

Response to Professor Cave's Spectrum Review

1 Introduction

This response is made by Gerald David OBE as an independent view based largely on forty years professional activity in the mobile radio industry and with particular reference to the technical reasons why the use of the radio spectrum is largely governed by the laws of physics and if the technical parameters are not critically adhered to then the end product i.e. the various uses of the spectrum will be unworkable.

Despite the technical excellence within the Radiocommunications Agency there is a great lack of understanding of the technical issues in the broader areas of government which has caused the author to write this response as in his opinion the government has ignored advice from many sound technical sources in pursuing this course of valuing the spectrum in accordance with the price given to it at an auction. There are few winners at auctions, occasionally a happy buyer and from time to time a happy seller but in general a very false value can be arrived at despite the claims that it will be the current market price. The negative impact on the remainder of the market caused by a high value reached in an auction can have repercussions throughout the business associated with that commodity.

The author has felt it necessary to provide a biographical section in order to fully explain the philosophy of this response and to avoid any confusion as to the thrust of his argument.

It is essential at this stage in the development of mobile radio that the UK as a nation is not disadvantaged by a drive for short-term financial return at the cost of the future of the mobile radio industry in the UK. Whereas clothing, art and jewellery may be quite rightly priced according to fashion, it would be extremely unwise to allow a technically complex industry with a great future to be damaged by short-term thinking.

2 Biographical Details

The author is Chairman and proprietor of Aerial Facilities Limited, a private closed company involved in the design, manufacture, supply and installation of radio frequency systems comprising filters, couplers, duplexers and all the associated hardware but the company does not manufacture radio nor own any licences, nor operate any systems.

Gerald David is primarily an engineer having learned the business rules the hard way, having started with three people in 1972 and ending up with three hundred people in 1999. He has sold Aerial Group Limited at considerable profit, retaining Aerial Facilities Limited purely as the manufacturing arm. His enthusiasm for radio stems from childhood and at the age of sixty-eight he now wishes to put back into the industry a gesture of gratitude for all the pleasure, money and job satisfaction that he has achieved over the years. This response, therefore, has no hidden agenda but is simply a plea for commonsense to rule and safeguard the future of the radio industry.

3 Use of the Radio Spectrum

The radio spectrum is a natural phenomenon which operates strictly according to the laws of physics. We have been able in the last century to develop equipment with more and more uses that have broadened the demand which started from safety at sea and has now become a commonplace means of communication between children in a school playground. This wide variety of usage has sparked an enormous growing demand for spectrum for certain groups of frequencies while others are becoming moribund and in fact have been abandoned largely due to their less practical utilisation for small handheld equipment on account of antenna size.

It should be remembered, however, that the radio spectrum is not inalienable and can be easily disrupted by accidental or deliberate interference and an example that should be quoted is that of cellular radio for the whole of central London could be effectively jammed by a very simple broadband oscillator, battery driven and supported by toy balloons which could be released from any reasonably high building and, depending on the weather, would probably operate for several hours before ascending into the upper atmosphere and being destroyed.

It is this fragility of radio frequency spectrum that must be respected and kept in mind when extended use of communications are proposed often without due regard to the consequences of damage to existing services. One has to question, therefore, the use of radio in the event of national conflict, since it can be so easily disrupted whether by an enemy or jealous commercial operators wishing to disrupt their competitors or, on a larger scale, political or foreign influences wishing to affect existing national operations. Such comments may seem alarmist but it should be remembered that in the early '70s at the height of the 'mini-cab war' radio systems were interfered with, control offices were bombed using both hand grenades and petrol bombs and there were many instances in London of such activity causing death and injury. There have also been attacks on radio investigation inspectors who have been seeking the sources of illegal transmissions.

It is to be hoped that control of the radio spectrum in the UK should not fall outside of these shores, since for commercial and political reasons it would be perfectly easy to pull the plug or drown out the emissions if sufficient benefit could be perceived in doing so.

From the above comments it may be seen that the value of the spectrum can be limited by its disruption or else the cost has to be escalated if security of the system can be raised to a level to avoid such interference. In assessing the true value to the nation of the uses of the radio spectrum the wellbeing and health and safety of the nation should be the dominant factor. This includes not only safety of life and limb but also the economic health and wealth of industry and the employment of those engaged within it safeguarded for the foreseeable future.

