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Prof Martin Cave
c/o Daniel Storey, Secretary, Radio Spectrum Management Review
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Dear Prof Cave

Treasury/DTI Consultation Paper: RADIO SPECTRUM MANAGEMENT REVIEW

The IEE is pleased to have the opportunity to comment on this Consultation Paper. The IEE represents 140,000 engineers drawn from a broad range of disciplines, including those concerned with telecommunications, radiocommunications and information technology. The ANNEX to this letter contains our response to the issues as listed in Annex A of your Paper, however, we would wish to make the following general points.

1. The radio spectrum is limited in extent, but it is infinitely re-usable. Under certain circumstances spectrum can be viewed as an environmentally friendly alternative to transport. It is capable of providing the bearers for a wide range of types of communications, including broadband applications. However, the characteristics of radio channels vary widely, depending on the frequency and environment. Perhaps the most significant aspect of **effective** spectrum usage lies in the correct choice of frequency band, so that the propagation and environmental considerations permit sufficient frequency re-use consistent with the level of performance quality necessary for the type of service to be offered.
2. Some of the limitations on frequency re-use are the results of complex international agreements which cannot be suddenly abrogated by the UK administration. Also, the technically most efficient use may require prohibitively stringent specifications for antennas and other equipment. Thus effective (**not** necessarily the most efficient) spectrum usage should be the pragmatic objective of good spectrum management..
3. The IEE would like to see emphasis to be placed on the phrase used in para 22 of the Consultation Paper "**to promote the best social and economic use of the radio spectrum**". There is a risk that a *laissez-faire* market approach which maximises the economic returns from services, will not necessarily result in the satisfactory provision of services which the majority of people would see as enhancing their business and private life. For example, revenue maximisation might favour 'video on demand' services to the detriment of mobile voice/data services.

If you require any further information or amplification of any aspect of this submission, please do not hesitate to contact me.

Yours sincerely

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Response of the INSTITUTION OF ELECTRICAL ENGINEERS to the Consultation Paper RADIO SPECTRUM MANAGEMENT REVIEW issued by the Chairman of the Independent Review Panel established by the Treasury and DTI.

1. Economic gains from efficient use of spectrum

i. *How best can Government assess the economic gains from enabling more efficient use of spectrum?*

Previous case studies have concentrated on particular sets of applications and developments from existing uses. The accelerated introduction of new applications enabled by rapid advances in technology, makes an accurate economic assessment of new market opportunities difficult. But it does not seem correct to state (para 7), that maximising revenue also maximises spectrum efficiency in auctions. If the measure of spectrum efficiency is total value ie producer benefit plus consumer benefit per unit bandwidth, as in para 16, then it seems clear that consumer benefits, and hence total value, will not be maximised by an auction which maximises revenue. For example, the end-user price to maximise revenue is likely to be higher than that which maximises consumer benefit.

ii. *How could information from market transactions and economic impact studies best help the design of spectrum management policies?*

Beyond the conclusion that it seems logical for spectrum to be priced so as to encourage its effective use, it is not clear how such information/studies could help except to maximise revenue.

2. Economic principles of spectrum management

iii. *How far can the overarching principle, that spectrum users should bear the opportunity cost of their usage, be applied in practice?*

The range of applications where this principle has possible value seems limited. To raise the price to the opportunity cost (which would be different for each user), could result in some users moving to media other than radio. This would reduce total UK economic value ie producer surplus plus consumer surplus, because consumer surplus would be reduced faster than producer surplus is increased.

If it is accepted that spectrum should be priced so as to encourage its efficient use then some bands which are unpopular eg because of poor propagation characteristics, will need to be near-zero priced to encourage their use.

iv. *How can the trade-offs between competing economic and social uses of spectrum be more clearly articulated in the principles governing spectrum management?*

The phrasing of this question seems to suggest that spectrum can be used either to create wealth or to provide services that fulfil a social purpose. There is a need to develop a clearer way of articulating all the various objectives of spectrum usage.

Economic use of spectrum, in the sense of minimum impact, is a laudable objective.

3. Legislative basis for spectrum management

v. *To what extent would a separate spectrum management duty for Ofcom be helpful, and how could this best be articulated in a new statutory framework for communications regulation.*

It is unwise for the consultation paper to compare the situation in Australia, a large country which can formulate its own policies without significantly affecting its neighbours, with that of

the UK. The UK is a small, densely populated country geographically close to a number of similar countries. The demands of European common policies and Directives add further complications. Spectrum management must therefore be central to the concerns of Ofcom.

vi. What additional statutory alternatives to apparatus licensing could assist Ofcomm in meeting its spectrum management objectives?

