

# Mobile Call Termination

BT's response to Ofcom's proposals

22 November 2006

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## Executive summary

### ***An unfair settlement for UK consumers***

In setting mobile termination rates, Ofcom has a duty to strike a balance between the interests of the mobile operators, which are entitled to recover all the costs they reasonably incur in terminating calls on their networks, and the interests of ordinary phone users, who are entitled to be charged no more than these reasonably and efficiently incurred costs. BT believes strongly that the proposals in the Consultation Document get the balance wrong, with the result that users of fixed phones in particular will be significantly over-charged.

Such an unwarranted transfer from ordinary fixed phone users to the mobile network companies cannot be allowed to go unchallenged and deserves to be subject to much more open and public debate than has so far happened.

It must not be forgotten that this is a service not subject to the normal constraints of competition, and is therefore one that consumers must rely wholly on the regulator to ensure a fair outcome. There is an overwhelming case for Ofcom to reconsider whether this is indeed a just settlement for UK consumers.

### ***Spectrum Costs***

The biggest single problem is Ofcom's treatment of the 3G spectrum licence fees. These were determined by an auction held at the height of the internet bubble that produced prices far in excess of true economic values. Despite this, the proposals in the Consultation Document value the spectrum at very close to the original auction value. Moreover, even though the prime driver of the auction was a belief that the 3G spectrum would support a whole new range of data services, the proposals allocate the bulk of the spectrum costs to voice services.

The overall effect is to produce a perverse result. Ofcom's own modelling concludes that the unit costs of voice termination will be lower on 3G networks than on 2G networks. This is exactly as one would expect, as a move to a superior technology should reduce the costs as compared with previous 2G networks. However, once Ofcom adds in its estimate of the cost of spectrum attributable to voice, the cost of voice termination on a 3G network is then **higher** than over 2G. This fails the basic "sanity test" that a superior technology should mean costs of existing services fall, not rise.

This failure arises because Ofcom has largely used the fees paid in the 2000 auctions as representing the current value of 3G spectrum in the UK. The 3G auctions raised huge sums and, because of these fees, fixed consumers will be paying, as a conservative estimate, around £175m per annum more for their calls to mobiles. These consumers are therefore not benefiting from new technology as one would expect.

Instead, the proposals in the Consultation Document would protect the mobile network operators and their shareholders from the mistakes they made in the past. They over-paid for the licences and have so far failed to generate the additional data revenues on which their calculations were based. This is business. Companies do make mistakes. But in normal competitive business life companies and their shareholders bear the costs of those mistakes and are not

able to pass their costs on to their own customers, or in this case the people who are direct customers of other networks, not theirs.

#### ***A fundamental contradiction***

There seems to us to be a fundamental contradiction in the logic in the Consultation Document. If it is indeed the case that most of the value of a 3G licence is related to continuation of existing services (as the Consultation Document assumes), this must be because 3G allows existing voice services to be delivered significantly more cheaply than on 2G. However, if the predominant benefit of 3G licences is cheaper delivery of existing voice services, then how possibly could these services become more expensive with 3G than with 2G?

#### ***The use of 3G Spectrum***

Rather than voice, we see the primary benefit of 3G is that it can provide a wide range of advanced data services that the mobile operators would have been unable to provide over 2G networks. The relatively disappointing commercial performance of mobile data services so far does not undermine this. It is therefore mistaken to allocate so much of the fees to voice calls. Licences were bought for one primary reason – to provide advanced data services – and consumers should not be charged as if they were acquired primarily for voice.

#### ***The value of 3G Spectrum***

There are also very good reasons to believe that the prices paid in the UK 3G auction do not reflect the economic value of a 3G licence in terms of benefits to UK consumers. The UK auctions themselves were extraordinary, raising the highest per capita fees in Europe and dwarfing those in most other European countries. To pass the fees on to consumers, Ofcom should be convinced that they represent the value of the spectrum in the UK – and that spectrum has been massively under-valued in virtually all other European countries. We have identified three reasons why we think Ofcom cannot be sufficiently confident on this crucial point:

First, the UK auctions took place at a time when investor exuberance pushed asset valuations above underlying values. Second, the valuations may have reflected the value of securing a “toe-hold” position in future European auctions. Third, the restrictions within the design of the auction may have pushed up prices above the true opportunity cost of the resource.

#### ***The value of 2G Spectrum***

It might be suggested that the reason our “sanity test” has been failed, and that consumer charges do increase with the switch to 3G, is that 2G spectrum has been licensed too cheaply in the past and warrants revaluation.

BT accepts that this is a valid theoretical possibility but we find the implied revaluation of 2G spectrum highly improbable. At the very least, we would expect a clear and compelling explanation by Ofcom as to why such an improbable increase is implicit in the regulatory proposals.

#### ***A reasonable alternative***

Rather than pass through virtually all the spectrum fees, we suggest that some relatively small proportion of the fees may well have been paid in order to access a cheaper technology for the provision of voice services and to provide a

migration path. We believe that the part of the spectrum fee that was acquired to save costs on voice call termination can be seen as a legitimate extra cost incurred by the mobile operators and which consumers might reasonably be asked to bear. This would be consistent with an approach which reflects the operators' efficiently-incurred costs for providing voice call termination.

It is also straightforward to implement such a regime. An allowance for the "cost savings" value of the spectrum fees could be achieved by setting call termination charges solely on the basis of 2G unit costs (and spectrum fees) for the entire volume of terminating traffic. This would have the effect of allowing the mobile operators the cost savings from 3G; these savings would also represent the permissible contribution to the 3G spectrum fees. That is, to the extent that the 3G spectrum was acquired to save costs on voice, efficiently incurred costs would be reimbursed. All the rest must be for other services, for which no regulatory control is necessary and in respect of which mobile operators and their shareholders should be rewarded if new services are successful.

Regulation based on the above "sanity test" suggests call termination rates in 2010/11 should be no higher than 4.3 pence per minute. This implies a price cap of around RPI-6.5% for the four years of the control. We estimate that, with a smooth glide path of price reductions, this would help to redress the balance for fixed-line consumers to the extent of £400m over the control period.

# 1 Overview

## 1.1 Introduction

BT welcomes Ofcom's recognition that termination of voice calls, regardless of the technology employed, requires regulation. Control of termination on 3G networks as well as 2G networks was something BT called for in its responses to all of Ofcom's recent consultations. Ofcom's previous decision to allow MNOs to charge a single blended termination rate, which includes an unregulated 3G termination charge, will have cost fixed-line consumers millions of pounds by the time the new control takes effect<sup>1</sup>.

Ofcom now has the opportunity to impose regulation that strikes the right balance between allowing the MNOs to recover the costs they reasonably incur in providing voice termination, promoting technologically neutral competition and last, but by no means least, protecting the interests of ordinary consumers. Unfortunately, the current proposals fail to achieve that balance and above all do not provide a fair deal for consumers.

