



**Vodafone's response to the Radio Spectrum Policy Group's consultation  
on Secondary Trading of Rights to Use Radio Spectrum**

**Comments submitted on behalf of:**

**Vodafone Germany**

**Vodafone Greece**

**Vodafone Ireland**

**Vodafone Italy**

**Vodafone Netherlands**

**Vodafone Portugal**

**Vodafone Spain**

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Brussels, 31 March 2004

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Sector: Mobile network operator

## Introduction

Vodafone welcomes the opportunity to provide thoughts and comments on the possible utility of spectrum trading within the EU.

Broadly there are two approaches to spectrum management. The first – and the one historically followed in Europe – is technical management where the emphasis is on ensuring that the spectrum is free of undue interference. The second is economic management, where the emphasis is placed on the allocating spectrum to the most valuable uses. Both approaches have their benefits and pitfalls. The objective for regulators and spectrum users is to find the most appropriate balance between them.

Spectrum trading is more readily identified with economic management of spectrum. In its comments, Vodafone shall differentiate between two forms of spectrum trading:

- trading to the same use – that is, the spectrum can only be used for one set of services irrespective of the spectrum licence holder;
- trading with change of use – that is, a buyer may be permitted to change the use to which the spectrum is put from one set of services to another (say, from PMR to mobile cellular, or from mobile cellular to broadcasting).

To help prevent confusion, any use of the phrase "spectrum liberalisation" refers to trading with change of use.

From an economic point of view, trading to the same use ensures "productive efficiency" – that is, within the constraint that the spectrum can only be used for a certain set of services, it is allocated to the person who values it most. Trading with change of use (spectrum liberalisation) ensures "allocative efficiency" – that is, because the spectrum can be used for any purpose (subject to interference constraints), it is allocated not only to the person who values it most but also, by extension, to the most valuable use. (In practical effect, some bands will be more suitable for certain services than others, but the market can determine this, relieving regulators of the burden of having to attempt to do so).

## General questions

### **1) Do you consider secondary trading of rights to use radio spectrum to be beneficial to consumers, businesses and radio users? why/why not?**

The benefits expected from trading are akin to those that arise from any well-functioning market mechanism. They include:

- where trading and change of use is permitted, the economically efficient allocation of spectrum between competing users and between uses so that the economy derives the maximum value from the deployment of spectrum;
- where trading is limited to the same use, the productively efficient allocation of spectrum across that use, again to the benefit of the economy generally and to consumers of the specific service;
- market entry – whilst entry is possible subject to government release of spectrum, it is not a dynamic process. Trading may allow users to access spectrum when and where they want.
- reduced technology risk because operators can decide if and when to launch technology rather than being faced with a one-off opportunity to obtain technology-specific spectrum;
- technology neutrality and non-discrimination. The allocation of spectrum to a given service or technology raises the possibility of discriminatory and technologically partial allocations which may be challenged by prospective users of the spectrum. Permitting trading with change of use removes this risk by giving everyone the opportunity, except where there are insurmountable technical or public policy constraints, of obtaining access to spectrum;
- removal of a barrier to expansion by increasing available supply, thereby reducing costs and safeguarding quality of service to the benefit of consumers;
- removal of the need for spectrum pricing – spectrum pricing is a surrogate for the market and adds no efficiency where trading is allowed.

It is, however, necessary to recognise that trading can bring risks to the orderly use of spectrum.

First, trading can, if improperly implemented, result in a significant increase in incidents of undue interference. It is essential that care is taken to elaborate property rights so that there are enforceable restraints on interference.

Second, the mobile industry, for one, has benefitted from spectrum harmonisation. Governments have been able to work together to identify and allocate spectrum such that Europe has enjoyed internationally-accessible mobile services. It is important that industry retains the ability to harmonise spectrum when harmonisation is a strategic and public benefit. Vodafone will write separately to the RSPG on this issue

with a view that it be included in the workplan for the RSPG. Harmonisation is covered in more depth in response to questions 17 and 21.

