Vodafone's response to Ofcom Consultation

Annual Licence Fees for

900 MHz and 1800 MHz spectrum

January 2014

Executive Summary

Vodafone welcomes the opportunity to comment upon Ofcom's proposals to revise the annual fees payable for 900 MHz and 1800 MHz spectrum.

Ofcom begins its consultation document with reference to the Direction[1],made by the Government in 2010 that it shall revise those sums payable for 900 and 1800 MHz spectrum, to *'reflect the full market value of the frequencies in those bands'* and, in doing so, *'have particular regard to the sums bid for licences in the 4G auction'* ('the Auction').

However, this is not a straightforward task. It is widely recognised that Ofcom cannot mechanistically deduce the full market value of 900 and 1800 MHz spectrum from the sums bid in the Auction for other spectrum. Rather, it must first decide which sums bid are relevant to any determination of the 'full market value' of the spectrum in the Auction. Then it must consider how those values might translate into market values of 900 and 1800 MHz spectrum, as that spectrum was not part of the Auction.

Ofcom must, of course, also have regard to other aspects of the Direction, notably its explicit purposes as well as to its other duties under EU and UK law which not only are not (and cannot be) excluded by the Direction, and which must be taken into account when interpreting it. Key among these are: furthering the interests of consumers and citizens, maximising the coverage of next generation wireless mobile broadband services, creating greater investment certainty for operators and ensuring optimal use of spectrum.[2]

Instead, **Ofcom proposes to take over £300m out of the UK mobile industry every year - more than £8bn over 20 years based upon a flawed approach to limited evidence and with no analysis of the potential impact of its decision upon consumers, coverage or investment certainty**.

Vodafone's position, in summary, is that:

Ofcom's present proposals are based on serious and deep-seated errors of assessment which conflict with its legal duties. These errors are profound and cumulative. They concern, among other things:

a) Incorrect inferences from the UK auction of the 'full market value' of 800MHz spectrum due to fundamental conceptual errors in approach and failure to correct for the distortive impact of the particular UK auction design;

b) Further errors in Ofcom's attempt to translate the market value for 800MHz into market values for 900 MHz and 1800 MHz spectrum;

c) Mis-application of international benchmark data through a failure to properly consider specific factual differences between the UK and other markets. Closer scrutiny demonstrates that international comparisons have less to contribute to understanding absolute market values for spectrum in the UK, but can shed useful light on relative values of 800 MHz vs 900 MHz spectrum;

d) Insufficient regard to the fundamental policy goals embodied in the Directive itself and in Ofcom's wider statutory duties outlined above;

e) Failure to recognise and properly evaluate the asymmetric nature of risk for fulfilment of statutory duties by (inadvertently) setting ALFs above or below true market value. We

[1] The Wireless Telegraphy Act 2006 (Directions to OFCOM) Order 2010 3024 of 20 December 2010
[2] See further Vodafone's legal analysis of Ofcom's proposals at Annex 1

show that the risks and harm resulting from setting ALFs above market value are systematically more serious for the achievement of Ofcom's legal duties and policy goals than those associated with 'undershooting' full market value; and

f) Failure to carry out a proper impact assessment that complies with Ofcom's own guidelines (and general best practice) by reviewing a range of policy options against a counter-factual.

For all these reasons, the current consultation proposals are fundamentally flawed - to such an extent that the only remedy is to run a fresh consultation that makes good the manifest deficiencies in the current analysis, enabling transparent, well-reasoned decisions following an open process.

These issues are set out in further detail below and in the body and annexes to this response.

Introduction

Full market value in the Auction

Ofcom correctly defines the concept from the Direction of 'full market value' as the market clearing price when supply equals demand but then fails to properly apply this concept to the evidence before it.

To properly apply its conceptual framework, Ofcom needs to consider carefully the degree to which the Auction was capable of revealing the *'full market value'* of spectrum. The Direction does not assume that the appropriate market value is directly observable from the Auction. Nor does it relieve Ofcom of the obligation to carefully assess the evidence and draw the correct conclusions from it. *'Having regard'* to the sums bid in the Auction does not mean that they all must or can be given the same evidential weight.

The price at which supply equals demand is that which the highest losing bidder or 'marginal excluded user' is prepared to pay for a given increment of spectrum. This is lower and not the same as the price a winning bidder is prepared to pay. Therefore, deriving 'full market value' from the UK auction data requires that Ofcom first determine who the marginal excluded user is and then to determine the relevant marginal increment of spectrum. Ofcom has failed to do either, even though the Direction clearly leaves this responsibility with it.

Ofcom falls into error when it fails to recognise that particular rules adopted for the Auction – namely the opt in rules and the level of reserve prices – are likely to have distorted the bids of participants and the prices paid in the Auction in ways which make derivation of market values more difficult. By failing to take these effects into account, the results Ofcom derives from its Linear Reference Pricing ("LRP") approach demonstrably do not reflect market values for 800 MHz spectrum, thus failing to meet the express requirement of the Directive.

Instead, a proper consideration of the current and potential users and uses of low frequency spectrum shows that the sums bid by EE for an incremental 2 x 5MHz of 800 MHz spectrum provide the best indication of the market value of 800 MHz spectrum that can be derived from the Auction. Neither Vodafone nor O2's values are revealed by the bids, but it is likely and logical to assume that their valuation of additional low frequency spectrum will be lower than EE's and the Auction reveals that EE's valuation for additional spectrum is higher than H3G and all new entrants.

EE's bids appear to include some 'contiguity premium' which reflects the additional value EE believed it would derive from holding 2x10 MHz as opposed to 2X5MHz of LTE spectrum and a 'strategic premium' arising from the benefit it would derive from excluding others from doing the same. These considerations do not apply to other increments or other spectrum such as 900 MHz, particularly after taking account of what EE won in the Auction. This means that the EE's bid values must be adjusted to derive a generic low frequency spectrum market value.

Once this is done, it is EE's bids which provide the best estimate of 'market value' for 800 MHz spectrum which we estimate lies between **£17.9m and £21.5m per MHz**. Ofcom then needs to use this and the market value of 2.6 GHz spectrum to estimate market values for 900 MHz and 1800 MHz.

Translating Auction results into values for 900 MHz and 1800 MHz

Ofcom has used a range of international benchmarks in an attempt to (i) derive absolute market values for 900 MHz and 1800 MHz spectrum from other markets; and (ii) derive the relative value of 900 MHz and 1800 MHz spectrum from values of 800 MHz spectrum and 2.6 GHz in order to apply these ratios to the values of spectrum which is derives from the Auction.

Ofcom is right to consider that international benchmarking can assist in deriving the market value of 900 and 1800 MHz spectrum in the UK which cannot be directly observed but its attempts to do so are fundamentally flawed.

Ofcom fails to recognise that, as with the Auction, results derived from other auctions may not reveal the market value of spectrum in those auctions due, for example, to their particular auction rules. Ofcom is wrong, for example, to assume that spectrum which clears at reserve prices provide a lower bound estimate of market value, when it is clear that these results instead reveal only an upper bound.

It further fails to consider differences in important drivers of spectrum value which mean that absolute values in other countries, even if indicative of market values in those countries, do not necessarily provide good evidence for market values in the UK. Ofcom fails to consider differences between those countries and the UK associated with: (i) profitability, (ii) voice vs data demand and (iii) urbanisation, all of which are likely to significantly affect spectrum market values.

Ofcom's approach therefore suffers from a major flaw as it attaches weight to auction results which either do not reveal market values or which reveal values which have little relevance to the UK. Had it approached this task rigorously, it would have found that international benchmarks have serious limitations in informing the absolute market value of 900 or 1800 MHz spectrum in the UK. Thus, it commits an error in placing reliance on international benchmarks of absolute value to determine absolute values in the UK.

Ofcom also relies upon international benchmarking to establish the relative value of 900 MHz spectrum from values of 800 MHz spectrum in markets where both have been auctioned together. Ofcom finds that 900 MHz spectrum is valued at between approximately 60% (Ireland) and 80% (Spain) of the value of 800 MHz spectrum.

However, the ALF Ofcom ultimately proposes for 900 MHz spectrum is valued at 83% of 800 MHz spectrum. This is higher than any of the ratios implied by Ofcom's own international benchmarking results. Ofcom presents no reasoning whatsoever for choosing a value outside the range of its own benchmarking evidence.

Vodafone believes that international benchmarking, properly undertaken, can reveal useful evidence about the relative values of 800 and 900 MHz spectrum to inform the market value of spectrum in the UK. Vodafone shows that the relative value derived from Ireland is the most reliable evidence of relative value as it reflects prices paid above the reserve price, unlike the relative values derived from Spain, Romania or Portugal, Ofcom's other reference points.

- This evidence must then be supplemented by direct UK evidence to determine where within the benchmarked range the UK is most likely to lie. Ofcom has failed to this, despite previous assurances that it would do so; and

- Work previously undertaken by Ofcom including cost modelling suggests a relatively greater discount should apply in the UK.

Moreover, Ofcom is seeking to derive values for spectrum some time after it has been auctioned. This means that, having derived values of 900 and 1800 MHz spectrum based on evidence and analysis of the valuations of marginal excluded users at the time of auctions, Ofcom must also consider whether and how such values are likely to have changed post-auction until the date it revises the annual fees. It did not do so.

Applying international benchmarks suggests UK auction values should translate into values for 900 MHz between **£12m and £15.9m** per MHz and for 1800 MHz between **£6.3m and £12.5m** per MHz.

Consideration of the purposes of the Direction and Ofcom's other legal duties

Then, Ofcom must consider how any estimation of full market value should be applied in light of the objectives of the Direction and its broader statutory duties.

Ofcom has failed to consider how it should have regard to 'creating greater investment certainty for operators', as required by the Direction. Vodafone contends that such 'certainty' requires that fees be set for a considerable period in advance, allowing operators certainty about what the levels of fees they will face in the future to allow them to manage their businesses accordingly. Vodafone contends that this is perfectly consistent with the requirement that fees 'reflect' full market value.

Ofcom is therefore required to set fees for a considerable period into the future, recognising that full market value may change during the period. Vodafone shows that there are many reasons to believe that market value of 900 and 1800 MHz spectrum will fall in future, relative to any fixed value derived from the Auction or international benchmarks. Ofcom must take this into account when setting fees for the period as frequent revaluations will, by their very nature, undermine investment certainty and lead to under-utilisation of the spectrum.

In addition, Ofcom has failed to consider properly the risks to investment and coverage which arise from setting ALF above full market value. Ofcom is expressly required by the Direction – and by its broader duties – to do so.

Ofcom failed to consider and mitigate these risks because it appears to be under the misapprehension that its estimates of full market value are well founded and any risk that the resulting fees might exceed true market value is therefore small. Yet it is clear that deducing market values for 900 and 1800 MHz spectrum from bids for a different spectrum frequency or from bids in other markets to derive market values in the UK – is bound to involve a significant risk of error, however rigorously undertaken.

Moreover, Vodafone shows that Ofcom was not sufficiently rigorous in any event and that much of the evidence on which Ofcom relies has been misinterpreted. The risk that fees might exceed true market value is, therefore, not small, as Ofcom supposes.

Ofcom dismisses the possibility that high ALFs could lead to spectrum being relinquished and lying fallow, based on an incorrect assessment of the level of uncertainty in estimating market value. Evidence from spectrum awards in other jurisdictions including Portugal and Spain show that regulators can and do mis-estimate market clearing prices for similar spectrum, with the attendant welfare losses when spectrum is not in use.

Ofcom is also wrong in its assessment of the asymmetric nature of the costs associated with setting ALF above market value as compared to setting ALF below market value. Even if the costs were in fact symmetric, as Ofcom claim, a proper consideration of Ofcom's broader duties would require it to err against setting fees above market value rather than below it. This is because setting fees above market value undermines investment certainty and does not maximise coverage, for which Ofcom must have particular regard under the Direction, whereas inadvertently setting them below market value does no such thing.

Vodafone shows that the neither the size of the costs of error nor the likelihood of them arising are, in any event, symmetric. The costs arising from setting fees above the market value clearly exceed those from setting them below it. Spectrum trading can mitigate any inefficient allocation of spectrum which might arise from ALF being below market value, whereas the costs of unexploited spectrum resulting from ALF being above market value are far less easily overcome.

Ofcom has failed to undertake any form of impact assessment to quantify the consequences of its proposed fees for investment, coverage, prices or another of the other factors to which it is required by law to have regard. It has further failed to properly consider any mitigation to such consequences such as the introduction of fees by glide-path which is its standard approach in circumstances where a regulatory change could otherwise cause a detrimental 'profit shock.'

Given that the risks of setting fees above true market value and the costs of doing so are both greater than Ofcom suppose, Ofcom is wrong to disregard these risks when assessing the overall evidence. Proper consideration of their duties would lead Ofcom to set fees near the **bottom end of any range of values** (provided those values are first derived correctly).

Finally, Ofcom is right to seek to convert lump sum values into annual fees in a way which makes operators 'indifferent' between those payment options. However, Ofcom singularly fails to do so. We also find serious errors with the manner in which Ofcom proposes to implement these changes to ALFs.

Conclusion

The current Consultation manifestly fails to discharge Ofcom's duties in respect of transparency and the reasoned exercise of its judgment. Therefore, before Ofcom can proceed with any proposals on spectrum fees, taking due account of the points made by Vodafone and other respondents to this Consultation, we believe Ofcom must re-consult. In particular, it must:

a) Carry out an impact assessment that complies with Ofcom's guidelines, outlining a number of policy options;

b) Undertake a full re-consultation on this range of options, recognising that Ofcom should be seeking to establish an ALF which balances the maximum productive benefits (lower prices and maximum investment) with allocative efficiency (optimal use of spectrum);

c) Explain transparently why and how the figure proposed by Ofcom within that range best meets its duties and obligations under the relevant EU and UK law; and

d) Set out a proper explanation of whether Ofcom believes that the net effect of these proposals is to further the interests of consumers or, if not, how Ofcom considers it is nonetheless obliged to introduce them but has done so in a way to minimise any detrimental impact.

The impact of Ofcom's proposals cannot be understated. As noted, its proposal would, as they currently stand, take more than £8bn out of the UK mobile telecommunications industry over the next 20 years. Recognising the vital role the industry plays in delivering economic growth and the connectivity which is central to the lives of virtually all UK citizens, Ofcom needs to be sure its proposals are backed up by a robust scrutiny of the evidence which is currently lacking. It must make sure it is not taking value out of a competitive industry which could be better put to work in improving mobile coverage, speed and services for consumers.

The rest of this response is structured as follows:

Section 1 sets out the framework of what Ofcom is (or should be) seeking to do and the evidence it has to inform its decision;

Section 2 considers what inferences of 800 MHz value Ofcom can properly draw from the UK auction;

Section 3 considers what inferences of 900 and 1800 MHz value Ofcom can properly draw from international benchmarks;

Section 4 describes further evidence which Ofcom must consider (but has currently ignored) to properly translate any of this data into a UK context;

Section 5 considers the implications of Ofcom setting ALF (inadvertently) above or below true market value and likelihood and quantum of consumer harm in that context; and

Section 6 considers issues with translating lump sums into annual costs and other issues of implementation.

Further details are provided in the Annexes below.

