

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title: Award of available spectrum: 2500-2690MHz, 2010-2025MHz and 2290-2300MHz

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Name Jane Cooper

Signed (if hard copy)

Orange response to Ofcom consultation on 'Award of available spectrum: 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz'

8 March 2007

Executive Summary

Orange welcomes the opportunity to comment on Ofcom's proposals for the award of 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz. Due to its potential importance to mobile operators, Orange's comments are limited, other than where stated, to the 2500-2690 MHz spectrum ('2.6 GHz').

The proposed award of 2.6 GHz spectrum represents the allocation of a significant amount of potentially very valuable spectrum, and as a result Ofcom is keen to press on with its award. Orange agrees that the 2.6 GHz spectrum is **potentially** of significant interest to users, including mobile operators such as Orange. This potential is dependent on how and when Ofcom chooses to allocate the spectrum.

Orange believes that Ofcom's current proposals risk critically undermining the 2.6 GHz spectrum, ultimately to the detriment of UK citizens and consumers, due to the significant number of outstanding issues which require resolution before any efficient award can be made. Orange believes therefore that Ofcom **must not proceed with the award under its current timetable** due to a number of significant issues with its proposed approach, including:

- ***Lack of clarity as to substitutable spectrum***

Ofcom has not provided mobile operators with any clarity as to how and when UMTS equipment could be used in the current GSM bands, with EU discussions on this issue currently ongoing.

This is extremely significant, as for mobile operators the GSM bands are a clear substitute to the 2.6 GHz spectrum. Mobile operators including Orange must know the extent to which, and on what terms they can use GSM bands for UMTS prior to being able to make an informed decision as to whether they want to seek award of 2.6 GHz spectrum, and how much they value that spectrum. Ofcom risks distorting any market award, leading to an inefficient outcome, should it not clarify this situation in advance of any allocation.

- ***Lack of certainty as to European dimension***

Ofcom appears to be pressing on with the award of 2.6 GHz spectrum regardless of the possibility that the EU may adopt a harmonising measure that could apply to this band. Orange believes that Ofcom has not demonstrated that there is significant consumer benefit at risk from delaying the award until this situation is clarified. Furthermore, there is very clearly a risk that Ofcom's proposed approach could be undermined by any EU harmonising measure. Orange would contend that Ofcom should wait until this situation is clearer (prior to the expected CEPT study and consequential RSC discussions) prior to initiating any award.

- ***Significant uncertainty with Ofcom's proposed interference management approach***

Ofcom is both proposing a move away from the CEPT band plan and the use of Spectrum Usage Rights (SURs) rather than spectrum masks in its quest to introduce technology neutrality in the 2.6GHz band. Orange has very real concerns that this approach could lead to significant inter-carrier interference, devaluing the spectrum and the commensurate benefits to consumers and citizens. Orange has commissioned an independent study annexed to this response which outlines a number of concerns with Ofcom's proposed approach, which must be addressed prior to any award of spectrum.

Orange would contend that to ensure the timely and efficient award of the 2.6 GHz spectrum Ofcom should follow the CEPT band plan and retain the use of spectrum masks. The expected IMT-accreditation of WiMax means that operators would have a choice as to what type of technology they want to deploy, which should partially meet Ofcom's technology neutrality objective. In any case in reality, Ofcom's proposed approach is not technologically neutral (as retention of the CEPT's 5 MHz channel bandwidth and 120 MHz duplex spacing demonstrates) and Ofcom should not let dogma stand in the way of the efficient of the 2.6 GHz band.

In the absence of a true spectrum market, Ofcom is the monopoly supplier of spectrum to UK spectrum users and has a clear duty to act responsibly to users of spectrum in respect of any spectrum award. Orange however considers that there are far too many problems with Ofcom's current proposals resulting in its current timetable for the award of 2.6 GHz spectrum simply not being realistic.

We would therefore urge Ofcom to firstly resolve the issue of how and when flexible use of GSM bands (including allowing UMTS) will be enacted prior to any award of 2.6 GHz spectrum. Whilst this process is ongoing, Ofcom can seek to resolve the numerous issues that arise from its current novel proposals or determine to revert to a more traditional form of assignment, based on the CEPT band plan. Nonetheless it is clear that there are too many uncertainties for Ofcom to award the 2.6 GHz spectrum without risking a seriously inefficient outcome.

Responses to Questions

Question 1: *Do you agree with these proposals for the awards of the three bands or have any other comments on the contents of this document?*

Orange refers Ofcom to the points made in the Executive Summary above and answers to subsequent questions below.

Question 2: *Do you agree with the analysis in section 5 or have any comments on adjacent interference issues?*

Orange generally agrees with the overall analysis in section 5 on adjacent interference issues. Of concern from Orange's reading of this analysis and its subsequent presentation at the workshop of 8 February is the fact it would appear that the 2.6 GHz band does potentially suffer from a number of adjacent interference issues which will certainly require further investigation and possibly resolution **prior to any award**.

In terms of geographically adjacent interference, the results of the work commissioned by Ofcom demonstrate the significant risk of interference in the North-West of England from Irish MMDS operators. To address this issue, Ofcom indicates that it has requested MMDS deployment details from COMREG in Ireland so as to undertake an updated interference assessment based on actual as opposed to theoretical deployment parameters.

Orange suggests that it would have been appropriate to delay consultation on 2.6 GHz allocation until this assessment is available, given its potential impact on the viability of the spectrum. Nonetheless it would appear clear that Ofcom needs to undertake this modelling work based on actual MMDS deployment to gauge potential geographic interference issues that could arise **prior to any award** of the 2.6 GHz spectrum. It is clear also that a Memorandum of Understanding on border coordination with the Republic of Ireland is of significant importance prior to any award.

In addition, in terms of geographically adjacent interference Ofcom will require a Memorandum of Understanding with the French administration to ensure cross-border coordination with France. Orange would observe that, in moving away from the CEPT band plan, Ofcom is making this process more difficult, and risks a situation whereby the onus is on the UK (and UK operators) to go to greater lengths to mitigate interference due to the UK not following international harmonisation measures.

Orange would also observe that Ofcom's proposals for technology and service neutrality mean that potentially both these MoUs will become redundant and require re-negotiation with **every** change of use or technology.