**2) What types of transfer of rights to use radio spectrum (full, leasing, partial etc.) do you consider can be beneficial to consumers, businesses and radio users? why/why not?**

All forms of spectrum trading should add incremental value to users of spectrum and consumers of services. This is because a trade will only take place where the value to the buyer of access to the spectrum is greater than the value to the seller or lessor.

Of the forms of trading available, most value should, in theory, derive from a system that allows the spectrum user to disaggregate spectrum and sell or lease it to any use. Trading restricted to the same use is unlikely to produce substantial additional value to the economy, except where a given use is chronically under-supplied and operators face barriers to expansion. They may then be able to acquire additional spectrum from less efficient operators.

The efficacy of trading is dependent, though, on the definition of clear property rights which must prevent incidence of undue interference to the parties involved in the trade and to third parties. It must also remain possible to harmonise spectrum where necessary harmonisation is unlikely to be achievable through the market. Governments and the RSPG should not await until harmonisation efforts have failed before stepping in, but should consider what criteria and framework should apply *ex ante* to a policy on harmonisation in a environment of spectrum trading.

**3) What rights and associated obligations do you consider should be within the scope of secondary trading of rights to use radio spectrum?**

Any secondary market requires a definition of the property right being traded. In theory, spectrum could be used for any purpose but certain frequencies are much better than others for any given service. The market should be able to decide the appropriate allocation. Two considerations come into play:

- i. the interference controls attached to the spectrum;

ii. the desirability of spectrum harmonisation and the ability of this to be achieved through a market mechanism. If a spectrum market is unlikely to ensure necessary harmonisation for an, otherwise, economically efficient service to be launched, then Governments may have to intervene to bring about harmonisation.

Beyond these caveats, it is not obvious that any obligations or conditions need apply to the use of spectrum. Roll-out obligations, for example, become unnecessary if spectrum is liberalised as the market will ensure the efficient use of spectrum and roll-out conditions will have no applicability to trades involving a change of use.

Spectrum pricing should not be entertained if spectrum is tradable and change of use permitted. By pricing, Vodafone refers to schemes that attempt to foster productive efficiency by charging operators for the use of spectrum. Trading to the same use will achieve the same end and trading with change of use also ensures allocative efficiency. Pricing only has a role where trading is unlikely to create efficiency because normal incentives to trade do not exist. This is notably the case in the public sector where any public user that trades spectrum maybe unable to keep any financial gains made. Consequently, the economic incentive to trade is removed. Pricing will incentivise public sector users to economise on the amount of spectrum they hold.

**4) Would you want to see secondary trading of rights to use radio spectrum introduced in your country or in the countries of interest to you?**

**a) If yes – why, to what extent? when? frequency bands/services?**

**b) If no – why not, are there other tools that better suit your needs?**

Yes, for the reasons given in answer to question 1.

Ideally, all spectrum should be tradable and liberalised, provided issues of harmonisation and interference can be adequately managed. The difficulty is constructing a system that introduces the concept of trading and change of use and also adequately manages interference. Ofcom in the UK have made proposals on spectrum liberalisation that appear to meet this concern. They envisage a system in which trades are notified to the regulator and the regulator can block a trade if it is likely to create interference. Their analysis of a prospective trade will rely on their own technical competence and on assurances provided by the parties to the trade. It may also be necessary to invite licensees in neighbouring areas or frequencies to comment on the prospective affect of the trade for their use of their spectrum. Over time, one would expect the market and regulator to be able to identify quickly those

trades – particularly ones that involve a change of use – that may create problems that must be resolved through prior negotiation with all potentially affected parties. The regulator may then be able to limit his need to intervene in the future, but, while a trading system is new and evolving, the level of oversight proposed by Ofcom provides a good means to manage interference concerns.

