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# **Three comments on other operator responses on modelling issues in Ofcom's Wholesale mobile voice call termination Market Review Consultation.**

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**Non-confidential**

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**Three.co.uk**

# Other operators do not raise any serious challenges to Ofcom's model.

- 1 This paper provides Three's<sup>1</sup> views on the cost modelling issues raised in the June 2010 responses from Vodafone, Everything Everywhere (EE), O2 and Virgin Media (VM) to Ofcom's April 2010 consultation.
- 2 With respect to the estimate of LRIC, Three accepts that some of the detailed assumptions in Ofcom's model are capable of further refinement. However, Three does not believe that any of the points raised by other operators give cause to doubt the inherent ability of the model to generate a reasonably reliable estimate of the appropriate termination rate. In particular:
  - a) Three does not agree with Vodafone's claims that the pure LRIC output from Ofcom's model is inherently unreliable. The aggregated cost driver approach has been an essential and undisputed feature of previous generations of Ofcom's LRIC+ model, and it is this approach which allows the model to estimate pure LRIC reliably. Any issues with the model's detailed assumptions are as relevant to the estimate of LRIC+ as they are to the estimate of LRIC. There is simply no LRIC-specific problem with the model, as Vodafone claims. Accordingly, there is no need for any adjustment to correct a non-existent problem, let alone the microcell/picocell adjustment advocated by Vodafone, which is entirely speculative and unsupported.
  - b) Three does not agree with EE's claim that Ofcom overstates network common costs, and thus understates LRIC. Ofcom makes no explicit assumption about the level of common costs, as suggested by EE, and to the degree that Ofcom's model implies anything about the level of common costs, that is attributable to the detailed assumptions within the model, which are available for challenge should EE have any relevant evidence.
  - c) Three does not agree with EE's claim that the modelling of pure LRIC ignores the coverage implications of losing termination traffic. EE's argument appears to be based on a misunderstanding of the meaning of LRIC.
  - d) Three does not agree with VM's claim that the pure LRIC estimate ignores spectrum. The opportunity cost of marginal spectrum has been reflected in terms of avoided network costs, exactly as suggested by VM.

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<sup>1</sup> Hutchison 3G UK Ltd.

- 3 As to the detailed assumptions within Ofcom's model:
- a) Three does not agree with O2's claim that the 25% market share assumption is inconsistent with the EC Recommendation, since that clearly envisages market shares other than 20%. In any event, Three notes that this assumption has very little effect on the level of LRIC.
  - b) Three does not agree with VM's claim that the model has overstated recent migration from 2G to 3G. In fact, close examination of the model suggests that recent migration has been understated.
  - c) Three does not agree with EE's claim that pure LRIC has been understated due to overstated traffic forecasts. Three expects levels of voice traffic to increase significantly under LRIC-based MTRs, and in any event observes that the level of pure LRIC is not sensitive to the assumed level of traffic.
  - d) Three acknowledges the observation, made by both O2 and VM, that the model may have been understating the number of macrocell sites in recent years, but believes that much if not most of this is attributable to the fact that assumed values for 3G cell radii are too high, as highlighted by Three in our June 2010 submission.
  - e) While there may be some merit in Vodafone's suggestion that some of the unit cost assumptions in the model need refinement, it is far from clear that the high level adjustments it advocates are appropriate, or that a more accurate set of refinements would have the effect estimated by Vodafone.
  - f) Three acknowledges that there may be further work to be done in calibrating the model against operator data, but does not agree with VM's suggestion that this will clearly raise the estimate of LRIC.
  - g) Three does not agree with Vodafone's suggestion that a higher WACC should be used for pure LRIC than for LRIC+.
  - h) Although Three has some sympathy with EE's querying of a step change in the WACC, it does not seem that a smoother transition would have any material effect on LRIC.
  - i) Three acknowledges that changes in WACC can have a complex effect on the level of LRIC, but does not agree with O2's suggestion that this shows any inherent anomaly in Ofcom's model.
  - j) Three does not agree with O2's suggestion that the presence of negative costs for a subset of backhaul network elements suggests a problem with the pure LRIC estimate. O2 does not seem to have appreciated that this can be a natural and reasonable consequence of the model's approach to modelling backhaul.

- k)** Three does not agree with EE's claims that pure LRIC should include a contribution to HLR and non-network administration costs. Neither of these costs would be materially affected by the cessation of third party termination.
- 4 Three does agree with two of the issues raised by Vodafone, regarding the modelling of Ethernet backhaul<sup>2</sup>, where the model would appear to contain some simple formula errors, and the impact of ringing time, where some uplift over a realistic estimate of call duration is warranted. In our June 2010 response, Three identified a number of issues with Ofcom's model, and suggested that after correction a more realistic estimate of pure LRIC would be 0.25p<sup>3</sup>. Three has re-run Ofcom's model, making additional corrections for the Ethernet Backhaul and ringing time issues, and finds that this generates a marginally larger pure LRIC of 0.26p.
- 5 With respect to the estimate of LRIC+, if Ofcom confirms its proposal to comply with the EC Recommendation and base termination rates on LRIC, a move Three strongly supports, Three questions whether it is useful or proportionate for Ofcom to expend any further significant effort refining its estimate of LRIC+.
- 6 However, for the record, Three does not agree with the objection raised by both Vodafone and EE, that the common cost allocation assumed in the LRIC+ estimate is inappropriate because it results in an unrealistic structure of prices. In Three's view, whatever common cost allocation is assumed, LRIC+ prices will always be unrealistic because they assume a linear pricing structure which is neither efficient nor observed in the real world. If realism is a relevant criterion for setting MTRs, the evidence suggests that they should not be based on LRIC+ at all.

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<sup>2</sup> An issue unconnected with the negative costs identified by O2

<sup>3</sup> Paragraph 234

# Most of Vodafone's alleged pure LRIC modelling errors are unfounded or immaterial.

- 7 The table below summarises the impact of Vodafone's claimed modelling errors. Over 80% of the claimed increase in pure LRIC from 0.51p to 1.05p, and 65% of the claimed increase in LRIC+ from 1.54p to 3.32p, is accounted for by 6 of the 25 alleged errors, highlighted below<sup>4</sup>.

