Related PolicyTracker Articles

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25 October 2005 - Ofcom licence terms inadequate says Australian expert

Ofcom's proposals to auction the 412 to 414 MHz and 422 to 424 MHz bands have raised a concern about managing potential interference

The criticism of Ofcom's approach to liberalisation comes from Michael Whittaker who led the introduction of flexible spectrum management techniques in Australia in 1994. He says the UK regulator's policies cannot meet the stated objective of introducing a wider range of services and technologies because Ofcom has not provided the means by which the value of the spectrum is clearly defined and maintained over the license period.

Earlier this month Ofcom announced a consultation on the license terms and conditions for the spectrum band 412 to 414 MHz paired with 422 to 424 MHz; formerly owned by the Inquam group. The planned auction follows the regulator's stated intention to release the unused spectrum outlined in its Spectrum Implementation plan. An auction proposal for the former GSM/DECT guard bands (1781.7-1785MHz paired with 1876.7-1880 MHz) was published in July. Ofcom wants to auction the 412 to 414 MHz and 422 to 424 MHz by a single round sealed bid. The license will be tradable, technology and service neutral and the licensee will be obliged to avoid undue interference to MoD users in the band.

Problems of definition

Whitaker's principal criticism of Ofcom's approach is that it fails to fully define the spectrum asset for the licensee which he argues is essential in any sale of spectrum rights; full technical definition is essential for effective outsourced spectrum management. By not putting in place adequate interference benchmarks Whittaker says Ofcom is in danger of repeating the mistakes made by the US Federal Communications Committee in awarding PCS licences in the 1990s. Here licensees are still complaining that too few interference benchmarks failed to protect the spectrum space asset leading to 'non-reciprocal spectrum access for dissimilar equipment standards'.

Like the FCC did, Ofcom's intention is for industry to bear the cost of negotiations and to design their own boundary conditions which Whittaker argues is likely to result in myriad of local UK arrangements which will be difficult to manage or, indeed, record in a centralised database that can be productively used by industry or neighbouring administrations.

Whittaker, now a director of Australian spectrum licensing consultants FuturePace Technologies, does not mince his words: 'It is fine rhetoric to speak of technology and service neutrality in economic terms but technically, in terms of providing a coherent strategy for the ongoing, efficient and cost effective management of spectrum, the challenge seems to be presently outside Ofcom's grasp.' •

25.10,05

12 April 2006 - Liberalisation means tackling the interference problem

Flexible access to the radio spectrum requires all interference benchmarks to be pre-defined, argues a new book. Countries relying on self-regulation will place an unfair burden on industry says its author, Michael Whittaker.

The purpose of providing flexible radio spectrum access is to harness the ensuing competition benefits from industry innovation in the provision of wireless services. Increased productivity depends primarily on the rate of technical progress. Technical innovation is the overriding factor yielding economic benefits. Before industry will invest in innovation it needs long-term certainty through the availability of fully defined rights for exclusive and flexible access to parts of radio spectrum space. Importantly, the utility of that spectrum needs to be preserved no matter what types of services are being operated in adjacent spectrum. If these basics are met, an environment is created in which competition can flourish within industry as opposed to having it directed or stimulated by a regulator.

The rules that authorise use of devices must be clear and legally robust. They must also be designed in a manner that minimises negotiation with adjacent licensees and the regulator, and when necessary, be capable of using guard space from the licensee's own spectrum rather than requiring their neighbour's spectrum (see later in this article).

The introduction of flexible spectrum management in Australia required me to work closely with legal and economic specialists. In my new book I try to bridge the technical divide that I observed between these specialist fields, presenting the fundamentals of radio interference management in a flexible usage context.

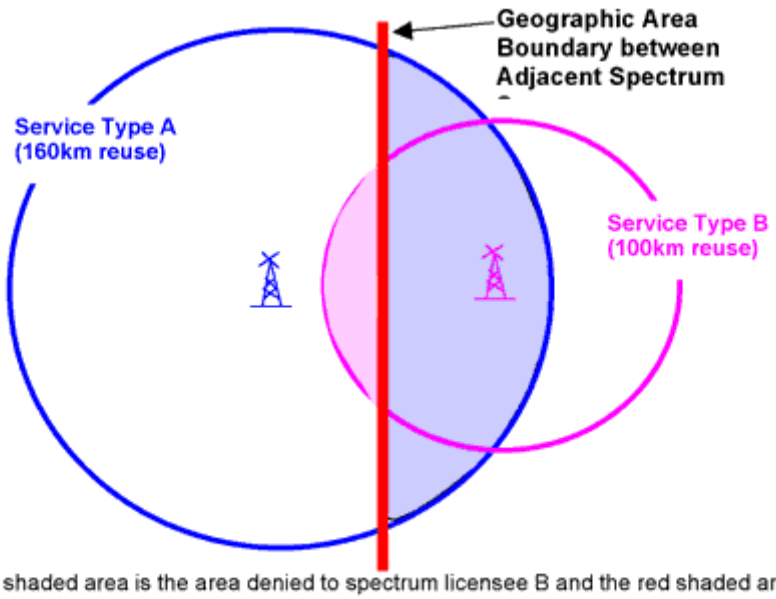
Current situation

The efficiency of spectrum use depends on how all devices inside and outside a part of spectrum are coordinated to minimise interference. There are quite a few interference mechanisms and they all need benchmarks: first, to define the utility (and hence value) of the spectrum and second, to provide a "line in the sand" for interference self-management including its settlement.

Managing a number of interference mechanisms across multiple spectrum space boundaries is a complex task. Complete definition of spectrum access rights requires much more than just a "spectrum mask". In practice, definition of rights has not been ideal. Regulators often provide:
• partially defined rights which do not allow a licensee to fully manage interference in a technology and service neutral manner; and/or
• rights which are not technology neutral; and/or
• rights which are not clear and/or legally robust.

The end result is no preservation of the utility of a licensee's spectrum space and reduced innovation resulting from costly and uncertain negotiation between adjacent licensees and the regulator. This could otherwise be avoided.

Under flexible access, interference cannot be managed using traditional methods alone. Figure 1 illustrates just one example (reuse of the same frequency band) where problems can arise when rules are incomplete. Flexible use requires a fundamental change in the way spectrum is managed: moving from a device-centric to a space-centric approach.



The blue shaded area is the area denied to spectrum licensee B and the red shaded area is the area denied to spectrum licensee A. Spectrum licensee B loses more spectrum space than licensee A, this is described as one form of **non-reciprocal spectrum access**. Note, Service Type B would not be allowed to operate at the shown location.

Essential requirements for space-centric management

Radio spectrum is multi-dimensional. A specific part of radio spectrum consists of not only a frequency band, but also a spatial volume (a geographic area and elevation plus height above ground) as well as a time period, five dimensions in total. Parts of the spectrum can be adjacent in relation to each of these dimensions.

From a technical perspective, managing interference across multiple spectrum space boundaries is not an easy task. It unleashes all the complexity of a multi-dimensional problem involving three spectrum access rights: explicit transmit rights; implicit receive rights; and rights of a legacy service.