The development of large new entrepreneurial services have been seen to be dangerous to the radio community where, like a balloon, the systems have been inflated beyond their natural resources or financial capability and have collapsed taking with them the flotsam and jetsam of unemployment, empty premises, unpaid suppliers and companies forced into liquidation. In the writer's opinion the priorities in the use of radio taking all of the above points into consideration could be as follows:-

3.1 Security Forces

This title should include the armed forces and their support operations, the police and other national security organisations, the fire brigade and any operations dealing with health and safety. The emergency services should include the ambulance and paramedic services together with those operations including rescue helicopters, lifeboats and any other services which are employed to preserve the safety of the nation.

3.2 National Broadcast

There is a positive need for the nation to have a source of totally reliable unbiased truth which reflects the actual state of the nation and has no commercial and as little as possible political bias. This used to be the case of the BBC services during World War Two when the nation relied on broadcasting to be informed of the day to day situation. We need to have a high level, widely based foundation for such a service and it would be best operated by an organisation where profit was not the operational motive. The services operated by such an organisation would, of course, include television, both terrestrial and satellite and should be funded by the nation, i.e. from the Treasury. These services would be perhaps part of an entertainment service which could be operated, as is the BBC at present, from a nationally based funding system which is, therefore, to some degree protected from simple commercial exploitation. The difficulty in providing such services will always be that of ensuring the quality of ethics and intention in providing the service. (Straightforward entertainment broadcasting is dealt with separately.)

3.3 Business Radio

This title is intended to convey those services upon which businesses, large or small, rely entirely for their operation. At the simplest level this would be a local taxi service or undertakers, including wedding cars and at the opposite end of the scale national organisations such as the RAC and AA who rely entirely on radio for communicating with their officers. In between these two ends of the scale are approximately 100,000 companies employing at the lower end of the scale three people and at the upper end 30,000. Many different solutions are applied for business mobile radio ranging from individual PMR licences up through PAMR and, of course, the cellular networks. The most cost effective for small companies are the private licences since there are no call charges and no infrastructure payments.

Many companies will apply all three solutions to different arms of their business. It is the small private licences that are the ground base of technique and training for radio technicians and the background to mobile radio over the past fifty years has been totally ignored by those who think they can make instant commercial profit by setting up networks.

It should be noted that the writer has not divided these business uses into spectrum bands since each and every one of the commercial users could employ any number of services including, quite often, VHF, UHF and SHF frequencies. It is the use of any radio spectrum that matters and can be valued as an asset to the business but regrettably due to the enormous publicity and hype associated with the public cellular services almost all the private licensed use is either ignored or forgotten.

It should be noted that this response has not divided these business uses into spectrum bands as that is an irrelevant detail among the global purpose of this report.

In the interests of the nation, therefore, it is essential to uphold the use of radio for small companies via their own private licence directly with government and it must represent good value otherwise its use will decline or worse the small licensees could be forced onto the public networks. The worse case scenario would be that due to default by the government and ignoring a proper perception of business radio all the small licensees disappear and we end up with perhaps two or, worse still, one single large public telephone network.

Those of us who grew up with the monopolistic situation of the Post Office controlling telephones, mobile radio licences and marine licences and all other forms of communication have vivid memories of the difficulties associated with getting any form of support or entrepreneurial response.

3.4 Entertainment Radio and Television

There is a growing requirement for more channels, a greater variety of sport and entertainment and generally this has been reflected in a increase in satellite and fibre-fed domestic and business installations. The five national UHF channels appear to be hard pressed to provide the quality of services that we normally associate with the national channels and there appears to be an ongoing domination of sport. There is also the technical development of digital television which, due to a lack of technical knowledge, the government has been led to believe can provide a national service in a very short space of time.

