



Radio – Preparing for the Future

Appendix D: Options for DAB replanning – A report to the DRDB
Analogue Radio Switchover Group

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Section 1

Introduction

1.1 Preamble

At the analogue Radio Switchover Group meeting of 11 February, the question was raised of whether some benefit might accrue from a re-planning of the DAB networks. Ofcom and Arqiva (previously ntl Broadcast) agreed to carry out some further work and to report back to the group.

This report examines the current arrangement of DAB multiplexes in the UK and investigates whether there are potential benefits that could arise from replanning the frequency and power allocations. Benefits arising from such a replan could be an expansion of the extent of coverage achieved by DAB services and/or an improvement in the robustness of reception in marginal signal areas or to users of indoor portable receivers. A review at this stage is timely, particularly as there are potentially five additional frequency blocks to be made available to DAB broadcasting in the UK by Ofcom.

1.2 Executive summary

A description of the current DAB arrangement is given followed by an outline of Ofcom's proposals for the future of Band III DAB. The report then addresses the constraints imposed upon the implementation and development of DAB in the UK, before examining some options for replanning.

The conclusions reached are that DAB implementation in the UK is fundamentally constrained by international considerations that determine where frequencies may be used. Existing international restrictions prevent existing transmitters for multiplexes near the UK coast from increasing power. This has a knock-on effect as it limits the potential for increasing the powers of transmitters further inland that use the same frequency.

International agreements are due for renegotiation at the Regional Radiocommunications Conference in May 2006 (known as RRC-06). Ofcom is aiming to negotiate power increases to help improve indoor reception for existing multiplexes and also to release some additional frequencies for DAB use in the future. However, until the RRC-06 negotiations have been concluded in June 2006, we will not know what boundary constraints on frequency use will apply to the UK. Therefore, there appears to be relatively little merit in developing detailed alternative plans until after RRC-06 gives us a clear set of criteria on which to base a replan.

Within existing constraints there could be some merit in re-allocating frequency blocks from areas where local muxes have been proposed but are not implemented because they would not (at the time) have been commercially viable. This could allow for a relaxation of some of the coverage constraints imposed upon a number of multiplexes as a result of their co-channel frequency relationship with multiplexes elsewhere. This will allow multiplexes to serve a greater proportion of listeners within their Primary Protected Area (PPA) through the use of power increases. In the specific case for Northern Ireland examined by Arqiva, the gains in population coverage are only to be made towards the east and are relatively small. However, in general the potential gains in coverage will vary widely with the specific restriction being removed and the modified transmitter configuration implemented by the multiplex operator.

The use of power increases in order to widen coverage or to improve service to indoor portable receivers is in most cases not likely to be feasible without seeking international agreement. An alternative to this would be to adopt denser networks (ie to use a greater number of small transmitters) to increase signal levels, although this also implies significant further investment.

If the RRC-06 delivers a favourable result, there would potentially be a further scope for changing some frequencies where a net benefit accrues and for coverage improvements. It should be noted that some limits on multiplex reach are in place for editorial reasons to maintain the integrity of the UK local map.

Section 2

The current DAB landscape

2.1 Overview

Currently seven frequency blocks are allocated to DAB broadcasting in the UK. Two of these blocks are allocated to national single-frequency networks (SFNs) and the remaining blocks allocated to smaller local or regional single-frequency networks with the five blocks re-used across the UK. Signals from the national networks are available to around 85% of UK households. Licences for local and regional multiplexes have been awarded to cover a similar percentage of the population, although current transmitter build-out reaches a lower proportion of households. In principle the national networks could continue to add transmitters to their networks to increase coverage to approach 100% of the population. This is because the same frequency is used for all transmitters in their network and there is no opportunity cost (in spectrum usage terms) of deploying new transmitters in a new area¹.