**5) What information and electronic communication facilities should be made available to facilitate implementation of secondary trading of rights to use radio spectrum?**

It is important that certain information is made available by the NRA to assist the development of a secondary market in spectrum. This information – which might be published on a public database – might include (taken from the recent Ofcom consultation on trading in the UK):

- name of the licensee
- contact details
- current use
- frequency boundaries
- geographic boundaries of rights
- power emission restrictions
- guard bands
- any restrictions on the use of the spectrum
- any fees attached to use of the spectrum
- details of any sub-lessees

Without the information outlined, transaction costs may be substantial and trades that would otherwise happen may not take place because buyer and seller could not find one another.

**Scope of trading – change of use, reconfiguration**

**6) Is the possibility to reconfigure rights important? If yes, what kinds of reconfiguration do you consider would benefit consumers, businesses and users of spectrum? (geography, frequency, time, other)**

Yes. In a simple trading system where no change of use is permitted, the ability to reconfigure spectrum, be it by time, geography or frequencies, will enhance efficient allocation of the spectrum. The practical effect is that a spectrum user can balance his need for spectrum against competing demands for the spectrum. While the licensee may have a need for all of the frequencies in a metropolitan area, he may be able to trade access to the spectrum to others who have need for it in rural areas. Similarly, he may only need some frequencies on a national basis and require additional frequencies only in high-demand areas, such as cities. Permitting disaggregation of spectrum allows the licensee to fine tune his spectrum usage, releasing more spectrum for alternative users.

**7) Is the possibility to use the spectrum in a flexible way important? If yes, what kinds of flexibility do you consider would benefit consumers, business and users of spectrum (service, technical constraints, other)**

Yes. As set out at the beginning of this response, allocative efficiency will be fostered where change of use is permitted. Vodafone therefore believes that regulators should attempt to define property rights in a manner that enables the market to trade spectrum for any use and that the market be free to determine the parameters of any trade made *vis a vis* time, geographic area and frequencies.

In an environment of converging technologies, the ability to trade spectrum to different uses removes the potentiality of discriminatory regulatory decisions. Currently, spectrum is allocated to service categories such as "Mobile" or "Broadcast". But technologies have capabilities that may support both mobile and broadcast applications. Consequently, regulators are left in the difficult position of attempting to determine what technologies should be permitted access to which frequencies. Trading to any use will allow the market to determine dynamically spectrum allocation and remove the need from regulators to take, potentially discriminatory, decisions on spectrum use. Instead, the emphasis of the regulator will be on an objective analysis of the risk of infringement of property rights (ie undue interference) that might arise because of a proposed trade.

**8) To what extent is the tenure an important issue in assessing secondary trading? (indefinite, rolling, fixed, annual, other)**

Vodafone supports the removal of finite licences. The duration of licences and the conditions under which they may be renewed, influence tenure and hence the ability with which licensees can plan their investments. Long licences give licensees more time to recoup the costs of their investments and give more flexibility in choosing between investment options. Short licences distort investment decisions if licensees choose investment projects that match the term of the licence, rather than those that use spectrum most efficiently. Removing finite licence terms will remove the need for licensees to 'presume' renewal of their current licence. "Presumption" is often necessary because technology life-cycles are not aligned with licence duration and so operators need to presume renewal or desist from network investment as the licence draws to its end. Ideally, the presumption should be that the licence will be held indefinitely with revocation only possible on very narrow grounds.

It is quite possible that some Member States will not be ready to remove termination dates from licences. That being so, Vodafone would counsel them to accept that lengthy licence periods are desirable for many investments, such as mobile. Twenty year licences should, in such circumstances, be encouraged.

Limited licence terms will also discourage trading on the secondary market. Purchasing a licence part way through its term leaves less time to recoup investment costs. If purchasers lack assurance that they will be able to regain the licence after it expires, they will be less inclined to enter the secondary market. This concern becomes more pronounced as the term of the licence approaches expiry. Removing finite licence terms will improve greatly the marketability of spectrum and emphasise the opportunity cost of not using licences efficiently. Competing users, new technologies and changing market opportunities will impose a discipline on incumbents to use the spectrum efficiently or sell or lease it to others who can. Indefinite licences will allow market participants to choose if and when they enter or exit the industry. Instead of facing an arbitrary cut off date, licensees could match their licence holdings to their business plans.

