

*The consultation period (originally three months) has been extended to allow interested parties to consider the Independent Review of Spectrum Management, conducted by Professor Martin Cave, which was published on 6 March 2002. The Government has now asked to receive comments by 5 April 2002.*

## **DIGITAL TELEVISION: THE PRINCIPLES FOR SPECTRUM PLANNING**

This paper sets out the Government's proposals on the principles for planning the use of the spectrum currently used for terrestrial television broadcasting once analogue transmissions cease. The Government announced in September 1999 the criteria to be achieved for reception of digital television before analogue terrestrial television broadcasts could be switched off, and said that these were likely to be met in the period 2006-2010. Developing and implementing the spectrum plan is likely to take over three years. If we are to be in a position where we can consider switching off analogue television transmissions from 2006, decisions need to be taken in the near future on the principles on which the plan is to be based. Knowing what spectrum will be available for digital television in 2006 and beyond will enable broadcasters to take well-informed decisions on investment in the short term. The aim of this consultation is to ensure that all those with an interest can feed in their views before those decisions are taken.

Switching off analogue transmissions will create an opportunity to release spectrum to expand digital broadcasting or for other purposes that can generate economic and social value. In this paper we propose that a certain amount of spectrum should be allocated for use by the existing digital television multiplex operators, and the remainder should be released for potential reuse. How this cleared spectrum should be reused should be decided nearer the time that it becomes available.

There are a number of constraints on our ability to take final decisions now on how to use the spectrum from 2006 onwards. International spectrum planning conferences looking at the broadcasting spectrum are due to take place in 2003 and 2005. Taking decisions in the UK on the principles we wish to apply will inform our input to those conferences, but we cannot be sure of the outcomes. We will need to leave room for flexibility. Similarly, we have no way of being sure now what services will have the greatest claim on the spectrum in the future – but we can be sure that failure to act now to give ourselves room for manoeuvre in the future will constrain our ability to meet those demands. The introduction of spectrum trading, or any other changes to the management of the radio spectrum, could also affect specific assignments in the future.

This paper seeks answers to the following questions:

- How much spectrum should be allocated to digital terrestrial television?
- Of that spectrum, how much should be allocated to public service broadcasting and how much to pay-tv?
- What level of coverage is required by terrestrial television for public service broadcasting, and for pay-tv services?
- Which spectrum should be cleared for reuse?

The Independent Review of Spectrum Management, which is expected to report in January 2002, may well make recommendations that could affect the allocation and assignment of spectrum, including that for television broadcasting. These will be taken into account with responses to this document in taking firm decisions on the principles for planning the spectrum for digital television.

Comments on this consultation should be received by 12 March 2002 and should be sent to

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Electronic versions would be appreciated. Responses will be published on the digital television website [www.digitaltelevision.gov.uk](http://www.digitaltelevision.gov.uk) except where respondents have specifically requested confidentiality. Any confidential parts of a response should be placed in a separate annex, so that non-confidential parts may be published with the author's identity. If the whole of a response is confidential, including the identity of the respondent, this should be clearly stated. Copyright in responses will be assumed to be relinquished unless specifically retained.

## **1. Setting the framework for the switchover from analogue to digital terrestrial television**

1.1 The Government announced in September 1999 the criteria to be achieved for digital television before analogue terrestrial television broadcasts could be switched off

- Availability: everyone who currently receives free-to-view analogue TV channels (BBC 1 and 2, ITV, Channel 4/S4C and Channel 5) must be able to receive those channels digitally (target: 99.4% coverage to compare with current analogue terrestrial figure for channels other than Channel 5)
- Affordability: switching to digital must be an affordable option for the vast majority of people (target: 95% of consumers have access to digital equipment)

It remains the case that this could start to happen as early as 2006 and be completed by 2010.

1.2 Over 8 million households (roughly 33%) have now chosen to access digital television by one of the available platforms (cable, satellite or terrestrial). To push this figure closer to the “access” target of 95%, the programme of action announced in February 2001 in *Opportunity for all in a world of change* focused on promoting and facilitating take-up of digital television. A key element in that programme is the comprehensive action plan for Government and stakeholders in both the public and private sectors. A draft of the action plan was published on 12 October (available at [www.digitaltelevision.gov.uk](http://www.digitaltelevision.gov.uk)). Digital television brings a wide range of new entertainment, education and information services to consumers. It will also offer a means for delivering Government services, and is one way of accessing the Internet (as is analogue television). Broadcasters are keen to exploit the diversity and interactivity that digital television, unlike analogue television, can support. Additionally, switching off analogue transmissions brings savings of the costs of dual transmission which could, for example, be reinvested in higher quality programmes. It also offers opportunities for increasing the efficiency of spectrum use by enabling us to release some spectrum for other uses.