Local and regional multiplexes, however, are subject to coverage restrictions for two principal reasons. Firstly, geographical restrictions are placed on coverage so as to maintain the ‘localness’ of local and regional multiplexes², consistent with the original licence award process. Secondly, frequencies are re-used in other parts of the UK and in order to minimise the effects of interference between licensed areas using the same frequency, it is necessary to place limits upon the transmitter heights and powers. The result is that multiplexes may in reality only be able to economically cover a proportion of their PPA. Later in this report we will look in more detail at three local multiplexes (South Hampshire, Swindon and Cardiff/Newport) that all use the same frequency and the constraints that this imposes upon them.

A shortage of frequencies also means that there are a number of areas such as Lincolnshire, Suffolk and Oxford where no local multiplexes have been licensed. As part of its review of radio, Ofcom is proposing that four or five further frequency blocks in VHF Band III be allocated to DAB. It is anticipated that one or two of these blocks will be allocated to national SFNs and that three will be allocated to local services. This will make it possible to provide a local multiplex in almost every part of the UK.

¹ The Digital One network currently uses two frequency blocks, 11D in England and Wales and 12A in Scotland. There is no national allocation in Northern Ireland.

² Local and regional multiplexes are allocated an area over which their services are protected from interference. This area is known as the Primary Protected Area or PPA

2.2 Background

Seven blocks of spectrum in VHF Band III³ were designated for use by digital radio services in 1994 by the government. Correspondingly, allocations for some of this spectrum were agreed at an international planning conference held in Wiesbaden in 1995 under the auspices of the CEPT⁴. This planning conference allocated two layers⁵ of coverage to every location in the participating countries. In the UK this gave the frequency allocations used by the BBC for the whole UK, Digital One for England, Wales and Scotland and the Northern Ireland multiplex operated by Score Digital, as well as allocations for the Channel Islands and Isle of Man.

For the remaining five frequencies, the Radio Authority⁶ was (in applying the flexibility afforded it by government) faced with a choice as to how to arrange radio services within these blocks. It would, in principle, have been possible to licence them all as sub-national multiplexes that could achieve near UK-wide coverage as single-frequency networks. In practice it would have been difficult to co-ordinate so many 'national' networks with the UK's neighbours and they would have been subject to significant coverage restrictions to the south and east of England, the West of Wales, and in all of Northern Ireland. Another significant factor is that national single frequency networks have to carry the same programming from every transmitter, or interference would occur leading to reception 'mush zones' where their coverage overlaps. It would therefore not have been possible to incorporate local radio services on 'national' multiplexes.

The Radio Authority decided that it was important to make provision for local radio in DAB and that that receiver uptake would be best stimulated by adopting a population-weighted approach to providing coverage. Consequently the remaining five frequency blocks were allocated for local or regional radio multiplexes. A programme of advertising and licensing local and regional multiplexes was undertaken where licences were awarded allowing coverage across areas with defined boundaries. Constraints on allowable transmitter power come in effect from two regulatory considerations. Firstly the

³ Band III is the portion of spectrum between 174 and 230MHz. This band is divided into 8 equal channels, each 7MHz wide. For historical reasons they are labelled channels 5 to 12. In the UK, channels 5 to 9 are used for PMR, while most of channels 11 and 12 are used for DAB. For DAB use the channels are divided in four and each portion given a suffix from A to D, for example 12A, 11C etc.

⁴ CEPT is the Conference of European Posts and Telecommunications. The Wiesbaden 95 agreements are due to be re-negotiated in 2006.

⁵ A layer of coverage can be thought of as the number of multiplexes that can be received in a particular location. The UK has two layers of national DAB, and two partially complete layers of local/regional DAB (three in the London area).

⁶ The regulator of commercial radio services up until 29 December 2003. The Radio Authority was one of five regulatory bodies replaced by Ofcom.

amount of interference between multiplexes using the same frequency must be limited. Secondly, the programme services are focused to a defined editorial area by specifying specific key locations beyond which their signals should not reach. This was done to maintain the integrity of the local multiplex map.