In respect of RADAR systems operating in the band 2700 – 2900, Ofcom concludes that these will generate interference in the form of increased bit error rate across the 2.6 GHz band, but that this can be handled by the existing Forward Error Correction mechanisms embedded within modern communication system. There does not appear to be any evidence presented to back-up this conclusion and Orange suggests that the interaction between the intermittent 'bursty' bit errors arising from RADAR interference and the closed loop retransmission and adaptive modulation and coding mechanisms of packet based communication systems is studied in more

detail before reaching any final conclusions. Until this is completed the effect of such interference creates considerable uncertainty on the value of this spectrum.

In sum, Orange generally agrees with Ofcom's analysis but believes that Ofcom may have understated the resultant conclusions from this analysis and their impact. Prior to any award there are a number of issues, in particular in relation to geographic interference with Irish MMDS operators, which require much further investigation by Ofcom.

Question 3: *Do you agree that Ofcom should authorise use of the spectrum bands 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz?*

Orange does agree that Ofcom should **in time** authorise the use of the bands identified. Given the large amount of spectrum at stake, its potential use and subsequent value, clearly Ofcom would be remiss in its duties were it not to make this spectrum available **on resolution** of all potential barriers to allocation.

The issue from Orange's perspective is more a question of a) *when* the spectrum should be made available and b) *how* it should be made available. Whilst these issues are addressed in further detail in the answers to subsequent questions, from Orange's perspective it is clear that Ofcom's proposed timings are **far too early** and that there are serious issues with its intended allocation methodology.

From Orange's perspective in terms of timing, Ofcom simply has **not made the case** as to why the 2.6 GHz band has to be allocated in the envisaged time frame. Furthermore, Ofcom has not set out what the possible consumer welfare implications are of delaying the award. Clearly there are some potential users of the band who require access as soon as possible; however there are also other potential users who may want access to these bands but need further information before being able to make this decision. Orange considers that Ofcom has a duty of care to **all** potential users of the band in this regard, and should not unduly influenced by a sub-sect agitating for immediate spectrum award.

There are currently from Orange's perspective numerous reasons why Ofcom's timetable is **not realistic**, including:

- Lack of clarity for use of UMTS in GSM bands and attached conditions – including timescales and how this will be achieved
- Lack of clarity as to possibility of mobile applications in digital dividend spectrum
- UMTS 2600 MHz equipment is currently not on manufacturers' development roadmap, meaning that spectrum may go unused until this equipment becomes available at an as yet unknown future date

In terms of Ofcom's proposed allocation methodology, Orange believes that, quite simply, Ofcom is introducing **far too many unknowns** and experiments into the award process, including:

- Spectrum Usage Rights – including significant risk of interference between TDD and FDD applications under current proposals. It is far from clear from Orange's perspective why SURs have to be applied to the 2.6 GHz band given the likelihood that WiMax will become a member of the IMT-2000 family of standards and therefore able to apply UMTS masks.

- Technology neutrality – significant move away from received method of allocating spectrum in the UK and Europe, with commensurate risks.
- ‘Clock auction’ – complex auction award that is currently untried. Orange would suggest that Ofcom should at least await the results of the 10 GHz, 28 GHz, 32 GHz and 40 GHz award before proposing its use in the 2.6GHz band.

From Orange’s perspective therefore, Ofcom is faced with a choice. It can either aim to meet its ambitious timetable by allocating the spectrum on a tried and tested basis (CEPT band plan, spectrum masks) or it can pursue its untested methods (technology neutrality, SURs) within a longer timeframe once the issues with these methods have been subject to much further investigation and resolution. It is in the opinion of Orange risky bordering on reckless for Ofcom to attempt to allocate such a valuable tranche of spectrum on the current proposed timetable whilst introducing novel concepts which have no proven track record.

Question 4: *Do you agree that awarding licences by auction would be the appropriate mechanism for authorising use of the spectrum bands 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz?*

Orange agrees with Ofcom's analysis that the 2.6 GHz spectrum should not be licence-exempt and therefore the question is how subsequent licences should be attributed. We recognise in this regard that auctions are **theoretically** the most efficient method of awarding spectrum. This is because there is of course an inherent risk with administrative allocation (or 'beauty contests') that regulators make incorrect decisions with resultant economic and social welfare loss. As such Orange does agree, **in theory**, that awarding licences by auction is potentially the appropriate mechanism for authorising use in the 2.6 GHz bands.

However, whilst theoretically auctions as a market mechanism offer the most economically efficient means of allocating scarce resources, it should be recalled **in practice** that there are fine examples of regulators making efficient administrative choices, in particular in relation to GSM.

Furthermore, Orange would contend that the question is moot, in that it is unlikely that Ofcom is open to persuasion on the issue of auctions, or recognise the potential benefits of administrative allocation in certain situations (Ofcom's total analysis on this question amounting to one page in the consultation document). There is also a degree of circularity in that by deeming the allocation should be technology neutral, Ofcom is left with no choice but to auction the spectrum. It would appear pertinent therefore to first ask **whether the licences should be allocated on a technology neutral basis** rather than whether they should be auctioned, as the latter is the consequence of the former.

Regardless, it seems clear that Ofcom will allocate the 2.6 GHz spectrum via auction despite the fact that auctions are not necessarily the panacea to allocative efficiency that Ofcom contends. Orange would suggest that in practice the choice of auction may have (potentially negative) implications for UK plc that Ofcom in its one page analysis has not recognised.

In particular Orange would make the observation in relation to the inevitable auction of the 2.6 GHz spectrum that, as with any market mechanism, there is a disconnect between economic theory and practice which Ofcom dogmatically fails to recognise. In particular, **market efficiency depends on a number of assumptions** (perfect information, transparency, non-distortion) **which in practice are often not present**.

This situation is exacerbated by the fact that there is as yet no competitive market for spectrum in the UK; instead the 'market' is dominated by a monopoly supplier of spectrum (Ofcom). Given that Ofcom has such monopoly powers in relation to spectrum supply, there is a great onus for Ofcom to behave responsibly ("non-abusively" in the parlance of competition law) to those who depend on spectrum as a crucial input to their business. The previous large-scale auction of spectrum in 2000 demonstrated the potential for auctions in a situation of monopoly supply to distort market structures and cost bases, which arguably the mobile industry is still recovering from¹.

¹ Interestingly, the European Commission subsequently commissioned a report from McKinsey as to the lessons to be learnt from the 3G licensing process, very few of which appear to have been heeded in relation to the allocation of 2 GHz spectrum.

Orange would also contend that if as anticipated Ofcom decides on allocating the 2.6 GHz spectrum by auction on a technology neutral basis, that it risks putting UK operators at a competitive disadvantage to operators in other EU Member States that do not use auctions and therefore do not potentially encumber operators with large sunk costs.