The explicit transmit rights inside a spectrum space must take account of three interference categories:
• separation from the geographic area boundary (linear type interference);
• separation from the frequency boundaries (linear type interference);
• frequency and distance separation from devices operating outside the space (non-linear type interference).
The three spectrum access rights can be in relation to three general types of service:
• one-way single frequency;
• two-way single frequency;
• two-way two-frequency.

Interference management and guard space

Guard space is spectrum space that is used to manage interference rather than to increase communication capacity. Guard space, which can be either a guard band; a guard area; or guard time, often replaces isolation between devices that could be provided by hardware.

Transmit rights are usually optimised around a single service type for benchmarking purposes, based on likely use for a band. To a degree, guard space can be reduced by operating similar service types in adjacent spectrum spaces. It has been said that guard bands are anathema to spectrum management. However, guard bands are already a valid and common source of isolation in traditional spectrum management depending on the specific economic factors. Trade-offs commonly occur between the value of spectrum and value of hardware.

Guard space

Two-way two-frequency services (FDD, for example, cellular mobile phone services) utilise much more guard band than two-way single-frequency services (TDD, for example, wireless broadband internet services). FDD services require two separate frequencies or channels for the base station and mobile (handset) transmitters while TDD uses one channel. In addition, FDD requires an inter-band gap, a guard band which separates grouped base transmit frequencies from grouped mobile transmit frequencies to assist with interference management. There is also an implicit use of guard space for FDD when equal amounts of uplink and downlink data are not sent and the communication capacity of two channels is not fully utilised.

Given that guard space is already a common interference management tool it is of no surprise that it must play an important role in flexible spectrum access. Whenever the operation of dissimilar technologies and services could lead to an inequity in adjacent spectrum use, utility can be preserved by having rules which require the spectrum licensee to provide any necessary guard space:
• from within the space of their spectrum licence; or
• through spectrum sharing or trading agreements with neighbouring licensees.

In the latter case, such an agreement also provides a commercial framework for compensation for the use of the adjacent licensee's spectrum. Thus it is possible to establish pre-defined rules for operating TDD services in spectrum optimised for FDD services.

Ofcom's award of frequencies at 1781.7 / 1880 MHz

Interference is interdependent. Interference depends on the relationships between all the devices using the spectrum. Paradoxically, in an interdependent system, freedom of choice can not exist without clear rules. Clear rules also provide benchmarks for any negotiation that turns out to be necessary. Many of the interference benchmarks that are necessary for outsourced spectrum management in a technology and service-neutral manner are missing from the spectrum access rights of Ofcom's award of frequencies at 1781.7 / 1880 MHz. Ofcom requires industry to develop a Code of Practice after the auction to manage interference even when there are already many examples from other regulators, including the USA and New Zealand that clearly illustrate the cost and uncertainty burden of such a practice. Industry will be negotiating about "shifting sand". Perhaps this burden will be reduced by virtue of low power limits for this band but Ofcom's approach is in no way a long-term general solution and does nothing to help assuage the fear that surrounds the implementation of flexible spectrum access throughout Europe.

Management for all services

Space-centric management with complete definition has been in use for the past 9 years, but only in Australia. The access rules are scalable and will work anywhere. Provided sufficient spectrum is released to avoid artificial scarcity and strategic hoarding, new entrants can get on with rollout of any technology and service assisted by spectrum trading or third-party arrangements and all without any intervention by the regulator. Click here for a brief comparison of device-centric and space centric management approaches.

Under a flexible space-centric approach, once access has been authorised, interference is separately managed to obtain the implicit receive rights. Therefore, the spectrum access rules must contain all the necessary technical interference benchmarks to make it practical for industry to accept responsibility for interference management. Interference management under flexible access might continue to be centralised or fully outsourced. In either case, full definition of the spectrum access rights in relation to all interference mechanisms is essential to provide transparency of regulator

decisions and minimise industry uncertainty. Such an approach could be used to manage interference across the borders of individual Member States of the European Community to provide equitable access and minimise need for negotiations when different technologies and services are used in adjacent countries. The space-centric approach clearly provides the ideal framework for the authorisation of future high powered dynamic spectrum access using cognitive radio. •

12.4.06

About the author:
Michael Whittaker has worked for 20 years in spectrum management and pioneered automated frequency assignment systems for the Australian government. He is now a director of FuturePace Solutions which designs web-based online transmitter certification and authorisation services. His latest book Flexible Radio Spectrum Access is available at www.futurepace.com.au

2 May 2006 - The EU's first roadmap for full liberalisation

Slotting in the final piece of the liberalisation jigsaw could be worth nearly £1bn a year says Ofcom, which is proposing technology and service neutral licences.

It has become a mantra in policy making circles that the way to realise the economic value of spectrum is full liberalisation – or the ability to trade frequency licences and change their use. This may be true but the big question is not what but how.

How can you put in place a structure which allows change of use but doesn't increase interference, preserves licence holder's legal rights and maintains a frequency plan which accommodates the wide range of uses society expects?

Enter Ofcom which has put forward the EU's first plan for putting change of use into practice. It is currently consulting on proposals to bring in technology and service neutral licences, called Spectrum Usage Rights or SURs.

The terms of the new SURs would be based on the emissions a licence holder is allowed to make. A limit would be set on geographic, in-band and out of band interference and if this was exceeded the licensee would be breaking the terms of their licence.

Spectrum Usage Rights: Ofcom's proposals

Terms:	The terms of SUR licences would be based not on what they can be used for, but on the level of emissions a licence holder could make in neighbouring bands or locations. (1.16)*
Interference:	• To prevent geographic interference licencees couldn't produce a signal which exceeds a specified power limit beyond their agreed boundary. (1.19) • In-band and out-of-band interference could not exceed a certain level for more than a certain percentage of the time. (1.20 - 1.21)
Negotiation:	Companies can change usage rights by negotiating with all their affected neighbours then applying for Ofcom's approval (1.26)
Trading:	SUR licences would be tradable (1.27)
Scope:	• apply to national or regional licences, not local licences (1.29) • Initially only new licences awarded as SURs but eventually all national or regional licences, including broadcast licences, converted to SURs (1.29)

** For full details see http://www.ofcom.org.uk/consult/condocs/sur/sur/; numbers refer to sections in the consultation document.*

How much difference would an emissions-based approach make? Initially, in practical terms probably not that much. Eric Fournier of the French regulator ANFR says once you set emission limits these greatly restrict the kind of technology which can be used in the band. 'When you define out of band emissions you need to assume to which kind of technology you apply it and which kind of technology it could interfere with. If you have made technology neutrality in the GSM bands, based on the GSM mask, you would have simply forbidden UMTS to enter this band,' he says, referring to the ongoing debate about liberalising the GSM bands. This issue will certainly be a major test for the SUR approach if it isn't resolved at a European level beforehand.

Professor William Webb, Ofcom's head of Research and Development, accepts that in most cases the emission limits approach will not offer much scope to change the technologies currently used. For, Ofcom, however in the circumstances where this is possible there is enormous value in companies being able to select different technologies or uses without the delay incurred in referring this to the regulator first. The regulator estimates this is worth £0.9bn annually to licensees and consumers, basing its calculations on the 2004 Analysys report for the European Commission.

