Mobile Call Termination – Proposals for consultation

Summary

Despite our misgivings over Ofcom's analysis of SMP in the market for mobile voice call termination, Vodafone strongly supports Ofcom's overall approach to establishing an appropriate set of remedies in this market. In particular, Vodafone endorses**:** the setting of a blended termination charge, the recognition that 3G costs lie above those for 2G in the medium term, the elimination of the 900MHz vs. 1800MHz rate asymmetry and the use of relatively conservative demand forecasts in the calculation of charges in recognition of the effect on investment in 3G and new services of levying too low a termination rate.

However, Vodafone takes issue with both the structure and level of the remedy chosen. Vodafone argues below that Ofcom should remove the 900MHz vs. 1800MHz asymmetry earlier than 2010/11 (we suggest that 2008/9 is appropriate) and that H3G's charges should be 'cut to cost' within a similar timescale. Vodafone also suggests a number of amendments to the cost model which indicate that it is appropriate for Ofcom to set a common charge for all operators of between 5.9 and 6.0ppm at 2006/7 prices in 2010/11.[1]

Outline of the Response

Our response is organised as follows:

Section 1 covers Ofcom's analysis of Market Definition, SMP and Countervailing Buyer Power (CBP).

Section 2 comments on the structure of Ofcom's proposed remedy i.e., the time required to remove the 900MHz vs. 1800MHz rate asymmetry and the glide-path to be applied to H3G's charges.

Section 3 discusses the level of Ofcom's proposed remedy for all operators.

Section 4 answers briefly the specific questions posed by Ofcom.

Section 1: Market Definition, SMP and CBP

1. It is now generally accepted by economists and regulators (including Ofcom[2]) that mobile call termination is provided in a "two-sided market" ("2SM") in

[1] Or higher by 0.33ppm if administration costs are recovered using economic depreciation (see annex 3)

[2] Consultation at paragraph 3.118

which a mobile network operator ("MNO") attempts to set a framework of interdependent prices which bring together two separate groups of customers; that is, callers (or their wholesale providers) and the receivers of calls. To provide a mobile call termination service, therefore, an MNO must both acquire a customer and ensure that a call is made to that customer. Ofcom appears to recognise this issue in its consultation, but attempts to deal with its consequences only at the stage of setting a remedy by expressly allowing for an externality mark-up. Vodafone acknowledges and welcomes the fact that Ofcom recognises the importance of two-sidedness here and in the remedies. However, Ofcom fails to appreciate that two-sidedness actually has important implications at both the market definition and the SMP stages of the analysis which Ofcom is obliged to undertake prior to setting remedies. It has important implications for how one determines a "competitive price", how one applies the SSNIP test, how one considers substitutability and market shares and how one analyses the independence of action which is a necessary component of SMP. These issues have been well debated in recent years, so Vodafone does not propose to go into detail on them again here.

2. In Ofcom's discussion of the impact of its dispute resolution powers on any finding of SMP, Ofcom claims that the CAT's judgment says it would be "illogical" to consider the impact of dispute resolution on the party whose SMP is being examined[3] but then goes on to consider it (and dismiss it) in any event. Vodafone does not agree with Ofcom's analysis of the CAT's judgment. What Vodafone understands the CAT to be saying (and the Commission in its RegTP veto decision) that a potentially regulated person cannot say that he does not have SMP because of the threat that if he exercises that SMP, new SMP remedies will be imposed upon him, however all existing regulation which does not rely upon the SMP status of the potentially regulated person can and should be taken into account when assessing SMP. Whilst it is true that the CAT's judgment could be clearer on these points, Vodafone believes that, taken in context, the CAT's reasoning is clear. Overall, Vodafone remains unconvinced by Ofcom's argument that in the exercise of its dispute resolution powers it could not (or would not choose to) set prices at a level which would properly constrain SMP.

3. Vodafone also notes that Ofcom rejects the evidence of recent negotiations of termination rates between fixed and mobile operators claiming to have found no material evidence that operators had the *"tools with which to bargain for a commercially acceptable intermediate outcome as might be expected in a competitive market"*[4]. Given the continued existence of the regulation of mobile call termination rates for many years in the UK, Ofcom should not be surprised that there is some uncertainty about the impact of the legal and regulatory process on the setting of commercial prices. Vodafone believes that with this in mind, it is too early to tell exactly how CBP might be exercised by operators. This is something that, to the extent prices remain commercially set in the future, Ofcom will need to keep under close review.

[3] Consultation at paragraph 5.19
[4] Consultation at paragraph 5.56

Section 2: Structure of Remedies

4. In our response to the previous consultation Vodafone urged Ofcom to:

   - recognise that the efficiently incurred costs of termination, for all MNOs, are a blended average of 2G and 3G costs.

   - set any price-cap at a level above the stand-alone 2G cost on the basis that the cost of 3G termination, at least in the medium term, lies above the cost of 2G termination.

   - recognise that setting too low a termination charge is likely to impact adversely operators' incentives to invest in 3G services (both in network infrastructure, subsidising 3G compatible handsets and the development of new services) and presage a significant loss in consumer welfare.

   - remove the asymmetry in termination charges between all operators.

5. Vodafone is encouraged that, in the main, Ofcom has followed this approach. Although Vodafone continues to believe that there is no robust evidence that cost asymmetries exist between any of the operators (see section 3 below) we support Ofcom's overall approach and, in particular, its policy decision to remove the asymmetry between the 2G operators. In paragraph 8 below we offer additional policy arguments to support an earlier removal of this anachronistic relic of previous regulation.

6. Furthermore, Vodafone supports Ofcom's cautious approach in the regulation of termination rates: *"Ofcom proposes, therefore that the level of the control should be set on the basis of conservative cost modelling assumptions intended to provide strong incentives for continued investment and innovation"* (paragraph 9.70). This approach chimes with the observations that Vodafone made about the risks associated with setting too low a termination rate in its response to the previous consultation.

Asymmetries

7. Vodafone recognises that Ofcom has adopted a different approach to the thorny and contentious issue of the 900MHz vs. 1800MHz termination rate asymmetry. Although Ofcom's modelling demonstrates that a much reduced asymmetry persists, it has taken a policy decision that the asymmetry should be removed at the end of the forthcoming price-cap period in 2010/11. Ofcom justifies its position in paragraphs 9.63 to 9.68 and notes in paragraph 9.72 that it does not expect this change will have *"a material impact on competition"*. Vodafone agrees. Furthermore, Vodafone submits that there are additional policy reasons that sustain this approach:

- A uniform price control will mimic the competitive outcome. Call termination is essentially a homogeneous product, and hence in a competitive market for termination, one would expect to see a uniform price for mobile call termination across all MNOs.

- Vodafone believes that Ofcom's approach in setting the level of charges at the costs incurred by an 1800MHz operator will engender the appropriate incentive properties. If 900MHz networks really are 'cheaper' than 1800MHz networks then operators with only 1800MHz spectrum will be incentivised to either acquire some spectrum at 900MHz (or below) or, alternatively, lease capacity from an incumbent 900MHz operator (see below). At the same time since, by Ofcom's analysis, both operator types will still be able to recover their efficiently incurred costs of terminating calls they will be able to make further investments in infrastructure, as required.

- Whilst in the past it may have been appropriate, in theory, to take spectrum as an "unavoidable" cost difference, there are a number of reasons why this will cease to be true in the future:

    - Ofcom itself argues that spectrum trading removes the need for differential termination rates based on technology. MNOs will choose to purchase whatever spectrum they prefer at market prices. In a free spectrum market, the value of spectrum will be affected by the cost of deploying network technology in that spectrum range. Thus MNOs will have the choice of buying, selling and swapping high value spectrum that provides better propagation properties and saves network investment, or lower value spectrum that requires greater network investment.[5] The choices of spectrum cost and consequential network deployment costs are, therefore, within each MNO's control. Not only will spectrum be an endogenous asset within the next year[6] **[Confidential]**.[7] There is therefore a real prospect that the putative cost asymmetry between the 2G operators will be further reduced or perhaps removed.[8]

[5] Although it should be noted that Vodafone would not expect any significant difference in market prices between 900 MHz and 1800 MHz spectrum, since the cost of network deployment of the two bands are now virtually identical – if not even favouring 1800 MHz.

[6] See Spectrum Framework Review: Implementation Plan; *"Subject to a satisfactory resolution of the issues connected with the applicability of liberalisation, Ofcom would seek to extend trading to the existing 2G licences in 2007"* (paragraph 9.67).

[7] **[Confidential]**

[8] A further point to note in the context of the possible introduction of spectrum trading is that, in an efficient spectrum market, any termination cost differential between 900MHz and 1800MHz operators would be reflected in a higher opportunity cost for 900MHz spectrum. This would further erode any difference in between the economic margins earned by MNOs under Ofcom's uniform price control.

- Furthermore, even after network investment in a particular spectrum has been committed, MNOs still have flexibility in use of spectrum through buying wholesale network capacity from other MNOs. The wholesale market is already competitive in respect of wholesale minutes for MVNOs,[9] and can be expected, over coming years, to develop a greater range of MVNO and wholesale capacity offers, allowing both MNOs and MVNOs to effectively gain access to a choice of networks operating in different spectrum bands. Therefore, even an MNO that has committed investment to a high network cost spectrum band (or had legacy investment in that band), could write-down the value of the sunk investment in future pricing decisions, and be able to purchase wholesale capacity from other networks in order to meet any incremental capacity needs going forward, if this were more cost effective than continuing investment in its original spectrum band.

- A "spectrum neutral" voice termination rate should be set and applied in future, for example, in the case of "4G" or WiMax operators. This has the obvious advantages of regulatory simplicity and certainty for potential new entrants that intend to offer a comparable mobile service to the existing operators. A clear policy signal from Ofcom that it expects a single common charge for mobile call termination (in effect that a combination of 2G and 3G infrastructure is the collective MEA) will give new mobile entrants certainty over a critical part of their business plan and save the considerable resource on the part of Ofcom, the established operators and the new entrant traditionally devoted to deliberating these matters.[10]

- This policy intent will also maintain the right investment signals. Potential entrants with more efficient technologies than the existing operators will be incentivised to enter in the knowledge that they will 'pocket' the difference between the market termination rate that they will levy and their underlying costs (or rather use it to acquire and retain customers). In contrast, inefficient potential entrants with a higher cost base will be discouraged from entry and, furthermore, from playing some elaborate regulatory game wherein the potential entrant opts for a less efficient technology in the hope that the higher termination rate that it receives will more than compensate for the disadvantage of running an inefficient technology.[11]

- Ofcom notes in paragraph 9.67 that the current MNP arrangements (which are now the subject of a separate consultation) *"distort the 'headline' average termination rate"* and that *"[a] single control may be more pragmatic in the*

[9] We use the term MVNO broadly to encompass national roaming e.g., H3G's recent auction for a proportion of its national roaming business.

[10] **[Confidential]**

[11] If Ofcom were to persist with the 900MHz vs. 1800MHz asymmetry then some differential in termination rates will have been in place for around 14 years by the end of the price-cap period. This will give a damaging and inefficient signal to potential new entrants to expect a permanent regulatory "leg-up" in the form of a higher termination rate by virtue of frequency at which they intend to transmit signals.

context of narrowing cost differentials and, further, may eliminate any incentives operators have to target subscriber acquisition efforts with reference to the termination rates of their existing network". These are important points. By 2010/11, the 2G operators will receive their underlying (common) termination charge less a small adjustment to cover the cost of porting on behalf of the donor operator. This will mean that Vodafone and O2 will no longer be artificially incentivised to encourage joiners from Orange and T-Mobile to port their existing numbers (because the former will receive the latter's higher termination rates) and conversely Orange and T-Mobile will no longer have an artificial motivation to encourage potential joiners from Vodafone or O2 to leave their number behind (i.e., to avoid only receiving their lower termination rate) and, in the meantime, the incentive will decline over time with the reduction in the magnitude of the rate asymmetry.[12]

- **.[Confidential]**[13]

Glide-paths

8. Vodafone submits that there are compelling policy (and empirical — see section 3 below) grounds to support the removal of the 900MHz vs. 1800MHz operator asymmetry. However, we see no reason why this should only be achieved over a 4 year period. Vodafone recommends that the asymmetry is removed during 2008/9 (i.e., all 2G operators are at cost by 2008/9). There are no grounds for the 1800MHz operators requiring a longer adjustment period. The adjustment being required of 1800 MHz operators (from 6.3ppm to 5.3ppm) amounts to an annual reduction of only around 7% per annum after allowing for inflation.