## 1.2 Market definition and market power

We agree with Ofcom that:

- there are separate markets for wholesale voice call termination on each mobile network (regardless of the technology employed);
- each Mobile Network Operator (MNO) has 100% market share in its respective market;
- no purchaser of this MNO service (including BT) exercises countervailing buyer power, and therefore each MNO has Significant Market Power in the relevant market.

## 1.3 Market remedies

Ofcom is correct in its proposals to impose on each of the five MNOs: a charge control; a prohibition on undue discrimination; a requirement to provide the service; and obligations to publish contracts, charges and volumes.

## 1.4 The proposals

We acknowledge that the proposals rest in part on a thorough and appropriate examination of network costs model, but the proposals also rest on a failure to assess and apply the correct level of other costs to voice call termination. This applies in particular to 3G spectrum.

The proposals essentially assume that the original auction values are a fair representation of the current economic value of the spectrum and that it is appropriate to allocate a substantial proportion of the spectrum cost to voice. Neither of these two assumptions is warranted; firstly, special circumstances, not the least of which was the TMT (Technology, Media and Telecommunications)

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<sup>1</sup> The figure in respect of BT's own customers is approximately £10m; this figure excludes any over-charge in respect of H3G's unregulated charges.

boom, drove the auction prices to levels which all independent commentators now agree far exceed the economic value of the spectrum; and secondly, the MNOs bought the spectrum to provide new data rather than voice services. The consequence is that fixed phone users will be required to significantly over-pay for the services they receive, in large part to compensate the mobile network operators for having over-bid in the spectrum auctions. The remainder of our response explores this in some detail.

## 2 Valuing spectrum

### 2.1 Introduction

Ofcom's own modelling unsurprisingly suggests that the unit costs of voice termination will be lower on 3G networks than on 2G networks. This is exactly as one would expect, as a move to a superior technology should reduce the costs of providing voice services, including termination, as compared with previous 2G networks.

However, once the cost of acquiring 3G spectrum licences is added in, the cost of voice termination over a 3G network is higher than over 2G. This result fails the basic sanity test that moving to a superior technology should cause costs of existing services to fall, not increase. We explain below in some detail how this bizarre result has come about and why it is mistaken.

From the consumers' perspective when ringing a mobile, there is no benefit whatsoever from mobile network operators having acquired 3G spectrum. Despite this, the Consultation Document does not explain anywhere why consumers should pay more for services that they already enjoy simply because the MNOs have freely chosen to adopt 3G technology to provide new services.

#### ***Allowances for spectrum***

The effect of adding in 3G spectrum licence costs on regulated charges is very considerable under Ofcom's proposals:

The Consultation Document proposes to add 1.1ppm for spectrum<sup>2</sup>, which increases the charges paid by consumers by around 30% over the network costs involved in the provision of voice services.

The large majority (up to three-quarters) of the 3G spectrum licence costs are attributed to voice services, with call termination accounting for about one-third of this. Therefore, up to one-quarter of the 3G spectrum costs are to be recovered from call termination under Ofcom's proposed approach.

By comparison, the cost of existing 2G spectrum is circa £64m each year. Even if all of this is considered to be for voice services (that is, ignoring any allocation of this amount to 2G data services such as SMS), around one third might be apportioned to voice termination – that is, just over £21m. The proposals in the Consultation Document would add around £150m to the annual spectrum costs levied on consumers.

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<sup>2</sup> In the case of the 2G/3G MNOs; the cost allowances in respect of H3G are higher.



### ***The logic of Ofcom's approach***

We have a number of observations on this:

First, it is highly implausible that the large majority of 3G spectrum costs are associated with existing voice services. The value of 3G spectrum is primarily about the options it creates for MNOs to offer advanced data services, not carry on with business as usual.

Moreover, there is a fundamental contradiction in the logic in the Consultation Document. If it is indeed the case that most of the value of a 3G licence is related to continuation of existing services, as Ofcom purports, then this must be because 3G allows existing voice services to be delivered significantly more cheaply than on 2G. However, if the predominant benefit of 3G licences is cheaper delivery of existing voice services, then how possibly could these services become more expensive with 3G than with 2G?

Fortunately, there is a solution to these conundrums. First, there are very good reasons to believe that the prices paid in the UK 3G auction do not reflect the economic value of a 3G licence in terms of benefits to UK consumers. Second, the proportion of the 3G spectrum costs that should be allocated to existing voice services cannot possibly be as large as Ofcom suggests. Not only is the 3G spectrum cost pie too large to start with, but also existing voice services, including termination, are receiving too large a slice. We expand on this reasoning below.

It is inevitably the case that trying to assess the economic value of 3G spectrum and what part of this is related to continuation of existing 2G services is fraught with uncertainty. Ofcom has attempted to address this by taking a scatter-gram approach, running various scenarios for its assumptions and averaging across these. This approach has bypassed basic common-sense checks. For instance, the economic value of 3G spectrum associated with existing voice services must be related to the cost savings that the superior technology can deliver in providing existing services. Ofcom's scatter-gram analysis fails to apply this fundamental constraint.

Although any estimate of incremental cost for voice call termination on 3G is uncertain, we know that there are certain bounds it should satisfy – in particular that it should not exceed the corresponding 2G unit cost (including 2G spectrum costs). This provides a simple and practical means of setting a regulated price ceiling, as we discuss below.

## **2.2 The effect of 3G on existing services**

### ***The benefits of 3G***

The primary benefit of 3G for MNOs is that they can provide a wider range of advanced data services than they would have been able to provide over 2G networks. At present, use of such service is limited, but it is expected to grow rapidly. 3G networks can carry a wide-range of different services (for example, Internet connectivity, office and intra-net applications, video-calling, streamed video on demand, broadcast TV etc) over a common platform.

We can expect further new services and applications using 3G and related technologies to emerge in the future, even though it may be difficult to anticipate what these might be at present. The full benefit of 3G licences in enabling new services and applications has yet to be fully realised.

As a secondary benefit, 3G networks can provide voice calls more cheaply than 2G networks. Moreover, there is much more flexibility within a 3G network to spread capacity between different services and users, and to degrade quality of service smoothly as capacity becomes stretched. As 3G handset take-up grows, MNOs can provide for growing voice traffic through 3G investment, rather than building more 2G capacity. This process of shifting new investment over to 3G is already happening. Indeed, MNOs may choose to accelerate the process of shifting to a platform with lower unit costs for voice by encouraging customers to switch to 3G handsets.

Thus, 3G is in the main about enabling new services and in part also about delivering existing services more cheaply. In a competitive marketplace, this should mean that the prices of existing services fall as a result of 3G, *regardless* of the fact that significant costs have been incurred to provide the option for future new services.