	Share of impact	LRIC Impact	Revised	Share of impact	LRIC+ Impact	Revised
Ofcom 2010			0.5077			1.5428
Ethernet backhaul	10%	0.0558	0.5635	1%	0.0159	1.5587
Shared site numbers	–	–	0.5635	(0%)	(0.0009)	1.5578
Network handset costs	–	–	0.5635	1%	0.0202	1.5780
Switch sites	4%	0.0240	0.5875	0%	0.0004	1.5784
HSPA costs	(0%)	(0.0001)	0.5874	8%	0.1437	1.7221
2G/3G weighting	2%	0.0093	0.5967	4%	0.0639	1.7860
Ringling time on voice	11%	0.0602	0.6569	5%	0.0952	1.8812
Historic data card market share	2%	0.0092	0.6661	1%	0.0240	1.9052
HSPA downlift	4%	0.0227	0.6888	2%	0.0270	1.9322
Future datacard market	(2%)	(0.0124)	0.6764	5%	0.0951	2.0273
Inter-operator site sharing	1%	0.0034	0.6798	1%	0.0096	2.0369
Site sharing unit capex	1%	0.0059	0.6857	1%	0.0211	2.0580
2G cell radii and utilisation	5%	0.0247	0.7104	(0%)	(0.0005)	2.0575
2G TRX numbers	(1%)	(0.0077)	0.7027	1%	0.0114	2.0689
3G coverage	(0%)	(0.0019)	0.7008	0%	0.0084	2.0773
3G cell radii	(1%)	(0.0063)	0.6945	2%	0.0313	2.1086
3G cell utilisation	2%	0.0110	0.7055	0%	0.0044	2.1130
Data busy hour	(1%)	(0.0033)	0.7022	2%	0.0361	2.1491
Voicemail	4%	0.0217	0.7239	2%	0.0350	2.1841
Erlangs rather than voice bits	0%	0.0005	0.7244	5%	0.0875	2.2716
Unit cost adjustments	17%	0.0906	0.8150	12%	0.2206	2.4922
Common cost allocation	–	–	0.8150	27%	0.4832	2.9754
Micro/pico site build increment	33%	0.1793	0.9943	–	–	2.9754
9.4% / 11% WACC	11%	0.0574	1.0517	19%	0.3463	3.3217
<b>Total impact</b>	<b>100%</b>	<b>0.5440</b>	<b>1.0517</b>	<b>100%</b>	<b>1.7789</b>	<b>3.3217</b>
Estimated impact						
– highlighted items	81%	0.4433		65%	1.1612	
– other items	19%	0.1007		35%	0.6177	

- 8 Each of the highlighted alleged errors is considered below.

<sup>4</sup> This is approximate as the precise impact of any particular change is partially dependent upon assumed preceding changes.

**The model should correct the Ethernet backhaul cost calculation.**

- 9 Vodafone has correctly identified<sup>5</sup> that the model fails to aggregate Ethernet costs properly: the network design module estimates a long-run total of 8,156 Ethernet links, whereas the Economic Depreciation module recovers the cost of just 1,018 Ethernet links.
- 10 The source of the error would appear to be a simple omission in the asset numbering inputs in the cost module of the model<sup>6</sup>. Re-running Ofcom's model having corrected for this error confirms Vodafone's estimate that this causes the pure LRIC calculated by Ofcom to rise by 0.056p and the LRIC+ calculated by Ofcom to rise by 0.016p<sup>7</sup>.

**The model should adjust for ringing time on voice.**

- 11 Vodafone states:  
"although voice traffic is billed in minutes, it is dimensioned in erlangs, yet a simple conversion from one to the other leads to an underestimate of actual measured erlangs. The problem appears to be that the simple conversion ignores unbilled circuit occupancy including call set up time. Using a "ringing time" uplift of 8 seconds per call to all voice calls will compensate for this error"<sup>8</sup>.

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5 Pages 44 to 45, Annex

6 Specifically, the cost module has missing values of 1 to 10 at cells B353:B362 of the "Linked Inputs" tab, and cells B353:B362, B819:B828, B1180:B1189, B1541:B1550, B2008:B2017, B2367:B2376, B2726:B2735, B3085:B3094, B3447:B3456, B3914:B3923 of the "Asset demand for costs" tab. A corresponding correction is also required in the second table of the "Total investment" tab, although this does not appear to affect the model output. In addition, the network module has a missing value of 3 at cell B148 of the "Asset demand for costs" tab; however this appears to affect only row labelling in that tab and not the model output.

7 The impact of this adjustment depends on other assumptions. Three finds that this impact is much smaller when applied to the refined assumptions suggested in our June 2010 response.

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**Unit cost refinements will not make a material difference.**

- 13 Vodafone states that Ofcom's model calibrates poorly against typical operator network costs, understating the Gross Book Value (GBV) of network costs by around 15%. It makes a set of adjustments to the assumed unit cost of network equipment in order to reduce this difference<sup>9</sup>.
- 14 The first set of adjustments relates to the historical path of unit costs for radio network equipment. Ofcom's model assumes significant falls in the unit costs of 2G and 3G cell site equipment, and in the cost of BSCs and RNCs, over the 3 years from 2005/06 and 2008/09:

Unit capex cost (£000, 2008/09 prices) <sup>10</sup>	2005/06	2008/09	Reduction
2G 3 sector macrocell equipment	95.5	26.2	73%
3G 3 sector single carrier macrocell equipment	98.7	27.1	73%
2G BSC (base unit excl ports)	694.0	238.0	66%
3G RNC (base unit excl ports)	1,793.7	615.2	66%