The removal of finite licences will put licensed operators, such as the mobile operators, on a similar footing as those using licence-exempt spectrum for commercial services that may compete in the same market. The current approach creates an anomaly in treatment. Whilst access to licence-exempt spectrum is not time limited, licences for individually assigned 3G spectrum are limited to 15 or 20



years typically. This does not constitute consistent treatment. 3G technology is likely to be in use beyond 2022 both because of the delay in developing the complex technology, but also because of the vast range of services that it will offer. As a technology deployed in licence-exempt bands can be used until the end of its commercial life and at no cost of access to spectrum, then a licensed operator should have equivalent length of access to acquired spectrum.

**9) Should the same rules and regulations apply for the whole of the spectrum?**

**a) Is there a need for different rules and regulations for different frequency bands? geographical areas? services? users?**

**b) If you see a need for different rules and regulations in question 8a above, please give examples**

Vodafone believes that, ideally, the same rules and regulations should apply to all spectrum. However, as it notes in response to question 3, it may be appropriate to charge public sector users for access to spectrum if trading does not provide an incentive to release under-utilised spectrum.

**Competition aspects**

**10) Should there be specific competition rules in relation to implementing secondary trading of rights to use radio spectrum, or is general competition law enough?**

General competition law is sufficient.

Spectrum is an asset not an "enterprise". Consequently, spectrum trading should be treated like other types of trading in assets such as land or commodities such as metals, coffee or wheat. Such markets have rules to ensure their proper functioning, but do not include an *ex ante* or merger-type analysis of each trade. In the same way, regulators should only be concerned to ensure that a spectrum trading market operates fairly (e.g., without collusion), transparently and limiting detrimental effects such as interference.

Market power in a particular asset or commodity is only valuable if it can be used to achieve a competitive advantage in a downstream market that relies on that input. Therefore, there is a fundamental difference between a market for an input that may have an indirect impact on a downstream market and a merger which affects a

market directly. The Independent Spectrum Review (the "Cave Review") explicitly recognised this distinction:

*"Nor is the review convinced that it is necessary to treat the purchase of spectrum - an input into a final product whose purchase may allow an increase in market share – in exactly the same way as a merger which directly raises market share. To do so would seem disproportionate."* (para. 7.46 emphasis in original)

The key consideration in any debate about spectrum trading is whether the downstream services market(s) is competitive. If the market is competitive then a regulator should not have any concerns – the market will ensure that spectrum is used efficiently. If the market is not competitive, then NRA has power to intervene and regulate those operators with significant market power in line with the processes and tools outlined in the New Regulatory Framework.

Quite simply, spectrum is inextricably linked to the services that are provided over it. Without the service and network technology the spectrum has no value. Demand for spectrum should be conditioned by the level of competition in the downstream services markets, that is, the amount of spectrum any efficient operator will use will be determined by the demand for its services in the downstream market. In a competitive market, an operator with surplus spectrum will be incentivised to sell it if there is demand for it. If no such incentive exists because of market power in the downstream market, it is at that level that regulatory powers are already available.

For these reasons, Vodafone believes that, in the context of spectrum trading, reliance on *ex post* competition law (as distinct from *ex ante* merger review type rules) is sufficient.

## **Hoarding**

Regulators are concerned that the introduction of a secondary market may lead to anti-competitive spectrum hoarding. While theoretically hoarding is possible in almost any market, Vodafone is not convinced that the spectrum market lends itself to effective hoarding, nor that regulators do not have adequate powers already to take action should it arise.

If regulators introduce spectrum trading with change of use, the actual quantum of spectrum available for any one use will be significant. In mobile, for example, a prospective 3G operator may identify spectrum at 450, 900, 1800MHz and 2GHz for potential use. It would be very difficult and expensive for any one operator to attempt

to foreclose entry through spectrum hoarding. Even if he were to do so, the likelihood is that any downstream benefit will be removed through *ex post* regulation.