### ***A simple analogy***

A simple analogy makes this clear. A dairy farmer is thinking of making large capital purchases – a new tractor to enable him to expand into arable farming and some additional land. Because there is a competitive milk market, the farmer cannot expect to be able to increase the price he charges for milk to pay for the new tractor and land. Even if the tractor generates some benefits for the dairy farming business (for example, faster hay cutting), its costs need to be covered from anticipated revenues from the new cereals business, else the investment would not be incrementally profitable. Moreover, there is no guarantee that the new cereals business will yield the revenues expected and so pay for the tractor. The milk price cannot be increased to pay for any shortfall and so the investment is at the farmer's risk.

The move from 2G to 3G is rather like all farmers moving from oxen to tractors, as there is a technological change affecting all competitors at the same time. For arable farmers, there is a large efficiency improvement, whereas for dairy farmers, there is a modest efficiency improvement. Mixed farmers cannot recover the costs of tractors from milk, as this would simply create a competitive opportunity for a pure dairy farmer not to mechanise and undercut on price. Therefore, mechanisation should not lead to a higher milk price and might even lead to a lower one. Were milk customers to be expected to pay more for milk because the cereals business was poor, they would in effect be taking on some of the risk in purchasing the tractor, when clearly this is a decision made by the farmer, for the farmer's interests, and he should bear the full risk of growing the cereals business.

Exactly the same logic applies to 2G and 3G. If MNOs expected to pay for 3G licences through higher charges for voice services, then this would have created an incentive for one or more operators to keep 2G as a standalone business that could then undercut 3G operators on price.

Another analogy might be an MNO deciding to purchase additional spectrum and infrastructure to provide new wireless broadband services at some point in the future. It could not expect to be able to fund these investments through higher charges for existing mobile services, as otherwise there would be an opportunity for other MNOs to take a different approach – not to diversify into wireless broadband but to offer relatively cheaper mobile services.

### ***The role of regulation***

Even though the price of mobile call termination is not competitively determined, the retail price of mobile calls is, and these principles are just as relevant. Regulation should be looking to proxy the outcomes that effective competition would produce, if that were feasible. Increasing the price of existing voice service to pay for the costs of acquiring 3G service is not an outcome compatible with effective competition and so not an outcome that regulation should be seeking to create. In the example above it is as if all the MNOs were able to agree and work together to increase the price of voice services which implies that the proposals, far from producing the outcomes that would be expected in a competitive market, are producing an outcome that would only be expected under monopoly conditions. Regulation normally aims to produce outcomes that mimic those that would result under competitive market conditions, but in this case it is producing an outcome that would apply only if competition were restricted – our farmers would only be able to increase the price of milk if they were to act together, collectively and illegally.

The Consultation Document fleetingly considers some of these issues in paragraph 9.19, where it says that:

*“there may be an argument for taking the cost of 2G termination as a benchmark for a reasonable cost of supplying MCT in general, irrespective of the technology used to supply it in practice.....It could be argued that the charge for this service should not be higher in the future as a consequence of the introduction of 3G as a new technology to supply what can be considered to be the same wholesale termination service.”*

There is more than just “an argument” to this effect. If regulation is seeking to proxy competitive outcomes, then it is a necessity that prices for existing services do not rise as a result of investments in new activities.

Ofcom dismisses this point in paragraph 9.21 on the grounds that it might mean that MNOs are then unable to recover their “efficiently incurred costs”. Whilst BT is very much in favour of regulation that ensures recovery of efficiently incurred costs, an investment that made it more expensive to deliver existing services cannot be efficient. Therefore, Ofcom’s objection is simply irrelevant. 3G investments lead to no increase in the functionality of voice calls to mobiles. There is no reason for efficiently incurred costs of providing voice services over 3G to be higher than 2G and, indeed they should be lower to the extent that 3G networks can deliver voice calls more cheaply.

### 2.3 The implied value of 2G spectrum

An upper bound on 3G spectrum costs associated with existing voice services is provided by 2G spectrum costs plus the network cost savings for voice services obtained from moving from 2G to 3G. The cost of voice services on 3G cannot be more than this otherwise it would not be rational for MNOs to migrate voice services to the 3G platform. 2G costs can therefore be used to inform an upper bound estimate of the value of 3G spectrum for voice services

BT appreciates that, if the logic of our "sanity test" is used to value 3G spectrum, then it is important that 2G costs are accurate. One part of these costs is for 2G spectrum, for which Ofcom raises an annual charge of £64m. Ofcom says these fees "are derived from estimates of the marginal opportunity cost of MNOs gaining an additional carrier of 2G spectrum"<sup>3</sup>. The only reason we can see why the "sanity test" might be failed is if 2G spectrum itself has been undervalued. To extend the analogy of the dairy farmer: the logic is that the value attached to the oxen has been too low; cost-based prices are then justified as being higher as the oxen themselves are to be deemed more valuable and should attract a higher cost allowance.

We can find little to give such arguments credence in this particular case and certainly the Consultation Document does not provide any evidence why 2G spectrum is now more valuable than the £64m annual charge. It also needs to be much, much more valuable - we calculate that the implied revaluation of 2G spectrum implicit in the call termination charges proposed by Ofcom is around £465m<sup>4</sup> each year – a figure over seven times higher than that currently thought to approximate the marginal opportunity cost of 2G. In effect, this is saying that MNOs have been under-charged for 2G spectrum for years, and by hundreds of millions of pounds.

Second, there is no systematic reason to expect that annual 2G charges are much too low. Changes in the economic value of spectrum depend on changes in both supply and demand. There have been major initiatives to increase the supply of spectrum, with licensing on a technologically neutral basis. Large amounts of spectrum suitable for mobile services will become available in the 2.6GHz band in the near future. Therefore, it is mistaken to assume that the value of spectrum is necessarily on an upward trend even if there is increasing demand, as there is also increasing supply.

### 2.4 The economic value of 3G spectrum

There is no reason to expect 3G to increase the efficiently incurred cost of voice services, including termination, and some reason to expect 3G to decrease it. It is perfectly easy to square this with an approach that seeks to identify what part of 3G spectrum costs should be allocated to voice services. However, this requires identifying the economic value of the spectrum and what share of it relates to voice services. If we have a methodology that leads to the costs of termination increasing with a move to 3G, then we know that, absent an

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<sup>3</sup> Paragraph A14.24 of the Consultation Document.

<sup>4</sup> At this valuation, 2G network costs (including the revised 2G spectrum allowance) would give the same level of charge for call termination as that modelled for 3G.

extraordinary increase in 2G spectrum valuation, we have either overestimated the economic value of the 3G spectrum or else allocated too large a share against voice services. The proposals appear to have done both.

### ***The UK 3G auctions***

There are well-established principles for how assets should ideally be valued for inclusion in a regulatory asset base in order to generate efficient price signals. Most importantly, assets should be valued on the basis of their current economic value, not book value.