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2	Deriving market clearing prices for 800MHz spectrum from the UK 800MHz/2.6 GHz Auction	January 2014
3	Observations from the UK 800MHz and 2600MHz auction 2013	July 2013
4	Critique of Ofcom's International Benchmarking Analysis	January 2014
5	Critique of Ofcom's International Benchmarking Analysis- Case Studies	January 2014
6	Spectrum Benchmarking - additional information provided to Ofcom arising from a meeting 3rd May 2013 between Ofcom and Vodafone	May 2013
7	Assessing Ofcom's conclusion of whether there are asymmetric risks in setting the appropriate level of ALF	January 2014
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1. Ofcom is seeking to establish a value for 900 and 1800 MHz which is unobservable directly

In this section we show:

a) The definition of 'full market value' must directly take into account how ALFs can promote the optimal use of spectrum and cannot be set any higher than necessary to meet this objective.

b) ALFs can promote efficiency enhancing re-allocations of spectrum at the margin where the value generated by the current holder for an increment of spectrum is less than the opportunity cost from excluding another potential user.

c) Therefore, the correct market value to set ALF to achieve the optimal use of spectrum and the fundamental purpose behind spectrum charging is the marginal (or incremental) market value, which is the opportunity cost of the marginally excluded user for an incremental spectrum block.

d) Therefore, the derivation of the appropriate level of market value cannot be reduced to one of estimating 'generic' or 'average' market values, as Ofcom has sought to do.[3] Thus, to apply the correct conceptual framework in line with its duties, Ofcom must consider the value of the appropriately defined increment of spectrum, which will require forming a view as to the likely identity of the marginally excluded bidder and/or excluded use for that spectrum.

e) Ofcom's current approach, based on average values for large blocks of spectrum is very likely to set ALFs above the incremental market value, leading to spectrum being relinquished and remaining unused or imposing additional costs on operators without any additional benefit in respect of ensuring optimal use of spectrum.

1.1 The task before Ofcom

It is worth setting out up-front the task before Ofcom:

- it seeks to establish a current market value ("the market clearing price"[4]) for an increment of 900 MHz and 1800 MHz spectrum in the UK today; and

- it seeks to revise spectrum fees payable on that spectrum in a way which meets its legal duties and objectives and 'reflects' that value.

It is obvious, but worth recalling, that neither frequency has been auctioned or traded in the UK (subject to the EE trade of 1800 MHz spectrum to which we refer below) and so Ofcom is required to rely upon indirect evidence to derive values. This fundamentally increases the rigour with which Ofcom needs to scrutinise the evidence it does have. Available evidence (of which Ofcom proposes to rely on the first two only) includes:

a) Historic information (February 2013) of UK auction prices for 800 MHz and 2.6 GHz spectrum which can be interpreted to provide some indication of market clearing prices for that spectrum at that time;

[3] See Consultation at 2.11

[4] As set out by Ofcom in the Consultation, the 'market clearing price' when supply meets demand is synonymous with 'market value' so we use the terms interchangeably in this response.

b) Historic information (2010 – 2012) of auction prices for 800 MHz, 2.6 GHz and, in a few cases 900 MHz and 1800 MHz spectrum where that spectrum was auctioned simultaneously in other EU countries;

c) A large body of Ofcom work including cost modelling and technical studies on the relative value and future availability of different spectrum bands in the UK including all of the bands above;

d) A sale (August 2012) of 2 x 15 MHz of 1800 MHz spectrum by EE to 3, the terms of which have not been disclosed publicly and to which Ofcom appears to attach no weight.

1.2 Ofcom's 'proposed approach to revising fees

When describing its proposed approach to revising fees at 2.8 of the Consultation, Ofcom quotes its own words from the First Competition Assessment:

> *"We consider that full market value is the price that would arise in a well-functioning spectrum market. This would be the market clearing price when supply equals demand."*[5]

With this statement, we agree.[6] Such prices can promote an optimal allocation of spectrum, in line with Ofcom's duties as described further in Annex 2.[7]

In applying this framework, the market value will be set, in an auction context, by the highest value unsuccessful bidder; referred to here as the "marginal excluded bidder" or in a non-auction context as the "marginal excluded user" as the case may be. This is, we understand, uncontroversial as it also accords with the approach advocated by DotEcon on behalf of Ofcom.[8]

In each case that Ofcom examines the evidence, it is seeking to establish the (directly unobservable) market clearing price so it needs to ask whether it has good evidence for the higher bound, lower bound or some other intermediate indication of market value. For instance, as we will go on to demonstrate, if an auction clears at the reserve price that price will represent the higher bound of market value; it tells you that at that price there were (just) enough buyers including a 'lowest value successful bidder'. But it does not tell you what the market clearing price would have been absent that reserve price; that is, the value placed upon it by the 'highest value unsuccessful bidder'.

This matters for four important reasons:

First, according to its legal duties and standard economic theory, Ofcom is right that it should be seeking to establish the market clearing price for 900 MHz and 1800 MHz spectrum which represents the lowest price at which the spectrum will be (or will remain) efficiently allocated.

Second, in highly liquid markets (like Vodafone shares) the spread between the bid price (the private value of the marginal excluded bidder) and the ask price (the lowest private value successful bidder) will be very small; (perhaps just 0.1p) so the difference between these concepts of value may not matter much. But in markets with few buyers like mobile spectrum

[5] Consultation at 2.8. Ofcom goes on at 2.9 to make it crystal clear *"that remains our view and is the basis upon which we have developed the proposals in this document."*

[6] This is with the proviso that, given the combinatorial nature of spectrum there may not be a unique set of band specific prices at which the market clears.

[7] For the avoidance of doubt, we strongly disagree with Ofcom's second bullet point in 2.8 regarding the setting of any estimate conservatively as will be addressed in Section 5 below.

[8] "Prices paid in the primary assignment of radio spectrum through an effective and competitive auction process should provide a good indication of market values with the market clearing price generally being determined by the valuation of the strongest loser." International benchmarking of 900 MHz and 1800 MHz spectrum value Final Report for Ofcom September 2013 at paragraph 3.

the spread will be wider. Thus, every pound Ofcom takes out of the spread by setting ALF higher than it needs to without improving allocative efficiency (ie. in legal terms, 'ensuring optimal use of spectrum') it will be reducing productive efficiency by taking real money out of a competitive industry that could otherwise use it to benefit consumers in terms of lower prices, greater investment or innovation.[9]

Third, this distinction underlines the central importance of carefully considering the impact of reserve prices on all auction-derived evidence. If the 'lowest value successful bidder' has a private value higher than the reserve price it will pay that reserve price. This does not, however, give Ofcom direct evidence of the 'true' market clearing price[10] which, without the distortion created by that reserve price, would have been set by the marginal excluded bidder. This is true even if all the spectrum in that auction was successfully sold.

Fourth, as the value of mobile spectrum is combinatorial in nature, the value of an increment of a spectrum to each operator is highly dependent on that operator's other spectrum holdings. As a result, the value of a marginal block of spectrum is very likely to differ substantially from the price operators were willing to pay for large packages of spectrum.

Therefore, identifying the market clearing price in a market with few, differently placed, buyers such as spectrum requires Ofcom to take a view on the marginal increment as well as taking account of the effect of the current distribution of spectrum on potential users' valuations and hence the market valuation.

Despite both Ofcom and Vodafone agreeing that Ofcom should be seeking to identify the market clearing price. Ofcom goes on to state at 2.12:

> *"We propose to estimate a full market value for 900 MHz and 1800 MHz spectrum that reflects the inherent value of the spectrum covered by these licences, but in generic terms – i.e. without seeking to reflect the specific circumstances of the existing licencees, or the uses that current licence holders are making or planning to make of the spectrum. So for example, we are consulting upon linear prices which do not distinguish the market value of one specific size of holding from the market value of another size of holding within each of the frequency bands, nor vary between licencees. We note that doing so would be especially problematic given the scope for trading of spectrum blocks which could cause holdings to be combined or divided."*

At this point Ofcom departs from the clear framework that it has previously elaborated. The market clearing price of spectrum cannot be accurately estimated without due consideration of the factors which Ofcom has explicitly chosen to ignore.

First, it is uncontroversial, as we have already noted, that the market value represents the price at which supply meets demand and will be the highest price offered by the marginal excluded bidder. This marginal excluded bidder is not some hypothetical average or abstract bidder, but is an actual participant in the auction. It is therefore necessary to determine, through careful examination of the bids, which of the participants is (or is most likely to be) the marginal excluded bidder for the purposes of determining the market value of the spectrum in question. Ofcom appear to suggest in the above paragraph that it is not necessary to do this.

Ofcom also seems to suggest in the above paragraph that there is a 'market value' that does not vary between auction participants. This is odd. Each bidder will have a different private value for the spectrum in question. This will necessarily reflect the 'specific circumstances' of the bidder in question, and the use to which the bidder intends to make of the spectrum. Only one of the

[9] See Annex 7 p. 3 et seq.

[10] That is, a 'market clearing price' for 800 MHz and 2.6 GHz spectrum, even before those values are properly translated into market clearing prices for 900 MHz and 1800 MHz spectrum.

bidders – the marginal excluded bidder – will have a private value that produces the market value.

Ofcom's reference in 2.12 to the *'inherent value'* of the spectrum "*without seeking to reflect the specific circumstances of the existing licencees, or the uses that current licence holders are making or planning to make of the spectrum"* is, therefore, confused. Any value in the spectrum can only be considered by assessing the users and potential users for the spectrum and the use to which they might put this spectrum. This gives rise to significant non-linearities and other combinatorial effects as was clearly accepted by Ofcom in the highly complex auction design it chose to ensure an optimal outcome and by the valuations expressed by operators in their bidding. To determine market values Ofcom must put its mind to factors including the potential excluded use / excluded user including operators' existing holdings of spectrum post-Auction as well as the marginal increment of spectrum.

It is these factors which, by definition, set the market clearing price. In particular, this has a profound impact on the way the UK auction results should be properly interpreted.

1.2.1 The potential excluded use and user

We can see that Ofcom has previously recognised the need to consider alternative uses for spectrum when setting market value and ALF. In its July 2012 auction statement it stated it would take account of further information post-Auction on *"the timescales for using 900 MHz spectrum for LTE, including the availability of LTE900 user devices and any development on standards; and… the value of initial deployments of LTE and how this compared to HSPA."*[11]

This is an example of Ofcom considering the evidence for the excluded use of 900 MHz spectrum; is it 2G, 3G or 4G and, if so in what realistic timeframe? Ofcom's claim now that it does not even seek to ascertain the uses to which the spectrum will (or could) be put is a significant failing discussed in detail at Section 4 below.

Similarly, Ofcom may determine that the marginal unit of spectrum would most likely be put to the same use as infra-marginal spectrum but by a different user. Thus, Ofcom must put its mind to the identity of the excluded user in any attempt to determine a 'market clearing price' As noted above, there is no such thing as an 'average' market clearing price- there is one price and it is set by the marginal excluded user's value of spectrum.

1.2.2 Identifying the marginal increment of spectrum

In deriving market values for the purposes of setting licence fees for spectrum, it is clearly necessary also to derive a value for a relevant increment of spectrum. The relevant increment of spectrum will be a minimum quantity which the holder may divest if its private valuation fell below the market value specified by the licence fee. The purpose of spectrum licence fees is to ensure the efficient allocation ('optimal use') of spectrum amongst spectrum holders, and this purpose is ensured by setting a fee in this way.

Ofcom therefore needs, if it is to derive a market value for spectrum that will inform the setting of licence fees, to consider what the relevant increment of spectrum is to be. Again, it is wrong to suggest, as it does in the paragraph cited above, that it can derive a market value without regard to the size of the increment under consideration.

The appropriate increment will depend on the mechanics of spectrum return and on technical standards which set the usable marginal increment. In cases like 900 MHz where the marginal increment is very different for different technologies (2G- 200 KHz, 3G- 5 MHz, 4G- 1.25 MHz) a view of the excluded use will also inform the marginal increment. The option for efficient re-

[11] See A12.50.2

allocation of spectrum is likely to be greater if relatively small increments of spectrum can be returned and reallocated.

Given the difficulty in ascertaining exactly what the marginal increment is, Ofcom goes on to say: *So for example, we are consulting upon linear prices which do not distinguish the market value of one specific size of holding from the market value of another size of holding within each of the frequency bands.*

As operators' spectrum values are not linear, with the incremental value of spectrum typically decreasing with spectrum holdings, this approach risks prices being set according to average prices for large increments of spectrum, such as average prices for packages acquired in the auction, which over-estimate the value of marginal spectrum.[12] The UK auction only gives Ofcom indications of the incremental value for 2 x 5 MHz increments (as these were the relevant blocks offered in the Auction) however Ofcom should recognise and allow for the fact that marginal 900 MHz and 1800 MHz spectrum could well be returned and re-allocated in smaller (less valuable) increments than this.

However, when considering spectrum blocks larger than 2 x 5 MHz, the report at Annex 2 sets out that operators' value will often include premia for improved technical performance which can be delivered by larger contiguous blocks of spectrum beyond the marginal increment ("contiguity premium"), the ability to continue to offer services using existing assets ("sunk costs"); or the ability to exclude other operators from using the spectrum ("strategic premium"). These additional sources of value must, as Ofcom proposes, be stripped out of any estimate of market value for the marginal block.[13]

At the end of 2.12 Ofcom states that will *"not distinguish the market value* [which] *vary between licencees.* This statement is a non sequitur. The market value set by the clearing price does not vary between licencees; only their private values will vary but this is irrelevant to market value.

As noted above, Ofcom's evidence-base currently consists of:

- a now historic UK auction of 800 MHz and 2.6 GHz spectrum; and
- historic absolute and relative values for 800, 900, 1800 MHz and 2.6 GHz spectrum in some other EU countries.

To interpret this data correctly, Ofcom must estimate the appropriate market clearing price for 800 MHz and 2.6 GHz spectrum in the UK removing, as far as possible, any distortions specific to the spectrum being auctioned[14] and the auction rules themselves.

Ofcom then needs to translate these estimated market clearing prices for 800 MHz and 2.6 GHz in the UK into appropriate and up to date estimates of the market clearing price of 900 MHz and 1800 MHz.

It currently proposes to do this by relying solely upon the observed relative valuations of the relevant spectrum bands when auctioned simultaneously in other EU countries. Proper analysis is a more complicated job than Ofcom appears to recognise because, of course, bids and prices paid in those other EU auctions may also reflect the value of large packages of spectrum and specific auction design decisions which obscure the true marginal market clearing price. We have provided a more detailed analysis of drivers of value in each of these auctions to illustrate this point and draw more robust conclusions from the evidence.

[12] Vodafone made this point to Ofcom in the May 2013 paper at Annex 11. See Figure 2 et seq.
[13] See Annex 2 at 1.1
[14] For instance the strategic value of excluding other bidders from 800 MHz spectrum or the value in being able to launch new 4G services which, at that time, were only able to be offered by one operator. See further Annex 11.

Finally, Ofcom needs to consider what developments may have impacted market clearing prices since the UK auction and, more particularly, since the EU auctions upon which it relies, some of which are now more than 3 years out of date.

We start by considering Ofcom's treatment of the data from the UK Auction.

2. UK 4G auction results need to be properly interpreted to give any indication of market values for 900 MHz and 1800 MHz spectrum

In this section we show:

a) The UK market price of the spectrum subject to ALF is not directly observable. Ofcom is forced, therefore, to rely upon indirect evidence which must be properly interpreted to inform its decision. This fundamentally increases the rigour with which Ofcom needs to scrutinise the evidence it does have.

b) In particular, the LRP methodology favoured by Ofcom does not attempt to measure the market value of an appropriate increment of spectrum, which is the correct conceptual approach, but instead attempts to mathematically decompose the opportunity cost of large packages of spectrum into average prices.[15]

c) Even when implementing its flawed LRP methodology, Ofcom has not taken full account of issues such as the impact of reserve prices when estimating market value from the auction outcome. As a result Ofcom has demonstrably over-estimated the market value of 800 MHz spectrum from the auction data.

d) However, a detailed examination of the UK auction data can provide reliable evidence for the incremental market value of 800 MHz spectrum if one accepts that EE is the marginally excluded bidder for low frequency spectrum, which is a very likely and logical assumption.[16]

These points are discussed further below and in Annex 2 to this response.

