

# Review of Radio Spectrum Management

Response of



10 May 2002

## **EXECUTIVE SUMMARY**

1. Professor Cave has produced a report which could be an important milestone in the history of spectrum management. The response of the Government and the actions that follow will determine whether this proves to be the case.
2. Vodafone finds convincing the framework for future spectrum management set out by Professor Cave. The emphasis on spectrum as an economic good and the policies that flow from this should leave the UK in a far better position to exploit the spectrum resource.
3. It is important that the international context of spectrum management is not forgotten. The UK not only has the opportunity to improve its own domestic management of the spectrum resource but can and should play a key and leading role in the international reform of spectrum policy. It should do this if it is to achieve all of the efficiency gains implied by Professor Cave's recommendations.
4. Vodafone is firmly of the view that spectrum trading should be pursued. There is no obvious reason why spectrum trading to the same use (eg IMT-222 spectrum traded to IMT-2000 use) should not be introduced as soon as practicably and legally possible. Vodafone will consider the draft Communications Bill published this week and consider whether the framework envisaged to allow introduction of spectrum trading is sufficiently flexible and swift.
5. It will not be possible to introduce extensive trading across services without a major review of the technical and legal issues that would need to be resolved first. Vodafone recommends that these reviews be started soon and be international in nature. There is consequently a role for the European Commission to play in the reviews and in the coordination of spectrum management reform generally within Europe.
6. Creating a system that allows for trading means that markets can begin to allocate scarce resources. This requires that questions about the legitimate length of licences and the nature of rights of use be addressed. Vodafone agrees with Professor Cave's suggestion that licences should be granted in perpetuity, subject to a compulsory purchase provision to safeguard necessary Government access to spectrum in defined and limited circumstances.
7. Vodafone strongly opposes the notion that spectrum pricing should be applied to spectrum that is tradable. Pricing, in such circumstances, will not improve efficiency and can only be seen as an attempt to extract rent from the spectrum without regard to efficiency. This would fall outside the terms of Article 11 of the Licensing Directive.
8. Professor Cave makes some tentative suggestions on appropriate windfall taxes while recognising that they would not add to spectrum efficiency. The mobile industry is highly competitive and the imposition of any form of windfall tax would be totally unjustified.
9. The economic model of spectrum management that Professor Cave sets out for commercial services should also apply to the public services in Vodafone's view. However, it recognises that it will take sometime before this is possible. Means of determining usage rights and consequential interference conditions are required before spectrum trading could be applied universally. But, as a long term goal, Vodafone would expect to see all spectrum, irrespective of holder, treated in the same manner.

10. The publication of the draft Communications Bill will require a separate response from Vodafone. Vodafone is supportive of Professor Cave's own recommendations on the legislative framework. The spectrum management objectives of the New Zealand Ministry of Economic Development, described in the report, are attractive and follow from the economic principles underlying many of Professor Cave's recommendations.

11. Vodafone hopes that the UK Government will take the opportunity provided by the report to undertake strategic initiatives that will radically improve the management of a valuable resource. The process will not be a short one. International agreement and policy coordination may be necessary to ensure the fully efficient use of spectrum. But the benefits to the UK from the process will be substantial and lasting.

## **INTRODUCTION**

Martin Cave and his team are to be congratulated for their work. The report could be an important milestone in the history of spectrum management. Whether it will be seen as such depends on the response of the UK Government and subsequent actions to realise and implement his proposals.

Vodafone hopes that the Government will implement the majority of Professor Cave's recommendations. Where Vodafone does have concerns, these are largely confined to clarification of some of the conclusions reached.

Vodafone also notes the timeliness of the report. There is already a growing debate in Europe around spectrum management reform. The Dutch Government recently hosted a high-level government and industry seminar on spectrum assignment that identified the introduction of spectrum trading as a key near-term issue. The Commission has tendered a project to review the effect of assignment policies on the development of the 3G market. Italian and German regulators are considering spectrum markets against an expectation of consolidation in the mobile sector. And the UK itself has just published the draft Communications Bill that would, if passed, provide a mechanism by which spectrum trading might be implemented.

