BT response to Independent Radio Spectrum Management Review August 2001

BT welcomes the opportunity to comment on the Independent spectrum management review. This response is structured in three parts:

Part I: A summary of key points.
Part II: A critique of the current position in the context of this Review.
Part III: Detailed responses to the questions raised.

Part I: A Summary of Key Points

- BT fully agrees that the spectrum makes a significant contribution to the economic and social strength of the UK. We therefore generally support the view that all users of the spectrum should be subject to incentives that encourage efficient use of the spectrum.

- Whilst a cost related to overall economic benefit is the right way to value spectrum in any given use, the definition (and measurement) of opportunity needs to be considered carefully. This requires that consideration is given to the overall economic benefit from spectrum and should include a balance of producer, consumer and treasury benefits. We do not believe the review document suggests the right balance of economic gain through spectrum use against spectrum cost - the focus may be too heavily upon the latter.

- Market-based pricing should be an input to the planning process, but not its sole determinant. For example, innovation in both services and technology has hitherto been evident particularly in the licence-exempt bands and BT considers this will continue to be an important source of innovation in the future.

- A key requirement is for the Radiocommunications Agency to improve strategic planning in spectrum management. Market processes will not reveal true opportunity cost unless, amongst other conditions, there is a stable framework in place. For suppliers, a key issue is dealing with ever-growing uncertainty and industry needs better information and some certainty about policy if it is to plan ahead and invest in new technologies. Better strategic planning is needed so that the basis of spectrum management is clear and predictable, whilst still being flexible.

- Spectrum trading seems a natural partner to spectrum pricing. BT supports a considered introduction of trading where it may improve flexibility of allocation and change of use. BT believes that a pre-requisite to effective spectrum trading is a change from apparatus licensing to spectrum licensing, with the necessary technical safeguards to protect other in-band and adjacent band users. We believe technical studies are needed to build confidence in this approach. The Radiocommunications Agency is likely to have an on-going role in trading arrangements for some time.

- We also see a continued role for RA allocation of spectrum to achieve strategic goals for usage. This, however, also needs to be flexible so that changes in allocation can be made if economic and/or social indicators suggest this to be beneficial. Such changes need to consider the impact of all parties involved and should include compensation for disadvantaged parties.

- BT considers that the function of the Radiocommunications Agency should be maintained within Ofcom. The spectrum must be managed as a single entity as fragmentation of the management of the spectrum would lead to a significant loss of flexibility.

Part II: A Critique of the Current Position in the Context of this Review.

Introduction

1. Over the past few years there have been a number of Government consultations on spectrum strategy issues, including general pricing methods and specific spectrum band allocations. Indeed, the frequency of these has been increasingly steadily with the growth in importance of the spectrum both for fixed and mobile use. It does seem clear however that, whilst spectrum management for communications has been reasonably successful to date, the current system of allocation is crumbling somewhat under the strain. It lacks both speed and flexibility and the Information, Telecommunications and Communications (ITC) industry has been calling persistently for an improvement in the strategic planning of the Radiocommunications Agency (RA).

2. Against this backdrop, BT believes that this Independent Radio Spectrum Management Review is both timely and important in highlighting and reconciling the numerous challenges facing Government and the RA as spectrum becomes increasingly central to the ITC industry and wider economy. We do not under-estimate the task but hope that these comments are of assistance to the RA.

Measuring success

3. Perhaps one of the biggest difficulties in a review of this type is in identifying successful policy. There is an underlying view permeating the review that the current spectrum allocation across all uses is in some way wrong. Moving on from this observation, on which most participants would probably broadly agree, is more difficult in that there does not seem to be a view as to how much spectrum should be available to the various different types of use. Without this, there will be voices calling for caution on the basis of "better the devil you know".

4. At a general level, the issue can be easily described – it is the task of maximising, or at least improving, the economic benefits associated with efficient use of spectrum. Three main groups can be identified - consumers, suppliers and government. However, the Review should recognise that spectrum management has important distributional effects between these groups and that benefits to one group may be at the expense of another. Policy should have regard to these effects and we suggest a balance of interests will often need to be considered.

5. In particular, BT strongly believes that income from spectrum licensing alone is not the right parameter for judging its value to UK consumers and producers. We would be

very concerned if this metric became a measure of success as it is unlikely to correspond to UK economic interests.

6. In general, we would caution against radical change without a clear view as to the consequences. There is much about the current system which works well, particularly in the context of international standards. Some spectrum must be managed at the global or at least European level if it is to be managed at all. There is a sound foundation which needs to be built upon, rather than all being risked against an unknown future.

Use of market prices

7. In particular, pricing alone does not necessarily provide the incentives to ensure the availability of spectrum for purposes that, although commercially challenging to the "spectrum operator", could nevertheless provide considerable economic benefit to the UK economy. Market prices rely on a strong alignment of private interests with public interests if they are to be a sound basis for resource allocation. This issue is not addressed in the consultative document.

8. Indeed, in the consultations leading up to the 1998 Wireless Telegraphy Act, together with the discussions that took place approaching the 3G auctions, the emphasis was put on spectrum pricing to encourage efficient use of the spectrum. Section 3 of the 1998 Act begins, "Having regard to the desirability of promoting the optimal use of the electro-magnetic spectrum…….". Spectrum pricing, whether by auctions or other means, has never been seen as an end in its own right.

9. This is not to deny that all spectrum users should pay appropriately for benefits enjoyed. Spectrum pricing related to opportunity cost will be useful in encouraging spectrum efficiency, but this instrument alone will not be sufficient. For example, experience to date shows that the results of applying spectrum pricing can be quite unpredictable. Attempts to auction spectrum for rural fixed wireless access illustrate the point. The economic development of the rural areas might be better served by an approach that places spectrum price as a lower priority than the overall economic development of rural areas.