In conclusion Orange would accept that there are **theoretical** benefits from auctions which could indicate that it is the most appropriate allocation measure. As with any market mechanism however there is often a difference between theory and practice (a situation exacerbated in the potential spectrum market, where there is currently a monopoly supplier of spectrum with the potential to incur monopoly rents) that risks leading to a sub-efficient outcome. Orange would finally contend that in consulting on the issue of auctions before the question of technology neutrality, Ofcom is actually 'putting the cart before the horse'.

Question 5: *Do you agree that it is likely to be in the interests of citizens and consumers to proceed with the award of the 2.6 GHz and 2010 MHz bands as soon as practicable, rather than to delay the award pending reduction in uncertainty relating to other bands?*

In short, Orange does **not agree** that there is **any conclusive evidence** presented by Ofcom as to **why it would be against citizens and consumers' interest to delay the award of 2.6 GHz spectrum** prior to resolution of a number of key questions.

From Orange's perspective there are instead **numerous reasons** in addition to the uncertainty relating to other bands **why Ofcom should delay** in particular the allocation of the 2.6GHz bands. The premise for this is the fact that Ofcom's proposals will tie-up the 2.6 GHz spectrum for a number of years. If therefore Ofcom, in its haste to allocate the 2.6 GHz spectrum makes sub-optimal decisions, this will have ramifications for that spectrum in the long term. Ofcom would therefore in this regard be acting against the UK citizen and consumer.

In addition to uncertainty to other bands, as Orange outlines below in response to subsequent questions, the uncertainties associated with, *inter alia*, the effectiveness and practicality of the SUR/PFD approach, auction technique and technical feasibility of the close sharing as proposed casts **considerable doubt on the likely success of awarding such a large amount of valuable spectrum**. This uncertainty will, in the eyes of potential bidders, massively devalue the spectrum and undermine the auction process leading to a valuable resource being inappropriately and inefficiently awarded.

In terms of the uncertainty relating to other bands, it is clear that there is **significant uncertainty** as to the possible allocation of substitutable spectrum for mobile operators which **must** be addressed prior to the award of the 2.6 GHz spectrum. This uncertainty means that it is unclear as to what value mobile operators should place on the 2.6GHz spectrum, especially if it is not known whether further substitutes will be made available by regulatory decisions. Possible substitutes for the 2.6 GHz spectrum from the perspective of mobile operators include:

- Current 900 and 1800 MHz GSM bands, which could be refarmed for new technologies
- Possible allocation of spectrum to mobile services resulting from the digital dividend

From Orange's perspective the 900 and 1800 MHz are clear substitutes to the 2.6 GHz band and operators need to know firstly **how and when** flexibility will be introduced into the 900 and 1800 MHz bands to allow the use of technologies other than GSM. Secondly, operators need to know what conditions will be imposed if any on the use of the spectrum for alternative technologies and most crucially the extent to which current spectrum holdings will be subject to change, if at all. Only when this issue is resolved will operators know what value they can place on the 2.6 GHz band as a substitute.

Ofcom **must** therefore first clarify the situation in relation to the 900 and 1800 MHz bands prior to proceeding with the 2.6 GHz award. The timescales for resolution of the 900 and 1800 MHz issue at EU and national level are, as Orange understands it, sufficiently short term that they should not overly delay the award of 2.6 GHz spectrum. In short Orange can see **no good reason why Ofcom should not delay the 2.6 GHz award prior to resolution of this issue.**

Another possible substitute is the spectrum that could be released as a result of the 'digital dividend'. Orange believes that there are compelling reasons why part of the digital dividend should be made available for mobile services so as to extend cost-effective geographic coverage. Nonetheless Orange does recognise that the timescales for the release of digital dividend are sufficiently long-run that they should not **by themselves** delay the award of 2.6 GHz spectrum. This is however another example of substitutable spectrum that presents operators with significant uncertainty.

From Orange's perspective, Ofcom has not made a clear case as to why the 2.6 GHz spectrum should be made available as soon as possible, without resolution of the uncertainty surrounding other bands. In particular, it is not clear to what extent there will be significant consumer welfare loss from delaying the allocation of 2.6 GHz spectrum, as Ofcom has not undertaken any such analysis. Whilst there is clearly a community of potential users that wish to deploy in this band now, there are also a number of other potential users that do not know whether they want to deploy in this band **due to the fact Ofcom has not provided sufficient clarity on the availability of possible substitutes.** Ofcom should be as alive to the concerns of the latter as the former.

In short, Orange believes there are **numerous, compelling reasons to delay the award** of the spectrum, including the current uncertainty in relation to other bands. Ofcom does not appear to recognise the potential 'one off' opportunity that the 2.6 GHz spectrum could represent to mobile operators if other avenues are not made available. Ofcom has a duty to reduce the amount of regulatory uncertainty in this area – which is something it is quite capable of doing if the spectrum award is delayed until other issues relating to substitutable spectrum are resolved. From Orange's perspective Ofcom has not made a convincing case as to what the consumer detriment would be from awarding this spectrum e.g. 1 year later (especially in light of the fact that 2.6 GHz UMTS equipment is unlikely to be available to UMTS operators for a number of years).

Orange believes that Ofcom as the monopoly supplier of spectrum has a clear duty to resolve the uncertainty in relation to other bands, in particular 900 and 1800 MHz, prior to any award of 2.6 GHz spectrum. If Ofcom proceeds without having resolved this issue, the auction outcome is likely to be inefficient due to potential bidders not having the information needed to determine the value they place on the spectrum. Ofcom **must** therefore address this issue in advance of the award.

Question 6: *Do you agree Ofcom should aim to award the bands 2500-2690 MHz, 2010-2025 MHz and 2290-2302 MHz by the end of 2007, while keeping the position on the 2.6 GHz and 2010 MHz bands under review in the light of possible developments in European regulatory fora?*

As above in relation to Question 5, Orange strongly believes that Ofcom should delay the award of the 2.6 GHz spectrum until numerous sources of uncertainty are clarified. Many of these sources of uncertainty are caused by Ofcom itself and it is clear that if Ofcom would revert to a more accepted means of spectrum allocation (e.g. following CEPT band plan and adopting spectrum masks) that some of these uncertainties would be removed and an earlier allocation would be more feasible. However, Ofcom's current (untried and untested) proposals introduce inherent uncertainty due to their novelty and for this reason Orange believes that further clarity is required prior to any award.