Eric Fournier also argues that for many years European regulators have responded to companies' requests to change technologies or uses. The final decision has usually been based on the potential for additional interference but in specific cases taking into account issues like harmonisation or competition.

William Webb accepts that change of use is possible already: 'You could argue all we're doing is making a process which was previously available but a bit esoteric and clunky much simpler and more open. Another way of looking at it is we are giving a lot more flexibility and capability which will encourage people to make major changes to spectrum [use].'

Sort it out for yourselves

The SUR approach puts a new emphasis on companies negotiating with each other. If a company wants to exceed its licence terms – by operating higher power transmitters for example - under SUR it is encouraged to discuss the changes with other affected parties. If agreement can be reached then Ofcom could agree to vary the terms of the licence. Again these negotiations with other affected parties usually take place at the moment in the UK and elsewhere in Europe before change of use requests are made. In France, for example, the ability to negotiate is built into the new 3.4-3.6 GHz licences. Where the UK differs is that it is trying to apply these principles across the board in the hope of stimulating innovation. Opinions are divided on whether this one-size-fits-all approach is practical or desirable.

Doesn't this mean that small companies could be at the mercy of big companies with teams of lawyers and enormous resources to devote to this kind of negotiation? Unlikely said William Webb, as SURs would only apply to national or regional licences and these are predominantly operated by big companies. Ofcom is also looking at making its software interference modelling tool available on its website to help companies with these negotiations.

One telecoms lawyer *PolicyTracker* spoke to was not so sure that economic inequalities would not be magnified. 'There's big and there's really big' said the lawyer, wondering how easy it would be to prevent the players with the deepest pockets sitting on spectrum to preserve it for future use.

'Can market forces really work effectively across the whole spectrum or only in small sections of it?' the lawyer asked, pointing out that the more regulators withdraw the less they can take positive action to encourage outcomes which are socially beneficial. Under the new SUV regime Ofcom would retain powers to deal with interference and anti-competitive behaviour, but how would they deal with spectrum hoarding when this was not an abuse of commercial power but merely socially undesirable?

The international verdict

However, one of the architects of Norway's liberalised spectrum management system does not agree that the scales will tip in favour of larger players. 'Under the regime today, [bigger companies] have more staff and larger budgets to persuade OFCOM to do what is best for them anyway' said Erlend Fanebust, formerly of the Norwegian regulator NPT and now with FDH Consulting.

While Fanebust thinks Ofcom is 'on the right track' Michael Whittaker, who performed a similar role in setting up Australia's liberalised system has strong misgivings. 'It is an impractically complex proposal that would fall in a heap at the implementation stage,' he said, which will result in high cost and uncertainty for licensees.

Whittaker's main criticism is the inadequacy of the mechanisms for controlling interference. In practice, he believes, they amount to controlling interference through negotiation. 'Ofcom is still clinging to the idea of using spectrum trading [as] the first step in negotiation and then conversion of those licences to flexible spectrum licences through endless negotiation rather than biting the bullet and re-allocating occupied spectrum by process of award with a fully-defined interference management framework,' said Whittaker.

Fanebust accepts that the risk of interference would be increased under the SUV system but believes this is outweighed by the benefits of a more flexible system. He argues that markets can resolve interference in an efficient way but the important thing is that an appropriate legal system exists to facilitate the negotiations.

What about the cheaters?

Ofcom's view that interference issues can be resolved through negotiation or trading without regulatory involvement is a fundamental shift and all the implications are unlikely to be immediately apparent. Our unnamed lawyer believes one key issue will be 'dealing with the cheaters', because not all licence holders are socially responsible companies who want to play by the rules. 'It's not in everyone's interest to reduce interference,' said the lawyer, 'and once you have a complex system of users and sub users it will take a long time to figure out who to go after.' Under Ofcom's proposals SURs can be used along with trading to set up a multi-tiered system of "parent" and "child" licences.

To be fair to the UK regulator the plans contained in the consultation document are not designed to address implementation issues, rather to build a mutually acceptable regulatory framework for technology and service neutral licences. Implementation will be addressed later but the timescale is quite tight. If this consultation is favourably received new licences could be issued in SUR form by the beginning of 2007, although the conversion of existing licences is regarded as a long-term process, taking 10-15 years. •

3.5.06

20 June 2006 - Will Ofcom's spectrum usage rights deliver?

With the closure of its consultation this week, Ofcom edges a step closer to defining spectrum usage rights. Here Australia's Michael Whittaker explains why he thinks the UK's communications regulator is barking up the wrong tree.

Nearly ten years ago, the Australian industry was provided with a very successful definition for spectrum usage rights (SURs). It ensures that the utility of a self-managed spectrum licence is not only clearly defined but also preserves flexible use and manages interference through the combination of a full suite of interference benchmarks plus, if necessary, use of guard space. Full definition has removed the need for negotiation with adjacent licensees and the regulator, except for the occasional spectrum sharing agreement.

To its credit Ofcom is keen to release sufficient spectrum in order to establish a viable spectrum market that will make strategic hoarding ineffective. However, the fundamental basis for that market, Ofcom's SURs' consultation document, is more theoretical than practical. Given the time and effort which has gone into the document, and the lengthy analysis that will be necessary after it closes, it is disappointing that it doesn't have greater depth. In the document's own words it represents "initial thoughts". With Ofcom spectrum awards already in progress in which interference management has been left mostly to negotiation, the solutions to the issues giving rise to this document are already quite overdue.

Too detailed and complex

What is clear is that optimum form for SURs will be an integrated technical, administrative, legal and economic solution. Optimisation requires trade-offs that can lead to use of alternate technical forms of SURs which take better account of all the issues. The consultation document incorrectly assumes that the technical form of SURs can be defined first without first considering all administrative, legal and economic factors.

On the one hand too much emphasis on certain aspects of Ofcom's definition of spectrum usage rights has created an impractically detailed and complex proposal which would lead to an unnecessarily high level of regulatory control, audit and consultation requirements. On the other, some other important aspects of SUR technical definition are ignored. Indeed, the way Ofcom has approached the definition poses a number of problems. In this article I discuss just three of those problems.

Firstly, it is not administratively practical to establish SURs which manage interference at a detailed level; for example, rights directly involving field strength for certain percentages of locations and time. Instead, broad limits that are technically clear and legally robust must be adopted which then support licensees in managing interference at a detailed level. The primary objective of the rights is not to determine whether interference is actually occurring but to enable the market to operate efficiently.

Secondly, the consultation document states that "In order to determine whether there is undue interference from a neighbouring licensee a process of measurement is required." In other words, a procedure for measuring received signal levels is proposed.