1.3 Our aim is for the UK to have the most dynamic and competitive market for digital TV in the G7, as measured by take up, choice and cost. The terrestrial platform has an important part to play in achieving this, and must be guaranteed sufficient spectrum if it is to operate effectively. But there are many other potential claimants for the spectrum, to deliver fixed or mobile applications for public or private services. We cannot predict with any certainty what will prove to be the most valuable uses for the spectrum in 2006 and beyond. Simply switching off the analogue broadcasting transmissions at some future date would leave pockets of spectrum scattered around the country in a way that made it difficult to reuse them. If we are to make the best use of the spectrum in the future, we must start planning now to free up spectrum in a way that maximises the future options.

1.4 Broadcasters want to know what spectrum they will be permitted to use after switchover so that they can invest wisely. Most new transmission equipment installed today for maintaining the analogue network would have a life expectancy beyond the 2006-2010 window. The transition to a fully digital network can be managed to minimise wasted investment in the analogue network, but contingency planning between the broadcasters (who generally share the costs at transmitters) will need to be put in place to deal with unexpected faults in the analogue network.

1.5 The development of an outline spectrum plan will probably take planners at least 6 months to complete with a further 12-18 months being required to develop this into a detailed plan. Depending upon the extent of the plan, its implementation leading up to switch-off would take at least 2 years. Switching off the analogue signals so that the digital signals could migrate to those channels (if that were the way we decided to proceed) could take over 2 years more. The current requirements of the broadcasters making investment decisions and the Government's indicative timetable for digital switchover both highlight the importance of starting the planning within the next few months.

1.6 The Government has a duty to ensure that the spectrum can be used after switchover to support the services (including television) that are most valuable – economically and socially - to the UK as a whole. In order to strike the right balance between guaranteeing spectrum now for digital television and clearing spectrum for reuse in the future, this paper seeks comments on the basis for the development of the digital spectrum plan. These comments will help the Government to undertake a cost benefit analysis of the options before final decisions are taken on the spectrum plan.

### **The analogue television spectrum**

1.7 The spectrum allocated internationally for television broadcasting is located between 470 MHz and 862 MHz in the radio spectrum. (See Annex A). This spectrum is split into 49 frequency channels, numbered 21 to 69. In the UK the channels used by analogue broadcasts, and thus subject to release, are the 46 frequency channels 21 to 68, with the exception of channels 36 and 38. (Channel 36 is used for radar and VCRs, and Channel 38 is used for radioastronomy). The existing digital services are interleaved between the analogue services. There is therefore 368MHz to be replanned for continuation of digital television and for possible other uses.

### **External influences on the outcome of the spectrum plan**

1.8 Radio waves do not respect political boundaries. TV signals are so powerful that UK transmissions have the potential to cause interference as far afield as Germany and Spain. The existing international agreements provide for most countries in Europe to be able to support four nationwide analogue networks. In the UK we have additionally allocated frequencies to deliver analogue Channel 5, various restricted TV services, and six digital multiplexes to a significant proportion of the UK population. The spectrum is also used within theatres, and by broadcasters and other programme makers, for radio microphones and other sound links.

1.9 New arrangements for sharing spectrum between countries will be made in an international conference scheduled to be held in May 2004 and in 2005 (this conference is separate from the World Radio Conference in 2003 that will consider whether the broadcasting spectrum can be assigned on a “co-primary” basis with other services). We cannot be certain about the extent to which the new arrangements will preserve aspects of the current international agreements. There are some advantages in seeking to maintain these arrangements as they would allow for a more straightforward, and less costly, transition from analogue to digital. However there may be pressure to take a different approach, notably to plan more explicitly for delivering services to portable and mobile television receivers.

Current international planning agreements make arrangements only for explicit delivery of services to fixed TV receivers with an outside aerial and, particularly in those countries that rely on cable and satellite for such reception, there may be pressure to adopt a more “cellular” approach to planning. This would have major implications for the number of transmitting stations required to deliver a network, and the amount of spectrum required.

1.10 The Independent Review of Spectrum Management is being undertaken by Professor Martin Cave who plans to report in January 2002. Any recommendations by Professor Cave on the application of spectrum management tools, such as spectrum pricing and trading, if accepted by the Government, could affect the shape of spectrum assignments by the time that switchover is achieved. These implications will be taken into account in taking decisions on spectrum planning for digital television in the light of comments received to this consultation. The next stage of planning for digital television will also be informed by the outcome of the work commissioned by the Radiocommunications Agency on the economic value of reuse of the television spectrum.