It should be remembered that it took twenty-three years to close down black and white television and the spectrum that it vacated has hardly been used apart from bits of Band III. To provide a replacement terrestrial service on the scale of the present UHF services will require a complete replacement network of transmitters on the digital service which, although making better use of spectrum, the existing service claimed 97% terrestrial coverage and UHF television would be extremely difficult to replicate without a complete duplication of the existing network. There is a good technical case for saying that lower transmitter powers could be utilised for the digital service but the writer is of the opinion that the calculations have not been made for coverage of every rural domestic habitation.

We should approach the closure of existing UHF terrestrial television with great caution less we disenfranchise a large percentage of the population.

3.5 Public Mobile Telephone Networks

These services are currently the most popular and the most demanding of spectrum use, having grown a hundred fold in less than ten years. The applications of the mobile telephone network include parts of items 3.1, 3.3 and possibly 3.4 above since the usage, although initially largely business orientated, has now developed into every aspect of domestic life and the use by adolescents forms a very high percentage of the call rate in off-peak hours. It is to be expected, therefore, that the public perception of this spectrum use is that it forms an essential part of modern life and whilst there is no doubt that business can be more easily conducted via the mobile telephone it would appear that the bulk of the channel occupancy and, therefore, the air-time is of a domestic nature and is spread across the non-business parts of the day, i.e. before 9 a.m. and after 6 p.m.

There is no doubt, therefore, that this spectrum activity represents considerable value to the nation and employs a large number of people together with the service providers including hardware providers who form the core of our new technology developments.

3.6 Other Uses of Radio

There are a wide variety of non-commercial, private and useful but not strategic uses of radio spectrum which include amateur, CB and other applications providing employment, entertainment and being a source of equipment sales and, therefore, manufacturing which should not be ignored.

3.7

The above broad uses are not divided into bands to avoid simplification of the headings into 2G, 3G, fixed links, etc. all of which are divided into user groups which mask the proper division of value and how the spectrum should be costed.

The next section of this response details an envisaged method of costing the spectrum which would be fair and encourage use, expansion of private services and particularly expand the industrial base which has been so severely damaged by the auctions for 3G.

4 Value of Spectrum

4.1 Background Information

In his report Professor Cave very nicely defines how we should analyse the value of spectrum and his comments are precisely fitting.

In terms of value to the nation the headings in section 3 which precede this paragraph give my view of the priorities of use and, therefore, the perceived importance but these should not necessarily be the order in which cost analysis should be applied.

The department of government responsible for allocating frequencies and for regulating the use of the spectrum must be of very high technical competence in order to ensure that the best possible technical analysis shall be applied to the allocation of spectrum and that the technology of use of the spectrum shall give maximum benefit to all users. This immediately brings one to the conclusion that commercial considerations are secondary in the interests of best use, since the safeguarding of radio spectrum from interference either accidentally or deliberately is a technical matter and detection of interference and its removal is also a highly technical subject.

The writer is reassured that the report does not recommend best commercial practice being applied to recovery of maximum return. On the other hand there is a compromise that can be struck between costing the spectrum at prices that the users can afford to pay without denigrating the technology, the best application of engineering and the best quality of radio installations. The very best use of the spectrum can only be made by utilising the best existing technology and for any period in time there will be a technology that is best current practice available at reasonable cost and familiar to those engineers engaged in installing and maintaining radio systems. There are, therefore, two areas of danger to be avoided in valuing the spectrum, these are:-

(a) **undervaluing the spectrum**

In which case a slovenly approach will be applied and neglectful use of channels perhaps employing techniques that have been long superseded.

(b) **overpricing the spectrum**

In which case there will only be those takers who have deep pockets and wish to squirrel away as much spectrum as they can to avoid their competitors having access to it. This also involves utilising financial resources which then deplete the coffers when it comes to installing infrastructure for the system. The result is an ineffective system with poor coverage and which is not the much trumpeted new scenario that it was held to be.

Both of the above scenarios have been witnessed in the UK and in recent years the compromise plan adopted by the Radiocommunications Agency placing the value of spectrum above that of administrative pricing and giving a return to the nation but not closing the use of the spectrum by smaller companies.

The most successful industry in the last decade has been telecommunications, particularly mobile radio and, of course, its connection to email and the internet. The manufacturers, suppliers and installers to the networks form a very material part of the UK industry and there are severe dangers in overspending on spectrum licences thus curtailing development and installation of hardware reducing the scope of activity in supplier companies.