9. In the case of H3G, Vodafone supports a modified version of Ofcom's Option 2 – 'cut to cost' within 2 years. This means that H3G should be required to cut its charges to 8.47ppm[14] in 2007/8 but then by a further 23% (i.e., to around cost at 6.5ppm) in 2008/9.

10. It may be that, in its attempt to support option 1, H3G will attempt to appeal to precedent and cite Oftel's 2001 proposed 4 year glide-path for the 2G operators. However, Vodafone urges Ofcom not to be seduced by this argument; the circumstances are now very different. In 2001, by Oftel's analysis, all operators had termination rates substantively above cost. Under that state of affairs competitive distortions between operators did not arise because all operators had 'extra' termination rate revenues which they could recycle, via the waterbed effect, into lower subscription charges. The distortions, if there were any, arose from an inefficient structure of prices leading to an over consumption of mobile telephony and an under consumption of fixed to mobile calls.

[12] **[Confidential]**
[13] **[Confidential]**
[14] This number gives a straight-line glide-path over the 2 year period to 2008/9.

11. At the present time, using Ofcom's analysis, we estimate that H3G's termination rates are 60% above its underlying costs. This represents a significant disparity compared with the 2G operators and interferes with competition. Ofcom should not perpetuate this distortion. H3G should compete on equal footing with the other operators and not enjoy an unfair advantage in the access and origination market by virtue of its superior ability to recycle excessive termination revenue into subscription charges (an obvious manifestation of which is H3G's 'We Pay' tariff).

12. In early 2003 the Competition Commission thought that operators' charges were sufficiently above cost to recommend a reduction of around 25% in nominal terms during a single year.[15] The Competition Commission took this decision **after** acknowledging the risks involved: *".. we are concerned about the probable effects that such an immediate and complete adjustment might have on the mobiles sector, and therefore on consumers. It would, in our view, be disruptive and create an unacceptable range of adjustment costs to consumers and the MNOs. This market disruption would not be in the interests of consumers. We acknowledge that the MNOs have embarked upon contracts with third parties based upon the continuation of a particular level (albeit excessive) of termination charges; we also acknowledge that there is likely to be a process of revenue adjustment from termination charges to other sources of MNO revenue and that this is unlikely to be achieved overnight; or, if it were attempted, it would lead to significant disruption."* The Commission's solution was to split the reduction into two cuts in termination rate over a 12 month period (but within a single financial year) and giving the operators a minimum of 3 months notice of the first reduction. Ofcom itself thought it appropriate to impose a 30% reduction in termination rates on the 2G operators in September 2004.

13. Vodafone's proposal is that H3G be required to reduce its termination rates to cost by 2008/9 (necessitating annual reductions in the nominal charge of 23%). This appears eminently even-handed and in line with the reasoning previously adopted by both the Competition Commission and Ofcom.

14. Vodafone submits that these changes will not be unfairly disruptive for H3G:

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[15] *The modification is a 15 per cent reduction in real terms in the level of the average termination charges of each of the four MNOs, to take effect within the period 1 April to 25 July 2003.This is to be followed by a reduction in the average termination charge equivalent to RPI –15 for O2 and Vodafone, and RPI –14 for Orange and T-Mobile for the period from 25 July 2003 to 31 March 2004;and then further reductions of RPI –15 for O2 and Vodafone, and RPI –14 for Orange and T-Mobile, in each of the years 1 April 2004 to 31 March 2005 and 1 April 2005 to 31 March 2006.The effect of these reductions will be to bring termination charges down to the level of the fair charge by the end of the period, as shown in Table 2.12. We believe that this approach is not inconsistent with the specific provisions and general requirements of applicable domestic and EC law.* [see paragraph 2.537 of Vodafone, O2, Orange and T-Mobile: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Vodafone, O2, Orange and T-Mobile for terminating calls from fixed and mobile networks. Published January 2003]

- Given the history of termination rate regulation over the past 8 years it seems a reasonable (and prudent) assumption that H3G must have been expecting a reduction in its termination rates over the forthcoming price-cap period. Indeed, Ofcom notes in its re-examination of H3G's SMP status[16] that during the course of a hearing on 8 October 2002, the CAT explored H3G's concerns that the regulation of the other MNOs would have consequences for H3G's own unregulated termination charges and that H3G expressed the view that:

> *"It is very unlikely that we would be able to sustain termination charges and hence calls to our network which are substantially different from the other networks.*
>
> *Now, I understand you have some misgivings over the transparency of that, but just in terms of the market that I am in, I cannot see that we would be able to get away with termination charges significantly above where the others were."*[17]

  It is not relevant that H3G appeared to believe that competitive pressures rather than regulation would lead to a reduction in their termination rates. The point is that H3G was expecting rates to decline over time. In any case, we learn in paragraph 4.62 that Ofcom's review of the evidence indicates that *"H3G was concerned about the risk that it might be regulated by Oftel and its prices could become subject to charge controls in the longer term"*. H3G has therefore already had *"sufficient time..to adjust to new levels and structures of mobile charges and take these changes into account in their business plans and planned capital expenditure"* (paragraph 9.16).

15. Not only has H3G had sufficient time to plan for a reduction in termination rates but it can expect to make up at least some of the revenue lost through rebalancing its prices. Although the extent of the waterbed is in contention it appears to be common ground between Ofcom and the MNOs that it exists. **[Confidential]**[18] H3G can, therefore, be expected to rebalance its prices to compensate, at least in part, for the reduction in termination revenue.

16. However, Ofcom should be mindful of paying too much attention to the relative bounciness of H3G's waterbed. It must keep in mind that it is correcting for a past inequality. H3G has been able to raise its rivals' costs by virtue of its excessive termination rates and use the money gained to enjoy a relative advantage in the outbound market. In addition, callers to H3G mobiles from fixed lines have faced higher prices than they should have done. Requiring H3G to reduce its termination rates to cost after a further 2 years will simply put them

[16] Assessment of whether H3G holds a position of SMP in the market for wholesale mobile voice call termination on its network Consultation Document.
[17] Transcript of H3G's hearing at the Competition Commission in the context of the 'Mobile Phone Inquiry', 8 October 2002, page 9 and 10.
[Confidential].

on an equal footing to their competitors; whether the waterbed is effective is not, strictly speaking, relevant.

17. **[Confidential]**

18. **[Confidential]**

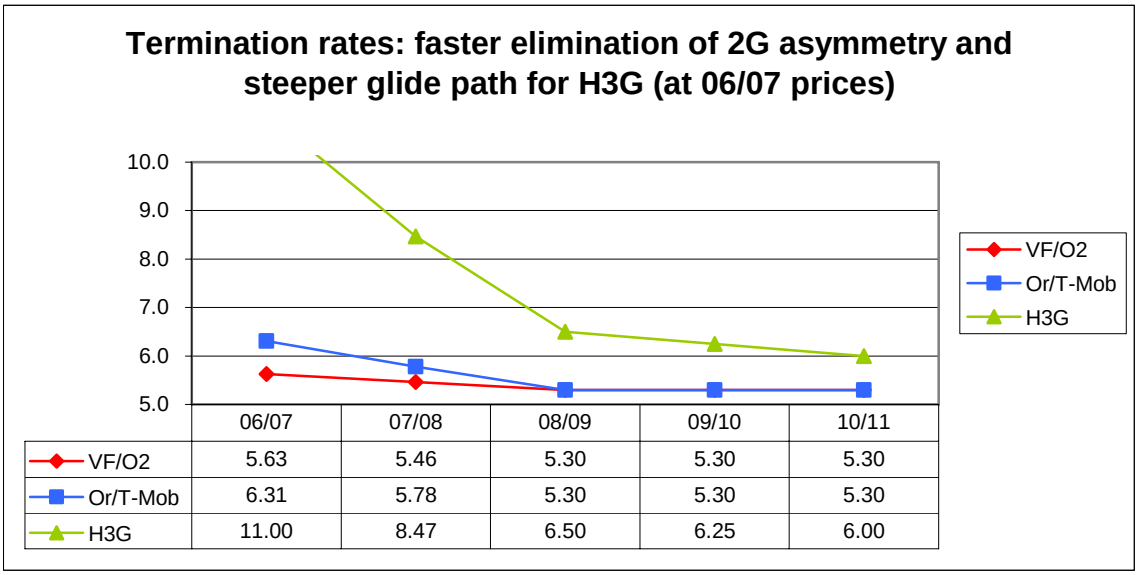
19. **[Confidential]**

20. In both 2003 and 2006 Vodafone has taken slightly less than 6 months to react to major shifts in its external environment. In a similar fashion we would expect H3G to be already planning its reaction to the conclusion of the market review in early 2007 and be in a position to institute any changes to its prices long before it is required to reduce its termination rates.[19]

21. In summary, Ofcom's (and Vodafone's) cost modelling work shows that H3G's termination rates are significantly above cost. This gives H3G a material and unfair competitive advantage and results in higher prices for consumers of calls to mobiles. In similar circumstances, and being well aware of the risks involved, both the Competition Commission and Ofcom have thought it appropriate to impose reductions of between 25-30% in mobile termination rates. The same logic applies today. Moreover, the evidence is that H3G has been anticipating, and therefore has been able to plan for, a reduction in its termination revenue for a number of years. If, bizarrely, H3G has been unaware of the likelihood of regulation then it still will have at least 12 months to plan for a reduction in its charges (i.e., from publication of the consultation document to reducing termination rates in 2007[20]). The available evidence shows that the mobile industry is well able to cope with material (from above cost plus externality to cost plus externality) reductions in termination charges. Vodafone therefore sees no evidence that its modification to option 2 would present a "*material risk to further investment in mobile services*" (paragraph 9.88). Indeed H3G's recent pronouncements[21], which have been made facing the prospect of a significant cut in its termination rate, hardly indicate that its future investment in UK mobile services in the UK is at risk.

22. In the graph below we summarise Vodafone's proposals for the structure of the price control remedy using Ofcom's values for the underlying costs.

[19] H3G has neither Service Providers nor a legacy billing system to delay its response.
[20] We see no reason why H3G could not delay any reduction in its termination rates until September 2007, or even later.
[21] See, for example, the launch of the 'X series'.



	06/07	07/08	08/09	09/10	10/11
VF/O2	5.63	5.46	5.30	5.30	5.30
Or/T-Mob	6.31	5.78	5.30	5.30	5.30
H3G	11.00	8.47	6.50	6.25	6.00

Section 3: Level of the Proposed Remedy

The cost of terminating calls

23. In annex 3 Vodafone details its suggested changes to the Ofcom model. The key modifications are:

The recovery of non-network costs: Vodafone believes that the quantum of non-network costs derived by Ofcom is too low for 2G/3G operators.

Market shares: The model assumes that H3G does not become cost efficient over the life of its licence. H3G should be assumed to reach market share parity earlier than 2021. See below for details.

Asymmetry between 900MHz and 1800MHz 2G/3G operators: Vodafone believes that the degree of asymmetry in modelled cost between the 900/1800MHz and the 1800MHz operator is overstated and that there are several corrections to the model parameters which need to be made to adjust for this: TRX limit, cell radii etc.

Asymmetry between 2G/3G and 3G only operators: outside of changes to market share there are valid adjustments to the model which narrow the gap between the 2G/3G operators and a stand-alone 3G operator.

Cost drivers and data services: The existing model gives excessive weight in the cost allocation drivers to data services. Vodafone suggests a way in which this may be ameliorated.