2.1 Ofcom cannot give greater weight to UK Auction evidence than it can bear

We do not dispute that the 4G Auction, properly interpreted, is an important input to aid Ofcom in its task. However, Ofcom must weigh this evidence critically, just like all the other evidence it considers. We set out in Annex 1 at Sections 4 and 5 why Ofcom cannot unquestioningly give greater weight to the UK auction than other evidence, simply due to the terms of the Direction.

This is clear when one considers that the Direction's requirement to *'have particular regard'* to the sums bid in the 4G Auction was established in 2010 - before the format of that auction was fully defined or known. The Direction does not specify how the Auction is to be conducted, but simply what Ofcom must do after it has been completed. Had the Auction been run differently Ofcom might have been unable to infer any market values from the auction results or, as we show below, had it designed the auction with no spectrum caps and/or much lower reserve prices, it might have been in a position to obtain much better evidence on operators' marginal value of 800 MHz spectrum from the auction. The Direction simply requires that Ofcom must now carefully weigh the evidence that it does have from the Auction in order to determine what, if anything, can be used to derive a view of the market value of spectrum.

Ofcom was fully aware of the Direction when setting the rules for the Auction but appears to have made decisions about auction design and implementation with little or no regard to its post-auction ability to estimate the market clearing price from the resulting bid data. Ofcom is left with the evidence which it does have which, as we show, can give some useful indication of the value of 800 MHz spectrum but which must be interpreted and translated with care into indications of market value for 800 MHz suitable for the purposes of the current consultation.

[15] See Annex 2 at 5.2
[16] See Annex 2 at 5.3

2.2 The reserve prices and opt-in rules have obscured the true market clearing prices and affected the conclusions Ofcom can properly draw from the UK Auction

The UK auction had a number of features which meant that bids did not properly reflect potential users' incremental private values for the marginal unit of generic low frequency spectrum (as would need to be the case to provide a proper benchmark against which to value 900 MHz spectrum). Key among these was the manner by which Ofcom set reserve prices, which meant that operators did not express incremental valuations less than the corresponding reserve prices and rules for opt in bidders. These considerations make Ofcom's LRP-derived estimates of market value unsafe.

2.2.1 Ofcom's LRP-derived estimate clearly overstates the incremental market value of 800 MHz spectrum

Ofcom has proposed relying on a methodology for estimating the value of 800 MHz spectrum from the auction results known as the Linear Reference Pricing ("LRP") method. The LRP method does not seek to estimate the incremental value of a marginal increment of spectrum but instead decomposes the prices paid in the auction for large packages of spectrum into linear prices per band. As such the LRP method estimates average prices paid across the packages, rather than attempting to estimate prices for marginal blocks. As the value of incremental spectrum typically declines with increased spectrum, an average spectrum value will tend to over-estimate the incremental value at the margin.[17]

In addition, Ofcom's application of this methodology is seriously flawed, as it did not take into account the limitations of the data used. In particular, Ofcom's calculation of the opportunity cost of packages includes the high reserve prices for blocks of 800 MHz spectrum which manifestly influenced the results of the methodology (discussed further below). As the reserve prices do not reflect true opportunity costs for spectrum they should not feed into any estimate of the (incremental) market value of spectrum.

It is straightforward to demonstrate that Ofcom's LRP-derived estimate for 800 MHz spectrum (268.5m for an A1 block) must be above market value. If one re-runs the winner and price determination algorithm with an A1 reserve price set just above £254m (rather than £225m), this leads to unsold 800 MHz spectrum. Since a market clearing price must be a price at which all spectrum sells (with none retained by the auctioneer), this shows that the results of the LRP methodology cannot be the true market clearing price.

Therefore, £25.4m/MHz must be above the market value for 800 MHz spectrum. We turn next to the impact of the reserve price (£22.5m/MHz) and show that, in fact, the true market value also lies well below this figure.

2.2.2 Distortion created by reserve prices

In the Auction, Ofcom set relatively high reserve prices for 800 MHz spectrum, in contrast to its previous policy of setting "low but non-trivial" reserve prices. These reserve prices meant that bidders did not submit pairs of bids showing their valuation of incremental 800 MHz spectrum if it was below that price, as the larger of any such pair of bids could not be a winning bid. It also meant that Ofcom's reserve prices affected the outcome of the auction in terms of prices paid as the 800 MHz reserve prices were used in the calculation of the 'second price' paid. This did not ultimately impact allocative efficiency as all spectrum was sold, but as a guide to the minimum price at which the market would clear which is equally important for maximising dynamic efficiency, it is clearly an overstatement.

[17] See Annex 1 at 5.2

Ofcom set the reserve prices for different purpose(s) than estimating a market value for the marginal block of spectrum.[18] Ofcom was not concerned with the dynamic effects related to the prices paid by successful bidders in the auction and in particular, did not consider the potential risk of setting the reserve price above a market clearing price but below the marginal operator's willingness to pay ("private value") which would lead to a reduction in dynamic efficiency[19]. As a result a level of reserve prices which may have been optimal in terms of ensuring an appropriate allocation of spectrum were not designed for the purpose of determining a benchmark value for the setting of ALF.

Analysis of the approach that Ofcom took to setting the reserve prices shows:

a) Ofcom set the reserve price for A1 blocks at £225 million in the auction, higher than the value recommended by Dotecon and Aetha.

b) The level of reserve prices was determined without reference to the risk that the resulting prices would be set above the market clearing price.

c) Ofcom set reserve prices as high as possible subject to these prices being below the willingness to pay of bidders.

d) Dotecon and Aetha's recommendations were based on the assumption that reserve prices would not be applied on a lot by lot basis, but on an aggregate level – which was the proposed approach at the time.[20] For this reason the recommendation was based on average prices, rather than marginal prices. There is no indication that the results of the analysis were revised to take account of the subsequent change to lot by lot reserve prices in the final auction rules.

e) The benchmarking approach which was used to inform Ofcom's determination of the reserve prices was based on information on operators' willingness to pay in other 800 auctions, potentially including any coverage premium associated with the first block of low frequency spectrum suitable for LTE.

f) The financial modelling[21] did not cover a wide enough range of packages to provide robust estimates of market clearing prices, particularly given that many of the packages modelled were irrelevant by the time of the auction, given the transfer of 1800 spectrum form EE to H3G. The limited information that was available indicates that there is a material risk that reserve prices for the A1 block may have been above a market clearing price.

Critically, in its consultation before the final statement, Ofcom proposed to allow all bids in the supplementary round where the bid for the package exceeded the reserve price for the package (subject to the constraints resulting from bidding in the primary round). This approach would have allowed bidders to submit package bids where the differential between bids was less than the differential in reserve prices between the packages. However in the final decision, Ofcom decided to apply the reserve prices on a 'lot by lot' basis, i.e. for any pair of bids, the difference in the bids had to be greater than the difference in the reserve prices for the packages. This significantly reduced the usefulness of the bid data for determining market value, as no direct information is provided on operators' marginal valuations for blocks where these are less than the corresponding reserve price.[22]

Ofcom attempts to use this shortcoming in the data as a reason to reject Vodafone's suggestion that analysis of the auction should start with an analysis of what prices would have been had the

[18] This is acknowledged by Ofcom at A8.37 of the Consultation
[19] See Annex 7 at p. 3 as well as Annexes 1 and 11.
[20] Paragraph 254 of the report
[21] Supplied by Ofcom only in response to various stakeholder requests.
[22] Annex 2 at 3.3.2

auction used nominal reserve values.[23] It is clear that, due to Ofcom's auction design, the reserve prices did impact prices so it is perfectly reasonable to consider what the auction can show with that distortion removed. Ofcom summarily rejects this on the basis that such an approach *"is likely to understate market value*"[24] (as opposed to Ofcom's approach which, as we will show, clearly and demonstrably overstates it).

Ofcom states:

> *"we recognise that reserve prices had the potential to influence the auction outcome (and indeed to some extent were intended to do so, at least to guard against some possibly inefficient outcomes), and that they were set by Ofcom rather than determined by the market. However, Ofcom sought to ensure that reserve prices did not have an unduly distortionary effect. Reserve prices were based on the evidence of prices paid in auctions in other countries for the same or similar spectrum…"* (Vodafone emphasis).[25]

Clearly, Ofcom's primary objective in setting rules for the Auction was to ensure an optimal outcome in line with its policy decisions. However now that they are seeking to use the Auction information revealed for the secondary purpose of setting ALFs they must derive only that which can be safely derived from it.[26] To conclude that it can use indications of market value which clearly were distorted (but according to Ofcom, not unduly distorted) is simply not good enough. It is Ofcom who set the auction rules as well as the reserve prices. It knew full well and had clearly stated that it would be using the outcomes of the Auction as important inputs into its calculation of ALF. So, as it knew the way it was going to treat the Auction evidence for setting ALF and could have more carefully balanced its primary and secondary objectives.[27]

Ofcom cannot 'punish' operators now when setting ALFs by deriving overestimated market values knowing that it could have ensured an evidentially more meaningful auction outcome but did not do so. At the time, Vodafone raised considerable concerns about the manner in which the design of the Auction could be gamed by operators to distort ALF outcomes. Ofcom should have been alive to these dangers.

Ofcom's claim that reserve prices were not 'unduly distortionary' as they were based upon prices paid in auctions in other countries starkly reveals the circularity in Ofcom's reasoning. Ofcom seeks to rely upon the UK Auction and international benchmarks as separate data points to support its view of ALF but, by its own admission, they are clearly interdependent.

In fact, it is clear that the reserve prices set by Ofcom did influence winner determination and the prices paid in the Auction.

- For EE, Vodafone and Telefónica the set of bids used to estimate the 'opportunity cost' of the package awarded to that bidder did include the reserve prices for 800 MHz spectrum[28];

- H3G paid the reserve price for the one block of 800 spectrum they acquired with an opt-in bid.

[23] First set out in Vodafone's submission from May 2013 and attached at Annex 3
[24] Consultation at A8.39
[25] Consultation at A8.37
[26] Alternatively, Ofcom could disregard the auction bids altogether if it, wrongly in our view, concludes that it cannot derive meaningful information about 'market value' from it.
[27] See in particular the way reserve prices were implemented in d) above.
[28] See Annexe 1 to "Deriving market clearing prices for 800MHz spectrum from the UK 800MHz/2.6 GHz Auction" at Annex 2

The inclusion of reserve price 'bids' for 800 spectrum in the calculation of the prices paid by three of the operators shows that if all of the bids by this bidder had not been made some spectrum would have been unallocated at the reserve prices. This demonstrates that the reserve prices for A1 spectrum (£22.5m per MHz) must be above the incremental market clearing price for that spectrum.

Ofcom can take no comfort from its statement that:

> *"the reserve prices for 800 MHz and 2.6 GHz spectrum did not prevent an outcome in which all spectrum in these categories were sold. We consider that this outcome supports the view that the reserve prices were not substantially out of line with market value."*[29]

As noted above, such a reserve price which is above the market clearing price but below the 'lowest successful bidder's' willingness to pay will clearly reduce static and dynamic efficiency in direct conflict with Ofcom's objectives and duties (described further in Annex 1, Section 5).

Furthermore, the impact of Ofcom's cavalier attitude to the data when it talks of reserve prices not being 'substantially out of line with market value' is easily demonstrated by a simple calculation. If Ofcom sets the spectrum value of each of 900 MHz and 1800 MHz by £1m higher than the true market clearing price, this adds £17.5m of cost to the UK telecommunications industry in the first year and will, over the 20 years for which Ofcom is setting ALF, take an additional £448m[30] out of that industry with a clear detrimental effect on investment and consumers. Therefore, Vodafone and other stakeholders are entitled to hold Ofcom to a high standard of proof and careful treatment of the evidence.

2.3 Evidence from the Auction on 800 MHz value assuming EE is the marginal excluded bidder

Given the concerns raised by Vodafone with the way in which the auction rules have obscured true market clearing prices, how then is Ofcom to best interpret the UK Auction evidence?

The answer is that the UK auction did provide some direct evidence of the opportunity cost of 800 MHz spectrum: EE's bids revealed information on its incremental valuation of 2 x 5 MHz blocks of 800 MHz spectrum. Furthermore, the available evidence is also consistent with EE being considered to be the highest value excluded user for low frequency spectrum.

a) EE could be expected to have a relatively high valuation of low frequency spectrum, given its relatively small holdings of low frequency spectrum compared to its subscriber base, particularly post-Auction as it will presumably be optimising at least parts of its network to exploit the 2 x 5 MHz of 800 MHz spectrum it acquired;

b) Given their large low frequency holdings,[31] Vodafone and O2 are likely to have relatively low incremental private value for additional low frequency spectrum;[32]

c) H3G's bids in the auction indicate that it has a relatively low valuation for additional low frequency spectrum;

[29] Consultation at A8.38
[30] Assuming inflation of 2.5%.
[31] Vodafone and O2 showed very high private valuations for the low frequency spectrum they acquired in the auction as this spectrum was required for them to offer competitive LTE services.
[32] Depending upon the spectrum ultimately released each might have a contiguity premium within that valuation but this cannot be guaranteed as if one of those operators chose to surrender spectrum, the other cannot ensure that it is the contiguous block for it. Nor could Ofcom necessarily do this through spectrum management powers as this could distort any subsequent auction.

d) None of the new entrants bid on 800 MHz demonstrating that their values were below the reserve price.

EE's expressed valuation of a single 2 x 5MHz block of 800 MHz spectrum was generally £230 million. [33] Operators' valuation of a first block of low frequency spectrum will tend to be higher than incremental spectrum beyond this as, all other things being equal, there is a 'coverage premium' attached to the first block. As EE acquired a single low frequency block in the Auction, £230 million is an upper bound on EE's valuation of additional blocks of low frequency spectrum in circumstances where there is no countervailing 'contiguity premium' (discussed below). EE's valuation of incremental spectrum, above the one block they acquired in the auction, will be an input to the forward-looking market valuation of non-contiguous low frequency spectrum such as 900 MHz. As such, this is consistent with result above, that the market valuation of an incremental block of 800 MHz spectrum is less than the reserve price of £225 million for a single A1 block.

If EE's bid data for incremental spectrum is used to estimate the incremental market value of 800 MHz spectrum for setting ALF, adjustments need to be made to the implied differential valuations shown. This is because:

a) The valuations reflect the value of low frequency spectrum pre-Auction while the ALF valuation will need to take account of the values post-Auction, to take into account the spectrum obtained in the auction;[34]

b) The valuations indicate a large premium for contiguous 10 MHz paired allocations of spectrum, due to the nature of current LTE technology, whereas it is very unlikely that spectrum subject to ALF would be relinquished and/or acquired in such large contiguous blocks;

c) The ability to prevent other operators from launching viable LTE services, or at least increasing the prices paid by other operators, meant that there could have been strategic value in making high bids for large amounts of 800 MHz spectrum.

As described in Annex 2, these adjustments can be made based on an analysis of the implied incremental valuations of 5, 10 and 20 MHz of 800 spectrum within EE's bids[35]. If we assume that the contiguity premium from 5 to 10 MHz was similar to that from 15 to 20 MHz, we can derive an incremental value for an additional 5 MHz of spectrum in addition to the 5 MHz that EE acquired in the auction.