I strongly believe that measuring received levels of interference in the field is not the best way to audit compliance. A legally robust and cost-effective method of determining whether interference exists is a desk audit process which checks the radiated power of a transmitter against transmission rights, not by measuring received field strengths; for example, using a method similar to the Australian device boundary construct. This boundary should not be viewed as a model for coverage or service area. It is a clearly defined transmission right, independent of what levels may actually occur on or past a geographic boundary. There is more on this in my book about "Flexible Radio Spectrum Access". See *PolicyTracker* 12.04.06 Liberalisation means tackling the interference problem

The third mistake that the Ofcom document makes is its assessment of the likelihood of interference through the mechanism of intermodulation: "These aspects of interference generally only become an issue with relatively high power transmitters and/or transmission/reception equipment in relatively close proximity."

Missing the point?

The only lesson taught by history is that most people do not learn from history.

Certainly, Pye Pty Ltd's experience with intermodulation interference in Australia in 1967 was quite different to Ofcom's. Pye described the prevalence of intermodulation interference for single-frequency land mobile radio base station receivers as on the verge of "becoming insoluble". (See deVille G. "Interference in V.H.F. mobile radio systems" Pye Proprietary Ltd., Melbourne, Victoria, Radio and Electronics Engineering Convention, Sydney May 22-26, 1967 pgs 190-191).

With the exception of low-power services and unless special measures are taken, this interference can occur at distances of up to 20 km under line-of-sight propagation conditions. However, the consultation document provides two options for management (a) no management and (b) first-in-time.

Ofcom's intended implementation policy and that is the consultation document's final word on the matter completely misses an important management requirement. The document states: "At present we do not see a need for any licence conditions specifically aimed at restricting intermodulation". Given the strong likelihood that interference will be caused by receiver intermodulation, it must continue to be managed under flexible spectrum access, in the same way that it is already being managed. Furthermore, special attention must be given to receiver intermodulation in the design of flexible spectrum access rules. Many transmitters create a veritable "forest" of intermodulation products which given the right conditions, can cause interference. Interference through receiver intermodulation can be restricted to co-located devices only through use of special technical solutions. Interference benchmarks will have to be established to support such outcomes. Ignoring the problem won't make it go away.

Avoiding uncertainty

If Ofcom persists with this “final word” on the matter it remains unclear exactly how receiver intermodulation will be managed. It seems likely that it will be another issue added to the already long list of interference matters to be handled at high cost and with the commercial uncertainty of ongoing negotiation.

At the moment it looks as though the UK industry would benefit from spending some time on finding a solution for change of use that provides it with operational certainty and a controlled and predictable cost structure for regulatory compliance. In fact, the fundamental principles underpinning that solution are already available.•

20.06.06

About the author:
Michael Whittaker has worked for 20 years in spectrum management and pioneered automated frequency assignment systems for the Australian government. He is now a director of FuturePace Solutions which designs web-based online transmitter certification and authorisation services. His latest book *Flexible Radio Spectrum Access* is available here

25 July 2006 - Spectrum rights: thorn in the side of regulators?

Today the UK communications regulator Ofcom acknowledged that more work is needed on the question of Spectrum Usage Rights. Is there anything Europe can learn from the recent furore over rights in New Zealand?

The story runs along the lines that New Zealand's Ministry of Economic development (MED) is 'threatening to take back' blocks of underutilised 2.3 GHz spectrum held by start-up operator Woosh Wireless. The MED says the report, published by Wireless Watch misrepresents the facts.

In a response to *PolicyTracker* the MED was unequivocal. 'The government, including the MED, has no access to these rights until they expire in 2010. There is no question of the MED "taking back" rights.'

The spectrum management rights in question are 2 of the 12 x 8 MHz blocks in 2.3 GHz band which were first allocated in 1990 for the purpose of providing a terrestrial broadcasting technology known as MDS. Woosh Wireless bought the management rights to these two blocks of 2.3 GHz spectrum from the original purchaser in 2000. But according to the MED neither Woosh nor any other right holder has made significant use of this spectrum since the original allocation in 1990. In addition, no spectrum licences – a prerequisite for use – have been issued. 'This,' says Brian Miller, the MED's manager for spectrum policy and planning, 'is a fact not a "claim".'

A further argument for the decision taken by Cabinet in 2004 not to renew the rights was the fact that no infrastructure had been deployed. In addition new technologies, like WiMAX, which can be deployed in this spectrum have channel plans (5, 10 MHz) not matching bandwidths of the current channel plan (8 MHz).

'There is no automatic provision for renewal of rights in fact or in law,' explains Miller. The intent of this policy is to provide certainty for actual and potential owners of management rights, subject to a case-by-case review no later than five years before the relevant expiry date (in this case 2010). 'If renewal incurs a risk that the rights will fail to achieve their optimal value to society, the spectrum reverts to the Crown and rights to its use may thereafter be re-allocated by market processes.'

What is clear is that the MED believes that this spectrum has not been sufficiently utilised and it argues that if 'common sense' prevails these rights (not the licences its stresses) be re-allocated before 2010 so that the business plans for use after that date have an adequate lead time.

Claims that this will lead to New Zealand falling behind in its roll out of wireless broadband are erroneous, says Miller. 'The new owners, which could be Woosh, could purchase existing rights from the owners or otherwise renegotiate use of the spectrum prior to 2010 – as has happened in 3.5 GHz. There are no regulatory restrictions to preclude this and, in fact, the Radiocommunications Act of 1989 specifically enables such secondary market transactions.'

MED is currently consulting on broadband spectrum issues.

Did New Zealand get it wrong?

As the world's first spectrum liberaliser back in the 1990s we have to ask if New Zealand got it wrong. According to Michael Whittaker MED was too hasty 'particularly in relation to their legal capacity to design a workable interference management framework. The engineers were steam-rolled by economists, as is happening with Ofcom right now,' says Whittaker. See *PolicyTracker* 20.06.06 Will Ofcom's spectrum usage rights deliver....

In New Zealand, and the same is true in Australia, 2.3 GHz spectrum has not been used to the public benefit and Whittaker argues that this is because spectrum rights have not sufficiently incentivised industry to innovate. Now the licensees are simply waiting to make a profit from the sale of the spectrum rather than providing new services which explains why MED will not renew these rights.

'This renewal re-auction dilemma is going to be around for a long time,' says Whittaker, but could have been avoided with spectrum access rights that limit costs and uncertainty relating to change of use.

Ofcom's next steps for spectrum usage rights are published today (July 25).

25.07.06

4 May 2007 - Opinion: spectrum trading – the framework exists

A flexible spectrum management regime to support both liberalisation and new developments like cognitive radio is already working well in Australia argues its creator, Michael Whittaker.

At the start of 2007, over 5000 WCDMA (850 MHz) base stations had been authorised under Australian spectrum licensing during the previous 3 months using an online process. Justin Milne the Group Managing Director of Telstra BigPond said on 20 March 2007 "Just a few months ago we launched our Next G™ wireless network (WCDMA 850MHz), which is the biggest and fastest mobile 3G network in the world, providing high-speed wireless broadband access to 98% of Australia's population. Because this network is not regulated we've been able to build it in record time and we can sell it at a price determined by the market to recoup our investment over time."