### **Key questions**

1.11 Consumers should be offered as wide a range of technology platforms for their television viewing as practicable. Terrestrial, cable, satellite, DSL, Internet, all have their place. This paper also assumes, as stated in the Communications White Paper *A new future for communications*, that

- digital BBC1, BBC2, ITV, Channel 4/S4C and Channel 5 will be available free at the point of viewing to all those who are currently able to receive the analogue versions of those channels
- these channels (plus any other public service channels and a public teletext service) must be carried on cable and satellite.

1.12 It would be possible to meet the availability requirement by using cable and, more realistically, satellite to plug any gaps that terrestrial cannot meet, or cannot meet at acceptable cost. However, we do not consider in this paper an option where there is no terrestrial television, which would enable all the spectrum to be released for reuse. First, the Government is committed to enabling competition on three digital television platforms. Secondly, were we to consider relying on digital satellite to provide coverage, a nationwide terrestrial network would still be required to fill the gaps where satellite coverage is not practical.

1.13 We assume that the success of digital television will depend on continuing take-up of services – both pay-tv and free-to-view – on all platforms. Free-to-view services will be available on satellite and cable, as well as on terrestrial, but viewers are only likely to be persuaded to “go digital” on those platforms by the pay-tv services. The amount of spectrum allocated to digital television should therefore be sufficient to support both public free-to-view services and pay-tv services.

1.14 Whatever option we adopt for the spectrum plan, there will be implementation costs for the network operators. For users, too, there will also be costs in switching from analogue to digital television. Some of these costs do not depend on the principles we adopt for the digital spectrum plan. For example, under any scenario most consumers will have an open

choice between terrestrial and satellite when deciding how first to access digital television services. Around half the population additionally have the option of cable services and access to services using DSL over the telephone line, or viewed over the Internet, will increase.

1.15 Experience shows that for a proportion of terrestrial households the existing aerial is too old or poorly adjusted to receive digital signals adequately. In these cases a new aerial has to be installed. When it comes to converting second and subsequent sets in a digital home, terrestrial customers should find that reception on portable sets using a set-top aerial should be at least as good as for current analogue reception if the digital services can make use of the converted analogue frequencies. Similarly, reception through a roof-top aerial should be similar to that provided today. Existing analogue television sets will need a set top box to decode the digital signal, or will need to be replaced by an integrated digital television set (iDTV) which includes the digital decoder. Satellite customers will be faced by a choice between specialist cabling to distribute the satellite signal to additional sets with each set requiring its own set top box and attracting charges for conditional access, or using terrestrial access through an aerial with a set top box. Before analogue transmissions cease there will need to be a solution to the conversion of VCRs, but again this is not dependent on how the spectrum is planned. This paper highlights where there might be additional costs for consumers depending on the decisions taken on spectrum planning.

1.16 In determining the spectrum plan for television certain key questions need to be answered:

- How much spectrum should be allocated to digital terrestrial television? Of that spectrum, how much should be allocated to public service broadcasting and how much to pay-tv?
- What level of coverage is required by terrestrial television for public service broadcasting, and for pay-tv services?
- Which spectrum should be cleared for reuse?

## **2. Allocating spectrum to digital terrestrial television**

### *The number of multiplexes*

2.1 Digital terrestrial television is transmitted on multiplexes, each of which uses one frequency channel (8MHz) of spectrum. Each multiplex can support six, or possibly seven, broadcast services in a quality similar to that of analogue.

2.2 There are currently six multiplexes operating in the UK:

- Mux 1 is operated by the BBC
- Mux 2 is licensed to Digital 3 and 4 to carry the services of ITV, Channel 4 and Teletext
- Mux A is licensed to S4C Digital Network (SDN) and carries the services of S4C, Channel 5, Gaelic language broadcasting in Scotland, and some services for the other broadcasters
- Muxes B, C and D are licensed to and operated by ITV Digital

The BBC services are operated under Royal Charter which is next due to be reviewed in 2006. The licences to operate the five other multiplexes were awarded in 1997 by the Independent Television Commission under the Broadcasting Act 1996. These licences are

for a period of 12 years, with an option to renew for a further 12 years. The following discussion is on this basis.

2.3 It would be possible to put all the digital equivalents of the analogue free-to-view services (BBC1, BBC2, ITV1, Channel 4, S4C and Channel 5) on to a single multiplex. If there were no further commitment to provide spectrum for public service broadcasting, and the overriding criterion was to release spectrum, this would be one way of minimising the amount of spectrum dedicated to digital terrestrial television in total, and to public service broadcasting in particular. However, it would be a radical solution that takes no account of our commitments to encourage public service broadcasting. It would also make it very difficult for free-to-view public services to be a key driver in the take-up of digital television.