Making these adjustments results in an estimated private valuation for EE for 800 MHz spectrum of **between £17.9 million and £21.5 million.** This range provides the best estimates of the incremental market value of 800 MHz spectrum that can be derived from the UK auction. Note that for reasons discussed in detail in Section 3 below we exclude co-existence / interference costs from all of these figures.

2.4 Terminal Value

[33] EE made three pairs of bids which showed high differentials for a single block of 800 spectrum. However these appear to reflect strategic value. See further Annex 2

[34] See S. 6(1) of the Direction *After completion of the Auction OFCOM must revise the sums prescribed by regulations under section 12 of the WTA for 900MHz and 1800MHz licences so that they reflect the full market value of the frequencies in those bands.*

[35] EE did not bid for 15 MHz of 800 spectrum, presumably because the incremental valuation from 10 MHz to 15 MHz was less than the corresponding reserve price

Ofcom assumes that the valuations underlying operators' bids in the Auction did not include any terminal value corresponding to cash flows after the end of the 20 year period. Ofcom's argument is that as ALF would be payable on the spectrum after the end of 20 year period and operators would expect the ALF to be set at market value then they would not expect to have any terminal value. This argument is fundamentally flawed as Ofcom does not adequately distinguish between the private value that an operator can expect to have after having operated the spectrum for 20 years and the market value of the spectrum at that point.

Operators' spectrum valuations in the auction will reflect the indefinite nature of the licences. At the end of the 20 year period operators will have made significant sunk investments in the spectrum which can reasonably expected to lead to the operator who acquires the spectrum in the auction being the highest private value user at this point, i.e. the cash flows that the operator can generate from the spectrum from 2023 is greater than other potential users. The market value of the spectrum in 2023 time will be expected to reflect the opportunity cost associated with the spectrum, i.e. the cash flows that could be generated by the marginally excluded user. As a result the difference between the expected private value and the expected market value is likely to be positive (in the same way that the private values of current holders of 900 and 1800 spectrum is expected to be higher than the market value underlying the ALF[36]). As a result it would be reasonable for operators to include a terminal value in their valuations for the auction reflecting this difference between the private value to the operator after 20 years of operating the spectrum and the market value of the spectrum at 2023.

Vodafone has not attempted to make this adjustment as, of course, it cannot know what EE's terminal value might have been. However, if EE did attribute part of its bid value in this way, this would reduce these figures further.

2.5 Alternatives to the 'EE excluded bidder' approach

2.5.1 The decomposition method should be preferred over Ofcom's LRP as it is a better fit to the evidence

Notwithstanding the points made above and in the alternative, Vodafone submits that removing the distortion created by the reserve prices and applying its decomposition method is a more robust method of determining market clearing prices than Ofcom's LRP. Ofcom describes it as *"broadly sensible"* but then rejects it on the basis that, it claims, LRP has a 'clearer rationale' and 'conceptual basis'.[37] This conclusion is surprising to say the least as Vodafone has mathematically demonstrated that the decomposition method more closely matches the actual bid evidence by revealing smaller 'excursions'. If the logic of the decomposition method is recognised and it more accurately reflects what we see in the real world then we fail to see any good reason for Ofcom to reject it.

Therefore, removing the reserve price "bids" from the calculation and using the decomposition method results in a materially lower spectrum market value estimate for 800 MHz of **£20.20m per MHz**.[38]

2.5.2 Exclusion of H3G bids from the Auction analysis

In addition and again in the alternative, Vodafone's previous submission (attached at Annex 3 "UK Auction Prices and ALF") makes the case that H3G appears to have bid strategically in the Primary Rounds in order to either increase overall prices paid or influence relative prices between bands thus increasing its probability of acquiring the minimum spectrum portfolio with

[36] See Annex 7
[37] Consultation at A8.33
[38] Consultation at Figure A8.11

the highest pay off (at the reserve price)[39] and therefore its bids should be excluded from an analysis of the UK Auction aimed at establishing true market values.

As Vodafone noted:

> *It seems highly improbable that H3G's valuation difference between packages was exactly the reserve price difference. However, recall that (knowing it was the only opted-in bidder) if H3G had just made their opt-in bids and no others, the auction rules would have guaranteed them to win one of the three opt-in packages at the reserve price. By raising all three opt-in bids by exactly the same amount (£360.5m), they maintained this property**: Provided the auction software awarded them an opt-in package, as it was almost bound to do, it would have to do so at reserve price**.*

Ofcom appears to accept this at A8.48 but then says that it has taken this into account in its discussion of sensitivities but not, tellingly, in its actual analysis.

The Vodafone submission went on:

> *But what about H3G's other bids? Was there a risk that one of them might have won instead and therefore at a price potentially much greater than the reserve price? Our conclusion is that H3G deliberately bid in a manner to minimize this risk. All other bids were structured so as to be highly unlikely to be winning bids. Their primary round bids for packages with A1 and A2 lots also included huge amounts of 2.6MHz (10 C lots and the D2 lot). It was virtually impossible for those bids to have won because that would have required preventing anyone else winning paired 2.6MHz spectrum. Notably, H3G made no attempt to increase these bids in the supplementary round: it simply left them at the largest primary round values.*
>
> *H3G's new supplementary round bids were all marginal extensions to the opt-in packages, with an incremental value well below the final round prices: about £6m-£7m per E block (for packages of 4, 5 and 9 blocks), and about £50m per C block (for up to two additional C blocks). We can assume these were not intended to be winning bids, but were aimed to set prices: indeed these bids did set prices for 2.6GHz. It appears that H3G did not attempt to price-set on extra 800MHz blocks, since at this stage in the auction there was too high a risk of winning such 800MHz spectrum.*

Vodafone suggested that H3G's bids should be removed from any analysis of the auction because, based on the above, there is good evidence that its primary round bids do not represent "truthful" bidding and therefore its true incremental value.

Ofcom rejects this on the basis that H3G could not be certain that its bids for additional lots would be unsuccessful and *"In our view it's not safe to conclude that H3G <u>only</u> made these bids in order to drive up prices for others"* (Vodafone emphasis).[40]

Presumably this means that Ofcom accepts <u>some</u> of H3G's rationale for this bidding pattern appears likely to have been aimed at driving up prices. However this example demonstrates Ofcom's lack of rigour when examining and determining how to treat the evidence from the UK auction.

Vodafone has put forward a consistent and logical explanation which fits the evidence of the observed bidding pattern which strongly suggests H3G's bidding in the primary rounds is unlikely

[39] By following a strategy designed to ensure that they only paid the reserve price for one of the MPPs, H3G would not have been able directly influence the package they acquired, which would have been dependent on other operators bids for packages including this spectrum. Thus only by influencing other operators' relative valuation of packages could they indirectly influence their pay off.

[40] Consultation at A8.51

to provide a realistic indication of H3G's true marginal valuation for 800 MHz spectrum.[41] The lack of any other bids for packages containing a higher amount of 800 MHz spectrum, other than the MPP packages, in the supplementary round strongly suggests the H3Gs true marginal valuation of spectrum was lower than the reserve price.

Ofcom may feel that excluding all H3G bids and spectrum from the auction is 'highly artificial'. But it has arisen as a rational response by H3G to benefit from the auction rules set by Ofcom. Faced with the evidence, what is Ofcom's solution? Instead, it proposes to take no account whatsoever of the clear evidence that H3G's marginal value for spectrum is very likely below the reserve price and thus, should reduce the value determined by Ofcom's LRP approach. This cannot be correct. For all of the reasons set out in Annex 1 and Section 5 Ofcom should, when faced with evidential uncertainty, err on the side of caution. Therefore, the value range arising from this methodology, namely **£13.5m to £16.8m** per MHz for 800 MHz spectrum must be preferred in preference over Ofcom's current methodology which demonstrably over-estimates market value, in part by including the impact of H3G's bidding.

2.6 Ofcom's additional sensitivities are unsound and should not be relied upon

2.6.1 Additional Spectrum Methodology ("ASM")

Prior to the Consultation, Vodafone submitted a paper to Ofcom commenting in part on the ASM. We concluded that:

> *"The ASM results for additional 800MHz spectrum are entirely dominated by a clearly non-serious EE bid for a very large package of 4 A blocks and 4C lots. EE had no chance of winning such a package in the real auction, and are very unlikely to have bid the same package price in the counterfactual auctions. The results are also dominated by factors like the reserve prices and spectrum caps, factors which are very unlikely to have been set the same way in the counterfactual auctions. The methodology gives wildly different valuations for different bidders, especially when applied to the 1800MHz spectrum. Accordingly, we would urge Ofcom to simply discard this methodology as giving inconsistent and irrelevant results."*

It appears that Ofcom agrees with the view that ASM is unreliable. It states at Paragraph 4.24 of the Consultation that it is *"highly sensitive to the underlying assumptions"*. We agree that ASM is unsound and cannot be used. We provided detailed reasons for this conclusion in our July 2013 submission at Annex 3.

However, despite Vodafone's criticisms of ASM prior to the Consultation, of its 12 'sensitivities' appearing in Figure A8.13 Ofcom retains five purportedly separate 'ASM sensitivities', three of which are above or wildly above Ofcom's LRP 'base-case', one which is virtually in line with LRP and one (ASM for 2 x 20 MHz) which is slightly below. It is unreasonable for Ofcom to include ASM results in its sensitivity analysis to determine a plausible range of values as the higher end of the range is clearly above a market clearing price for 800 MHz spectrum. One can only suspect that these sensitivities have been added to flatter the 'reasonableness' of the LRP estimate by suggesting it is somewhere in the middle of a range of plausible estimates, whereas without these ASM points it becomes clear that the LRP is right at the top of the range of estimates.

Moreover, it shows how Ofcom's treatment of sensitivities is partial. It accepts, at least in part, the logic and evidence put forward by Vodafone why H3G's primary round bids for large

[41] Spectrum floors in the UK 4G auction: an innovation in regulatory design, Geoffrey Myers notes "Although these were H3G's highest bid amounts, they were for such large packages that effectively these 4 bids […] were not relevant in influencing the winning outcome or prices."

amounts of 800 MHz spectrum could not be meaningfully said to express its true value for spectrum and yet Ofcom rejects that (lower) sensitivity out of hand and does not include it in Figure A8.13. In contrast, the ASM methodology where, again, Ofcom recognises much of the criticism of the methodology still makes up nearly half of Ofcom's total sensitivities.

2.6.2 Removal of competition constraint sensitivity

We accept that Ofcom's spectrum caps policy will have had the effect of depressing auction prices. However, this does not affect our view that Ofcom cannot properly remove this constraint when seeking to identify a current or forward-looking spectrum value, provided this policy is expected to continue in the future. Having devoted a huge amount of effort in analysing the market and the need, in Ofcom's view, for 4 credible national wholesalers of mobile services. Unless Ofcom has changed its policy, it is (and will continue to be for some time) the clearing price in the presence of spectrum caps which is the appropriate measure for Ofcom to identify. Therefore, we agree with Ofcom's conclusion that it is not appropriate to adopt such an approach.

2.6.3 Removal of revenue constraint sensitivity

DotEcon's proposed 'removal of revenue constraint approach' does not modify our conclusions above. DotEcon's approach adjusts the decomposition of prices paid in the auction for reserve prices, but fails to account for the impact of reserve prices on the overall level of prices themselves. Moreover, it is clear that this approach varies widely from the real world. Again we agree with Ofcom that it should not be used as a sound basis for revising annual licence fees.

2.7 Conclusion

Vodafone has demonstrated in this section that the LRP method clearly overstates the market value for marginal 800 MHz spectrum. Our preferred analysis of the UK Auction is to derive values from the EE bid data which provide a range of **£17.9m/MHz to £21.5m/MHz.**

In the alternative, either removing the distortion created by the reserve prices by setting these at a nominal level and using the decomposition method, which provides a market value estimate of **£20.3m/MHz** or removing H3G's bids from the Auction analysis which provides a range of **£13.5m to £16.8m/MHz** should be preferred ahead of Ofcom's application of its flawed LRP method.

We turn next to the question of how the correct 800 MHz market value shold be properly translated into UK market values for 900 and 1800 MHz, initially by reference to international benchmarks.

3. The benchmarking data as used by Ofcom cannot be relied upon to establish absolute 'market values' for 900 MHz spectrum in other countries but provides a starting point for relative values

In this section we show:

a) Ofcom relies on a small sample of observations that depict a high degree of variability which Ofcom does not seek to understand or explain. Ofcom also does not undertake an appropriate assessment of the comparability of the international results to the UK. This approach increases the risk of setting ALFs above true market value.[42]

b) Far greater detailed analysis is required to translate international benchmarks into useful information for UK spectrum values and, in particular, Ofcom has not accounted for variations in significant drivers of spectrum value, namely: margin per user, 2G penetration and urbanisation.[43]

c) Moreover, the way Ofcom has weighted the international evidence is flawed and inconsistent:
   i. Ofcom has misinterpreted those auctions which cleared at their reserve price; this represents an upper bound rather than a lower bound of market value;[44]
   ii. Ofcom treats the data inconsistently, effectively discarding auction results for 1800 MHz which fall below its view of the UK value but treating as 'more important evidence' three results for 900 MHz which are above its own view of the UK value of 800 MHz;[45]

d) However, it is possible to correct for many of Ofcom's errors and derive more robust results from a benchmarking analysis.

These points are discussed further below and at Annexes 4 and 5 to this response.

3.1 Introduction

Recalling the discussion at Section 2 above, having identified the true market clearing price for 800 MHz and 2.6 GHz from the UK auction, Ofcom needs to translate those prices into relevant values for 900 MHz and 1800 MHz in the UK. As described in Section 4 later, Ofcom does this by inference only and ignores valuable UK-specific evidence which should inform that decision.

However, even in respect of the method that Ofcom does use, that is comparing the UK auction results with results in other EU countries, it is clear that there are a number of weaknesses in Ofcom's treatment of the benchmarking data which mean that a more thorough analysis is required before any meaningful inferences can be drawn. Vodafone asked Frontier Economics to undertake this analysis, attached at Annexes 4 and 5 which built on Vodafone's prior submission to Ofcom from May 2013.[46] In both cases, the reports conclude that absolute values cannot be relied upon but, relative valuations between 800 MHz and 900 MHz spectrum, done carefully, do offer a starting point for such analysis. UK-specific factors which need to be applied to this 'starting point' are addressed in the next section.

3.2 Ofcom treats auction outcomes in a biased and internally inconsistent way

[42] Annex 4 at 3.4
[43] Annex 4 at 3.1
[44] Annex 4 at 3.1
[45]
[46] At Annex 6.

Ofcom's approach in relation to estimating the 900 MHz market value is inconsistent with its approach to estimating the 1800 MHz market value. When estimating the 1800 MHz market value, it puts less weight on those outcomes that are below what Ofcom considers to be the lower-bound of the market value in the UK, i.e. the value of 2600 MHz spectrum derived from the recent UK auction. However, when looking at European auctions of 900 MHz spectrum, Ofcom's sample consists of seven observations which it considers to be 'more important' evidence but three of these observations (the absolute values for Ireland, Romania and Greece) are above what Ofcom's considers to be the upper-bound of the market value of 900 MHz spectrum in the UK, namely the market value of 800 MHz spectrum derived from the recent UK auction. Therefore, these observations are at best of very limited value as relevant evidence and should be treated as 'less important evidence' for the purpose of deriving 900 MHz ALF estimates.

3.3 Ofcom relies on an incorrect estimate of the upper-bound for the market value of 900MHz in the UK, which leads to inflated estimates of the market value of 900MHz spectrum.