Apparatus licensing may offer advantages for some types of application, particularly for low power applications with dynamic spectrum attribution. However, there are likely to be substantial disadvantages if this kind of licensing carries with it significant flexibility in location, or in antenna performance or pointing. Such flexibility would be counterproductive in seeking efficient and effective use of the spectrum in the crowded UK environment where new applications may seek rapid future deployment.

vii. How far can new modes of licensing, based upon access to defined spectrum rather than defined apparatus, assist in enabling more efficient use to be made of spectrum?

The EMC and R&TTE Directives are ineffective in controlling the immunity of, and unwanted emissions from, equipment. Already, poor equipment characteristics can set a limit to radio system deployment, particularly in crowded urban situations. To maintain efficient spectrum use, any development of new modes of licensing would have to be in concert with new ways of ensuring adequate equipment performance.

4. Regulatory framework for spectrum management

International dimension.

viii. How can the UK's stance towards international spectrum management policy best reflect the opportunity costs of different spectrum uses?

Because of the attitudes and priorities of other administrations in international negotiations, a move towards taking account of opportunity costs will have to progress slowly and on a case-by-case basis. Even though the system of International treaty making conferences is showing signs of strain and the method of separating different applications by means of definitions of radio services is becoming less appropriate, the time scales for change are long.

The best opportunity for change may be for satellite systems, where current strains are severe and there have already been some suggestions for introducing economic factors into the evaluation of satellite proposals.

ix. What scope is there for greater autonomy in domestic spectrum policy within the constraints imposed by the UK's national commitments?

Article S4 of the Radio Regulations (RRs) sets the international constraints on spectrum use outside the framework of the RRs. For terrestrial propagation, interference may occur for small percentages of time out to ranges of up to several hundred kilometres, particularly in those frequency bands between around 100 to 3000 MHz.

At lower frequencies the ranges are longer, but the new provisions for frequency adaptive technologies could provide opportunities.

At higher frequencies long distance interference may be more restricted to specific types of environment. Nevertheless it is likely that a UK-only use of the spectrum would need to be restricted to low power uses or to uses at millimetric wavelengths. Beyond this a common European approach would be necessary.

x. How should the UK judge the trade-off between a more liberal approach to spectrum management and one in which technology standards and spectrum access are mandated as part of a strategic industrial trade policy?

Effective spectrum use in the national interest we would seem to require the most liberal approach to spectrum management possible consistent with retaining control of those technical issues which hinder efficient/intensive frequency usage.

xi. If there were greater latitude in international allocations and/or the UK's implementation of such decisions, to what extent would market mechanisms result in harmonisation of equipment and transmission standards?

It seems unlikely that market mechanisms alone will promote efficient spectrum usage. While a market might establish *de-facto* standards for a specific application, it would be unlikely to take account of the conflicting requirements of other users. Examples of this are the advocates of the introduction of technologies and frequency usage from other parts of the world which conflict with current UK and European usage, and the previous proposals for data over power lines (PLT) which took little account of the impact on radio applications.

National dimension.

xii. Within the current and proposed statutory framework, what improvements (if any) could be made to the institutional arrangements for spectrum management in the UK?

The consultative arrangements set up by the Radiocommunications Agency (RA) seem to be effective and widely involve representative organisations, industry etc, and the provision of information through the RA's library is very good.

However, there appears to be a shortage of RA staff possessing the necessary depth of experience and expertise particularly with regard to: understanding the needs of industry, developing services, service requirements, and the constraints imposed by other services eg in shared and adjacent bands. Staff involved in actual consultation processes should be seen to be more pro-active in open discussions so as to encourage the formulation of good quality spectrum management processes and decisions.

With regard to Spectrum Auctions, depending on the circumstances, there are often more appropriate alternatives. For example, applicants might be encouraged to form consortia, so that an auction would not be necessary. Reverse auctions, where the winner is the bidder who promises the lowest service charges, could help to keep down customer costs.

xiii. To what extent would greater transparency of specific data on current and prospective spectrum uses support efficient spectrum use? What are the key issues and trade-offs pertinent to the provision, by RA, of an on-line database containing spectrum utilisation details? How far is transparency compatible with commercial confidentiality and public safety and security considerations?

As a result of the Stewart recommendations it is understood that a database of mobile 'phone base stations will soon become freely available. Also, third generation cellular (3G) networks are beginning to co-operate with regard to sharing resources, including mast sites. These have come about because of concerns for public safety and the need to reduce costs. This is in sharp contrast to earlier phases cellular systems rollout where individual network providers viewed confidentiality as being essential to obtaining better coverage than their competitors. Now, competitive advantage seems to depend on service aspects, rather than coverage, and the need for confidentiality has reduced.