The application of auctions to the use of spectrum is extremely dangerous particularly in those areas where perceived benefits and profits are based on huge expansion of new systems and new infrastructure. The cost of spectrum should certainly not exceed the cost of hardware and the infrastructure but in recent cases the prices paid for spectrum licences have been many times greater than the total cost of implementing the systems. This will have serious negative impact.

4.2 Pricing the Spectrum

The writer has been engaged over many years in various exercises conducted by DTI, Radiocommunications Agency and various consultants to ascertain the value of spectrum and how it should be charged to users. The early exercises were somewhat primitive in their concept but more recent studies i.e. 1993 and onwards have produced some very interesting balances between the cost of purchasing vehicles and maintaining them compared to the cost of the radio systems. The perception as to the profitability improvement to a company by the use of radio and also whether or not it would be viable as a commercial exercise without radio has also been costed and the notes that follow are prepared from many years of practical experience by the writer of small commercial operations relying on mobile radio.

For a private mobile radio operation employing a single base station and, say, two or three mobiles I had always considered that this annual licence should cost no more than the road tax for a vehicle which in current prices is £160 per annum. The calculation, therefore, is based on a single private frequency of 12.5 KHz bandwidth in either VHF or UHF bands and having a coverage area of radius 17.84 kilometres which equates to a circle enclosing 1,000 sq kilometres. This is a typical London coverage small PMR system.

This costing is very similar to those charges currently made for such a licence and have proved not to be too onerous for the small private users described in this section.

The value placed on such a licence was based on £10/KHz/1,000 sq kilometres of coverage. This produced a licence fee for a single private user of £125.00 per annum for a 12.5 KHz system that could be reproduced at approximately 25 kilometre intervals across the country. It was also considered that it would be a shared channel but for exclusive use the fee should be double i.e. £250.00 per annum.

The present licensing arrangements take into account the congestion and the above calculation is for a semi-congested area which would, therefore, have a multiplier of two for a congested area and divided by two for a non-congested area.

Taking this system as a base parameter the calculation can now be extended to a trunked network having four channels and being exclusive to its 1,000 sq kilometres. This would produce a licence fee of £1,000 per annum. If we now take a large network covering say 10,000 sq kilometres and having four channels i.e. 50 KHz bandwidth the licence fee would now amount to £5,000 per annum.

Taking the scale of coverage up to a cellular type system having a national coverage of 250,000 sq kilometres and a bandwidth of, say, 50 MHz the annual fee would be £100 million, i.e. £2.5million/MHz. For a twenty year licence this would cost £2 billion. These costs can be seen to be about one-third of recent auction prices and are probably somewhat higher than would give great impetus to the hardware and interface sections of the industry.

In the writer's view the above formula works well up to medium to large private licences but would not be recommended for new cellular systems. They should be given a 40% discount on this calculation if we are to see the proper development of well engineered systems.

The present poor coverage of GSM is entirely due to funding restrictions and the fact that the licences were wrongly based i.e. population based not terrain coverage. This will also apply to digital television. All future licences should be based on 90% terrain coverage after four years irrespective of population density if we are to have proper nationwide coverage. Otherwise it is not possible to recommend cellular radio, for emergency services, county councils, etc. particularly rescue services since the very difficult areas which account for many fires and accidents are currently not covered by the cellular operators. In fairness to large operators they must see a return for their shareholders when planning future expansion and any imposition or restriction must therefore be applied to all of them in like measure. (See appendix for more details.)

5 Spectrum Trading

The current reservations held in respect of spectrum trading are likely to be based on the history of illegal use of licences, hoarding of spectrum and other anti-competitive means of precluding other organisations of obtaining reasonable access to existing licensed spectrum.

If the pricing and allocation of licences were to be a more open and transparent operation then the trading of such licences for an equitable fee should become a normal operation within the business.

In the UK we have severe restrictions against the sale of working systems utilising existing frequencies from being amalgamated with other companies' operations at the time of a merger or takeover. This seems unreasonable for business use but there have been good reasons in the past for these restrictions. A more open culture should be developed in the whole matter of spectrum sale and licence transfers.