Ofcom incorrectly estimates the market value of 800MHz spectrum from the recent UK auction to be £29.9m per MHz. As described in Section 2 above, the reserve price for 800MHz spectrum[47] was set above the market clearing price. Therefore, UK auction prices overstate the true market value. Therefore, the appropriate market value to use from the UK auction is value is likely to be much lower, in the range £17.9m to £21.5m per MHz[48]. As a result, Ofcom overestimates the upper-bound for the market value of 900MHz spectrum in the UK which means that Ofcom incorrectly treats absolute benchmarking auction results (Romania and Spain) that are below £29.9m but above the more realistic upper-bound of £21.5m as relevant or 'more important' evidence.[49]

3.4 Ofcom uses an incorrect UK market value for 800MHz spectrum when calculating the equivalent value of for 900MHz spectrum when using benchmarks of relative prices.

As noted, Ofcom's estimate of the UK market value of 800MHz spectrum is inflated because of two factors: not correcting for the impact of the above market clearing value reserve prices and by inappropriately including co-existence costs. As Ofcom's 800MHz benchmarks from other jurisdictions are net of any co-existence costs, to make a proper comparison, the appropriate UK 800MHz benchmark to apply must also be net of co-existence costs.[50]

Adding co-existence costs to its estimate of the market value of 800 MHz from the UK auction is an unnecessary adjustment which logically leads to 'double counting' these costs. The estimated appropriate value of 800 MHz spectrum in the UK already includes the cost of mitigating DTT interference because the bids in the UK auction reveal information about bidder valuations of 800MHz spectrum after deducting all essential costs of operating an 800MHz network, including the cost of mitigating DTT interference.

Adding this cost back on to the auction outcome is just effectively counting separately one of the cost elements of operating an 800 MHz network, the absence of which would, of course, lead to a higher valuation of 800 MHz spectrum. But this same logic would apply to any cost. If the cost element of backhaul or base station rents were removed, then the spectrum valuation would similarly be inflated but would not be reflective of the true market value of spectrum.

This is clear when one considers that DTT mitigation costs were a known issue in multiple European markets, including Spain, Italy, Ireland, and Portugal. As such, the cost of mitigating DTT interference must have also been incorporated in those bidders' valuations of 800MHz spectrum revealed in the auctions. Of course, Ofcom cannot know what those assumptions were and add them on to the values revealed in those auctions. Accordingly, to use international

[47] The A1 blocks without coverage requirements.
[48] Please see Annex 2
[49] Annex 4 at 3.3
[50] Annex 4 at 3.3

comparisons on a like-for-like basis, the 900/800MHz ratios derived from the international benchmarks must be applied to the revealed 800MHz value from the UK auction without adding any additional costs to arrive at a comparable value for 900MHz spectrum in UK. Ofcom may consider that these costs are likely to be higher in the UK than in other countries but it cannot directly observe that, nor make adjustments to any other network costs such as backhaul, site rental or rates which will also vary between countries.

Treating co-existence costs differently from other costs therefore adds insoluble complexity to Ofcom's task and there is no clear rationale for applying them only to 800 MHz spectrum. Buyers of 900MHz spectrum have to bear costs relating to the need to clear the spectrum before re-farming. Should these additional costs be deducted from 900 MHz values? If not, why not?

Therefore, the only reasonable and transparent approach for Ofcom to take is simply to exclude all network costs, including coexistence costs, from all spectrum bids for both UK and international comparisons.[51]

3.5 Ofcom misinterprets information that auction outcomes provide about market value in a countries where spectrum is sold at the reserve price.

Ofcom incorrectly concludes that auction prices underestimate market value for auctions in which spectrum cleared at the reserve price by assuming that this was the result of "limited competition". In fact, given that these auctions cleared, by definition the prices paid must be at or above the market clearing price.

When the lowest value successful bidder (i.e. the one with the lowest private value but which acquires the final increment of available spectrum) has a private value higher than the reserve price it will pay that reserve price. This is not, however, the same as the market clearing price which is set (in the absence of that reserve price) not by the lowest value successful bidder but by the marginal excluded bidder.

As such, auction prices which clear at a reserve price are an upper bound for the market clearing price of spectrum in such auctions – the market cleared at the reserve price but could well have cleared at a lower price had that reserve price been set at a lower level.[52]

3.6 Ofcom does not appropriately control for country- and auction-specific factors that could make auction outcomes in benchmark countries less comparable to the UK.

Ofcom takes into account certain expected drivers of spectrum value, and adjusts auction outcomes accordingly. However, it fails to consider many other more important factors and the extent to which these might affect auction prices relative to UK values.

[51] In any event, Vodafone can demonstrate that certainly it anticipated that the size of the UK interference problem was far smaller than Ofcom was predicting and it follows that full interference costs should not be applied. For instance, Simon Pike of Vodafone made an industry presentation entitled *"800 MHz Coexistence Organisation of MitCo"* to a workshop facilitated by Intellect on 18th May 2012 and that presentation clearly states *"Vodafone believes that Ofcom's estimates of the number of affected households will prove to be over-estimates. Ofcom's modelling still includes a number of worst-case or worse-than-average assumptions [and] … is not supported by real experience of deployment: Only a handful of cases in Germany [with] over 7000 800MHz sites now deployed [and] only 2.3 cases per thousand households in French trial in Laval.* A similar presentation titled *"800 MHz Coexistence: Practical experience from deployments and trials"* was also made by Mr Pike to the GSMA on 18 October 2012 which noted no significant interference issues in Germany, France, Sweden and the USA despite significant deployments and/or LTE tests in those countries. Real-world experience with DMSL has just underlined the strength of these points.

[52] See further Annex 4 at 3.1

The simple fact of the matter is that deriving meaningful values from international comparisons is difficult; far more difficult that Ofcom seems to appreciate. It is no short-cut to determining 'market value'. To get a series of meaningful data points one must be confident that you have properly identified and properly compensated for a wide range of country-specific factors. This is precisely why, in previous judicial proceedings, the appeal courts have taken a sceptical view:

> *"…it is difficult to draw any firm conclusions derived from disparate facts plucked out of the information about a range of international markets."*[53]

This is particularly the case when one recalls the enormous impact of Ofcom's proposed decision. By every £1m that it gets the value of 900 MHz and 1800 MHz 'wrong' it takes £17.5m out of the UK telecommunications industry in the first year and nearly £450m over the 20 years for which ALFs are being set, to the potential detriment of UK consumers. As such, stakeholders are entitled to expect very high standards of diligence from Ofcom in the way it collects and analyses the data upon which it relies.

3.7 Ofcom relies on a small sample of observations a high degree of variability, which increases the risk of setting ALFs above true market value.

The fewer valid observations Ofcom's benchmarking analysis is based upon with a high degree of unexplained variation between countries, the greater the risk that Ofcom's estimate will materially differ from the true market value. When working with such a small sample, Ofcom should take a conservative approach and set ALF prices towards the lower end of the appropriate range of values resulting from the benchmarking analysis. This is because, as explained in Annex 7 the potential welfare losses resulting from inadvertently setting ALFs too high (i.e. above true market value) are likely to be more significant than any losses that might arise from setting ALFs below market value.

Overall, Frontier found that international benchmarking evidence about the absolute value of 900MHz and 1800MHz spectrum alone in other countries cannot be confidently relied upon to inform the true market value of 900MHz and 1800MHz spectrum in the UK. This is because the benchmark values are extremely variable, presumably reflecting country specific factors which cannot be adequately controlled. By contrast, international benchmarking evidence on the relative valuation of 800MHz and 900MHz spectrum provides some basis for deriving a range for the market value of 900MHz and 1800MHz spectrum in the UK and should be given greater weight.

In order to derive these results Frontier first asked whether each of the auction outcomes revealed market clearing values for the relevant country and analysed issues of market structure and auction design to determine if the auction outcomes could be considered to provide reliable estimates of market value. Second, they considered whether the revealed market value was or was not reflective of spectrum value in the UK. While Ofcom attempted to control for some drivers of spectrum value they did not account for the most important ones: margin per user, 2G penetration and urbanisation.

These modifications lead to a far more robust set of results[54]than those presented by Ofcom/DotEcon with a proper range for the market value of 900 MHz derived from international benchmarks between **£12m and £15.9m** per MHz and a range for 1800 MHz between **£6.3m and £12.5m**.

The 'base case' 900 MHz range is derived by excluding results which are either above or below the upper and lower bounds of UK market value[55] respectively and applying the range of relative values between 900 MHz and 800 MHz (61% to 81%) to the mid-point of the correct market

[53] Vodafone v Ofcom [2008] CAT 22, paragraph 127
[54] Full details are set out in Annex 4 Section 3.1 and accompanying case-studies at Annex 5.
[55] Full details are set out in the Annex 4 Section 3.1 and accompanying case-studies at Annex 5.

value for 800 MHz in the UK derived from the 'EE as excluded bidder' methodology described previously in Section 2, namely £19.7m/MHz.

The 1800 MHz range is derived by the same method, again excluding results which are either above or below the upper and lower bounds of UK market value respectively, and applying the range of relative values observed (32% to 64%) to the UK 800 MHz market value of £19.7m/MHz.

As we discuss in the next section, Ofcom must then go on to consider how to apply these figures in a UK context and to estimate a current forward-looking value from historical data.

4. Ofcom must consider additional sources of evidence in addition to and as an aid to proper interpretation of the international and UK benchmarks

In this section we show:

a) Ofcom has not considered its own direct evidence that 900 MHz spectrum is worth considerably less than 800 MHz and instead, it relies upon inference alone to determine the relative values of those bands.

b) It not only applies a lower relative discount of 17% between 800 MHz and 900 MHz compared with the range it observes in other EU auctions (20% to 40%), but it ignores its own work that would suggest a larger discount is appropriate in the circumstances of the UK market.

c) In particular, Ofcom unquestionably accepts that auctions with the simultaneous release of 800 and 900 MHz spectrum can be directly translated into UK values. But unless those simultaneous auctions properly exclude all sources of value beyond the marginal increment, the lack of spectrum certainty until the end of the auction will tend to inflate values. In contrast, the Direction requires Ofcom to value 900 and 1800 MHz sequentially after bidders have won 800 MHz and 2.6 GHz spectrum, thereby reducing the value of 900 and 1800 MHz spectrum.

d) Given the significance of its proposals, Ofcom should not reject appropriate alternative methods to value spectrum including technical modelling which has been used by Ofcom in respect of all other spectrum bands, including identifying the value of the 700 MHz band for providing mobile communications services.

e) Ofcom must take full account of future spectrum availability; information which is new and could not have fully informed bids in the UK auction, much less Ofcom's international benchmarks.

f) Ofcom has not met its own tests and operators' legitimate expectations for further detailed analysis of these issues as it clearly set out in its statements prior to the UK Auction.

These points are discussed further below and at Annexes 8 and 9.

4.1 Introduction

In previous sections of this response, we have considered the UK auction and from it derived an appropriate market value for the auctioned 800MHz spectrum, at that time. We have also applied this value to the international benchmarks to assist with the calculation of UK equivalents for 900MHz and 1800MHz market value. Collectively, this work provides a starting point for the range of market value of 900MHz and 1800MHz spectrum in the UK.

This is because the idea of deriving a market value for 900 MHz from the market value of 800 MHz is premised upon the assumption that 900 MHz is an (imperfect) substitute for 800 MHz in serving the same end customer demand. The level of that substitutability will, critically, depend upon what other alternatives are available to operators. Therefore, to properly apply this starting point to derive current UK spectrum market values, Ofcom needs to ask itself two further questions:

- Are there UK-specific characteristics which support a particular relative valuation between 800 MHz and 900 MHz spectrum? (Is 900 a more or less likely substitute to 800 MHz in the UK compared with other markets?)

- Have there been new developments since the benchmark auctions and/or UK auction which mean current values should be adjusted? (Has 900 become a better or worse substitute for 800 MHz since the relevant auction, whether UK or international?)

It appears from the Consultation that Ofcom has not engaged in either of these steps.

4.2 Ofcom provides no direct UK evidence for the relative values it is proposing between 800 MHz and 900 MHz

First, it is important to recognise that Ofcom has derived its view of the value of 900 MHz not directly, but indirectly from auction data, using the UK auction to supply an anchor point of 800 MHz market value and international data to obtain a value for 900 MHz, using absolute and relative auction data. From these observations Ofcom has emerged with a view that the value of 800 MHz is £30m per MHz, and the value of 900MHz is £25m. This means that accepts an implicit value discount between the two of 17%. However Ofcom's actual conclusion is far weaker than this. It says:

> "*we consider on balance that 900 MHz is unlikely to have a higher value*[56] *than 800 MHz spectrum in the UK, i.e. the value of the 800 MHz spectrum in the UK is likely to set an upper limit on the value of 900 MHz in the UK* ".

This is totally inadequate as a way of deriving the market value of un-auctioned spectrum and is an extraordinarily weak conclusion in light of Ofcom's direct evidence that, in fact, 900 MHz spectrum is clearly and consistently worth much less than 800 MHz spectrum.

Ofcom has failed to derive, develop, or consider in this consultation any logical reasons why the level of value discount between 800MHz and 900MHz of 17% that it has obtained from this method of inference might or might not be the correct percentage to adopt in the UK. We note that in the July 2012 statement Ofcom did suggest that it would conduct such an exercise of reviewing the relative values of 800MHz and 900MHz. We consider the failure to embark on such an analysis in the present consultation to be an abdication of responsibility on Ofcom's part, particularly significant given the enormous sums that will be transferred out of the industry as a result of this proposed levels of spectrum fees.

The only evaluation on the relative value of 800MHz and 900MHz in the present consultation is limited to paragraphs 4.41 and 4.42. The entirety of Ofcom's general research on the UK use of mobile spectrum and the detailed underpinning of relative spectrum value in the UK, apart from passing references in Annex 6 to work done in other contexts, is unaccountably dismissed in a single sentence of 4.42:

> *"As discussed in Annex 6, the technical evidence is not sufficiently clear-cut or robust to derive a reliable inference about the relative value of 900 MHz and 800 MHz."*

This represents a step back from the previous discussions by Ofcom on mobile spectrum fees in auction consultations. In the July 2012 auction statement, Ofcom's assessment was more measured:

> *"A12.49 We have not assessed the relative values of 900 MHz and 800 MHz spectrum in detail, and do not have a firm view on this. There are countervailing arguments, as set out in the different responses. We will assess the points raised fully*[57] *when we consult on ALF after the Auction.*

[56] Vodafone emphasis
[57] Vodafone emphasis

A12.50 We do not agree that it is critically important for Ofcom explicitly to address this issue now. This is because:

12.50.1 We would anyway be unable to give a definitive view at this time. This is because we would have to take account of the further information that is likely to become available before ALF is set for 900 MHz spectrum, and responses to our planned ALF consultation. To take a definitive position now would be likely unlawfully to fetter our discretion.

12.50.2 There is likely to be materially better information on which to make this assessment by the time we consider setting ALF for 900 MHz spectrum in 2013. In particular, there may be more information about the following which may be relevant to setting ALF for 900 MHz spectrum:

a) Additional European Auction results involving both 800 MHz and 900 MHz spectrum being Auctioned together;

b) The timescales for using 900 MHz spectrum for LTE, including the availability of LTE900 user devices and any development on standards[58]; and

c) The value of initial deployments of LTE and how this compared to HSPA.

There may also be additional information on the relative value that stems from responses to our specific ALF consultation."

