAUWI)

Telefónica O2 (O2)

The Scottish Government

Transfinite Systems Ltd (Transfinite)

UK Chamber of Shipping

Vodafone

Seven confidential responses

Electronic copies of the non-confidential responses to this consultation can be found on Ofcom's website <http://stakeholders.ofcom.org.uk/consultations/srsp/?showResponses=true>

Annex 2

Issues related to specific licence sectors

A2.1 The following issues were raised by responses that are so specific to the individual licence sector that they cannot be addressed within this general Framework, or are non-pricing issues that this consultation did not address. These comments have been passed to the relevant business unit in the Spectrum Policy Group of Ofcom and will be considered as and when the fees for these licence sectors are reviewed.

Licence class/sector	Stakeholder Comments
Fixed Links	Transfinite strongly disagree with the statement in A8.27 that implied that the auction price was the primary determiner for the price of fixed link assignments.
	Arqiva indicated they have sympathy that there is no geographical factor in the FL algorithm.
Fixed Wireless – Scanning Telemetry	<p>TAUWI, on behalf of the Water Industry, requested a special case for a reference rate for water industry use of spectrum noting that;</p> <ul style="list-style-type: none"> • they were unclear as to which higher value users could use the spectrum in the UHF band currently allocated to the Water Industry, and whether those users would pay the mobile reference rate for the band; • that their use was 'mission critical' and that alternative delivery mechanisms were not always available (e.g. fixed line); • the national UK reference rate as applied, does not account for the rural/remote nature of their stakeholder operations. • that because of their distinct use, in the band, that opportunity cost is met in this instance, although they acknowledge Ofcom's aims in keeping fee structures simple and transparent.
Mobile Cellular in 900 and 1800 MHz Business Radio, including the emergency	<p>"Three" suggested that Ofcom should not wait for the combined 800MHz and 2.6GHz mobile spectrum auction to take place before specifying the framework for setting AIP fees on 900MHz and 1800MHz spectrum, as this would add uncertainty and distort the auction process.</p>

<p>services</p>	<p>BT argued that trading values may be a better indicator of marginal value and auction outcomes a better indicator of full market value.</p>
	<p>“Three” stated that they did not agree that the process for post-review evaluations has been adequately applied in the case of mobile spectrum.</p>
	<p>FCS [stakeholders] reflected, on a number of fronts, that spectrum auctions are not see as appropriate for the sectors they represent;</p> <ul style="list-style-type: none"> • Stakeholders could not afford the high prices likely at an action. • A number of the stakeholders are Government funded and therefore, they argue, it is difficult for them to raise funding for participation in spectrum awards. • Linked to the above: where Government bodies did participate in awards that this involvement; “would be subject to challenge from the other participants”
	<p>Network Rail suggests that AIP has been misapplied to their GSM-R licence. They reference statements in the con doc around; Efficiency, External Constraints, Commercial Drivers, Benefits to Society and Current and Future Alternative Uses.</p>
	<p>The Scottish Government argued that the business radio area licence should recognise regional congestion and include greater granularity in the fee levels. They also argued that if a band is classified less popular, AIP may not be needed and that there is insufficient granularity between the most and least, popular business radio bands.</p>
	<p>The Scottish Government made specific reference to the auctions; at 412 MHz and L-band, saying that this indicated that fees for similar spectrum are too high.</p>
	<p>FCS made mention of the; DECT guard band and UHF2/412 MHz, auctions. They reflected that they feel that the latter was poorly designed, and add that due to the time that has passed following both awards, results of these would not be useful, in any review of licence fees.</p>
<p>Satellite</p>	<p>C&W said that the price of spectrum used by satellites is determined by the operators not the regulator arguing that this will be set based on what the satellite operator thinks the market can bear. They explained that where congestion for satellite spectrum is high then the access charges charged by the satellite operators are similarly high. They argued therefore that it would be</p>

