



**Solaris Mobile Limited Response to Ofcom Consultation**  
**“Authorisation of terrestrial mobile networks**  
**complementary to 2 GHz mobile satellite systems” Second**  
**Consultation**

*December 2008*



## **EXECUTIVE SUMMARY**

Solaris Mobile Limited (“SML”) welcomes the initiative undertaken by the Office of Communications (“Ofcom”) to determine how best to integrate the requirements of Decision 626/2008/EC (the “MSS Decision”) into their national regulatory framework.

SML has previously made a submission to Ofcom in the course of the first consultation.

Ofcom’s proposal regarding Administered Incentive Pricing (“AIP”) raises three questions:

1. Is it necessary to apply AIP on the 2GHz MSS radio spectrum used by CGC to achieve efficiency?
2. Has the method used to compute the AIP for the CGC spectrum been applied correctly?
3. Will the application of AIP by Ofcom and the use of administrative cost recovery charges elsewhere in the EU jeopardise European harmonisation?

For the first two questions the answer is No. For the third question the answer is Yes.

SML at this time maintains that usage fees applied to spectrum access licences for CGC should be done so on an Administrative Cost Recovery (“ACR”) basis. It is SML’s opinion that, given the limited number of potential licensees, ACR in conjunction with concurrent trading of spectrum rights is sufficient to ensure efficient use of MSS 2 GHz spectrum. The proposed application of licence fees based on the opportunity costs derived from GSM 1800 MHz spectrum is disproportionate, flawed and undermines the benefits of the ‘harmonised’ allocation of spectrum in the internal European market.



## **INTRODUCTION**

SML welcomes the work undertaken by Ofcom in establishing a national framework for 2 GHz MSS services in the UK, including those with a complementary ground component ("CGC"), which follows the adoption of the MSS Decision on the selection and authorisation of systems providing mobile satellite services by the European Parliament and Council. SML, a company jointly owned by SES Astra S.A. and Eutelsat S.A., will provide mobile satellite services ("MSS") in the 2 GHz MSS band, also known as the S-band, across Europe from early 2009, when SML expects to launch their S-band payload, SML-1. Recognising the necessity for spectrum and regulatory certainty in advance of operation, SML would encourage Ofcom and all European Union ("EU") Member States, and the European Commission ("EC"), to establish their own regulatory frameworks by that time.

## **PRELIMINARY DISCUSSION**

SML's network has been designed for the provision of broadcast and two-way multimedia services direct to vehicles, mobile satellite terminals and consumer handsets. While the business plan included by SML in response to the EC's call for applications<sup>1</sup> is derived entirely from MSS revenues, SML see the operational and commercial value of integrating CGC into their network.

In urban environments satellite line-of-sight blockages commonly limit MSS availability. A terrestrial network component can remove this problem and enhance the user experience, as has been witnessed through the success of Broadcast Satellite Services ("BSS") to mobile terminals<sup>2</sup>.

There is value in terrestrial cellular networks' increased spectrum efficiency over traditional MSS services, and the corresponding economies of scale such networks provide for consumers' service tariffs, user terminal equipment and handset pricing. CGC is attractive as an alternative platform for traffic in the event of a network outage on the satellite, and vice versa.

Under the MSS Decision, there is no obligation on applicants which are successful in the European Selection and Authorisation Process ("ESAP") to provide CGC. SML's network is designed with the intention of supporting CGC. While recognising the potential benefits of CGC, it is SML's intention only to deploy CGC in those EU Member States in which it makes sound commercial and operational sense.

In their previous consultation<sup>3</sup> on CGC, Ofcom proposed that an AIP of £554k per 2x1 MHz be applied to CGC licences in the UK. At that time Ofcom proposed to levy a CGC licence fee against the entire block of spectrum assigned to a given operator through ESAP. SML

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<sup>1</sup> Commission Administrative Procedures 2008/C 201/03

<sup>2</sup> Sirius XM Radio

<sup>3</sup> Authorisation of terrestrial mobile networks complementary to 2GHz mobile satellite systems of 15 January 2008



welcomes Ofcom's new proposal only to levy fees against that spectrum which is specifically used for CGC operations.

It is SML's understanding that spectrum usage fees collected from commercial licensees in the UK in the year up to the end of March 2008 amounted to £124.3m<sup>4</sup>. In the event of the ESAP concluding with two MSS operators selected to use 2 GHz spectrum, and each seeking to utilise 2x5 MHz for CGC, 2 x £5.54m would represent a further £11.08m of revenue or 8.2% of all fees collected. While SML recognises that Ofcom have yet to set the final value for these licences in the UK, SML views £554k per 2x1 MHz of spectrum for CGC as grossly disproportionate to the opportunity presented. This proposal represents neither an attractive commercial proposition nor a regulatory necessity for the selected MSS operator to deploy CGC in the UK.

SML notes that Ofcom have stated AIP shall apply to the spectrum used by CGC networks in the UK. SML disagrees strongly that AIP should be applied to the CGC networks' use of spectrum. We attach a report by Apex Economics (Dr. Chris Doyle) which provides a cogent and robust case against the application of AIP in this case. SML also agrees with the alternative proposal of forbearance set out in the Apex Economics report. Until Ofcom are better informed about underlying spectrum values regarding CGC networks' use of radio spectrum, forbearance would be best implemented by fees determined in accordance with administrative cost recovery. Ofcom should only re-visit the issue of fees for CGC networks use of spectrum once it is better informed through the usual channel of a public consultation. SML would also like to draw to the attention of Ofcom that their application of the Smith-NERA method to compute AIP for CGC networks' use of spectrum is flawed. This is demonstrated in the attached Apex Economics report.

As the report shows, Ofcom's proposals raise three questions:

1. Is it necessary to apply AIP on the 2GHz MSS radio spectrum used by CGC to achieve efficiency?
2. Has the method used to compute the AIP for the CGC spectrum been applied correctly?
3. Will the application of AIP by Ofcom and the use of administrative cost recovery charges elsewhere in the EU jeopardise European harmonisation?

For the first two questions the answer is No. For the third question the answer is Yes.

Concurrent trading of spectrum rights ought to achieve the efficiency desired by Ofcom and therefore make the need for AIP redundant.

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<sup>4</sup> Section 499 Licence Fees and Penalties Account Year ended 31 March 2008, Ofcom June 2008



Ofcom have incorrectly applied their method to compute the AIP value because it has not taken due account of constraints in Decision 626/2008/EC. Ofcom assert that AIP should be equivalent to the level set for the 2G mobile network operators. The proposal to set AIP at this level is shown to be wrong and consequently detrimental.

As it is likely that Member States elsewhere in the EU will apply cost recovery charges for the CGC spectrum, the Apex Economics report shows that economic theory can support the application of such charges in the UK. In addition to the economic case, adopting the approach of cost recovery will be more compatible with the aim of the single market and should promote greater harmonisation in the EU.

In short, the report argues that Ofcom are wrong to apply AIP to the CGC spectrum and that they incorrectly apply the Smith-NERA method to assess the level of AIP for CGC spectrum. The application of AIP in the UK by Ofcom is also likely to be detrimental for the single European market, in particular jeopardising the prospects of pan-European MSS operations.

SML fully agrees with the economic and other arguments set out in the report – see Appendix.



## ANSWERS TO QUESTIONS

*Question 1: Do you agree with our proposals for the detailed terms and conditions of the CGC Licence set out in this document or have you any other comments on the issues raised in this document?*

SML agrees with Ofcom's proposal to authorise spectrum access licences for CGC operations. As Ofcom have noted, draft CGC standards are currently under consideration at the European Telecommunications Standards Institute ("ETSI")<sup>5</sup> and SML prefers to wait until the conclusion of this activity before stating a preference as to how transmission rights are defined.

SML, however, does not agree with Ofcom's intention to apply the principle of AIP to the spectrum access licences for CGC while also intending for the 2 GHz MSS spectrum for CGC in the UK to be tradable, subject to the constraints in the MSS Decision. SML believes that the possibility to trade concurrently the 2 GHz CGC spectrum negates the necessity for AIP, and that a licence fee based on ACR is more appropriate.

SML understands that the majority of other national regulatory authorities ("NRAs") plan to levy licence fees based on ACR. If the UK adopts CGC licence fees based on an 'artificially' high AIP, whilst other NRAs adopt an approach based on ACR (resulting in much lower licence fees) it is possible that the satellite licensee for 2 GHz will not deploy CGC in the UK. This would defeat the harmonised European approach for spectrum allocation adopted by the MSS Decision resulting in a fragmented European market, and economic and social disadvantages for UK consumers. Even if Ofcom were to maintain that it is correct that they should apply AIP – which SML rejects for the reasons already stated - Ofcom are yet to decide on the level of AIP to be applied to CGC. Ofcom are under a statutory duty to give due consideration to identifying the correct 'opportunity' cost associated with the 2 GHz MSS spectrum. In such a situation, while still maintaining and reserving its position that AIP is not appropriate for this spectrum, SML would contend that a low (that is, minimal), level of AIP should be similar to the level of ACR as considered by the other NRAs in the European Union. Decision 2007/98/EC<sup>6</sup> allocates the 1980 – 2010 MHz and 2170 – 2200 MHz frequency bands to MSS, including those incorporating a CGC. The MSS Decision defines the ESAP for identifying successful 2 GHz MSS applicants and resulting in publication of a selection decision in the Official Journal of the European Union ("OJ"). This decision is binding on all EU Member States. To that end, any alternate use of the spectrum is restricted to a non-interference and non-protection basis diminishing the opportunity cost.

When calculating the level of AIP to be applied to 2 GHz CGC spectrum, Ofcom should reference the MSS infrastructure, CGC channel size and the operational constraints and

<sup>5</sup> DEN/SES-00283-1

<sup>6</sup> Commission Decision of 14 February 2007 on the harmonised use of radio spectrum in the 2GHz bands for the implementation of systems providing mobile satellite services

obligations imposed by the MSS Decision and the guidance provided to NRAs in relation to administrative charges by Directive 2002/20/EC<sup>7</sup>.

SML believes that these constraints and guidelines were not taken into account at the time of Ofcom's original consultation on CGC. SML believes that setting AIP at a level equivalent to those set for second generation public wireless networks in the 1800MHz band is inappropriate. MSS operators are unlikely to use channel sizing of 200 kHz for their CGC network. It is thought that the channel sizing for CGC networks will be more akin to those used in W-CDMA networks. Further, CGC network architecture is essentially different to that deployed for 2G networks in the 1800 MHz band, as is mandated by the MSS Decision<sup>8</sup>.

The MSS Decision makes it clear how S-band spectrum is to be used. In this regard it is significant that it is not permitted to use the S-band for purposes other than for MSS/CGC. If Ofcom were to apply AIP, therefore, they would have to do so in that context: recognising a zero opportunity cost for other uses of the spectrum. SML has previously made this point in our submission of 25 March 2008. In answer to question 10 we said:

*As indicated above, the opportunity cost for the 2 GHz MSS bands cannot be based on terrestrial cellular networks as the best alternative use, as such systems cannot be deployed under the current regulations. This approach should therefore not be used as a basis for setting spectrum usage fees for CGC.*

Further, as Ofcom are proposing to allow concurrent spectrum trades of the spectrum, SML notes that AIP is unnecessary and that in effect this implies a zero AIP. SML views this solution as optimal and consistent with Ofcom's statutory obligations.