- 15 Vodafone doubts the scale of these falls is justified and suggests that too steep a fall in prices contributes to the fact in the top down calibration exercise against operator data, Ofcom's model understates the GBV of network assets. Vodafone reduces the fall in prices to around 50% for cell sites and around 15% for BSCs and RNCs.
- 16 The second set of adjustments is based on a 7.5% uplift to the assumed unit capital cost of all network assets, which Vodafone claims reduces the GBV understatement to around 5%.
- 17 Vodafone may be right in suggesting that some unit costs need revisiting. However, only Ofcom has access to the detailed cross-operator data necessary to make accurate adjustments. It is far from clear that the high level adjustments Vodafone has made are appropriate, or that a more accurate set of adjustments would have the scale of effect on pure LRIC and LRIC+ estimated by Vodafone. For example:

a)



<sup>9</sup> Pages 87 to 93, Annex  
<sup>10</sup> Rows 235 to 336, "Unit investment" tab, Cost module

- b) Three has already identified, through its work on the Donor Conveyance Charge<sup>11</sup>, that the historical cost of at least one network component, MSCs, is understated due to a failure to update the historical unit cost profile to match the latest capacity assumption: correcting for this serves to narrow the GBV understatement without affecting current and future unit costs, in direct contrast to Vodafone's approach.

**It is not surprising that LRIC+ predicts unrealistic prices.**

- 18 Vodafone objects that the model generates LRIC+ outputs which suggest an unrealistic structure of prices due to the assumed allocation of common costs. In Three's view, whatever common cost allocation is assumed, LRIC+ prices will always be unrealistic because they assume a linear pricing structure which is neither efficient nor observed in the real world. If realism is a relevant criterion for setting MTRs, the evidence suggests that they should not be based on LRIC+ at all.
- 19 Vodafone's specific objection is that prices based on the LRIC+ outputs would recover an unrealistically high share of common costs from data services:
- "the model does not reflect what happens in practice and, in particular, is not allocating fixed and common costs between voice and data correctly"<sup>12</sup>
- "This charging structure suggested by the model just looks wrong in comparison with the structure of prices in the real world"<sup>13</sup>.
- 20 Vodafone concludes from this that the LRIC+ outputs should be adjusted so that data services should be recovered on a pure LRIC basis, and that common costs should be allocated evenly to all other services, including voice termination, on a LRIC+ basis.
- 21 Vodafone, and the other mobile operators who advance similar arguments, are correct to query any model which predicts an unrealistic structure of prices. However, they are unreasonably selective in identifying the features of the LRIC+ model which lead to an unrealistic structure of prices. A more complete consideration of the issues leads to a very different conclusion on the appropriate charge for voice call termination.

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11 28.07.10 email to Paul Jacobus

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13 Page 37, Annex

- 22 The LRIC+ model generates a set of unit prices for each identified service, which collectively recover all common costs on a broadly Equi-Proportional Mark-Up (EPMU) basis.
- 23 One feature of this structure of prices is the use of EPMU for common cost recovery. There may be some merit in the suggestion that this is out of step with the voice v data price relationship currently observed in the retail market. However it may be that it is this observed relationship, rather than an EPMU approach, that is unrealistic and in the longer term unsustainable. There is clear and increasing pressure for voice prices to fall relative to data prices<sup>14</sup>. Among other things, technologies such as VoIP and Skype which arbitrage inconsistencies between voice and data pricing are applying increasing pressure for voice prices to fall.
- 24 In any case, a more fundamental feature of the structure of prices generated by the LRIC+ model is the assumption of linear pricing for every service: that within a given period common costs are recovered by setting all prices at a constant per unit level, regardless of the level of usage per subscriber, with no fixed or quasi-fixed charges.
- 25 This linear pricing structure bears no relationship whatsoever to the pricing structures we actually see in the retail market. Taking Orange's tariffs<sup>15</sup> as an example:
- a) The £15 Canary 24 month contract offers 100 minutes, an average price of 15p per minute. For an additional £5, the £20 contract offers an additional 100 minutes, an average price of 5p per minute. For an additional £10, the £30 contract offers an additional 400 minutes, an average price of 2.5p per minute. For an additional £5, the £35 contract offers an additional 300 minutes, an average price of 1.7p per minute.
  - b) The £15 Canary 1 month SIM-only plan offers 200 minutes, an average price of 7.5p per minute. For an additional £5, the £20 plan offers an additional 400 minutes, an average price of 1.25p per minute.
  - c) The standard voice call price under the Canary pre-pay tariff is 20p per minute. This applies to spend of less than £10 a month (i.e. 50 minutes), but after that point top-up rewards reduce average call prices significantly. For example, a £10 monthly top up is rewarded with 100 free off-peak minutes, so that the £10 incremental spend from £10 to £20 buys a total of 150 minutes, an average price of 6.7p per minute.

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<sup>14</sup> See for example, Heavy users of mobile data face higher fees, Financial Times, 28.07.10

<sup>15</sup> As at 29.07.10

- d)** The £10 Racoon 1 month mobile broadband plan offers 1GB, an average price of £10 per GB. For an additional £5, the £15 Dolphin plan offers an additional 2GB, an average price of £5 per GB. For an additional £10, the £25 Panther plan offers an additional 8GB, an average price of £1.25 per GB.

26 Other operators' tariffs show similar patterns. For example<sup>16</sup>:

- a)** Vodafone's £15 18 month contract offers 100 minutes, an average price of 15p per minute. For an additional £5, the £20 contract offers an additional 200 minutes, an average price of 2.5p per minute. For an additional £5, the £25 contract offers an additional 300 minutes, an average price of 1.7p per minute.
- b)** T-Mobile's £10 1 month SIM-only plan offers 100 off-net minutes, an average price of 10p per minute, plus through its "Flexible Booster" plan, the option of unlimited on-net minutes, an average price of essentially zero<sup>17</sup>. For an additional £10, the £20 plan offers an additional 500 off-net minutes, an average price of 2p per minute.
- c)** Vodafone's standard voice call price under its pre-pay plan is 20p per minute, which applies to up to £10 of spend (i.e. 50 minutes). However with a "Freedom Pack", a £10 top up is rewarded with an additional 100 free minutes (with a limited life of 30 days), so that the £10 incremental spend buys a total of 150 minutes, an average price of 6.7p per minute.
- d)** O2's £10 18 month mobile broadband contract offers 1GB, an average price of £10 per GB. For an additional £5, the £15 contract offers an additional 2GB, an average price of £2.50 per GB.