10. Spectrum is also a tool for government to encourage innovation, particularly with regard to efficiency. There is indeed some evidence for this from the area of licence-exempt use where there are no licence fees. This policy has encouraged risk-taking by allowing low cost of entry into the market, as well as allowing relatively inexpensive exit if the venture fails As a result, there have been some highly innovative services and technology introduced into these bands. This has occurred without determination of the opportunity cost.

Managing uncertainty

11. From the perspective of spectrum use for commercial purposes, BT would like to see a national regime that manages to be both clear and predictable but also flexible. The current regime already suffers from a piecemeal approach to major spectrum changes and BT therefore supports the thrust of the current document insofar as it is exploring new ways of meeting challenges resulting from changing technology and industry structure. Indeed, the increasing number of players itself requires facilitation to allow swifter changes of use and user. However, we are concerned that uncertainty might be increased by a radical policy change.

12. This would be disadvantageous as uncertainty makes investment more risky and, ultimately, harder to finance. Financial "hurdle rates" for business cases will tend to increase and some projects may not go ahead because of a wide variability in expected returns. So flexibility needs to be introduced without adding to uncertainty inherent in markets.

13. This is not addressed in the consultative document but requires a significantly extended UK spectrum strategy that sets out the planned evolution of all the UK spectrum within a structured timeframe. The strategy could, for instance, maintain a view of the spectrum at 3, 8 and 15 years out to allow the connections between events and the areas of uncertainty and risk to be visible - at least to the greatest extent possible. This would help spectrum users who are being asked to invest significant money to secure their spectrum to make informed decisions. It would also help the RA in its role as interface to the international spectrum management community.

Future Mapping

14. BT strongly supports the "future mapping" studies underway within the RA as such techniques can provide useful indicators against an uncertain future. BT believes that a new strategic approach must recognise and accommodate future uncertainty as a principal input. If economic policy targets suggest future goals for the use of the spectrum, then open-minded review techniques, such as future mapping, can provide early indicators of the likelihood of goals being achieved. Course corrections are then possible well before significant failures occur.

15. As an active participant in the RA workshops to explore this approach, BT is very disappointed that the publication of the Report of the 2nd workshop, held at the end of January this year, has been delayed, as this could have been an important background reference for this present consultation.

16. In essence, future mapping promotes the concept of evidence-based policy. This involves the monitoring of current spectrum use, analysis of lessons learned from earlier changes, updated future mapping of economic and technology trends and full, open and transparent consultation. This can provide a vision for spectrum management that is flexible and based on an adequate breadth and depth of evidence. Market forces alone cannot provide this strategic direction.

Spectrum trading

17. BT is generally supportive of spectrum trading as we believe it may be a source of flexibility. However, this is subject to the appropriate framework being in place in order to maintain industry confidence in UK spectrum management and to provide protection against congestion and interference. Any system should prevent against hoarding and the fragmentation of usable spectrum slots. We believe more work is needed so that there is a better understanding as to how trading would work in practice rather than in principle.

18. It must also be recognised that spectrum trading will make profit at the trading level the end-goal of market participants. The impact this will have on spectrum users, and on spectrum management generally, should be considered further. Experience from any other jurisdictions who have made such a policy would be welcome.

"Marketed" and "Non-marketed" Uses

19. The review's distinction between market and non-marketed use is helpful in drawing out the balance of spectrum use within the economy. Although outputs cannot be valued by the market for the non-marketed sector, the Review is right to identify spectrum inputs into non-marketed outputs as having the same opportunity cost as use in the marketed sector. Efficient delivery of non-marketed services involves economy of use of spectrum. Thus, whilst Government should continue to play a part in setting a social policy framework that will broadly inform use of spectrum, it should also pay explicit regard to the consequences for spectrum use in the "marketed" sectors.

20. A key question is the extent to which spectrum pricing is the right tool to deliver efficiency in the supply of non-marketed services. BT believes that other tools may be necessary – for example, corporations and public bodies involved in the provision of non-marketed services could be encouraged to scope the results of spectrum decrements. This could set out the cost of alternative means of delivering the same non-marketed service.

Future Role of Ofcom

21. Whilst BT sees that certain routine licensing functions could be handled by the private sector, we believe the need for spectrum management (i.e. the change management) and policy to be strategic, flexible and linked to policy. This means that it will be essential to maintain a function similar to that of the Radiocommunications Agency within Ofcom. We firmly believe that the spectrum must be managed as a single entity in order to allow objective decisions to be made across and between all areas of spectrum use. In contrast, any solution that fragmented the management of the spectrum would lead to great difficulties and a significant loss of flexibility.

22. We do see possible scope for a private venture "broker" role to facilitate spectrum trading within a liberalised, but managed, spectrum market.

Answers to questions raised in the consultative document follow.

Part III: Detailed Responses to the Questions Raised

Economic gains from efficient use of spectrum

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

Economic theory tells us that the Government should seek to maximise the sum of producer and consumer surpluses and payments to the Government (what we might call "government surplus"). A difficulty not recognised in the consultation paper is that it will not be possible to maximise all of these terms at the same time. For example, high payments to the Government will usually be at the expense of either consumers (via higher prices) or producers or both.

In many ways, the economic issues are analogous to those found in setting taxation policy which suggests that the economic principles of spectrum allocation and pricing should be the same as those used to guide taxation policy. For example, unlicensed spectrum can be seen as analogous to "tax exempt" services and treated as such due to the "merit" characteristics of the services supplied.