It would not be an unreasonable proposition to consider the radio licence as an asset of the company which could be valued according to a formula which might be developed in due course, e.g. the licence fee x the profit over working capital ratio or some such relationship that would enable a fair market value to be developed. An alternative would be to simply value the whole of the radio system at its current market price and that the licence should be considered as part of that valuation.

The problems that arise when purchasing bankrupt or defunct companies is that the records that are available often conflict with the records held by the Radiocommunications Agency. There has been a limiting factor in the legal conditions covering radio licences that do not allow the radio frequencies to be treated separately from the company as a whole. Thus the Radiocommunications Agency has been forced to take a 'start from scratch' approach new licence application approach. This has in many instances to the writer's knowledge severely damaged the operation of the proposed takeover of the radio system and in many cases produced delays which have resulted in the radio system never being operated again. Such negative situations are not in the interests of business generally and a more open approach should be adopted.

6 Recommendations

All future development in mobile radio should be encouraged and supported by government and the nation so that the outcome will be better systems, carefully costed and developed with the objective of proper nationwide coverage. This means that the cost of licences for radio spectrum should properly reflect the potential market and encourage technical development and high standards of engineering.

The Radiocommunications Agency should be supported and encouraged in its technical standards and this means allowing them to be funded sufficiently from licence fees to give the technical support that is necessary.

In the new proposals for OFCOM it is essential that radio users that are not covered by broadcasting or telecommunications Acts do not lose their rights and conditions of licence since the smaller licences do not appear to be covered in OFCOM proposals. At present all these users are well catered for by the Radiocommunications Agency.

7 Spectrum Management

There have been many suggestions both from inside the radio industry and from users that licensing of spectrum could be allocated to commercial operations that would allocate sub-divided blocks of frequency to certain user groups. The management of such arrangements works under certain conditions but in a small country with a very high population such as the UK the dangers of co-channel interference and poor re-use of the channels form a significant technical problem. This can be compared to the vast areas and low population density in the USA where such systems are thriving.

The quality of operation of radio systems depends entirely on the planning and engineering of the system as defined previously. A well run organisation with a structure such as RA could easily manage all of the spectrum allocation if it was given the funds and resources needed to encourage private licence growth.

In the case of public networks i.e. cellular operators, the block of frequency associated with the licence is normally managed internally within the organisation by its own engineers and the UK history to date has demonstrated good technical co-operation between the cellular operators in order to reduce interference to a minimum. There is a self-preservation motive in this good management as all of the operators require a high quality of service and they, therefore, impose the same demands on their colleagues.

There are no good examples of privatised frequency management for others but there are good examples of self-management in closed user groups. In the UK a polished version of the present Radiocommunications Agency operation would be the best solution for spectrum management.

8 Conclusion

The dangers that arise from the euphoria generated by the recent auctions could be extremely damaging to the radio industry and we are already suffering a downturn in the economic welfare of the suppliers, manufacturers and service providers. This is a by-product of deprivation of funds resulting from these auctions.

The problem with spectrum auctions is that they can encourage the wrong speculative approach by organisations who have not understood the radio propagation process.

All of the above problems have stemmed from ignorance of radio propagation whilst driven by huge commercial exploitation which, in the right place, is healthy but when misapplied is extremely dangerous. (See Annexes.)

To properly support radio design and manufacturing in the UK the cost of spectrum should be carefully adjusted to be an incentive rather than a disincentive for new developments. The health of this industry will contribute largely to the wealth of the nation.

Gerald David OBE

4 September 2001

Annexes

Annex 1

Spectrum Pricing Calculations

The formula from which a simple multiplier can be driven is the charge per annum of:

$$£10/\text{KHz}/1,000 \text{ square kilometres}$$

This works for any number of channels and in any frequency band in the range that we are considering, which is 30-3,000 MHz.

(In due course mobile spectrum will escalate beyond 5 GHz and the formula will still hold but the area covered will reduce drastically.)