One of the key risks in relation to this spectrum is the potential for an EU Decision in relation to this band and its consequent possible impact. Clearly, there is a risk that the 2.6 GHz band could be subject to an EU harmonising measure which could prohibit certain usages or technologies. Given the fact that Qualified Majority Voting is in operation in the Radio Spectrum Committee, and that, therefore, it is feasible that the UK could be outvoted on this issue (as it is outside the vanguard of the majority of EU opinion) Orange would contend that declaring, as was done at the workshop of 8 February that the spectrum is awarded "*caveat emptor*" is not sufficient. Ofcom has a duty of care to the potential licensees of 2.6 GHz spectrum to clarify the nature of potential EU regulatory risk and that it would therefore be appropriate to delay award whilst discussion at the RSC and CEPT are still underway.

The uncertainties highlighted under Question 5 will massively undermine the award process if they are not addressed. Furthermore the uncertainty in the European position is of particular concern and it is inconceivable that bidders could offer the true value of the spectrum until this is resolved. Before awarding the 2.6 GHz spectrum Ofcom **must** therefore wait until:

- The European decision has been made later this year or alternatively there is greater clarity of the EU regulatory situation
- It has resolved the issues relating to 900 and 1800 MHz spectrum
- Technical issues relating to potential interference and the use of SURs have been resolved

Question 7: *Do you agree with Ofcom's proposals for licence conditions (technology neutrality, tradability, conditions of tenure and absence of roll-out obligations)?*

Orange would contend that the licence conditions as referenced in the question can be categorised in two distinct ways as follows:

1. Technology neutrality – including absence of roll-out obligations
2. Tradability – including conditions of tenure

In relation to technology neutrality, Orange would first observe that Ofcom seems to rely on the Framework Directive to justify its pursuit of technology neutrality. The Framework Directive does of course look to treat similar services in a similar manner. However, whilst technology neutrality is an objective, the Framework Directive "*does not preclude the taking of proportionate steps to promote certain specific services*

where this is justified"². In addition, Article 6 (1) of the Authorisations Directive as elaborated in Annex B states that conditions may be attached to rights of use for radio frequencies including "*designation or service or type of network or technology*". In short, Ofcom is **not obliged** by the Framework Directive to undertake a technologically neutral approach.

Regardless, Orange would contend that Ofcom is not actually proposing technology neutrality insofar as Orange would understand it. Ofcom is certainly broadening the potential usage of the spectrum (although the extent to which the value of the spectrum may suffer from multiple technology usages thereby outweighing any benefits of this approach is clearly an issue). Ofcom is instead offering, at best, **quasi**-technology neutrality. This much is obvious from the fact that Ofcom is proposing allocating spectrum in 5 MHz blocks which is clearly more predisposed to some technologies rather than others, as well as the preservation of the 120 MHz duplex spacing for paired spectrum which could thwart the deployment of any other technology that requires a different duplex spacing.

The absence of rollout obligations are as Ofcom states an outcome of the 'technology neutral' approach that it has taken – clearly it would be meaningless for a PMSE operator and a mobile operator to have similar roll-out obligations. This is in itself a good example in terms of illustrating the issues with Ofcom's proposal for 'technology neutrality'. Whilst Ofcom undertakes its analysis with the supposition that PMSE may be a viable application in the 2 GHz spectrum, PMSE operators are not in practice going to be able to compete with telecoms operators for spectrum for PMSE usage, in particular in the 2.6 GHz band where they currently operate.

Whether it is by the market or Ofcom, ultimately in any award process technologies will be discriminated against – in choosing to pursue 'technology neutrality' Ofcom is merely leaving the process of discrimination to the market rather than making the judgment itself. Nonetheless it is clear that PMSE, despite in all probability not being able to pass the market's test (i.e. the technology which has the greatest economic value), still has significant cultural and social importance to the UK and by extension to its citizens and consumers. The market mechanism in this instance is not sophisticated enough to undertake account of this value to the UK. Whilst Ofcom is correct in saying therefore that PMSE operators cannot have roll-out obligations in the same way as e.g. mobile operators, it is in fact disingenuous to compare the two, given the extreme unlikelihood that PMSE will be awarded any of the 2.6 GHz spectrum under Ofcom's current proposals.

It would therefore be better for Ofcom to recognise that the 2.6 GHz spectrum is most valued by mobile and nomadic applications and should therefore be reserved for these services, with the possibility of rollout obligations, similar to 3G licence obligations, being introduced. Given that WiMax is likely to join the IMT family of standard anyway (and should therefore be able to use UMTS spectrum masks) there would appear to be few downsides for Ofcom to allocate the 2.6 GHz spectrum to IMT technology (without having to introduce its untried SUR concept) other than the fact that it will not be able to claim the award as 'technologically neutral'.

Further to this point Orange would contend that Ofcom's analysis as to whether there is potential for discrimination between the roll-out obligations incumbent on mobile operators and potential users of the 2.6 GHz spectrum is slightly disingenuous. Mobile operators have invested significant sums to grow the mobile market and meet coverage requirements. This success is subsequently attracting new entrants

² Recital 18, Directive 2002/21/EC on a common regulatory framework

looking to deploy potentially disruptive technologies to compete in the communications market.

Orange welcomes this given the benefits of competition to the customer and to the market in general. However, it is clear that in removing coverage obligations, Ofcom is enabling potential new market entrants in a way that it did not for 2G and 3G new entrants, by allowing them to compete off a lower cost base brought about by the absence of roll-out conditions. Orange welcomes competition but believes that the playing field must be equal for all and that it would be appropriate for roll-out conditions to be attached to licences for 2.6GHz that are assigned to IMT.

The issue of spectrum trading is from Orange’s perspective less problematic. If spectrum trading as a policy is to be enacted, it makes sense for any new award of spectrum to be tradable. Implicitly Ofcom also appears to be relying on spectrum trading to undo any potential market failures from the initial allocation. However, Orange would note that in practice trading may not be able to address all possible failures in initial allocation and should not be viewed as a panacea for initial mistakes in this process. Ofcom must not rely on untried secondary trading to correct all issues arising from the initial reward.

One such example as to the shortcomings of secondary trading to correct initial misallocation is in relation to change of use. If, for example, as in Figure 1 below all the 2.6 GHz spectrum was to be assigned to TDD applications, in practice trading is likely to be insufficient to enable any future move to FDD applications, given the possibility of there being different owners of spectrum at the relevant duplex spacing (e.g. 120Mhz).