Measurement is also likely to be difficult for some of these terms. It should be recognised in this context that there is not a good understanding of the economic data (and underpinning logic) used to derive the "striking results" that are presented in the table given in the consultation paper "Economic impact of radio". BT suggests that the data is re-visited, its veracity established and a full explanation provided of the rationale for the results shown.

Once this has been achieved, and the foundation is understood, sensitivity analysis should be presented showing, in directional terms at least, what might be expected to happen if pricing on the basis of opportunity cost is introduced. What will happen if spectrum were to shift in a way consistent with the initial data presented in the consultation paper? Without such a view, industry is unclear as to what specifically the Government expects to happen to spectrum allocation as a result of the initiative.

At present, BT is unclear as to how to interpret the results presented in the two tables. Trusting to the market without any idea of the effect that market forces might bring about would be a poor basis for management of such a vital resource.

We would expect that a reallocation of the proportion of spectrum between various sectors (improving supply where it is too scarce) in a way which is optimum would tend to even out market value per MHz for all sectors which operate in similar portions of the frequency

spectrum. This outcome is a possible measure of a successful policy, but relies upon private costs to reflect public costs consistently (see discussion on externalities below).

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

Market transactions should help reveal the value of spectrum with similar functionality (this will usually be spectrum of similar frequency). Information from these transactions should help in deriving administrative prices which broadly reflect opportunity cost. However, it will be important that false inferences are avoided – spectrum is not a commodity and so whenever market prices are used as a benchmark for prices set on an administrative basis, these need to be on a like-for-like basis. Where necessary they should be subject to careful adjustment for the differences involved, in BT's opinion this would be particularly difficult over time.

Economic principles of spectrum management

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

Clearly, this question centres on the correct identification of the opportunity cost of particular spectrum. It would be helpful if this term could be defined. BT's suggestion is that opportunity cost is "the value of the spectrum in its next best use". That is, what value is forgone by using the spectrum in one way rather than another? This definition would recognise that spectrum may have no opportunity cost if it has no other economic use.

True opportunity cost must also reflect any externalities, such as the cost of interference and/or congestion on other users. **Externalities** can be both positive and negative. For example, certain use of spectrum may have broad economic efficiency benefits and/or social benefits – beneficial effects which are not reflected in market prices as the benefits do not accrue to the undertaking paying for, or at least using, the spectrum. Negative externalities, in contrast, warrant higher prices than those delivered by the market. In general, whenever there are externalities, market prices will not reveal true opportunity cost.

In addition, for the markets to work effectively as a way of revealing private valuations requires that certain conditions are fulfilled. We mentioned externalities above. Equally important is that there exists **full information** on the part of market participants. Spectrum management policy should therefore be stable and consistent over time, so it does not spring "surprises" on market participants. Indeed the very step of making substantial blocks of additional spectrum available for a similar service (increasing supply) would be expected to significantly reduce the market price. This would mean that previous sales of spectrum might have been on terms that exceeded the market price under a new regime for spectrum

management. Whilst policy may need to be implemented gradually, piecemeal policy developments must be avoided. We see this as a major challenge for Ofcom.

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

One way to approach the issue of trade-offs is to understand the impact of marginal changes to spectrum uses. Thus corporations and public bodies involved in the provision of non-marketed services could be encouraged to scope the results of a reduction in specified levels of spectrum usage ("spectrum decrements"). This could set out the cost of alternative means of delivering the same non-marketed service or, where similar service levels are not possible, at least set out the services which are made possible by utilisation of the spectrum being reviewed. It would then be for the Government to decide whether these services justify the spectrum required (as well as, of course, any ancillary public sector costs in providing the services).

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?

BT believes it would be essential. The UK's spectrum users and the international spectrum management community both need an effective, efficient and specialised technical/regulatory/consultation interface into the UK administration. RA has traditionally provided this interface, and both the UK customers and the other administrations have been generally satisfied.

Whilst Ofcom will be primarily concerned with communications issues, the spectrum is used by all sectors of the economy and the UK community at large. The decisions that have to be made on spectrum use do not just concern the balance and opportunity value within the communications sector, but require adjustment of the balance of spectrum use and pricing across all the sectors. The mandate for a spectrum management duty within Ofcom must therefore allow that duty to take a balanced view across the whole spectrum, and to make objective decisions on changes within and between the different sectors of spectrum use.

In short, BT remains convinced that a function similar to that of the present RA would allow the spectrum to be managed holistically, and hence efficiently. We cite the example of the current US search for spectrum for 3rd generation mobile, and the interplay of the three separate spectrum "owning" agencies (FCC, NTIA, DoD) as an example of the complexity that can arise where the responsibility for spectrum management is distributed.

Historically, the structure of RA has been maintained on the basis of the main radio services (Fixed, Mobile, Broadcast, etc.) and the interaction between these vertical management channels on key issues has sometimes had to be encouraged by the spectrum users. In an era of convergence (which BT sees as inevitable), and spectrum management action aligned with broad economic objectives, the internal structure behind the public interface may need to be rather different. A structure reflecting a broad social and economic vision of the whole spectrum on different time scales (e.g. 3, 8, 15 years out) might be effective in giving policy guidance to a more flexible spectrum market. We certainly believe the UK's published spectrum strategy would be greatly enhanced if it were to indicate future prospects within a structured timeframe. This would allow the connections between current events and between current and future events to be explored, and if necessary clarified, by the spectrum users.

BT therefore believes that UK domestic and international spectrum policy should reflect a broadly-based national spectrum strategy that considers not just the opportunity cost of topical individual applications, but also the potential interactions between major issues, which may have some differences in their timing and uncertainties.