27 So linear only pricing is simply not observed in the retail market. Fixed or quasi-fixed charges (where unit prices for early tranches of usage are much higher than unit prices for later tranches) and non-linear prices are widespread, even in the pre-pay voice sector. For good reason: linear pricing is inherently inefficient in an industry such as mobile, where fixed costs are high and marginal costs are low.

28 If therefore we are to follow Vodafone's principle of testing the validity of modelled charges by reference to whether they lead to a realistic price structure, we should conclude not only that there may be merit in some re-allocation of common costs between voice and data under LRIC+; we should also conclude that in general, charges should not be set under the assumption of linear pricing. However, since that assumption

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<sup>16</sup> As at 29.07.10

<sup>17</sup> A clear example of the persistence of on-net/off-net price differentials.

is a defining characteristic of LRIC+, but not of LRIC, that leads us to a conclusion that charges generally, and voice termination charges in particular, should not be based on LRIC+.

- 29 This conclusion renders arguments about how common costs should be allocated within a LRIC+ model entirely academic. More broadly, it demonstrates why pure LRIC is clearly a more efficient and more realistic basis for setting MTRs than LRIC+, because it does not force a set of prices into an inefficient and unrealistic linear pricing structure, which is clearly inconsistent with both theoretical and market evidence of efficient pricing structures.
- 30 Furthermore, the lack of linear pricing in the retail market invalidates the use of Ramsey pricing arguments in favour of LRIC+ over pure LRIC, because such arguments are based on a standard Ramsey model under which operators are constrained to charging linear prices only. Once the reality of non-linear pricing and the widespread existence of fixed and quasi-fixed charges are recognized, the conclusions of a standard Ramsey model no longer apply. This was clearly acknowledged by Ofcom in its 2007 MCT decision<sup>18</sup>.

**Vodafone's micro/pico site build increment adjustments are flawed and unsupported.**

- 31 Vodafone advances a number of arguments which attempt to show that the pure LRIC output from Ofcom's model is inherently unreliable. None is convincing. For example, Vodafone states:

“No attempt has been made to ascertain whether the model correctly “knows” what is incremental and what is common. Any implicit or explicit division in the model between common and incremental costs is unlikely to be accurate...

the pure LRIC methodology employs a simplistic approach that assumes the same network parameters that build a network that is roughly the same as a real world network would be relevant in a world without voice termination, i.e. where traffic volumes were significantly lower.”<sup>19</sup>

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18 Paragraphs A17.23 To A17.31, Mobile call termination statement, Ofcom, 27 March 2007

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- 32 Vodafone is mistaken. The model does not need to “know” what is incremental and what is common. As explained in Three’s July 2009 submission<sup>20</sup>, since all demand is combined to form aggregated cost drivers, all the model needs to “know” is how network design varies in response to changes in aggregated cost drivers. It is irrelevant whether the change is due to changes in demand from one year to another within the model, as intrinsic to this and previous undisputed generations of the LRIC+ model, or whether the change is due to the exclusion of third party call termination.
- 33 If the model is fit for purpose for LRIC+, then it is also fit for purpose for LRIC. Conversely, if there are features of the network design algorithms in the model that make its estimate of pure LRIC unreliable, these same features will necessarily also make its estimate of LRIC+ unreliable. While refinements to the model are always possible, many of the objections raised by Vodafone<sup>21</sup> are simply a reflection of the fact that this model, like any other, necessarily incorporates modelling simplifications. If any of these simplifications lead to significant inaccuracies, this will affect the LRIC+ outputs as much as the pure LRIC outputs, because both depend on the same simplifications. There is simply no LRIC-specific problem with the model, as Vodafone claims.
- 34 Vodafone’s position may in part be caused by confusion over the way in which pure LRIC costing actually works. It states:
- “It is workbook 4 that holds the results of the incremental exercise; the worksheet entitled “linked inputs” shows (when the pure LRIC macro is run) network volumes and costs that are the product of “inputs with incoming” less “inputs without incoming”. Examination of these net values, that represent the change in network volume and cost as a result of the removal of the termination traffic increment, reveals some strange quirks...
- These anomalies serve to suggest that the model is being asked to produce results for which it has not been fully designed. There can be little confidence therefore on this “full network minus” approach that the model is actually correctly recording the incremental assets and their associated costs that might arise from the alternative approach of a bespoke model building a network without termination and then overlaying termination traffic on top of this, and observing the incremental build that results.”<sup>22</sup>

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20 Pages 62 to 63

21 For example, issues relating to the cell site algorithm at pages 98 to 100 of the Annex

22 Pages 103 to 104, Annex

- 35 Vodafone appears to be suggesting that there is some difference between what it describes as a “network minus” approach, where termination is removed from a full service starting point, and what it describes as a “bespoke” approach, where termination is added to a less than full service starting point. There is no such difference.
- 36 The “network minus” approach identifies pure LRIC as  $(a) - (b)$ , where:  
(a) = the cost of providing all services (the starting point); and  
(b) = the cost of providing all services other than termination.
- 37 The “bespoke” approach identifies pure LRIC as  $(d) - (c)$ , where:  
(c) = the cost of providing all services other than termination (the starting point); and  
(d) = the cost of providing all services.
- 38 However, none of these costs is affected in any way by the order in which it is calculated. So:  
(c) is identical to (b);  
(d) is identical to (a); and  
as a result,  $(d) - (c)$  is identical to  $(a) - (b)$ .
- 39 In other words, both approaches give exactly the same result.
- 40 On the basis of these fallacies and misapprehensions, Vodafone embarks on an entirely speculative estimate of an adjustment to the pure LRIC estimate, based on an assumption that in the absence of third party termination traffic, the proportion of urban and suburban traffic handled by microcells and picocells would be half that currently assumed for a full service network.
- 41 The adjustment is however completely unrelated to any alleged LRIC-specific failings in the model. Vodafone's assumption that the proportion of traffic handled by microcells and picocells would halve in the absence of third party termination traffic is entirely unsupported, but to the degree that an assumption of this nature has any validity at all, it posits a relationship between traffic levels generally and the proportion of traffic handled by microcells and picocells, which has as much validity within the framework of the LRIC+ model as it does within the framework of the pure LRIC model.