There was no need for negotiation for the authorisation of these stations just a requirement to place certified data into a central register. The process was fully self managed, business decisions were taken, bases deployed and authorised and all without reference to either the Regulator or other licensees. Importantly the rules that allowed the authorisation of WCDMA850 in 2007 were truly technology and service neutral since they were provided to industry 10 years previously in 1997.

In 1989, the Australian Government concluded that apparatus licensing would not be able to cope with the anticipated rate of equipment change and laid legislative foundations for spectrum licensing which would treat radio spectrum as a commercial asset with a clearly defined utility under conditions of flexible use where technology and service would be determined by the licensee. While the New Zealand Government moved with unprecedented rapidity to privatise former Government activities, publishing their Radiocommunications Act in 1989, Australia's new Radiocommunications Act took until 1992 to emerge.

In 1994, I was privileged to be made primarily responsible for the technical definition of spectrum licensing in Australia. In 1995, the solution was presented at a conference in London and the first spectrum licences were issued in 1997. The uniqueness of the Australian system was made clear at the London conference when an FCC official privately said, when asked about interference management for their PCS licences, to the effect "We let the economics of greed manage it", meaning there was to be considerable reliance on negotiation. Greed might work, but it can have very high transaction costs.

A "unique benchmark" in spectrum management

The now 10 year proven, general solution for equitable access to radio spectrum space under conditions of flexible use, designed in Australia, is being referred to as space-centric management because interference management for new devices occurs at the boundaries of a spectrum space using explicit transmit rights and implicit receive rights in relation to all interference mechanisms *(1)*. Only this technique can provide the necessary technical and legal certainty. Explicit transmit rights are independent of what actual levels may be received on, or past any spectrum space boundary and the legal framework must be able to support the provision of such rights. Ofcom's Spectrum Usage Rights are not the equivalent of space-centric management because they are partially defined and are based on explicit receive rights.

Because different technologies and services utilise different amounts of spectrum space, technology and service neutrality can only relate to the spectrum access pathway. The space-centric technique is authentically technology and service neutral because it provides all the necessary practical rules for access by all technologies and all services in the initial spectrum licence conditions. Authentic neutrality arose first in Australia because of the creative freedom provided by the following pre-existing factors:
• sufficient coherent political will;
• a relevant legal framework *(2)*;
• implementation not Standards-driven;
• a centralised online database; and
• perhaps most importantly, a cooperative multi-disciplinary implementation team.

Although Australia's auction system borrowed heavily from the FCC, the accompanying interference management framework was very much home-grown and uniquely different to both USA and New Zealand. The framework has since been described as a "unique benchmark in modern spectrum management" by the ITU *(3)*.

Australia's framework required a new type of technical definition to achieve minimal negotiation and hence minimal cost and uncertainty in relation to wireless network rollout and interference management. In spite of the amount of time that has now passed, the space-centric technique pioneered in Australia still remains the most flexible and most technically and legally certain framework currently available for spectrum licensing.

A solution for Europe

While Regulators have been tasked with managing spectrum, they have traditionally employed a process that focused mainly on managing devices. Equipment Standards have been central to traditional device-centric spectrum management. The current dilemma in Europe about how to implement flexible access to support industry-driven innovation logically requires spectrum management to have much less emphasis on Standards (see comments of Mark Bogers, Is it time to update the R&TTE Directive? *PolicyTracker* 28.03.07). The entrenched political and power structures built around device-centric spectrum management need to be disengaged. The large effort put into the strategic gaming that accompanies Standards development actually reduces the potential for innovation.

Space-centric management is able to shift the management process away from Standards, back to the primary resource: spectrum space; and in so doing, maximises innovation potential by:
• providing authentic technology and service neutrality;

• making technical and legal sense in the process of spectrum trading/sharing;
• taking the spectrum allocation out of Standards wars;
• providing an immediate response to an innovative equipment manufacturer; and
• maintaining IP and business plan confidentiality.

Essentially, there must be sufficient information in the spectrum licence conditions to provide a basis for new equipment design and authorisation. Such an approach creates a ready-made framework for the authorisation of dynamic spectrum access using software reconfigurable and cognitive radio. •

Michael Whittaker is now a director of the consulting company, FuturePace Solutions. You can find out more about Flexible Spectrum Access Rights at the pre-conference workshop of the 2nd Annual European Spectrum Management Conference, Brussels on 4 June.

4.5.07

Notes
(1) Except for specific legacy services.
(2) While the Radiocommunications Act 1992 did not provide a clear technical solution, there were nevertheless sufficient legal “hooks” to allow a full solution to be designed later on.
(3) Leite F. “Spectrum management for a converging world: case study on Australia” ITU February 2004

14 August 2007 - Opinion: one step forward and two steps back – the UK L-band auction

Michael Whittaker, the architect of Australia's liberalised spectrum management framework, warns that the self regulation proposed by Ofcom in 1.5GHz could allow companies to devalue their competitors' licences.

There has been some progress with spectrum right definition in Ofcom's 1.5 GHz spectrum auction consultation published 25 July 2007. For the first time Ofcom seems to be aware of the benefits of specifying a single propagation model as a basis for testing compliance with in-band, adjacent-area PFD (field strength) limits.

Given Ofcom policy had previously mandated very expensive and essentially impractical field strength measurements as a means of certifying compliance this is a major, albeit incomplete, development. (See consultation document: The award of available spectrum: 1452 - 1492 MHz (L-Band)

Of course, the PFD limits are then not the primary limits, becoming merely a part of the way in which limits on radiated transmit power are specified. The primary restriction becomes the radiated power at the antenna not field strengths away from antennas, i.e. not the actual levels of the interfering field strength in area-adjacent spectrum licences. This method of formulating the spectrum right that is related to management of in-band, adjacent-area interference was first proposed to the UK regulator in a public consultation response in 2001 by FuturePace and repeated in subsequent responses. That was over six years ago when it was already a proven solution in Australia!

Ofcom proposes that propagation model ITU Rec 1546 version 3 be used for testing compliance with the aggregate PFD limits contained in the licence. In terms of formally defining legal rights for licensees, sophisticated propagation models are very complex and difficult to draft in strict legal terms (being called up as a software package is also not legally appropriate). Propagation models are in a continuing state of refinement and thus should not be "set in stone" as licence conditions.

Ofcom have proposed version 3 be used but what happens when version 4 becomes available? Depending on Ofcom's final design this approach may not provide legal or technical certainty for licensees. Far better to establish clear regulatory benchmarks for radiated power at each transmit antenna and leave the detail of interference management to industry who can then select their preferred propagation models based on their commercial interest in technical success. Industry has after all, software development skills at least equivalent to Ofcom.

Reform or tinkering?

The selected propagation model has a significant role in determining the actual value of auctioned licences because it affects spectrum utility. While Ofcom says "Rights…will not be changed without good cause", a right purchased at auction for a price determined by those rights should not be changed at all. Instead, compensation should be paid by the regulator for any change in licence conditions or early resumption where the licence is not perpetual. But then as Orange very observantly quipped in its 2.6 GHz response "it is misleading to characterise the SUR as rights" and "proposals within the consultation document amount to little more than 'tinkering' with the Wireless Telegraphy Act licence conditions". Certainly a supporting legal framework for SUR is now long overdue.