As importantly, if Ofcom were to apply an AIP while other NRAs do not, or if Ofcom apply AIP to a level incongruous with other NRAs, Ofcom would not fully take into account the requirements set out in Article 8 of Directive 2002/21/EC<sup>9</sup> or their objectives under the Communications Act 2003 let alone the development of the internal European market.

Article 8 of Directive 2002/21/EC states that NRAs shall take proportionate measures to ensure no distortion or restriction of competition and shall encourage efficient investment in infrastructure and promotion of innovation. Additionally, NRAs are to contribute to the development of the internal European market.

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<sup>7</sup> Authorisation Directive of 7 March, 2002

<sup>8</sup> CGC shall as required by this Decision (Title III, Authorisation, Article 8, Complementary ground components, Paragraph 3(b)) : "... constitute an integral part of a mobile satellite system and shall be controlled by the satellite resource and network management mechanism; they shall use the same direction of transmission and the same portions of the frequency bands as the associated satellite components and shall not increase the spectrum requirements of the associated mobile satellite system;"..

<sup>9</sup> Framework Directive of 7 March 2002. Article 8 requires that national regulatory authorities shall *inter alia*: promote competition; contribute to the development of the internal market; and promote the interests of citizens of the European Union.



Under the Communications Act 2003, Ofcom should ensure optimal use of spectrum in the UK and availability of spectrum across the UK. The principles Ofcom are required to apply to meet these objectives must be proportionate and consistent. Additionally, Ofcom should have regard, when meeting the objectives stated above, to promoting and facilitating investment and innovation. For the reasons stated above, Ofcom would meet these requirements and those set out in Article 8 of Directive 2002/21/EC by applying ACR as it is intended by the other European regulatory authorities.

*Question 2: Do you agree with our proposed approach for including the conditions imposed by Decision No 626/2008/EC in the CGC Licence?*

SML generally concurs with Ofcom's interpretation and proposals for implementation of Title III of the MSS Decision detailing the "Authorisation" of applicants by EU Member States.

The MSS Decision does not require Ofcom to implement an authorisation process. Title III, Article 7 of the MSS Decision simply dictates that operators must have the right to use the specific radio frequency in the Commission decision adopted pursuant to Articles 5(2) or 6(3) of the MSS Decision and the right to operate a mobile satellite system.

MSS systems are not currently subject to authorisation by Ofcom, as stated in section 6.7 of the Consultation Document, and it is not clear to SML why such an authorisation needs to be introduced.

The reasoning set out in section 6.6 of the Consultation Document states that the common conditions defined by Article 7(2) of the MSS Decision cannot be captured within licensing arrangements for CGC. However, SML believes the common conditions could more efficiently be captured in the licence exemption for MSS 2 GHz handsets, and would provide an operator with right of use of the frequencies identified for that operator under the selection decision. This would avoid the need for a Statutory Instrument and further consultation by Ofcom.

SML concurs with Ofcom's interpretation of Title III, Article 8 of the MSS Decision addressing CGC authorisations. It is clear that operators are free to select spectrum for CGC from the same portions of frequency bands as the associated MSS system. It is, however, important to recognise that the volume and portions of spectrum used by an operator may vary over time. To that end, while recognising the importance of protecting services in adjacent bands, it would be better not to refer to specific frequency bands for operation with CGC.

*Question 3: Do you believe that the technical parameters used to define transmission rights should be based on spectrum usage rights or spectrum masks?*

Any approach adopted by Ofcom should be in line with any European Communications Committee (ECC) or ETSI technical standards for CGC base stations.

SML has no objection in principle to the application of Spectrum User Rights ("SUR") for CGC spectrum access licences and recognises the potential advantage this approach offers.





However, without knowledge of the number of licensees, a precise channel plan, and the adoption of the ETSI standard for CGC base stations currently under draft, it is not appropriate to arrive at a final conclusion. SML nonetheless concurs with the approach proposed by Ofcom for in-band and out-of-band aggregate power flux densities over a pre-defined geographical area hosting at least ten transmitters.

*Question 4: Do you agree with our proposed SUR parameters for CGC?*

SML has no objection to the proposed SUR parameters proposed by Ofcom for CGC. As noted in the answer above, SML would prefer to wait until the number of licensees, a precise channel plan and the final conditions of the ETSI standard for CGC base stations are known before commenting on the values of the parameters proposed. As identified by Ofcom in the consultation document, these parameters can and, SML believes would, impact the levels of interference of a given channel. Further, SML recognises that the application of SUR for CGC spectrum access licences may potentially afford the CGC network operator with greater flexibility in their spectrum channel plan over a spectrum masks approach.

*Question 5: Do you agree with the spectrum masks parameters proposed?*

SML has no objection with the proposed spectrum masks parameters for CGC proposed by Ofcom. As in the two answers above, SML believes there are factors that need to be understood before SML can agree completely.

*Question 6: Do you agree with the proposed changes to the other standard technical licence terms and conditions?*

SML agrees with the proposed changes to the other standard technical licence terms and conditions.

*Question 7: We have assumed that the CGC base station and user terminal characteristics will be similar to those for equivalent 3GPP equipment. Specifically, we have assumed a maximum transmitted power of 31 dBm/5MHz for CGC handsets, and a maximum transmitted power of 61 dBm/5MHz for CGC base stations. Do you agree these are reasonable assumptions?*

SML agrees that these are reasonable assumptions.

*Question 8: We have based our analysis of compatibility between CGC and other radio systems on studies of analogous scenarios conducted for the 2.6 GHz award – do you agree with this assumption?*

SML agrees with this assumption.

*Question 9: Do you have any comments on the assumptions of the deployed network modelled for the SUR parameters?*



SML agrees with the modelling assumptions Ofcom have used to model the SUR.

# **The 2GHz MSS bands, CGC and AIP: A Critique of Ofcom's Proposals and an Alternative Policy Proposal**

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1 December 2008

## **Abstract**

Ofcom has proposed the application of AIP to CGC spectrum use by MSS operators in the UK. In this paper I argue that AIP are not necessary to achieve efficiency, as concurrent trading possibilities are an adequate substitute for AIP. Furthermore, Ofcom's calculation of the proposed AIP is flawed and this could cost the UK economy over £1 billion in value. I also argue that the application of AIP in the UK undermines the objective of a single market in the EU. I propose an alternative policy of forbearance with regard to fees and use of spectrum by CGC networks. Over the foreseeable future Ofcom should adopt a policy of administrative cost recovery alongside the proposed concurrent spectrum trading. This alternative approach is consistent with past statements made by Ofcom with regard to the application of AIP, supported by economic principles and in line with single market and harmonisation objectives of the EU.

## About Apex Economics

Apex Economics provide economic consulting services in the fields of economic regulation and competition policy relevant to the broadcasting, radio spectrum and telecoms sectors.

We have over 15 years of providing economic and business consulting experience to numerous corporate and government clients. Apex Economics has also provided expert testimony in Ireland and the United States.

Led by Dr. Chris Doyle, former Director of Telecoms at London Economics and Vice President and Head of the Telecoms practice at Charles Rivers Associates (UK) Ltd, Apex Economics serves clients facing regulatory challenges.

Dr. Doyle is also an Associate of the Centre for Management under Regulation at Warwick Business School and an Associate Fellow in the Department of Economics at Warwick University in the United Kingdom.

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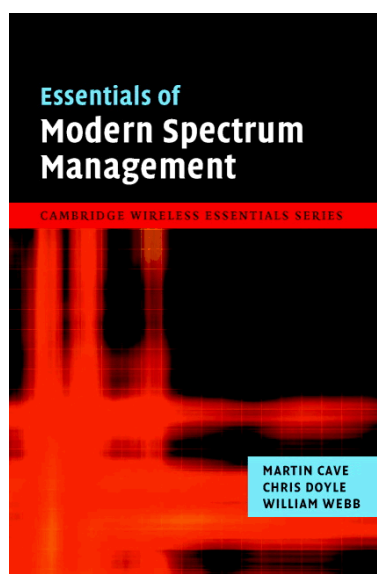
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## About Chris Doyle

Chris Doyle is an economic consultant who has written extensively on the economic management of radio spectrum. He is the co-author, along with Professors Martin Cave and William Webb, of the textbook *Essentials of Modern Spectrum Management* published by Cambridge University Press in 2007.



Chris was a key member of the consulting team that advised Ofcom in 2003/4 on the setting of Administered Incentive Prices (AIP).

He wrote substantial parts of the Indepen Report 2004<sup>1</sup>, and made a number of presentations to officials and stakeholders at the then Radiocommunications Agency and Ofcom.

He has also provided advice on spectrum pricing to the Dutch Ministry of Economic Affairs and to a number of other clients.

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<sup>1</sup> See "An economic study to review spectrum pricing", Indepen, Aegis Systems and Warwick Business School, a report for Ofcom, February 2004:  
[www.ofcom.org.uk/research/industry\\_market\\_research/m\\_i\\_index/spectrum\\_research/independent](http://www.ofcom.org.uk/research/industry_market_research/m_i_index/spectrum_research/independent)

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## Abbreviations used

AIP	Administered Incentive Prices
CGC	Complementary Ground Components
ESAP	European Selection and Authorisation Process
EU	European Union
MSS	Mobile Satellite Services
WTA	Wireless Telegraphy Act 2006

## Executive Summary

This paper has been commissioned by Solaris Mobile Limited and is a critique of Ofcom's proposals to apply Administered Incentive Prices (AIP) on spectrum used in the UK by operators of Mobile Satellite Systems (MSS) operating in the frequency bands 1980-2010MHz and 2170-2200MHz (the 2 GHz MSS bands). MSS operators may use the MSS bands in the UK to support Complementary Ground Components (CGC).

In this paper I argue that Ofcom is wrong to apply AIP to the CGC spectrum and that it applies incorrectly the method for assessing AIP for CGC spectrum. As a result the proposed AIP could cost the UK economy over £1 billion in value. The application of AIP in the UK by Ofcom is also likely to be detrimental for the single European market, in particular jeopardising the prospects of pan-European MSS operations.

Ofcom's proposal regarding AIP raises three questions:

1. Is it necessary to apply AIP on the 2GHz MSS radio spectrum used by CGC to achieve efficiency?
2. Has the method used to compute the AIP for the CGC spectrum been applied correctly?
3. Will the application of AIP by Ofcom and the use of administrative cost recovery charges elsewhere in the EU jeopardise European harmonisation?

For the first two questions I answer No. For the third question I answer Yes.

Concurrent trading of spectrum rights ought to achieve the efficiency desired by Ofcom and therefore make AIP redundant.

Ofcom has incorrectly applied its method to compute the AIP value because it has not taken due account of constraints in Decision 626/2008/EC. Ofcom asserts that AIP should be equivalent to the level set for the 2G mobile network operators. The proposal to set AIP at this level is shown to be wrong and consequently detrimental.

I propose an alternative and superior policy with regard to the setting of fees for the CGC spectrum is forbearance. Ofcom should forbear from applying AIP until it is better informed. This approach has the merit of allowing spectrum trading unfettered time to function and is consistent with Ofcom's past policy with regard to the application of AIP:<sup>2</sup>

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<sup>2</sup> Para 4.1.3 in Ofcom (2004), "Spectrum Pricing: A consultation on proposals for setting wireless telegraphy act licence fees", 29 September 2004.



“Ofcom considers it better to wait to get a market valuation of this additional spectrum and then assess the implications for existing mobile spectrum, rather than second-guess the impact.”