2.4 BBC and ITV are already providing digital-only free-to-view services on the terrestrial platform and are planning more. Taken with Channel 4's services, there is a strong argument for maintaining two multiplexes for use by the public service broadcasters only. On the basis set out in paragraph 2.8 below, each of these multiplexes requires an average of six frequency channels to be certain of reaching at least 95% of households.

2.5 The three multiplexes licensed to ITV Digital and the one licensed to SDN can support 24 services at any one time (fewer if the viewing quality is increased compared with analogue, more if the viewing quality is decreased). For the commercial services, since it is not possible with a finite amount of spectrum to match the capacity for numbers of services available on satellite, or on cable, viability relies more on the quality and desirability of the services.

2.6 As part of the spectrum planning process, we could consider licensing one or more further digital television multiplexes. This might offer the opportunity for more free-to-view public services by giving ITV and Channel 4 separate multiplexes, thereby also giving Teletext room to expand. S4C and Channel 5 might also welcome the opportunity to expand their services. Or it might enable more subscription or pay-per-view services, whether from ITV Digital or from a new network operator. However any additional national multiplex would increase our commitment to digital terrestrial television at the expense of the opportunity to use the spectrum for other purposes.

*Q1. Our working assumption is that planning will continue for six multiplexes, as today. However we would also be interested in views on the costs and benefits of a more radical re-planning. This could be either reducing or increasing the number of multiplexes by one. Do you have views on this?*

#### Network configuration

2.7 The digital terrestrial television (DTT) network used in the UK follows the traditional broadcasting planning pattern of high powered transmitting stations (which maximise coverage from any one frequency) together with lower powered transmitters filling the gaps in coverage using frequency channels from the same part of the spectrum. The map at Annex B shows how groups of frequencies are used to cover the UK. This differs from the approach used in some broadcast networks and in other technologies such as mobile telecommunications of using the same frequency to provide a given service across the country. Because the DTT system has been designed around the current analogue frequency

assignments there is a limit to coverage that can be achieved whilst analogue is retained. The current network of 80 sites which extends across the UK is capable of providing some services to over 80% of households . Depending on how the spectrum is used, this could rise to 90% - 95% of households once analogue transmissions have been withdrawn.

2.8 Providing a higher level of population coverage means using more transmitters, which has consequences for both the cost of the network and the number of channels required. The planning pattern requires the allocation of five frequency channels for one multiplex to provide services to at least 90% of households, possibly reaching 95%. Six frequency channels, instead of five, must be allocated to a multiplex if it is to be able to reach all the households which currently receive analogue terrestrial transmissions, and, indeed, if it is to be certain of reaching at least 95% of households.

2.9 In principle it would be possible to create a network based on a repeat pattern using fewer frequency channels for each multiplex. This would allow the same number of digital services to be provided in a smaller amount of spectrum than today's pattern based on a minimum of five frequency channels for each multiplex. However, planning a network on this basis would require complete reconfiguration of the existing infrastructure since not enough of the existing 1100 transmitters may be in the right place for the new network. It would also mean ignoring current international agreements on use of the spectrum and the power levels permitted for different frequencies in different locations. Consumers, too, would be more likely to find that the digital transmissions for their area were being provided on frequencies for which their old aerials (tuned to analogue transmissions) were not suitable.

2.10 Complete reconfiguration of the network would enable DTT to be provided using fewer frequency channels than if the current network is used as the basis, and hence more frequency channels would be released for reuse. Both bases have costs and benefits.

*Q.2 What do you see as the costs and the benefits of maintaining the current basis for network configuration compared with those for adopting a configuration using fewer frequency channels?*

2.11 We are committed to supporting existing regional services. Ensuring that regional services can be viewed by all those who wish to in the appropriate region requires careful control of power levels of transmissions from each site on particular frequencies from each site. The current method of planning using interleaved frequency assignments enables the broadcasters to support the full range of national and regional services in analogue form. We propose to continue to plan on this interleaved basis.

*Q3. Do you agree that we should continue to plan on an interleaved basis to support regional services?*

2.12 We are also committed to developing a spectrum plan which gives the holders of Restricted Service Licences a clearer indication of long-term prospects for local television services.

*Q4: To what extent should the future planning of this spectrum take account of the provision of local services?*

2.13 Current planning methodology is based on providing reception to television sets with a good quality roof-top aerial. This, fortuitously, also allows a certain level of reception by televisions using set-top aerials. Latest studies suggest that reception of digital broadcasts by set-top aerials could be at least as good as for analogue broadcasts using the transmission power levels which could be available once analogue broadcasts cease. However, if it were decided to plan more explicitly for *mobile* reception, this would have implications for network topology, channel requirements, and channel capacity.