Annex 1.1

Wide Area Coverage

The basic formula is for wide area coverage on a small scale for a small private user but will extend simply for multiple channel users where the bandwidth increases up to, perhaps, 50 MHz. Taking 50 KHz for a four channel system and area coverage exceeding the 1,000 sq kilometres and can often be as much as 20,000 kilometres e.g. National Rivers Authority (NRA). For four channels covering this area the annual fee would be £10,000. Since the area of the UK is approximately 250,000 sq kilometres for national coverage and based on a 1 MHz bandwidth the calculation will be £2.5 million per annum.

$$£10,000 \times 250 = £2.5 \text{ million per MHz per annum}$$

The cost of the licence per annum would be a far better accounting policy to any user who can budget the outgoings on an annual basis despite the fact that the legal contract would be for ten to twenty years, thus ensuring security of tenure of the spectrum. Any break in the contract conditions could cause the licence to be withdrawn i.e. if the terrain coverage was not met or some illegal activity transpired.

Adjustments could be made by negotiation on the above calculation where it was thought that encouragement should be given to new technology or to entrepreneurial proposals that would be in the interests of the UK economy.

Annex 1.2

Fixed Links

The approach to fixed links for licence charges can still be driven by the simple formula:

$$£10/\text{KHz}/\text{per link path in bands of linear length}$$

A sensible approach would be the first band 1-5 km, the next band 5-10 km, 10-20 km and 20-40 km. Beyond 40 km a special consideration would have to be given since the links would have to be repeated (perhaps even for 20 km, depending on the difficulty of the terrain).

The previous calculation would hold for wide band links e.g. typically 1 megabit = 500 KHz bandwidth. At present there are 64 kilobit systems operating on 50 KHz bandwidth. With clever modulation techniques it is possible to push through much higher bit rates for these bandwidths but that would assume that the technology is available to all users. These calculations have to take into account the typical present case.

For very small links a calculation of £1 per KHz per 100 metre linear could be applied and with the future prospect of 5 GHz interface coverage within one organisation links can be envisaged of 500 KHz operating within a 20 metre range.

There have been some proposals to de-regulate such applications and this is discussed in 1.3 below. It can certainly be considered that the amount of data passing down a link should give it licence value and an annual rate is convenient for accounting purposes. If, however, the amounts were to be less than £50 per annum it could be considered that the administrative costs of collecting the fee would become an unrealistic proportion of the value. In this case a five or ten year fee collection could be applied in advance of the issue of the licence.

Annex 1.3

Security Forces

The pricing of spectrum for this category should be considered in two separate calculations the first being the actual value based on the KHz per square kilometre formula which would give a very large contribution since it represents probably 200 MHz of spectrum at £2.5 million per MHz = £500 million, which is the figure currently shown by Professor Cave as the total licence fees for the UK.

This figure could be discounted by arrangements with the Treasury on the basis that spectrum retained for emergencies could be paid for at a special rate. However, there is significant evidence that an increase in the cost for this sector would produce better spectrum management.

Annex 1.4

Entertainment Broadcast and Television

The present income derived from broadcast fees form a significant portion of the total licence fees collected and this indicates that perhaps this sector is the only one that is properly valued and costed. However, to support the nation with a proper national public broadcast system there should be a heavy subsidy of at least one channel in sound broadcast and one channel in TV which could concentrate on value and quality of content rather than have to degrade its service for commercial reasons. This should be drawn from a common pool of all the income derived from spectrum fees. It would, therefore, be the key of the British democratic process and be politically independent from any current government.

Annex 1.5

Business Radio

The simple generic formula derived at the beginning of this paper would be applied to all forms of business radio and could be modified for 'start-up' or new technology schemes which the RA or DTI thought were innovative and to be encouraged. For state of the art and competitive networks e.g. 2G and 3G, etc. a form of beauty contest coupled with a partial 'Dutch Auction' but with pre-determined capped amounts could be applied to those services where genuine and equitable competition is available.

What must be pointed out is the situation where the quality of the service to be provided is limited by the funds available after paying excess fees for the licence. There is no purpose in setting up auctions for low value and limited interest spectrum e.g. below 300 MHz since the cost of the process is likely to exceed the funds available from the protagonists.