This approach could be likened to "version management" of the UK spectrum strategy as a whole. It could ensure a greater measure of "backward compatibility" of spectrum policy as time progresses, and hence might avoid the issues raised under *questions iii and xii*. There is no reason why the same approach could not be adopted on a wider-scale, i.e. within the EC and CEPT, and there would be opportunities for the UK to demonstrate leadership in this respect.

BT recommends that the current UK spectrum strategy is further developed to become a key tool for the future UK spectrum management environment.

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

BT supports moves to licence spectrum rather than apparatus. This is in line with BT's proposals to provide limited numbers of national self-managed channels for operators rolling out fixed link networks. Provision of limited amounts of spectrum to end users to manage themselves can lead to highly efficient utilisation of spectrum and a reduction in the amount of spectrum that an operator needs access to. As emphasised below (*question vii*), BT believes that spectrum licensing is a pre-requisite for spectrum trading.

In the context of licence-exempt spectrum, it can be argued that this is already an instance of "spectrum licensing". However, in this case, even though the apparatus is not licensed, light regulatory control over the types of apparatus and applications that are permissible in the licence-exempt bands should remain.

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

BT believes, that with the almost total transition to digital radio systems, the spectrum (for communications purposes at least) could in future be defined in terms of specific spectrum blocks managed via appropriate generic in-block and out-of-block emission controls. This would be in keeping with the R&TTE Directive and WTO objectives etc. in allowing greater choice and flexibility in the market place, and allow spectrum users to update the technologies to improve the efficiency with which they use their spectrum. It would also be an essential precursor to spectrum trading, as the spectrum value would then be a "known quantity", rather than being a variable which depended on the technology currently in place in an adjacent block. Change of use (within the defined spectrum allocations) would therefore be facilitated.

This approach could work well in the spectrum for communications applications because the relevant community has been self-motivated to move to efficient digital systems, with this motivation being re-enforced by the spectrum pricing that has been targeted on the sector. In other sectors, opportunity cost incentives to transition to digital systems and technical studies to create the necessary levels of confidence are possibly needed before this approach would lend itself to the other communities of spectrum users. Confidence would certainly need to be established for any spectrum use that had safety of life implications.

Licensing spectrum use instead of apparatus will ensure that alternative users of the same spectrum pay the same (e.g. satellite and terrestrial operators both wanting use of shared bands). However, this choice of use will only be appropriate in bands not already heavily used by one service and where sharing is feasible. Furthermore it will be necessary to take into account the fact that some services, e.g. satellite systems, work to international standards and efficiency is a somewhat arbitrary concept and very difficult to measure or to change on a unilateral basis. Similar arguments clearly exist for some of the spectrum used by the aeronautical and maritime community.

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?

The UK should continue to ensure that international allocation decisions make more spectrum available to those services that have demonstrated the greatest need and economic

benefit (in terms of the benefit to the UK interests). In practice, there is no reason why UK interests should differ from those of our European partners so that we would not expect to find ourselves out on a limb in most matters. We would not therefore see any need or justification for a policy of going it alone.

BT believes that the UK has in the past been generally successful in leading the international community on major spectrum issues. Significant change should not therefore be required. However, the European Commission plans to take a greater strategic role (and extensive powers) to steer major European radio spectrum policy initiatives. Therefore UK spectrum policy and strategy must be credible if it is to influence EC policy and flexible in accommodating the results. To do this the UK must have suitably high level, open and transparent consultative processes in place to build a supportable national spectrum strategy that can be used in achieving these objectives.

BT believes that UK domestic and international spectrum policy should reflect a broadly based national spectrum strategy that considers not just the opportunity cost of topical individual applications, but also the potential interactions between major issues over time. There will of course be some uncertainties involved and that is why here, as elsewhere, BT consideration of a strong strategy should also include consideration of an exit strategy.

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

BT does not believe that international agreements are a significant constraint. Indeed, BT sees the ITU and CEPT frameworks as creating opportunities for large-scale markets, and this is to the economic advantage of all players. Indeed, in the telecommunications context, we believe that UK-specific solutions would be of limited, or even negative, value. A narrow focus on opportunity costs in the UK would detract from the wider considerations of European and Global markets. The economic benefits of European/Global markets should outweigh national considerations, and ultimately bring greater benefits to the UK we therefore see neither need nor scope for greater autonomy.

It is generally recognised that international agreements can take a significant time to put in place, and some streamlining of the processes might be advantageous for the future. A move away from technology-specific spectrum allocations should help to improve this situation. The more flexible approach to licensing discussed in *question vii*, together with spectrum trading, should allow adequate flexibility for innovation and market responsiveness at the national level.

There is already considerable flexibility in the use of most spectrum (in terms of the provisions of the ITU Radio Regulations). So long as the usage in the UK does not cause harmful interference to other services operating in other countries the UK can already act to its own best advantage. Indeed, we believe that there is considerable scope for more flexibility in the interpretation of international radio regulations (see also *question xi)*. This could help, for example, to facilitate broadcast/telecommunications convergence, where there is some certainty that convergence will happen. Whereas, because of the significant uncertainty over market dynamics, a dependence on opportunity cost as an incentive may prove less reliable.

On a European basis there is also considerable scope to operate a range of services within the CEPT regulations. The exception is for harmonised systems like DECT, GSM and UMTS. However, even some European decisions offer many options (e.g. choice of TETRA bands). There is no evidence that these systems based on harmonised standards and frequencies have been to the detriment of the UK, in fact they have been highly successful.

We believe the preferred approach should be to promote a strong and enduring UK strategy for more general acceptance via streamlined and responsive European/ITU change management processes.

x. How should the UK Government 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 and trade policy?

BT certainly believes that UK spectrum policy should be an integral part of the general economic policy. However, we do not believe that a clear strategic policy is incompatible with a more liberal approach to managing the spectrum, or indeed with a continued recognition of the powerful economic benefits of (especially international) technology standardisation.