It is also difficult to take action, *ex ante*, to prevent hoarding without disrupting normal commercial activity. Operators may well hold unused spectrum against expected future demand, for example. This would be a sensible action to take especially where the demand for new services is unpredictable. The flexibility that holding spectrum provides has value for the operator. Action to prevent hoarding may also impinge on good risk management practices. It may also impact the development of intermediaries who have a role in creating efficient markets – in the same way as insurance brokers do.

### **The role of the spectrum management authority**

#### **11) What do you see as the main responsibilities for a spectrum management authority in regards to secondary trading of rights to use radio spectrum?**

The introduction of trading requires, first, the definition of property rights. This will be the responsibility of the regulator as it introduces the right legal framework for a trading regime. Once trading has been introduced, there need be no further role for the regulator in setting property rights except where the public sector releases additional spectrum into the market. (Even then, it may be possible for the public sector body selling the spectrum to agree the property rights with the buyer and any affected parties without recourse to the regulator).

Traditionally, in other asset markets, the regulator has the responsibility of ensuring that property rights are obeyed and respected and to enforce any action against those who contravene rights. In most contexts, the regulators are the police – who enforce – and the courts - who adjudicate on disputes.

Spectrum is an asset that requires some degree of technical management beyond the normal specialism of the police and the courts. Furthermore, actual management and identification of interference by spectrum users themselves is difficult. A taxi company, for example, has little or no understanding of the technical aspects of the PMR service it may use but may, nevertheless, be the owner of the spectrum property right.

Given the technical complexity of effective spectrum management, there is a significant role for the radio regulator to police spectrum rights, investigate possible infractions and act as a dispute resolution arbiter.

The regulator should also be guardian of the licence database, registering trades and updating details on the database.

There will be a policy role for the regulator if spectrum harmonisation is considered desirable but cannot be achieved through the market. The regulator may have a role in determining the criteria against which requests for harmonised bands are judged; making the judgement and, if necessary, clearing bands as a means to harmonise spectrum use. This suggests some form of compulsory purchase scheme that might be used by the regulator forcibly to acquire spectrum.

**12) To what extent is spectrum management authority approval of trades a benefit or an impediment to the development of a market for secondary trading of rights to use radio spectrum? Under what circumstances do you consider it would be necessary for a spectrum management authority to refuse a trade?**

In theory, there may be no need for the regulator to agree trades provided property rights are adequately defined and transparent. Buyers and sellers could agree any changes to property rights with third parties that might be affected. If all parties are content, then the property right could be amended.

Practically, it may still be useful for the regulator to retain a role in clearing trades. Regulators could be notified of a trade and then be given the opportunity to agree or reject the trade if, on technical interference grounds, it would conflict with someone else's property rights or with spectrum users in another country. Rejection would spark a negotiation where it may be possible for all interested parties to reach a compromise.

**13) What specific measures could a spectrum management authority take to handle the issues if secondary trading is introduced? (ex ante approval procedures, ex post notification, competition aspects, limit change of use, interference aspects, other)**

Answers to previous questions have covered this question. The key to any trading system is the extent of the property right granted and the degree to which it may be amended by the market.

**14) To what extent should the national spectrum management authority actively facilitate secondary trading of rights to use radio spectrum?**

The regulator needs to define initial property rights and then remove impediments to trade. Such impediments include roll-out obligations, which may be irrelevant to future proposed uses of the spectrum, and spectrum fees over and above the contribution to the purely administrative costs of the regulator itself. Fees, such as administrative incentive pricing fees used in the UK, will potentially distort the efficiency of trading, particularly where change of use is permitted, and adds no additional economic efficiency.

The regulator need not *actively* facilitate trading. Spectrum users themselves should be the active element of any market. But the regulator can assist development of the market by the passive publication of a licence database (see Q5).

The regulator should not take measures that unnecessarily restrict the activity of intermediaries in the spectrum market. Intermediaries have a potentially valuable role to play in ensuring a thick market – that is a market in which all or most potentially profitable trades are made.

