Vodafone Response to Ofcom Consultation:

Coverage obligations in the 700MHz and 3.6-3.8GHz spectrum award Ofcom's approach to verifying compliance

1.Background

Vodafone welcomes the opportunity to comment on Ofcom's plans for how it would verify compliance with the proposed coverage obligations.

Were the man on the Clapham omnibus to be asked how they thought Ofcom would check whether the holder of a coverage obligation had met that obligation, in all likelihood they would answer that Ofcom would carry out sufficiently detailed tests to make sure there really was signal at 90% of landmass and indoors at 140,000 premises. The assumption would be that Ofcom would carry out drive tests over sufficient distances to make a compelling sample, would crowd-source information from user handsets, and would survey the owners of the homes and businesses involved. Only then could Ofcom be sure that the operator was meeting its coverage obligations. Of course, industry-insiders will realise that this just isn't practicable:

1. An assessment of the proportion of transport corridors covered provides an imperfect proxy to geographic coverage, and in any case, we can be fairly certain that one of the required routes that Ofcom drives will be along The Strand to deal with the legal challenge from obligation holders disagreeing with the specifics of the routes that have been chosen.
2. Crowd source information can betray biases of which users download the necessary application software, and when used to provide absolute information[1] can provide as much information about the quality of the handset reception as the quality of the network.
3. Surveys would once again betray biases of the sample. Of the 140,000 premises, only a subset would be customers of the obligation holder, so be able to answer questions about their indoor coverage. These respondents may overwhelmingly report that they had coverage, but for the remainder, it would be difficult to answer the question of whether they are non-customers because the coverage holder had failed to provide them coverage, or because they chose an alternative operator for other reasons. In addition, those responding would have a variety of property types, so would a sample suggesting that the obligation holder had failed to meet the obligation be indicative of poor performance on their part, or that Ofcom had chosen to survey householders with thick walls?

It is therefore inevitable that Ofcom must assess compliance using predictive modelling tools. We should be absolutely clear, however, that this means that Ofcom is not auctioning an obligation to provide coverage to 90% of UK geography – instead, it is auctioning an obligation to provide coverage that when run through an agreed coverage prediction model, suggests that there might be a reasonable probability of having good

[1] We note that crowdsourced is better suited to providing *relative* network performance rather than assessing an absolute metric, e.g. 90% of pixels where handsets have reported had a signal strength of >-105dBm.

coverage at 90% geography. These two assertions of coverage are not the same – inherently the Ofcom coverage obligation is only as good as the coverage prediction model that underpins it.

The elephant in the room is that there **is** no industry-agreed coverage prediction model. Ofcom's proposed approach to assessing compliance lays this bare – an Ofcom tool will be used, but Ofcom does not have sufficient confidence in it so is planning to calibrate it using the obligation holder's model. This is not so much a case of operators marking their own homework, but is instead allowing operators to set the grade boundary on the exam and carry out their own *viva voce.*

This situation would be simply unfortunate, were there not huge sums of taxpayers' money involved. However, in reality, this assessment process will determine whether the recipients of potentially £700M of spectrum discounts have met their obligations. That is £700M that would have otherwise gone into Treasury coffers and could have been used to fund essential services such as schools and hospitals. The situation is not simply unfortunate, but is instead inadequate and unacceptable audit of the use of public resources. It is this point – along with the proposed obligation only benefiting a subset of consumers, and distorting the award of spectrum – that leads Vodafone to the conclusion that Ofcom's current approach to the auction is wrong and that it would be better for the obligation to be for operators to play a full role in a coverage infill scheme with Ofcom and Government oversight. Under the proposal set out in Section B.2 of Vodafone's response to the main consultation, there would be no need for Ofcom to seek to determine whether operators are meeting arbitrary coverage goals four years hence, as they would be playing an active role in governing the scheme as it progresses.

Notwithstanding Vodafone's overall position, for the remainder of this response we assume that Ofcom is pressing ahead with an auctioned coverage obligation to reach an arbitrary percentage of geography.

2.The proposed assessment methodology

Vodafone's understanding of the proposed assessment methodology is that Ofcom has a coverage model, but is not sufficiently confident in its accuracy hence needs to calibrate it. We can fully understand that: Ofcom is not a network operator. The calibration will be with respect to each obligation-holder's coverage prediction model – so if, immediately post-the auction, Ofcom's model predicts that the obligation holder's network achieves 83% but the holder's model predicts only 81%, then when it comes to carrying out the final assessment, Ofcom would use its own model but would look for 92% coverage rather than 90%. In other words, if post the auction, there is a discrepancy between the operator model and Ofcom's, then the operator's model prevails.

The flaw in this approach can be illustrated with a simple example. Imagine that the two coverage obligations are awarded to two operators that form a mast-share joint venture. Operator A and Operator B therefore have identical mast grids, and identical coverage. Operator A's coverage model is optimistic, and suggests that it has 82% coverage. Conversely, Operator B's coverage model is pessimistic, and suggests only 78% coverage. Ofcom's model puts the coverage at 80%. In this situation:

- Ofcom will determine that A needs to achieve 88% coverage according to the Ofcom model (at the time of the auction according to the operator model it needs an extra 8%, so that 8% is added to the Ofcom assessment of 80% to result in a target of 88%).
- Conversely, Ofcom will determine that B needs to achieve 92% coverage according to the Ofcom model (at the time of the auction according to the operator model it needs an extra 12%, so that 12% is added to the Ofcom assessment of 80% to result in a target of 92%).