Annex 1.6

Entertainment Broadcast

The comments made in appendix 1.5 above could be expanded if further services were proposed for entertainment channels and there is a case for auctions under these circumstances i.e. it would be difficult to make a fair judgement by a beauty contest for proposals that were purely an investment plan presented via a business case. If the spectrum available is limited then an auction could be a reasonable solution

Annex 1.7

Public Mobile Telephone Networks

The comments made in the main body of the text would apply to the costing at £2.5 million per MHz of spectrum and this level should not cause negative effects on the quality of the infrastructure and hardware to be deployed in the system.

The terrain coverage problem is currently spoiling all of the existing services and there are reports that better coverage is available when hill walking in Nepal than when hill walking in the Chilterns. This situation comes about as the result of the population based formula by which the existing public mobile telephone networks are operated.

Annex 1.8

Aeronautical

The contribution in this sector when examined in the table of total licence income seems very small for the percentage bandwidth allocated to these services when compared to maritime which has 5% of the spectrum but income fifteen times greater than aeronautical which has 25% of the spectrum.

If the standard formula was applied to this situation there would be a serious improvement in the income. When compared to the cost of the installation and the income derived from the use of radio in aviation then there is a serious anomaly in the licence charges.

Annex 1.9

Maritime

The present charges for a ship's licence seem extremely low and an example is that for yachts costing between £50,000-£500,000 the annual licence fee is £20. This appears to be an amount which, when compared to the cost of collection of the fee and the other costs of running a boat appear to be insignificant.

To encourage the use of hand-portable emergency radios a low fee could be continued but for a fixed installation on board a much larger fee in the range of £50-£100 would seem to be more appropriate.

The present costs of mooring and maintaining even a small yacht of twenty-five feet in length exceed £2,000. This is also a very rapidly increasing market and can be regarded as hobby and amenity orientated expenditure.

Annex 1.10

Amateur/CB

The present arrangements for these categories do not produce sufficient licence income for the amount of spectrum that they are allocated. Bearing in mind the cost of the equipment in these categories a licence fee of £25-50 could be applied which might encourage the users to value their spectrum. As with other categories there might be a strong case for a five or ten year licence to avoid the unreasonable costs of collecting the fees.

Annex 1.11

Low Power Applications

There is a widespread tendency throughout Europe for de-regulated spectrum for those applications employing 100 milliwatts or less and there has been pressure in Europe to raise the upper limit of Low Power applications even to 1 watt.

The problems presented by such a system would be unwarranted propagation affecting other users and it is the writer's view that an upper limit of 100 milliwatts should be applied for Low Power applications.

Since many of the uses in this category are extremely valuable to society and include security, monitoring and meter reading applications, which have a very high value in terms of their earning capacity and should, therefore, be charged for the licence.

The approach to deregulate spectrum was made in order to save administrative costs i.e. the recording and collection of licence fees, etc. The writer is of the opinion that a licence fee should be charged but the full regulatory regime could be avoided if the powers are sufficiently low. It is suggested, therefore, that a 'full-life' licence should be applied and the fee should relate to the service income. A starting base of £10 could be applied for domestic installations rising to perhaps £1,000 for a wide area meter reading scheme. Particularly in instances where hundreds of salaries are saved, the perceived value to the organisation probably amounts to hundreds of thousands of pounds and the licence fee could be calculated accordingly.

There should also be a record in the regulator's computer database of all the systems in use so that some idea can be gained of the spectrum pollution to be expected in those frequency bands.

Annex 1.12

Total Spectrum Income

In Professor Cave's report the total licence fees amount to £512 million per annum. Utilising the simple derived formula in this response it can be easily seen that even with heavy discount in several areas a total income of at least £900 million could be generated and probably up to £1,700 million per annum if the discounting were not applied to the same degree.

The arguments for long term contracts and payment of spectrum fees in advance is one which has to take into account the cash flow of the organisations involved but the writer is of the opinion that an annual fee attached to a long term contract is a better way of seeing good health in business.

Speculative development in the telecommunications area has regrettably been connected to 'bubble development' which, when not soundly technically based ends in failure of the proposal. A steady gently upward pressure on spectrum costing would produce better development in the industry and give developers and manufacturers some security and comfort in their investments.