Figure 1 – All 2.6 GHz spectrum assigned to unpaired

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
2500	2505	2510	2515	2520	2525	2530	2535	2540	2545	2550	2555	2560	2565	2570	2575	2580	2585	2590	2595	2600	2605	2610	2615	2620	2625	2630	2635	2640	2645	2650	2655	2660	2665	2670	2675	2680	2685
Operator 1						Operator 2						Operator 3						Operator 4						Operator 5						Operator 6							

It could be imagined that after the initial award, a new entrant may wish to acquire spectrum to offer UMTS FDD – in Figure 2 below from operators 1 and 5 as the holders of spectrum which is 120 MHz apart. However, unless this new operator were able to simultaneously negotiate acquisition of, for instance, 3 blocks of spectrum from operators 1 and 5 to pair them for an FDD application, in practice it would end up being forced to pay above normal market rates as it would be clear to the selling parties that their spectrum was not substitutable with any other spectrum, distorting the market. Alternatively operator 1 may wish to exit the market and be a willing seller whereas operator 5 may not, meaning that pairing spectrum for FDD use would again not be possible.

Figure 2 – TDD to FDD

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
2500	2505	2510	2515	2520	2525	2530	2535	2540	2545	2550	2555	2560	2565	2570	2575	2580	2585	2590	2595	2600	2605	2610	2615	2620	2625	2630	2635	2640	2645	2650	2655	2660	2665	2670	2675	2680	2685
Operator 1						Operator 2						Operator 3						Operator 4						Operator 5						Operator 6							

In short, Orange wishes to illustrate that trading is not a 'solve-all' solution to market inefficiencies or problems caused by the initial allocation of 2.6 GHz spectrum. Instead Ofcom should look to pre-empt any issues that can be envisaged now and not automatically assume that that an untried market mechanism (in an imperfect spectrum market) will correct all or any issues.

Question 8: *Do you have views on whether or not there should be a "safeguard" cap on the amount of spectrum that any one bidder could win in an award for the 2.6 GHz bands and, if so, do you have a view on whether 90 MHz would be an appropriate size for a safeguard cap?*

Orange recognises that, **theoretically**, a pure spectrum market should rely on *ex post* competition law to ensure that potentially dominant market player(s) do not act abusively by virtue of their spectrum holdings. However, as this is the first occasion where Ofcom is introducing its technology neutral approach and given that it would not be appropriate for Ofcom to introduce any further elements of experimentation or risk into the 2.6 GHz award, Orange believes that it is right that Ofcom should seek to cap *ex ante* the maximum amount of spectrum that one bidder could win in the award.

Given that it would appear to be justified for a cap to be introduced, the issue is then at what level this cap should be set. From Orange's perspective **the proposed cap of 90 MHz is extremely high**, and furthermore it has not been sufficiently justified by Ofcom. The only current justification provided by Ofcom is that 90 MHz has been selected as the appropriate cap as it is 50% higher than the "*largest individual requirement of which we are aware*".³

Orange would contend that this is an arbitrary means of selecting the level of the spectrum cap. If the largest requirement that has been identified is in the region of 60MHz, Orange would contend that this should be the basis of the spectrum cap. What is the benefit of enabling an operator to acquire 50% more spectrum than Ofcom itself recognises is likely to be needed – other than to enable potential acquisition of spectrum by spectrum brokers?

Furthermore Ofcom has not made it clear whether the cap would continue after the award of the spectrum – i.e. if the cap is an *ex ante* restraint on the amount of spectrum that can be held in the 2.6 GHz band after the award. If this is not Ofcom's intention and, subject to *ex post* competition law operators could acquire as much of the 2.6 GHz band they required, there would surely, by Ofcom's logic, be the ability for spectrum trading to address any additional requirements for a given operator. If an operator required more spectrum than the proposed spectrum cap then it could purchase this spectrum from other holders to make up this shortfall.

Orange would therefore propose that:

- The spectrum cap should be set at a maximum of 60 MHz
- Ofcom states explicitly that the 60MHz limit will be lifted on completion of the award, with the ability of spectrum trading (subject to competition law) to address any potential additional requirements.

³ P. 86, section 6.155

Question 9: *Do you agree with Ofcom's proposal to package spectrum as lots of 2 x 5 MHz for paired use and 5 MHz lots for unpaired spectrum and to allow the aggregation of lots by bidders?*

Orange does agree with Ofcom's proposals to package spectrum lots of 2 x 5 MHz for paired use and 5 MHz lots for unpaired spectrum, as these spectrum blocks are the most appropriate for the most likely technologies envisaged in this band. Orange would make the point that by determining the spectrum packaging in this way Ofcom is *de facto* moving away from its stated aim of technology neutrality as there could be numerous applications with the potential for innovation and consumer benefit which require spectrum to be packaged in different ways. By following the CEPT band plan in this regard Ofcom appears to be implicitly recognising the benefits of harmonisation, which makes its insistence that the award is technologically neutral somewhat puzzling.

It is furthermore critical that bidders should be allowed to aggregate lots contiguously up to the safeguard cap to be decided by Ofcom as per Question 8. What does not appear to be clear is how, under Ofcom's proposals bidders will have visibility of which lot they are bidding for. The 38 spectrum lots are not of equal value, given their distinct characteristics (e.g. proximity to band edge and adjacent interference, proximity to TDD/FDD neighbours) and Ofcom as such needs to be much more explicit in how operators will be able to avoid lots they do not wish to acquire. In particular, Orange is concerned that any FDD application adjacent to a TDD carrier – even with a guard band – would be seriously devalued by the potential intra-carrier interference.

Orange has commissioned an independent technical study (Annex 1) examining, *inter alia*, the spectrum packaging proposals from Ofcom and their potential technical ramifications (and consequent impact on valuations) – attached as Annex 1 to this response. This study shows that FDD operations need to be safeguarded with the definition of appropriate guard bands, emission constraints, the banning of reverse duplex operation, EIRP restrictions and base station coordination. Orange would therefore urge Ofcom to reconsider its proposals in light of this study's conclusions.

Question 10: *Do you agree with Ofcom's proposed approach to allow the respective amounts of paired to unpaired spectrum for the band 2500-2690 MHz to be varied (maintaining the 120 MHz duplex spacing and allowing additional unpaired spectrum, if needed, at the top end of the band)?*

Following Ofcom's assertion that the auction will be technology neutral, it is clear that it would be necessary for the auction process to allow varying amounts of paired and unpaired spectrum, including the possibility of all 190 MHz being allocated to unpaired applications. As detailed above, Orange does not necessarily agree that Ofcom's proposed technology neutral approach is the right one, but if this policy decision is to be made it is consequential that the auction process should be able to determine the amount of paired and unpaired spectrum.