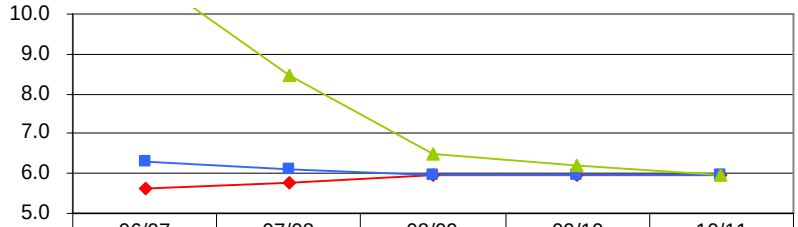
Cost trends: Vodafone believes that further modification is still required to the cost trends e.g., the capex cost trends for two shared assets, HLRs and transits, stop at 2009/10. Vodafone suggests that, in line with other shared assets, their cost trends should be extended to 2020/21.

Economic depreciation: In the course of the review of this and the previous version of the model Vodafone has become increasingly aware of flaws in the operation of the present economic depreciation methodology (described as "original ED" in the model) and has come to prefer the revised ("simplified") method.

Traffic: Vodafone believes that Ofcom has incorrectly modelled the mix of outbound traffic.

24. In total these adjustments suggest a common charge for all operators of 5.9-6.0ppm in 2010/11 (at 2006/7 prices). The graph below shows our suggested path of prices over the period.

Termination rates: faster elimination of 2G asymmetry and steeper glide path for H3G (at 06/07 prices) to Vodafone modelled outcomes



	06/07	07/08	08/09	09/10	10/11
VF/O2	5.63	5.78	5.95	5.95	5.95
Or/T-Mob	6.31	6.12	5.95	5.95	5.95
H3G	11.00	8.47	6.50	6.20	5.95

25. Of particular concern to Vodafone is Ofcom's new assumption that it takes a further 15 years (i.e., from now until the end of the licence period) for H3G to achieve parity in market shares with the other UK MNOs; an extension of 11 years from the position in 2005. In 2005 Ofcom was confident that market parity could be reached by the end of 2009.[22] It now is effectively assuming that H3G remains at a sub-(efficient) scale for the entirety of its licence, and in the crucial

[22] "*H3G's historical and forecast share of mobile subscribers have been constructed from company statements and perspectives from a range of brokers, using linear interpolation between these data sources where necessary. It is assumed that H3G's network will have a 20% share of all mobile subscribers by 2010. This is also broadly consistent with the third party subscriber forecasts for H3G referred to above.*" Wholesale mobile voice call termination explanatory statement and notification of proposals, June 2005, E.26.

year for the current regulation, 2010/11, will only have a market share of 11.7%, virtually half the size of the other operators. Although an initial period of sub-scale operation is to be expected, a more reasonable expectation should be that H3G manages to compete on an equal footing with its rivals for a large part of its licence (at least two-thirds) and in particular becomes NPV positive during the course of its licence. We know from H3G's submissions to the CAT that it did not expect to sustain a higher termination rate. It presumably knew that termination rates are regulated at cost plus an externality and therefore we infer that it believed that its costs would be in line with those in the rest of the industry.

26. Although Ofcom's (unrealistic) assumptions may align with some brokers' reports or other 3rd party sources Vodafone submits that allowing any operator to enjoy higher termination rates on the basis that it cannot compete effectively in the market place amounts to a bad policy decision. It should not be an empirical question about when external commentators, or H3G itself, now think that it will achieve uniformity of share with its competitors but rather a policy decision by Ofcom that is decided ex ante. The issue is not how long it will take H3G to achieve parity but what an efficient entrant could and should be expected to achieve and therefore how long other operators be penalised (through paying higher interconnection charges) in the interim.

27. Ofcom's 'empirical approach' will invite every new mobile entrant, by extension, to claim a sub-scale premium in its termination charges by arguing that it is difficult to take market share from the established mobile operators or, more perversely, to retard its own progress in the market for fear that it will be penalised by Ofcom in the form of a lower termination rate. In effect, the regulator is signalling that it is prepared to compensate H3G (and by analogy any new entrant) for its failure ever to achieve cost efficiency. Vodafone urges Ofcom to be extremely wary about perpetuating endogenous reasons for differentials in termination rates particularly when those reasons have such unappealing incentive properties.

28. The European Commission is alive to the disadvantages of perpetuating termination rate asymmetries on the basis of scale.

> *Nonetheless, the fact that a MNO entered the market later and that it therefore has a smaller market share can only justify higher termination rates for a limited transitory period. The persistence of a higher termination rate would not be justified after a period long enough for the operator to adapt to market conditions and become efficient and could even discourage smaller operators from seeking to expand their market share. The Commission has indicated in a number of cases that it is necessary to ensure that the asymmetries do not remain in force for too long and that the MTRs of each MNO should be*

brought down to the cost of an efficient operator as soon as possible.[23] (our emphasis)

29. In the recent Polish market review of wholesale markets for call termination on the public fixed telephone networks of alternative operators the Commission notes:

> *Generally, the most appropriate means to achieve effectively regulated termination rates would be to base their calculation on a cost model that takes into account the necessity for alternative operators to become efficient over time.*[24] (our emphasis)

30. H3G has had its transitory period (4 years by the time the next price-cap period kicks in) under which it should enjoy an asymmetry in termination charges on the basis of scale. This point was eloquently put by the Competition Commission in 2003.

> *In principle, we agreed with T-Mobile that the cost of terminating calls should, in the short term, take into account the extra cost of an MNO with a market share of total traffic lower than the average. This should ensure that even a relatively small MNO receives enough income to finance its termination business. The appropriate cost, in the short term, for an operator with a lower than average market share is the cost of an efficient operator with that actual market share. However, over a period of two to three years we think that an MNO with a lower than average market share has the opportunity to capture at least an average share of the market. Therefore, by 2006, we would expect there to be no need for any extra cost due to low market share, and the extent to which any extra cost would be relevant in the earlier years of any price control would depend on decisions taken on the glide path between current prices and the cost projection for 2006. (paragraph 2.277, our emphasis)*

31. In the quote above note that the Competition Commission referred to T-Mobile's *opportunity* to obtain equivalent market share. In other words it was assessing what was a reasonable period of time to allow T-Mobile to build an equivalent

[23] Case FR/2006/0461: Price control obligation related to voice call termination on individual mobile networks in metropolitan France. Comments pursuant to Article 7(3) of Directive 2002/21/EC 1

[24] Case PL/2006/0502: wholesale call termination on the public telephone network of alternative operators provided at a fixed location in Poland Comments pursuant to Article 7(3) of Directive 2002/21/EC1

market share. The Commission did not trouble itself with whether this concurred with either T-Mobile's or 'the market's' expectations.

32. Vodafone urges Ofcom to revisit the assumption of H3G's market share progression within the model. We believe that it is reasonable (in fact very generous) to assume that H3G achieves parity by 2012. This gives H3G 6 years from now (or 9 years in total) to achieve market share parity and is double the time previously allowed to operators by both the Competition Commission and Ofcom, just about fits with the European Commission's view of a 'transitory period' and now means that H3G achieves cost efficiency with the rest of the market before its licence runs out. This is consistent with H3G's claims on its web-site (www.three.co.uk) that it *"has created a new network with new rules that have changed the mobile world"* and has *"created a different type of business by defining a new category which fuses together information, communication and entertainment in to a single mobile device"*. Surely such a mould-breaking company should not be expected to take 20 years to achieve market share parity with its rivals?[25]

33. In order to answer this rhetorical question Vodafone has constructed a simple stylised, but realistic, model of how the market share of a new entrant could develop in the UK market. The model starts with the end year market sizes assumed by Ofcom in September 2006 and a constant churn of 35% (in line with the current market average). It then calculates the number of churning customers as churn multiplied by the average base in the year. New customers are represented as the increase in market size in the year. The model then calculates the proportion of each of these (new customers and churned customers) that are drawn to the new entrant.

    - For new customers, there is a choice of 5 operators, so the base proportion of new customers likely to go to the new entrant is 20%, but this is modified in the early years after launch by a brand preference scalar because the new entrant will have a brand that is less attractive than the established operators and probably fewer channels to market. This is a disadvantage that the new entrant should be expected to eliminate rapidly - and could even switch to a value greater than 1 for a while as was the case for Orange in its early years.

    - Churning customers have a choice of only 4 networks, i.e., they will not return to the network they have churned from. In the first year from launch the new entrant has 100% of the churn pool available to it, so could receive 25% of the pool, but this is then adjusted by the same brand preference scalar. As the new entrant's market share rises then this 25% opportunity falls back towards 20%

[25] We note that 3 Italia reports a significantly higher market share than H3G UK.

The new entrant's total customers at year end are then calculated from the sum of the connections in the year and the opening balance less churn in the year: the incumbent market share is the balance divided by 4[26].

The table below shows the relative progress of the new entrant in the market. Under a set of conservative assumptions for a company that has *"changed the mobile world"* we see that H3G could be expected to achieve parity by 2012 at the latest.

New entrant market share growth

	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Market size per Ofcom (millions)	49.0	54.0	60.0	64.0	65.3	66.1	66.6	67.0	67.3	67.6	67.9
Churning customers		18.03	19.95	21.70	22.63	23.00	23.22	23.38	23.50	23.61	23.71
New customers		5.00	6.00	4.00	1.30	0.80	0.50	0.40	0.30	0.30	0.30
Proportion of customers going to new entrant:											
Brand preference scalar		0.10	0.45	0.30	0.60	0.80	1.00	1.00	1.00	1.00	1.00
New customers		2.0%	9.0%	6.0%	12.0%	16.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Churning customers		2.5%	11.1%	7.1%	14.1%	18.2%	21.9%	21.1%	20.6%	20.3%	20.2%
New entrant connections:											
From new		0.10	0.54	0.24	0.16	0.13	0.10	0.08	0.06	0.06	0.06
From churn pool		0.45	2.22	1.54	3.19	4.19	5.09	4.93	4.84	4.80	4.79
Closing new entrant customers		0.55	3.12	3.81	5.82	8.10	10.46	11.81	12.57	13.03	13.32
Closing new entrant market share	**0.0%**	**1.0%**	**5.2%**	**6.0%**	**8.9%**	**12.3%**	**15.7%**	**17.6%**	**18.7%**	**19.3%**	**19.6%**
Closing incumbent market share	25.0%	24.7%	23.7%	23.5%	22.8%	21.9%	21.1%	20.6%	20.3%	20.2%	20.0%

34. As a consequence of revising the market share assumption the fair charge for H3G falls to a level consistent with that of the 2G/3G operators in 2010/11 thereby undermining the case for any asymmetry in mobile termination rates.

The death of the WAF

35. Vodafone wholeheartedly supports the unlamented death of WAF. As evidence and for completeness we attach, as annex 4, a paper previously submitted to Ofcom on the deficiencies of the WAF in October 2005.

The allocation of spectrum costs

36. Ofcom is correct in accounting for the purchase price of 2 carriers (2x10MHz) of spectrum within the cost model. This spectrum has been purchased to provide radio capacity for both voice and data services, and the same opportunity cost is attributable to both categories of services.[27]

[26] Once the new entrant has reached 19.5% market share this is deemed to be parity to choke off the asymptotic growth implied by the model structure

[27] It may be argued that the current value of the spectrum is less than what was paid at the time of purchase, but operators had no flexibility in the timing of purchase and had to pay the perceived "economic value" at this time. In theory Ofcom could recognise a depletion of this value, but in this case would also need to include the holding loss incurred by operators in the meantime. In practice, Ofcom's approach of incorporating the full purchase price seems reasonable.

37. Ofcom discusses two methods for allocating spectrum costs: (1) radio traffic; or (2) total traffic. Since the capacity constraint on spectrum is in terms of the way it is used, i.e., by radio traffic (and, if anything, the cost of spectrum is incremental to radio traffic), Vodafone can see little merit in allocating spectrum costs via total traffic. This approach would result in relative services price (e.g., for voice vis-à-vis data) not reflecting the true opportunity cost of spectrum used by each type of service. In particular data services will be imputed with a price that does not take account of the higher level of spectral efficiency of these services, with the risk that consumption will be reduced to below economically efficient levels. For this reason Vodafone believes that radio traffic should be used as the basis for the allocation of spectrum costs.