The international debate highlights a crucial point. Spectrum reform is a process that will begin at the national level and quickly permeate to regional debates. Within Europe, the UK is constrained in what it can achieve on its own. Europe acting in a coordinated manner will achieve still more. But national reform should happen now, where it is possible.

### **Fundamental framework**

In essence, Professor Cave's report sets out a policy framework that works against two separate timelines:

- first, there are those actions that should be undertaken in the near term that aim to optimise spectrum efficiency within the current framework of spectrum management and, in particular, international allocation policy. Actions include the introduction of spectrum trading, where spectrum is traded for the same use, and the application of spectrum pricing to drive efficiency in public-sector organisations;
- second, there are those actions that pursue a long-term objective to create an economic market in spectrum, free of unnecessary regulation. The key action here is the delineation of usage rights. This will require significant technical and legal work, but the objective is the right one.

There is also a distinction made in the ability to implement recommendations. Some recommendations can be implemented nationally without debate with other Governments, but others can only work optimally if there is a degree ( Europe-wide) of coordinated reform. This is clearly seen in the accompanying consultancy paper produced by Aegis and Indepen on the implications of international regulation and technical considerations on market mechanisms in spectrum management. Issues of cross-border interference may only be fully resolved where countries share the same spectrum management policies.

In its response to Professor Cave's report, Vodafone sets out its view on a number of key policy areas. It also attempts to define areas of further work and research that the Government and industry should pursue to realise Professor Cave's recommendations.

## **INTERFERENCE MANAGEMENT**

Interference is, as Professor Cave says, “unavoidable and ever present”. It is this natural phenomenon of spectrum that has been used to justify the significant institutional infrastructure that now envelops spectrum management.

Vodafone agrees that interference has the potential to be a significant threat to the operation of wireless technologies. It does not believe that interference of itself justifies current arrangements. Interference will occur where two or more parties consume the same resource at the same time. It is for this reason that property rights over land have been developed over many centuries. The objective for regulators and industry must be to endeavour to define rights in spectrum that confer meaningful protection for spectrum users from interference without unduly obstructing the efficient functioning of the spectrum market.

The report of Aegis and Indepen is valuable. It sets out a framework for thinking about the creation of technology neutral interference safeguards while recognising that the ability for the RA (or Ofcom) to act in isolation from other neighbouring countries limits the extent to which meaningful liberalisation of spectrum can be implemented. It does say:

*“Overall though, if there is to be spectrum management based on spectrum blocks of one sort or another, and there is to be negotiation regarding the boundary conditions associated with these blocks, there is no technical reason (from a national point of view) why service independent licensing cannot be introduced.”<sup>1</sup>*

Vodafone believes that it is appropriate for further work to be undertaken to assess the extent to which spectrum usage rights can be defined. This work will need to look at inter-frequency and border interference, and consider the degree to which spectrum sharing can be used to increase the available spectrum.

There is also a legal discussion to be had. While technical limits may be placed on spectrum to safeguard against the possibility of adverse interference, there may be a need to enforce usage rights across national borders. This will require some degree of mutual recognition of rights; cooperation between enforcement agencies; and a fast-track legal dispute resolution process.

This leads to a conclusion that the European Commission should seek to coordinate spectrum reform activities in Europe. An important role should be played by the Spectrum Policy Committee, set up by a Decision of the Commission. However, for meaningful discussion to take place there, it is important first that all Governments accept the need to approach spectrum reform in a coordinated manner. There is need for a policy debate in the Spectrum Policy Committee and this should be informed by prior reports on the potential application of usage rights in Europe. Vodafone hopes that the UK Government will support this view and will lobby its counterparts in Europe to address spectrum reform now.