A spectrum management regime that emphasised broad applications areas and their societal/economic advantages rather than concentrating on specific technologies and applications would be workable. Where general social and/or economic policy suggests advantages in promoting new radio applications, this can be done by via the availability of technology-independent spectrum blocks in which a variety of appropriate "standards" can be used. The standards (which could be formal or proprietary) are beneficial, *inter-alia*, in demonstrating compliance with the spectrum regulation and with health and safety requirements.

To achieve the economies of scale essential to make technology introduction a success it is invariably necessary to align frequency and equipment use with the European market. UK interests will not be different from, say, France and Germany. Trade policy tends to dictate

that any good technology will be accommodated in Europe if there are no fundamental technical grounds to oppose it (e.g. the IMT2000 family members could all have been introduced, not just UMTS). Requirements should come via CEPT/ETSI and if acceptable to the majority of countries the UK should adopt these decisions.

International co-operation is crucial for satellite services where global markets, are sometimes needed in order for a particular service to work economically. Nationally the UK is too small to have any great influence in this area

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?

There has been discussion recently at national, European and global levels relating to the possible need for "softening" the traditional radio service definitions (Fixed, Mobile, Broadcasting etc.) to create greater leeway for technical innovation and spectrum management.

BT has not had experience of its own, nor seen any documented evidence from elsewhere, that suggests that the top-level international regulation is a significant barrier to progress, or what any alternatives might be. BT does not therefore believe, at this time, that the Service definitions necessarily need to be changed. We do believe that there is considerable scope for a modernised and more flexible interpretation of definitions and allocations, and that there may be some scope for changing frequency allocation to give, for example, some bands that have fixed, mobile and broadcasting allocations. These actions could facilitate convergence whilst allowing the best of the present regime to be maintained.

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?

Historically the UK and CEPT have tended to treat major spectrum issues sequentially and somewhat in isolation, and this has caused interactions between the value of different parts of the spectrum that have not necessarily been anticipated, but which have probably impacted on the overall economic benefit. Going forward we believe there is a potential danger that spectrum auctioned for a particular application, with a focus on the opportunity cost of that specific application, could sterilise progress on related applications because of perceived or real risks of market and competition distortion.

A framework needs to be in place that reviews the effectiveness of future spectrum management decisions. It should incorporate transparent consultation processes open to all those either directly or indirectly affected, and allow adjustments in policy to be made in the light of experience gained. As already noted, BT believes that the UK might be well served by an evidence-based spectrum management regime. Key elements of such a regime could be: -

- An enhanced UK spectrum strategy document based on the ideas given under "question v";
- Timely, open and transparent consultation with spectrum users;
- Appropriate monitoring of spectrum usage to assess re-farming potential and to ensure ongoing need;
- A forward-looking research programme on spectrum efficiency, new services and propagation issues to improve the precision of spectrum planning tools and techniques;
- Appropriate metrics for spectrum and economic efficiency.

Whilst the trends in recent years have been towards centralised management of frequency assignments by RA, we believe this has suppressed the benefits of allowing major users to self manage spectrum to best economic/commercial effect (e.g. for rapidly growing national fixed-link networks).

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?

BT is strongly supportive of more open access to information on current and proposed frequency assignments in the UK. We believe such information would allow the practicality of new services and the extension of existing services applications to be explored by the prospective players, in advance of formal approaches to Government. It is far better if this preparatory work can be handled in advance; as it allows a better-prepared case to be presented and greatly reduces the load on the administration. We do not believe there will be significant problems associated with a public assignment database, but some safeguards would be needed to maintain security and confidentiality where necessary.

In addition to information on existing assignments, other information such as details of UK geographic exclusion zones where there are certain restrictions on satellite Earth station deployment should be published and justified.

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?

BT believes third party spectrum management organisations could represent a barrier to the flexibility that a new UK spectrum regime needs to achieve. An "SMO" approach could lead to additional inertia and overhead costs, speculative investment and restricted access to spectrum. The overhead of monitoring the performance of such bodies would appear to make the idea unattractive.

UK government and the private sector have considered the concept of third-party spectrum management during several earlier consultations. In the past it seemed difficult to find a suitable business case to sustain such an entity unless there was a significant mark-up on spectrum costs. Whilst that argument may or may not still be valid, the situation will anyway be different in the future because of the need for flexibility and responsiveness to change. Once spectrum becomes fragmented, flexibility is lost. However, so much depends on the regulatory regime, the future framework for spectrum trading, and whether change of use would be within the remit of such an organisation.

We believe this topic is of secondary importance that could prove to be a distraction, and that it would not generally enhance the economic value achievable from the spectrum. We therefore believe that it could be considered later, once the general framework of UK spectrum management has been decided.

Where there might be a role for independent players is in connection with spectrum trading. Some kind of "broker" function that brings together buyer and seller and tests technical and regulatory compliance issues could be fast and effective, and save Ofcom time and money. However, such an idea would need to be considered carefully in the light of emerging policy for spectrum trading.

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?

BT does believe that the review's distinction between marketed and non-marketed use is helpful, not because we believe it should be perpetuated beyond the review, but precisely because the distinction exists and any policy of market driven spectrum allocation must, as a precursor, require an eradication of this distinction. This is not necessarily to say that BT believes that the "market" should be used to set *all* prices, and we believe that Government

does and should continue to play a part in setting a social policy framework that may broadly inform allocations and use of spectrum.