38. If, as an alternative, Ofcom takes the view that spectrum is a fixed and common costs then Vodafone would strongly argue that the efficient cost allocation should be weighted towards incoming voice services in order to allow the development of new 3G services.

The magnitude of the optimal externality

39. Vodafone generally supports the modelling approach adopted by Ofcom. The approach is sensitive to the choice of parameter α. This parameter is meant to capture the impact of leakage through the inability of MNOs to target the externality subsidy at marginal subscribers, and lies between zero and 100% in value.

40. It is difficult to determine an appropriate value for this parameter within the 0-100% range, and so Ofcom uses a pragmatic approach of specifying a range of 0-75%. Vodafone does not believe that the lower bound of this range (zero) is credible. It is inconceivable that there will be no leakage, and so a more sensible range will be 25-75%. This will increase the lower bound externality in Tables A16.4 and A16.5.

41. However, Vodafone also believes that a further consideration is relevant to determining an appropriate range for α. It is clearly the case that the externality surcharge on call termination is only effective to the extent that it generates additional revenue for MNOs. In paragraph A16.38 Ofcom states that all terminating minutes, both fixed-to-mobile (F2M) and off-net-mobile-to-mobile (M2M), should contribute to the externality subsidy, even though the externality surcharge for the latter category of calls will be paid by other MNOs. Ofcom justifies this approach by arguing that in the latter case the externality surcharge will be passed on to retail prices for M2M calls and so will represent a source of revenue for the industry, along with the payments MNOs receive from fixed network operators. However, Ofcom provides no basis for this full pass-through assumption and has previously calculated that pass-through of mobile termination rates in the retail tariffs of fixed network operators is only around 64%. Indeed, in the case of M2M calls, MNOs may be prepared not to pass through the full termination rate to retail tariffs if they expect that each outbound call has a

certain probability, say 0.67, of generating a return call for which a termination payment will be received, giving a lower net cost of termination if 0.67 of a return call is included.[28] In this situation it will be optimal for the MNO to pass-on only 33% of any termination rate to retail prices – and so only 33% of any externality surcharge. [29]

42. The Ofcom model is flexible enough to capture this effect through the α parameter. By assuming total pass-through of the termination rate in M2M calls, Ofcom define α by the relationship:

    total revenues required = total subsidies required / (1- α)

    where α is the extent of leakage. However, if we incorporate the fact that there is only 33% pass-through of the termination rate in M2M calls, we have the relationship:

    total revenues required
    = total subsidies required / [(1- α) x (FTM+0.33MTM)/(FTM+MTM)]

    If, for the sake of illustration, we assume FTM and MTM calls are of equal volume, we have:

    total revenues required
    = total subsidies required / [0.67 x (1- α)]
    = total subsidies required / (1 – 0.33 - 0.67α)

43. This shows that the pass-through effect can be incorporated into the Ofcom model by substituting α with 0.33+0.67α. Therefore, the previous range of 0.25 to 0.75 becomes 0.50 to 0.83. Using this range in the Ofcom externality model shows that the range of possible externalities rises from 0.01-0.36ppm (see Figures A16.6 and A16.5) to 0.02-0.49ppm. This reinforces Ofcom's externality estimate of 0.3ppm.

Cost of Capital

44. Vodafone continues to support the use of the Capital Asset Pricing Model (CAPM) as the principal tool for determining the WACC of MNOs. Vodafone does, however, believe that the equity risk premium (ERP) assumed by Ofcom (4.5%) remains too low. **[Confidential]**

[28] There is a body of old econometric evidence from fixed networks that indicates that for each outbound call an expected 0.67 inbound calls are received in return (see Lester Taylor's book "Telecommunications Demand in Theory and Practice" Kluwer Academic Publishers, 1994, pages 135-136. This quotes a range of 0.67-0.75 based on a study of US toll traffic). There is little reason to believe that this has changed.

[29] To see this, consider that an MNO will price M2M calls based on its marginal cost consisting of:marginal cost of origination + termination rate – 0.67x surplus on return traffic which equals marginal cost of origination + (termination cost + externality) – 0.67 externality which equals marginal cost of origination + termination cost + 0.33 externality

45. However, Vodafone also notes that the CAPM is not sufficient to capture all sources of risk to which MNOs are exposed. In particular, Ofcom should:

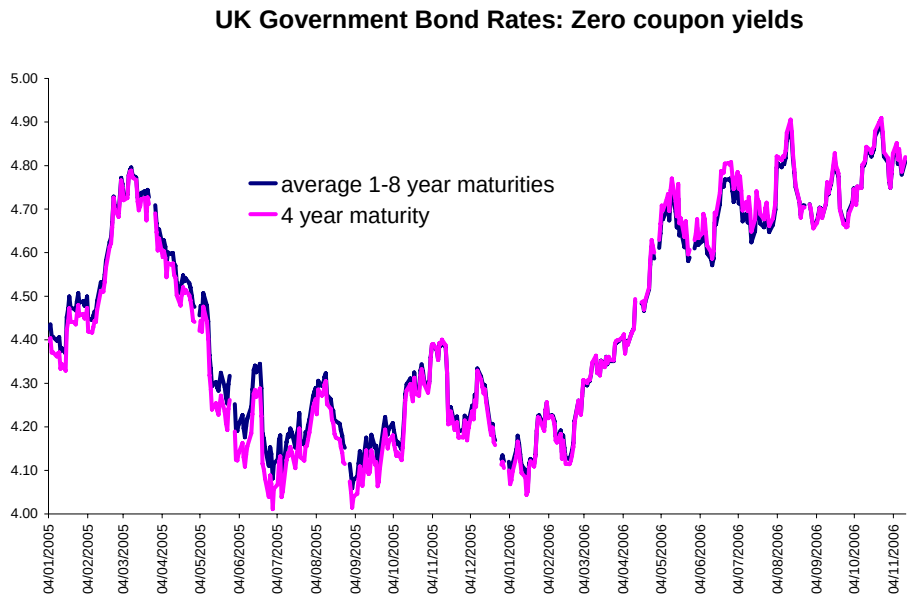
- adopt a cautious demand forecast for new services in its LRIC model, in order to capture a necessary contingency against project specific risk; and

- take account of the impact of uncertainty on market development, and the optimal allocation of costs between voice termination and other services.

46. Vodafone is concerned that, following recent movements in interest rates, Ofcom's assumption of a 4.6% risk free rate is no longer appropriate. Ofcom correctly bases its estimate of the risk free rate by reference to the yields on UK government bonds, studying a range of maturities. In Vodafone's view, this should match the maturities of the assets. The LRIC model assumes a range of asset lives up to 20 years,[30] but a weighted average (weighted on network investment in 2011/12 – the target year) would indicate 8 years. Assuming that, on average, assets are half way through their lifetime, an appropriate average maturity period would be 4 years. Therefore, Ofcom should either adopt a 4 year maturity period for the risk free rate or, if it wishes to reflect a range of maturities, take the average of 0-8 years. In both bases the appropriate risk free rate currently stands at 4.8%.[31] Chart 1 shows the evolution of this rate since January 2005. It is clear that rates have risen by 0.2% since the summer of 2006, and by more since the beginning of 2006 – a fact that Ofcom may not have taken into account in its assumptions.

[30] Apart from 50 years for the GSM licenses.
[31] Calculated from zero coupon spot yield curves calculated by the Bank of England

Chart 1:

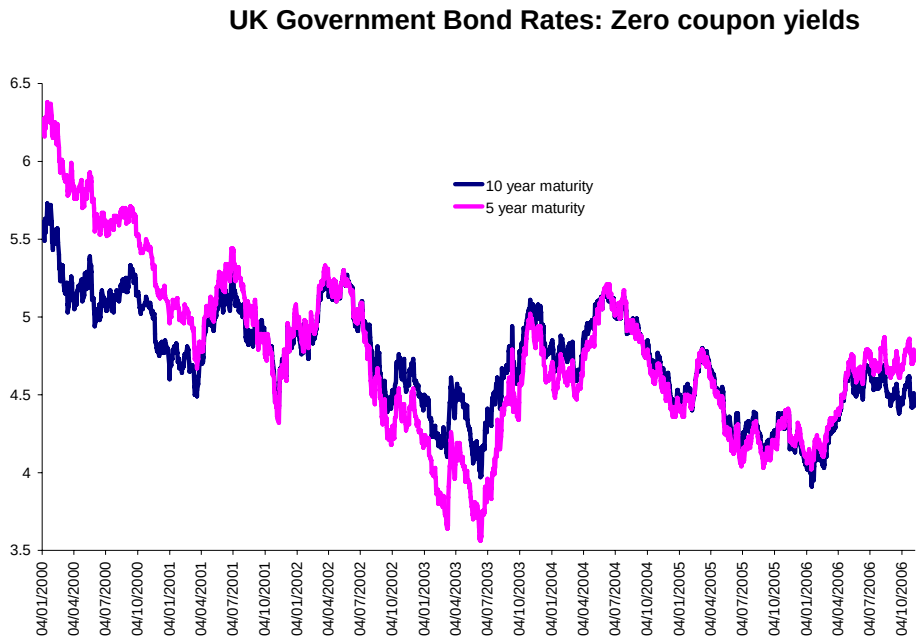


47. Ofcom has a concern that its assumption should not be unduly influenced by the short term transitory movements in interest rates. However, balanced against this are the following facts:

- Economic theory is quite clear that the current rate is the market's best expectation of interest rates over the forthcoming maturity period, taking account of all current and past information, and so should already have discounted any short term transitory movements;

- The higher rates recently observed are perfectly consistent with longer term averages shown in Chart 2.

Chart 2:



48. On the basis of the above evidence, Vodafone considers an appropriate risk free rate to be at least 4.8%. This raises the cost of capital to around 11.5%.

Section 4: Answers to the specific questions raised by Ofcom

Question 1: Do you agree with Ofcom's market definitions?

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?

Vodafone believes that Ofcom erred in not considering the impact of 2-sided markets on market definition and SMP. Furthermore, we remain unconvinced by Ofcom's argument that in the exercise of its dispute resolution powers it could not (or would not choose to) set prices at a level which would properly constrain SMP.

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 March 2011.***
- ***A charge control on fixed to mobile MCT to apply until 31 March 2011***
- ***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***

Yes except that Vodafone takes issue with the burdensome and unnecessary requirement to supply Ofcom and any requesting party with copies of all of its access contracts. Vodafone believes that it should be sufficient to supply one sample copy of an access contract and affirm, in writing, that it does not differ in any material respect from the other agreements. If Ofcom has reasonable grounds to suspect that this is not the case then it can require copies of all access contracts.

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. Vodafone believes that the efficient charge for all operators in 2010/11 should be between 5.9-6.0ppm.

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 (2006/7 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***

Please see our answer to question 4 above. In the absence of a common rate for all operators Vodafone supports a modification to option 2 (or a faster implementation of option 3): a full reduction to cost after 2 years.

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?

Please see the answer to question 4 above. Using its own and Ofcom's analysis of cost Vodafone advocates an elimination of the asymmetry in 2008/9.

List of Annexes

Annex 1: Letter from Oftel (26 March 2003)

Annex 2: **[Confidential]**

Annex 3: Comments on the cost modelling

Annex 4: Comments on the WAF

Annex 1

Don Wilson
Vodafone Ltd

8891
nic.green@oftel.gov.uk

NBP/595/449/1
26 March 2003

Dear Don

ENQUIRY INTO PLANNED PRICE CHANGES

I understand that Vodafone is due to make a number of price changes, specifically to its pre-pay offering from 1 April. With Oftel's consultation document on mobile access and call origination due for publication before Easter, Oftel would like to ensure that the document shows proper awareness of these changes.

Please can you therefore confirm what specific changes have taken place since 1 March, or are in the pipeline for the 6 months from April, for the following:

a) call charges;
b) handset prices / subsidies;
c) any other charges.

Please provide details for contract as well as pre-pay packages.

Due to the tight timescale for publication, please can you provide this information by 2 April, and I would very grateful if you could do this any sooner. Note that I am making the same request to the other mobile networks. Please can you call me as soon as possible if there will be a problem in providing this information.