- 42 For example, 3G third party termination traffic accounts for less than 10% of Voice Equivalent Busy Hour Mbps in the suburban geotypes in 2014/15. If it were true that the loss of this much traffic would cause the proportion of traffic handled by microcells in these geotypes to halve from 6.5% to 3.25% in 2014/15, then the model should also see this proportion rise in future years as traffic levels are forecast to increase. 3G traffic levels in 2020/21 are forecast to be 66% higher than those in 2014/15, which would suggest the microcell proportion would rise to roughly 25% by that date<sup>23</sup>. Only by holding assumptions of this nature up to rigorous scrutiny through inclusion in a fully integrated model can their credibility be tested. In this case, that test would seem to be in danger of failing.
- 43 In summary, Vodafone's generic objections to the pure LRIC functionality of the model are unjustified and its attempt to adjust the model's pure LRIC estimate via a microcell/picocell adjustment is flawed and unsupported. If any of the network design algorithms within the model warrant refinement, this should be done within the model so that their validity and impact on both pure LRIC and LRIC+ can be fully tested.

### **The model should not use a different WACC for pure LRIC.**

- 44 Vodafone objects to the 7.6% WACC used in Ofcom's model and argues that a WACC of 9.4% should be used for LRIC+, and one of 11.0% should be used for LRIC. The former represents the mid point of Vodafone's estimated range of 7.7% to 11%; the latter represents the top end of that range<sup>24</sup>.
- 45 Three will be commenting separately on other operators' comments on the appropriate WACC. At this stage, Three notes Vodafone's argument for the use of a higher rate for LRIC:

“When a regulated price is set on the basis of “LRIC+ common cost” there is arguably a degree of symmetry in error costs associated with either under-estimation or over-estimation of the WACC. Over-estimation may result in the company making excessive profits, whilst under-estimation (provided the marginal

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23 If 100 units of traffic are carried 93.5% by macrocells and 6.5% by microcells, and the loss of 10 units of termination traffic causes 96.75% of traffic to be carried by macrocells and 3.25% by microcells, this suggests that roughly one third of incremental traffic must be carried by microcells. An increase from 100 units of traffic to 166 units of traffic would therefore see 33 of those additional units of traffic carried by microcells. In total, this would mean that around 40 of 166 units would be carried by microcells.

24 Pages 58 to 60

cost of capacity is still covered) will simply result in a reduction of profits for company to a level below that which will provide a return on the total investment, but which will still incentivise incremental investment where necessary.

If, however, Ofcom pursues a pure LRIC approach, this symmetry of error costs will no longer apply. Under-estimation of the WACC (for example, adopting a short term low beta) will make investment in incremental long run capacity no longer commercially justified. For this reason, under a pure LRIC framework, Ofcom should adopt the figure at the upper end of the range in Table 16, i.e. 11.0%.”<sup>25</sup>

- <sup>46</sup> Three does not agree with Vodafone's logic. There is nothing asymmetric about a regime where investment is rewarded at a central estimate of WACC. Moreover, even if the central estimate turned out to be marginally too low, this would have no discernible effect on investment behaviour, since investment in third party termination capacity is in practice indistinguishable from investment in capacity for other services, so investment decisions are made at an aggregated level, not service by service. Three can see no reason to use a different WACC for pure LRIC than for LRIC+.
- <sup>47</sup> Moreover, of particular interest is Vodafone's admission here that pure LRIC based charges for a service provide sufficient incentive to invest in the incremental capacity for that service. This rather undermines arguments that a move from LRIC+ to pure LRIC will damage future investment. On Vodafone's logic, such a move won't damage future investment in third party termination; and why should users of third party termination services pay for investment in other services?

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<sup>25</sup> Pages 59 to 60

# Everything Everywhere substantially misrepresents how the pure LRIC model works.

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## EE confirms that the “waterbed effect” does not exist.

- 48 Before commenting on EE’s modelling points, Three has two brief observations to make on EE’s contribution to the pure LRIC v LRIC+ debate.
- 49 First, EE argues that profitability is already unsustainably low<sup>26</sup> and that a move to pure LRIC may cause profitability to fall further<sup>27</sup>.
- 50 If true, this does rather call into question the existence of the mythical “waterbed effect” and EE’s claims that a move to pure LRIC will cause an increase in other charges.
- 51 Second, EE argues that a move to pure LRIC will damage the MVNO sector<sup>28</sup>.
- 52 It’s strange to learn then that at least two major MVNOs, Asda and Tesco, support a move to LRIC.

## The step change in WACC does not make a material difference to pure LRIC.

- 53 EE objects that the step change in WACC has some strange effects: “Ofcom’s assumption that the cost of capital for the mobile sector has fallen sharply leads to an exaggerated and highly implausible view that the overall cost of termination has decreased suddenly from the estimated costs incorporated into the current controls. In particular, Ofcom’s economic depreciation approach (which is intended to smooth costs over time) actually has the perverse result under Ofcom’s new assumptions of exacerbating the effect of Ofcom’s assumed reduction in the cost of capital.”<sup>29</sup>
- 54 Details of the objection are in EE’s Annex B, which is not available publicly.

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- 55 Ofcom's model does assume a step change in the WACC, from 11.5% in 2008/09 to 7.6% in 2009/10. However, assuming that 7.6% is an appropriate WACC for 2009/10 onwards, this suggests that the WACC in 2008/09 and preceding years is overstated, and that operators are benefiting from the overstatement in the current price control period. It is not an argument for a higher WACC from 2009/10 onwards.