It is not clear to Vodafone that the present consultation actually achieves these objectives – we find no trace of Ofcom examining further information, beyond that which existed in July 2012 (with the one exception of more international auctions) or undertaking a proper consideration of the timescales for using 900MHz spectrum for LTE, or an explanation of why such matters are no longer worth consideration. Ofcom has also unaccountably ignored its own very substantial recent body of work on relative spectrum value.[59]

It is readily apparent from the international auction data, that where 900MHz and 800MHz spectrum are auctioned simultaneously, the observed value of 900MHz spectrum is considerably less than that of 800MHz. A value discount of 20-40% between the two bands has been observed by Ofcom, not the 17% implied for the UK by the present Ofcom consultation.[60] Such a level of discount is not an accidental product of the international auction data – rather there are reasons why in general such a discount would be expected and why, in the UK, the lower end of international observations of discount, i.e. 40% should be adopted if not more.

Instead of properly engaging with these issues Ofcom simply throws its hands up in the air and concludes:

"arguments can be made on both sides as to whether 900 MHz [sic] has a higher or lower value than 900 MHz. In addition, future releases of HSPA+900 and LTE800 (including LTE Advanced) may change the balance of relative technical performance between the bands, and the alleged commercial first-mover advantages of 900 MHz are equally difficult to estimate with certainty."

In our view the qualitative and quantitative technical modelling submitted is not sufficiently clear-cut or robust to derive a reliable inference about the relative value of 900 MHz and 800 MHz."[61]

[58] Vodafone emphasis
[59] See further Annex 8
[60] If one were to discard the £3m cost relating to UK 800MHz interference, then the extent of the value discount between 800MHz and 900MHz allowed by Ofcom would be only 7%.
[61] Consultation at A6.33 and 6.34

But Ofcom has conducted no qualitative or quantitative technical modelling aimed directly at answering the question before it; namely the appropriate relative values between 800 MHz and 900 MHz (and between 1800 MHz and 2.6 GHz). The work done to date by Ofcom can inform and act as a starting point to further investigation of this important issue but to conclude that because that work done for other purposes cannot be simply recycled to answer the question in front of Ofcom today and, upon that basis, decide it is not worth further investigation is a clear abdication of Ofcom's responsibility to look for and at the available evidence.

Prior to issuing any Statement in respect of spectrum fees, Ofcom must include a clear analysis of the direct evidence for and reasoning behind the relative values of 800 MHz and 900 MHz spectrum and for all of the reasons set out in Annex 8 include in any Statement, a conclusion that 900 MHz spectrum is clearly less valuable than 800 MHz spectrum in the UK.

Ofcom then needs to go on and decide what is the appropriate level of discount for 900 MHz compared with 800 MHz in the UK, whether inside (or even outside) the range it observes in the international benchmarks.

4.3 There are UK-specific reasons for considering a larger discount between 800 market value and 900 market value would be more appropriate

4.3.1 In the UK there is a need for sequential, not simultaneous valuation of 900MHz

In the international auctions which Ofcom examines where both 800 MHz and 900 MHz were auctioned, this took place simultaneously. In its present consultation, Ofcom is, in effect, assuming that the value of non-auctioned 900MHz spectrum can be best derived from pretending that it has been auctioned, and that such a hypothetical auction occurred simultaneously with the 800MHz/2600MHz auction, without in any way changing the value of the spectrum that was in fact made available to mobile operators in the auction. There is no explicit recognition in the present consultation that Ofcom has made either of these joint assumptions, neither of which is correct.

To derive a proper view of the value of 900MHz in the UK for the purpose of setting forward looking spectrum fees, it must be considered that any valuation of 800MHz from the auction and 900MHz are not and should not considered to be simultaneous events.

Ofcom is in fact required by the Direction to revise the spectrum fees for 900MHz and 1800MHz after completion of the Auction:

> "*6.—(1) After[62] completion of the Auction OFCOM must revise the sums prescribed by regulations under section 12 of the WTA for 900MHz and 1800MHz licences so that they reflect the full market value of the frequencies in those bands.*
>
> *(2) In revising the sums prescribed OFCOM must have particular regard to the sums bid for licences in the Auction*."

This means that the market value of these bands must be derived not simultaneously with the auction, but as a subsequent act.

There is good reason to think that unlike markets where 800 and 900 MHz spectrum was auctioned simultaneously, the market values of 900 MHz and 1800 MHz spectrum are likely to be lower when valued sequentially post-auction because operators will then know what other frequencies they (and their rivals) hold and will be able to value any increment of spectrum against knowledge of new holdings which they did not previously have.

[62] Vodafone emphasis

As Ofcom established in its preparatory work for the auction, for example in setting reserve prices for the auction, no particular spectrum band can be valued in isolation. In reality any valuation of a particular band must be made in the context of the multi-band portfolios of all mobile operators resulting from the auction. Therefore, the effect of the auction, by satisfying the immediate demand for spectrum with which to launch the competitive 4G services that will rapidly become the major component of mobile activity in the UK and, thanks to the particular outcome which means that all major mobile operators now have some low-frequency spectrum in the form of 800 MHz, this must mean that the forward-looking value of the non-auctioned 900 MHz spectrum will inevitably be lower.

What is more, as the cost for this 800 MHz spectrum is now sunk, it has indefinite title and total cost certainty over the next 20 years, it will form the 'core' low frequency holding for all 4 major UK operators. Any additional spectrum brought into use on top of the basic LTE coverage layer which has been deployed will therefore be used principally for capacity, rather than coverage. Under these circumstances each successive incremental unit has a lower value to the operator than previous increments.

Given that 800 MHz is a core Tier 1 band for LTE with a clear technology roadmap whereas the LTE900 ecosystem is uncertain and may never arrive at scale given the number of operators who will have legacy 2G and some 3G technologies on that spectrum for many years to come and therefore cannot free it up for LTE, there is also reason to think that the relative impact of greater spectrum certainty would be to depress the value of 900 MHz more than 800 MHz. This is especially true if, as discussed in the next section, further spectrum release (eg 700 MHz and other bands) take place before a significant LTE900 ecosystem is established. The 900 MHz band's suitability as a substitute for 800 MHz is likely to decline as it is increasingly used by operators (at least in part) to serve a 'rump' of 2G-only customers and 700 MHz becomes the complementary band for core LTE 800 and 2600 MHz deployment.

This conclusion is not affected by future development of the HSPA ecosystem based principally on 2100 MHz and, to a lesser extent, on 900 MHz. The HSPA and HSPA+ technology is demonstrably inferior to LTE as recognised by Ofcom in its consultation on the liberalisation of EE's 1800 MHz spectrum and discussed extensively in Vodafone's response to that consultation. Ofcom stated at 5.6 of that consultation:

> *"LTE and WiMAX technologies are designed to provide high speed mobile data services. LTE technology specifically, has a number of advantages over3G/UMTS/HSPA technology because underlying differences in these technologies enable LTE to operate more efficiently with respect to the use of spectrum. Specific aspects of network performance where LTE delivers advantages over 3G/UMTS/HSPA, include greater cell spectral efficiency, improved latency, scope to prioritise traffic and the potential for higher peak data rates."*

Again it is surprising that Ofcom has not relied upon any of this information in this current Consultation and instead concludes simply that *'arguments can be made on both sides.'* This is insufficient.

4.3.2 Ofcom's prioritisation of spectrum release increases operator certainty about the availability and timing of alternative bands

Another potential factor is additional knowledge, post-Auction, about the potential availability of future spectrum. Again, this will alter the post-auction market value relative to values observed in the auctions themselves, as we explain below. In the UK, Ofcom has published extensive information in and around their Mobile Data Strategy which is significantly further advanced and more detailed than information available to operators in other national markets. This might, therefore, be expected to mean that UK-specific post-Auction market values have changed

relative to market values observable at the time of the Auction and relative to other markets whose auctions were held earlier with far less spectrum certainty.

As noted, it is only since the Auction that this clearer quantified road map for the release of spectrum with potential timings of such spectrum release has become available in the UK in the form of the Mobile Data Strategy. This road map is a significant new fact that needs to be taken account of in the forward looking value of mobile spectrum, but Ofcom has failed to do so. Ofcom must have been aware that this work was being undertaken, even if it had not been published, at the time the Consultation was being prepared.

Ofcom has expended a very considerable effort on forward looking mobile spectrum issues as indicated in the 2013/14 Annual Plan in particular in relation to future mobile spectrum release – but there is little if any trace of this in the present consultation:

> *"2.8 Securing optimal use of spectrum – this is a fundamental element of our strategy and a major area of our work. Our preferred approach is the use of market mechanisms. However, in some cases we recognise that regulatory action may be needed. Our wider duties, including the goals of effective competition, informed choice and widely available networks and services, can also be supported by our spectrum decisions."*

Moreover, Ofcom has very recently confirmed in its draft plan for 2014/15 that spectrum issues, particularly in relation to the release of additional mobile spectrum, will remain at the forefront of its activities. We find the absence of any such consideration, and any examination of the effect of the proposed mobile spectrum fees on consumers in the present consultation document a very significant omission.

The greater the number of alternatives for meeting the same underlying demand, the lower the incremental value of any one of those alternatives. Clearly this is relevant if Ofcom continues to seek to rely upon the absolute values from its benchmarking exercise, but it is also relevant for relative values.

4.3.3 New information since the international auctions

Similarly, Ofcom appears to have done nothing to update the outputs of its benchmark auctions, notwithstanding that some of these are now up to 4 years old. For its benchmarking work on 900 MHz, 3 of Ofcom's observations are from auctions in 2010, 8 observations in 2011 and 4 in 2012. Of that, its 'more important evidence' comes from Greece and Spain in 2011 and Ireland and Portugal in 2012.

However there have been a number of developments since some of those auctions which have generally indicated that more spectrum will be available than previously considered and in generally shorter timeframes:

a) WRC-12, February 2012: Allocation of 694-790MHz to Mobile in region 1 and identification of this spectrum for IMT.

b) WRC-12, February 2012: Decision for agenda item for WRC-15 on future spectrum for mobile broadband, and the subsequent work in ITU and by Ofcom.

c) Radio Spectrum Policy Programme; published on 14th March 2012: Article 3b) states that "every effort should be made to identify … at least 1200MHz of suitable spectrum [for wireless broadband] by 2015. It is important to note that the figure of 1200MHz does not appear in the Commission proposal for the RSPP of 2010, which only states "make sufficient appropriate spectrum available in a timely manner to support Union policy objectives". Therefore this represented a significant recognition by European policy-makers of the need to identify and release further suitable spectrum.

d) 2.3-2.4GHz: RSPG Opinion on Licensed Shared Access, November 2013 and the establishment of CEPT Group FM52, which first met in October 2012: "WGFM decided at its 64th meeting in April 2012 to establish a Project Team (PT) during its 65th meeting, with the aim to develop harmonisation measures in the band 2300-2400 MHz." A number of initiatives have been launched in 2013 targeted at enabling access to this spectrum widely across Europe, through the use of licensed shared access.)

e) 3.4-3.6GHz Revision of ECC Decision (11)06; Consultation on draft closed in November 13 and now expected to be finally approved by ECC in March 14.

f) Finally, we understand momentum is building for an agenda item for the WRC after WRC-15, to consider further spectrum for mobile broadband at higher frequencies. Ofcom is supporting this as a CEPT proposal, having consulted the UK Government Spectrum Strategy Committee.

Given the central role Ofcom plays in a number of these fora identifying, harmonising and releasing spectrum it needs to take these developments into consideration when seeking to interpret historic data from its international benchmarks as a guide to current market values.

It is absolutely clear from the face of the Direction that Ofcom's obligation is to reflect current market values for 900 and 1800 MHz spectrum. As discussed in further detail in Annex 1 at Section 2.9 any other interpretation would require Ofcom to ignore potentially relevant information such as that referred to above and totally undermine this consultation process. Therefore, it is completely insufficient for Ofcom to attempt to 'update' its estimate of current market value simply by applying an RPI adjustment to its view of 'market values' at the time of the UK Auction.

4.4 The impact of future spectrum release on investment certainty

If, as Vodafone contends, there are a range of factors, all of which point to the market value of spectrum diminishing over the period for which licence fees apply, then Ofcom must consider the risk that fees set at levels which appear plausible in 2014 will nonetheless come to exceed lower market values in subsequent years. While Ofcom may consider that the way to address this uncertainty is to revisit the ALF regularly in order to make adjustments to 'market value' which purport to take these changes or trends into account. However, in doing so, Ofcom would be neglecting its legal duties, as presented in the Direction itself as well as in its broader duties and the requirements under European law which require it to 'create greater investment certainty' within which operators can undertake investments.[63] Regular or constant reassessment of fees would clearly fail to provide the certainty which Ofcom is required to seek and would mean disregarding the objectives, taken as a whole, of the Direction.[64]

4.5 Is there a counter-case that increasing data demand from customers could drive spectrum value up?

Against this, Ofcom could consider that the rising demand for connectivity which underlies policy-makers' desire to identify and release this spectrum in the first place could mean rising spectrum value over time.[65] However, as shown in Annex 10, this additional consumer demand is not forecast to be accompanied by growing profitability for operators. Therefore, there is certainly no evidence put forward by Ofcom which supports rising spectrum values and much from its own work referenced in Annex 8 which clearly shows that with Ofcom's pro-active policy to release more spectrum, values are almost inevitably going to fall further.

[63] See Annex 1 at 5.157
[64] See Annex 11 at 3.4 and Annex 1 at 5.157
[65] Ofcom makes this point at A9.51 of the Consultation, quoting from its UHF Statement

In a situation where the demand for mobile data is rising (and initial indications of 4G take-up are encouraging, reported to be faster than any country after Korea)[66] but the willingness to pay of customers for data is nowhere near linear to volume, the benefit to consumers of high mobile data traffic is not matched by a benefit to mobile operators in terms of rising revenue per user per unit of capacity supplied. Therefore, the ability of operators to provide the additional capacity to meet any anticipated demand increase is dependant upon the economics to the operators of such provision. Ofcom will be compelled by its duties to identify and release more spectrum or face growing unmet mobile data demand from UK citizens and consumers. Conversely, high spectrum costs imposed by Ofcom will be a deterrent to the supply of incremental spectrum capacity. A falling revenue per incremental unit of spectrum will mean that the value to operators of utilising incremental spectrum above that necessary to achieve basic coverage is diminished – this again suggests that not only will spectrum values fall, but 900MHz will be worth significantly less than 800MHz and the value gap between them will grow.

4.6 In these circumstances, Ofcom must also make use of other information on market value that is available to it such as cost modelling

Cost modelling is an approach that has been widely employed by Ofcom and other NRAs to inform spectrum fee setting. In the present circumstances, cost modelling should be used to understand why 900MHz will have a lower value than 800MHz, can suggest an appropriate size of the discount that needs to be applied to the historic auction value of 800MHz to derive a reasonable post auction forward looking market value of 900MHz (and 1800MHz) and as an important 'cross check' for the purposes of spectrum fee setting in the light of uncertain evidence for proposals with such significant consequences.

4.6.1 There is no conceptual reason for Ofcom to reject cost modelling

Ofcom's conceptual framework behind cost modelling for other spectrum bands is entirely consistent with the terms of the Direction. Ofcom states in the context of setting fees under an AIP regime based on cost modelling that it uses cost modelling to establish "*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*."[67] This is substantively identical to the approach Ofcom describes in this Consultation: "*We consider that full market value is the price that would arise in a well-functioning spectrum market. This would be the market clearing price when supply equals demand."*[68]

Therefore, Ofcom's rejection of cost-modelling as a method of deriving market value for 900 and 1800 MHz spectrum is as inexplicable as it is misconceived.[69]

Ofcom's criticisms of the effectiveness of modelling in this consultation are incorrect and misdirected – Ofcom is using the obvious known (but not insurmountable) difficulty of coverage modelling as a reason not to embark on the currently required capacity modelling approach. Ofcom has overcome these practical difficulties in the past and gives no reason why it is impossible or impractical to do so here, especially given the potential impact of its proposals. In fact, Ofcom even used coverage based modelling to assist with setting the reserve prices in the Auction in 2012.

