COMPETITION POLICY FOR THE 2.3 AND 3.4 GHZ AWARD

PREPARED FOR HUTCHISON 3G UK BY POWER AUCTIONS LLC

31 January 2017

NON-CONFIDENTIAL

1. Executive Summary

Power Auctions welcomes this opportunity to comment, on behalf of Hutchison 3G UK, upon Ofcom's proposals to introduce extra competition measures in the award of spectrum in 2.3 GHz and 3.4 GHz bands. Our main points argued herein are as follows:

[✂ - When value complementarities are taken into account it is clear that the auction rules are unlikely to be effective to prevent strategic bidding.]

2. Preliminaries

In this section, we distill the main empirical features of the auction environment that we will utilise later in making predictions of the auction outcome under different scenarios.

2.1 Presence of strong value complementarities for [✂ - certain packages]

This subsection takes the value estimates from the *Analysys Mason report*[1] to reach the conclusion that there are strong value complementarities [✂ - for certain packages].

[✂]

2.2 True Demand Functions

In the PSSR auction, bidders will effectively be expressing their interest in acquiring lots by means of demand functions, where quantity is a weakly decreasing function of price. Here, we highlight the well-known fact that the demand functions for preferences with value complementarities have a very distinctive shape.

[✂]

2.3 [✂ - Outcome for] Each Band under Non-strategic Bidding

[✂]

[1]"The difficulties Three faces in winning PSSR spectrum absent appropriate competition measures," Analysys Mason report for Three UK, 6 December 2016.

3. Theoretical Discussion

In this section, we develop the main theoretical arguments and intuitions that will be used to derive predictions of the auction outcome under different scenarios.

3.1 Incentives to Bid Strategically

The PSSR auction presents three substantial motivations for deviating from truthful bidding. They are known as "demand reduction", the "exposure problem", and strategic investment (foreclosure).

Demand reduction is implied by the uniform-price nature of the payment rule employed by the PSSR auction. The most common flavour of demand reduction in the context of spectrum auctions is a form of tacit collusion among bidders "to split the market" at low prices. Note that this incentive generally skews the auction outcome toward an allocation with more winners than we would get from non-strategic bidding. For example, two bidders can amicably settle on winning 20 MHz each of the 2.3 GHz spectrum at a low price (two winners) instead of engaging in a war of attrition to win 40 MHz at a higher price (a single winner).

The **exposure problem** is traditionally created by the prorating rule. In the context of the PSSR auction, the prorating rule will be implemented using a "standing high bids" implementation. The use of the prorating rule results in possibilities for bidders to get stuck with an undesired package at a high price. To illustrate, consider the 2.3 GHz band with four 10 MHz lots and two bidders. Suppose that Bidder 1 is bidding for 30 MHz and Bidder 2 is bidding for 20 MHz. If Bidder 2 attempts to drop its demand to 0 MHz at a price equal to its average value for 20 MHz, it will be stuck winning 10 MHz at its average value for 20 MHz, which is unprofitable given value complementarities. Avoidance of the exposure problem causes a bidder to drop out at a lower price than its maximum average value—and hence creates a higher minimum quantity than $q^{\min}$ of Section 0. Thus, sufficient value complementarities and the resulting exposure problem can drive the auction outcome toward fewer winners than we would get from non-strategic bidding.

Finally, as shown in the *Analysys Mason report,* the current state of the UK wireless market creates incentives for large incumbents to engage in **strategic investment** (i.e. foreclosure of their smaller rivals). [✂]

[✂] Of the three motivations we have discussed for deviating from truthful bidding, the only incentive that potentially facilitates the winning of spectrum by weak bidders is demand reduction.

The problem of demand reduction is well known. However, the academic literature that is devoted to studying this problem is limited to environments with constant or decreasing marginal values. Therefore, it can be misleading or wrong to apply the general logic of demand

reduction to environments with value complementarities (increasing marginal values). In the rest of this section, we will develop some new theoretical results demonstrating that value complementarities create a strong disincentive to demand reduction and may prevent demand reduction from occurring at all. [✂]

3.2 Formal Analysis of the [✂] Model

In this section, we provide a formal analysis of a stylized model of the multi-unit auction. [✂] A full analysis of this model with complete proofs can be found in the Technical Appendix. In the main body of this Report, we limit our exposition to the description of the model and a statement of the main results.

3.2.1 Model

[✂ - description of the model]

3.2.2 Uniform Price Auction

Following the approach that is generally taken in the academic auctions literature, we obtain our insights into the SMRA auction format that is proposed for the PSSR award by performing an equilibrium analysis of the sealed-bid auction with the corresponding payment rule. There are at least two standard references for this approach. The first reference is Vickrey's seminal 1961 article on auctions, which studies the dynamic English auction for a single item by examining the sealed-bid second-price auction.[2] The second reference is the "demand reduction" article by Ausubel, Cramton, Pycia, Rostek and Weretka (2014), which notes: "The theorems of our article are stated formally for static multi-unit auctions … . However, most of our results can be adapted to any auction context where equilibria possess a uniform-price character. For example, in the simultaneous ascending auctions used for spectrum licences, there is a strong tendency towards arbitrage of the prices for identical items."[3] Meanwhile, the sealed-bid uniform-price auction provides a compact representation of the SMRA, and its equilibrium analysis is much more straightforward than for the full SMRA auction, permitting us to obtain clean results.