I argue that support for a policy of forbearance from applying AIP derives from at least three sources:

1. Informational constraints – Ofcom is not positioned at this stage to assess precisely or confidently the marginal value of CGC spectrum to a typical MSS operator, and past statements made by Ofcom suggest a policy of waiting until better information is obtained is superior;
2. Economic principles – the theory of the second best lends support to fees which are not in accordance with ‘first best levels’ (which arguably AIP seek to proxy); and finally
3. European harmonisation – EU policies with regard to the single market and the harmonisation of regulation.

# 1. Introduction

I have been commissioned by Solaris Mobile Limited to comment on Ofcom's proposal to apply Administered Incentive Prices (AIP) on spectrum used in the UK by operators of Mobile Satellite Systems (MSS) operating in the frequency bands 1980-2010MHz and 2170-2200MHz (the 2 GHz MSS bands). MSS operators may use the MSS bands in the UK to support Complementary Ground Components (CGC).<sup>3</sup>

The award of the 2GHz MSS spectrum is coordinated at a European level and a European Selection and Authorisation Process (ESAP) has been determined in accordance with Decision 626/2008/EC.<sup>4</sup> I note that this Decision is binding on the UK.

Article 9(1) of Decision 626/2008/EC states:

“Selected operators shall be responsible for compliance with any conditions attached to their authorisations and for payment of any applicable authorisation and/or usage fees and charges as required by laws of Member States.”

It would appear that Ofcom has a right to attach conditions to authorisations including terms relating to usage fees. Ofcom has proposed to apply AIP on the CGC spectrum in the UK.

**In this paper I argue that Ofcom should not apply AIP to the CGC spectrum. I also show that Ofcom's position of ignoring constraints in Decision 626/2008/EC means that it incorrectly calculates AIP for the CGC spectrum. As a result the proposed AIP could cost the UK economy over £1 billion in value. The application of AIP in the UK by Ofcom is also likely to be detrimental for the single European market, in particular jeopardising the prospects of pan-European MSS operations. I suggest a better policy would be one of forbearance, whereby Ofcom**

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<sup>3</sup> CGC are formally defined in Decision 626/2008/EC (see note 3 below) as: “complementary ground components’ of mobile satellite systems shall mean ground-based stations used at fixed locations, in order to improve the availability of MSS in geographical areas within the footprint of the system’s satellite(s), where communications with one or more space stations cannot be ensured with the required quality.” CGC are therefore equipment used terrestrially to enhance the service provision by a MSS provider. It is also required in the Decision that “complementary ground components shall constitute an integral part of a mobile satellite system and shall be controlled by the satellite resource and network management mechanism; they shall use the same direction of transmission and the same portions of frequency bands as the associated satellite components and shall not increase the spectrum requirement of the associated mobile satellite system;”.

<sup>4</sup> DECISION No 626/2008/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 June 2008 on the selection and authorisation of systems providing mobile satellite services (MSS) available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:172:0015:0024:EN:PDF>

**applies administrative cost recovery fees on the CGC spectrum used in the UK over the foreseeable future.**

I argue that support for a policy of forbearance from applying AIP derives from at least three sources:

1. Informational constraints – Ofcom is not positioned at this stage to assess precisely or confidently the marginal value of CGC spectrum to a typical MSS operator, and past statements made by Ofcom suggest a policy of waiting until better information is obtained is superior;
2. Economic principles – the theory of the second best lends support to fees which are not in accordance with ‘first best levels’ (which arguably AIP seek to proxy); and finally
3. European harmonisation – EU policies with regard to the single market and the harmonisation of regulation.

## 2. Ofcom's January 2008 CGC consultation

Ofcom published a consultation document<sup>5</sup> dealing with the authorisation of CGC spectrum use by MSS operators on 15 January 2008 in which it stated:<sup>6</sup>

“We should apply Administered Incentive Pricing (AIP) to licences awarded for CGC in order to encourage efficient use of spectrum. We should set AIP at a level consistent with current rates of AIP for other comparable bands around 2GHz. We consider the relevant benchmark rates to be in the region of £554,000-713,000 per 2x1MHz, and propose a rate of around £554,000 per 2x1MHz.” (Emphasis added)

As the CGC spectrum bands are adjacent to spectrum bands used by mobile applications, Ofcom has argued that the spectrum would be viewed by mobile operators as a close substitute.

The comparator proposed by Ofcom to determine the AIP charge level for the CGC spectrum is the AIP charged for use by Public Wireless Networks in the 1717-1880 MHz band (the 2G 1800MHz operators).<sup>7</sup>

On this basis an MSS operator seeking up to 2x15MHz of 2GHz MSS spectrum for CGC use would face an annual usage charge of £8.3m. In current prices this would be almost a £150 million spectrum usage charge over an 18 year licence period.

The amount proposed for usage of 2GHz MSS spectrum in the UK is substantial and runs the risk of handicapping the success of MSS businesses and the use of CGC in the UK.

Using conservative assumptions, I estimate that the net benefit of the CGC component of the MSS businesses in the UK could amount to around £65 million per year, or £1.17 billion in current prices over an 18 year licence period.<sup>8</sup> The proposed application of AIP might lead MSS operators in the UK not to invest in the CGC element of the business. If this were the case, the economy could lose over £1 billion in value.

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<sup>5</sup> “Authorisation of terrestrial mobile networks complementary to 2 GHz mobile satellite systems”, Ofcom Consultation 15 January 2008, [Referred hereafter as Ofcom (2008a)].

<sup>6</sup> Ofcom (2008a) page 1.

<sup>7</sup> Para. 8.28 in Ofcom (2008a).

<sup>8</sup> I have used data on the net impact of radio spectrum in the UK as estimated by Europe Economics for Ofcom, see [http://www.ofcom.org.uk/research/radiocomms/reports/economic\\_spectrum\\_use/](http://www.ofcom.org.uk/research/radiocomms/reports/economic_spectrum_use/). I assume that the CGC element of an MSS operation would comprise 15% of the value of the business and that an MSS operator's business would deliver 2% of the value provided by Public Wireless Networks as calculated in Europe Economics (2006) “Economic impact of the use of radio spectrum in the UK”, a report for Ofcom, 16 November 2006.

**Ofcom's proposal to set AIP for CGC spectrum on MSS operators in the UK at levels on a par with 2G 1800MHz mobile operators could result in the UK losing over £1 billion in value.**

In the year up to end March 2008, spectrum usage fees collected from commercial licensees in the UK amounted to £123.3m.<sup>9</sup> The AIP applied to MSS operators could raise as much as £16.6m per year.

**MSS operators venturing into a new market facing considerable risks are expected to pay an amount in excess of 13% of the current fees raised from the many established commercial users of radio spectrum in the UK.**

Ofcom's proposal regarding AIP raises three questions:

1. Is it necessary to apply AIP on the 2GHz MSS radio spectrum used by CGC to achieve efficiency?
2. Has the method used to compute the AIP for the CGC spectrum been applied correctly?
3. Will the application of AIP by Ofcom and the use of administrative cost recovery charges elsewhere in the EU jeopardise European harmonisation?

For the first two questions I answer No. For the third question I answer Yes. My reasoning is presented below.

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<sup>9</sup> See "Section 400 Licence Fees and Penalties Account Year ended 31 March 2008", Ofcom June 2008 available at [http://www.ofcom.org.uk/about/accoun/reports\\_plans/annrep0708/section400.pdf](http://www.ofcom.org.uk/about/accoun/reports_plans/annrep0708/section400.pdf)

### 3. Are AIP necessary for the CGC spectrum?

Ofcom proposes to apply AIP on the CGC spectrum to encourage efficient use of the spectrum. More generally Ofcom's policy has been to apply AIP on spectrum not awarded by way of auction. In this chapter I focus on the question of whether there is a need to apply AIP to achieve efficient use of the spectrum.<sup>10</sup>

AIP are at best an imperfect mechanism for promoting efficiency. They rely on judgements made by regulators and are consequently prone to a margin of error. Spectrum trading and competitive spectrum markets are superior non-regulatory mechanisms which are also consistent with efficiency objectives.

It is surprising that Ofcom is seeking to apply AIP on CGC spectrum and at the same time proposing to make the spectrum tradable subject to constraints in Decision 626/2008/EC.<sup>11</sup> The constraints in Decision 626/2008/EC are such that trading of the CGC spectrum could only take place among MSS operators and the number of such operators will be four or less.

The fact that there will be a small number of MSS operators is important. It is well known that the Coase Theorem<sup>12</sup> is more likely to hold in practice when the number of entities engaged in potential trades is relatively small.<sup>13</sup>

**Given the certain prospect of no more than four MSS operators using CGC spectrum in the UK, I contend that the possibility of spectrum trading would be sufficient for efficiency and hence is a substitute for AIP. The possibility to trade concurrently 2GHz MSS spectrum used for CGC in the UK obviates the need for AIP, as spectrum trading possibilities would be a substitute for AIP. I contend that spectrum trading for this spectrum is a valuable tool in promoting efficient spectrum use.**

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<sup>10</sup> I address AIP in greater detail in the following chapters.

<sup>11</sup> Ofcom has stated that concurrent trading of the spectrum will be permitted, where rights may be total or partial. See paras. 5.36-37 in "Authorisation of terrestrial mobile networks complementary to 2 GHz mobile satellite systems: A statement and second consultation on proposals for authorisation of 2 GHz MSS Complementary Ground Components (CGC)" Statement & Second Consultation, 3 November 2008, [Referred hereafter as Ofcom (2008b)].

<sup>12</sup> In law and economics, the Coase theorem, attributed to Ronald Coase, describes the economic efficiency of an economic allocation or outcome in the presence of externalities. The theorem states that when trade in an externality is possible and there are no transaction costs, bargaining will lead to an efficient outcome regardless of the initial allocation of property rights. In practice, obstacles to bargaining or poorly defined property rights can prevent Coasian bargaining. See [http://en.wikipedia.org/wiki/Coase\\_theorem](http://en.wikipedia.org/wiki/Coase_theorem) and Ronald H. Coase (1960) "The Problem of Social Cost." *Journal of Law and Economics*. 3.

<sup>13</sup> Small numbers have been demonstrated to be of significance in the attainment of outcomes compatible with the Coase Theorem in the water sector, see Ruml, C. Carter, "The Coase Theorem and Western U.S. Appropriative Water Rights". *Natural Resources Journal*, Vol. 45, No. 1, February 2005. Available at SSRN: <http://ssrn.com/abstract=539023>.

Ofcom has asserted, however, that spectrum trading will not be sufficient on its own:<sup>14</sup>

“On the issue of the principle that tradable licences should not be subject to AIP, Ofcom has previously consulted on this specific issue and concluded in its statement on Spectrum Trading that AIP should continue to apply for tradable spectrum. Ofcom reached this conclusion as it is concerned that spectrum trading alone, while an important aid to more optimal use of the spectrum, may not be fully effective at promoting efficiency. Ofcom considers therefore that for the foreseeable future the benefits of maintaining AIP should exceed the costs.”

I note that the consultation on spectrum trading referred to in the above statement took place in 2004, almost five years ago.<sup>15</sup> Furthermore, the view that trading will be insufficient on its own to achieve efficiency is weak, in that Ofcom states “it may not be fully effective”.

The possibility for spectrum trading makes efficiency gains more likely in practice than the application of AIP calculated by Ofcom.

If Ofcom were to assess more closely the nature of the CGC spectrum and the fact that the number of licence holders eligible to trade will be very small, it ought to form a view that trading will be an adequate substitute for AIP.