With the policy change, Ofcom also now has the task of specifying the terrain database to be used with the propagation model. Ofcom apparently "has no preference at this stage over the provider….There are a number of potential suppliers of such data, for example Infoterra, Computamaps and others." For the sake of repeatability and thus unambiguous spectrum rights, only one dataset should be specified just as a single propagation model has been proposed. However, Ofcom runs the obvious risk of providing a windfall for one supplier. By way of example of what should be done, the Australian regulator created its own Digital Elevation Model (RadDEM) in 1995 and to its credit, 1 year *before* the official Australian DEM became available. RadDEM is now the basis for establishing all spectrum rights in Australia.

To much self regulation

Much of the detail of technical conditions is apparently to be later ironed out by not one, but now two, Industry Codes of Practice (ICP). Apparently licensees should agree to a Code of Practice within 6 months after the licences are awarded. The Code should deal with the procedural and technical issues with managing engineering coordination such as:
• limiting transmission powers to that just necessary to effectively provide service;
• selection of sites in a manner that will minimise the probability of mutual interference; and
• identifying the type of information that needs to be communicated between licensees and the arrangements for its exchange.

Limiting transmission powers is a primary responsibility for Ofcom in establishing a practical framework which includes all necessary negotiation benchmarks for licensees and which essentially establishes the value of a licence. Issuing industry with a carte blanche instruction to "sort if out if we don't get the technical conditions right" does not constitute responsible or competent regulation.

Similarly, expecting industry to sort out the data exchange requirements is unreasonable. Again to its credit, the Australian regulator provided a central online database, essential for legal and technical certainty for not only licensees but also the regulator, for all spectrum licences issued beginning 1997.

The insurmountable problem associated with leaving critical technical benchmarks to be thrashed out in an industry group which is supposed to establish a Code of Practice is that licensees face the prospect of a competitor effectively in charge of determining a varied utility for spectrum purchased at auction for a price based on its original utility. Ofcom's proposal for the Code can be interpreted as "we don't know where to set all negotiation benchmarks so we'd like you all to agree to set them among yourselves" meaning UK industry must then estimate the value of the auctioned spectrum based on very uncertain and costly negotiation outcomes with its competitors.

Perhaps Ofcom is prepared to accept that the price paid for the spectrum will be significantly reduced because it has not set all the necessary technical benchmarks? The Australian method of spectrum right formulation, clearly not yet studied in-depth by Ofcom, is designed to operate without negotiation which is possibly why it has now operated successfully for 10 years without litigation. •

14.8.07

About the author:
Michael Whittaker is now a director of the consulting company, FuturePace Solutions

11 February 2008 - Opinion: Industry remains concerned about Ofcom's flexible licensing proposals

As the latest SUR consultation closes Michael Whittaker contrasts the UK and Australian model of flexible spectrum licensing and finds Ofcom's offering wanting.

The UK mobile industry is generally unhappy with Ofcom's design for flexible spectrum usage rights (SURs). The level of restriction to market-driven innovation caused by spectrum usage rights is, to a great extent, affected not only by the method of construction of technical conditions but also by the legal and policy regimes in which the technical conditions operate.

CEPT Report 019 (WAPECS) lists candidate technical constructions for flexible spectrum usage rights. Model 3, Ofcom's approach to spectrum usage rights involves the mere dispensation of a licence that is 'limited' as to revocation and with technical conditions capable of revision. UK industry has repeated in consultation responses that it is not comfortable about having to deal with such a prospect.

Model 6, Australia's Space-Centric Management is a technical/legal solution which has been providing commercial certainty with low management and enforcement costs to industry for the past 11 years. It offers authentic legal rights i.e. the issue and trading of licences through spectrum auctions provides spectrum usage rights akin to a commercial dealing involving a quasi-contractual deal for an indefeasible company asset (a precise spectrum utility specified in the licence - effectively robust technical/legal definitions for "harmful interference"). An updated review and comparison of Model 3 and Model 6 is available here

SURs or SUCs?

What a legal right comprises depends on what is said by what confers it. Only the law can guarantee security of expectation in being able to utilise, retain and trade spectrum rights. One of the main functions of legal systems is to provide remedies for breach of rights including payment for damages.

Given there is no clear right of compensation in the Wireless Telegraphy Act 2006 for degraded utility for an issued licence resulting from Ofcom's unilateral direct or indirect changes to spectrum usage rights during a change of use process, Ofcom's SURs (Spectrum Usage Rights) are more accurately described as SUCs (Spectrum Usage Conditions), as they do not fulfil the usual requirements for 'rights' in the strict legal sense. The typographic error in their final Regulatory Statement is prophetic: "Rights of spectrum users should be clearly defined and users should feel comfortable that they will not be *charged* without good cause"(para. 2.1) for indeed, with conditions capable of forfeiture, the value of such licences will not be very high.

This inconsistency is discussed, for example, by Orange (and seemingly misinterpreted by Ofcom) in their response to Ofcom's consultation document: "Orange is surprised that Ofcom has not addressed the constraints imposed on it by the current legal framework, under which it is able to confer little in the way of 'rights' on the holder of a spectrum licence and consequently has little material from which to build a coherent system of spectrum usage rights. The difficulty is vividly illustrated by the fact that SUR are not rights at all but a 'method of specifying technical restrictions in licences'".

Effectively in agreement with the Orange observation that "proposals within the consultation document amount to little more than 'tinkering' with the Wireless Telegraphy Act (WTA) licence conditions", Ofcom has decided to retain its view that the current legal framework is sufficient "to impose technical conditions given by SURs". Mistakenly, Ofcom also continues to refer to its technical conditions as 'rights'. The technical licence conditions might be supported under the WTA. However, Orange says "it is misleading to characterise the SUR as rights".

Ambiguity of Ofcom's 'rights'

Ofcom is often vague on the issue of just what type of 'rights' are being devolved, for example see their final Regulatory Statement, "specification of interference levels (as spectrum usage rights) allows neighbours to plan their networks more accurately, with less uncertainty or margin for error because they have a better idea of the interference levels to expect" when elsewhere in the document "interference levels are not a guaranteed right that a licensee can rely on".

In the same document, Ofcom says "A better way to control interference between licensees is to specify in a licence the interference a licensee is allowed to cause, rather than the signal it is allowed to transmit". However, the WTA apparently states that licence terms must relate to transmissions from particular equipment "SURs control the PFD radiated by equipment". There is little certainty with regard to exactly what right is to be purchased. Ofcom's Aggregate Power Flux Density (PFD) approach to rights' definition is inherently ambiguous as to whether it delivers transmit or receive rights.

In spite of Ofcom interpreting consultation responses as industry agreement to progress with primary rights specified as PFD, Ofcom's very recent change to compliance verification involving propagation models is causing an effective 180 degree conceptual reversal of its SURs. (See the consultation which closed on 8.2.08) This is a volte face because the primary aggregate PFD limits become secondary as they are no longer the direct specification of the interference field strengths that a licensee is allowed to cause, but are simply inputs to determine the signal level a licensee is allowed to transmit. Those transmit levels will not result in the aggregate PFD limits being the actual interference levels.