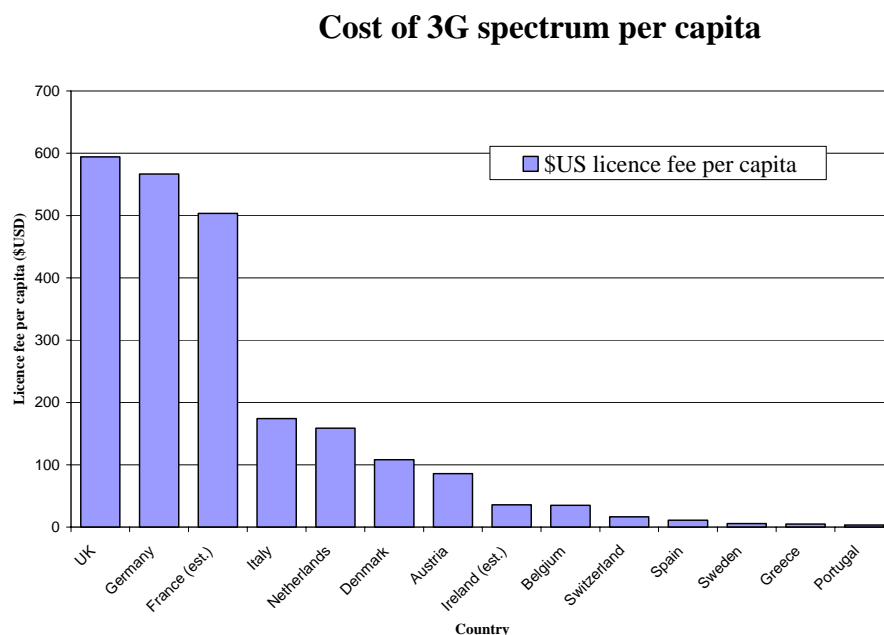
There is a wide variety of reasons why the UK 3G auction prices are a poor reflection of current economic value of 3G spectrum to UK consumers:

- the bubble on telecommunications asset prices was at its peak at the time of the auction;
- the UK auction, being the first of a sequence of EU 3G auctions, may have encouraged competition, not just for a UK licence, but also to secure a toe-hold position in future auctions; and
- the design of the auction might well have led to more revenue being raised than was necessary to secure efficient allocation, so may not reflect opportunity cost.

There is little or no consideration of these points in the Consultation Document.

The fact that the UK auction produced prices that were the most expensive in Europe (on a per capita basis) and widely divergent from EU averages (see **Figure 1** below) although ought to have been reason enough for a *close scrutiny* of the factors which may have been responsible for this outcome and hence of the reliability of the auction as a guide to the economic value of the spectrum.

**Figure 1: Cost of 3G spectrum per capita**



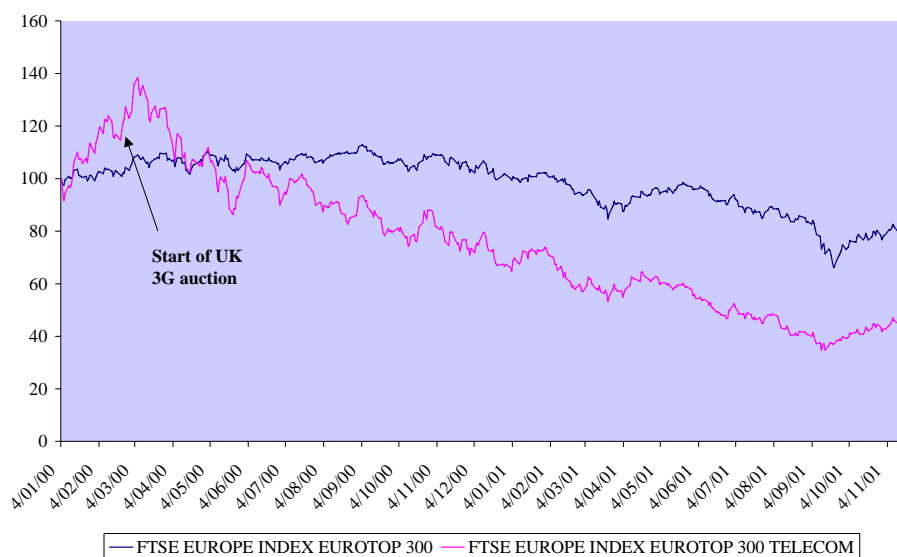
NOTES: The **German** auction followed closely that of the UK and was likely to have been affected by the TMT bubble and toe-hold issues in the same way as in the UK. Two

licences were returned and the 3G fees written-off. The figure in respect of **France** was the subject of later adjustment following protests and/or lack of interest: the price was revised by the French government to €619m plus 1% of annual turnover for the duration of the licence.

### **Timing**

The willingness to pay for 3G licences in the UK were clearly influenced by the market bubble on TMT stocks that was at its peak at the time the UK auction took place in April 2000. The timing of the auction relative to stock prices can be seen in **Figure 2** below.

**Figure 2: Telecoms equity index vs. market index**



This bubble was relevant for a new entrant's valuation of a licence as a rational strategy at the time was to win a licence, get a management team and supplier contracts in place quickly and then IPO prior to bringing services to market. In order to do this, entrants bid up the auction price in what were wholly exceptional circumstances in order to profit from the market situation. The implication is that the auction fees are very unlikely to be an accurate measure of the underlying economic value of the spectrum to UK consumers, but rather an artifice of extraordinary equity prices.

### **The European context**

Second, there is a strong argument that the UK 3G auction was influenced by being first in the sequence of major EU auctions. Having acquired a UK licence provided a synergy benefit in competing for licences elsewhere and these "toehold" advantages, even if small, have been shown in theoretical models to have significant impact on competition within auctions.<sup>5</sup>

The importance of winning the first auction came about because a pan-European footprint was considered attractive to MNOs owing to the potential benefits of

<sup>5</sup> See Jeremy Bulow & Ming Huang & Paul Klemperer, "Toeholds and Takeovers," *Journal of Political Economy*, vol. 107(3), pages 427-454, June 1999.

significant economies of scale arising from sharing technological best practice; savings in equipment and handset costs from increased bargaining power with suppliers (as well as obtaining handsets in good time and ahead of rivals); and the forecast capture of lucrative roaming traffic. A contemporary Durlacher report noted:

"The mobile operators' current acquisition activities are targeted primarily at optimising the core processes for delivering mobile voice, creating synergy effects in terms of economies of scale and scope and generally reducing the large fixed costs of being a mobile operator."<sup>6</sup>

There were also benefits to be gained from roaming between commonly owned networks in different Member States. A larger footprint can provide benefits in terms of competing for roaming traffic and roaming customers with other domestic operators. Value-added services (such as GPRS-based internet access) can roam across closely integrated partner networks. In addition, a presence in numerous European countries enables an operator to launch associated marketing campaigns and thus build a strong European brand presence.