**I dispute Ofcom’s view that in the foreseeable future the benefits of maintaining AIP should exceed the costs. Given concurrent spectrum trading ought to deliver the efficiency gains possible, taking account of Decision 626/2008/EC, AIP will in practice serve only to inflate the cost base of MSS operations to the detriment of consumers and the UK economy.**

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<sup>14</sup> Para. 5.67, Ofcom (2008b).

<sup>15</sup> “A Statement on Spectrum Trading: Implementation in 2004 and beyond”, Ofcom Statement, 6 August 2004.

## 4. Spectrum charges and efficiency

Section 13 of the Wireless Telegraphy Act 2006 (WTA) permits Ofcom to recover sums greater than those it incurs in performing its spectrum management functions.

In practice Ofcom has applied AIP as a charging mechanism which yields revenue above management cost and takes into account a number of objectives set out in Section 3 of the WTA:

“must also have regard, in particular, to the desirability of promoting—

- (a) the efficient management and use of the part of the electromagnetic spectrum available for wireless telegraphy;
- (b) the economic and other benefits that may arise from the use of wireless telegraphy;
- (c) the development of innovative services; and
- (d) competition in the provision of electronic communications services.”

Ofcom appears to refer to the above objectives collectively as efficiency objectives and relates the achievement of these objectives directly to the application of AIP.<sup>16</sup> I agree that the interpretation of the above objectives is consistent with the concept of efficiency in economics:

- “efficient management and use” – is what economists term *productive efficiency*;
- “economic and other benefits” – is what economists would term *allocative efficiency and externalities*; and
- innovation – is what economists term *dynamic efficiency*.

The setting of AIP may entail conflict between some of the efficiency objectives. AIP in particular are suited to achieving productive efficiency and it is less clear how effective they are at achieving allocative and dynamic efficiency objectives.

Notwithstanding Section 13(2) of the WTA does not state that charges in excess of cost recovery should meet all of the efficiency objectives set out in Section 3 of the WTA.

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<sup>16</sup> For example, see A5.7 in Ofcom (2008a).



## 5. AIP and efficiency

If effectively competitive markets for radio spectrum existed in the UK, the efficiency objectives outlined in the previous chapter would be achieved without the need for Ofcom to compute and apply spectrum charges such as AIP.

Although Ofcom has embarked on a process of liberalisation of spectrum markets with a view to promoting effectively competitive markets, in practice the majority of spectrum is subject to AIP.<sup>17</sup>

Ofcom published a statement on spectrum pricing in 2005 (Ofcom (2005)) in which it provided a clear position on the application of AIP, emphasising reliance on opportunity cost measures.<sup>18</sup> I support this interpretation.

In Ofcom (2005) it is also remarked that the opportunity cost used to evaluate AIP ought to reflect all possible uses of the radio spectrum and not just current or incumbent uses:<sup>19</sup>

“In determining appropriate spectrum prices under AIP, fees are set to equal the marginal value of spectrum based on its opportunity cost. The opportunity cost of spectrum is the value to the user that derives the highest benefit from being able to use it (i.e. it is the costs they save from either gaining or losing a quantum of spectrum). Importantly, this may not correspond to the current licensed user of a particular band of spectrum. If this would indeed turn out to be the case, then the incentive can lead to spectrum being reallocated to a different user who attaches relatively greater value to being able to use it.”

This approach to measuring opportunity cost was adopted following the recommendation in the Indepen Report 2004 (see note footnote 1 above).

In Box 5.1 I present a hypothetical simple example illustrating the application of the *generalised* opportunity cost principle. I shall show subsequently that Ofcom’s application of the principle is wrong in the current case.

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<sup>17</sup> See “Spectrum Framework Review”, Statement 28 June 2005, Ofcom.

<sup>18</sup> “AIP is an important mechanism for fulfilling this duty [achieving the objectives set out in Section 3 of the WTA]. This is because AIP signals to spectrum users the value of the spectrum resource that they are currently using or could potentially make use of. Ensuring that users pay AIP for their spectrum creates the proper incentive for users to only use spectrum that they value as highly as any other potential user. This implies that those users to whom spectrum is worth less than AIP will not have the incentive to use this spectrum. Hence, AIP can promote the efficient use of spectrum by creating incentives that ultimately lead to the allocation of spectrum to those who value it the most.” In Ofcom (2005): “Spectrum pricing: A statement on proposals for setting Wireless Telegraphy Act licence fees” 23 February 2005, Ofcom, Para 2.9.

<sup>19</sup> Para 2.10 Ofcom (2005).

### Box 5.1 AIP and the Opportunity Cost Principle

Assume that there are three Frequency Bands A, B and C and that these bands have been allocated administratively to specific Uses 1, 2 and 3 respectively. Thus, Use 2 cannot make use of Frequency Bands 1 and 3. Further, suppose that Users I are assigned to Use 1, Users II to Use 2 and Users III to Use 3.

The numerical values in Table 5.1 below refer to the marginal value a typical user in each use attaches to the respective frequency band.

Users in Use 1 value an additional unit of Frequency Band A at £10, an additional unit of Frequency Band B at £15, etc. The valuations reflect the different physical properties of the frequency bands (e.g. propagation).

Table 5.1 Illustrative spectrum valuations

	Frequency Band A	Frequency Band B	Frequency Band C
Use 1/Users I	£10	£15	£7
Use 2/Users II	£4	£6	£9
Use 3/Users III	£2	£8	£12

It is important to understand how the marginal valuation of spectrum for each use is computed in Table 5.1. It is identified by measuring how the cost of supplying the current output level of a use varies as the amount of spectrum varies in each frequency band (using the Smith-NERA method, described in Annex 1). For example, a user in Use 2 with an additional small amount of Frequency Band A would have lower operating costs of £4, whereas a small additional amount of Frequency Band B would lower operating costs by £6. Costs fall because the user needs to use less of other inputs when faced with more spectrum. Therefore Frequency Band B is more valuable in Use 2 than Frequency Band A.

If the spectrum allocation is inflexible, meaning spectrum can only be used in the use determined in the initial administrative process, the AIP should be set at £10 for Frequency Band A, £6 for Frequency Band B and £12 for Frequency Band C. A user within a given use not willing to pay the AIP charges might return some spectrum to the administrator and this would then become available for other users in the same use who may be willing to pay the AIP and by implication are more efficient (productively). The original application of AIP in the UK in 1998 was based on setting prices to achieve this kind of efficiency gain.

Following the Indepen Report 2004, AIP were calculated to take account of all possible uses of a frequency band. In this more general setting, the AIP would initially be set at £10 for Frequency Band A, above £6 and below £15 for Frequency Band B and £12 for Frequency Band C. The difference with the previous AIP is with respect to Frequency Band B, where the price is higher reflecting the higher valuations of this band in Uses 1 and 2. With a more general approach to AIP some Frequency Band B would migrate to Use 1, where it confers higher value to society. The higher charge for Frequency Band B would help promote a more efficient allocation of the spectrum.

## 6. AIP and CGC spectrum

In line with Decision 626/2008/EC, CGC spectrum for use by MSS operators will not be auctioned. Ofcom has confirmed that AIP should therefore apply:<sup>20</sup>

“For cases where auctions are not used, our current practice for fees applied to equipment licences is to apply Administered Incentive Pricing (AIP).”

If trading of the CGC spectrum were not possible, I would agree that properly calculated AIP for the CGC spectrum should ensure that spectrum is efficiently distributed between MSS operators. However, as I noted in Chapter 3 above concurrent trading of the CGC spectrum ought to be regarded as a substitute for AIP and should therefore lead to an efficient distribution of spectrum between MSS operators.

AIP applied to CGC spectrum will only serve to raise the costs faced by MSS operators and will not be effective at achieving efficiency gains above and beyond what could be achieved through the proposed trading mechanisms.

Furthermore, Ofcom has proposed a level for AIP charges which has not taken due account of the constraints in Decision 626/2008/EC – preferring instead to place faith in long term aspirations where such constraints may not hold.<sup>21</sup>

“It is important to understand in this context that Ofcom’s aim is not to achieve any specific short-term change in the use of spectrum. Rather, Ofcom’s aim is to ensure that holders of spectrum fully recognise the costs that their use imposes on society. Ofcom appreciates that many holders of spectrum are not in a position to make rapid changes to their use of spectrum in response to the application of AIP. However, we observe that even where international and other constraints limit the alternative use of spectrum, even in the long term, there are usually opportunities for the users of such spectrum to influence changes to this use and, further, that without an appropriate price signal to such users, a change of use of such spectrum is unlikely ever to occur.”

The presumption that constraints inherent in Decision 626/2008/EC should be ignored when considering AIP means that MSS operators compliant with the Decision will be burdened with additional costs in an attempt by Ofcom to make others “influence changes”.

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<sup>20</sup> Paras. 8.10-11, Ofcom (2008a).

<sup>21</sup> Para .5.66, Ofcom (2008b).

This approach to setting AIP seems to be placing a disproportionate burden on the pricing instrument and amounts to an implicit admission by Ofcom that in the short term, which may extend over many years and even over the lifetime of the MSS licences, AIP will be ineffective.

The fact Ofcom has not taken due account of the constraints in Decision 626/2008/EC has also led it to propose an AIP charge which is higher (and probably substantially higher) than it should be. The AIP level proposed is equivalent to the charge levied on the second generation public wireless operators in the 1800MHz band.

Before addressing the detail, it is worth pointing out that if the CGC spectrum could be used by others without constraint (in other words if Decision 626/2008/EC were ignored), then setting an AIP charge at the level proposed by Ofcom might be appropriate.

**However, recognition of the legally binding constraints in Decision 626/2008/EC suggests that the correct AIP, if AIP are needed at all, have not been computed by Ofcom.**

The AIP charge faced by the second generation public wireless operators operating in the 1800MHz band is £554,400 per 2 x 1MHz. This figure was calculated and applied originally by the Radiocommunications Agency after 1998 and continued by Ofcom in 2005, despite receiving advice in the Indepen Report 2004 to increase substantially the charge.<sup>22</sup>

The method used to compute the value £554,400 is based on what is known as the Smith-NERA method (see also Box 5.1). This method examines the additional cost that would be faced by an efficiently operated mobile network if the amount of spectrum were decreased by one channel – in a GSM network a channel is measured at 200kHz.<sup>23</sup>

Thus a second generation public wireless operator should value 2 x 1MHz of the 1800MHz frequency band at a value no less than nearly five times £111,000, where £111,000 is the value of a single paired channel. Ofcom's AIP charges indicate that no other application currently values the 1800MHz spectrum above this amount.

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<sup>22</sup> See "Spectrum Pricing: A consultation on proposals for setting wireless telegraphy act licence fees" Consultation Document, Ofcom, 29 September 2004, especially section 4. Ofcom stated in 2004/5 that this value would be reviewed sometime in 2007/08, though this has not yet occurred. It is also noteworthy that estimates of AIP can vary significantly according to the assumptions invoked in the analysis.

<sup>23</sup> GSM uses the Gaussian minimum shift keying (GMSK) modulation scheme. With a Gaussian filter (alpha = 0.3) and a symbol rate of 270.833 kS/s, GSM has a total RF bandwidth of slightly less than 200 kHz. One interesting difference between the 2G and 3G cellular standards is the channel bandwidth. In contrast with GSM, wideband code division multiple access (WCDMA) has a symbol rate of 3.84 MS/s. Using a root-raised cosine with an alpha of 0.22, we can calculate the RF bandwidth to be  $((1+0.22) \times 3.84) = 4.68$  MHz. See <http://www.rfdesignline.com/howto/206904824>.