To add to the error, there is an increasing number of pragmatic elements in the proposal e.g. the PFD limit to manage interference across the geographic boundary used to be "at or beyond" the boundary. Now it is simply "at the boundary" and "at" is to be specified as a distance "R". Over-simplification will not provide, as Ofcom has claimed for its aggregate PFD spectrum usage rights, more certainty as to interference levels throughout a neighbouring geographic area. There are other examples.

Going down the path of pragmatism to improve technical clarity could be an improvement except that current proposals will not optimise market-driven innovation in the UK. Technical clarity does not necessarily translate into legal certainty. In any case, the legacy of the technical construction bequeathed by Ofcom's original SURs consultation will continue to haunt the ongoing process owing to the existence of the final Regulatory Statement, which was premature. The Statement is flawed in a number of ways, especially to the extent that non-linear interference mechanisms will need to continue to be managed through either worst-case engineering or slow equipment standardisation processes.

Ofcom will remain central

The provision of pseudo-rights and the effective conceptual reversal of Ofcom's basis for defining them are just further additions to a long series of unfortunate events continuing to dog the unleashing of market-driven innovation in the UK and creating unnecessary industry concern about flexible spectrum licensing generally, including in Australia.

Two hidden objectives seem to have guided Ofcom's design: (i) no compensation from the regulator; and (ii) no central transmitter/receiver database. This severely limits options for industry self-management. Ofcom is increasingly central to management of change of use. In contrast, the Australian regulator wanted to be out of the loop to improve the bottom line and thus provided the necessary technical and legal framework.•

11.02.08

About the author: Michael Whittaker is Managing Director of Futurepace RF Solutions and an architect of Australia's spectrum licensing system.

22 May 2008 - First SUR auction 'a success' despite industry fears

Ofcom say they are pleased with the results of the L-Band auction even though major players in the UK market had urged them not to use the new technology-neutral licenses known as SURs.

Spectrum Usage Rights or SURs are the UK take on liberalized licensing. They are tradable and designed to allow operators to use any technology provided it does not cause interference to other users. They work by ensuring that adjacent receivers do not suffer interference, particularly if a neighbour changes the use of their licence.

SURs give greater flexibility by allowing licence conditions to be varied in negotiation with Ofcom and neighbouring license holders.

While the UK's major market players support licence liberalisation in principle, they could not support SURs in their current form. Most of those responding to the most recent SUR consultation on 9 January urged Ofcom to delay commercial deployment. Orange said the mobile consumer would suffer "increased levels of interference and a decreased quality of service." T-Mobile said Ofcom was pressing ahead with SURs "without taking any steps to validate [them] at a practical level by applying [them] to a current network." According to Vodafone Ofcom's approach was "inherently extremely complex, and possibly completely unworkable." BT and transmission company Arqiva also said that SURs were not ready for deployment.

Ironically, despite this strongly worded opposition, there was no shortage of bidders for the L-band auction. Eight companies took part, including Arqiva, and all 40MHz of spectrum was bought by the US chip developer, Qualcomm, for £8.3 million (€10.7 million).

Furthermore, Qualcomm has made no complaints about SURs and while it is not something they have directly commented on, sources close to the company say they are "happy" with the licences. Qualcomm intends to use the spectrum to experiment with new services and sees the liberalised licences as part of that experimentation.

There is no evidence of concerns about the legal certainty which SURs grant licensees affecting the price paid. £8.3 million was in excess of most industry expectations and the transmission company Arqiva, which has a very detailed knowledge of the UK market, dropped out at an early stage of the bidding.

Unpopular with mobile operators, popular with new entrants

Professor William Webb, Ofcom's Head of Research and Development says the auction went very well and taking SURs from concept to implementation is a "great step forward." He says many of the stakeholder concerns were allayed by workshops held after the January consultation, and by changes subsequently made to the licences.

Professor Webb says the resistance has mainly come from the mobile sector: "The mobile operators view is that adjacent licences are likely to be held by other operators who they are very used to working with. They're used to the existing system so see no reason to change. However, new entrants tend to be happier with SURs because they don't have a tradition of working with the earlier licences." Most of the other bidders in L-band would be classed as new entrants: Adolphus,ePortal Holding K.S.C., MLL Telecom, The Joint Radio Company,Vectone Network and WorldSpace UK.

A further irony is that this first use of SURs may never prove whether the licences are actually effective. "The main rationale is to protect against interference when neighbours change the use of their licence," says Professor Webb, "so it will be some time before we can tell if [SURs] have done what is intended. It may be that this doesn't get proved at all with L-band because Qualcomm has bought all the spectrum so there will be no adjacent interference."

Focus on receivers or transmitters?

Australia has had a liberalised licensing regime for over a decade, and its principal architect, Michael Whittaker, is also critical of the Ofcom approach. He says focusing on receiver protection is fundamentally flawed because many factors from topography to weather can affect the strength of signals at the edges of a spectrum licence. "It's impossible to design things precisely when you're focussing on receiver protection, you end up with technical conditions that are extremely fuzzy" says Whittaker, now the managing director of consulting firm Futurepace RF Solutions. "What Australia does is have definitions based on radiated power at the transmit antenna in relation to all interference mechanisms and when you do that you can define it very precisely, which is what you need for legal purposes."

Professor Webb doesn't agree: "In principle most people would say its better to regulate the interference caused. It is possible to do this in a way that is not too burdensome for operators, hence we've moved from measurement to modelling. There is a lot of complexity but it sits in a software system and the end user only has to press the button which checks the licence conditions."

SURs will not be used in this year's UK 2.6GHz auction but they could be used in the auction of digital dividend spectrum.•

An article by Michael Whittaker assessing the latest developments in SURs is available here.

22.05.08

By Martin Sims

Attachment to 22 May 2008 - Ofcom becoming more central to the after-auction management of spectrum licences

For the avoidance of doubt, Ofcom has now clarified that its spectrum access licences are not exclusive and that there is little likelihood of compensation if Ofcom requires changes to licence conditions which reduce 'rights' without licensee agreement. Ofcom has reserved its right to issue additional licences after the auction for use of all or part of the auctioned spectrum and no refund will be made except at the absolute discretion of Ofcom[1]. As previously suggested Ofcom's SURs are SUCs, conditions and obligations without authentic legal rights (see PolicyTracker "Industry remains concerned about Ofcom's flexible licensing proposals", 11.02.08). This goes to the heart of the major technical and policy differences that have arisen between Australian and UK spectrum licences. In their most recent final SUR Statement[2] Ofcom now admits to possible shortcomings regarding legal certainty: "we have discussed these issues further with those that raised them in order to understand their concerns in detail and discuss what might be done to address them".

The Australian spectrum licensing regime was specifically intended to embody a very high level of regulatory certainty for licensees and therefore required a new type of technical definition to achieve minimal negotiation and hence minimal cost and uncertainty in relation to wireless network rollout and interference management.