Orange agrees that Ofcom is correct to maintain the CEPT band plan's 120 MHz duplex spacing. Clearly, again, however this is not in itself a technologically neutral approach and illustrates the confusion at the heart of Ofcom's proposals. Ofcom is recognising the benefits of harmonisation and resultant scale economies (that enable e.g. mass handset production and resultant consumer benefits) by maintaining the 120 MHz spacing. Given that Ofcom implicitly recognises the benefits of such harmonisation (and the risk unless the 120 MHz spacing is maintained that the UK

could miss out on such benefits) it is curious that Ofcom maintains that it is following a purely technologically neutral agenda. In short, Ofcom's policy appears to be to 'have its cake and eat it'.

Furthermore, Ofcom is by enforcing the 120MHz duplex spacing discriminating against potential paired applications that may require a different duplex spacing. In addition, as Orange has detailed above, in practice once the 2GHz spectrum is assigned to a particular use (e.g. FDD) it will be extremely difficult, regardless of spectrum trading to change that usage.

As per the detailed comments made in Annex 1, FDD operations need to be safeguarded with the definition of appropriate guard bands, emission constraints, the banning of reverse duplex operation, EIRP restrictions and base station coordination.

Question 11: *Do you agree with Ofcom's proposals for a 5 MHz restricted block between FDD and TDD neighbours and between TDD and TDD neighbours and with a modified out-of-band base station mask for second adjacent 5 MHz blocks?*

Orange believes that Ofcom's proposals for restricted use, rather than guard bands, are seriously flawed. Furthermore the definition of the restricted block is inconsistent in Ofcom's consultation documents⁴ meaning that it is difficult to ascertain the exact proposals or their meaning in this regard. To this end we have commissioned a technical study to examine these and other issues further, as per Annex 1.

In short however, Orange would recall that sharing studies have conclusively demonstrated that adjacent channel TDD / FDD sharing is not feasible, especially next to the FDD uplink.

The proposals appear, furthermore, to allow 'picocellular powers' in channels between FDD / TDD and TDD / TDD systems. As per Figure 16 of the consultation document, it is envisaged that EIRP levels of +28dBm/MHz will be permitted, equivalent to a total transmit power of around +34dB (assuming an isotropic antenna) in a 5MHz channel, rather higher than the +24 to +27dBm typical of UMTS picocellular base stations. In short Ofcom's proposals for picocellular powers between FDD / TDD and TDD / TDD systems are significantly higher than Orange's practical experience of picocellular EIRP levels, and that such 'restricted' use could therefore cause significant adjacent channel interference.

In contrast, the CEPT proposal for a guard band is sensible, and should be deviated from with great caution, as Ofcom would lose both the benefits of an interference-free regime and the benefits of harmonisation as detailed above. The proposal for restricted use as opposed to guard bands appears to be another example of Ofcom deviating from trusted spectrum management and policy methods, and instead proposing fairly radical experimentation in what, as it has recognised is potentially valuable spectrum.

Orange would maintain that the out-of-band (OOB) base station masks are clearly required, but there is some ambiguity as to what the values should be and whether they are feasible for all base station types. For further information please see section 2.5 of the report annexed to this response.

⁴ The terms 'restricted', 'constrained' and 'guard bands' appear to be used interchangeably.

Question 12: *Do you agree with Ofcom's proposals to award the 2010 MHz band as a single 15 MHz lot?*

Given the size of this block and its unsuitability to be subdivided Orange agrees that it would appear sensible to award the 2010 band as a single 15 MHz lot. Orange would contend that it is not immediately clear why the award of this block could not go ahead before the award of the main block of 2.6 GHz spectrum.

Question 13: *Do you agree with Ofcom's proposals to award the 2290 MHz band as a single 10 MHz lot?*

Again, given the size of the band and its unsuitability to be split this appears reasonable.

Question 14: *Do you agree with Ofcom's proposals to combine the award of the 2.6 GHz and 2010 MHz bands and to hold the award of the 2290 MHz band separately and in advance?*

Orange believes that the 2.6 GHz and 2010MHz bands should not be awarded in a single auction based on the current proposals because of the uncertainties in the usability of the spectrum under the proposed licence conditions and suitability of the auction process. The principle of SURs, technical restrictions to achieve sharing and the auction process all require further investigation, before trialling perhaps either with another band or a subset of this band.

Question 15: *Do you agree with Ofcom's proposals for a two-stage auction design for the 2.6 GHz and 2010 MHz bands?*

Orange makes the following comments on the assumptions that the issues detailed above are resolved prior to any auction of the 2.6 GHz spectrum. There are, in short, far too many issues requiring resolution or clarification for Ofcom to be considering at this point in time the intricacies of the auction design.

With this proviso in mind, Orange is generally concerned that the proposed auction methodology is yet another example of Ofcom treating the 2.6 GHz band spectrum as an experiment. Given the importance of this band, Orange would have thought that it would be appropriate for Ofcom to remove as many elements of uncertainty and experimentation as possible.

Nonetheless Orange contends that the auction is actually a three-stage process. The third stage is critical as it should allow undesirable channels to be avoided. Orange would propose that a form of second-price auction should be introduced into this third stage to allow undesirable assignments to be avoided. Without such a mechanism, operators have no comfort that they can avoid spectrum they do not value which commensurately undermines the whole auction process.

Furthermore, given that operators will not know what technologies are to be used until after the auction is finished, it is not clear how a precise valuation by bidders can be reached. In one possible outcome, if the 190 MHz were largely to be awarded to 4 WiMax operators and one UMTS FDD operator, assuming similar interference characteristics, the spectrum to the FDD operator in this example may be more valued than if all possible paired spectrum had been assigned to numerous UMTS

FDD operators. Operators will only be able to truly value the spectrum *ex post*, once the neighbouring spectrum proposed usage is known.

Orange has further concerns as to the auction design as follows. Firstly Ofcom has not detailed the proposed increments in the 'clock auction' nor detailed to what happens to these increments over the duration of the auction. It is not clear, for example, whether the increments will stay the same (therefore regressing in proportion to overall value) or will remain proportionately the same.

Whilst it is clear that further work on the auction design is required, Orange would suggest that Ofcom should first set about addressing the numerous uncertainties and points of clarification around the 2.6 GHz spectrum prior to further considering the auction's design. We look forward to further discussion and consultation on this issue.