## **Recommendations and actions**

Vodafone:

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<sup>1</sup> Page 22, Implications of international regulation and technical considerations on market mechanisms in spectrum management; Report to the Independent Spectrum Management Review – Aegis Systems Ltd and Indepen Consulting Ltd, 6 November 2001

- supports Professor Cave's recommendation that the RA explore fully the scope for, and means to, transfer more responsibility to operators for interference management;
- believes that an on-line frequency register, as proposed by Professor Cave, is a key requirement for further liberalisation of spectrum management. The recent consultation on publication of transmitter location information is a first step. A register might include the following information:
  - frequency range;
  - geographic extent;
  - duration of associated licence;
  - location of transmitters;
  - interference conditions;
  - name, address and contact details of frequency user;
- believes that a further technical report on interference management is required that:
  - builds on the Aegis/Indepen report;
  - assumes Europe wide moves to spectrum management reform, adopting the principles outlined by Professor Cave;
  - adopts as a tenet that spectrum should be freely tradable to any use;
  - details the actual and specific means to manage interference within Europe;
  - considers the application of power flux density limitations and the degree to which they can be generic;
  - explores whether industry could dynamically negotiate changes in limits if European-wide frequency databases were created;
- believes that a further report on the economics of spectrum allocation is required to understand the effect of transaction costs on the development of an open spectrum market. In particular it should determine whether any service category – for example satellite – will always require internationally-allocated spectrum because transaction costs would be prohibitive in an open market. This would need to follow on from the findings of the technical study;
- believes that a legal study is required to address the enforcement of usage rights across international borders. This report could be done in parallel to the technical study.
- suggests that all three reports could be discussed by the Spectrum Policy Committee. (It may be possible for the Commission to take over funding of one or all of the reports).
- suggests that the technical and legal reports could be completed by mid-2003.

## **LEGISLATIVE FRAMEWORK**

Vodafone's comments under this section are a response to Professor Cave's findings and recommendations. Vodafone will respond separately to the legislative framework set out in the draft Communications Bill published this week.

Professor Cave says:

"From the viewpoint of economic efficiency, it could be argued that there should simply be a primary duty [on Ofcom] to promote competition as this is likely to be the most robust means, in the long term, of delivering continuing improvements in consumer benefits, including through services delivered via radio spectrum".<sup>2</sup>

Vodafone believes this is right.

It is informative to note the objectives of the New Zealand Ministry of Economic Development, as set out page 89 of Professor Cave's report. Against a primary objective to maximise the value of spectrum to New Zealand society, the sub-objectives follow a line of logic that the market should allocate resources and that some degree of sustainable competition and clear usage rights are required to ensure this is achieved.

Vodafone recognises the application of competition law to spectrum trades. Where a concentration of spectrum results in the creation, strengthening or abuse of a dominant position, then it is likely that competition law remedies will be applied. What is far less obvious is the application of public policy objectives to an economic input like spectrum. It is important that the duties placed on Ofcom do not extend to the imposition of industrial policy through spectrum regulation. That is simply a means of taxing spectrum users by constraining supply of a required input. Vodafone notes that the "review would have concerns were Ministerial directions on spectrum management to be used as an active lever of industrial policy".<sup>3</sup> It also notes that the draft Communications Bill has provided scope for the Secretary of State to intervene in spectrum management<sup>4</sup>.

Vodafone will study the details of the draft Communications Bill and respond directly to the appropriateness of the functions and objectives of Ofcom in spectrum management set out and on the scope for the Secretary of State to intervene. At first sight, Vodafone is encouraged by the Government's apparent willingness to disengage from *ex ante* management of the broadcasting sector.

## **Recommendations and actions**

- At Recommendation 6.1, Professor Cave suggests a formulation of a duty to be placed on Ofcom for spectrum management that reads: "to maximise, by ensuring the efficient allocations and use of the spectrum, the overall value derived by society from using the radiofrequency spectrum".

Vodafone supports this duty.

Vodafone would suggest that "and use" might be deleted from the formulation. It is not clear how Ofcom could deduce whether spectrum was being used

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<sup>2</sup> Para 6.18, Review of Radio Spectrum Management, March 2002(Cave Report)

<sup>3</sup> Para 6.30, Cave Report

<sup>4</sup> Clauses 7 and 112, Draft Communications Bill, 7 May 2002

efficiently, nor why it is necessary to do so if the market is allocating the resource.