Where there are predictable advantages of some bidders over others, these can have profound effects on competition in auctions, particularly open auctions. If one bidder knows that another bidder should be able to make more profitable use of a licence than it can itself, this is a substantial disincentive to raising the level of its bid, especially given that business cases assessments of the value of licences are highly uncertain. Many of the later open auctions in the EEA (e.g. the Netherlands, Italy and Switzerland) were not at all competitive, reflecting the strong and predictable advantages that winners of earlier auctions had.

Given this, competition in the UK was not just to offer 3G services in the UK, but also to win a toe-hold advantage in subsequent 3G auctions. These benefits (the hence the valuation represented by the licence fee) accrue to the mobile operators but not to UK consumers. The UK Government was indeed either fortunate or skilful in being the first major country to auction 3G licences, and hence reaping a monetary return for UK taxpayers by offering these toe-hold advantages. Auction prices were not just about competition to serve the UK market.

### ***Opportunity cost***

Third, there were certain features of the auction that mean prices overstate the opportunity cost of spectrum. One large (2x15MHz) licence was reserved for an entrant. This artificially reduced the supply of large licences and led to strong competition amongst incumbent MNOs to secure the remaining large licence. Indeed, some commentators have suggested that competition for the unreserved large licence might have been driven by motives other than simply winning the licence (for example, exhausting bidders' budgets available for later EU auctions).<sup>7</sup> Therefore, auction revenues are likely to have been significantly

<sup>6</sup> Durlacher Research, March 2000, Mobile Commerce Report, page 4.

<sup>7</sup> See Tilman Borgers and Christian Dustmann, "Strange Bids: Bidding Behaviour in the United Kingdom's Third Generation Spectrum Auction", *Economic Journal*, Vol. 115, No 505, July 2005 and following comment by Dan Maldoom.

higher than strictly necessary to achieve efficient allocation of the spectrum and so above opportunity cost.

Recent developments strongly confirm that the economic value of 3G spectrum is overestimated by the UK auction price. First, as Ofcom recognises, O<sub>2</sub> has impaired the value of its UK licence, so is of the view that the economic value of its licence (as measure by its future benefits) is less than what it paid for it. However, Ofcom notes that only O<sub>2</sub> has impaired their UK 3G licence and hence Ofcom shows the scenario where this impairment is averaged across the three operators with the same licences as O<sub>2</sub>. The impairment of around 50% made by O<sub>2</sub> is thus shown as an overall reduction of one-third this amount for three of the operators i.e. an impairment of just under 20%. As we discuss below, this scenario is one of a number in the scatter diagram and the final decision taken by Ofcom reflects an overall impairment across all operators of about 10%.

### ***Conclusion on the value of spectrum***

There is therefore every indication that the auction prices significantly overstated the true value of the spectrum so that it is inappropriate and unfair to the customers of fixed networks simply to take the UK 3G auction prices as indicators of the current economic value of 3G spectrum without further consideration.

Taken at face value, Ofcom's current approach would suggest that the value of 3G spectrum varies dramatically across EU Member States. This is unlikely to be the case as the factors affecting the value of 3G spectrum and the businesses that can be based on it (at least per head of population) are broadly similar. At the very least, it would have been better to have based the proposed on termination charges on an average of EU auction prices.

Put differently, if the UK auction had been held later in all likelihood the auction would have realised much less and the amount that ordinary UK customers would have been asked to pay towards the cost of the spectrum would have been much less. In such circumstances, UK customers are entitled to expect regulatory protection from the over-payments made by the MNOs, rather than customers having to underwrite guaranteed returns for MNOs.

## **2.5 Market valuations of mobile operators**

Market valuations of MNOs clearly indicate that investors no longer consider 3G licences to be worth the full amount paid for them. UK MNOs are all part of global corporations, but a good indication of their individual value is available from equity research analysts, who routinely assess the value of companies using a 'sum of the parts' method based on discounted cash flow analysis and other parameters. **Table 1** below shows analysts' recent assessments of the average enterprise values of UK MNOs.



**Table 1: Analyst assessments of enterprise value**

	<i>Average Enterprise Value (£m)</i>	<i>Licence Fee (£m)</i>	<i>Licence fee as % of EV (approx)</i>	<i>Brokers</i>
<b>Vodafone</b>	9,300	5,964	65%	Exane BNP Paribas, Merrill Lynch, UBS, Lehman Brothers
<b>O<sub>2</sub></b>	10,100	4,030	40%	Merrill Lynch
<b>T-Mobile</b>	6,700	4,004	60%	Morgan Stanley
<b>Orange</b>	6,600	4,095	60%	Merrill Lynch, Exane BNP Paribas, JP Morgan
<b>H3G</b>	2,100	4,385	210%	Morgan Stanley, UBS, Merrill Lynch

With the exception of H3G, UK MNOs currently derive only a few percent of their revenue from 3G services, and it is clear that the licence fees would represent an unrealistic proportion of their valuations if they were in fact still valued by the market at their original auction value. This is yet again a clear indication that the economic value of the licence is significantly less than the auction price.

The operators bought their licences knowing that they were taking a risk, with both major upsides and downsides. Although there have been delays in rolling out networks, and difficulties in procuring suitable handsets, the main issue has been that market demand has not materialised at the level and price-points envisaged in original business cases.

In 2003, Peter Erskine, Chief Executive of O<sub>2</sub>, commented: "It is like saying that you paid so much for your house and kidding yourself that it's worth twice the actual market value...I think there is a general understanding in the European telecoms market that we overpaid for 3G."

## 2.6 Evidence of declining valuation

A very direct example of the falling value of 3G spectrum is provided by the experience in Denmark, where the acquisition of Orange Denmark by TeliaSonera led to one 3G licence being returned to the Government. This achieved a substantially lower price when re-auctioned compared to the original price paid. Whereas the initial four licences sold for DKK950 million each in 2001, the returned licence sold for only DKK530 million in 2005 (albeit the duration is 20% shorter). The Norwegian Government awarded four 3G licences by beauty contest in 2000 for a fee of NOK200 million each. Two of these licences were subsequently handed back and one was re-assigned by auction in 2003 for NOK62 million.

Again, there is no consideration in the Consultation Document of this evidence.

We would also note that Ofcom has plans to award spectrum in the 3G expansion band at 2.6GHz, possibly next year. This is a close substitute for existing 3G spectrum held by MNOs and so its price would give a direct measure of the value of 3G spectrum. When this spectrum becomes available, it will provide a transparent metric for the value of 3G spectrum in general. It seems utterly incredible that this spectrum would reach similar prices per MHz as the 3G auction in 2000.

## 2.7 Impairment reviews

Whilst O<sub>2</sub>'s impairment of its licence provides positive evidence of its economic value being less than the auction price, there is no contradictory inference to be drawn from the fact that other MNOs have not written down the value of their licences.