**Community aspects**

**15) Do you consider that adoption of individual regimes by EU member states will cause problems for consumers, businesses and radio users? If yes, in what ways and to what extent?**

It would clearly be desirable if the EU as a whole moved towards spectrum liberalisation following the same rules and the same timetable. In this way, fragmentation of policy is averted and regulatory complexity limited. However, if it is a choice of one or two Member States liberalising now and others doing so only after a few more years or delaying liberalisation until all Member States are ready to do so, then Vodafone would favour the first option. This is predicated on there being adequate interference controls set down in property rights.

An area which the RSPG might consider is the framework for cross-border interference management where there is a dynamic spectrum environment. Property rights on either side of a border may be affected by any given trade. It is not

sufficient for one national regulator to agree a trade if the affect for a user in a neighbouring country is catastrophic. Regulators may want to consider a framework for notification of trades that may create cross-border issues and a policy on dealing with trade requests expeditiously so that administrative processes do not impair irrevocably the introduction of a secondary spectrum market.

**16) Do you consider that the EU should take measures to facilitate the implementation of secondary trading of rights to use radio spectrum? If so, in what areas and to what extent?**

The legal competence of the Commission in the field of spectrum is limited. Consequently, their ability to facilitate implementation of trading is dependent on the will of the Member States to consider issues at an EU level. Facilitation at an EU level might be directed at the creation of an internal market in spectrum, with a view to reducing regulatory complexity and impediments to economic activity. The development of an internal market will, necessarily, move some level of legal competence to Brussels.

Debate within the EU of spectrum trading should help identify best practice, even if some Member States pursue trading whereas others do not. For that reason, bodies such as the Radio Spectrum Policy Group should provide fora for debate.

**17) To what extent is European harmonisation of frequencies an important issue in regards to secondary trading of rights to use radio spectrum?**

Harmonisation is a very important issue to the extent that, if the market cannot achieve harmonisation, then there may need to be a mechanism that allows Governments to impose harmonisation. The RSPG needs to develop a policy on harmonisation in good time and not wait until market attempts to harmonise have failed. The issue of harmonisation requires in-depth analysis to determine the value of harmonisation, the conditions under which it is necessary, the degree to which the market might create harmonisation absent administrative intervention and the criteria against which any administrative intervention may be considered. Vodafone believes that the Radio Spectrum Policy Group should take this issue forward on its work programme and will write to the Group separately on this matter.

## **Related experiences and examples of secondary trading**

### **18) What are your experiences with the current spectrum management regimes?**

Vodafone operates networks on five continents. It has significant experience of a range of administrative and market spectrum management regimes. On the whole, administrative management of spectrum has been effective in controlling the incidence of undue interference. It has been far less effective in achieving the economically efficient allocation of spectrum with the consequence that mobile operators, for example, have faced significant monopoly prices to access spectrum.

### **19) What are your experiences of secondary trading of rights to use radio spectrum?**

Vodafone operates in Australia, New Zealand and the US where varying forms of trading are implemented. Experience in those countries have influenced the comments made in this consultation response.

### **20) Please describe specific scenarios in which you consider that the introduction of secondary trading of rights to use radio spectrum would be beneficial**

Vodafone envisages that leasing and hiring of spectrum may enable:

- leasing of spectrum for an event, such as the Olympic Games which creates a significant but short-term spike in the demand for spectrum;
- the removal of an existing barrier to expansion where, for example, a mobile operator is facing capacity constraints in an urban area. In the same way that Regus provide short-term office accommodation, operators may seek to lease spectrum from another spectrum user in the short-term while they attempt to acquire spectrum for the long-term;
- swaps of spectrum at 900 and 1800MHz between existing licensees to enable them to construct spectrum assignments to accommodate wide-band technologies, like W-CDMA.

Trading to the same use simply extends these gains by changing the time period over which the exchange of property rights has an effect. For example, a mobile

operator may acquire additional mobile spectrum if he faces barriers to expansion because his current spectrum is fully utilised. Trading with change of use – for example, where a mobile operator may want to acquire spectrum at relatively low frequencies in order to provide cheaper coverage and can identify potential spectrum currently used for a different service – creates allocative efficiency.