Thus, in the sections that follow, we analyse the sealed-bid uniform-price auction: [✂]

[2] Vickrey, W. (1961), "Counterspeculation, Auctions and Competitive Sealed Tenders," *Journal of Finance*, 16(1): 8–37.

[3] Ausubel, L., P. Cramton, M. Pycia, M. Rostek and M. Weretka (2014), "Demand Reduction and Inefficiency in Multi-Unit Auctions," *Review of Economic Studies*, 81 (4): 1366-1400.

3.2.3 Main Results

[✂][4] [✂][5] [✂]

3.2.4 Discussion of main results

[✂]

3.3 Implications for the 2.3 GHz band [✂]

[✂][6][✂][7]

[✂]

3.4 Implications for the 3.4 GHz band [✂]

[✂][8]

[✂][9] [✂]

[4] [✂]

[5] [✂]

[6] [✂]

[7] [✂]

[8] [✂]

[9] [✂]

4. Analysis of Seven Options for Intervention

In this section, we consider seven main options for intervention. Ofcom considered the first five of these competition measures (options A – E) in its 21 November 2016 Condoc, while option F is the combination of a reservation in the 2.3 GHz band with Ofcom's option E, and option G is the combination of a reservation in both bands with Ofcom's option E:

- Option A – a cap of 255 MHz (about 42%) applied only to immediately useable spectrum, which would have the effect of excluding BT/EE from acquiring 2.3 GHz spectrum (but would permit it to acquire an unlimited quantity of 3.4 GHz spectrum);
- Option B – a cap of 150 MHz (about 25%) of immediately useable spectrum, which would have the effect of excluding both BT/EE and Vodafone from acquiring 2.3 GHz spectrum (but would allow both to acquire unlimited quantities of 3.4 GHz spectrum);
- Option C – a cap of 255 MHz applied only to immediately useable spectrum (as in option A) combined with an overall spectrum cap set at 340 MHz (around 37% of the sum of currently held spectrum, the spectrum in this award and 700 MHz spectrum), which would have the effect of excluding BT/EE from acquiring 2.3 GHz spectrum and limiting it to 85 MHz of 3.4 GHz spectrum. This option would also place a small constraint on Vodafone's total spectrum acquisitions;
- Option D – reserving two lots, each of 20 MHz of 2.3 GHz spectrum, for operators with smaller spectrum holdings (e.g. less than 90 MHz) or new entrants, which would exclude BT/EE and Vodafone (the two MNOs with the largest current spectrum holdings) from acquiring 2.3 GHz spectrum;
- Option E – an overall spectrum cap of 255 MHz, about 30% of mobile spectrum, which would have the effect of excluding BT/EE from acquiring any spectrum in this award and limiting Vodafone to acquiring at most 75 MHz of spectrum in this award;
- Option F – reserving 20 MHz of 2.3 GHz spectrum for an operator with a smaller market share (e.g. less than 20%) or a new entrant, combined with an overall spectrum cap of 255 MHz (as in option E); and
- Option G – reserving a package of 20 MHz of 2.3 GHz spectrum plus 40 MHz of 3.4 GHz spectrum for an operator with a smaller market share (e.g. less than 20%) or a new entrant, combined with an overall spectrum cap of 255 MHz (as in option E).

Below we discuss the most likely outcomes of the auction under each option. For this exercise, we utilise Analysys Mason's "upper end" estimates of operators' intrinsic values and strategic values.

4.1 Outcome analysis under option A

Ofcom's option A establishes a cap of 255 MHz, but only on "immediately usable" spectrum. As such, BT/EE is excluded from acquiring any spectrum in the 2.3 GHz band, but despite its large holdings, the most spectrum-rich operator is completely unconstrained in the 3.4 GHz band. This intervention places no constraint on any other bidder who might participate in this award.

[✂]

4.1.1 Allocation of the 2.3 GHz band

[✂]

4.1.2 Allocation of the 3.4 GHz band

[✂]

4.1.3 Likeliest outcome under option A

[✂]

4.2 Outcome analysis under option B

Ofcom's option B establishes a cap of 150 MHz, but only on "immediately usable" spectrum. As such, both BT/EE and Vodafone are excluded from acquiring any spectrum in the 2.3 GHz band, but despite their large holdings, the two spectrum-rich operators are completely unconstrained in the 3.4 GHz band. This intervention places no constraint on any other bidder who might participate in this award.

4.2.1 Allocation of the 2.3 GHz band

[✂]

4.2.2 Allocation of the 3.4 GHz band

[✂]

4.2.3 Likeliest outcome under option B

[✂]

4.3 Outcome analysis under option C

Ofcom's option C establishes a cap of 255 MHz on "immediately usable" spectrum (as in option A) combined with an overall spectrum cap set at 340 MHz. As such, BT/EE is excluded from acquiring 2.3 GHz spectrum and is limited to 85 MHz of 3.4 GHz spectrum. This intervention also places a small constraint on Vodafone's total spectrum acquisitions. It places no constraint on any other bidder who might participate in this award.