	<p>important that when regulators set licence fees for service providers (i.e. PES licensees) that they don't set them at a level that in combination with access charges renders service provision uneconomical within that territory.</p>
	<p>Intellect added that, in particular, satellite operators have world-wide public service obligations for which it is unlikely that a subsidy exists or will be created and that therefore they believe that AIP, therefore, should not be applied.</p>
	<p>ESOA argued that satellite users and broadcasters should not be charged AIP as charging AIP will reduce the uptake of safety services provided over satellite leading to a reduced safety of life and will act as a disincentive for the provision of TV programming that is beneficial and often essential to the circulation of critical information to all UK citizens, as well as foreign communities within the UK. They went on to argue that satellite will often be the only platform able to reach isolated or underserved areas as well as ships at sea and aircraft and that it plays a vital role in ensuring social, economic and national cohesion in addition to public security.</p>
	<p>ESOA also said that the when setting fees it was important to take account the public good attached to spectrum for cross-border services such as satellite.</p>
	<p>ESOA argued that the inclusion of feasible alternative uses in calculating AIP fees is wholly inappropriate for spectrum used or available to satellite use.</p>
	<p>Inmarsat argued that AIP, implemented as it is, at a national level is not an effective incentive for the efficient use of spectrum for satellite systems due to their international characteristics.</p>
	<p>ESOA argued that AIP was not appropriate for satellite use of spectrum because they said strong market forces already stimulate efficient spectrum use by the satellite sector as the use of satellites is charged on a per MHz basis. Even if deemed attractive from a theoretical perspective, they argued AIP can never achieve its intended goals in practical situations and is therefore likely to have significantly negative consequences on the satellite sector. Indeed they argued it would act as a disincentive to optimal use in short and long term as satellites would cease to use it in UK.</p>
	<p>Inmarsat argued that the destabilising effect caused by the application of principle 3 has the potential to deter investors who require a level of regulatory certainty in order to realise a return on investment over the</p>

Maritime	15 years of a satellite
	UK Major Ports Group (UKMPG) and British Ports Association (BPA) indicated that they believe that there is an opportunity for Ofcom to liberalise maritime VHF spectrum, through international negotiation on how CSR International channels are used making their use more efficient and permitting the release of some spectrum.
	UKMPG/BPA expressed the opinion that Ofcom had dismissed the ports claims that there are inconsistencies in the justifications given, by Ofcom, for the application of AIP to CSR(I) ⁵¹ channels on the basis that the increase is relatively modest. They also say that these two issues are not forgotten by the industry and will be readdressed when there are further fee reviews.
	UKMPG/BPA make a number of arguments around CSR(I) channels;
	<ul style="list-style-type: none"> • using the concept of “assignments” for CSR(I) ports channels is flawed.
	<ul style="list-style-type: none"> • efficiency of the CSR(I) band can only be achieved through international negotiation and better management by the regulator.
	<ul style="list-style-type: none"> • the referenced rate for CSR(I) is “very arbitrary” and lacking in any mathematical justification.
	<ul style="list-style-type: none"> • there is no marketable alternative for the internationally assigned CSR(I) channels.
	BPA/UKMPG said they thought that Principle 3 is simplistic and unsatisfactorily prescriptive. Firstly because the concept of congestion they believe is inherently flawed in its application to Maritime and secondly because they argue it fails to recognise that spectrum in the maritime international VHF band does not only need to be protected for use by neighbouring countries but also in contiguous waters where international shipping may be operating. Finally they argue it ignores the impact of geography as UK is an island nation where no one part of the country is far from the sea and the potential to reassign maritime VHF to alternative use is very limited.
UK Chamber of Shipping and BPA/UKMPG did not accept that congestion was an appropriate indicator of demand for maritime	

⁵¹ CSR(I) refers to Coast Station Radio (International), which is a coastal based radio service that is used to communicate with international shipping.