So we are in the situation where Operators A and B, despite having identical coverage, are expected to add 8% and 12% respectively to their coverage in order to meet the obligation. Not only does B have to provide 50% more additional coverage than A, but the cost of providing that coverage would be significantly higher, because it is well understood that the cost of providing coverage increases exponentially. For example, if the costs of serving successive percentages of geography increases by 12-13%, B's costs will be double those of A, despite having identical starting mast networks.

Clearly, this situation leaves bidders for the obligation with every incentive to game the system by overstating their coverage in geographic terms[2] in the run up to the auction.

The only mitigation in the proposal is that the maximum adjustment to the target is 5% - but that amounts to hundreds of £millions' worth of mast deployments.

Vodafone agrees that it would be inappropriate to rely on operator prediction models, but clearly the proposed mechanism of calibrating using the obligation holder's model cannot be considered satisfactory either. Vodafone does not agree with the proposal.

3.Better alternatives

In this section, we offer two alternatives to Ofcom's proposals.

3.1 Use a non-calibrated Ofcom model

Under this approach, the obligation-holder would be required to provide a network that, according to Ofcom's coverage model, provided coverage to 90% of geography (broken down by individual nations) and

[2] We have already observed – see response to Question 1 of the main consultation – that there will be a counter-incentive to understate coverage to premises in the run up: this is not a mitigation as it is entirely possible to manipulate coverage reporting to achieve both goals.

140,000 premises that were unserved at the time of the auction. Assessment would be via the Ofcom model.

According to the accuracy of the model, its predictions might or might not equate to the operator *actually* providing 90% coverage, and might or might not align with what the operator's coverage model suggested. However, this would be irrelevant: the obligation would be to achieve 90% coverage according to the Ofcom model.

As operators have access to the Ofcom model now, and would be provided access to any changes made to refine the model prior to the auction, they would be able to assess the costs of fulfilling the obligation according to that model. Thus, there would be a level playing field.

We do acknowledge that discrepancies between the Ofcom and operator models may drive the operator to deploy masts to maximise coverage according to the Ofcom model, hence deploying masts in marginally different locations to where they may otherwise have been deployed. However, this is a small price to pay in order to achieve consistency and to prevent obligation holders gaming the system.

3.2 Calibrate the Ofcom model better

Once again, in this approach assessment of the coverage obligation would be using the Ofcom coverage model. However, in this approach, the Ofcom model would be generically calibrated according to the average of all four mobile operators' models, rather than narrowly for a specific obligation holder.

Percentage approach

In the simplest approach, Ofcom would gather evidence from each of BT, Telefonica, Three and Vodafone. Each operator would provide a percentage coverage at -105dBm as predicted for their mast grid using their own model, along with details of that mast grid. Ofcom would then execute its own model against those same mast grids, and determine the percentage delta in comparison to the operators' predictions. So for example if the delta compared to the operator predictions was -2%, 0%, 1% and 2% respectively, the average delta would be an over-prediction of 0.25%. This would then be applied to the required modelling target of 90% as proposed in Ofcom's scheme.

The collaborative exercise on coverage modelling between operators and Ofcom has identified that the accuracy of predictions can vary markedly according to terrain. To this end, it may be appropriate to carry out the calibration exercise for each of the UK nations separately, or in the case of Vodafone's regional proposal[3], for each of the regions in question.

For information, Vodafone is carrying out the exercise of comparing the output of our model applied to the Vodafone mast grid at February 2019, with the output of the Ofcom model (for the UK as a whole): we will provide information on this exercise confidentially to Ofcom in the near future.

[3] See Section B.3 of Vodafone's response to the main consultation

Pixel approach

Ofcom might like to consider a more sophisticated approach to calibration. In this approach, once again evidence would be gathered from each of the mobile operators of the predicted signal strength in each geographic pixel for their mast grid. Ofcom would then apply its model to the same grids.

Ofcom would then take all pixels in the operator model outputs with predicted signal strengths of -105dBm, and compare these to the signal strength predicted by its own model. This would provide an absolute delta, so if for example the average predicted strength from the Ofcom model was -103.5dBm, Ofcom would use that as the threshold for assessing coverage rather than -105dBm. We note that because the average delta will almost certainly be a non-integer, this approach works best if Ofcom's model predicts a signal strength to n-decimal places then rounds to a signal strength, rather than if the model works on an integer basis only. As with the percentage approach, there are further refinements that could be considered to reflect terrain, such as assessing the delta on a regional basis.

Vodafone has not yet carried out a pixel-level comparison between the output of Ofcom's and our model applied to the Vodafone mast grid at February 2019, but would be prepared to do so if Ofcom considered this beneficial.

4.Conclusions

Vodafone's preferred approach to coverage obligations would negate the need to assess whether a subset of operator have achieved an arbitrary 90% coverage level. In absence of this, we recognise that usage of an Ofcom prediction model is inevitable. The proposals set out in the consultation to calibrate the model are unacceptable to Vodafone, and should prove unacceptable to any stakeholder that believes public spend should be properly monitored. The approach of simply using operators' own models would be even more unacceptable.

We have presented alternatives whereby either the Ofcom model will be used on an uncalibrated basis, or calibration is carried out against all operator models rather than narrowly those of obligation holders.

Vodafone UK
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