- Recommendation 6.2 suggests that the Cabinet Office UK Spectrum Strategy Committee be reviewed to ensure that it effectively balances the competing demands for spectrum. Vodafone notes that the work of this Committee is closed to industry, whereas public services are able to attend. This is unlikely to result in an even-handed outcome and is also unlikely to maximise efficient use of the spectrum. Vodafone believes strongly that a review of the Committee is required and that it should consider the degree to which it is possible to open up debate in the Committee to the industry. (Vodafone does recognise that there may be issues of national security that preclude a wholly-open committee structure but that these issues are likely to be few in number).
- Vodafone believes that the review of the role of the Cabinet Office UK spectrum Strategy Committee should be subject to, at least, informal consultation with industry, with a view to how industry can best participate in the discussions of the Committee. Agendas of future meetings should also be made publicly available on the RA website.
- Recommendation 6.3 says the Government should limit its powers to intervene in the details of spectrum licensing. Vodafone agrees. Intervention should only be permitted in clearly defined circumstances and after a cost-benefit analysis.
- On spectrum licences, it seems to follow from the logic of Professor Cave's findings that the current licensing system is insufficiently flexible to reap all the benefits of spectrum management reform unless amended. Vodafone agrees with Recommendation 6.4 that spectrum access licences be introduced as a means to facilitate the dynamic allocation of spectrum within given interference constraints.
- Vodafone believes that the technical study on interference management to support usage rights, noted earlier in the section on interference, will help define the conditions to attach to the new spectrum access licences. It is consequently important that the technical study is undertaken soon.

## **MARKET MECHANISMS FOR MANAGING SPECTRUM**

This is, for Vodafone, the most important part of Professor Cave's report. However, it is necessary to bear in mind that the discussion on interference management defines the parameters for the economic reforms proposed by Professor Cave. This is important when considering the order of future actions.

### **Trading**

Professor Cave recommends that all spectrum users should face economic incentives to manage their spectrum efficiently. In pursuit of this end, he recommends that spectrum trading be implemented in the UK as soon as possible and that operators should be allowed to change the use of spectrum within international allocations.

Vodafone broadly agrees with Professor Cave. It is highly desirable that the market has a means to reallocate spectrum as valuations of it change.

- **Extent of trading**

It is, however, also important that the introduction of spectrum trading does not destabilise market valuations nor create significant, and possibly intractable, interference problems. Vodafone supports the introduction of spectrum trading where spectrum is traded for the same use (eg IMT-2000 spectrum is traded for IMT-2000 use). This should not cause significant issues as international coordination has already taken place. More widespread spectrum trading of the type suggested by Professor Cave – change of use within international allocations – is a logical next step but should only be countenanced after extensive technical consideration of the relevant interference controls that should act on the spectrum and the development of a clear understanding how legal enforcement of rights can operate efficiently across borders.

In terms of the form of trading to be implemented, Vodafone believes that it should be possible to disaggregate spectrum and sell blocks of spectrum defined in terms of frequencies, geographic extent and time (the ability to lease access). Each trade should be registered with Ofcom.

- **Competition**

Vodafone shares Professor Cave's analysis of, and conclusions on the competition issues that may arise from spectrum trading. The ability to hoard spectrum to create a dominant position will be difficult.

Even where a concentration of spectrum raised concerns for regulators, it would be necessary to translate that concentration into real dominance on a wholesale or retail market. That would require a market analysis and, if dominance is found, remedies that may not act on the spectrum concentration itself.

- **Length of licences**

Licence tenure will clearly have an effect on the spectrum market. Not only is security of tenure within the life of the licence important, but also the length of the licence itself.

If spectrum trading is introduced in a manner that allows for the dynamic reallocation of spectrum across services, then the need for spectrum to return to the RA (or Ofcom) for reallocation disappears. Consequently, there is no longer a need for fixed termination dates on licences.

Professor Cave, like Vodafone, recognises, that Governments may still wish to intervene in the spectrum market to safeguard public policy objectives. Vodafone strongly believes that such objectives should be limited – to national security, safety of life and/or the satisfaction of international obligations – and subject to a cost-benefit analysis when intervention is considered. Within this framework for intervention, licences should be issued in perpetuity with a compulsory purchase provisions for Ofcom<sup>5</sup>.