*Q5. What factors would have to be taken into account in order to plan to support mobile broadcasting services?*

### **3. Coverage required for terrestrial television for public service broadcasting and for pay-tv services**

#### *Public service broadcasting*

3.1 Analogue terrestrial services (other than Channel 5) are currently available to 99.4% of UK households. Their digital equivalents reach about 75% of UK households using 80 of the existing 1100 transmission sites. When the current equalisation plan is fully implemented, the digital free-to-view services should be available to 80% of households, with coverage for the pay-tv multiplexes of around 75%. Using those sites, but moving the digital services from the frequency channels they are currently using to the frequency channels which the analogue services currently use, would boost coverage for the public service multiplexes (BBC and Digital 3&4) to between 93% and 95% (it is difficult to predict the exact numbers until further detailed planning work is undertaken). Adding a further 40 transmitters (to a total of 120) would push coverage up to between 95% and 96%. Providing the digital equivalent of the analogue services to 99.4% of households can be achieved only by converting the existing analogue frequency assignments for digital use at the majority of the current 1100 analogue sites.

3.2 The approximate costs of the changes necessary at the transmission sites to deliver DTT transmissions on the two public service multiplexes at full post-switchover levels are set out below. The table assumes that the two public service multiplexes will use frequency channels previously used for analogue services and so are able to benefit from existing international agreements for high power transmission levels. If these are not used, each transmitter will have to operate at a lower power, and so more transmitters will be required to support a given level of coverage. The first 80 sites (those already being used for digital transmission) comprise 50 key transmitters plus 30 to provide regional coverage, with an average coverage of 250,000-300,000 households. There will be costs of approximately £50m for each network (averaging around £1.6m at each of the 80 sites) to make the changes necessary to switch the digital transmissions from their current frequencies to the ex-analogue frequencies, and to boost the power levels to those allowed once there is no need to protect analogue transmissions in the UK. Sites beyond the initial 80 serve fewer households and require less investment per site to convert to digital transmission even though no conversion work has yet been undertaken. The 40 next most significant sites, serving 10,000-15,000 homes each, will cost around £20m (averaging £500,000 each) to convert for each network. The remaining sites mainly serve between a few hundred and a few thousand homes, with

some intended to serve only around 80 homes. These would cost an additional £30m (on average around £30,000 each) for each network to convert.

### Coverage and cost of two Public Service DTT multiplexes

Number of DTT sites	Coverage using ex-analogue frequencies	DTT transmitter Costs	Number of current analogue homes unserved
80 Sites	93% - 95%	£100m	1.2 - 1.7 million
120 Sites	95% - 96%	£140m	1.0 - 1.2 million
1100 Sites	99.4%	£200m	0

These figures suggest that, to be sure of reaching at least 95% of households, the BBC and Digital 3&4 would each have to invest £70 million in converting the transmitter networks. They would each have to invest a further £30 million to be sure of reaching every household that can currently receive their analogue transmissions.

3.3 An important benefit of high DTT coverage for consumers is that it will enhance the possibility of ensuring reception on portable sets or sets used with set-top aerials. It is likely to offer the best means, at present, of providing digital television to the second and subsequent tv sets in a household, which usually rely on portable reception.

3.4 It is possible to reduce the costs of providing coverage of the public service free-to-view services to 99.4% of households if other technologies are used to supplement terrestrial. Cable and DSL are unlikely to add significantly to terrestrial coverage, but satellite can. ITC research has found that digital satellite coverage from ASTRA reaches between 96% and 98% of UK homes when using typical dish installations (ASTRA themselves claim over 99%), some of which will be in areas which it is difficult or very costly to reach by terrestrial. Adding satellite to the terrestrial options improves total coverage as follows:

### Coverage of two Public Service DTT multiplexes plus digital satellite

Number of DTT sites	DTT + Dsat Coverage	DTT transmitter Costs	Number of current analogue homes unserved
80 Sites	99.6%	£100m	100,000
120 Sites	99.8%	£140m	50,000
1100 Sites	99.99%	£200m	0

3.5 However, there are additional reception costs that consumers would face if obliged to receive digital services by satellite because terrestrial broadcasts were not available. First, they would need to acquire a receiving dish and a set top box. An indication of the cost of purchase and installation is the £100 charged by BSkyB for those connecting their phone lines to the set top box for an initial period of 12 months. Secondly, since all services transmitted via satellite, including free-to-view programmes from the public service

broadcasters, are encrypted to ensure that they can only be viewed within the licensed geographical area (the UK), there is a conditional access charge for the unscrambling service. The conditional access charges levied by BSkyB are currently paid by the BBC to enable licence payers to access their services via digital satellite. A typical household with 2 or 3 televisions and a VCR, each using a set top box, would attract conditional access charges of up to £30 each year.