In other words, Ofcom has estimated that a second generation public wireless operator would need to install extra infrastructure (principally base stations) to compensate for less spectrum if its output were to be unaffected by a small reduction in spectrum. The additional cost of this infrastructure is estimated to be at least £111,000 per channel (paired).

In accordance with the theory articulated in the previous chapter, AIP for the 1800MHz frequency band is then set at the estimated marginal valuation of the spectrum.

The CGC spectrum to be used by MSS will not use a second generation GSM mobile network technology. Furthermore, use of the CGC spectrum will need to adhere with constraints set out in Decision 626/2008/EC, which require that satellite infrastructure transmission bandwidths will need to be complied with by the CGC network and the management of the CGC network will need to be undertaken by MSS operators.

**The AIP proposed by Ofcom for the CGC spectrum is wrong on two counts:**

- **First, it is based on an outdated technology that will not be used with the CGC spectrum;**
- **Second, it fails to take account of the constraint that the CGC spectrum shall be used in conjunction with the satellite element of the MSS business.**

The proposal to value the CGC spectrum based on a technology that is outdated and on calculations that appear to be five years or more old is wholly unsatisfactory.

If the Smith-NERA method with regard to the CGC spectrum is to be applied by Ofcom it should be based on an assessment of the impact on costs faced by MSS operators for spectrum changes that reflect the likely prevailing technology that will be deployed by such systems. Ofcom has not done this, and in practice it is unlikely that it could perform such a computation with confidence, given the paucity of information about MSS operations at this moment in time.<sup>24</sup>

The AIP value estimated some years previously and proposed for the CGC spectrum does not represent a correct application of the Smith-NERA method given Decision 626/2008/EC and is likely therefore to result in significant distortions. I have claimed above that the impact of the charges could lead to the UK economy losing over £1 billion in value if CGC elements of the MSS

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<sup>24</sup> Ofcom's relatively poor information about MSS businesses is evident in parts of Ofcom (2008b), for example see paras. 5.83 and 5.84.

business are not rolled out in the UK. I note that Ofcom has acknowledged that its proposed AIP may be detrimental for the rollout of CGC.<sup>25</sup>

However, if Ofcom persists in seeking to apply AIP on use of spectrum by CGC, it should recognise the constraints on flexibility in Decision 626/2008/EC. Box 6.1 builds on the previous example shown in Box 5.1 to illustrate this point within a hypothetical context.

### Box 6.1 AIP and Spectrum Usage Constraints

As in Box 5.1 assume that there are three Frequency Bands A, B and C and assume that these bands have been allocated administratively to specific Uses 1, 2 and 3 respectively. Thus, Use 2 cannot make use of Frequency Bands 1 and 3. Further, suppose that Users I are assigned to Use 1, Users II to Use 2 and Users III to Use 3.

Unlike before, assume that Frequency Band B can only be operated by Users II. Frequency Band B is like CGC spectrum and Users II are pan-European MSS operators.

The numerical values in the Table in Box 5.1 are modified to reflect the relative inflexibility of Frequency Band B.

The revised valuations are shown below in Table 6.1. The key difference between Table 6.1 and Table 5.1 is the lower valuations in Use 1 and 3 for Frequency Band B. The marginal valuation of Frequency Band B is based upon using the spectrum to deliver mobile services using a MSS network infrastructure. Therefore the value at the margin ought to be equal to that of User II, which is £6.

Table 6.1 Spectrum valuations and usage constraints

	Frequency Band A	Frequency Band B	Frequency Band C
Use 1/Users I	£10	£6	£7
Use 2/Users II	£4	£6	£9
Use 3/Users III	£2	£6	£12

The correct AIP for Frequency Band B is £6, whereas in the absence of constraints it could be as high as £15.

<sup>25</sup> Para 5.82 in Ofcom (2008b) states “we are mindful of the potential risk that setting a fee at the full opportunity cost level might, of itself, discourage or even prevent CGC networks being deployed in the UK. This could lead to the spectrum being under-used, which is unlikely to be an efficient outcome for citizens and consumers.”

## 7. An alternative policy proposal for CGC spectrum fees

Given the informational constraints confronted by Ofcom with regard to the nature of costs experienced by MSS operations and their use of CGC networks, this ought to provide a justification for caution when seeking to apply AIP on the spectrum to be used by CGC.

Unlike in the case of other radio services, where Ofcom was able to make use of several years of data to compute AIP, MSS operations are new and commercially untested in the UK.

It is difficult to envisage how the Smith-NERA method can be applied with confidence in this context. Estimates of AIP for spectrum used for CGC by MSS operators are likely to have very wide intervals. In line with past experience of applying AIP, Ofcom should recognise this and adopt a cautious approach to the setting of AIP for this spectrum.

This is what Ofcom did with regard to the setting of AIP for the spectrum used by public wireless network operators:<sup>26</sup>

“Ofcom considers it better to wait to get a market valuation of this additional spectrum and then assess the implications for existing mobile spectrum, rather than second-guess the impact.”

I recommend that Ofcom should revise its policy on AIP for the CGC spectrum use and defer application of AIP charges to enable a better assessment of market valuation. By doing this Ofcom would also give concurrent spectrum trading the chance to work, obviating the need for regulatory intervention at all.

**A policy of forbearance where initially spectrum fees for CGC use are set at administrative cost recovery levels appears a preferable approach. The risk of error in assessing AIP for CGC use is too great at this stage in the development of MSS businesses. Furthermore, the setting of AIP, particularly high AIP based on 2G operations, runs the serious risk of undermining the efficacy of concurrent spectrum trading possibilities.**

The argument in favour of forbearance is strengthened further by the fact that MSS operations have a pan-European dimension. This is considered in the following chapter.

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<sup>26</sup> Para 4.1.3 in Ofcom (2004), “Spectrum Pricing: A consultation on proposals for setting wireless telegraphy act licence fees”, 29 September 2004.

## 8. European harmonisation and Ofcom's application of AIP on CGC spectrum

Ofcom's proposals for applying AIP on CGC spectrum in the UK are likely to be out of kilter with most Member States in the European Union. Most Member States in the EU will likely apply administrative cost recovery pricing for CGC spectrum, or a zero usage price.

Ofcom examined whether a zero fee (or cost recovery fee) would be a better alternative to AIP for the CGC spectrum in the UK. It argued that a zero AIP would not allow price signals to work effectively. Ofcom claimed that a zero fee might encourage some users to apply for MSS spectrum in the ESAP process as a way of avoiding paying for potentially higher cost spectrum in closely related bands, where the latter may be 'optimal'<sup>27</sup> for these alternative uses.

Ofcom referred in particular to the possibility of mobile TV, which can be deployed across a number of spectrum bands including that released from the closure of analogue TV broadcasting in the digital dividend process, L band and 2.6GHz. Ofcom noted that these other bands are the subject of auctions in the UK. It is suggested that a zero AIP could distort auction processes and hence undermine efficiency.

However, Ofcom's adherence to 'first-best' economic principles is likely to be damaging in a pan-European context. Economic theory predicts that it is generally not desirable when designing policy to set prices (more generally policy instruments) at 'first-best' levels where distortions persist elsewhere – the setting of spectrum charges at administrative cost recovery levels elsewhere in the EU is equivalent, in this context, to distortions.<sup>28</sup>

As MSS operations are pan-European in nature, economic principles suggest that Ofcom might be better advised at this stage in the development of European spectrum markets to fall into line with practice in other Member States – even if this is acknowledged to be 'second-best'.

**In addition to the economic case for administrative cost recovery, adoption of this approach is highly likely in other Member States and hence its application in the UK would be more compatible with the aim of a single market and harmonisation.**

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<sup>27</sup> Optimal used here is meant to be understood as compatible with economic efficiency rather than engineering efficiency.

<sup>28</sup> This prediction follows from a result known in economics as the General Theory of the Second Best due to Lipsey, R.G. and K. Lancaster (1956) "The General Theory of Second Best", *The Review of Economic Studies*, Vol. 24, No. 1. pp. 11-32.



## 9. Conclusion

Ofcom has proposed the application of AIP to CGC spectrum use in the UK. In this paper I have argued that AIP are not necessary to achieve efficiency, as concurrent trading possibilities are a perfect substitute for AIP.

I have also argued that Ofcom's application of the method for calculating the proposed AIP is flawed and as a result this could cost the UK economy over £1 billion in value.

Rather than press ahead with the application of AIP based on incorrect comparators, I have argued that Ofcom should adopt a policy of forbearance.

**In practice forbearance would amount to the application of administrative cost recovery fees for the CGC spectrum in the UK for the foreseeable future.**

Support for this forbearance policy is threefold:

1. Informational constraints – Ofcom is not positioned at this stage to assess precisely or confidently the marginal value of CGC spectrum to a typical MSS operator, and past statements made by Ofcom suggest a policy of waiting until better information is obtained is superior;
2. Economic principles – the theory of the second best lends support to fees which are not in accordance with 'first best levels' (which arguably AIP seek to proxy); and finally
3. European harmonisation – EU policies with regard to the single market and the harmonisation of regulation.

## Annex 1 The Smith-NERA method

In a report for the Radiocommunications Agency published in 1996, a consortium of consultants proposed a method for computing the value of radio spectrum based upon economic principles which has become known as the Smith-NERA method.<sup>29</sup> The Smith-NERA method was endorsed in the Indepen Report 2004 and continues to be applied by Ofcom.

The Smith-NERA method assesses marginal values of spectrum by calculating the additional cost (or cost saving) to an average or reasonably efficient user as a result of being denied access to a small amount of spectrum (or being given access to an additional small amount of spectrum).

The additional cost (or cost saving) depends on the application and is calculated as the estimated minimum cost of the alternative actions facing the user. These alternatives may include (as set out on p.11 of Indepen Report 2004):

- investing in more/less network infrastructure to achieve the same quantity and quality of output with less/more spectrum;
- adopting narrower bandwidth equipment;
- switching to an alternative band;
- switching to an alternative service (e.g. a public service rather than private communications) or technology (e.g. fibre or leased line rather than fixed radio link).

It was stated in the Indepen Report 2004 that this approach overstates the value of spectrum for reductions in spectrum and understates the value for increases in spectrum. An average of the values obtained from an increase and a decrease in spectrum would therefore give a reasonable approximation to the value.

It is important to note that when calculating the marginal value of spectrum the approach assumes that the quantity and quality of output produced by the use remains constant.

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<sup>29</sup> *Study into the Use of Spectrum Pricing*, NERA and Smith System Engineering report for the Radiocommunications Agency 1996.