The high level of commercial certainty required for an Australian spectrum licence derives from its nature as an indefeasible company asset as opposed to the mere dispensation of a defeasible licence, thus necessitating a rigorous approach to the construction of technical licence conditions. Authentic spectrum rights which devolve the full task of spectrum management to industry were essential. Importantly, the technical conditions had to be constructed in a manner which promotes innovation by being capable of precise translation into equipment design and avoiding any reliance on mandatory equipment standardisation processes.

There is a tendency for regulators to prefer partial solutions when formulating spectrum rights. In the USA, Weiser and Hatfield observe[3]: "At present, the regulatory strategy for guarding against interference is notoriously undefined, moves too slowly to offer effective guidance, raises transaction costs (as well as entry barriers), and leads to the under use of spectrum…..The not-so-hidden secret of the FCC's traditional spectrum policy regime is that it avoids the very difficult tasks of defining property rights clearly enough to allow for marketplace transactions and instituting an effective enforcement regime. To advance its spectrum policy reform agenda, the FCC will have to define spectrum rights and protections against interference (and the correlative right to interfere) far more clearly than has historically been the case."

The resulting vagueness of partial solutions for spectrum rights simply continues the centrality of regulatory bodies in the after-auction management process. Ofcom have not provided a common device database and quite a few other essentials necessary for full outsourced management. They say "The market is better able to determine optimal outcomes such as boundary conditions, than the regulator". Ofcom expects industry to supply the missing bits *after* the auction. One must wonder just what is being auctioned. The interdependent nature of interference requires *consistent* interference benchmarks and *common* administrative tools. Industry can now only become more and more dependent on Ofcom for change of use as well as for interference management in general. Ofcom's original vision: "In the medium to longer term we expect the effect of this to be that Ofcom increasingly withdraws from managing the radio spectrum" is not being realised. Instead, their role is expanding: "we have modified our original proposals to increase Ofcom's involvement in the process of negotiating changes to SURs". Deciding just whose neighbouring "rights" are "affected" under a change of use is problematic to such an extent that Ofcom is now fully "responsible for advising as to the affected parties". Why does Ofcom design technical licence conditions which preserve its centrality in spectrum management when market-driven innovation is their objective? Such designs might make spectrum management more flexible for the regulator but offer less flexibility for the licensee, increasing the risk of a reversion towards administrative regulation and weakening the move towards spectrum allocation through market mechanisms. The resulting licences are likely to have reduced tradability.

Using space-centric management rather than Ofcom's primary aggregate power flux density limits, Australia has demonstrated it is possible to create a robust legal and technical regulatory framework for full self-management of flexible spectrum access by industry. Market-driven innovation has been active for the past 11 years. Regulatory bodies have been completely removed from technology and service decisions. Anything less puts an unnecessary brake on market-driven innovation.

Michael Whittaker, Futurepace RF Solutions (www.futurepace.com.au), Australia

[1] See para 2.14 and Annex 1, para 10 "Auction of spectrum: 1452 – 1492 MHz, Information Memorandum Update" Ofcom 13 March 2008
[2] Ofcom Statement on "Spectrum Usage Rights: Licence verification approaches" 15 May 2008
[3] Weiser, Phil and Hatfield, Dale N., "Spectrum Policy Reform and the Next Frontier of Property Rights". George Mason Law Review, Vol. 60, No. 3, April 2008

To be published - Regulatory Model for Interference in a Liberalised Regime

Radio spectrum has been traditionally allocated on the basis of a licensee's right to use it under the expectation that 'harmful' interference will not be experienced. A focus on receiver protection might be appropriate for centralised management but walking along the same well-worn path when designing a reference framework for self-managed flexible access, leads to inefficient outcomes.

The term 'harmful interference' features extensively in European legal instruments. Because of its rather fuzzy definition, centralised interference management continues to involve high levels of compromise, consensus and collaboration between member states. Some regulators tend to believe the same process will work for spectrum licences and are delivering partial solutions for spectrum rights which subsequently require interference to be managed by industry negotiation, for example, "It should be noted that Ofcom will not be placing a formal coordination obligation on licensees in this respect, rather it is expected that licensees will cooperate voluntarily". In the absence of clear interference benchmarks for all interference mechanisms, licensees are left with no authoritative reference for these negotiations and can lose significant levels of spectrum utility through worst-case spectrum planning.

The recently released EC report (10 April) on radio interference regulatory models http://ec.europa.eu/information_society/policy/radio_spectrum/docs/ref_docs/interference_final_report.pdf explores "the possibility of using interference definitions as a method of defining the rights of spectrum users in a liberalised environment." The report "suggests that a single universal definition of harmful interference suitable for all applications and technologies is unlikely to be realisable". The report's conclusion is not unexpected given the many years the ITU has wrestled with trying to quantify, and give practical meaning to, 'harmful interference'. Defining unacceptable levels of interference has never been straightforward. For flexible spectrum access, an interference level which causes problems for one technology may be inconsequential for another.

What a legal right comprises depends on what is said by what confers it. A right may be conferred 'positively' or 'negatively'. Lawyers recognise it is much easier in drafting terms to establish the content of a right by defining it negatively i.e. you may use the spectrum subject to certain restrictions, rather than trying to describe the extent of the right in positive terms. Whatever is not expressly prohibited is permitted. Therefore, *explicit* (primary) transmit rights with *implicit* (secondary) receive rights produce a more practical outcome when defining spectrum access rights, as the 11 year success of Australia's space-centric management demonstrates.

Explicit transmit rights can be designed to take account of transmitter density and require no regulatory constraints on receiver design. Protection from interference is specified indirectly rather than directly. A spectrum licensee designs a network to cope with the levels of interference that are encountered when adjacent licensees operate their transmitters in accordance with their explicit transmit rights. The spectrum licensee decides which interference levels are indeed harmful to its technology and service and designs its network accordingly. Such a process constitutes market-determined 'harmful interference'. With explicit transmit rights there is no requirement for regulators to define unacceptable interference levels.

Explicit transmit rights are a complete reversal of our conditioned way of thinking. Of necessity, use of explicit transmit rights as primary rights requires an alternate legal definition of 'harmful interference' to replace the existing definition as the occasion requires, for example "means interference caused by transmitters not operating in accordance with the applicable Community or national regulations". Such a definition can be precisely implemented, based on limits for power radiated at an antenna rather than receiver protection.

The EC report might have fruitfully explored a full solution of explicit transmit rights. Ofcom has been motivated by industry to retract their SURs which "specify in a licence the interference a licensee is allowed to cause", and use instead, the explicit transmit conditions of a transmitter emission or block edge mask for their 2.6 GHz auction. While a transmitter (antenna) mask has always been an important element of space-centric management it is only part of the solution. Ofcom's 2.6 GHz licensees could have also had the necessary additional interference benchmarks to ensure full release of the spectrum's innovation potential through simplicity, greater commercial certainty and lower management costs.

During spectrum auctions, bidders might have marketing and share price issues foremost in their consideration. However, the innate utility of the spectrum asset they are purchasing eventually becomes a concern, but after sale, negotiation leverage with a regulator has been lost.

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