3.6 Both options show that there are some homes that can today receive analogue television that are unlikely to be able to receive television once analogue broadcasts stop unless the whole current transmission network is converted. Until we engage in detailed planning it will not be possible to pinpoint where these households are, and to define the profile of numbers covered by each additional site. However it appears that around 120 digital transmission sites combined with satellite coverage would leave the number of analogue homes unserved well below 100,000 and probably below 50,000. Detailed planning could determine where it would be worth broadcasters investing in additional transmitters (normally only worthwhile where an additional 80 households or more are served). The detailed planning should also identify communities where, as today, the broadcasters in conjunction with the ITC and the BBC could provide assistance to self-help groups.

3.7 We would welcome comments on these estimates of households covered by any given number of transmitters and the costs associated with providing digital transmissions. This information is key to determining how much it would cost to ensure that any given proportion of households could receive the digital equivalents of existing analogue free-to-view services by terrestrial means. The almost universal availability of digital satellite services provides households now with one route to digital television, but it is essential that we establish the costs of consumers having a choice of at least two platforms.

*Q6. Does this analysis of coverage potential and associated costs adequately inform those taking decisions about the level of coverage by terrestrial means that should be required for public service broadcasters?*

*Q7. Our working assumption is that the public service broadcasters should be required to reach a certain minimum percentage of households by the terrestrial platform. However, we would like your views on whether it is right to require a minimum, what that might be and the associated costs and benefits?*

#### Pay tv services

3.8 While it is desirable for pay tv to be as widely available as practicable, there is no overriding public policy requirement for availability to exceed what the pay tv operators are prepared to fund. The current equalisation programme (when fully implemented) together with the Fast-track power increase programme will provide reliable coverage to between 72% and 75% of the population. After switchover, the changes at the existing 80 sites to boost power levels once interference with analogue is no longer an issue could extend coverage to 90% of the population.

	<b>Core coverage of Pay DTT</b>	<b>Costs</b>
<b>Current Position</b>		
80 Sites	72% - 75%	
<b>After Switch-Over</b>		
80 Sites	88% - 90%	?
120 Sites	90% - 92%	?

The cost figures are not yet known with any certainty but will have to reflect the likelihood that these networks will have limited access to those frequencies currently used for analogue transmissions with their associated higher permitted power levels.

3.9 Our working assumption is that the networks supporting the four multiplexes carrying predominantly pay tv services should be allocated sufficient spectrum to support coverage of 90% of households, but that the level of coverage should be a matter of commercial judgement for the operators.

*Q8. Do you agree that the level of coverage provided by the networks supporting the four multiplexes carrying predominantly pay tv services should be left to the commercial judgement of the operators?*

#### **4 Clearing spectrum for reuse**

4.1 The number of digital television multiplexes to be supported, the basis for planning the network and the coverage requirements, together determine the amount of spectrum required for DTT, and consequently the amount that can be cleared for reuse. The options have different costs and benefits, both economic and social, which must be taken into account before decisions are taken on the basis for developing a detailed spectrum plan.

4.2 The analysis of network planning in section 2 described the main options for that part of the spectrum which is to be used for DTT. It is also worth taking into account that if the basic network is developed using five frequency channels for each national multiplex, it is possible to interleave further full and half capacity multiplexes, capable together of supporting up to 24 services at any one time. These offer potential to meet a wide range of needs. Some capacity could be used to deliver Government services to the home with an interactive return path. There is scope to deliver locally focused television services for which, to date, very little spectrum has been available. The spectrum should also be available to remove the anomalies in the existing system where some viewers are unable to receive the appropriate regional broadcasting for their area. None of these options is likely to be available if the basic network is developed using fewer frequency channels for each national multiplex.

### Spectrum summary

	Reconfiguration		Current configuration	
	UHF channels used	UHF channels freed	UHF channels used	UHF channels freed
6 muxes, minimum 90% coverage	24	22	30	16
2 muxes 95% minimum, 4 muxes 90% minimum	26 (10+16)	20	32 (12+20)	14
Services using interleaved channels	No		Yes	

4.3 The spectrum summary above indicates that at least 24 frequency channels and possibly up to 32 frequency channels would be required to support public service broadcasting and pay-tv services on six multiplexes. Detailed planning may show that one or two additional frequency channels are required to provide extended coverage and resilience. This means that it should be possible to clear for reuse at least 12 frequency channels and quite possibly 20 frequency channels.