## Annex 2 Curriculum Vitae

Attached

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**Qualifications**

<b>Date of birth</b>	<b>Education</b>	<b>Nationality</b>
6 April 1960	<p>Secondary: Xaverian College, Manchester 1971-78, 7 O levels, 4 A levels</p> <p>University: University College Wales, Cardiff 1978-81, First Class honours, Economics – highest grade in year</p> <p>University of Warwick 1981-84 MA and Ph.D. in Economics</p>	British

**Current and past positions**

<b>Year</b>	<b>Current positions</b>	<b>Location</b>
July 2004 - present	Associate Fellow, Department of Economics, University of Warwick and Centre for Management under Regulation, Warwick Business School	Warwick
May 2002- present	Apex Economics	

<b>Year</b>	<b>Previous positions</b>	<b>Location</b>
July 2004- February 2007	Senior Research Fellow, Centre for Management under Regulation, Warwick Business School	Warwick
May 2002-June 2004	Independent economic consultant Associate Fellow, Department of Economics, University of Warwick Associate Fellow, Centre for Management Under Regulation, University of Warwick	Warwick
August 2000 – April 2002	Vice President, Practice Head Telecoms, and Director of Charles River Associates (UK) Ltd.	London
October 1999 – July 2000.	Director of Telecoms, London Economics	London
January 1996 – September 1999	Senior Research Fellow, London Business School	London

October 1992 – December 1995	Senior Research Officer, Department of Applied Economics, University of Cambridge	Cambridge
October 1989 – September 1992	Research Officer, Department of Applied Economics, University of Cambridge	Cambridge
October 1986 – September 1991	Fellow, Gonville and Caius College, Cambridge	Cambridge
October 1985 – September 1987	Junior Research Officer, Department of Applied Economics, University of Cambridge	Cambridge
October 1984 – September 1985	Lecturer, Department of Economics, University of Essex	Colchester
	<b>Other previous positions</b>	
January 2003 – June 2003	Visiting Lecturer, London School of Economics	London
January 1999 – March 1999	Adjunct Professor, INSEAD	Fontenbleau, France
September 1991 – March 1992	Visiting Professor, CERGE, Charles University	Prague, Czech Republic
October 1991 – September 1992	Assistant Director of Studies, Gonville and Caius College	Cambridge
January 1989 – May 1989	Visiting Assistant Professor, Queen's University	Kingston, Canada
October 1988 – September 1989	Affiliated Lecturer, Faculty of Economics and Politics, University of Cambridge	Cambridge
October 1985 – September 1986	College Supervisor, St. John's College	Cambridge

## ***Consulting assignments (in reverse chronological order)***

### **Independent economic consultant May 2002-present**

**Client:** *St. Helena Government and DFID, September 2008 – current*

Task: Negotiate licence terms with service provider(s).

*Client contact: Peter Wilson, DFID*

**Client:** *Digicel Cayman Islands, August 2008 – September 2008*

Task: Write submission to regulator ICTA on mobile termination rates.

*Client contact: Mark Scanlan, Digicel*

**Client:** *BBC June 2008 – July 2008*

Task: Advise on spectrum auction in relation to digital dividend released (DDR) spectrum.

*Client contact: Najma Raja*

**Client:** *Telecommunications Regulatory Authority, Oman, May 2008 – September 2008*

Task: Advise on spectrum matters, auction design and spectrum pricing.

*Client contact: Intercai Mondiale*

**Client:** *Telekom Polska, June 2008 – July 2008*

Task: A report looking at investment incentives and functional separation.

*Client contact: Telekom Polska*

**Client:** *SingTel Optus Australia, April 2008 – current*

Task: Provide advice and write report on structural separation and the National Broadband Network tender competition.

*Client contact: Andrew Sheridan, Optus Australia*

**Client:** *Competition Commission UK, April 2008 – current*

Task: Provide advice on cases of relevance to the electronic communications sector.

*Client contact: Marie Clarke*

**Client:** *Operator in South Africa, April 2008*

Task: Prepare and advise on consultation responses on market power and remedies.

*Client contact: AAACS*

**Client:** *OTE, February 2008 – September 2008*

Task: Report on functional separation. Includes presentations to senior management.

*Client contact: AAACS*



**Client: Gibraltar Regulatory Authority (GRA), January 2008 – current**

Task: Assistance on design and implementation of remedies in market reviews.

Client contact: Stewart Brittenden, GRA

**Client: ComReg, March 2008**

Task: Organized and presented a series of training workshops on spectrum auctions.

Client contact: Triona Kelly, ComReg

**Client: InfoDev World Bank, August 2007 – November 2007**

Task: Lead Consultant and Team Leader for World Bank training programme on competition policy for COMESA members in Addis Ababa, Ethiopia.

Client contact: Boutheina Guerhazi, InfoDev

**Client: Gibraltar Regulatory Authority (GRA), August 2007 – November 2007**

Task: Assistance on review of Market 16, mobile termination. Cost modeling.

Client contact: Stewart Brittenden, GRA

**Client: HSL, August – October 2007**

Task: Economic advice to private client in relation to a Chapter II 1998 Competition Act case before Ofcom. Issues: refusal to deal, excessive pricing and alleged abuse of dominance. Market: wholesale termination of SMS.

Client contact: Mark Hay, HSL

**Client: Dublin Port Company, August – September 2007**

Task: Independent report examining cost of Dublin city HGV exclusion zone.

Client contact: Michael Cleary

**Client: Eircom, June 2007 – August 2007**

Task: Academic policy paper on structural and functional separation.

Client contact: Victoria Ergus, Eircom

**Client: Department of Communications, Information Technology and Arts, Australia, March 2007 – May 2007**

Task: Contributor to report “The Analysis of Spectrum Policy Trends”.

Client contact: George Barker, ANU

**Client: Jamaican Fair Trading Commission, April 2007 – February 2008**

Task: Technical training provided to staff and economists in the Fair Trading Commission and the Office of Utilities Regulation on competition policy issues pertinent to network industries. On site workshops, seminars and one-on-one training; development of case study materials.

Lead consultant

Client contact: David Miller, JFTC

**Client: Falklands Islands Government, December 2006 – current**

Task: Retainer arrangement with the Falkland Islands Government, providing advice on the reform and regulation of the telecommunications and communications sectors. In particular addressing where legislation requires revision and assisting the FIG in negotiations with Cable & Wireless Falkland Islands.

*Lead consultant*

*Client contact: Pete King, Government Secretary, FIG*

**Client: Cable & Wireless Guernsey, December 2006 – February 2007**

Task: Advice in relation to an appeal submitted by C&WG to the Utilities Appeal Tribunal in Guernsey regarding the denial of a 3G licence in a comparative selection contest in June 2006.

*Client contact: Jane Langlois, Regulatory Manager, C&WG*

**Client: Major UK broadcaster, Confidential UK, January 2007 – March 2007**

Task: Advice in relation to Ofcom's Digital Dividend Review. Working as part of a team led by David Lancefield at PricewaterhouseCoopers, London.

*Client contact: Confidential*

**Client: EBRD for CRC in Mongolia, September 2006 – March 2008**

Tasks: (A) One week training programme for regulatory staff in Mongolia on the following topics: (i) Competition policy – market definition and market analysis relevant to network industries (ii) Price regulation – price caps, price floors and margin squeeze (iii) Spectrum management policy – auctions, secondary trading and administrative incentive prices. (B) Design of the interconnection regime and rates, framework and modeling, plus advice on the application of dominance concept. Implementation and design of regulations dealing with the structural separation of the incumbent operator.

*Client contact: Andrew Dymond, Intelecon (Canada)*

**Client: TCRA Tanzania, October 2006**

Task: One week on site training programme for 20 communications regulatory staff in Tanzania on the following topics: (i) Competition policy – market definition and market analysis relevant to network industries (ii) Price regulation – price caps, price floors and margin squeeze (iii) Spectrum management policy – auctions, secondary trading and administrative incentive prices (iv) Interconnection – costs, forward looking LRIC, sender keeps all, ECPR (retail minus) (v) Numbering – economics of portability.

*Lead consultant*

*Client contact: Goodluck Ole-Medeye, TCRA*

**Client: Associates for Research, September 2006**

Task: Organization and presentation of training course on radio spectrum management policy for 20 executives from Thailand, Sweden, Tanzania, Kenya and Luxembourg. Course held at London School of Economics.

*Client contact: Charles Opara, Associates for Research Ltd*

**Client: Home Shopping Network Inc. and iBuy TV Limited, July 2006 – August 2006**

Task: Prepared expert economists report on market definition in a competition case involving an alleged abuse of dominance. The focus of the report was on two-sided markets. Worked closely with lawyers from Gibson Dunn & Crutcher.

*Lead economic consultant*

*Client contact: James Ashe-Taylor, Gibson Dunn & Crutcher LLP, London*

**Client: ComReg, June 2006 – September 2006**

Task: Organized and presented a series of training workshops on the new regulatory framework with the focus on market definition and market analysis. Wrote and supplied training manual to assist regulatory staff when conducting market reviews.

*Client contact: Caoimhe Donnelly, ComReg*

**Client: Ofcom, May 2006 – February 2007**

Task: Economist contributing to project assessing the dividend associated with fixed links and improved spectrally efficient technologies.

*Client contact: Ofcom*

**Client: Gibraltar Regulatory Authority (GRA), May 2006 – March 2007**

Task: Undertaking the 18 market reviews for the GRA in accordance with the 2002 EU Directives.

*Client contact: Stewart Brittenden, GRA*

**Client: PriceWaterhouseCoopers, April 2006 – May 2006**

Task: Advise on auction design for Iraq GSM licenses. Wrote report for financial advisors to the Interim Iraq Government.

*Client contact: Jitesh Shah, Corporate Finance PWC London*

**Client: Montserrat Government and FCO, January 2006 – December 2006**

Task: Report and site visit advising on the liberalization of the telecommunications sector in Montserrat. Undertook cost study to assess viability of network competition on Montserrat.

*Client contact: Francis Kayada, FCO*

**Client: Anacom (Portuguese telecoms national regulatory authority), February 2006 – May 2006**

Task: Advising on the competition implications of the bid submitted by Sonae for Portugal Telecom. Report submitted examining market analysis of the mobile and fixed sectors in the context of the proposed merger. Prepared suggested remedies to address competition concerns.

*Client contact: Pedro Duarte Neves, Director, Anacom*

**Client: TAIEX European Commission for the Lithuanian government, November 2005**

Task: Prepare, organize and present workshop on the EU Regulatory Framework on Electronic Communications. This was held on 3 and 4 November 2005 in Vilnius,

Lithuania. The focus was on competition policy and market reviews under the European regulatory framework. Course of seminars and lectures presented to members of the national regulatory authorities in telecommunications and energy, and to judges (presented jointly with Professor Martin Cave).

*Client contact: Jurate Masiulionyte, RRT, Lithuania*

**Client: Associates for Research, November 2005**

Task: Presentation of training course in the form of lectures and seminars on economic regulation of telecoms; regulation of pricing; joint dominance and the electronic communications regulatory framework in the EC.

*Client contact: Charles Opara, Associates for Research*

**Client: British Virgin Islands Government, July 2005 – May 2006**

Task: Retained advisor to the BVI Government on the liberalization of the telecommunications sector. Member of Government liberalization negotiation team. Undertook cost study analysis to assess viability of competition in the cellular market, tariff analysis, and other related issues.

*Client contact: Neil Smith, Financial Secretary, BVI Government*

**Client: Public Electronic Communications Network (UK), June 2005 – June 2006**

Task: Economic advice to private client in relation to a Chapter II 1998 Competition Act case before Ofcom. Issues: refusal to deal, excessive pricing and alleged abuse of dominance. Market: wholesale termination of SMS.

*Client contact: Rod Kirwan, Denton Wilde Sapte, London*

**Client: Ascension Island Government, June 2005 – May 2006**

Task: Advising on reform of the telecommunications sector. Wrote report for the Ascension Island Government on the status of telecommunications and its regulation in Ascension. One site visit for a week and meetings with local officials.

*Lead consultant*

*Client contact: Michael Hill, the Administrator, Ascension Island*

**Client: European Commission Competition Directorate, June 2005 – December 2005**

Task: Advice in relation to Statement of Objections regarding an Article 82 abuse of dominance case involving two mobile network operators in the UK. Market: national market for international roaming onto cellular networks. Alleged abuse relates to excessive pricing.