- **Trading and other management tools**

Vodafone strongly disagrees that spectrum pricing might be retained and act on spectrum that is tradable<sup>6</sup>.

As the original Smith-NERA report into spectrum pricing said: “active spectrum pricing will not assist in achieving greater economic efficiency in a traded market”<sup>7</sup>. Consequently, the only reason for the Government to levy a charge would be to extract rent from the spectrum. This would be contrary to Article 11 of the Licensing Directive.

Similarly, Vodafone does not agree that any form of windfall tax should be levied on trades where spectrum was originally assigned by beauty parade.

Professor Cave suggests that, if windfall gains are perceived to be an issue, spectrum pricing might be levied on tradable spectrum, presumably until such time that it was traded. Vodafone notes that this would not enhance spectrum efficiency and would distort the market<sup>8</sup>.

Applying a tax to the return on the trade is also likely to act against efficiency. Any tax will create a disincentive to trade at the margin. While a trade might be profitable in the absence of a tax, this need not be the case where a tax is present because of the effect of transaction costs.

Finally, valuing the profit is difficult. A beauty parade is simply a one-round auction of a rather opaque kind. Prospective tenders give up some value in a bid to obtain the spectrum. There are costs involved in just the same way as an auction. To distinguish between auctions and beauty parades therefore is not helpful.

Turning to the principle of a windfall tax, such taxes have been imposed where regulatory error has resulted in specific sectors making substantial excess returns. Mobile is a competitive industry evidenced by the fact that the sector as a whole does not make its required rate of return. Vodafone can see no reason therefore to suggest that there is any monopoly rent being earned that is due to regulatory error. There are no windfall profits<sup>9</sup>.

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<sup>5</sup> Recommendation 7.5, Cave Report

<sup>6</sup> See Annex 1 for a fuller analysis

<sup>7</sup> Quoted, para 7.54, Cave Report

<sup>8</sup> See Annex 1 for a fuller analysis

<sup>9</sup> Vodafone recognises that asymmetric assignment models acting on the different industry players could create conditions where windfall taxes might be justified. However, this is not the case in cellular mobile.

## **Restrictions on spectrum licences**

Vodafone supports Recommendation 7.2.

Vodafone agrees with Professor Cave that roll-out obligations are otiose especially where spectrum trading is implemented. If anything, they serve only to create a distortion in the investment market by potentially requiring uneconomic investment.

Service restrictions should also be removed wherever possible, subject to the correct framework to manage interference effectively.

## **Auctions**

In its response to the initial consultation of Professor Cave, Vodafone indicated its support for auctions to assign spectrum.

It is important to recognise, though, that an efficient primary market (the use of auctions) requires an ability for the market to correct in a secondary market if valuations change. It is imperative, then, that spectrum trading be introduced. It is also important that Governments recognise that prices paid at auction have, in part, been a reflection of artificial scarcity created by Governments' own allocation policies. If auctions remain politically sensitive, it will be because, amongst other things, Governments have not addressed the scarcity issue. Hence, Vodafone's view that a technical study, as a prelude to more extensive spectrum trading, is undertaken soon to define property rights that should go some significant way to relieving the scarcity issue.

## **Spectrum pricing**

Vodafone remains unconvinced that spectrum pricing has been correctly introduced in the UK. The introduction of spectrum trading will remove the need for spectrum pricing.

## **Recommendations and actions**

Vodafone:

- strongly supports the need for economic reform of spectrum managements as outlined by Professor Cave;
- understands that the Government will bring forward a consultation paper on spectrum trading later this year;
- believes that spectrum trading should be introduced in the near term that will allow trading of spectrum to the same use;
- advocates that spectrum trading should apply to spectrum irrespective of the original means of assignment;
- is strongly of the view that it would be inappropriate to attach spectrum pricing to spectrum that may be traded. To do so would be a means of rent extraction by the Government and be contrary to the EU Licensing Directive;

- does not believe it would be appropriate to levy windfall taxes on spectrum;
- supports the use of auctions to assign spectrum but believes that Governments will always be open to criticism for their use if they do not introduce a secondary market in spectrum, nor take measures to relieve the scarcity created by current spectrum allocation policies;
- does not believe that public policy obligations should act on the pricing of spectrum. Instead, they should be separately funded by Government.