Question 16: *Do you agree with Ofcom proposals to award the 2290 MHz band through a second price sealed bid auction?*

Orange has no specific comments in relation to the auction proposals for this band.

Question 17: *Do you have a preference for either of the two approaches to specifying technical licence conditions?*

At this point in time, given the current level of work undertaken and the uncertainties with Spectrum Usage Rights (SURs), Orange has a strong preference for the use of spectral power masks. Orange believes that there are significant problems with Ofcom's untried and untested proposals for SURs and that it would be reckless for Ofcom to proceed with allocation based on SURs prior to these issues being resolved. Many of Orange's concerns were raised in our response to Ofcom's Spectrum Framework Review⁵ and seemingly have yet to be addressed.

To this end Orange would contend that Ofcom should not be proceeding with untried SUR approach in such potentially important spectrum and that instead it would be more appropriate for the SUR approach to be trialled in other bands first. Orange has commissioned an independent report annexed to this response which highlights the considerable problems with Ofcom's proposed approach for SURs. The use of spectral power masks is therefore strongly preferred until problems highlighted in this report with the SUR/PFD technique have been resolved.

As a starting point, Orange would contend that whichever technique is chosen, initial power limits need to be set that are consistent with the protection afforded by the **current regime as a minimum**, even if that requires the imposition of suitable guard bands. Ofcom should not be proposing a new approach to specifying technical licence conditions that is not as effective as the current system. In addition, Orange would propose that Ofcom needs to set out more clearly and explicitly a cost-benefit analysis for any move to an SUR-based regime.

In particular, Orange believes that masks will always be needed to control spurious emissions, and the control of (near-in) out-of-band (OOB) emissions appears to only be practically feasible through the definition of similar masks. Base station coordination, considered in earlier reports must also be retained in some capacity,

⁵ <http://www.ofcom.org.uk/consult/condocs/sfr/responses/orange.pdf>

although the new procedures must be workable – coordinating with multiple parties at short notice would not be acceptable.

Question 18: *Do you have any comments on the transmitter spectrum masks defined below?*

Orange has a number of comments as follows. Firstly the OOB emission restrictions in channels offset by 10MHz (e.g. Figure 17 in the consultation document – 26dB) appear to be inconsistent with the additional isolation requirements identified by Masons in its technical report (40 to 60dB).

Another concern relates to User Equipment (UE) transmit power. The transmit mask for UE seems to assume UE transmit power up to +30 dBm. Orange would suggest however that +24 dBm, the current allowable UMTS maximum, is more realistic. Ofcom's proposals are problematic because by specifying the EIRP in dBm/MHz and by not (seemingly) excluding concatenation of the blocks to allow wider channel bandwidth to be used, it is permitting much higher average powers to be transmitted than are currently allowed today. For instance a system employing 20 MHz channel bandwidth would in theory be allowed to transmit at +37 dBm/5watts. However it can be easily envisaged that systems capable of supporting 100 MHz channel bandwidth will be developed which would permit +44 dBm/25watts. As such Orange would contend that **average** power levels above +24 dBm total power (regardless of bandwidth) are not generally reasonable for mobile devices.

Furthermore, Orange believes that operators must also know the maximum in-band power that can be transmitted in order to calculate receiver blocking characteristics of victim receivers at minimum coupling loss locations, based on total power received and not power spectral density.

An addition concern relates to Ofcom's analysis which seems to be based purely on UMTS channel bandwidth of 5 MHz, with the spectrum mask OOB limits specified out to 250% from the centre frequency of this 5 MHz channel (i.e. 12.5 MHz). This 250% value is typically the one used by 3GPP and is needed to cover the spectrum characteristics of a signal due to its own modulation, noise and spectral regrowth arising from non-linearities (in the Power Amplifier), and should be met with no additional RF filtering. The spectrum mask is defined, taking into account the allowable adjacent channel interference, so that a group of contiguous carriers (e.g. the whole of the current UMTS frequency allocation of 60 MHz) can be supported in the same base station without the use of any additional filtering on each carrier.

Spectrum mask OOB limits are therefore clearly proportional to channel bandwidth which the Ofcom proposal does not take account of (e.g. for a 20 MHz channel the OOB limit = 50 MHz from centre frequency not 12.5 MHz). The potential consequences of the current Ofcom proposal are that it seems to prevent the optimal deployment of Long Term Evolution (LTE) and probably WiMax in wider channel bandwidths than 5 MHz. On the other hand specifying the spectrum mask OOB limits in a manner proportional to bandwidth is very likely to lead to non-reciprocal interference limits between neighbours using different channel bandwidths with the wider channels causing more interference than narrower ones. Such non-reciprocal effects do not seem to be compatible with a technology neutral operating environment yet sticking with the current proposals would seem to hamper the deployment of future wider bandwidth systems. This dichotomy illustrates the difficulties with developing technical conditions that are truly technology neutral.

An additional comment is that the emissions allowed in the 'restricted' channels (see Figure 16) appear to be higher than would be considered 'typical picocellular' powers, and are likely to cause interference in adjacent channels being used by FDD technology.

Finally, the power masks also need to be extended to include restrictions on spurious emissions from other bands.

Question 19: *Do you have any comments on the SUR parameters defined below?*

Orange has annexed to this response an independent technical report which details a number of the problematic issues that are raised with the proposed move to SURs.

Orange would observe that the SUR parameters defined in the consultation document differ from those calculated by the independent study commissioned by Orange. The main factor driving this difference is the choice of propagation model (see Question 21). This difference highlights the pitfalls of attempting to define licence usage restrictions based directly on a combination of network/technology characteristics *and* the properties of the environment (calculated or measured) in which radio systems are to operate.

The PFDs to be applied to the guard channels between FDD and TDD systems (para 9.81 of the consultation document) are shown to be equal to those in the main channels. These should be reduced to reflect those PFD levels that would be expected when the channels are used as guard channels.

Question 20: *Do you have any comments on the SUR methodology and assumptions detailed in this annex?*

The report annexed to this report highlights a plethora of concerns relating to the proposed SUR/PFD methodology set out in this and previous consultations, and which to date Ofcom appears to have ignored. Specifically these concerns are:

- **PFD limits in principle:** PFD limits alone provide a blunt tool for controlling radio emissions, one which is not sufficiently sharp to take account of the complexity of issues raised by detailed technology and network configuration combinations that would be allowed with the current proposals.
- **Implementation:** many questions relating to the way in which the licences would be issued remain unanswered. The value of spectrum that is proposed to be auctioned is far too great for prototype techniques to be trialled.
- **Enforcement:** the proposals present very real technical and operational enforcement difficulties, which there is a danger Ofcom's field staff will not be in a position to overcome.