*Client contact: Manuel Martinez-Lopez, European Commission*

**Client: ITU, May 2005 – September 2005**

Task: Commissioned by the ITU to write a report on spectrum management harmonization in 15 West African states. The report submitted to the WATRA (West African Telecommunications Regulators Assembly) meeting in WATRA validation workshop, Accra, Ghana. Attending were CEOs of the 15 regulatory authorities attached to WATRA.

*Client contact: Doreen Bogdan, ITU, Geneva*

**Client: Turks and Caicos Islands Government Attorney General's Chambers, March 2005 – December 2005**

Task: Advising on liberalization of the telecommunications sector. Drafting new licenses and developing framework for competition regime. Three separate visits to assist government in preparation for liberalized telecommunications markets. Worked closely with legal counsel and external legal support. Helped draft legislation.

*Lead economic consultant*

*Client contact: Kurt Defreitas, Attorney General, TCI Government Executive*

**Client: Falklands Islands Government, August 2004 – present**

Task: Retained by the Falkland Islands Government to advise on the reform and regulation of the telecommunications and communications sectors.

*Lead consultant*

*Client contact: Pete King, Government Secretary, FIG*

**Client: Independent Communications Authority for South Africa, July 2004 – January 2005**

Task: Advising on the design and implementation of a price-cap (on and off-site). Assisting staff at ICASA and drafting consultation report and assisting Commissioners in the public hearings.

*Client contact: Tracy Cohen, Councillor, ICASA, Johannesburg*

**Client: Commission for Communications Regulation, Ireland, April 2004 – December 2005**

Task: Advice on the application of remedies, market definition and analysis in market reviews under the new regulatory framework. Drafting notices and assisting in appeals. Close involvement in the mobile access and call origination review and appeal, interconnection review, and retail minus consultation. Advise on the appeal involving Hutchison 3G Ireland and mobile termination.

*Client contact: Isolde Goggin, former Chairperson, ComReg*

**Client: Ministry of Economic Affairs, Netherlands, June 2003 – January 2004**

Task: Key economist on team undertaking work on providing a conceptual framework for the application of new spectrum charges in the Netherlands. With Quotient Associates and Tilburg University. Report available at: [Final Report](#).

**Client: Digicel Aruba (New Millennium Telecommunication Services B.V.), October 2003**

Task: Provide expert testimony in court on the concession fee.

*Lead consultant*

*Client contact: Isaac Waincier, CEO, NMTS*

**Client: Radiocommunications Agency, United Kingdom, April 2003 – December 2003**

Task: Review the economic methodology used to form spectrum prices in the UK, and develop extensions where necessary. Key economist on team. Wrote report submitted to Ofcom and subsequently implemented by Ofcom. With Indepen with Aegis Systems.

*Client contact: Phillipa Marks, Indepen*

**Client: Radiocommunications Agency, April 2003 – December 2003**

Project: Contributed as economist to study into the impact of reduced research into electromagnetic contamination. Project led by Quotient Associates with York EMC.

**Client: ECTEL (Eastern Caribbean Telecommunications Authority), December 2002 – March 2003**

Task: Advise ECTEL Board on the design of new retail price-cap for ECTEL member states. Completed report and made presentation to ECTEL Board in St. Lucia.

*Client contact: Anderson Reynolds, ECTEL.*

**Client: Cellular operator in Middle East, November 2002**

Task: Assess call termination charges and tariffs for SMS in Europe and elsewhere. Report for client and on site assistance in meetings with Ministry.

*Lead consultant*

*Project manager: Confidential.*

**Client: New entrant cellular operator in the Caribbean, October 2002 – September 2003**

Task: Provide expert testimony to court and advised on a range of issues connected with licence valuation and interconnection terms. Advising senior management during interconnect negotiations.

*Client contact: Jarleth Burke, Jones, Day, Brussels.*

**Client: Hutchison 3G UK, October 2002**

Task: Provide expert opinion and report on spectrum trading. Report submitted to Ofcom.

*Project manager: Confidential.*

**Client: Major European ISP, June 2002 – January 2003**

Task: Advice on competition issues related to alleged leverage of dominance by an incumbent telecommunications operator, and submit expert opinion.

*Project manager: Confidential.*

**Client: Government of Anguilla, British West Indies, April 2002 – April 2003**

Task: Member of government negotiation team. With Professor Martin Cave completed report “Costs, Price Rebalancing and Competition in the Anguilla Telecommunications Market”. Several on site visits and presentations to Government officials and Governor.  
*Client contact: Kenn Banks, Government of Anguilla.*

**At Charles River Associates UK Limited (August 2000 – April 2002)**

**Client: Energis plc, January 2002**

Task: Completion of expert report submitted to Oftel, UK telecoms regulator.  
*I wrote an expert’s report “[xDSL interconnection at the ATM switch: Pricing methodology](#)” which was Annex 1 of the Energis submission to Oftel in response to the draft Directive “Interconnection with BT’s ATM network” published December 21, 2001.  
Energis manager: Andrea Dworak.*

**Client: UK mobile network operator, December 2001**

Task: Joint-Manager of Competition Commission inquiry on Calls to Mobile  
*Assisted the preparation during the early stage of submission by operator to Competition Commission. Counsel: Chris Watson at Allen & Overy.*

**Client: Goldman Sachs, June – July 2001**

Task: Visit leading fund managers in the City.  
*Produced paper examining the consequences of the new EU telecoms directives for spectrum trading. Client was interested in possible ramifications for the German 3G market. Met with over twenty-five different leading fund managers to discuss spectrum trading and other telecoms issues. Goldman Manager: Louis Greig.*

**Client: Victor Chandler International, May 2001**

Task: Modelling of new betting product.  
*Client required revenue analysis of new betting product. Work involved completion of report and simulations. Victor Chandler Manager: Matthew Avison (now with Littlewoods).*

**Client: Global telecoms equipment manufacturer, April – June 2001**

Task: Expert testimony.  
*Completed expert report submitted to the US District Court for the Eastern District of Texas, Sherman Division. Provide expert testimony to the court arguing a case for Material Adverse Effect. The client who was a defendant in a class action case brought by shareholders in a US company acquired by the client. The class action was dropped following submission of expert reports. Counsel: Chris Malloy at Skadden, Arps in New York.*

**Client: Partner Communications (Orange) Israel, January – December 2001**

Task: Bid support and strategy in Israeli 2G and 3G spectrum auction.

*Principal advisor to UMTS management team (Sharon Haran and Adi Biran) regarding bid strategy. Visited client on two separate occasions to prepare senior management (CEO and CFO) for auction – involved mock auctions and meetings. Completed several notes, and wrote responses to auction rules prepared by the Ministry of Communications (MoC). MoC implemented suggestions made regarding bid forms. Partner manager: Sharon Haran.*

**Client: Elektrim S.A., December 2000 – January 2001 (Polish energy group with telecoms interests)**

Task: Expert Testimony.

*Wrote and submitted an expert report to the International Court of Arbitration of the International Chamber of Commerce. Cross-examination took place in New York, January 30, 2001. The client was a respondent/counter-claimant in a dispute involving an acquisition. Testimony related to an alleged material adverse effect. Counsel: John Gardiner at Skadden, Arps in New York.*

**Client: Nigerian Communications Commission (with Radio Spectrum International), September 2000 – January 2001**

Task: Design GSM spectrum and assist implementation.

*Principal advisor and auction designer for world's first ascending clock spectrum auction. Liaising with leading auction academic Professor Peter Cramton, I specified the auction rules and wrote significant portions of the Information Memorandum. Led bidder workshops and bidder briefings, and worked with Executive Vice Chairman Ernest Ndukwe to determine auctioneer increments. NCC manager: Ernest Ndukwe.*

**Client: FirstMark Communications UK Limited, September 2000 – November 2000**

Task: Bid support and strategy in UK BFWA spectrum auction.

*Working with Professor Peter Cramton led a team that provided bid support to the client for the UK BFWA spectrum auction. A simple Bid Track Tool (BTT) was designed using Excel and visual basic programming. The BTT was designed to be used independently by the bid team, comprising the UK Senior VP (Keith Cornell) and other senior managers. Conducted mock auctions with staff and provided detailed guidance on strategy. FirstMark manager: Keith Cornell.*

**Client: Omnitel (Vodafone), September 2000 – October 2000**

Task: Bid support and strategy in Italian 3G spectrum auction.

*Working with Professor Peter Cramton led a small team that provided bid support to the client for the Italian 3G spectrum auction. A sophisticated yet user-friendly Bid Track Tool (BTT) was designed using Excel and visual basic programming. The BTT was designed to be used independently by the bid team, comprising the CEO and other senior managers. Conducted mock auctions with the CEO and CFO, and provided detailed guidance on strategy. Omnitel manager: Giovanni Strocchi.*



**Client: British Horseracing Board (BHB), August 2000 – January 2001**

Task: Write and submit report to the Gambling Review Body

*Undertook detailed cost-benefit analysis investigating merits of allowing gambling in public houses in the UK. Work involved modelling and survey design. Results presented to the Board at the BHB, and subsequently submitted by the BHB to the Gambling Review Body, chaired by Professor Alan Budd. BHB manager: Tristram Ricketts, Secretary-General to the BHB.*

**Client: Energis plc, August 2000 – October 2000**

Task: Advise on strategy in Bow Wave Process (local loop unbundling)

*Undertook software modeling of strategic options for the bow wave process. Provided client with user-friendly software to analyse different scenarios for assessing local loop unbundling. Energis manager: Paul Roberts.*

**At London Economics Limited (October 1999 – July 2000)**

**Client: Meridian Communications Limited, March – July 2000**

Task: Expert testimony.

*Completion of report “The Economics of Mobile Telephony: Elements, Costs, Objective justifications, and Access Pricing”. This was submitted to the High Court in Ireland in a case presided by Justice O’Higgins. I was cross-examined in the High Court, Ireland on July, 15, 2000. Counsel: Dominic Dowling.*

**Client: GroupTrade.com, January – May 2000**

Task: Quantifying the benefits of business to business e-procurement for small to medium sized enterprises in the UK.

*Undertook detailed modeling to quantify the benefits of business to business e-procurement. Co-authored the report “[Business-to-Business e-procurement: Small and medium sized enterprises](#)” with Paul McShane. GroupTrade manager: Dominic Owens.*

**Client: Telecom New Zealand, January – April 2000**

Task: Report submitted to Ministerial Inquiry into Telecoms, New Zealand.

*I co-authored a report with Nick Carver (then at Quotient Communications) for the client entitled “[The Dynamics of Local Access: Telecommunications in New Zealand](#)”. The report examined in detail different access technologies and described likely evolutionary paths for market structure. The report was submitted to the New Zealand Ministerial Inquiry into the telecoms sector.*

**Client: Victor Chandler Business Services, April – July 2000**

Task: Modelling of lottery style betting product.

*Client required detailed modeling of a new lottery style betting product. Presentations made to interested parties. Statistical work undertaken in collaboration with Dr Michael Pitt at University of Warwick. Victor Chandler manager: Paul Pullinger.*

**Client: Worldcom, February – March 2000**

Task: Expert report and submission to the European Commission.

*Completion of report: “Pricing principles for call origination and access services” which was submitted to the European Commission. Detailed economic analysis of call origination services. Worldcom manager: Barney Lane.*

**Client: One.Tel UK Limited, January – April 2000**

Task: Bid support for the UK 3G spectrum auction.