The public pressure for information about radio stations seems likely to extend to applications other than mobile phones, and there seem to be no compelling reason for retaining secrecy on spectrum utilisation. However, it is recognised that for defence/police/security/emergency services, there may be good reasons for not being so open.

xiv. *To what extent could intermediaries play a valuable role in buying rights to manage a particular frequency band and then selling access to parts of this spectrum to users on a commercial basis?*

Such an approach is valid in circumstances where a resource is in good supply and there are no technical constraints as to its use. However there are limits to the amount of spectrum available, also technical constraints imposed by the differing requirements of spectrum users and the environment. These, together with the fact that a main aim of most good businesses is to maximise profits, suggest that the result of such an approach would not be efficient spectrum management.

5. Spectrum use: marketed and non-marketed outputs

xv. *To what extent is the review's distinction between radio spectrum used for marketed and non-marketed goods a helpful one?*

The premise of this section seems to be arguable. A broad and useful assessment of spectrum value would need to take account of other factors, some of which would compound. For instance, what are the grounds for differentiating between a mobile phone call (a marketed service) for an ambulance and the ambulance controller's use of a radio circuit (a non-marketed service) to direct an ambulance to the caller? What, if instead of an ambulance, a 'radio controlled' taxi is being called?

Also, the category of unlicensed products seems to have been overlooked eg cordless phones, Blue-tooth etc. Such products add to the consumer surplus, and thus the UK economy, even though the spectrum is not marketed.

xvi. *How far can public policy objectives for the delivery of non-marketed goods be separated from the regulation of access to the spectrum necessary to deliver such services?*

The efficient and effective use of spectrum is presumed necessary for all services (marketed or non-marketed). The present spectrum manager (RA) has used dialogue with its customers, other spectrum managers, equipment standards bodies etc to push towards ever more efficient and responsible use of spectrum. It is difficult to see what other approaches could be used.

6. Issues in non-marketed uses of spectrum

Defence

xvii. *Has the consultation paper provided a valid description of the factors affecting defence use of radio spectrum?*

It does not seem appropriate to describe spectrum apparently idle but essential for the defence of the country, as being used inefficiently. Procedures for defence pre-emption of spectrum when needed is an appropriate way of increasing spectrum utilisation in some, but by no means all, circumstances.

The table of defence spectrum use provided in the consultation paper, does not include the highly important defence uses of frequencies below 30MHz which exploit the particular characteristics of those frequencies.

xviii. *What opportunities exist for commercial and other civil users to share spectrum with the defence establishment in the UK?*

Opportunities have been taken up in the recent past and the procedure used of examination and discussion, on a case by case basis responding to specific identified needs, should continue.

xix. *What further incentives could be introduced to encourage more intensive and efficient use of spectrum allocated for defence?*

No answer.

Broadcasting

xx. *Has the consultation paper provided a valid description of the factors affecting use of radio spectrum by the broadcasting sector?*

Because of the convergence of delivery technologies, the definition of broadcasting may need to be revised. However, the requirement to provide a terrestrial broadcasting service that covers remote and rural areas, means that there can only be modest changes in the future power and coverage area of the main broadcasting services. This requirement also means there is limited scope for moving to higher frequencies where wide area coverage is more difficult to achieve.

xxi. *How can the Government's commitment to value the spectrum used by broadcasters be implemented in a way that encourages spectrum efficiency?*

The move to digital modulation may result in spectrum savings however, the two issues of digital modulation and the introduction of additional channels should not be confused. A way might be found that combines the two issues while recognising public service broadcasting (PSB) obligations, but the costs to consumers resulting from any enforced changes in the way these obligations are delivered must be considered.

xxii. *What further incentives might be introduced, consistent with wider broadcasting policy and with previous Government commitments about television and radio license fees, to encourage greater spectrum efficiency by commercial broadcasters? Are there differences in the approach to incentives before and after the proposed switchover from analogue to digital terrestrial broadcasting?*

There are other questions that need to be addressed such as: receiving equipment subsidies to those who wish to take up subscription services, and the obligatory nature of return channels from the digital terrestrial TV (DTT) viewer.

xxiii. *What incentives might be introduced, consistent with wider broadcasting policy and the Government's approach to the funding of the BBC and its public service remit, to encourage greater spectrum efficiency by the BBC?*

The BBC should use spectrum in a way that is demonstrated to be as efficient as commercial channels.