**The pure LRIC model does not overstate network common costs.**

- 56 EE argues that Ofcom's model overstates network common costs, and thus understates LRIC:  
"Ofcom proposes to implement an approach to pure LRIC which estimates a cost level one third (Ofcom's calculation) of that of Ofcom's LRIC+ approach. In doing so, Ofcom's approach assumes that the cost of providing coverage accounts for the majority of network costs. Ofcom's new unsupported assumption is wholly inconsistent with the detailed analysis of the nature of coverage costs provided previously by Oftel."<sup>30</sup>
- 57 Ofcom's approach makes no assumption about the level of common costs. Three is not aware of any estimate of common costs having been made, either in Ofcom's consultation or in its model. The relationship between pure LRIC and LRIC+ is generated entirely by Ofcom's model, in accordance with the approach set out in the EC Recommendation. If EE wishes to challenge that relationship, it should do so by challenging the specific assumptions contained in Ofcom's model, not by challenging assumptions that have neither been made nor relied on.

**EE's alleged "coverage implications" are unjustified.**

- 58 EE argues that the pure LRIC modelling is simplistic and ignores the coverage implications of losing termination traffic:  
"Ofcom has also modelled pure LRIC in a highly simplified way that fails to consider all the parameters that would change if operators were not to supply termination services. For example, sites in rural and remote areas are heavily reliant on voice revenues and if operators were no longer to receive revenues from terminating calls, a significant number of 2G and 3G sites would cease to be

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profitable. This is a serious issue that requires extensive, detailed modelling. The implication is that Ofcom's proposals would result in reductions of coverage, which is contrary to other work Ofcom is currently undertaking to encourage greater mobile coverage. However, Ofcom has simply assumed that coverage would remain unaffected by whether or not an operator supplies termination. As such, Ofcom has significantly underestimated the pure LRIC cost of termination."<sup>31</sup>

- 59 EE has misunderstood the meaning of LRIC. The pure LRIC of a service is equal to the costs avoided by no longer providing a service, while continuing to provide all other services in their present form. It is not necessary, not appropriate, and often not meaningful to try and predict some sort equilibrium profit maximising state if the residual set of services was provided in isolation.
- 60 For example, any such prediction would be dependent upon the pricing of individual services, which in turn would lead to absurd conclusion that the pure LRIC of a service was dependent on the pricing of that and other services. Therefore the question of what coverage might be in a hypothetical world without termination is irrelevant.

**The pure LRIC model does not wrongly exclude administration costs.**

- 61 EE argues that the pure LRIC estimate wrongly excludes a contribution to non-network administration costs:  
"Ofcom's pure LRIC also excludes a contribution to administration costs despite the efficiency of such a contribution and the Competition Commission determining in its resolution of the appeals against the current mobile call termination Statement that such a contribution is reasonable. Ofcom has presented no new evidence to justify the rejection of the Competition Commission's finding."<sup>32</sup>
- 62 The Competition Commission made no such finding on the treatment of costs under a pure LRIC approach. In fact, the Competition Commission accepted Ofcom's treatment of administration costs as common costs<sup>33</sup>, and on that basis one would not expect to see any administration costs included in LRIC.

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33 Paragraphs 3.77 to 3.87, and 3.93 to 3.94, Competition Commission 2009 determination

**The pure LRIC model does not wrongly exclude HLR costs.**

- 63 EE argues that the pure LRIC estimate wrongly excludes a contribution to HLR costs:  
“Ofcom also excludes termination contributing to HLR costs despite these costs mainly being incurred to support the supply of termination. As the Competition Commission found in 2003:  
“the purpose of HLR updates is to enable an incoming call to reach the intended mobile handset more economically than if the whole network had to be paged each time a call arrived. Therefore incoming calls are also a cost driver. On balance, we concluded that the DGT’s case for excluding the cost from terminating calls was not wholly persuasive: in the absence of call termination there would be no need for location updates. Hence, the fairer approach would be to allocate the cost across terminating calls including on-net calls.”<sup>34</sup>
- 64 However, the Competition Commission made no finding on the treatment of costs under a pure LRIC approach. As with all categories of cost, HLR costs should be included within pure LRIC to the extent that they would be avoided by the cessation of third party call termination. In this regard, Three notes that the Competition Commission finding from 2003 which EE quotes relates to termination generally, i.e. to on-net termination as well as third party termination, and that the sentences immediately preceding the quotation presented by EE confirm that HLR costs are invariant to the volume of termination, and therefore to the cessation of third party termination:  
“We noted that HLR updates take place all the time that a handset is switched on, whether or not any incoming calls are actually received by that handset or any other. In that sense, the cost of the HLR and updating it is not incremental to the volume of incoming calls.”<sup>35</sup>
- 65 Three notes that this is entirely consistent with Ofcom’s model, which predicts no saving in HLR costs as a result of the cessation of third party termination.

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35 Paragraph 2.271, Competition Commission 2003 determination

**The pure LRIC model does not misallocate costs between voice and data.**

- 66 EE argues that Ofcom's LRIC+ calculation allocates too many costs to data: "The allocation of costs between voice and data in Ofcom's cost model is completely inconsistent with the actual cost allocation decisions of operators in the competitive UK market. In particular, Ofcom has underestimated the relative contribution of voice services to incremental network costs, and has also (implicitly) allocated too great a share of common costs to data services. This error is clear from a comparison of retail prices for data in the UK, and the data unit costs that Ofcom's model produces. The modelled unit costs for data are an order of magnitude too high, which means that the modelled unit costs for voice services are too low."<sup>36</sup>
- 67 EE's objection echoes a similar objection by Vodafone, addressed above.