Section A14.29 of the consultation document asserts that the other MNOs have not done this because "whilst market conditions may have changed since the time of the auction they have not changed to the extent that from an accounting perspective, necessitate an impairment of their licences". It does, however, go on to note that such an assertion is "not entirely unambiguous". We would go further than this and suggest that, not only is it "not entirely unambiguous", but it is not possible to draw conclusions about the current value of 3G licences from the fact that four MNOs have not written down their 3G licences following impairment reviews. To do so would be to misinterpret the basis of impairment reviews and how they are intended to be carried out, as set out in the International Financial Reporting Standards ("IFRS") applied by the MNOs<sup>8</sup>.

Under IFRS an entity applies International Accounting Standard ("IAS") 36 Impairment of Assets to determine whether an asset is "impaired" and needs to be written down. This is determined by comparing the asset's "book carrying amount" to the "recoverable amount", that is, the net present value of the future cash flows associated with the asset. IAS 36 does, however, recognise that in many cases an individual asset may not generate cash flows that are largely independent of those from other assets and so allows this recoverable amount to be calculated for an entire cash generating unit ("CGU") rather than the asset alone. An obvious definition of a CGU in the case of the MNOs would be the entire UK business versus their other national businesses and it is on this basis that the operators seem to have conducted their impairment reviews<sup>9</sup>.

Conducting an impairment review at CGU level means that the value of all of the CGU's assets is assessed in aggregate and compared to the present value of the cash flows that the business ("CGU") as a whole is expected to generate. It is possible, therefore, that some would have a recoverable amount less than their carrying amount and some a recoverable amount that is more were each

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<sup>8</sup> The parent companies' consolidated accounts are prepared under IFRS; the UK subsidiary accounts can be prepared under IFRS or UK GAAP, where FRS11 would apply. In substance, UK GAAP and IFRS are the same with regard to impairment reviews.

<sup>9</sup> This was certainly the case for O<sub>2</sub> in their impairment review in 2003, and paragraph A14.29 of the Consultation Document suggests this is also the basis on which the other MNOs have undertaken impairment tests).

assessed in isolation. This means, in theory, that the value of the 3G licences could indeed have fallen below their 2000 values (less amortisation), but it is impossible to tell this from these impairment reviews since the need for an impairment has not been assessed at an individual asset level.

What is more, even if the recoverable amount calculation resulted in an impairment loss at the CGU level, it must first be written down against any goodwill allocated to that CGU, ahead of any other assets. Therefore, if a CGU is carrying a significant amount of goodwill, this would act as a "buffer" against writing down other assets, and IFRS would not allow an impairment loss to be recorded against the licences until all of the goodwill had been eliminated.

In the case of O<sub>2</sub>'s 2003 review of its UK subsidiary CGU, it wrote off first its goodwill, and then part of the carrying value of its 3G licence, such was the scale of its impairment. The other MNOs may still be carrying substantial amounts of goodwill which would need to be written down first in the case of any impairment in value being established – £2.2bn for T-Mobile's UK subsidiary as one example – even if in theory some reduction in recoverable value to its 3G licence had occurred.

We conclude from this analysis that impairment reviews cannot be relied upon to provide a safe indication of the value of 3G licences. Absence of impairment does not indicate that the economic value of the 3G licence remains close to the original price paid (less amortisation).

## 2.8 An alternative approach to valuation

Another means of establishing a realistic value for the 3G licences today would be to carry out a financial valuation exercise, seemingly not attempted so far in this Market Review. We have sought independent expert advice and have ascertained that established methodologies exist for this purpose. These are based on the "Fair Value" premise, which would need to be applied, for example, by the acquirer in the event of one of the UK MNO businesses being taken over (under IFRS 3 Business Combinations).

Indeed, we have gone further and applied the most appropriate of these established Fair Value methodologies to assess firstly the value of the licences as they may have been calculated in 2000 (that is, with assumptions from the time regarding income potential and investment requirement), and then carried out the same exercise applying today's more realistic assumptions to derive an illustrative 3G licence valuation today. We have looked at the valuations on a "Greenfield" basis, which would seem the most appropriate since it attempts to ascertain the value of a licence on a stand-alone basis<sup>10</sup>. On this basis, we arrive at a current valuation for the licences of the order of £1bn, as against the values in 2000 in excess of £4bn, to use as a starting point for the 3G licence cost elements in the proposals. Further details of the methodology and calculations can be found in **Annex B** of this response.

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<sup>10</sup> The "Greenfield" approach assumes that the business is built from scratch starting with only the licence and equipment in place. Start-up costs and investments include building all other intangible assets, including workforce and brand, thereby isolating the value of the licence and the equipment.

As part of the process of establishing future mobile termination rates, Ofcom undertook a rigorous modelling exercise with external support to establish network costs attributable to mobile termination. It would have been reasonable to expect a similarly rigorous approach to have been taken in relation to 3G costs, particularly given the presence of established methodologies fit for this purpose. We would advocate that Ofcom carries out a thorough and independent validation, using an approach such as one based on "Fair Value", before allowing any part of such a large cost element to pass through to customers.

## 2.9 The use of 3G spectrum

If we put aside issues related to the 2000 3G auction price drastically overestimating the economic value of 3G spectrum, we are still left with the question of how much of the value of 3G spectrum is to do with enabling new applications and services and how much is to do with providing existing voice services.

Ofcom effectively suggests that around two-thirds to three-quarters of the value of a licence is related to providing existing services. By implication an implausibly small share of the value of a 3G licence appears related to provide new advanced data services.

At the time of the UK auction, there was great uncertainty about the potential development of data services markets and the likely take-up of 3G. Indeed, this uncertainty is still largely unresolved. Therefore, business cases needed to consider a wide range of possibilities. Buying a 3G licence was an entry ticket into competing for these future new markets, but clearly there was no guarantee that demand for these new services would materialise. Indeed, the likely future growth of 3G-based services and applications is still highly uncertain. It is still the case, however, that having 3G spectrum insures an MNO against the possibility of not being able to offer some future new service that become popular.

This observation immediately implies that the value of 3G licences in enabling future advanced data services cannot be estimated by considering only the most likely case for the development of these services. This would produce a gross underestimate of the potential benefits. Having a 3G licence allows MNOs to take a shot at capturing the up-side in cases where there is rapid growth in demand for services and applications based on high-speed data.

Clearly the high licence values reflected in the auction prices were caused by exuberant optimism about future market opportunities for advanced data services, even though this optimism might now seem misplaced. This means that willingness to pay for licences in the 2000 3G auction was in the main due to anticipated revenues from new services, not anticipated cost savings for existing voice services. Indeed, BT was itself a participant in that auction (prior to the demerger of *Cellnet*). The contribution of cost savings on voice services to BT's overall 3G business case was small. There is little reason to expect other MNOs to have taken a different view.