*Client required bid support and market analysis to prepare and participate in the UK 3G auction. Work was carried out in close collaboration with joint Managing Directors Bradley Keeling and Jodee Rich. Software designed to aid bid team, and mock auctions and simulations undertaken. One.Tel manager: Jodee Rich.*

**Independent (November 1992 – September 1999)**

**Client: UUnet, September 1999**

Task: Report.

*“European telecommunications operators and internet access: market structure and economic issues”. UUnet manager: Sally Weatherall.*

**Client: Department of Telecommunications, Advanced Level Telecom Training Centre, Ghaziabad, India, July 1999**

Task: Lectures on telecoms regulation.

*With Dr Tim Kelly of the ITU presented a course of lectures to over twenty five managers. DoT manager: Mr. H.P. Meena.*

**Client: Telecom Italia, March 1999**

Task: Report.

*“A study on interconnection between fixed and mobile networks: developing strategy”. Presented to senior management in Rome. Telecom Italia manager: Giovanni Amendola.*

**Client: European Commission, December 1997 – June 1998**

Task: Expert Report.

*A report was produced looking at MVNOs with respect to a number of economic and regulatory issues associated with the implementation of the EU telecoms regulatory framework, especially with regard to interconnection and access. EU manager: Richard Crawley.*

**Client: OECD Competition and Consumer Policy Division, May 1995**

Task: Report.

*“[The economics of access pricing](#)” with Dr Mark Armstrong. Presented to OECD conference on Competition and Regulation in Network Infrastructure Industries, Budapest, May 1995.*

**Client: *British Telecom, March 1995***

Task: Report.

*“Review of the UK telecommunications market structure” with Robert Browne and Ian Burnett.*

**Client: *UNDP, May 1994***

Task: Report.

*“Telecommunications: privatization and regulation in the UK”.*

**Client: *HM Treasury, December 1993***

Task: Report.

*“Network access pricing” with Mark Armstrong.*

**Client: *Bell South Enterprises, November 1992***

Task: Expert Report.

*“The development of PCS in the UK: lessons for the FCC” appendix to submission to a FCC Docket on PCS.*

## ***Papers and publications on telecommunications and related network industries***

Structural separation and investment in the National Broadband Network environment  
A paper for Optus Australia, June 2008, available at [www.optus.com.au](http://www.optus.com.au)

Contracting across separated networks: lessons form theory and practice  
*Communications and Strategies* No 4, 2007 (with Martin Cave).

*Essentials of Modern Spectrum Management* [book]  
Cambridge University Press, August 2007 (with William Webb and Martin Cave).

Market prices boost efficiency  
*Policy Tracker, Spectrum*, pp. 10-12, March 2007

Collective Dominance, Market Analysis and the 2002 EU Framework Directive:  
The case of mobile access and call origination in Ireland  
*Digital Economic Dynamics: Innovations, Networks and Regulations*, edited by  
Paul J.J. Welfens and Mathias Weske, chapter 7 pp. 141-170, Springer Press 2007.

Where are we going? Technologies, markets and long-range policy issues in European  
communications  
*Information Economics and Policy*, pp. 242-255, 2006  
With Martin Cave and Luigi Prosperetti.

Convergence and Spectrum Licensing  
*Trends in Telecommunications Regulation*, chapter 6, ITU Geneva, December  
2004.

[On the design of the GSM auction in Nigeria – the world’s first ascending clock auction](#)  
*Telecommunications Policy*, vol. 27 (5-6), 383-405, June-July 2003.  
With Paul McShane.

[Licensing of 3G mobile systems: Chairman’s report](#)  
*ITU News*, Issue 9, 2001, Geneva, September 2001.

[Local loop unbundling and regulatory risk](#)  
*Journal of Network Industries*, vol. 1, no. 1, June 2000.

[Liberalisation of utilities and evolving European regulation](#)  
*Economic Outlook*, vol. 24, no. 3, 18-26, April 2000.  
With David Coen.

[London's growth sectors: telecommunications – ahead but watch out for Amsterdam](#)

*The New Statesman*, April 10, 2000 (London Supplement).

[Vodafone-Mannesmann is just the beginning](#)

*The Wall Street Journal*, editorial features, February 11, 2000.

[Virtual moves in mobile markets](#)

*Telecommunications*, February pp. 55-57.

A European Market for Electricity?

*Monitoring European Deregulation*, Annual Report Number 2, published by CEPR/SNS, November 1999. Multi-author study. Introductory chapter.  
With Martin Siner.

Bandwidth and minutes exchanges

*European Telecommunications Intelligence Bulletin*, vol. 1, no. 1, 12-13, November 1999.  
With Toby Robertson.

Designing economic regulatory institutions for European network industries\*

*Current Politics and Economics of Europe*, vol. 9, no. 4, 83-106, 1999.  
With David Coen.

The Economics of the Media: The Convergence of the Transition Countries

with EU Member States, published by the Research Centre of the Slovak Foreign Policy Association, Bratislava, May 1999. (Book of 211 pages.)  
With Martin Cave, Zdeněk Hrubý and Anton Marcincin.

[Market structure in mobile telecommunications: the receiver pays principle and qualified indirect access\\*](#)

*Information Economics and Policy*, vol. 10, no. 4, 471-488, December 1998.  
With Jennifer C Smith.

Liberalizing Europe's network industries: ten conflicting priorities

*Business Strategy Review*, vol. 10, no. 1, 55-66, autumn 1998.  
Reprinted in Italian in *Management Publications*, Editiones PMP.

Europe's Network Industries: Conflicting Priorities (Telecommunications)

*Monitoring European Deregulation*, Annual Report Number 1, published by CEPR/SNS, September 1998. (Book of 258 pages, plus xxii.)  
Lead author of Part 1 (140 pages), other authors: Lars Bergman, Damien Neven and Lars-Hendrik Röller. Co-author on part 2 with Jordi Gual, Lars Hultkrantz and Len Waverman.

Social obligations and access pricing: telecommunications and railways in the UK  
Chapter 8 in *Opening networks to competition: the regulation and pricing of access*,  
edited by David Gabel and David F. Weiman, Kluwer Academic Press, 1998.  
With Mark Armstrong.

Programming in a competitive broadcasting market: entry, welfare and regulation  
*Information Economics and Policy*, vol. 10, no. 1, 23-39, March 1998.

Self regulation and statutory regulation  
*Business Strategy Review*, vol. 8, no. 3, 35-42, Summer 1997.

Promoting efficient competition in telecommunications  
*National Institute Economic Review*, no. 159, 82-91, January 1997.

Sectoral regulation: telecommunications in the EU  
*Journal of European Public Policy*, vol. 3, no. 4, 612-28, December 1996.

The access pricing problem: a synthesis  
*Journal of Industrial Economics*, vol. XLIV, no. 2, 131-150, June 1996.  
Reprinted in *Economic Regulation*, edited by Paul L. Joskow, Edward Elgar  
Publishing Limited, 1999, chapter 24, pp. 673-692.  
With Mark Armstrong and John Vickers.

The pricing of access in networks: theoretical and practical issues  
*Rivista Internazionale di Scienze Sociali*, vol. 103, no. 1, 27-38, 1995.

Some efficiency aspects of price regulation  
*European Transactions on Telecommunications*, vol. 6, no. 4, 415-420, 1995.

British Telecom  
Chapter 4 in *Welfare consequences of selling public enterprises: an empirical  
analysis*, edited by A. Galal, L.P. Jones, P. Tandon, and I. Vogelsang,  
Oxford University Press, 1994.  
With Manuel Abdala, Ingo Vogelsang, Leroy Jones and Pankaj Tandon.

Access pricing in network utilities: theory and practice  
*Utilities Policy*, vol. 4, no. 3, 181-189, 1994.  
With Martin Cave.

Common carriage and the pricing of electricity transmission  
*The Energy Journal*, vol. 13, no. 3, 63-93, 1992.  
With Maria Maher.

## ***Current teaching and supervision***

### **The economics of competition policy**

Ten lectures third year economics undergraduates at the University of Warwick – Intermediate economics of competition policy: theory and practice course, since 2003. Supervision of MBA dissertations and doctoral students.

## ***Seminar presentations (since 2000)***

Digital Dividend Review and Switchover – Where are we now?

Keynote presentation to Westminster eForum “After Whitehaven – Next Steps for the Digital Dividend Review” conference, London, 30 January 2008

Vertical separation and value

Presentation to Telecom Separation – Regulatory & Financial Implications conference, Le Châtelain All Suite Hotel, Brussels, 17 October, 2007

The Liberalisation of Spectrum Management: What needs to be done?

Presentation to GSM Association, 19 June 2007

Spectrum Policy changes in the UK and lessons for the Netherlands

Presentation to Trends en ontwikkelingen in de ether WTC Rotterdam, 6 June 2007

Pricing Radio Spectrum

Presentation to ARICEA meeting in Cairo for COMESA, Cairo, 22 May 2007

The Price of Radio Spectrum: Using Incentive Mechanisms to Achieve Efficiency

Presentation to ITU Workshop Market Mechanisms for Spectrum Management, Geneva, 22-23 January 2007

Review of EU Spectrum Policy

Presentation at Improving the Regulatory Framework for Electronic Communications: Challenges for the Next Decade, conference of CBKE (University of Wrocław), CIL (Hungarian Academy of Sciences), WIK, under auspices the Polish regulator UKE, University of Wrocław, Wrocław, 18-20 October 2006

Joint Dominance and the Electronic Communications Regulatory Framework in the EU

Presentation to JUS Forum Telecom (Norwegian Lawyers), Oslo, 5 November 2005

An Examination of Collective Dominance Under the New Electronic Communications Regulatory Framework

Presentation to Gibson Dunn Annual Competition Conference, Brussels, Belgium, 11 October 2005

- The Implementation of Spectrum Trading in the UK  
Presentation to National Communications Authority Annual Conference, Budapest, Hungary, 16 September 2005
- EU Policy, Mobile and Broadband: Lessons for West Africa  
Presentation to WATRA CEO Forum, Accra, 8 September 2005
- Regulation and Competition: Price controls and other regulatory instruments in telecoms and water  
Presentation, St. Andrews, 13 May 2005
- Towards a New Era in Spectrum Management  
Presentation to Global Symposium for Regulators, ITU, Geneva, 8 December 2004
- Regulation and Competition in Telecoms and Water  
Warwick Business School, 29 November 2004
- The New Regulatory Framework in European Telecommunications: Paving the way for competition  
LINK Centre, WITS Business School, Johannesburg, South Africa, 22 October 2004
- The Economics of Spectrum Pricing  
Department of Economics, University of Warwick, 16 January 2004
- The Theory and Practice of Spectrum Pricing  
London School of Economics, 3 November 2003
- The New EU Regulatory Framework for Electronic Communications: Market Definition  
Roundtable presentation to Faculdade Economia da Universidade Nova de Lisboa, Portugal  
3 February 2003
- Market Definition and Dominance  
Presentation to the ITU Competition Policy Workshop, Geneva, 20-22 November 2002
- Government Objectives for Broadband Access: Is Policy Consistent?  
Presentation to CEPR/ECARES The Evolution of Market Structure in Network Industries Final Conference, Université Libre de Bruxelles, 8/9 November 2002
- Spectrum Trading: Where, When and How?  
Presentation to international conference on Convergence in Communications Industries, Warwick University, 2-4 November 2002



Mobile Telecommunications and Competition Policy: Comparing Australia and the United Kingdom

International Telecommunications Society, Madrid, 9 September 2002.

Spectrum fees, charges and auctions

On the move the CEPT 10th annual conference, Vienna, 17-19 April 2002

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