In particular section 3.5 of this report details a series of issues in relation to the SUR methodology and assumptions.

Orange's overriding concern is that responsible network operators will, according to the proposals laid out, be unable to maintain good quality networks at a reasonable and predictable cost because of unpredictable interference from networks operating in adjacent bands willing to accept a lower quality of service. This would severely

reduce the worth of the spectrum, and threatens to undermine the entire auction process.

Question 21: *Do you have any comments on the use of the Visualyse tool as described, on the assumptions or the propagation model proposed in this annex?*

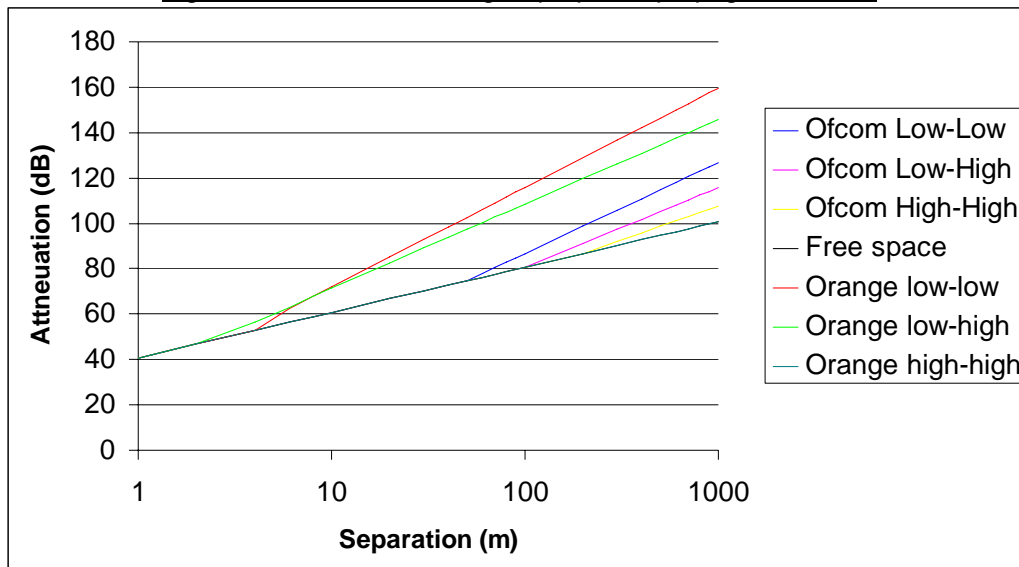
In relation to the Visualyse tool Orange's first comment is that Visualyse was initially developed to simulate satellite communications and so would therefore be able to present results in the form of PFDs. But any tool that has the agreed formulae, assumptions and parameters built in should be sufficient to calculate appropriate SUR parameters, as long as the systematic uncertainties in the resulting values in a cluttered ground-based environment are acknowledged.

In relation to the propagation model Orange does not believe that the propagation model that has been used by Ofcom⁶ is appropriate. This is significant because the proposed PFD limits are closely dependent on the model chosen. In particular:

- Predictions of path losses towards the edges of macro cells appear to be underestimated (by up to 30dB);
- The height dependency of path losses does not appear to have been modelled, particularly for a high-sited base station to base station.

Orange's proposes the use of Cost 231 Hata⁷ model, because it better models the variation of propagation loss with height, the predictions of which Figure 1.

Figure 1 - Ofcom and Orange's proposed propagation model

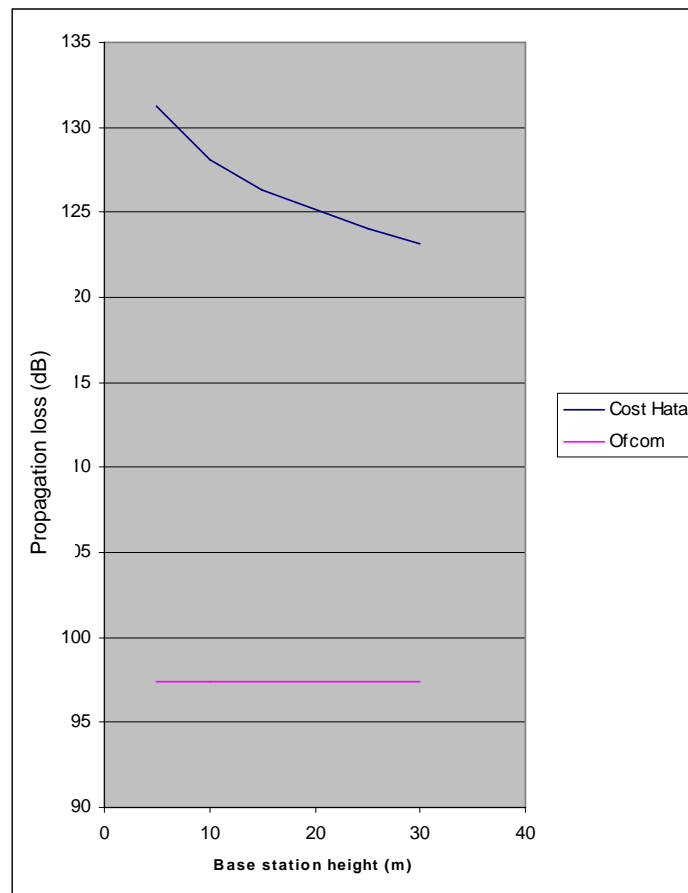


Predictions of variation of propagation loss with base station height are shown in Figure 2 below for both models.

⁶ Award of available spectrum: 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz, A12.21

⁷ Line of site visibility has been assumed for the high-high (base station to base station case), and where the Cost/Hata model predicts less than free space loss, free space has been substituted

Figure 2: Ofcom and Orange's proposed propagation model, variation with base station height (300m separation)



Agreement of appropriate propagation models (with alternatives for varying terrain types) should therefore be an imperative for Ofcom.

Question 22: *Do you have any comments on the assumptions detailed in this annex?*

The figures are based on 'typical' deployments, whereas the SUR parameters should consider worst case scenarios (plural), if going such a broad brush approach is to be adopted.

The FDD DL base station height of 10m may be typical for microcells, but for macrocells 25m is more usual, making them more vulnerable to interference from other radios, especially similarly placed (above rooftop) base stations.

Annex 1
Independent study commissioned from ICC on 'Spectrum Usage Rights in the 2.6 GHz band'