**The pure LRIC model does not unjustifiably overstate traffic forecasts.**

- 68 EE argues that Ofcom has overstated traffic forecasts and so understated costs: "Ofcom has underestimated efficient costs by adopting voice and data traffic forecasts that are highly unlikely to be realised in practice. Ofcom's voice forecasts per subscriber are based on projecting forward an apparent growth rate from a few recent observations rather than taking a longer term average. Further, Ofcom's forecasts do not take into account the not insignificant risk that traditional voice traffic per subscriber may fall in future particularly with the growth in substitutes such as VoIP calls facilitated by rapid take-up of smart phones and improving VoIP applications for such phones."<sup>37</sup>
- 69 Details are in EE's annexes D and E, which are not available.
- 70 Three does not believe this objection is relevant to the calculation of LRIC. First, as Ofcom has shown, the level of pure LRIC is not sensitive to such demand assumptions. Second, as Three indicated in its submission, under pure LRIC voice demand can be expected to increase dramatically.

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- 71 Even under LRIC+, Three would still expect some increase from historical trends, as a result of the significant fall in MTRs.
- 72 Three accepts that VoIP is eventually likely to have a significant impact on the voice market. However, this is likely to take some time, as widespread mobile VoIP is only really viable under LTE, whereas data traffic growth is happening now. Moreover, it is far from obvious that the effect of a major threat from VoIP would be falling voice volumes. This would suggest the operators would maintain high prices for voice calling and stand by while the market arbitrated the difference between voice and data pricing, thus undermining the voice market. It is equally if not more likely that operators would respond to a VoIP threat by cutting the cost of voice calls. This would suggest that the impact of VoIP might actually be a rise in voice volumes.
- 73 EE also suggests:  
“Further it is not clear that Ofcom’s demand volumes are consistent with the available spectral capacity”<sup>38</sup>
- 74 However details of this appear to be in the unavailable annexes.

# O2 wrongly claim that the pure LRIC model is anomalous.

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## The pure LRIC model does generate apparently counter-intuitive impacts of WACC on costs.

- 75 O2 suggests that the model's calculations are anomalous because of a counter-intuitive impact of WACC on costs:
- “A reduction in the WACC leads to an increase in 2G termination rates under pure LRIC but a decrease in under LRIC+. An increase in the WACC has the opposite effect. A reduction in the WACC also leads to a fall in 3G termination rates under pure LRIC but an increase under LRIC+. Ofcom has failed to explain this unexpected outcome....
- The pure LRIC model estimates termination rates to be lower under the higher WACC scenario than under the lower WACC scenario when high voice volumes are also assumed. This anomaly does not occur for the low-volume assumption.”<sup>39</sup>
- 76 Intuitively, one would expect the termination rate to increase with a higher WACC, because with most cost recovery mechanisms, capital costs are recovered after they are incurred. O2 states that it observes this pattern in some cases, but that it observes the reverse pattern in other cases.
- 77 Three has had difficulty reproducing all of the results cited by O2. Nevertheless, O2 is correct to observe that the termination rate sometimes falls with a higher WACC, and sometimes rises with a lower WACC.
- 78 Three does not however agree with O2's implication that the mere existence of the reverse pattern per is evidence of an anomaly in the model. The path of cost recovery generated by Ofcom's Economic Depreciation (ED) approach can sometimes reverse the typical pattern of capital costs being recovered after they are incurred. For example where demand is falling over time, as it is in on 2G networks, ED causes recovery to be shifted back in time to periods of higher utilisation, so that some capital costs are recovered before they are incurred. In addition, because the relationship between termination traffic and its impact on incremental costs is not linear, due to the lumpy nature of investment, this can also cause recovery to occur before expenditure.
- 79 The interactions are complex, but that does not necessarily make the results anomalous, if the ED approach is accepted.

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**The pure LRIC model does generate apparently anomalous “negative opex”.**

- 80 O2 suggests the presence of negative costs in the model is evidence of a problem:  
“the pure LRIC approach also results in the model predicting negative operating costs, for example, for 8Mbits, 16Mbits and 32Mbits microwave-link assets and backhaul base units in particular (random) years. These results are unexplained by Ofcom (unlike site upgrade OPEX). This problem does not occur under the LRIC+ model and highlights further problems with the pure LRIC approach”<sup>40</sup>
- 81 As explained by Ofcom in its consultation document<sup>41</sup>, the model replaces microwave backhaul with Ethernet backhaul above a certain traffic threshold. The increment of third party termination traffic could cause this threshold to be crossed, with the result that pure LRIC would reflect the addition of Ethernet costs, net of the saved microwave costs. Microwave costs could therefore appear negative without indicating any shortcoming in the model.

**Three agrees with O2 that Ofcom has understated the required number of 3G sites.**

- 82 O2 objects that the model’s site count does not calibrate well with reality:  
“As shown in Annex 10 of the consultation, the slope of the number of sites differs substantially from the MNO average, indicating that further calibration is required for the model to be robust.”<sup>42</sup>
- 83 Ofcom’s consultation<sup>43</sup> shows that the model predicts total macrosites of 9,002 in 2005 Q2, rising by 1,532 to 10,534 by 2009 Q3. This compares with 2G/3G MNO average figures of 8,534 in 2005 Q2, rising by 2,332 to 10,866 by 2009 Q3.
- 84 The quarterly figures shown in the consultation are not directly observable from Ofcom’s model, but they do appear to be broadly consistent with the model’s annual output, which predicts 9,174 macrosites in 2005/06, rising by 1,437 to 10,611 by 2009/10.

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41 Paragraph A8.85

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43 Figure 24

85 A key driver of site growth during this period is the increase in 3G coverage, which is assumed to rise from 12% of the UK by area in 2005/06 to 37% by 2009/10. This increase is responsible for 808 out of the 1,437 additional macrosites<sup>44</sup>.

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87 So to the degree that Ofcom's model generates a slope for macrosites that is too flat, as argued by O2, much if not most of this is attributable to the fact that assumed values for 3G site cell radii are too high. Increasing the slope by correcting these assumptions actually serves to reduce LRIC.