4.4 There are a variety of potential uses of the spectrum. The areas where demand for spectrum are increasing are Public Mobile Multimedia (3G and beyond), Private Mobile Systems (covering the expanding needs of, for example, the Utilities and the Emergency Services for trunked mobile communications systems), delivering the Government's E-Government/Commerce agenda (covering Health, Education and Transport frequency needs) and Programme-Making (to deal with the growth of events and the increasingly sophisticated way in which wireless systems are used to enhance events such as the Grand Prix, Theatre shows, sports matches etc). Within broadcasting, there may well be demands to release more capacity for DTT operators to enable an expansion of services, and there is growing interest across Europe in delivering broadcast television and mobile multimedia services to moving vehicles (cars, trains and buses) and other devices (lap-top computers, tv walkmans etc.).

4.5 It may be possible to provide some of these services on spectrum interleaved between the national multiplexes, but other uses require the same frequency to be available across the country. There is no need now to decide what cleared spectrum will be used for after switchover, nor what process should be used for making assignments. Indeed, it would be misguided to attempt to do so against the background of rapidly developing technologies, changing market demands, international discussions on the future allocation of the relevant parts of the spectrum, and developments in the UK regulatory framework following from the White Paper *A new future for communications*. But if we do not develop a plan now that clears a significant amount of appropriate spectrum our options for reuse will be severely constrained (even for broadcasting).

4.6 A least cost plan, as put forward in the ITC's Genesis report, would clear the bottom 5 frequency channels (21-25), the top 5 frequency channels (64-68) and the 2 channels in the middle (35 and 37). This would require very limited work in terms of retuning viewers' equipment or providing new aerials as the frequencies would be rearranged within existing planning groups. Such a plan would also allow for a significant amount of interleaved spectrum which could support additional broadcasting services.

4.7 However to maximise flexibility on reuse, the frequency channels should be

- cleared nationwide – otherwise only regional applications are possible
- contiguous – to allow for smaller and larger licensing packages
- in the part of the UHF spectrum where it is most likely to be possible to obtain international agreement on reuse.

4.8 The frequencies at the top part of the UHF spectrum are adjacent to spectrum used for 2G mobile (and designated internationally for mobile so that refarming to 3G in the future is possible). Also the channels above Channel 60 are not used exclusively for broadcasting in the rest of Europe which inhibits the power levels that can be used for broadcasting in some parts of the UK (but would not necessarily affect mobile services for which much lower power levels are required). The frequencies at the lower end of the UHF spectrum are adjacent to spectrum used for private mobile radio and expansion of such services could be attractive.

4.9 Clearing 10 frequency channels at the top of the UHF band, rather than 5 at the top and 5 at the bottom, is possible, particularly if it is possible to use some of the bottom channels (below 30) to fill in for the channels cleared above 60. But clearing channels 59,58,57 is significantly more difficult in terms of the numbers of homes affected. Channel 56 is currently only used for a small number of high power services (Channel 5 and BBC 2) and should be possible to recover relatively easily.

4.10 The potential costs to consumers of the different options arise from the possibility of needing a new aerial. Although universal aerials, capable of receiving transmissions on any of the frequency channels 21 to 68, are available, most homes use an aerial designed to work only with the group of frequencies used by the local transmitter. If we adopt a spectrum plan that clears more than half the frequency channels in any particular group, the households affected will need a new aerial in order to receive different frequency channels. For example, we estimate the cost of new aerials required by 3 million homes by clearing Channels 56-59, in addition to Channels 60-68, would be around £400 million. Annex B illustrates how the various aerial groups are used around the UK.

*Q9. Which channels are cleared will depend on the costs and benefits of different replanning options. For example clearing 5 channels at the top and bottom of the frequency range is less disruptive to consumers and has lower switching costs than clearing ten at the top end. The benefits, though, will depend on the use to which such freed up spectrum can be put. We would like your views on the costs and benefits of different options.*

*Q10. Which frequency channels should we clear?*

## **5. Summary of questions**

5.1 It is important for the success of digital television, and for it to be possible to switch off analogue terrestrial transmissions, that we start now to develop the spectrum plan. We think that the plan should support six national multiplexes. Two of those multiplexes, carrying public services, should be set a coverage requirement, but the other four multiplexes should be left to provide coverage in accordance with their commercial judgement. We believe that it is possible to develop a plan on this basis that releases nationwide 12 –20 frequency channels. Decisions on what the released frequencies should be used for should be taken later when the international framework is firmer and the market is better able to value the options.