[✂]

4.4 Outcome analysis under option D

Ofcom's option D reserves two lots, each of 20 MHz of 2.3 GHz spectrum, for operators with smaller spectrum holdings (e.g. less than 90 MHz) or new entrants. As such, BT/EE and Vodafone are excluded from acquiring 2.3 GHz spectrum, but despite their large holdings, the two most spectrum-rich operators are completely unconstrained in the 3.4 GHz band. This intervention places no constraint on any other bidder who might participate in this award.

4.4.1 Allocation of the 2.3 GHz band

[✂]

4.4.2 Allocation of the 3.4 GHz band

[✂]

4.4.3 Likeliest outcomes under option D

[✂]

4.5 Outcome analysis under option E

Ofcom's option E establishes an overall spectrum cap of 255 MHz. As such, BT/EE is excluded from acquiring any spectrum in this award, while Vodafone is limited to acquiring at most 75 MHz of spectrum in this award. It places no constraint on any other bidder who might participate in this award.

4.5.1 Allocation of the 2.3 GHz band

[✂]

4.5.2 Allocation of the 3.4 GHz band

[✂]

4.5.3 Likeliest outcomes under option E

[✂]

4.6 Outcome analysis under option F

Option F reserves 20 MHz of 2.3 GHz spectrum for an operator with a smaller market share (e.g. less than 20%) or a new entrant. In addition, it places an overall spectrum cap of 255 MHz on each operator, as in option E. As such, BT/EE is excluded from acquiring any spectrum in this award, while Vodafone is limited to acquiring at most 75 MHz of spectrum in this award. It places no constraint on any other bidder who might participate in this award.

4.6.1 Allocation of the 2.3 GHz band

[✂]

4.6.2 Allocation of the 3.4 GHz band

[✂]

4.6.3 Likeliest outcome under option F

[✂]

4.7 Outcome analysis under option G

Option G reserves a package of 20 MHz of 2.3 GHz spectrum plus 40 MHz of 3.4 GHz spectrum for an operator with a smaller market share (e.g. less than 20%) or a new entrant. In addition, it places an overall spectrum cap of 255 MHz on each operator, as in option E. This would have the effect of excluding BT/EE from acquiring any spectrum in this award and limiting Vodafone to acquiring at most 75 MHz of spectrum in this award.

4.7.1 Allocation of the 2.3 GHz band

[✂]

4.7.2 Allocation of the 3.4 GHz band

[✂]

4.7.3 Likeliest outcome under option G

[✂]

5. Critique of Ofcom's view on strategic investment

In ¶4.225, Ofcom acknowledged that "It might be argued that strategic investment would be easier if there were strong value complementarities for large blocks of spectrum." Ofcom goes on, in subsequent paragraphs, to dismiss the likelihood of strategic investment. However, there are numerous deficiencies in Ofcom's argument.

5.1 Regardless of what happens in the 3.4 GHz band, [✂ - perpetrator(s)] obtain strategic value by foreclosing [✂ - target(s)] from the 2.3 GHz band

[✂]

5.2 The evidence suggests strong value complementarities for [✂ - certain packages]

[✂]

5.3 Strategic value from the 2.3 GHz band alone, together with strong value complementarities [✂ - for certain packages], make foreclosure likely

[✂]

5.4 Our analysis takes account of Ofcom's two other "mitigating" features

[✂]

6. Conclusion

In some of its important actions taken in the past several years, Ofcom has indicated a strong desire to maintain a wireless market with four credible national wholesalers. Such actions have included its integration of a minimum spectrum portfolio into the January 2013 4G auction, and its opposition to the recent proposed merger of O2 and Three. In this context, it is regrettable that Ofcom's weak competition policy proposed for the PSSR Award would effectively go in the opposite direction.

Indeed, Ofcom opened its 21 November 2016 Condoc by reiterating that it wants "to ensure that consumers and businesses continue to benefit from a competitive market in the provision of mobile services" (¶1.3) and "to further the interests of consumers in relevant markets, where appropriate by promoting competition" (¶1.4). However, by the time Ofcom considered and analysed options for addressing competition concerns in Section 5, it seems to have put producer surplus ahead of consumer surplus. For example, in ¶5.64, Ofcom indicated that it preferred an outcome with one winner rather than two, if the one winner would obtain greater intrinsic value (i.e. producer surplus). And, in ¶5.74, Ofcom expressed hesitancy at preventing the operator with the greatest foreclosure incentive from acquiring a large block of the 3.4 GHz spectrum because it might have the highest value.

The issue here is that competition policy necessarily conflicts with unconstrained "efficiency", when the notion of efficiency equates to value maximisation by bidders, and value in turn refers to producer surplus. (Otherwise, regulators would allow a single operator to acquire all of the spectrum, since that would maximise producer surplus.) Regulators should implement efficient auctions, but efficiency must be constrained by effective competition policies that protect consumer surplus.

[✂]