## **21) Any other comments**

There are a number of other policy areas that also need consideration:

### **Licence-exempt spectrum**

Vodafone believes that both the 'licensed' and 'licence-exempt' models of spectrum use can co-exist satisfactorily. However, Vodafone believes there is no need for further allocation of spectrum for unlicensed use beyond the spectrum already allocated. For example at 2.4GHz (83.5 MHz bandwidth) and in the 5GHz-6GHz range (3 bands totalling 600MHz of bandwidth: 5150 to 5350MHz; 5470 to 5725Mhz; 5725 to 5875 MHz – where the 3rd band is still subject to sharing studies) significant amounts of spectrum are already available for unlicensed use.

The current popularity of unlicensed bands may simply reflect the problems of obtaining access to individually licensed bands in an administrative spectrum regime. The introduction of trading and liberalisation will remove this administrative impediment. As a consequence, the current distortions in technology development (where technologies are being designed for available spectrum – i.e., the unlicensed bands) will reduce over time and reveal the true demand for both individually licensed and unlicensed bands.

### **Underlay technologies**

Vodafone has a particular concern about the development of underlay technologies.

Underlay technologies, that operate in spectrum licensed to others and avoid the creation of interference by working at very low power levels, are being advocated as a means to improve the efficient use of spectrum. Vodafone believes such technologies, of which Ultra-Wideband is the best known, have the potential to affect adversely any future spectrum market by causing severe interference problems.



Whilst individual users of underlay technologies may be operating their equipment correctly in order to avoid interfering with the primary user (and owner) of the individually licensed spectrum band, in aggregate the underlay technology users may cause harmful interference to the primary user. It will be impossible to police such a system and identify who should turn off their equipment. More pertinently, in the context of trading and liberalisation, the potential for uncontrollable interference will act as a rigidity on the spectrum market. Those wanting to deploy new but interference sensitive technologies—of which mobile might be one—will be constrained in their choice of candidate bands.

Regulators should not rely on being able to resolve the interplay of underlay rights with a trading regime at some point in the future simply through interference criteria. It is far more difficult to define criteria to meet a particular "interference temperature" or "noise floor" below which underlay technologies might be permitted to operate where transmitters and/or receivers are mobile or portable. Whilst a mobile terminal may ordinarily be some distance from any potentially interfering transmitter, this will not always be the case. The interference temperature at the terminal varies substantially with the separation of the terminal from the transmitter and it will be very difficult to define technical criteria that ensure the interference temperature is not exceeded. For example, for a transmitter technology that might be widely embedded in office equipment, it would be hard to derive appropriate protection of mobile terminals, while still offering useful functionality.<sup>1</sup>

There is an additional difficulty in defining operational criteria for unlicensed equipment, where the number in use cannot be controlled, and there is typically very little restriction on the type of usage. In these cases it is likely to be necessary to use worst-case assumptions about the quantity and use of unlicensed devices when defining technical and operational criteria, as there is no regulatory means to restrict these once unlicensed devices have entered the market.

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<sup>1</sup> There is a critical issue of quality of service. A mobile network will plan to achieve a call drop ratio of less than 1%. For example, although a transmitter may only breach an interference temperature in, say, 1% of the office space, this effect may be magnified by the mobility of the handset. Mobile phones are not evenly distributed throughout an office. Office workers typically spend the majority of their time at their desks, in front of their computers. If the transmitter is embedded in the computer, the proportion of time that the interference is breached will be much greater than 1%. Also, a call may be dropped if the phone is carried through the effected 1% of the office space at any time during the duration of the call. Average metrics of interference (commonly derived by Monte Carlo analysis) can therefore seriously under-estimate the real-life effects of interference.

To set interference temperatures below which unlicensed technologies may operate will act against future flexibility of the 'exclusive use' bands. The opportunity to deploy new technologies may well be restricted because historic interference temperatures are not conducive to the effective use of the new technology. Resetting the interference temperature applicable to bands will be a long process as some opportunity must be given for those using unlicensed technologies in the bands to migrate, amend or stop their use.