### Questions for answer

*Q1. Our working assumption is that planning will continue for six multiplexes, as today. However we would also be interested in views on the costs and benefits of a more radical re-planning. This could be either reducing or increasing the number of multiplexes by one. Do you have views on this?*

*Q2. What do you see as the costs and the benefits of maintaining the current basis for network configuration compared with those for adopting a configuration using fewer frequency channels?*

*Q3. Do you agree that we should continue to plan on an interleaved basis to support regional services?*

*Q4: To what extent should the future planning of this spectrum take account of the provision of local services?*

*Q5. What factors would have to be taken into account in order to plan to support mobile broadcasting services?*

*Q6. Does this analysis of coverage potential and associated costs adequately inform those taking decisions about the level of coverage by terrestrial means that should be required for public service broadcasters?*

*Q7. Our working assumption is that the public service broadcasters should be required to reach a certain minimum percentage of households by the terrestrial platform. However, we would like your views on whether it is right to require a minimum, what that might be and the associated costs and benefits?*

*Q8. Do you agree that the level of coverage provided by the networks supporting the four multiplexes carrying predominantly pay-tv services should be left to the commercial judgement of the operators?*

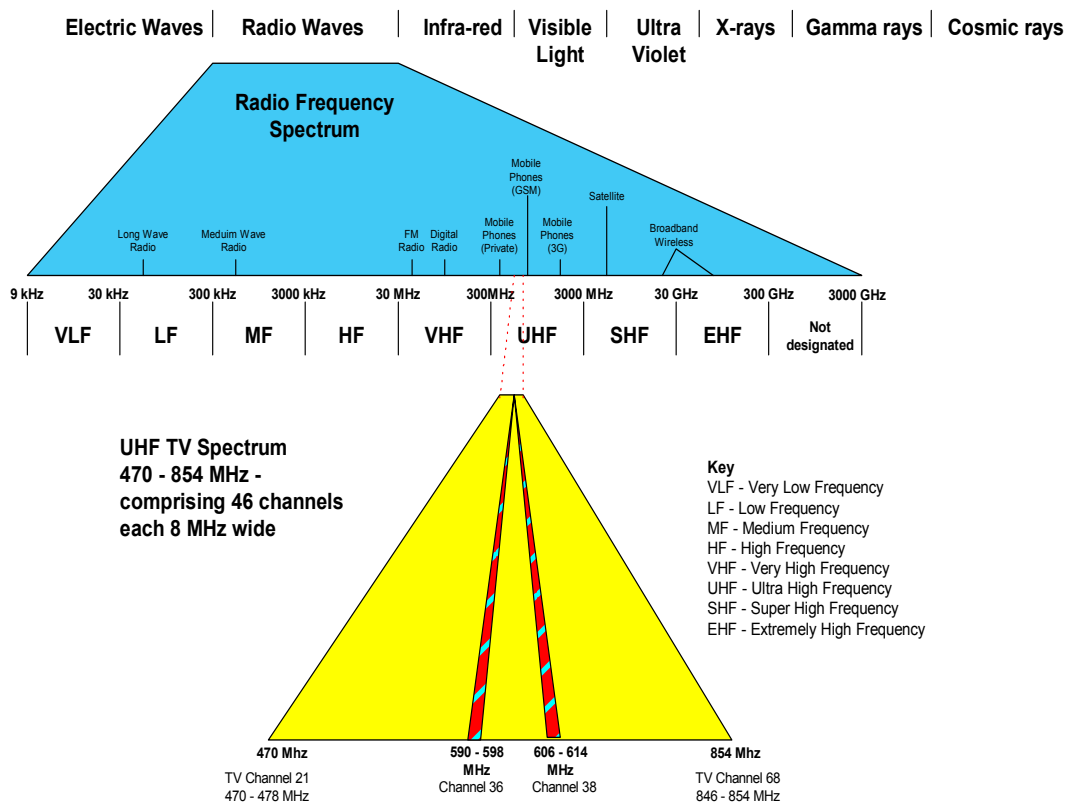
*Q9. Which channels are cleared will depend on the costs and benefits of different replanning options. For example clearing 5 channels at the top and bottom of the frequency range is less disruptive to consumers and has lower switching costs than clearing ten at the top end. The*

*benefits, though, will depend on the use to which such freed up spectrum can be put. We would like your views on the costs and benefits of different options.*

*Q10. Which frequency channels should we clear?*

General comments are also welcome.

**Electromagnetic Spectrum Showing the Radio Frequency Portion Including the UHF TV Channels**



**Annex B**  
**Map showing channel groupings used in the UK (courtesy of an ntl original)**