88 Three also notes that such a correction would have implications for Vodafone's GBV calibration argument.

**The model's market share assumption does not make a material difference to pure LRIC.**

89 O2 objects to Ofcom's market share assumption for the minimum efficient scale (MES) of the hypothetical operator:

“Ofcom provides little evidence to underpin the return of the market share assumption back to 25%...Ofcom fails to explain why its analysis departs from the European Commission recommendation in setting an MES above the target value of 20%”<sup>46</sup>.

90 Ofcom's 25% assumption is based on a view that, in a market with  $n$  operators, the hypothetical efficient operator can reach a market share of  $1/n$  by the end of the model period<sup>47</sup>. This view is consistent with that taken by Ofcom in the last review and endorsed by the Competition Commission.

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44 Re-running Ofcom's model while holding 3G coverage constant at 12% from 2005/06 to 2009/10 shows total macrosites rising by 629, from 9,174 in 2005/06 to 9,803 by 2009/10. The difference of 808 between this increase and the increase of 1,437 in Ofcom's model is therefore attributable to the increase in 3G coverage.

45 Section 5.4

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47 A8.37, Ofcom consultation

- 91 The 25% assumption is not inconsistent with the EC Recommendation. The Recommendation clearly envisages market shares other than 20%: “To determine the minimum efficient scale for the purposes of the cost model, and taking account of market share developments in a number of EU Member States, the recommended approach is to set that scale at 20% market share. It may be expected that mobile operators, having entered the market, would strive to maximise efficiency and revenues and thus be in a position to achieve a minimum market share of 20%. In case an NRA can prove that the market conditions in the territory of that Member State would imply a different minimum efficient scale, it could deviate from the recommended approach.”<sup>48</sup>
- 92 In any event, Three notes that this assumption has very little effect on the level of LRIC. Three has re-run Ofcom’s model, assuming a 20% rather than 25% market share, and estimates that this causes LRIC to fall marginally from 0.51p to 0.50p.

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48 Annex, EC Recommendation

# Virgin Media does not raise any material objections to the pure LRIC model.

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## **VM misunderstands the pure LRIC modelling of spectrum costs.**

- 93 VM objects to Ofcom's treatment of spectrum in LRIC:  
"The opportunity cost in this instance needs to be evaluated as the cost of building more base stations. The opportunity cost is therefore not zero"<sup>49</sup>.
- 94 Three does not understand VM's objection. What it asks for is exactly what Ofcom has done.

## **Ofcom has understated, not overstated, the rate of migration from 2G to 3G.**

- 95 VM suggests that Ofcom has overstated the rate of migration from 2G to 3G:  
"According to section A8.40 the slower rate of migration to 3G suggests that "31% of handsets were 3G-capable in Q1 2009/10". Figure 7 implies that the 2007 model figure of 44% in Q1 2009/10 has been used as the basis of Ofcom's latest projection. This therefore clearly indicates that in Q1 2009/10 that 13% more of the total traffic terminated should be assumed to be carried on the 2G network (instead of the 3G network)."<sup>50</sup>
- 96 VM is correct, there is a discrepancy between A8.40 and Figure 7. However this is because Figure 7 does not in fact show the proportion of handsets assumed to be 3G capable, as labelled, but the proportion of gross additions taking 3G handsets. Examination of Ofcom's model shows that it assumes only 25% of handsets were 3G capable in Q1 2009/10. So in fact Ofcom's model appears to be understating not overstating recent migration; and as highlighted in our June 2010 response<sup>51</sup>, Three also questions the assumed rate of future migration.

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49 Page 9

50 Page 10

51 Paragraphs 214 to 217

**Three agrees with VM that Ofcom has understated the required number of 3G sites.**

- 97 VM objects to the accuracy of the model's site count calibration:

“Figure 24 contains the key metric upon which Ofcom's relies – ‘Comparison of total macro sites between model output and 2G/3G MCP data’. Ofcom's model does not accurately capture the number of base stations actually provisioned. The slope of the model's predicted base stations has been too flat over the period 2005 to 2009.

In Q3 2009 Ofcom's model estimates 10,534 base stations when the actual figure is 10,866. This represents a shortfall of 332 base stations or 3.1%.

The significance of the flatness of the model's estimates of base stations is that in future, it will similarly underestimate the number of base stations that need to be added and therefore underestimate network operator's costs. At a minimum, we would expect the model to be set to reflect the latest count of base stations i.e. 10,866 in Q3 2009.”<sup>52</sup>

- 98 Three refers to our comments above on a similar objection by O2.

**VM's total cost calibration objection is untested.**

- 99 VM objects to the calibration of total costs:

“Figure 26 indicates that GBV is the cost model is consistently lower over 2006-2008 period than was actually achieved by operators. In 2008 the GBV was £4,088M – when compared to £3,920M predicted. This is a shortfall of 4% of the total.

In addition, Figure 28 indicates that opex is the model is consistently lower over 2006-2008 than actually achieved. In 2008 the opex was £360M – when compared to £353M predicted. This is a shortfall of 2% of the total.

In conclusion we believe Ofcom's modelled 2008 GBV and Opex should be increased to more accurately reflect operator's actual costs.”<sup>53</sup>

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- 100 Three shares Ofcom's reservations<sup>54</sup> over placing too much reliance on either capital cost accounting data in isolation or operating cost accounting data in isolation, given the substitutability of the two cost categories both over time and in terms of accounting treatment. This substitutability introduces a margin of error that is much more significant than is present in, for example, the question of asset counts. In the light of those reservations, Ofcom's approach of calibrating to a reasonable rather than absolute degree of precision seems reasonable. If a higher degree of precision were warranted, Three would suggest that, at a minimum, the calibration ought to be conducted over a much longer period than three years, in order to gain a more reliable and representative view of the relationship between capital costs and operating costs over time.
- 101 It is therefore far from clear that the issue highlighted by VM suggests that pure LRIC is understated.
- 102 Vodafone's calibration argument considers a longer period of time, which reduces but does not eliminate this reservation.

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54 Paragraph A10.15, Ofcom consultation