Aeronautical	channels.
	<p>The CAA argued that aeronautical spectrum is needed to meet operational and safety requirements that are coordinated and harmonised within both a national and international framework. The frequencies are implemented to support approved services in relation to the specific nature of the operational environment. As a result, an individual service provider has little, if any, flexibility to make changes to frequency requirements without jeopardising their operation. Therefore pricing is extremely unlikely to deliver any efficiency benefit within aeronautical spectrum.</p> <p>IATA argued that to ensure safe and regular, harmonised worldwide operations, aviation is outside of the realm of potential pricing schemes and thus should not be included in the Framework. They argued further that pricing in this case would achieve nothing but an increase in revenue to the UK Government.</p> <p>NATS stated that as they have said in previous Ofcom consultations they do not agree with the principle of AIP being applied to spectrum used by aviation.</p>
	Space Science
<p>STFC added that they wanted it to be made clear that Science will suffer if the costs of AIP fees are not fully compensated for by increases in grants and further argued that in many cases it is not likely to be practical for them to tie down the requirements for individual spectrum bands to a specific science project, research body, or even to a specific scientific discipline leading to them having to pay the fees and being unable to pass these on to the individual users.</p>	
Other Issues	<p>Arqiva suggested Ofcom exit the spectrum market for business radio and fixed links therefore allowing SMOs move use onto a more efficient footing.</p>
	<p>A confidential response noted that the use and definition of congestion is sector specific and indicated that they believe that further thinking on the definition and measurement of congestion is needed.</p>
	<p>Transfinite expressed the view that Ofcom should also consider, as a strategic objective, the transfer of management of more bands to SMOs that would be able to set prices according to market principles.</p>

	<p>David Hall Systems Ltd said that they understood that there have been some questions about “Ofcom powers to apply telecommunication policies such as spectrum pricing to other non-telecommunications sectors”. Mr Hall argued that this issue needs to be addressed and resolved to ensure the wider policy objectives are met.</p>
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Annex 3

Glossary

AIP	Administered incentive pricing – setting charges for spectrum holdings to reflect the value of the spectrum in order to promote optimal use of spectrum
Allocation	Use of a frequency band. Entry in the table of frequency allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radio communications services or the radio astronomy service under specified conditions. This term is also applied to the frequency band concerned
Assignment	Authorisation given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions
Avoidable cost	The cost that would not be incurred if the activity in question ceased
Band re-planning	Revising assignments in a band to release a block of spectrum
Band sharing	Fitting a new use in a band in the ‘white spaces’ between assignments for the existing use
BIS	Department for Business, Innovation and Skills
EU	European Union
Exemption	Exemption from the requirement to hold a licence in order to use specified radio equipment, granted by Ofcom under regulations
Frequency Band	A defined range of frequencies that may be allocated for a particular radio service, or shared between radio services
GHz	Gigahertz – unit of frequency equal to one thousand MHz
Harmonisation	The identification of common frequency bands throughout a region (e.g. Europe) for a particular application and, in some cases, technology
Hz	Basic unit of frequency – one hertz is equivalent to one cycle per second
IA	Impact Assessment
Interference	Unwanted disturbance caused in a radio receiver or other electrical circuit by electromagnetic radiation emitted from an external source

ITU	International Telecommunication Union - the United Nations agency for information and communication technology responsible for developing and publishing the international Radio Regulations
MoD	Ministry of Defence
MHz	Megahertz – unit of frequency equal to one million Hz
Ofcom	Office of Communications. Ofcom is the independent regulator for the UK communications industries, with responsibilities across television, radio, telecommunications and wireless communications services
Opportunity cost	The cost of a decision or choice in terms of the benefits which would have been received from the most valuable of the alternatives that was foregone
Radio Regulations	International Radio Regulations made by the ITU, which have the status and force of a treaty, allocate frequencies globally to various applications and deal with cross-border interference
Radio spectrum	The portion of the electromagnetic spectrum below 3000 GHz used for radiocommunications
RSA	Recognised Spectrum Access
Spectrum	The range of electromagnetic radio frequencies from LF frequencies to x-rays and gamma rays
Spectrum liberalisation	Removal of unnecessary restrictions from licences and RSA to allow holders greater flexibility to change how they use spectrum
Spectrum trading	Ability of spectrum users to transfer rights and obligations under spectrum licences or grants of RSA to another person in accordance with regulations made by Ofcom