## 2.10 Ofcom's scenario-based approach

Ofcom has taken the approach of running a number of scenarios for possible treatments of licence costs and then averaging across these. Whilst it is true that there is uncertainty about what the economic value of 3G spectrum is and what part of this relates to voice services, this approach is destined to produce arbitrary and internally inconsistent results.

Averaging across a scatter-gram with scenarios all receiving equal weight is entirely arbitrary as the outcome is simply a reflection of the cases that the analyst has chosen to include. As the discussion above illustrates, many other factors which would justify other scenarios have not been considered and hence are omitted from the scatter-gram. In effect, the consideration is a partial one, and hence likely to be biased if one attaches any credence to the possibility that, for example:

- the UK auction was influenced by the TMT market bubble;
- "toe-hold" positions were important;
- the auction design created an artificial shortage in the supply of large licences.

Further, this approach fails to recognise that there is a systematic link between the value of 3G spectrum and the split of this value between new services and existing voice services. More optimistic valuations of 3G spectrum are based on higher expected revenues from new services and so should be associated with a smaller share of the value of 3G spectrum being associated with existing services. Therefore, any scenario in which the 3G spectrum value is higher should also have a smaller share of this associated with voice services. Ofcom seems to have omitted this consideration.

For example, in Ofcom's Scenario 2, having access to a third carrier is associated with a greater market share. Having a third carrier benefits an MNO as it avoids the need to build so much new network capacity if there is strong demand for data services. However, this seems to ignore the fact that the value of a third carrier to MNOs is to do with insurance against high data traffic outcomes and so provides no benefit for voice services.

All the evidence suggests that the original auction prices significantly overstate the true economic value of the 3G spectrum. Indeed we have never seen any evidence or arguments to the contrary. In these circumstances, it is misleading to rely on a simple averaging of selectively chosen scenarios, rather than attempting to make a proper judgement of the true value of the 3G spectrum when used for voice termination. This is especially so when there is a simple, clear and reasonable methodology that could and should be used.

We know that the part of the spectrum valuation associated with voice services should not exceed the value of 2G spectrum it replaces plus any network cost savings associated with moving to 3G. This is the greatest amount an operator in a competitive market should pay for 3G spectrum to migrate existing services, else it is better off not to migrate them. This upper bound is not uncertain.

## 2.11 BT's suggestion

We believe that Ofcom should recognise that there is no way of knowing exactly why such high fees were paid in the 2000 UK auction – although there are, as we have discussed above, a number of approaches that could be used to arrive at a more appropriate current value than have been taken so far. It can also be recognised that some of the fees may well have been paid in order to access a cheaper technology for the provision of voice services and to provide a migration path. The part of the spectrum fee that was acquired to save costs on voice call termination can be seen as a legitimate extra cost incurred by the MNOs which consumers might reasonably be asked to bear. This would be consistent with an approach which reflects the MNOs' efficiently-incurred costs for providing voice call termination.

It is also straightforward to implement such a regime. An allowance for the "cost savings" value of the spectrum fees could be achieved by setting call termination charges solely on the basis of 2G unit costs for the entire volume of terminating traffic. This would have the effect of allowing the MNOs the cost savings from 3G and this allowance (the difference between the 2G and the 3G pence per minute network costs) would also represent the permissible contribution to the costs of 3G spectrum. That is, to the extent that the 3G spectrum was acquired to save costs, efficiently incurred costs would be reimbursed.

Regulation based on such a methodology would be technology-neutral as the resulting charges could be viewed as either based on 2G costs alone or based on 3G network costs plus an allowance (one based on efficient cost savings) for 3G spectrum. That these come to the same amounts seems to BT to be eminently sensible as the costs are, after all, for the provision of the very same service. It would end the need to use labels such as '2G voice services' and '3G voice services' as if these are different services when they are not. Customers simply cannot make 'a 3G call' from an ordinary fixed telephone.

Under such a regime it could also be the case that the risks and rewards of developing new data services would remain with the MNOs and their shareholders. This is in marked contrast to the current proposals which share 3G risk between those customers calling mobile networks (who pay more for voice services the less successful is data) and the operators themselves. The technology neutral approach therefore also has far better incentive properties.

The effect of this approach can be approximately quantified from the cost modelling undertaken by Ofcom. Rather than there being price cap of RPI-1.5% we estimate that the control should be of the order of 5% lower each year – that is, around RPI-6.5%. This would save consumers around £400m over the duration of the price controls over and above the small reductions proposed by Ofcom.

### 3 Other important issues

#### 3.1 Network Externality

BT strongly disapproves of this allowance, which is applied to fixed customers whenever they call mobile customers. The effect of this surcharge is to transfer funds from customers of fixed networks to those of mobile networks. Leaving aside any efficiency arguments, the intervention is not technologically neutral regulation as it discourages fixed networks (which are "taxed") whilst benefiting mobile networks (which are subsidised). The basis of the problem is that there is no reciprocity in the funding arrangements between fixed and mobile networks, in that mobile networks do not pay any surcharge when their customers call fixed networks, but they benefit when fixed customers call their networks.

Ofcom is at pains to draw a distinction between the externality surcharge and universal service provision (USO) – see paragraph 9.49. Ofcom has told us that, whereas the former is related to economic efficiency (in that an efficient provider of network-based services would subsidise some marginal customers to prompt them to join/continue on the network), the latter is much more a function of social policy. However, there can be no doubt that the social policy the USO addresses is that of ensuring that consumers who might not otherwise be able to afford fixed access, do take service. Indeed, the Universal Service Directive mentions, in particular, consumers on low incomes or with special social needs. This objective is very close to the concept of the marginal customer for mobile networks – indeed, customers who might not otherwise purchase a mobile are likely to have the same characteristics. Further, when Ofcom has looked at the costs of the USO in the UK, it has found that circa 65% to 80% of the cost of the fixed line USO is incurred in providing subsidised tariff options or packages. That is, the majority of the cost derives from measures designed to increase (or indeed maintain) fixed-line penetration.

The fact that the USO is wider than an efficiency-based intervention, and has its origins in social concerns not economic efficiency, should not obscure the fact that it encompasses very similar notions. Indeed, the difference in this regard seems to be that the fixed line intervention has a more developed sense of targeting than has been considered for the mobile sector.

Indeed, in paragraph A16.1 of the Consultation Document, Ofcom explains that

*"users of both fixed and mobile communication networks benefit from having a large number of mobile subscribers with whom they can communicate. In general, however, when consumers decide whether or not to subscribe to a mobile network, they take their own private benefit into account but not the benefit that fixed and other mobile subscribers derive from contacting and being contacted by them, and from the ability to contact and be contacted by them. This discrepancy is the source of the "network externality".*

If universal service is not also about correcting for the network externality, where is the intervention that applies the same correction for fixed services to take into account the benefit deriving to others from contacting and being contacted by them on their fixed line?