The consequence of the above argument is that the introduction of underlay technologies and the necessary, associated interference temperatures may create an opportunity to enhance spectrum usage but will affect some economically significant users unduly. Three real risks are that:

- mobile or portable technologies are likely to be inadequately protected, with quality of service consequences;
- flexibility in the future use of any frequency may be adversely affected by historic interference temperatures and consequential easements;
- the credibility of spectrum rights may be undermined entirely if adequate interference controls cannot be assured.

Regulators should not pursue a policy on underlay technologies in isolation from their work on spectrum liberalisation. At the minimum, it would be appropriate to ensure that no underlay technologies were allowed to use spectrum that might be used now, or in the future, by mobile technologies, such as 2G, 3G, W-LAN, PMR and paging. In consequence, these technologies should be restricted to spectrum above 6GHz. Vodafone believes that this would not be a significant constraint in their ability to deliver the services that are presently envisaged.

### **Spectrum Pricing**

The important issue of spectrum pricing is not covered explicitly by the questionnaire.

Vodafone believes that there will remain a role for spectrum regulators even under the most liberalised form of spectrum management. That being so, Vodafone also accepts that spectrum users may be required to bear the administrative expenses of the regulator. Aside from these costs, however, Vodafone does not believe there is

any case for or merit in retaining spectrum pricing above the administrative costs of the regulator once trading with change of use is permitted.

The Authorisations Directive and its predecessor, the Framework Directive, clearly considers that the application of fees should be limited to those necessary to fund the regulator and to ensure the optimal use of scarce resources, such as spectrum and numbers. Vodafone believes that the consequence of this is, if a spectrum management system can ensure the optimal use of frequencies without imposing spectrum charge, then charges cannot be levied.

Trading to any use should allow the market to ensure the optimal use of spectrum. The regulator will retain a significant role to ensure that trades do not create undue interference and the market will ensure that frequencies are assigned efficiently given the interference constraint. Applying charges or fees to such a system will not add anymore efficiency to what trading can achieve and, if charges are set too high, may actually distort the efficient allocation of spectrum.

This is not to say that charges or pricing do not have a role where trading cannot deliver optimal use of the spectrum. As has been noted already, pricing of public sector spectrum may still be needed if the public sector user is unable to retain gains made from trades and so is not incentivised to use spectrum efficiently.. But where trading creates all available efficiencies, the case for spectrum prices is not apparent.

### **Spectrum harmonisation, International and EU Agreements, Decisions etc**

Article 9.4 of the Framework Directive prohibits Member States from allowing the change of use of spectrum that has been previously harmonised by a Decision of the Radio Spectrum Committee or any previous Community measure.

If spectrum is traded to a different use than that to which it has been previously harmonised, this suggests that there is a more economically efficient use of the spectrum than the harmonised use. The conclusion to be drawn is that harmonisation may be creating inefficiency.

At the same time, Vodafone has been a beneficiary of harmonisation in the past which has helped create the international mobile market, so there needs to be a balance. Harmonisation has contributed to the successful and expeditious development of the mobile industry, for one, and there may remain a need for administrative action to support harmonisation in the future if markets are unlikely to be able to achieve harmonisation.

It is Vodafone's view that the Radio Spectrum Policy Group – possibly through a sub-working group to which industry would be invited to participate – should review the merits of harmonisation and under what conditions a market may be expected to create harmonisation. From that analysis can be determined the need to retain harmonisation measures at international and EU level.

### **Revocation conditions**

In answer to question 8, Vodafone stated its preference for licences with no end dates, simply a rolling 5-year revocation period. In this way a meaningful property right can be created that does not have a time-dependency attached to it.

The RSPG consultation does not address the appropriate conditions for revocation of a licence. Vodafone would, for example, have serious reservations about revocation conditions based on an uncoded "consumer interest" test. Taking away someone's property right is a significant step and the reasons for doing so must be tightly limited if the integrity of the market is not to be undermined.

**Vodafone**

**2 April 2004**