The main distinction that seems to exist between marketed and no-marketed sectors is that market-based incentive mechanisms aimed at economising on spectrum are harder to implement in the former than the latter. Clearly, however, opportunity cost of spectrum should be the same whether the final output is "marketed" or "non-marketed". This suggests that different levers must be found for the non-marketed sector - but levers that nonetheless have the same objective as those used to allocate spectrum in the supply of commercial services.

However, the extent to which it is worth *knowing* what the opportunity cost of all the spectrum used in, for example, the production of defence services is unclear if it has already been decided that, on the basis of political calculus, the service is vital and the spectrum must be made available. Instead, it seems sensible to focus on encouraging **efficiency of use** of spectrum in the production of non-marketed services. This concerns use "at the margin" and we suggest one way of assessing marginal use in our answer to *question ix*. Another way may be to set an administrative price for the use of spectrum by non-marketed service suppliers – although clearly the budgetary implications of such a change would need to be worked through carefully. We see price or other mechanisms having most value where they effect spectrum use by publicly funded bodies at the margin.

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?

Even where public policy objectives involve the delivery of radio-based services, we do not see that a measure of economics cannot come into play in encouraging spectrum efficiency.

BT suggests there may be considerable scope for an open approach to spectrum access for such services. For example, it may be possible to have competition in the technical solution used for the delivery. This might be facilitated by ensuring that sufficient spectrum is made available, without entering into precise frequency bands or technologies.

Issues in non-marketed uses of spectrum

Defence

xvii. Is this a valid description of the factors affecting defence use of radio spectrum?

No comments.

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

BT clearly recognises that, in times of difficulty, and perhaps during major exercises, the defence forces have need of significant amounts of spectrum for their communications, navigation, surveillance and weapons systems. If a realistic price is to be applied to that spectrum, then the possibility of sharing spectrum appropriately during less stressful times may provide opportunities for some innovative spectrum management ideas to help the defence sector with cost recovery.

In some ways the defence organisations managing spectrum in this way could be likened to spectrum resellers, as discussed under *question xiv*. Another viewpoint would be to consider this as temporary spectrum trading (albeit on a pre-emptive basis). In either case, should such arrangements prove to be profitable, it might not be an incentive to minimise spectrum requirements at all. This is a possible undesirable outcome that would not be to the benefit of all, and reinforces the need to consider all the possible outcomes of the introduction of a liberal spectrum market (see also BT responses under *questions xxxi, xxxii and xxxiii*).

There may be possibilities in terms of freeing currently unused military spectrum for commercial exploitation. For terrestrial applications geographic frequency sharing has worked well in the past (e.g. public cellular extension bands). However, in order to benefit the satellite industry (the defence community are significant satellite spectrum users) the use of pre-emptible spectrum needs to be agreed on an international basis.

Presumably the sharing would be via one or more commercial deals with the non-defence sharers, but what constraints on sharing applications/commercial opportunities and timing would there be? The consequences of releasing spectrum unexpectedly into various economic and market sectors would need to be carefully considered. All the concepts discussed in this context in the review document warrant careful consideration, as the implications could extend way beyond just the defence spectrum.

BT believes that the timing of any change that would allow MoD to offer spectrum to sharing partners, and the sectors of spectrum use into which such spectrum might be launched, need careful consideration and consultation, as there is a risk of market de-stabilisation. If such ideas are to be considered, then they should become part of a managed UK spectrum strategic plan, as discussed under *question v*.

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

BT's general view is that all users of spectrum should reflect opportunity cost of their spectrum use in decision making. However, there seems little point in attaching a price to all spectrum required for defence purposes only to reimburse this cost in the budget setting process. This would be "playing shop" and will only increase the cost and administrative burden of government.

In response to *"question iv"* we suggested analysis of decrements of spectrum. More generally, we suggest that practical incentives should focus on marginal use of spectrum - and an important first task down this route might be to identify where defence capabilities do offer possible spectrum savings (or even "sales"). This is not an issue that can be dealt with by market forces, which inevitably means need for some government management. Pricing incentives alone are not likely to be adequate.

Broadcasting

xx. Is this a valid description of the factors affecting use of radio spectrum by the broadcasting sector?

We do not believe the description is entirely complete. In the context of digital broadcasting, and particularly digital audio broadcasting (DAB), there is a clear wish by many broadcasters to become fully engaged in the "convergence" market place in which they would be one supplier of interactive multimedia services that would also be available from the telecommunications and internet platforms. This was very aggressively demonstrated during the DAB community's presentations to the CEPT Radio Conference in Lisbon (October 2000).

The review consultation includes traditional broadcasting spectrum as a "non-marketable" area for in-depth analysis. In general, it is difficult to see why much of the broadcasting sector is classified in the "non-marketable" category. We believe the review should distinguish the issues that pertain to commercial broadcasting from those of purely public service suppliers in future. BT's view is that different levers are likely to be needed in the two areas.

Use of "excess" broadcasting spectrum for, say, data services, clearly provides risks rewarding inefficient use as well as giving unfair advantage over operators of non-broadcasting services who pay the full value of their spectrum. For effective competition, it is necessary that all competitors - including broadcasters - pay the full market rate for spectrum before they could allow others to use it for other purposes. Alternative use should

not be allowed to deliver the same services for which others have had to pay much higher fees and should have equitable licensing procedures.

BT therefore believes the future management of digital broadcasting spectrum, and its opportunity cost and pricing, should be considered in the context of the spectrum used by all the convergence players.

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

We believe Government should secure an independent assessment of what spectrum the broadcasters require for true broadcasting following analogue switch-over, and charge fee levels that give incentive to achieve this. In addition, broadcasting licences could also be awarded on the basis of the quantum of spectrum required – that is, tenders could be on the basis of how little spectrum (or what particular spectrum) is required for the delivery of coverage and other obligations.