We have also seen press reports concerning the potential purchase of Singlepoint by Vodafone. Please can you confirm whether there is any substance to these stories, again to ensure that we are fully informed before the consultation is issued rather than for actual publication in the document.

Yours sincerely

Nic Green

Annex 2

[Confidential]

Annex 3

Comments on Cost Modelling

Introduction

Vodafone welcomes the changes that were made in the latest version of the model, recognising that many of them were suggested by Vodafone in its critique of the previous version[32]. However not all of Vodafone's suggestions have been implemented and a more thorough review of the September 2006 version reveals that further modification is both possible and necessary.

Vodafone believes that the current version of the model does not correctly reflect the costs of termination of a 2G/3G operator and identifies in the sections below several adjustments that should be made. Since Ofcom's assessment of the cost in 2010/11 for a 2G/3G operator of 5.3p in 2006/07 prices is the result of a review of a range of outputs from the model rather than from a single scenario, direct comparison of model changes to this individual value is not possible. Instead Vodafone examines the impact of modifications to six scenarios, which collectively seem to approximately represent the upper and lower bounds of the ranges that Ofcom has laid out for the three operator types on the medium level basis, i.e. 4.5-5.5ppm for 900MHz 2G/3G, 4.8-5.8ppm for 1800MHz 2G/3G and 5.4-6.7ppm for 3G only.[33] [34] For brevity, only the model output in 2010/11 is given in the tables below.[35]

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Output range	4.5p to 5.5p		4.8p to 5.8p		5.4p to 6.7p	

The possible modifications identified below are not an exhaustive list, merely a sample: for ease they have been grouped by Vodafone into several categories[36].

[32] Vodafone – comments on Ofcom 17th March 2006 LRIC model, May 2006

[33] These scenarios are: 2G/3G lower bound £3.3bn licence, radio traffic recovery, medium voice and data, upper bound £4.0bn licence, radio traffic recovery, medium voice only (for both 900MHz and 1800MHz operators) and 3G only lower bound £4.4bn licence, radio traffic recovery, 3 carriers, medium voice and data traffic, and upper bound £4.4bn licence, radio traffic recovery, 3 carriers, medium voice only traffic.

[34] Since the 3G only operator coverage details used by Ofcom have not been supplied for reasons of confidentiality these have been estimated by Vodafone so that a 3G only set of results similar to those shown on page 201 of Ofcom's document can be generated by the model.

[35] The characterisation of the upper bound scenarios by Ofcom as voice only is not strictly correct, since each of them assume a substantial takeup of video telephony, so in reality they are circuit switched only scenarios: if for example Ofcom's low proportion of video telephony were to be substituted for the "medium" one currently used, then the upper bounds rise by 0.15p and 0.28p for 2G/3G and 3G only respectively.

[36] One area not discussed here, for example, is the set of several errors that still persist on location updates, in MSC driver allocation (busy hour to annual scaling adjustment as previously discussed in the May document), recovering costs from subscribers before service launch, equi-recovery across all calls rather than on a per bit basis, etc. The collective impact of these changes is at odds with the detail of the explanation required.

Justification of each issue has also been deliberately brief: further argument (and further modifications) can be supplied if required.

Recovery of non-network costs.

Vodafone believes that the quantum of non-network costs derived by Ofcom is too low for 2G/3G operators. The sum of £107m in 2004/05 prices (or £112m in the model's 2006/07 prices) has been determined by Ofcom as the network proportion (39%) of total administration costs (£275m in 2004) for the average 2G/3G operator – the same total has also been used for the 3G only operator. In making this calculation, Ofcom has identified total network costs of £972m and total retail activities of £1,534m. Vodafone believes that the total of relevant retail costs is overstated.

A confidential addendum to this Annex explains:

- That the use of gross handset costs is an error of principle – net handset costs should be used, i.e., the operator's handset cost *after* the contribution that the customer is prepared to pay to upgrade his handset from the "base" model provided free of charge to the customer by the operator handset subsidy to a more sophisticated one.

- The sums paid to a distributor or dealer to obtain a connection are not relevant as a factor in determining the allocation of administrative overheads since this activity involves very little internal administrative resource (and much higher per unit costs).

- Using Vodafone actual costs, the revised handset cost for 2004/05 appropriate for the allocation of administrative costs is identified.

Two further points can be made. Firstly the year chosen for establishing the baseline of retail cost, 2004, can be characterised as a period when H3G were very aggressively pursuing customer growth, with substantial handset support payments, forcing a matching reaction from the 2G/3G operators. Using this to calculate 2010/11 costs is inconsistent with the assumption in the latest model extending the period that the 3G operator will take to reach market parity from 7 years from launch to 18 years. If Ofcom are content to assume that H3G are to take a further 11 years to reach market parity there is an implicit assumption that their aggressive pursuit of customers will not continue at the 2004 level, and hence that the level of handset cost expenditure in the market will decline. Secondly, recent market developments, such as Vodafone's announced decision to stop connecting contract customers through Carphone Warehouse and H3G's announcement that they plan to substantially increase the proportion of connections made in-house, rather than through the much more expensive dealer channels can be seen as trends likely to reduce the annual quantum of handset costs for network operators. Both of these points suggest that the level of retail costs used for cost allocation purposes will decline. Also the model forecasts that the level of network costs for a 2G/3G operator will be higher in 2010/11 than in 2004/05. This too indicates that the relative weighting of administration costs will shift away from retail towards network over time.

Taking the conclusions from the addendum to this annex and applying them to the market as a whole, Vodafone believes that the total retail cost for allocation purposes is overstated by Ofcom by on the order of £700m. This revises the allocation of administrative costs as follows:

Total relevant retail activity:	£834m
Total network cost:	£972m
Total relevant costs:	£1,806m
Administration costs:	£275m
Share of admin costs allocated to network:	£148m – in 2006/07 prices £155m.

Vodafone believes that the sum of £155m should be substituted for the £112m currently used in the model for 2G/3G operators. Ofcom has taken the view that the administrative cost of the 3G only operator is identical to that of the 2G/3G operators in absolute terms. The implication of this is that the mark-up for the 3G only operator for admin costs is much greater than for the 2G/3G operator, 0.34p vs. 0.19p or so. Vodafone has difficulty with this approach: by Ofcom's market share forecast the 3G operator in 2010/11 will have 11.7% of the market and each 2G/3G operator 22.1% share: in other words the 3G operator will be little over half the size of the 2G/3G operators. It is hard to see that under these circumstances an efficient 3G only operator could have the same level of network administrative costs as a 2G/3G operator or a mark-up 80% greater. Vodafone suggests that the admin costs for the 3G operator should be at most no more than 75% of the 2G/3G level, i.e. at or close to the original Ofcom cost of £112m.[37] These changes to the network administration costs give the following results:

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Admin fees £155/£112m	4.679	5.505	4.919	5.771	5.468	6.579
Impact vs. base	0.066	0.081	0.067	0.081	0.000	0.000

Vodafone is also considering whether the use of a simple mark-up is the optimum cost recovery method: it may be more appropriate to recover administrative costs incurred as part of a network business through economic depreciation principles. A conservative assessment of the rising level of network administrative costs from 1993/94 to 2004/05 to £155m (with an assumption of constant costs thereafter) was modelled as a new asset element. Recovery of these total costs incurred is then made through economic depreciation principles, using an all network traffic driver that weights services across the whole network, taking account of different weights in different parts of the network, in a manner similar to the drivers discussed in the cost driver section below. Running this in both the upper and lower bound scenarios for the 2G/3G operator results in an increase in the average cost recovered of 0.33ppm over the summary result of 5.97ppm reported on page 43 below.

[37] If the increase in the 2G/3G operator admin cost is not accepted, then the 3G only operator cost should be reduced to 75% of £112million. Either way this still gives the 3G only operator a mark-up greater than the 2G/3G operator.

Market shares

Ofcom have in this version of the model considerably extended the period over which the 3G operator rises to a 20% market share, i.e., to parity with the modelled 2G/3G operator. Prior to this Ofcom has assumed in all termination modelling since 2001 that market parity by the new entrant will be achieved by the end of 2009. In 2001 Oftel assumed a launch date of 2002 with parity achieved in end 2009, 7 years after launch. In 2004 and 2005 the assumption implicit in the 2G modelling was that the 3G operator, having launched in 2003 would still reach a 20% market share by the end of 2009. In the 2005 consultation Ofcom revised the forecast on total market size, but left unchanged the assumption that the 3G only operator would reach market parity by the end of 2009. "*H3G's historical and forecast share of mobile subscribers have been constructed from company statements and perspectives from a range of brokers, using linear interpolation between these data sources where necessary. It is assumed that H3G's network will have a 20% share of all mobile subscribers by 2010. This is also broadly consistent with the third party subscriber forecasts for H3G referred to above."*[38]

However, in the current version of the model, it has been assumed that the 20% point will not now be reached until 2020, or another 14 years. For the reasons outlined in the main body of this document[39] Vodafone does not believe that this assumption is appropriate for an efficient 3G only operator. Combining such a long gestation period with a higher regulated termination rate seems to be a reward for inefficiency, particularly in the context where H3G is able to run tariff packages such as "We Pay" which seem to reward the customer for inbound calls received.

Vodafone welcomes however the assumption of the end point of a 20% market share for the average operator, i.e. that there will be five equal sized operators in the mobile market for the foreseeable future. Any relaxation of this assumption, for example allowing some mobile traffic in the future to be carried by other operators will clearly reduce the traffic volumes of existing operators and hence increase termination rates above those currently proposed.

Vodafone has modelled a scenario of market share convergence in 2012.

3G only operator market share

	Mar-04	Mar-05	Mar-06	Mar-07	Mar-08	Mar-09	Mar-10	Mar-11	Mar-12
Ofcom 2005 - 2009 convergence	1%	5%	9%	11%	14%	17%	20%	20%	20%
Ofcom 2006 - 2020 convergence	1%	5%	5%	7%	9%	10%	11%	12%	13%
Vodafone 2012 convergence	1%	5%	7%	9%	11%	13%	15%	17%	19%

	Mar-13	Mar-14	Mar-15	Mar-16	Mar-17	Mar-18	Mar-19	Mar-20	Mar-21
Ofcom 2005 - 2009 convergence	20%	20%	20%	20%	20%	20%	20%	20%	20%
Ofcom 2006 - 2020 convergence	14%	15%	16%	17%	18%	18%	19%	20%	20%
Vodafone 2012 convergence	20%	20%	20%	20%	20%	20%	20%	20%	20%

[38] Wholesale mobile voice call termination explanatory statement and notification of proposals, June 2005, E.26.
[39] Paragraphs 25 to 33.

There is an impact on the 3G operator as the earlier the 20% point is achieved, the larger the total lifetime volumes and hence the lower the unit costs: clearly there is a reciprocal effect on the 2G/3G operator. Vodafone has calculated the change in traffic volumes and hence on inbound costs resulting from these four convergence scenarios[40]. The results are as follows:

Market share convergence

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Market share convergence 2012	4.677	5.508	4.922	5.778	5.067	6.069
Market share convergence 2009	4.722	5.565	4.971	5.839	4.462	5.308
Impact vs. base (2012)	0.064	0.084	0.070	0.088	-0.401	-0.511

Vodafone sees no reason why anything more pessimistic than the still very conservative 2012 convergence scenario for an efficient 3G only operator should be adopted.[41] In the 2012 scenario, the indicated ranges for the 2G/3G 1800MHz and the 3G only operators are very similar.

Asymmetry between 900MHz and 1800MHz 2G/3G operators

Vodafone believes that the degree of asymmetry in modelled cost between the 900/1800MHz and the 1800MHz operator is overstated. This asymmetry is eliminated if the appropriate adjustments are made to the model.

Vodafone continues to urge that the TRX per sector limit is raised for 1800MHz operators from the present 4.5 to at least 6 to reflect the removal of a previously perceived technical limitation. The reasoning behind this and the method for developing appropriate evidence was discussed in detail in Vodafone's critique of the previous version[42] and will not be repeated here.