## **COMMERCIAL SERVICES**

### **Public mobile telecoms**

Vodafone largely agrees with Professor Cave's analysis which follows from his earlier chapter on Market Mechanisms for Managing Spectrum. However, as noted previously, Vodafone does not agree that spectrum pricing should continue to attach to spectrum that is tradable.

### **Licence-exempt spectrum use**

Again, Vodafone broadly agrees with Professor Cave's analysis. However, Vodafone believes that any change to the current licence-exemption regulations to permit commercial use of such spectrum should be done incrementally. As Vodafone outlined in its recent response to the RA consultation on this issue, there is a real risk of the "tragedy of the commons". That is, if all restraint on the commercial use of licence-exempt spectrum was removed then widespread deployment of outdoor systems might prevent any meaningful use of the spectrum. Vodafone favours an approach that allows for commercial indoor-use of the spectrum and envisages outdoor use provided that the limited lifting of restraints shows no adverse interference concerns. Vodafone does, however, support the contention that licence-exempt spectrum, albeit in time, should be usable for the provision of commercial services<sup>10</sup>.

### **Satellite services**

Vodafone supports Recommendation 8.5

Mobile satellite services have not been a commercial success. This is no doubt, in part, due to the existence of a cheaper and more advanced alternative, terrestrial mobile, and also the substantial costs of creating and upgrading a viable satellite network.

The relative failure of mobile satellite has not, however, led to significant reallocation of MSS spectrum. This is unfortunate. 3G spectrum has been identified at 2.5-2.69GHz, but 40MHz is still potentially for MSS use, yet there is a massive difference in relative user base.

Vodafone believes that the UK should begin discussion within the ITU on the correct market incentives to apply to use of satellite spectrum.

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<sup>10</sup> Recommendation 8.2, Cave Report

## **OTHER ISSUES**

### **Public Services**

Professor Cave suggests that spectrum pricing should be extended to all public services spectrum. He does not however believe that spectrum trading should be used instead to incentivise a change in behaviour. He argues that the introduction of trading would be a premature action until such time that the “commercial market in spectrum access has developed to the point that the Government could credibly remove the ‘safety net’ of reserved spectrum for public services”<sup>11</sup>. Vodafone agrees that extending trading to public services spectrum now would be premature.

### **Broadcasting**

Vodafone believes that there is a case for introducing spectrum trading to broadcast spectrum. Some broadcast spectrum is tied to licences acquired through auction. Spectrum pricing should not attach to such spectrum but the users should still be incentivised to economise. Leasing is recommended by Professor Cave but this suggests that trading could also apply to broadcast spectrum, with trades defined in terms of time.

### **Public Safety Services**

Vodafone does not agree with the view that the pool of spectrum reserved specifically for the delivery of public safety services be widened<sup>12</sup>. Spectrum has already been reserved for the public safety services and the move from analogue to digital systems should reduce the size of the necessary spectrum pool. .

Vodafone also does not agree that the group of users eligible to access public safety bands should be extended<sup>13</sup>. This is simply a means to widen the scope of the Airwave licence in a manner that was never originally intended by the DTI nor envisaged by industry when the licence was put out to public consultation. It is already questionable whether the existing list of users falls within the relevant ERC decision that designated spectrum for public safety use.

### **Recommendations and action**

- Vodafone believes that the Cabinet Office UK Spectrum Strategy Committee should consider how to incentivise central Government users of spectrum so they can enjoy the financial benefit of any spectrum trade. (There is always the risk otherwise that what they earn, say, in spectrum trades, they lose in the following Spending Review or are unable to keep as appropriations in aid). This is not an urgent action because trading cannot apply to public services spectrum for the foreseeable future.
- Vodafone believes that spectrum trading should be extended to broadcast spectrum.