Ofcom's own cost modelling on the use of 700MHz for mobile use conducted for it by Analysys Mason in March 2013 already yields a base scenario for low frequency spectrum and is, as such, a good starting point to estimate the value of 900 MHz. This model sets a value for 700

[66] http://www.rethink-wireless.com/2014/01/08/uk-cellco-claims-fastest-lte-uptake-outside-korea.htm
[67] SRSP at 1.9
[68] Consultation at 2.8
[69] See further Annex 11 at 4.2

MHz spectrum (a reasonable proxy for 900 MHz and in many ways a better one[70]) at around £9m per MHz. This finding reinforces the lower end of the estimates of market value derived by Vodafone elsewhere in this response.

In summary, Ofcom has used technical modelling before and continues to do so in a wide variety of other spectrum bands. Its conceptual approach between cost modelling-based AIP fees and the exercise it is engaged in here are identical. Ofcom cannot reject, on the basis that it does not (yet) have a model perfectly calibrated to address the issue in this Consultation, the use of cost modelling inputs. It is for Ofcom to seek out the evidence and apply it. In fact, when one looks, recent modelling work by Ofcom both tends to support the value range observed by Vodafone from a proper examination of the UK Auction and applying corrected discounts arising in international auctions to translate relative 800 MHz values into 900 MHz values.

Ofcom should, under these circumstances, undertake a modelling exercise to establish the value of 900 MHz and 1800 MHz spectrum, most likely using the recent Analysys Mason work as its starting point.

We now move on to the question of asymmetries of risk in setting ALFs above or below the true market value and how that should influence Ofcom's treatment of the evidence and the setting of rates in the face of uncertainty.

[70] As 800 MHz values include a 'competitive premium' for the launch of LTE services, 700 MHz spectrum may well be a better proxy for 900 MHz value. See further Annex 9.

5. In the face of evidential uncertainty Ofcom should adopt the lower end of any derived range of market value due to asymmetric risks regarding errors of assessment

In this section, we show:

a) There is a clear and accepted asymmetry in terms of welfare loss if ALF is set in a way which means that the market fails to clear.

   i. The risk of setting ALF above a market clearing price is increased if Ofcom sets ALF, as proposed, using average or infra-marginal private values rather than marginal private values, which are likely to be much lower.
   ii. There is no established means of reversing a decision which sets ALF above the true market value other than a potentially very inefficient surrender of (some) spectrum and re-allocation.
   iii. Engaging this uncertain mechanism or frequent spectrum re-valuations will lead to overall greater investment uncertainty.

b) Any increase in ALF, and hence industry cost, is likely to reduce industry investment in the UK in the long run, reducing dynamic efficiency and hence consumer welfare.

   i. Investors could interpret high ALFs as an attempt to expropriate value generated by past investments which will dampen incentives for new investments.
   ii. Increases in ALFs will reduce cash available for short term investments or lead to capital being directed to other, more profitable, jurisdictions.
   iii. As such there is a prima facie case for consumer harm in the form of higher prices, lower investment or innovation if ALFs are set above true market value.

c) In contrast, the efficiency losses from setting ALFs below true market value are limited.

   i. Ofcom provides no evidence of inefficient use of spectrum by existing users;
   ii. Even if there were a risk of inefficient use of ALF spectrum, in principle the incremental welfare loss with setting ALF below market value is immaterial as spectrum trading in this case should be as effective as ALF in incentivising an efficient reallocation of spectrum.
   iii. Ofcom suggests the incorrect pricing signals of below market value ALFs would lead to downstream competitive distortions and significant consumer harm but it does not evidence this or explain how it believes this harm operates today.

These points are discussed further below and at Annex 7.

5.1 Introduction

Ofcom states at 2.8 of the Consultation:

> *"We interpret the term "full market value" to mean that we do not discount our estimate of the price that would occur in a well-functioning market, nor do we set it conservatively compared with the available market information."*

We agree that Ofcom needs to arrive at a single figure for each of 900 MHz and 1800 MHz ALF which will represent Ofcom's 'best estimate' of the appropriate figure taking account of all of the evidence as well as its duties and objectives. As explained below, these duties and objectives require Ofcom to have particular regard to the consequences that would follow if Ofcom were to set licence fees above or below 'full market value'. Again, this is not an abstract exercise, to be undertaken independently of its assessment of the evidence of market value. Ofcom's legal duties in this matter, as provided by EU and UK law, were established before and take precedence over the Direction.[71]

Thus, Ofcom must consider how to weight those duties in light of:

a. the robustness of the data which is actually available to it as to the 'full market value' of 900 MHz and 1800 MHz spectrum and the consequent probability of error;

b. the consequences of such errors, both in terms of setting a licence fee above full market value and of setting a fee below; and

c. how to treat these risks, in light of proper consideration of its duties and objectives.

5.2 The probability of error

We have explained in previous sections how Ofcom has erred in its treatment of the evidence that is available to it in attempting to derive the full market value of 900 MHz and 1800 MHz spectrum. In particular, we have shown that:

a) Ofcom failed to recognise the need to define the relevant increment of spectrum and the relevant bids that are necessary to derive market value from the Auction;

b) Ofcom failed to recognise how the reserve prices and opt in rules limit the information which can be derived from the Auction when seeking to derive market values;

c) Ofcom places reliance upon absolute values of 900 MHz and 1800 MHz spectrum in benchmarking data from other countries which are not reliable indicators of market value in the UK;

d) Ofcom failed to consider how relative values derived from benchmarking data in other countries might differ from relative values in the UK;

e) Ofcom failed to consider other evidence from the UK, including cost modelling, that might assist in deriving a more robust estimation of market value in this context;

f) Ofcom failed to consider how market values derived in auctions might subsequently change post-auction, or how market values may otherwise vary over time.

Ofcom cannot, in these circumstances and with the evidence that is available to it, do anything other than conclude that there is a significant risk that it will derive values which deviate significantly from 'true' market value.

[71] See further Annex 1 at 5.142 to 5.152.

5.3 The consequences of error

Ofcom itself claims to have considered the consequences of setting values which deviate from true market value. It says at A9.2:

> *"We have, therefore considered whether there is a material risk that (inadvertently) setting ALFs above true market value or (inadvertently) setting ALFs below true market value, could lead to a significant welfare loss arising from the inefficient use of spectrum."*

This acknowledges that if Ofcom were convinced, on the facts, that there were a material risk that setting ALFs either above or below true market value could lead[72] a significant welfare loss, then Ofcom would be obliged to reflect this in the manner in which it revised the spectrum fees payable. Ofcom does not argue that there is no point considering the risks of inadvertently setting ALF above or below true market value because the terms of the Direction prevent it from doing anything about it. It accepts that the ultimate decision on the level to which the fees are revised sit with it and the risks and consequences of error are relevant considerations as to how it takes that decision.[73]

This is further reinforced by what Ofcom says at 3.35:

> *"In making these proposals, we have considered our principal duty to further the interests of citizens, and the interests of consumers where appropriate by promoting competition, and we have considered our duties relating to the optimal use for wireless telegraphy of the electro-magnetic spectrum, the desirability of encouraging investment and innovation, the desirability of encouraging competition, having regard to the interests of consumers in respect of choice, price, quality of service and value for money. We consider that our proposals for implementing the requirement in the Direction are consistent with our statutory duties."* (Vodafone emphasis)

In its Legal Annex[74], Vodafone shows that simply declaring the purported 'consistency' between Ofcom's proposals and its statutory duties falls well short of the legal requirement that Ofcom properly 'put its mind' to ensuring that consistency. Nonetheless - and although Ofcom have fallen far short of the analysis required - it is important to recognise that Ofcom and Vodafone disagree about the facts and not the need for a proper analysis of the consequences of setting fees above or below full market value. Ofcom's reasoning for concluding that the risks can be disregarded is based upon a two-stage test. First, Ofcom asks if the risk is symmetric or asymmetric and, if asymmetric, could it lead to significant welfare loss? Ofcom's views are summarised below:

[72] Note that this is Ofcom's language from the quote above. It does not require actual or even likely harm.
[73] As noted in Annex 1 this is why we say the Direction requires Ofcom to revise the fees so that they reflect 'full market value and 'have regard' to the sums bid in the Auction. This is not the same as mechanistically transferring any figure that Ofcom comes up with directly across to the spectrum fees. Ofcom must first satisfy itself that the answer it has arrived at meets its other duties and objectives.
[74] Annex 1 at Sections 1 and particularly 5.87

Risk	Symmetric or Asymmetric	Could lead to significant welfare loss
Return of spectrum	"We recognise there may be an asymmetry"[75]	Unlikely because private values are likely considerably higher than proposed level of ALF Change of use/user could outweigh the fallow costs
Efficient use and investment decisions	No clear reason to expect asymmetric[76]	
Consumer prices	Symmetric- lower prices benefit consumers but risk distorting downstream market signals[77]	
Network investment vs spectrum	Not clear that there are material sources of asymmetry[78]	

Even in Ofcom's terms, it appears to consider that if the question of symmetric or asymmetric risk is 'not clear' in its mind, this is enough for it to dismiss the risk. This falls well short of the requirement on Ofcom to properly reason and evidence its decisions. In any event, we show below that Ofcom is wrong to dismiss these risks or consider that they could not lead to significant welfare loss.

5.4 Risk of returning spectrum

Ofcom's discussion of these various risks starts with the risk that operators will return marginal spectrum. It already accepts that this risk is asymmetric and significant in quantum. But Ofcom says it is convinced there is a low risk of welfare loss as a result of 'mitigating factors.'

In doing so, Ofcom relies upon the assertion that there will be a large gap between the private values of existing users of spectrum and the market value. This, Ofcom believes, minimises the risk that the spectrum will be left fallow as a result of an existing user wishing to divest it (and being unable to trade it).

We have already shown that any estimation of market value undertaken by Ofcom carries a significant risk of deviating from true market value. But there is as much uncertainty again surrounding the private values of existing users of spectrum, which are both unknown and also likely to change over time. The possibility that setting an ALF at the current best estimate of market value could lead to productive spectrum being left fallow now or in the future is therefore real and unavoidable. Ofcom's attempts to downplay this risk, considered next, are not credible.

5.5 Private values above market value prevent operators handing spectrum back

[75] Consultation at A9.4 first bullet
[76] Consultation at A9.4 second bullet
[77] Consultation at A9.5
[78] Consultation at A9.6

Ofcom has not provided any explanation for why it believes that the relationship observed between private and market values for large packages of spectrum in the 800 MHz and 2.6 GHz auction can serve as a proxy for the relationship between private and market values for marginal increments of 900 MHz and 1800 MHz spectrum.

In general it would be expected that the private value of spectrum will decrease with the overall size of spectrum holding with the result that the difference between private and market values for marginal spectrum will be much lower than the average for large packets of spectrum.[79]

- Both the 800 and 2600 spectrum available in the auction provided capabilities that were not previously available - the ability to roll out LTE in low frequency spectrum and the availability of large contiguous blocks of spectrum respectively. As such the blocks would attract a private value premium which would not apply to 900/1800 spectrum at the margin.

- There is empirical evidence from international benchmarking that operators' private values for 1800 and 900 spectrum may be considerably lower than the private bids in the UK auction would imply. For example in Spain, in the most recent auction[80], Vodafone did not bid for incremental 900 spectrum at a reserve price considerably lower than their bids for 800 spectrum in the UK auction.

The risk of error is clearly compounded by the need to set spectrum fees for an extended period of time, during which private values can change significantly as for example, operators can substitute different, lower cost, spectrum to serve the same need or market conditions change and depart from earlier expectations. We consider in Annex 1 how Ofcom's duties require it to deal with these challenges.

Even if Ofcom were right to claim that the difference between private value and market value mitigates the risk of spectrum being left fallow, it does so at the risk of expropriating private value from investors. Ofcom claims to recognise that

> *"in principle, there is a level of ALF which could lead to expropriation of some of the value of existing assets which are timed to the spectrum which … could increase the perceived regulatory risk and dampen the level of future investment in the sector."*[81]

If rational investors consider that Ofcom's objectives are to expropriate shareholder value, or simply that Ofcom is unconcerned if it does so because it relies on this to avoid the risk that spectrum is left fallow then, contrary to Ofcom's claims, this will have a significant negative impact on network investment.[82]

5.6 Possibility of a welfare-enhancing change of use / user

The likelihood of a welfare enhancing change of use other than for mobile telephony seems so low as to be able to be discounted. The 900 MHz and 1800 MHz frequency bands are designated for mobile use on a world-wide basis. There are enormous ecosystems built up around them and future technological development planned. Ofcom is thus really talking about a change of user; either between the existing mobile operators or a new entrant.

[79] Annex 7 at p. 15 et seq.
[80] November 2011
[81] Consultation at A9.39 and A9.40.
[82] Annex 7 at p. 19 et seq.

Ofcom's position here is inconsistent. On the one hand, Ofcom rely upon sunk costs as a reason to discount the possibility that existing users will hand spectrum back. Yet Ofcom also wishes to discount sunk costs to claim there is a significant chance of a welfare-enhancing change of user. It cannot have it both ways.

Ofcom sets out a stylised example to demonstrate that there could be a welfare enhancing change of user. While theoretically true it is, and remains, very unlikely. This is principally because, as demonstrated in the paper submitted by Vodafone to Ofcom in May 2013 (See Figure 5 of the submission attached at Annex 11), the net incremental value of the new user needs to overcome the total welfare loss of fallow spectrum. This strongly stacks the odds against a welfare enhancing change of user particularly if the technical standards and ecosystem mean that user will be offering similar services in the same market as the original user.[83]

Ofcom's stylised example actually shows that even with perfect information, it is only under certain conditions that a reallocation to a more efficient use will be welfare improving outcome (where the re-award process is quick, where the alternative user has a significantly higher valuation than the current user) and where a large spectrum block is released in one go. These are optimistic and unsupported assumptions.[84]

5.7 Impact of spectrum trading

The case for ALFs leading to welfare-enhancing spectrum reallocation becomes even weaker when one considers that a trading regime should ensure that the market is able to obtain these benefits without ALFs of any kind.[85] There are several points to made in this context.

First, Ofcom's reasons for dismissing trading – that no trades have occurred and there may be 'strategic' reasons for this – are as likely to be evidence that spectrum is already in the hands of the highest private value users as evidence of a failure of trading. Ofcom has made no attempt to ascertain which is the more plausible explanation.

Second, even if it were correct, Ofcom cannot rely on this 'absence of evidence' to suggest ALF would improve matters or that ALF needs to be at the proposed level to achieve that benefit. If there is a problem with trading this should be addressed directly by Ofcom seeking to streamline the trading regime by issuing guidance on spectrum trades where it would have a positive presumption of approval- as has been done in the US; a market with many spectrum trades and no annual fees.