The existing model changes the cell radii for urban and suburban sites for 2G 900MHz operators in 1999-2001 from 1.9 km to 1.2km and from 3.3km to 2.3km respectively. This seems wrong: it appears to suggest that there were initially coverage holes (for the 900MHz operator alone) that were filled 7 years after service launch by adding additional sites. Vodafone can see no good reason for not using the lower radii to ensure proper coverage from first network build.

The model currently has a high proportion of traffic in urban and suburban areas for 1800MHz operators covered by microsites, 11%, up from the 3.5% used in June 2004.

[40] Vodafone has reattached the traffic engine from the previous version of the LRIC model and back-solved the migration and usage per customer scenarios developed by Ofcom to generate each of its 4 traffic scenarios per operator type. Alternative customer numbers can then be run with these usage parameters to generate total traffic volume scenarios under different market share assumptions and/or different mixes of service growth.

[41] Note that if the 2012 convergence scenario is adopted, then the 3G operator's administrative costs should be increased from 75% to perhaps 90% of the 2G/3G value in 2010/11

[42] Vodafone – comments on Ofcom 17th March 2006 LRIC model, May 2006, pages 55 to 60

Given the large quantity of spectrum available to 1800MHz operators, the need to provide fill-in capacity through a microsite layer is much less than for a 900MHz operator. It is believed that one of the two 1800MHz operators does not use microsites at all. Vodafone suggests the 11% be reduced to 5% for urban and 4% for suburban geotypes.

The table below shows the cumulative impact of these modifications to the model inputs.

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
1800 TRX ceiling revised	4.612	5.424	4.785	5.615	5.468	6.579
+ 900 cell radii revised	4.660	5.476	4.785	5.615	5.468	6.579
+ reduce 1800 microcell traffic	4.660	5.476	4.753	5.579	5.468	6.579
+ award of 900 spectrum to 1800 ops	4.660	5.476	4.720	5.543	5.468	6.579
Impact vs. base	0.047	0.052	-0.133	-0.147	0.000	0.000

After the adjustments, the mid-points of the two 2G/3G ranges both round to 5.1, and are less than 0.065p apart. Vodafone suggest that this indicates that there is no substantive cost difference between the two operator types.

Asymmetry between 2G/3G and 3G only

There are three separate types of changes in this category; modifications to 2G, to shared asset elements and to the 3G coverage for 2G/3G operators.

Vodafone discussed in its previous critique the issue that having a constant utilisation for 2G is not correct and that lower values than the steady state should be expected in the early years of network development[43]. Vodafone has modified the 2G utilisations on the reasonable growth inputs sheet of spreadsheet 2-Network.xls to allow for all 2G assets other than TRX and backhaul to start at 80% of the constant utilisation value for that asset type and rise to the final value between 1994 and 2000.

It should be noted that although the 2G quantity calibration seems to work fairly well in 2004, there is still a substantial difference in 2001, particularly in TRX quantities, where the model is under-predicting actual historic volumes. This seems to suggest that the 2G part of the model is not installing capacity early enough and hence is understating lifetime costs – possibly this is a result of the somewhat weak 2G non-homogenisation adjustment in the model not forcing sufficient capacity growth across the urban and suburban geotypes in the early years, or possibly the utilisation curve requires more significant adjustment. Either adjustment could potentially improve the long-term calibration of the model and push up the modelled total 2G cost recovery.

An efficient 2G/3G operator will, in order to minimise cash outflows, first roll out 3G hardware on sites already built for 2G, only constructing new sites where no suitable 2G site is available. The model currently assumes too low a proportion of sites that become shared by the addition of 3G site equipment in the early years – Vodafone has

[43] Vodafone – comments on Ofcom 17th March 2006 LRIC model, May 2006, pages 34-36

raised the proportion slightly to allow for the fact that the first priority on deploying a 3G network is to utilise available 2G sites.

As discussed in the previous critique, Vodafone does not believe that the logic used for the count of new site builds and 3G site upgrades is quite correct. Vodafone has substituted a slightly different algorithm, that starts with a (falling) percentage of 2G sites in service that are not capable of being shared, to identify the pool of shareable sites out of which 3G cell site requirements are first drawn[44], with the balance of demand being settled by new build of 3G only sites. This results in a slightly larger number of sites being built, to more closely reflect operator reality.

It can be seen from the table below that the previous adjustments, although increasing the asset quantity requirement, actually reduce the cost recovery. This is a product of the defective operating cost pricing for 3G site upgrades. A 2G macrosite at 2004/05 rates has an operating cost of £7,935, yet when a 3G site upgrade with an operating cost of -£8,102 is overlaid, the site is in aggregate actually generating a negative operating cost of -£167 in the model. This also occurs for micro sites and pico sites, where the negatives are -£827 and -£1,572 respectively. Vodafone suggests that a site upgrade actually generates a small operating cost outflow, in terms of renegotiated leases, more equipment to support etc, and hence the 3G site upgrade operating cost should be adjusted commensurately[45].

The model seems to assume that 2G/3G operators will build only to the 90% pop level, whereas the 3G only operator will build to approximately the 97% population level[46]. It seems perverse to assume that the 2G/3G operators would surrender competitive advantage, in terms of the provision of 3G only services to 7% of the population in this way.[47] The model also assumes that 2G/3G operators will retain 2G service in perpetuity as a "backstop" to 3G. This does not seem economically feasible or the logical actions of an efficient operator.[48] Whilst the date of 2G switch off is uncertain, it would seem sensible to model coverage on 3G at levels close to 2G depth. Vodafone has modified the Ofcom 3G coverage for 2G/3G operators to increase the depth of coverage: so as to reach 97% population coverage, but also to provide a reasonable coverage in rural 3 and rural 4 to allow for the possibility of 2G shut off, so that 81% area coverage is achieved. (This is still conservative, being some way behind 2G's 99% population and 97% area coverage.)

The model also does not take account of the fact that the 3G only operator is more able to optimise its 3G network than a 2G/3G operator. The former starts with a clean sheet, whereas the latter must build their 3G network as an overlay on top of an

[44] Creating a 3G upgrade asset which does not disappear if 2G equipment is withdrawn from the site.
[45] Vodafone – comments on Ofcom 17th March 2006 LRIC model, page 53
[46] Based on Vodafone's estimation of the 3G only operator's coverage modelled by Ofcom.
[47] It might be sensible to match this with an assumption that the 3G operator ends up with a 7% market share advantage!
[48] For example looking at the "lower bound" 1800MHz 2G/3G scenario, the model shows a "costs recovered" for all 2G services in 2020/21 of £71.4m and "costs incurred" of £103.2m (purely for the 2G only assets, before considering any costs embedded in the shared assets). In financial accounting terms, the HCA module appears to show an operating cost and depreciation total (in 2006/07 terms) of in excess of £140m, suggesting an outflow nearly double the indicative inflow.

existing network, forcing some compromises in design: the 2G/3G operator's desire to share 2G sites will mean a less perfect tessellation of 3G cell site deployment and hence require slightly more 3G sites than a 3G only operator, and also will curtail the ability to roll-out 4 sector cell sites, since existing sites and planning schemas are unable to accommodate more than 3 sectors per site.

One further way in which the model is deficient for 2G/3G operators is that it defines shared assets as those asset elements that can be shared between 2G and 3G services, and then seeks to recover their costs from all services. This is a simplification however in that shared asset types such as cell site builds in actual fact fall into three separate categories: those cell sites originally built for 2G that are never used by 3G, those that are specifically built for 3G and never used by 2G, and those that are originally built for 2G and are then also used by 3G. Only the latter are genuinely shared – the other two categories should not be recovered from 2G and 3G services combined. Since there are many more 3G only cell builds than 2G only, the current error in the model is that 3G only assets are being in part recovered from 2G, and there is a degree of cross-subsidy between services and between years.[49] Vodafone has modified the model to develop three separate service related cell site build types.[50] The amended model shows a higher 3G cost and a lower 2G cost, that when blended in 2010/11 virtually equate to the blended value of the unamended version, but in years prior to that give a lower blended rate than before, and in subsequent years a higher blended rate. Since the actual impact in 2010/11 is immaterial, Vodafone is not necessarily recommending this somewhat complex modelling change, but is raising it since the understating of the 3G cost in the model by means of the subsidisation of 3G by 2G may lead Ofcom to make incorrect inferences on the relative costs of 3G in a 3G only and a 2G/3G environment.

The impact of these adjustments, individually and collectively is shown on the table below – the gap between 2G/3G and 3G only is reduced by approximately 0.2p.

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Rising 2G utilisation	4.635	4.450	4.872	5.711	5.468	6.579
VF % of shared sites	4.609	5.420	4.851	5.683	5.468	6.579
VF site build methodology	4.567	5.377	4.802	5.635	5.468	6.579
Correct opex for 3G site upgrades	4.642	5.461	4.887	5.733	5.468	6.579
Deeper 3G coverage for 2G3G	4.632	5.443	4.870	5.707	5.468	6.579
3 sector limit for 2G3G	4.708	5.507	4.950	5.772	5.468	6.579
All changes collectively	4.797	5.609	5.040	5.877	5.468	6.579
Impact vs. base	0.185	0.185	0.187	0.188	0.000	0.000

[49] In that these costs are in part being recovered from 2G, partly in a period prior to the 3G only assets' actual construction date

[50] There are other shared assets, principally backhaul and core transmission, that suffer similar issues: Vodafone has not attempted to model these but expects the same cross-subsidisation feature to exist for these asset types

Cost drivers and data services

Vodafone has previously identified its concerns to Ofcom on the issue of circuit switched vs. packet switched service allocation. It has made several points that are not repeated here on the difficulties of attaching an appropriate weight to delay tolerant data services, whose demand peaks may not coincide with the network busy hour[51]. Vodafone welcomes the approach of Ofcom of using a "voice only" scenario (although in fact this includes a significant proportion of Video Telephony traffic) to mark the upper bound of the costing range, and then deriving an averaged result. Vodafone believes however that the lower bound, which is a mixed voice and data service offering, is set too low since it overemphasises the cost of data. Vodafone suggests below a few simple changes to cost drivers that can be made to partially redress this balance, although the concerns expressed previously still remain. Further modelling may be required to revise the allocation of cost to data.

Vodafone believes that the data down shift should be increased from 3 to 4 to reflect in some nominal way the more effective use of spectrum provided by HSDPA/HSUPA.

The switch site driver is currently using the "all traffic" driver: Vodafone believes that it is more appropriate that it uses a driver based on the MSCs that are housed in the switch sites, i.e. an "all MSC" driver.

The 2G network management system costs are allocated using the 2G total traffic driver, but this is incorrectly named, since it actually records the 2G radio network traffic. An appropriate NMS cost driver should reflect the whole network costs and traffic flows. Vodafone has created a 2G network traffic driver, which weights the radio network (with the 2G total traffic driver) at 70% and the core at 30%, using core values of 1, 0.4, 0.9,1, 1.5 and 1.2, (for the voice, messaging and data services respectively) derived from an aggregation of the switch and the core transmission weights. A factor to consider is that on-net traffic may count as two legs in the radio network, but it only passes once through the core.

A more significant change is to the 3G radio and 3G traffic drivers (which in turn impact the all radio and all traffic drivers used for allocation of shared assets). A key point about the 3G data traffic is that it is asymmetric – Ofcom characterises it at 80% download and 20% upload, yet it is the total, both up and down that is measured as the traffic volume. This asymmetry is also reflected in the dimensioning, in that more resources are consumed for the downlink, in terms of both equipment and spectrum than the uplink. CS services, voice and VT, however are symmetric, in that they require an equal uplink and downlink capability, in traffic volume, equipment, and spectrum. In developing the algorithm for cost allocation Ofcom have followed the approach used in previous 2G voice only modelling of using only the downlink. This was perfectly reasonable where all services are symmetric, but is not correct in circumstances of mixed services, some symmetric, some asymmetric.

[51] Vodafone – comments on Ofcom 17th March 2006 LRIC model, May 2006, pages 70-74.