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<sup>11</sup> Para 9.6, Cave Report

<sup>12</sup> Recommendation 13.2, Cave Report

<sup>13</sup> Recommendation 13.3, Cave Report

## **IMPLEMENTATION**

Vodafone broadly agrees with the timetable set out by Professor Cave.

Vodafone believes that the work on spectrum trading should begin immediately to ensure that trading of spectrum to the same use may be implemented in 2003. For this reason, Vodafone hopes that the RA will be in a position to issue its proposed consultation document on spectrum trading before the summer.

There is one significant action that has not been included by Professor Cave: that is the need for technical and legal studies on the development of usage rights in spectrum to support the most extensive form possible of spectrum trading. This work has been noted earlier in the section on interference. From this piece of work may flow further work internationally to shape the reform of spectrum management across Europe. Without international moves – and it seems that others, such as Italy, Germany and the Netherlands also recognise the need for new spectrum management policies – the framework for spectrum reform outlined by Professor Cave will not be fully realised.

Another area that is not included in Professor Cave's timetable is that of the work of the Spectrum Policy Committee. This EC committee should have a central role in harmonising spectrum reform in Europe and ensuring that the full benefits of reform are achieved. This need not involve ceding competence to the Commission, but would make the most of the existing European framework to help development of national policy. Vodafone notes that the debate in Europe on spectrum trading is already advancing.

## **Recommendations and actions**

Vodafone suggests the following additions to the timetable outlined by Professor Cave:

- September 2002: discussion in Spectrum Policy Committee of forms of spectrum trading, assuming trading is restricted to the same use
- Mid-2003: completion of technical study on interference and usage rights
- Mid-2003: completion of study on legal enforceability of usage rights across borders
- September 2003: discussion of reports in Spectrum Policy Committee
- December 2003: completion of economic study on transaction costs in spectrum trading assuming trading across services

**SPECTRUM PRICING**

- **Spectrum pricing and trading**

Table 1 considers whether spectrum pricing applied to tradable spectrum will increase spectrum efficiency..

<b>Table 1 – User net valuations</b>		
<b>User</b>	<b>No administrative charge</b>	<b>Administrative charge of 1</b>
A	1	0
B	3	2

Suppose that user A currently has an assignment of spectrum and that he has a valuation of 1 for this. User B currently has no spectrum and has a valuation of 3 (see second column). The difference in the users' valuations could arise for several reasons. For example, B may be more efficient than A, or may wish to use the spectrum to provide a more valuable service than that provided by A.

In this case, allowing trading would result in B buying spectrum from A at a price between 1 and 3. This increases economic efficiency since spectrum is moved from a low-value to a high-value use. The magnitude of the efficiency gain from trade is given by the difference in the users' valuations, and is equal to 2 in this example (ignoring any transactions costs).

Now suppose that spectrum users are charged an administrative price of 1. This reduces the (net) value of spectrum for both A and B by 1. In other words, with an administrative charge of 1, A's net value is 0 and B's is 2 (see third column in Table 1). Trading would now result in B buying spectrum from A at a price between 0 and 2. As before, this is efficient since spectrum is moved from a low value user to a high value user, and the increase in efficiency is again equal to 2.

There is, therefore, no increased efficiency as a result of applying spectrum pricing to tradable spectrum.

- **Spectrum pricing and windfall gains**

Table 2 considers the effect of applying spectrum pricing to tradable spectrum as a means to claw back perceived windfall gains.

<b>Table 2 – User net valuations</b>		
<b>User</b>	<b>No administrative charge</b>	<b>Administrative charge of 1 on initial assignment; 0 if traded</b>
A	1	0
B	0.5	0.5

In the example, an administrative charge is applied to spectrum until such time that it is traded. In the absence of the charge, user A (the current spectrum user) has a net

valuation of 1, and user B of 0.5. However, if an administrative charge is applied, User A is incentivised to sell spectrum to User B, notwithstanding the fact that the optimal user of the spectrum is User A. Of course, the market would, in time, unwind this perverse outcome but transaction costs will have been introduced into the process.