Other means may be found to unbundle commercial broadcast licences from the spectrum element of the licence. This is important if the spectrum is to have alternative uses because, as noted above, spectrum that the broadcasters wish to use as players in the world of convergence should be priced as for other players in that emerging market.

xxii. What further incentives might be introduced, consistent with wider broadcasting policy and with previous Government commitments about television and radio franchise 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 TV broadcasting?

No comments.

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?

See suggestions in *answers ix and xv* above. BT suggests it is worth considering whether there might be expected to be any differences in the levers appropriate for the BBC and those for other publicly financed bodies. None are clear to us at this time.

Aeronautical and maritime services

xxiv. Is this a valid description of the factors affecting use of radio spectrum by aeronautical and maritime services?

No comments.

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

No comments.

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 comments.

Emergency services

xxvii. Is this a valid description of the factors affecting use of radio spectrum by the emergency services?

No comments.

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

No comments.

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

Our response to *question viii* contained concerns relating to additional spectrum supply that might result from sharing. Those comments also apply here.

Spectrum pricing and auctions

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

The spectrum pricing for fixed and fixed-satellite services has been introduced progressively within the UK and current fee levels give sufficient incentives to users. BT has freed up significant amounts of fixed link spectrum in bands below 10GHz. However, it is largely the telecommunications sector that has been targeted, and the review should now address the balance of financial impact across all spectrum users.

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

The Consultation paper does not suggest any differences in the objectives of administrative (incentive) pricing and auctioning of spectrum licences. The two approaches therefore seem to differ only in the mechanics of spectrum management, with administrative pricing being based on estimates of marginal value (*para. 98 of the consultation document*) whilst auctioning allows market participants to reveal their estimates of market (marginal) value.

This suggests administrative pricing is more suitable to the non-marketed sector or, more generally, where market valuations (which reflect private costs and benefits)., are not considered to be accurate indicators of true valuation. This divergence will usually be due to externalities, the definition of which might be stretched to include government objectives of "promotion of innovation" and "wider economic benefits."

For market participants, once the auction is complete it may appear that auctions provide more certainty than administrative pricing. This may help business planning by removing variability of spectrum charges as one source of uncertainty. However, the value of spectrum already auctioned will be dependent on the administrative prices set for spectrum used to deliver substitute services. This suggests that an important pre-condition for auctions to accurately reflect spectrum valuation is stability in spectrum management generally and in administrative prices in particular.

BT would also request that the RA considers how to minimise the extent of uncertainty caused by a switch to market-driven spectrum prices. Companies cannot make use of spectrum without making largely irreversible investments. The greater the uncertainty the about the revenues and recurring costs (which will include spectrum fees) associated with any investment, the higher will discounted cash flow "hurdle rates" be set. Investment which might go ahead on the basis of known spectrum costs might not where the charges are unknown. This point to a key challenge for spectrum management – the introduction of more flexibility without adding to the uncertainty always inherent in markets.

Auctions seem most suitable for commercial applications that are without significant side-effects. They reveal private valuations at a historic point in time. In contrast, spectrum trading should reveal up to date valuations and thus the extent to which, for whatever reason, private valuations change over time. In setting administrative prices, spectrum trading could therefore clearly be considered as a guide to private valuation of equivalent spectrum space.

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

As suggested under *question xxxi* above, auctions may be most suitable where "externalities" are low – in these circumstances, private valuation will more closely match true opportunity cost.

The choice of spectrum on this basis is just one factor that needs to be considered. A clear **route map** for the timing of auctions and availability of new bands also needs to be provided. Administrative prices for spectrum space used in substitute services also needs to be known with at least some degree of certainty if bidders are to be able to gauge the value of any particular frequency.

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?

This is a complex area worthy of consideration in its own right. Whilst it seems clear that there are benefits to be had in introducing a greater degree of flexibility and speed into spectrum allocation, it does not appear that all types of use, nor allocation could be treated equally. This is because some spectrum deployments require greater harmonisation than others while some technologies and types of use may have greater potential to cause interference.

This implies that there still seems to be a need for some central management decisions about the detailed criteria which may be attached to any particular frequency allocation. Until the growing trend towards "polite technologies" and adaptive techniques becomes more the norm, BT envisages the potential for the development of a "spectrum matrix" which would indicate how given spectrum may legitimately be traded.

We have explained elsewhere in this document why we would be concerned if profitability were permitted to become the over-riding driver in the allocation of spectrum. *(See Part II paras 17,18,19 and Question xxxi.)* Yet if this were not the case, it is difficult to see how a genuine secondary market could develop. Again, this suggests to us the need for further consideration.

This is not to suggest that BT does not agree with much in the consultation paper – for example, spectrum trading requires at a minimum clear specification of enforceable rights, including associated interference limits. Spectrum trading seems most likely to be possible where ownership rights are available on a long-term basis whether originally acquired via an auction or made available at administrative prices on a long-term basis. To avoid "pure" windfall gains (that is, gains made without the possibility of losses also being incurred) spectrum trading should only be permitted where the current licensee has bought the licence in an auction or administrative pricing adequately reflects the value of the frequency assignment. This would also address the need for safeguards to prevent unfair competition which could arise if spectrum obtained without recourse to its economic value is used in the provision of services competing with those using spectrum priced on the basis of a defined competition environment (e.g. 5 UMTS licences) (see also the comments under *questions iii, xx and xli*).

Notwithstanding the various difficulties, BT suggests that fixed links may be an area where spectrum trading of national channels may be feasible, for example, trading might be associated with core bands being migrated to access applications instead. In the satellite area, on the other hand, the issues are more complicated. For example, due to the international dimension, transponder management and hence frequency arrangements are generally managed by the satellite operators (e.g. Intelsat), who are not the entities (e.g. earth station operators) to whom "licences" are granted by national administrations.