Accordingly, Ofcom cannot dismiss spectrum trading, as it attempts to, in order to argue that there will be significant inefficiencies if ALFs are set below true market value and the costs of setting ALFs too low are therefore of a similar magnitude to those associated with setting them to too high. We show in Annex 7 that a proper weighing of the arguments and evidence suggests:

a) Ofcom cannot be confident that the gap between private values and market values ensures that spectrum will not be left fallow, particularly when setting licence fees for an extended period of time;

[83] Annex 7 p. 8 et seq.
[84] See further Annex 11 and Annex 7 at p. 13
[85] Annex 7 p. 11 et seq.

b) Ofcom cannot rely on sunk costs to ensure that existing users will not return spectrum, because this is inconsistent with other its argument for welfare-enhancing reallocation and because, even if correct, it will undermine investment incentives (which its duties and, in particular, the Direction do not allow it to do);

c) Ofcom itself shows that the costs of spectrum being left fallow are very substantial;

d) Ofcom cannot dismiss spectrum trading as a means of ensuring the efficient allocation of spectrum irrespective of the level of ALF in the market. Ofcom fails to consider whether the absence of trades to date reveals that current spectrum is efficiently held, as opposed to being evidence that trading cannot be relied upon, as Ofcom assert; and

e) Even if Ofcom is correct in its view that trading cannot be relied upon, the proportionate policy response is to address the underlying reasons for this, not, as Ofcom do, to disregard the risks of setting ALFs above market values.[86]

5.8 Impact on consumer prices

Ofcom argues that (inadvertently) setting ALF below true market value will result in inefficient investment decisions by operators and incorrect downstream market signals.[87] The implication of this is that Ofcom considers there to be a current distortion of investment decisions by UK operators and the downstream market which it is seeking to correct through the adoption of ALFs. Yet these distortions, which would appear to arise in a market which Ofcom otherwise describes as being effectively competitive, are not presented. Again, no weight can be given to such assertions without Ofcom considering, in detail, the nature of the distortions which it observes and then demonstrating that the adoption of a particular approach to the setting of ALFs is justified and required in order to remedy them in a manner consistent with its overall legal duties. Such unsupported reasoning is a direct result of Ofcom's failure to do a proper Impact Assessment on its proposals.[88]

5.9 Impact on the trade-off between spectrum and network investment

One way of avoiding higher spectrum fees is for operators to reduce their holdings and reduce coverage or build a higher density of sites to use remaining spectrum more intensively. As noted below, new Single Radio Access Network (SRAN) equipment means that if a site is upgraded from what is currently a 2G only site, it will be upgraded to 3G and 4G at the same time as the incremental cost of exploiting all of the capabilities of the hardware is relatively small.

If higher spectrum fees mean more network build and the use of less spectrum, operators are likely to concentrate that network build in urban areas where spectrum re-use can be heavy and site density will be high. In contrast, in rural areas, a reduction in usable spectrum would require uneconomic new sites to be built or upgraded. Instead, an operator is likely to 'make do' with rather thinner or less complete coverage. To this extent, higher spectrum costs will create a new, lower equilibrium in relation to the economic viability of sites. Consumers will lose both breadth and depth of coverage.

[86] It is worth noting in this regard that it has been Ofcom's practice to set AIP rates at 50% of the value resulting from application of the network cost model, precisely to recognise this form of asymmetric risk. See Annex 11 at 4.2

[88] Annex 1 at 5.83 to 5.164

While Ofcom has attempted to describe this trade-off between spectrum and network build as a symmetric risk, it is clear that it is not. If higher spectrum costs slow down or prevent the upgrade of 2G only sites to 3G and 4G, this will fly in the face of the objectives of the Direction which include maximising next generation wireless mobile broadband services.

Moreover, in terms of both cost and disruption to customers and citizens the building of more sites in order to avoid or minimise spectrum charges conflicts with Ofcom's other policy decisions. Indeed, much of Ofcom's work in its Mobile Data Strategy identifying additional spectrum bands to be released is being undertaken precisely so that consumers can enjoy greater coverage and capacity without large-scale increases in site numbers.

Finally, Ofcom has failed to ask UK mobile operators to assess the potential impact on their network investment plans if Ofcom were to set ALFs in the manner proposed in the consultation document. It should have done so as part of a proper impact assessment process, which Ofcom has also failed to undertake. Vodafone provides, at Annex 10, some evidence relevant to the undertaking of this exercise. Again, these are the kinds of issues we would normally expect to see covered by a proper Impact Assessment.[89]

Finally, we turn to the question that, having established a lump sum value for 900 and 1800 MHz spectrum in the UK in a manner consistent with the evidence, Ofcom's duties and the risks of error, how should Ofcom turn that value into an annualised fee?

[89] Annex 1 at 5.83 to 5.164

6. Lump sum conversion of resulting values and issues of implementation

6.1 What is the proper approach to making operators indifferent between a lump sum payments and an annual fee?

We agree with Ofcom's conceptual approach that to set ALFs appropriately, they should be implemented in a manner which means operators will be 'indifferent' between paying the annual fee or the lump sum value.[90] However, Ofcom has failed to properly implement that approach in its proposals.

6.1.1 The cost of capital versus the cost of debt

Ofcom has converted the lump sum spectrum values into annual fees by using an annuity calculation. The lump sum has been converted using the Weighted Average Cost of Capital (WACC). Whilst there are other issues in the way Ofcom has chosen to convert the lump sum values into annual fees, the use of WACC is the most material and contentious.

In charging for spectrum on an annual basis, Ofcom has effectively issued a loan to each of the MNOs. The ALFs rank higher than any returns to shareholders. Indeed, returns to shareholders, whether in the form of dividends or retained earnings will be the residual value once ALFs have been paid. Ofcom is effectively having its cake and eating it by placing itself at the top of the hierarchy of lenders whilst accruing part of the returns that are intended to compensate equity investors for the risk they assume by being at the bottom of the hierarchy. As such, from Ofcom's perspective it is significantly better off by charging licence fees that are annualised on the basis of WACC. It has effectively invested the upfront fee in a low risk investment with high risk returns.

The only way that using WACC could be appropriate would be if Ofcom considered that its 'financing' did not sit at the top of the investment hierarchy because there exists a significant risk of operators renouncing the spectrum and returning it to Ofcom. For this risk an equity premium might be appropriate. But Ofcom makes it absolutely clear in the Consultation that it considers the chance of operators returning spectrum at the proposed levels of ALF are insignificant. [91]

But Ofcom's position is totally inconsistent. Either the risk of return is not material in which case ALFs are most akin to a secured debt and the Cost of Debt must be used or the risk is real in which case Ofcom has failed in its legal duties to promote the interests of consumers, provide greater investment certainty to operators and most notably, ensure optimal use of spectrum which cannot be the case if spectrum lies fallow for any significant period.[92]

Whether Ofcom takes account of those risks and reduces the ALF accordingly or simply decides that, in its view, the risk of return is not material the result is the same: ALFs set in a manner to minimise the risk of return of spectrum reinforces the argument for ALFs to be annualised using a Cost of Debt. The implications of this are explained in more detail in the paper written by Oxera Consulting, attached at Annex 12.

In short, Ofcom has justified its use of WACC by claiming this is the measure that makes the MNOs indifferent between a lump sum payment and annual licence fees. But Ofcom has erred in reaching this conclusion. By introducing annual licence fees that are higher up in the hierarchy of providers of finance, the annual licence fees have increased the volatility of equity

[90] Consultation at 5.21 and 5.22.
[91] Consultation at A9.38
[92] Note that for tradable spectrum to be returned and lie fallow would require that with the level of the attached ALF payments, the current user was not able to find any willing purchaser of that spectrum. This means the ALF is not only above the private value of the current user but is above the private value of all potential users. At this point, the ALF must be above market value.

holders' returns. Even when the expected returns are equivalent, when volatility is increased equity investors require greater compensation. True equivalence/indifference is only achieved when the licence fees are annualised on the basis of Cost of Debt rather than WACC.

Therefore, Ofcom has erred in using WACC to annualise the lump sum spectrum values. From Ofcom's perspective the result is a mix of equity and debt returns for a form of financing that sits at the top of the investment hierarchy while from MNOs' perspective the result of introducing much higher ALFs is increased volatility in shareholder returns without any additional compensation. This is not consistent with the Direction or Ofcom's wider duties as it results in annualised licence fees that are in the range of 20% - 30% above those that would be achieved in the open market for asset financing of this variety.

[CONFIDENTIAL MATERIAL REDACTED]

6.1.2 Is Ofcom justified in making a 'tax shield' adjustment?

Ofcom highlights two differences between lump sum payments and ALF with respect to tax:

a) ALF is adjusted for inflation and is therefore constant in real terms. Lump sum value is amortised based on nominal value and is therefore declining in real terms. As such, relatively more of the tax shield from ALF payments arise in the early years; and
b) The full ALF payment is tax deductible (including the implicit finance charges) whereas only the nominal spectrum value is tax deductible in a lump sum payment scenario. This results in a significantly higher tax shield under ALF.

Ofcom's tax adjustment factor is proposed to equalise the net impact of ALF and a lump sum value to return the MNO to indifference.

We agree in principle with the first of Ofcom's differences but it is largely immaterial. The far bigger impact is due to the second difference which we believe is an error on Ofcom's part. Ofcom have ignored that a MNO that purchases spectrum based on a lump sum (say, auction) basis will need to finance that purchase. Assuming that the MNO retains an optimal level of gearing, a significant proportion of the funding will be through debt. Any interest charges associated with the issued debt will be tax deductible. Assuming that the loan is repaid over the life of the asset (i.e. 20 years), interest payments will be front-loaded, to some extent countering Ofcom's first difference. The inclusion of interest charges associated with the spectrum payments significantly erodes the tax shield benefits of ALF compared to a lump sum payment.

Additionally, as explained in Annex 12, the correct discount rate to use when annuitising the lump sum value is cost of debt and not WACC. As such, Ofcom has overstated the difference between ALF and a lump sum payment by overstating the annual fee (in real terms). Once this error has been corrected, the tax shield benefit of ALF compared to the lump sum payment will be negligible rather than the current assumption of 11%.

6.2 Should Ofcom use RPI or CPI to measure inflation?

In paragraphs 5.41 to 5.47 of the Consultation, Ofcom considers whether CPI or RPI should be used as the measure of spectrum value indexation, and concludes that it should continue with RPI. In 5.47 Ofcom rejects the use of a specifically built spectrum index:

"There is also a risk (which Ofcom has no ability to control or mitigate) that they may not be available in the future….. While these risks also apply to CPI and RPI, we consider that the risk is lower."

Unfortunately the same consideration would appear to apply to RPI as well. The RPI measure, whilst still currently extensively used, is no longer a National Statistic because of the findings by the ONS in 2013 that:

a) *the methods used to produce the RPI are not consistent with internationally recognised best practices; and*

b) *the resulting decision to freeze the methods used to produce the RPI, and only to contemplate 'routine' changes*

This clearly imperils the long term survival of the RPI as a reliable measure. An alternative measure, the RPIJ has been introduced as a potential substitute – however it currently has the status of an "experimental measure". It cannot be assumed therefore that it will be continued with, without substantial alteration and potential discontinuity, for the extensive period contemplated by the spectrum fee consultation. The advantage of an alternative to RPI or RPIJ is relatively obvious.

Ofcom states in its December consultation on the rate of mobile DCC charge:

"We recognise that in more recent charge controls we have considered the use of the CPI inflation index and proposed to make it the default inflation index for the LLU/WLR and future charge controls. However, in order to ensure consistency with the estimate of the weighted average cost of capital ("WACC") and the equipment unit price trends in the 2011 MCT model we propose to maintain the use of the RPI inflation in the specific circumstances of this review."

In the present circumstances the use of inflation indexation has no obvious historical precedent in mobile spectrum fee setting, and thus there is very much less of a consistency problem. We understand that the use of a measure other than RPI may cause Ofcom a short-term difficulty with its WACC estimation, but this is not a clear reason to adopt an index where the long-term appropriateness and even its survival is in question.

The analysis thus inexorably leaves the CPI as the least worst choice for a general inflation indexation for a 20 year recovery measure. Therefore we believe that, at this point, CPI should be preferred over RPI for setting annual spectrum fees.

6.3 Introduction and Implementation of new ALF rates

The Direction obliges Ofcom to ensure that spectrum charges that it sets will promote greater investment certainty. In other words, the regulatory environment in which investment decisions are made by mobile operators should be enhanced through the way in which spectrum charges are set. Certainty is a necessary pre-condition to investment decisions in infrastructure, which is no doubt why the Direction mentions maximising coverage of next generation services in the same breath as investment certainty.

In this case, there are two obvious ways in which Ofcom has singularly failed to promote conditions that will increase the certainty necessary for investment decisions:

a) The absence of any transition period over which new spectrum charges are phased in; and

b) The way in which Ofcom proposes to seek payment of spectrum charges from mobile operators following their imposition.

6.3.1 The absence of a transition period

The lack of any consideration of how a significant rise in spectrum charges will diminish incentives to invest and innovate is already a source of considerable concern elsewhere in our response. But that concern is exacerbated very considerably through Ofcom's decision not to allow for a period over which new spectrum charges are phased in. The proposed level of spectrum charges represents a five-fold increase in the current level of such charges. Ofcom has made clear in the context of other regulatory decisions, most notably price controls, that operators must be allowed to adjust to unexpected cost shocks of this magnitude or consumers are likely to be made worse off as these operators seek to defray these costs through the adoption of short-term commercial measures that are likely to have an adverse impact on consumers. This is why Ofcom has allowed for the phasing in of significant changes to the industry-wide cost structure through the use of glidepaths. But Ofcom rules out the use of such a mechanism in this case on the basis that:

> *"Licensees have known since December 2010 that fees would be revised to reflect full market value. We believe that revised fees can be implemented in a single step without having an adverse impact on services delivered to customers."*[93]

We have already addressed Ofcom's unwarranted assertion that implementation can take place without an adverse impact on services and customers in our criticisms of Ofcom's failure to carry out a proper Impact Assessment and initial evidence of the impact of inflated ALFs on Vodafone's network deployment plans.[94]

We move on here to Ofcom's claim that mobile operators knew that increased spectrum charges were in the offing to defend a decision not to allow for a period of adjustment. In this case, mobile operators knew even less about Ofcom's likely direction of travel than in the case of a price control where previous cost models and methodologies would provide an indication of a likely range within which a new charge control might fall. In this case, the mobile operators could not even establish a range of likely charges for the simple reason that prior to the Auction, no operator could have known the outcome and the level of new charges resulting from the application of a methodology which Ofcom deliberately (and rightly) kept vague prior to the Auction so that it did not unduly influence bidding behaviour. The first time that a range – which Vodafone's analysis reveals to be far from credible – became known was in November 2013. No operator could, on any objective analysis, be said to have had sufficient notice about the likely increase in fees and therefore to have had time to plan and react appropriately.

The case for Ofcom to provide for some transition period is therefore compelling. To do otherwise would not be compatible with Ofcom's general duty to create a climate that is conducive to investment by its stakeholders and, in the specific context of the Direction, to do so by promoting greater certainty. These arguments are set out in detail at Annex 1.[95] Vodafone believes that Ofcom must revisit this issue and consult upon what is an appropriate period over which new charges may be phased in.

6.3.2 The mechanics for the recovery of charges

Intertwined with the issue of transition periods are the mechanics that Ofcom intends to put in place to recover the new fees from licensees.

This is a matter that we consider in greater detail in Annex 1, but the simple point is that Ofcom's proposal will mean operators would pay twice for one payment period following the imposition of a new charging regime.[96] That type of arrangement is unprecedented and unlikely to be compatible with the provisions of the Direction in that it would clearly represent a charge in

[93] Consultation at 1.20
[94] See Annexes 1 and 10
[95] 5.118 to 5.135
[96] 5.136 to 5.141

excess of full market value – in effect applied retrospectively - that will again create a further disincentive to investment.

These are concerns that Ofcom must address in a further consultation through a new proposal. The most prudent way forwards, that is more likely to be consistent with Ofcom's wider legal duties and obligations, would be to allow for existing spectrum charges to be extended for a transitional year so that any charges apply on a genuinely forward-looking basis. Taking the wider objectives of the Direction into account, such an approach would have a much greater prospect of driving investment certainty in the short and longer term.

Vodafone Limited
17 January 2014