In developing the relative weighting of voice and data in cost drivers in the model Ofcom have taken the total data volume, weighted it by 80% for the downlink proportion, so that 1MB = 0.8MB in the DL, or 6,553.6kb. For voice, one call = 12.2kbps or 732kb per minute, so therefore in the model 1MB of data is equivalent in resource consumption and cost weighting to 8.95 voice minutes[52]. This however does not consider the UL at all. In the uplink there is only 0.2MB or 1,638.4kb of data, whilst for voice there is still 732kb per minute, so that in cost weighting of the uplink "1MB" of data is equivalent to 2.24 minutes. The correct approach is to look at the resources that are required for both the DL and the UL collectively: here one voice call requires 12.2kbps *2 or 1,464kb per minute: this means that the total demand of 1MB is equivalent in resource consumption to 5.60 minutes[53], not the 8.95 minutes in the model. It is this 1:5.60 relative weighting that should feed the cost drivers, not the 1:8.95 currently held in the model.

It is relatively straightforward to adjust the cost drivers sheet to permit this adjustment (which also is required in similar vein for messaging). In practice the overall data weighting of 0.8 in the model becomes 0.5 (then subsequently modified by the RAN downlift) for the 3G total traffic and the 3G radio interface drivers. These then also change the all radio traffic and all traffic drivers.[54]

The impact of all of these changes, individually and collectively is shown in the table below[55].

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Data down shift to 4	4.690	5.424	4.933	5.690	5.645	6.579
Switch site driver revised	4.650	5.450	4.890	5.716	5.513	6.608
2G NMS driver revised	4.614	5.425	4.854	5.691	5.468	6.579
3G radio driver revised	4.732	5.424	4.977	5.690	5.741	6.579
3G total traffic driver revised	4.653	5.424	4.896	5.690	5.536	6.579
Both 3G drivers revised	4.772	5.424	5.020	5.690	5.809	6.579
All changes collectively	4.863	5.452	5.113	5.717	5.973	6.608
Impact vs. base	0.251	0.028	0.260	0.028	0.505	0.028

The practical impact of these changes is to bring up the lower scenario without significantly impacting the upper (which has no data traffic), thus narrowing the range.

[52] This weighting is then adjusted in the radio network by the 3:1 (or 4:1) factor so that the equivalence becomes 1MB = 2.98 voice minutes.

[53] Or 1.89 minutes in the RAN

[54] The 3G total traffic driver is not correct at all: it is probably about right for backhaul but not much else since it takes no account of the relative weighting in the total traffic mix for either the proportion of costs driven by the radio traffic driver or those core elements dimensioned by other drivers but as it is at present only used for the 3G NMS this is not particularly relevant (unless it is used as the alternative and illogical method for allocating spectrum costs).

[55] As an aside, it appears that the model substantially underestimates the capacity of a 3G SGSN so that it builds 100 SGSNs for every GGSN – eliminating this error has a very small impact on voice termination (through the admin markup) but increases the model's fidelity.

Cost trends

Whilst Vodafone recognises that Ofcom has made some improvement to the cost trends in the model against the previous version, we believe that some modification is still required:

At present the capex cost trends for two shared assets, HLRs and transits, stop at 2009/10. Vodafone suggests that in line with other shared assets, their cost trends be extended to 2020/21.

2G asset cost trends now stop at 2010/11, despite it being an integral part of the network assumptions that 2G coverage continues in perpetuity. Vodafone believes that the cost trends for these assets should continue to 2020/21, but at a reduced rate to indicate reduced global demand for 2G equipment. Vodafone suggests using 50% of the rate applied in 2008/09.

The capital cost trend for macro cell sites uniquely continues rising at 1% beyond 2020/21. Vodafone suggests that Ofcom consider capping it off at 2020/21 as demand for new builds falls away: this makes virtually no difference to the termination result, but it helps restrict the GBV output by the model in 2039/40.

Currently, the operating cost trend for all property assets[56] rises at 5% per annum through to 2039/40. This produces a very high operating cost total in 2039/40, as can be seen on spreadsheet 5 – HCACCA.xls. Vodafone believes it would be acceptable to halve the 5% rate beyond 2010/11, and stop it entirely at 2020/21 as the network build approaches saturation: again this makes an imperceptible difference to the 2010/11 termination result, but it does significantly restrain modelled operating cost growth beyond that point.

The table below shows the collective impact of these changes to capital and operating cost trends.

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
VF revised trends	4.669	5.480	4.941	5.777	5.503	6.622
Impact vs. base	0.056	0.056	0.088	0.087	0.035	0.042

Economic depreciation

In the course of the review of this and the previous version of the model Vodafone has become increasingly aware of flaws in the operation of the present economic depreciation methodology (described as "original ED" in the model) and has come to prefer the revised ("simplified") method.

Some of the issues encountered are:

[56] Macro cell sites, micro cell sites, pico cell sites, and main and remote switching sites

Generally the original ED method does not recover costs incurred fully in the period to 2039/40. This is not always immediately apparent as the "check cost recovery" sheet is missing from this version of the model, but this is easily restored from the previous version. On most scenarios Vodafone has run, the simplified method either recovers the costs exactly (i.e. the PV of costs recovered is identical to the PV of costs incurred) or is at least much closer to this balance point than the original method.

The previous version of the original method did not cope at all well with the 2G shut down, since it relied on the existence of traffic volumes in the last year of the model to feed the terminal value. This has been addressed in this version of the model by taking the last year of active usage to become the terminal value, but this is in many ways a 'fudge' rather than a reasoned correction. The original method works well when faced with a high closing volume, i.e. an assumption of rising traffic volumes towards a peak which is then sustained infinitely, but is less clever in its cost spreading algorithms when faced with falling or vanishing demand. Vodafone suggests that the principle of eventual closure of a service is more logical than its infinite life, and the choice of economic depreciation method should reflect this. The simplified method has no problems in this regard, and no need of a terminal value.

The original method does not perform well when faced with a single asset with operating costs that vary over time. This can be seen in 2G spectrum fees and was also noticeable during Vodafone's experiments with the recovery of administrative costs through economic depreciation, in that in the early years a somewhat eccentric negative recovery is experienced: this forces a higher than otherwise necessary recovery in subsequent years[57]. It would probably be possible to devise an ad hoc fix for this problem, but only by introducing a tailored variant to the algorithm. No such problem occurs with the simplified method, which seems to recover the 2G spectrum fees in a reasonable manner.

Vodafone extended the cost recovery check sheet to compare the PV of costs incurred against the PV of costs recovered on an individual asset basis. Generally individual assets under the original method either over recover or under recover in the period to 2039/40 to a relatively small extent. This seems to relate to how the terminal value of costs relates to the terminal value of recovery for each asset[58]. The 3G spectrum asset element, however, consistently under-recovers its costs in the period to 2039/40. The original method seems to rely in effect on a continuing infinite outflow of costs and a similar infinite recovery: for most assets, which have annual operating costs and regular capital replacement, this applies, and the two terminal values of cost and recovery more or less balance out. However the 3G spectrum involves one single upfront payment and thus has no terminal value of cost incurred, but requires under the original method an infinite recovery period. If one assumes that 3G services do not have an infinite life, but terminate in 2040, at this point a significant proportion of the 3G spectrum cost would still remain unrecovered. Looking at the PV of cost recovery against cost incurred over the period to 2039/40, the PV of the former is only

[57] The peculiarity of the results for the 2G spectrum fees can be seen on sheet E32 of spreadsheet 4 – Economic.xls

[58] Defined by the relationship between capital and operating costs and traffic volumes in the last year

95-96% of the latter[59]. Arguably therefore the recovery in every year to 2039/40 should be increased by 5% to compensate. Given that the contribution of the 3G licence to termination is 1.0p – 1.5p[60] for the 2G/3G operator, this suggests that there should be an adjustment to the result, of approximately 0.075p in 2010/11. No such problem exists with the simplified method, which recovers the 3G licence fee cost in full over the period to 2039/40.

The original method also seems very sensitive to fluctuations in the cost of capital. Vodafone has previously drawn Ofcom's attention to the very steep cost step, particularly for 3G, that occurs at 1st April 2006[61], the point at which the cost of capital drops by 0.7%[62]. The 3G cost of termination more than halves at this point, whereas under the simplified method the step although visible is small, and commensurate with the size of the cost of capital change. Vodafone has also experimented with scenarios where the cost of capital temporarily fluctuates in the future.[63] The original method tends to exaggerate the effect of short-term fluctuations, whilst the simplified method seems to damp the impact down, creating a much smoother profile. One continual complaint from Vodafone is that Ofcom has been unable to resist "tweaking" the forward-looking cost of capital[64] – it really should adopt a cost recovery methodology that is reasonably insulated from such adjustments.

A wider point is that the frequent changes to the cost of capital made by Oftel, the Competition Commission and Ofcom suggest both that there is considerable uncertainty on the correct value to adopt and that the cost of capital is a variable not a constant. It follows therefore that the adoption by Ofcom of 11.3% as the value to adopt as a future constant is just a view, and one that is unlikely to be precisely replicated in reality. It would be sensible therefore to adopt a costing methodology, such as the simplified method, that limits rather than exacerbates the impact of forecast error.

There is no obvious reason why the more complex original method produces a logically more correct answer. There do not seem to be any theoretical underpinnings that suggest that this method is preferable to all others. Indeed, there are theoretical reasons why the simplified method is the correct approach. Basing the time profile of depreciation per unit of output on input price trends mimics the prices that would be faced by a hypothetical new entrant in each year, relative to all other years. It therefore achieves the correct time-profile, and is consistent with Einstein's dictum: "make everything as simple as possible, but no simpler".

[59] Only 70% of the licence cost is in fact recovered by 2020/21
[60] Obtained from running the lower and upper bound 2G/3G scenarios, as is, and with no licence contribution
[61] Vodafone – comments on Ofcom 17th March 2006 LRIC model, pages 28-29
[62] This represents in proportionate terms a reduction of 6% on the previous value
[63] By falling from 11.3% to 11% for 2008/09-20010/11 and then reverting to 11.3% thereafter, and by a similar temporary rise to 12%
[64] Oftel Sep 01 12.5%, Competition Commission Dec 02 11.25%, Oftel May 03 12%, Oftel Dec 03 12.25%, Ofcom Jun 04 12%, Ofcom Jun 05 11%, Ofcom Sep 06 11.3%.

The simplified method is easier to understand, being only approximately half a dozen calculations per asset type/year, whereas the original method is a little obscure, harder to follow, and much less intuitive. The new method also requires significantly less spreadsheet resources in terms of space and recalculation time than the original method.

Vodafone's conclusion therefore is that the simplified economic depreciation method should be used. The impact of switching to this method is shown in the table below.

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Alternative ED	4.767	5.592	5.100	5.952	5.447	6.561
Impact vs. base	0.155	0.168	0.248	0.263	-0.021	-0.018

Traffic

Vodafone has deliberately not incorporated in this document any modification to Ofcom's customer usage forecasts and the assumptions that underlie them. Estimating traffic volumes of current and future services in 2020/21 is inevitably a very subjective and uncertain exercise: it may be that Ofcom's preferred medium solution overstates the median outcome particularly for VT and data services, but this is not certain. Vodafone continues to believe that Ofcom's high volume scenario is implausible, particularly for data usage on 3G.

Vodafone however thinks that Ofcom's detailed modelling is incorrect in the proportion of on-net traffic assumed. Vodafone's conclusion is that the proportion is overstated by Ofcom for a mature mobile market with five equally sized operators, where the volume of inter-network traffic can be expected to grow at a faster rate than intra-network traffic.[65] [66] The impact of reducing the on-net proportion to 26% from Ofcom's 28.7% is as follows:

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Reduce onnet %	4.653	5.491	4.895	5.759	5.525	6.669
Impact vs. base	0.041	0.067	0.042	0.069	0.057	0.090

[65] Vodafone – comments on Ofcom 17th March 2006 LRIC model, pages 74-75

[66] Vodafone notes that Ofcom has in the current version considerably increased the inbound/outbound traffic ratio: given the expectation of falling volumes of traffic originating and terminating on the fixed networks in the future, this change only makes sense in the context of a falling rather than a static onnet proportion.