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

The licensing of technologies within spectrum blocks with defined in band and out-of-band emission limits would greatly facilitate spectrum trading, for example it would enable trading of national channels. Changes in technology and changes of application area (e.g. from traditional point-to-point links to Fixed Wireless Access), albeit within the framework of the frequency allocations currently in place, would then be possible whilst avoiding unacceptable impact on neighbours. This would further enhance the utility of the spectrum. However, without technical limits in place, the licensing of spectrum access as opposed to apparatus could lead to fragmentation of the spectrum due to geographical and/or adjacent band incompatibilities. This must be carefully avoided.

Clear security of tenure for the licensee would be needed. For the satellite domain, any constraints on the use of spectrum licences due to co-ordination issues with other services would need to be known.

In principle the starting point should be the greatest level of freedom commensurate with international Radio Regulations. A second consideration is that, Ofcom must be satisfied that use will not impinge on other users in the same or adjacent frequency bands, and that competition is not unduly affected.

Satellite Earth stations would need special consideration in terms of the sharing environment with other services.

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

See *question xxxiv*

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 licences, best be defined to facilitate spectrum trading?

See *question xxxiv*

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

BT believes that Ofcom would have a central role in policing a more liberal spectrum market, monitoring transactions in both a competition policy and conflict resolution and arbitration role. The detail of lightweight, expedient and effective processes will need to be determined via open and transparent consultation with spectrum users once the general framework for future spectrum management is better known.

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?

BT considers that the Review should include a comparative assessment of the methods which have been used both in the UK and globally and gauge both the benefits and disbenefits which may have arisen. The disadvantages of the beauty contest have been previously well explored and there is an increasing acceptance (or resignation) to the notion that spectrum auctions are here to stay. The design of the auction though, is expected to be

a key factor in its success or failure. A number of designs have been employed with more or less success. However it needs to be recognised that there can and will be different criteria by which success may be judged: these have not always been declared before the event and may not be immediately apparent. In some cases, notably New Zealand, considerable freedom of use is granted for the tenure of the licence and this has created few difficulties which were not foreseen and judged acceptable by the design authorities and government. However this may not be deemed to be the right solution for all bands nor in all geographical areas. It is in part the greater level of freedom which has, it would seem, left the US in a difficult position in respect of finding appropriate spectrum to ensure that the benefits of 3G mobile can be enjoyed in the US as they are to be elsewhere. Every opportunity should be taken to assess the methods employed and to inject the learning into future decisions concerning allocation.

The key lessons which should be learned from experiences so far are the need to have analysed *all* the probable/identifiable outcomes from a particular allocation given the market circumstances, and the need to retain an avenue to correct any distortions which may result.

The boundaries of spectrum regulation

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

BT believes there remains a strong case for licence exempt spectrum for certain applications. However, the use of such spectrum should be addressed within and overall UK economic/spectrum strategy.

The available evidence shows that licence-exempt bands have provided, and continue to provide, an essential stimulus for technology, applications, services and scientific innovation. BT is aware of the great progress made in the USA resulting from the licence-exempt framework in place there. In particular, the Wireless LAN bands and the *Unlicensed-National Information Infrastructure* (U-NII) bands have provide licence-exempt spectrum targeted at low-cost, mass-market digital telecommunications, and this has triggered a wide range of new technology solutions. The access to unlicensed spectrum and the easy entry into, and exit from, the market place allows a greater element of commercial risk taking. The creation of sector-specific U-NII licence-exempt spectrum rather than a reliance on general "ISM" bands appears to have been successful, in the US environment at least. However, much more careful evaluation of the benefits and problems of the US licence-exempt bands, and indeed similar bands in other countries, would be appropriate before any major conclusions are drawn.

In the context of our own UK telecommunications sector, licence-exempt spectrum has been encouraging the growth of a tetherless periphery around the main public

telecommunications networks for some time. The starting point was cordless telephones (e.g. CT1, CT2 and DECT), but an increasingly sophisticated market now seeks to extend this environment to embrace wireless LANs, simple Fixed Wireless Access and the networking of domestic appliances etc. Such a tetherless environment will be a significant driver of a wide range of low-cost terminal devices and encourage a mass-market for broadband information services. There are also economic efficiency benefits (promoting mobile e-commerce) as well as social benefits (e.g. domestic cordless phones).

Congestion and quality of service are key issues to be dealt with in "licence-exempt" bands. With innovative technologies and applications the market will decide what interference levels are acceptable and, where problems arise, users will fall back on licensed technologies, or licensed technologies which have unlicensed technology embedded in the terminals to give extra capacity when it is required and available. Effective inter-working between local area and wide area networks should be allowed, as it would be to the common good of both sectors.

The Radiocommunications Agency has indicated its intention to undertake its own consultation on the use of licence-exempt spectrum for commercial and non-commercial purposes later this year. The issues are many and complex, including the need to take a broad view of the relationships between licensed and unlicensed applications within the same sector, and the economic impact on the opportunity cost of already licensed spectrum. BT will contribute to that consultation, and encourages the Review to take full account of its findings.

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

The regulatory regime could mandate which standards and systems can share the band, set limits on in-band power and out-of-band emissions.

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?

BT believes that so-called "polite" technologies, when coupled with the advanced adaptive techniques now becoming commercially available at low cost (e.g. adaptive antennas, adaptive modulation schemes and software configurable radio), can greatly enhance the potential for the beneficial use of licence exempt spectrum, or other scenarios for shared spectrum, whilst minimising regulatory requirements. Radio regulation may eventually only need to cover emission limits for such equipment.

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