The difference is in the funding. BT (in the form of its customers and shareholders) funds the subsidies for fixed customers and there is no contribution

from mobile operators. The funding of the subsidies for mobile customers is, however, also met by BT's customers (and, via the distortion which results, our shareholders). Around one in ten consumers are now "mobile only" – that is, they do not have, or have relinquished, a fixed line. This figure is likely to be higher than it would otherwise be because of the preference the arrangements provide for mobile services. We believe this is a market distortion and that a non-discriminatory regulatory treatment of fixed and mobile networks is now imperative given that service substitution has become ever more pervasive.

Our primary dispute is therefore with the principle of the arrangements, not in the detail of the computations that Ofcom has conducted. However, in one respect we do think that these ought to be revisited.

The surcharge is based on "the current price of an unsubsidised entry-level handset" of **£70**. Basic handsets appear to be able to be bought for around £30 and this may include some free airtime, meaning the net cost is lower still. The figure of £70 would imply to us a handset having a specification including camera, MP3 and Bluetooth facilities, none of which is needed for basic voice connectivity. Ofcom's own market research shows an average of £44, with £57 (for Pay As You Go) and £18 (for those with a contract), the former presumably attracting very little subsidy. Furthermore, these figures are for average handsets not basic handsets, so will include features not necessary for receiving voice calls. A figure of £70 therefore looks excessive and we would expect Ofcom to use a more realistic figure when calculating the network externality surcharge.

### 3.2 Administration costs and efficiency projections

Ofcom proposes to allow the MNOs to recover 0.18ppm (in the case of the 2G/3G operators) or 0.32ppm (H3G), for administration costs in respect of mobile termination. BT calculates this at approximately £25m per annum per MNO; this is to say £125m in total. BT's own most recent equivalent in respect of fixed termination (shown in BT's regulatory accounts as General Management, General Support and Finance & Billing) is £23m. The voice traffic carried by BT is roughly equal to the total voice traffic of the MNOs which suggests that on a like-for-like basis, the unit costs allowed the MNOs are much higher than those allowed to BT.

In order to provide the right signals to the market, it is therefore imperative that Ofcom is sure it has assessed these costs at the correct level. Even at the proposed level of charges, it is inappropriate for Ofcom to assume that this level of costs will remain constant over the four years. The likely increase in call minutes terminating on mobile networks ought to reduce the administration burden. In addition, Ofcom ought to expect the MNOs to make efficiency gains over the period. Indeed, at least one operator (Vodafone) has recently been reported as aiming to remove up to 20% of its overhead base over the next few years. Ofcom projected BT's annual efficiency gain to be somewhere in the range of 2.5% to 4.5% each year<sup>11</sup> and we might expect something not dissimilar here.

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<sup>11</sup> Paragraph 6.88 in "Review of BT's network charge Controls, Explanatory Statement and Notification of decisions on BT's SMP status and charge controls in narrowband wholesale markets", Ofcom, 18 August 2005.



## 4 Responses to Ofcom's questions

### 4.1 Question 1

*Do you agree with Ofcom's market definitions?*

Yes. There are separate markets for wholesale voice call termination on each mobile network.

### 4.2 Question 2

*Do you agree that each of the five MNOs has SMP in the market for wholesale mobile voice call termination provided by it to other Communications Providers in the UK?*

Yes. Each Mobile Network Operator (MNO) has 100% market share in its respective market. Given the absence of any countervailing buyer power, each MNO has SMP in the relevant market.

### 4.3 Question 3

*Do you agree that it is appropriate to impose the following SMP conditions on each of the five MNOs: a charge control on mobile-to-mobile MCT to apply until 31/03/11; a charge control on fixed-to-mobile MCT to apply until 31/03/11; a prohibition of undue discrimination; an obligation to meet reasonable requests for MCT on fair and reasonable terms; an obligation to publish access contracts; an obligation to publish charges and notify call volumes.*

BT agrees that each of these conditions is appropriate.

### 4.4 Question 4

*Do you agree that the appropriate level of the target average charge to apply to mobile-to-mobile MCT and fixed-to-mobile MCT in 2010/11 in respect of H3G is 6ppm (2006/7 prices), and in respect of the 2G/3G MNOs is 5.3ppm (2006/7 prices)?*

No. BT believes that these levels are inappropriate. For the reasons we have set out in this response, we contend that the target average charges should be lower.

#### 4.5 Question 5

*Which of the following glide path options should be used to define H3G's target average charge in each of the first three years of the charge control period:*

*Option 1 - A smooth glide path with charges reducing at a constant percentage rate in each of the four years from today's average charges to the target determined for 2010/11; Option 2 - A one-off partial cut to 8.5ppm (2006/6 prices) for the first year followed by a smooth glide path to ensure that the maximum average charge aligns with the target determined for the final year of the charge control; Option 3 - A cost based glide path with charges reducing immediately to align with the 3G-only operator cost benchmark for 2007/8, and then set equal to the forecast cost path thereafter, such that in 2010/11 the maximum average charge aligns with the target determined for that year.*

BT has consistently argued for termination on 3G networks to be included in the control and there is no evidence that a sharp reduction to cost presents a material risk to further investment. We therefore view Option 3 as the one that provides the most appropriate control in the circumstances. The alternative is to perpetuate the evident consumer detriment.

#### 4.6 Question 6

*Do you agree that the 2G/3G MNOs should be required to reduce their charges in line with a smooth glide path of constant percentage rate in each year of the charge control such that average charges in the fourth year (2010/11) align with the target determined for that year?*

It is important that the next price control should not start with "blended rates" which include currently unregulated charges for call termination on 3G networks. It would certainly be quite wrong for Ofcom to impose cost-based regulation but to start from a position where some charges (for call termination on 3G mobile networks) are not cost-based at all. BT has raised the issue of excessive (and not cost-based) call termination rates via 3G with Ofcom separately. This problem will be perpetuated into the next regime if these rates are included in the start-point for the new control.

We understand from paragraph 9.92 of the Consultation Document that the proposed controls will start from the headline level of the current 2G controls, in which case our fears about this issue may be unfounded, but we would appreciate confirmation from Ofcom on this point.

Provided this is addressed, BT supports a glide path to 2010/11, but to a target pence-per-minute rate of about 4.3ppm. We consider such a figure is likely to be a fair assessment of efficiently-incurred costs based on (a) Ofcom's modelling and (b) a treatment of the 3G licence fee which recognises that these licences were acquired predominantly for data services and not to provide voice.

## *ANNEX A* Countervailing buyer power

This annex has been provided to Ofcom on a confidential basis.

## ***ANNEX B*** Alternative approach to 3G valuation

This annex has been provided to Ofcom as a separate document.

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