Summary

Running a set of scenarios that cumulate the changes discussed above gives the following results (assuming an admin cost for the 3G only operator in 2010/11 that is 90% of the 2G/3G cost):

Outputs in 2010/11 in p	2G3G 900		2G3G 1800		3G only	
	Lower	Upper	Lower	Upper	Lower	Upper
Ofcom base position	4.612	5.424	4.852	5.690	5.468	6.579
Admin impact	4.679	5.505	4.919	5.771	5.545	6.679
Market share 2012	4.746	5.593	4.992	5.863	5.124	6.143
2G asymmetry	4.795	5.645	4.856	5.714	5.124	6.143
2G3G asymmetries	4.976	5.825	5.034	5.892	5.124	6.143
Cost drivers	5.241	5.853	5.301	5.920	5.590	6.170
Cost trends	5.299	5.914	5.379	6.001	5.601	6.186
Simplified ED	5.468	6.102	5.585	6.227	5.587	6.172
Reduce onnet %	5.519	6.174	5.638	6.301	5.656	6.261
Mid-points	5.846		5.970		5.959	

It can be seen that the mid-points of the ranges for the final scenarios for the three operator types are virtually identical, at 5.9 - 6.0 ppm.

Vodafone has compared the outputs from its final scenarios to MNO averages for GBV, operating cost and network quantities, as follows:[67]

2G/3G GBV £m	2001	2002	2003	2004
MNO Average	2,710	3,092	3,311	3,629
Ofcom model ouput	2,726	2,921	3,198	3,605
Vodafone average model output	2,646	2,806	2,999	3,354

2G/3G operating costs £m	2001	2002	2003	2004
MNO Average	338	327	338	340
Ofcom model ouput	309	339	361	376
Vodafone average model output	312	339	356	368

Network quantities	2G Macrocells	3G Node Bs	2G TRXs
MNO Average	7,770	3,330	67,350
Ofcom model ouput	8,132	3,439	63,958
Vodafone average model output	7,639	3,439	61,197

This demonstrates that Vodafone's suggested modifications do not give rise to increases in network quantities and costs above the actual operator experience – rather that the Vodafone average model outputs are generally below both the Ofcom model outputs and the MNO averages, in cost and network quantity. This suggests that there is further scope for improving the fidelity of the model by adjusting some of the calibration levers listed by Ofcom in A12.13, for example utilisation and capital unit costs. Vodafone has not attempted to carry out this exercise, but is confident that it would result in a further increase in the modelled cost of termination for 2G/3G operators.

[67] Results given as Vodafone average model output are the averages of the 4 2G/3G scenarios, i.e. lower and upper bound 900MHz and lower and upper bound 1800MHz scenarios.

[Confidential]

Annex 4:

Application of the Weights Adjustment Factor

1. Vodafone has looked carefully at Annex I of the December 2003 publication. We still recommend a removal of the WAF from the calculation of the TAC.

2. Vodafone's analysis is based on a re-characterisation of the illustrative example in Table 1 (see appendix). Importantly, Vodafone (like Ofcom) assumes that average cost is unchanged in years 1 and 2 but also that in year 0 when the TAC was set that it was set equal to the forward looking cost of termination expected in year 1[68] i.e., the cost of termination was expected to be 9.5ppm[69]. We also assume that the costs do not change in Year 1 as a consequence of the changes in the traffic profile. We feel that this is a reasonable assumption because in paragraph I.16 Ofcom states that *"[t]he new TAC method is not based on the assumption that average termination costs change as the traffic mix varies and the Director is not introducing the new methodology to accommodate changes in average costs"* and again in I.20 *"[t]he new method to calculate the TAC does not rely in any way upon the presumption that there are cost changes"*.

3. The table now shows that the MNO in the example, under the old method, makes a supra-normal loss in year 1 of 4ppm. In year 2, the TAC stays at 9.5 and the MNO revises prices to recover the cost of termination (Vodafone, like Ofcom, assumes that the change in inbound traffic profile does not affect the

[68] See paragraph 6.5 of the December document: *"Ofcom is of the view that the most appropriate and economically efficient basis for regulatory charge controls is forward-looking LRIC. The LRIC of voice termination is the additional cost an MNO incurs to provide termination. This can also be seen as the cost that the firm would avoid if it decided not to provide voice termination, taking a long-run perspective. LRIC based charges correspond more closely to the charges that would prevail in an effectively competitive market than accounting-based measures of cost. It is a fundamental goal of price regulation to mimic the effects of a competitive market and this consideration underpins the use of LRIC."*

[69] In similar vein, the June 2004 statement clearly identifies that the TAC in the first year should be set at the absolute value of 5.63p.

cost of termination). Customers with an average traffic profile (10% peak, 90% off-peak) pay, on average, 9.5ppm for termination, which, by assumption, is equal to cost and therefore the MNO makes neither a loss nor a gain on termination.

4. Under the new method the TAC in year 2 is reduced, by the application of the WAF, to 5.5ppm. This perpetuates the supra-normal loss into year 2 since the TAC is set below cost (5.5ppm versus 9.5ppm). This is at odds with Ofcom's desire to prevent *"arbitrary losses to the MNOs from shifts in the traffic mix"* (paragraph I.24). In the Ofcom example, re-basing the TAC to reflect the weights in the AIC only looks reasonable because the underlying cost of termination is assumed equal to the AIC i.e., there is no loss or gain. In other words the example implies that Ofcom assumes, contrary to the text, that the change in traffic profile in year 1 does reduce the cost of termination from 9.5ppm to 5.5ppm.

5. The hypothetical example in the December publication has been used by Ofcom to support the Director's proposal by showing that *"The old method allows the regulated MNO to increase headline prices if peak traffic goes down, even though (by assumption) there is no change in average cost. This results in a substantial unearned gain"*. However, Vodafone's (in our view) more appropriate re-working of the example demonstrates that although the MNO, under the old method, is able to put up prices in year 2 there is no unearned gain in year 2 because the effect is simply that the MNO recovers its costs of termination.

6. It therefore appears that the application of the WAF does not support the objective of forcing MNOs to reduce charges to move them in line with costs (see paragraph I.30) but rather moves charges away from cost. In the example shown, under the second method, the TAC in year 2 is set at around 42% below cost (it is easy to derive another example where the TAC is set above cost – see below).

7. Vodafone believes that there is an alternative way of considering the issue of changes in traffic profile. It is not that under the old method the rates need to rise between years 1 and 2 to a inappropriate level, thereby denying the consumer of termination the benefit to which they are entitled, but that the purchaser of termination received a windfall benefit in year 1 of 4ppm (the reciprocal of the windfall loss suffered by the mobile operator), given that the rates in year 1 were 'wrong', i.e. insufficient to recover the MNO's cost of termination. Under the new method this 'wrong' is perpetuated into year 2. This conflicts with Ofcom's statement in the June 2004 statement that *"the adjustment factor here is intended to ensure that the TAC this year is not distorted by under- or over-shooting last year, i.e. that the target is calculated as if there had been neither under- nor over-shoot."* (paragraph 6.44).

8. Vodafone's view of the underlying objective of regulatory control is that it is to ensure that the TAC equals the Average Revenue in a given year, where AR = current year time of day rates weighted by current year time of day traffic proportions. However since AR is only known retrospectively, the measure AIC, using current year time of day rates weighted by previous year time of day traffic proportions was developed. This gives regulatory certainty, but to Vodafone the AIC is thus not an end in itself, but merely the best available surrogate measure for the real measure, AR.

9. To illustrate this point Vodafone has added a third variant of the hypothetical example which assumes that perfect foresight exists. In this world, there is no need for the TAC to be based on last year's traffic mix, since this year's mix is known in advance and hence rates can be set so that AR will equal TAC. Here the rates for year 2 would also have been applied in year 1, since that would have made the average revenue equal the TAC in both years. As a consequence, the rates in year 1 and 2 would also be unchanged. In the absence of perfect foresight it is the rates of year 1 that are 'wrong'.

10. Ofcom's desire to make that TAC weights consistent with the AIC appears to serve no useful end. In the example shown the effect of the WAF is move the

AIC below (or above) cost in year 2 as well as year 1. In our view this can only be justified if the movements in traffic profiles are also associated with changes in cost however this is not assumed in the example given and explicitly excluded as a justification for the WAF in the commentary.

11. Moreover, and perhaps more seriously, the new method introduces a competitive inequality when operators are experiencing differential movements in time of day traffic distribution. Unfortunately, Table 1 only shows the situation for one mobile operator. If we assume there is a second mobile operator, whose traffic profile is (and moves in) the exact reverse of that shown in Table 1. That is, in "Year 0" the traffic distribution is 10%/90% (peak/off-peak), changing to 90%/10% (peak/off-peak) in "Year 1". In order to achieve a "Year 1 TAC" and "Year 1 AIC" of 9.5ppm, this second operator would be able to charge a peak price of 17.27ppm and an off-peak price of 8.64ppm, thus achieving a "Year 1 Average revenue" of 16.41ppm: this would then become the TAC for Year 2. Therefore, whereas the 1st mobile operator has "Year 2 revenue of 5.5ppm", the 2nd operator has "Year 2 revenue" of 16.41ppm although both MNOs have the same underlying cost of termination.

12. **[Confidential]**

13. Vodafone suggests therefore that in the context of the roll-over year, the WAF be set aside, and the rate for 2006/07 be set with reference to absolute levels, i.e. 5.63ppm and 6.31ppm.

WAF may be calculated on the wrong base

14. If Ofcom maintains the WAF then Vodafone believes that base of traffic on which the WAF is calculated is incorrect. There are two possible interpretations of WAF:

    a. Either the WAF is meant to reflect the change in costs that might arise from changes in the traffic mix. In this case the WAF should be measured not on the mix change of the direct traffic, but on the year on

year traffic mix change on the traffic that is actually carried on the network, i.e., the total of direct traffic plus ported in traffic.

b. Alternatively if the WAF is designed to keep charges constant then it should be based on the year on year traffic mix change on the direct plus ported out traffic i.e. the total of traffic charged at Vodafone termination rates**.**

15. At present Vodafone has calculated the WAF, perhaps erroneously, on direct traffic only. However since ported traffic and direct traffic have a significantly different time of day mix, the use of direct alone seems to satisfy neither principle.[70]

16. **[Confidential]**

17. **[Confidential]**

18. Vodafone considers that the use of direct traffic time of day mix changes to calculate the WAF is not correct and unfairly penalising, **[Confidential]**. Whether it is more appropriate to use direct + ported in, or direct + ported out, Vodafone is unable to say at this stage, since Vodafone is not clear on what grounds Ofcom is arguing for the retention of Oftel's WAF.

Vodafone UK

3r[d] October 2005

[70] Vodafone has no disagreement with the principle that it is only direct traffic that should be regulated – Vodafone's point is that the WAF should be calculated on a base that includes ported traffic of one form or another.

Appendix

Ofcom Table 1 - December 2003

	Old Method			New Method		Perfect Knowledge	
	Year 0	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
TAC per Ofcom		9.50	9.50	9.50	5.50	9.50	9.50
Time of day rates							
Peak		10.00	17.27	10.00	10.00	17.27	17.27
Off-peak		5.00	8.64	5.00	5.00	8.64	8.64
AIC - using weights		9.50	9.50	9.50	5.50	not needed	
Weights - prior year volumes							
Peak		90%	10%	90%	10%	not needed	
Off-peak		10%	90%	10%	90%	not needed	
Current year volumes							
Peak	90%	10%	10%	10%	10%	10%	10%
Off-peak	10%	90%	90%	90%	90%	90%	90%
Average revenue		5.50	9.50	5.50	5.50	9.50	9.50
Per Oftel interpretation							
Average cost ????		5.50	5.50	5.50	5.50		
Unearned gain???		0.00	4.00	0.00	0.00		
Per Vodafone interpretation							
Average cost = TAC		9.50	9.50	9.50	9.50	9.50	9.50
Undeserved loss		-4.00	0.00	-4.00	-4.00	0.00	0.00