Aeronautical and maritime services

xxiv. *Has the consultation paper provided a valid description of the factors affecting use of radio spectrum by aeronautical and maritime services?*

There is a conflict between the encouragement to reduce spectrum use (it is difficult to think of efficiency in this context) and the safety of life imperative.

xxv. *Given the international harmonisation constraints, where could new economic incentives most encourage more efficient use of spectrum in the UK?*

No answer.

xxvi. *How far could changes in spectrum use charges be reflected in air traffic control fees which are passed on to users of UK airspace and landing services?*

No answer.

Emergency services

xxvii. Has the consultation paper provided a valid description of the factors affecting use of radio spectrum by the emergency services?

Probably.

xxviii. How far can spectrum prices influence emergency services to make efficient use of spectrum over time?

If spectrum pricing has any effect it is likely to lead to a reduction in the performance of emergency services.

xxix. What scope might there be for sharing of spectrum access with other users to enable more efficient spectrum use?

Very little, although there might be scope in some cases, such as rural areas, for sharing TETRA capacity with some non-commercial users eg local authorities and environmental agencies, on a pre-emption basis.

7. Spectrum pricing and auctions

xxx. How far have economic incentives from spectrum prices helped to encourage efficient spectrum use?

Probably not at all although, taking a wider view, spectrum auctions seem to have had a detrimental effect on the telecommunications industry. It is clear that the high prices paid at the 3G auction has resulted in damage not only to the industry but possibly the UK economy.

xxxi. Where should the balance lie between administratively-set incentive prices and competitive auction of spectrum licenses? To what extent could the two approaches be combined to encourage spectrum efficiency?

Experience seems to support the view that auctions are best used only in cases when there is no way of making a choice on technical or other grounds. Earlier consultation documents indicated that auctions could include the consideration of other factors in addition to price - this aspect seems to have been completely overlooked.

It could be argued that spectrum efficiency can be achieved by using low spectrum fees to encourage use and using technology to increase capacity.

xxxii. What factors should determine the choice of frequencies subject to auction of licenses?

See response to xxxi above.

As an additional point, if there are to be regional auctions, thought needs to be given as to what should be done with the proceeds. There is an argument that, at least some of, the proceeds need to be passed to the local government since, to the extent that prices will rise, consumer surplus would be reduced in the region.

8. Spectrum trading

xxxiii. Which areas of spectrum use are most amenable to and which areas offer the greatest potential efficiency gains from the introduction of spectrum trading.

Spectrum trading tends to have the same problems as auctions ie maximising producer (operator) surplus rather than consumer surplus (hence total UK benefit). Its use would be best restricted to change of ownership and similar matters, where the frequencies are to be used for the same purpose and subject to the same conditions as before. Any other type of trading would tend towards less effective spectrum use and greater interference risks.

However, it could be argued that trading would permit 'remedial action' in circumstances where an auction has been seen to be damaging. For example, the recent 3G auction where the high bids/costs seem likely to result in delays in service provision.

xxxiv. To what extent would a move to licensing of spectrum access, as opposed to wireless apparatus licensing as now, facilitate spectrum trading?

Apparatus licensing is also associated with conditions as to frequency, location, power and configuration of antennas, so to consider these to be alternative approaches seems confusing.

xxxv. What changes to the terms and conditions of licenses for the operation of wireless equipment and/or for access to spectrum would facilitate spectrum trading?

No answer.

xxxvi. If new modes of licensing spectrum access (rather than equipment operation) were introduced, how could rights to spectrum usage, such as interference standards and length of licenses, best be defined to facilitate spectrum trading.

No answer.

xxxvii. What market infrastructure, such as spectrum registers and dispute resolution procedures, could facilitate spectrum trading?

No answer.

xxxviii. What lessons can be learnt from the experiences of other countries (such as Australia, New Zealand and the United States) in introducing different modes of spectrum trading?

These countries have very different geographies, environments and population densities to the UK (and Europe). Any extrapolations from their experiences to the UK situation should be made with great caution.

9. The boundaries of spectrum regulation

xxxix. What factors should guide regulators in setting the boundaries of licence-exempt spectrum use?

The potential for interference and acceptable quality of service are the key factors.

xl. What remit should regulators hold over licence-exempt spectrum use, other than ensuring it does not interfere unduly with licensed spectrum use?

The use of equipment to a specified standard is essential. This should include measures to ensure that receiving equipment is specified to be sufficiently immune, as this will effect service quality.

xli. How far can developments in radio technology provide an alternative to regulation in licence-exempt spectrum bands, particularly where the potential for interference with other users is very low given the propagation and power characteristics of the signals concerned?

Techniques such as dynamic frequency selection, for interference avoidance, are likely to improve spectrum usage.