It was also clear that the demand from broadcasters for capacity within a multiplex would not be uniform across the UK. In areas where population density is relatively high, a greater number of advertising-funded programme services are viable than in more sparsely populated areas. The Radio Authority allowed for this by providing greater capacity in populous areas in the form of overlapping coverage between local and regional multiplexes.

The Radio Authority's plan resulted in a distribution of local and regional DAB multiplexes as shown in Figures 2 and 3.



Figure 2: Local DAB multiplexes

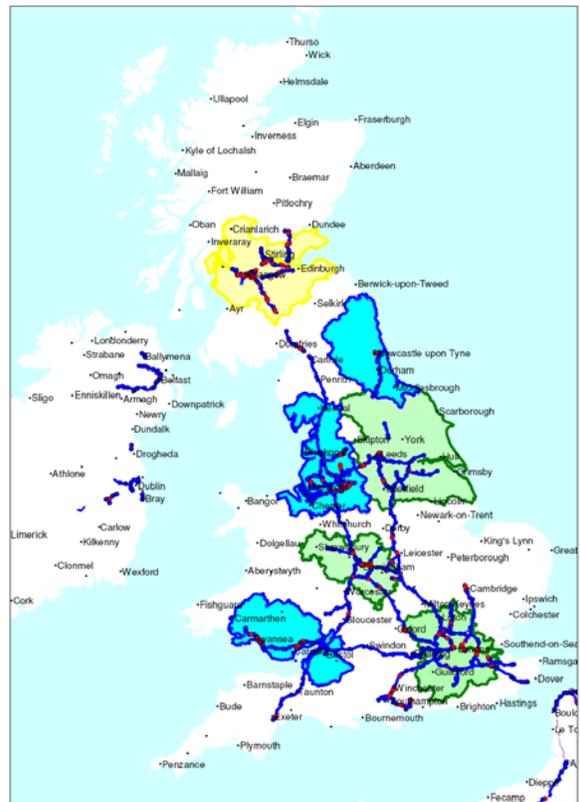


Figure 3: Regional DAB multiplexes

The plan relies upon intensive re-use of frequencies and careful management of the international restrictions upon them. Nevertheless, a number of areas do remain where a local DAB multiplex has not been licensed. This is principally due to either a lack of an available frequency block (for example the Oxford area), or to economic factors where

even though a frequency is available, licences were not advertised. This was usually as a result of feedback from industry that suggested there would be no applicants for licences in those areas at that time.

An outline of the constraints upon the seven frequency blocks is summarised in Table 1 below.

Table 1: Existing seven frequency blocks, their uses and international constraints

Block	International restrictions	Use			Notes
		England & Wales	Scotland	Northern Ireland	
11B	Television (France and Ireland) DAB (Belgium)	Local	Local	None	
11C	Television (France & Ireland)	Local	Local	None	
11D	Television (France and Ireland) DAB (Netherlands)	Digital One	Local	None	
12A	DAB (Belgium and Ireland) Short-range devices (France)	Local	Digital One	None	Not west Wales
12B	DAB (Belgium) military (France)	BBC National	BBC National	BBC National	
12C	DAB (Ireland) Military (France)	Local	Local	None	Not south coast
12 D	Military (France)	Local	Local	Local	Not south coast

Section 3

Ofcom's proposals for the future development of DAB

3.1 Increasing the number of local and national multiplexes

Ofcom has recently carried out a consultation as Part one of its Review of Radio. One of the proposals contained within the consultation is to make five further blocks of Band III spectrum available to DAB (channels 10A to 10D and 11A). It is hoped that three of these blocks would be allocated to local DAB multiplexes to address the 'white spaces' between the current local DAB multiplexes and Figure 4 indicates where it is proposed to licence the new local multiplexes. Two blocks would ideally also be allocated to national multiplexes to increase the choice of national commercial services. All of these proposals are subject to gaining international approval for the proposals at the ITU⁷ Regional Radio Conference to be held in 2006.

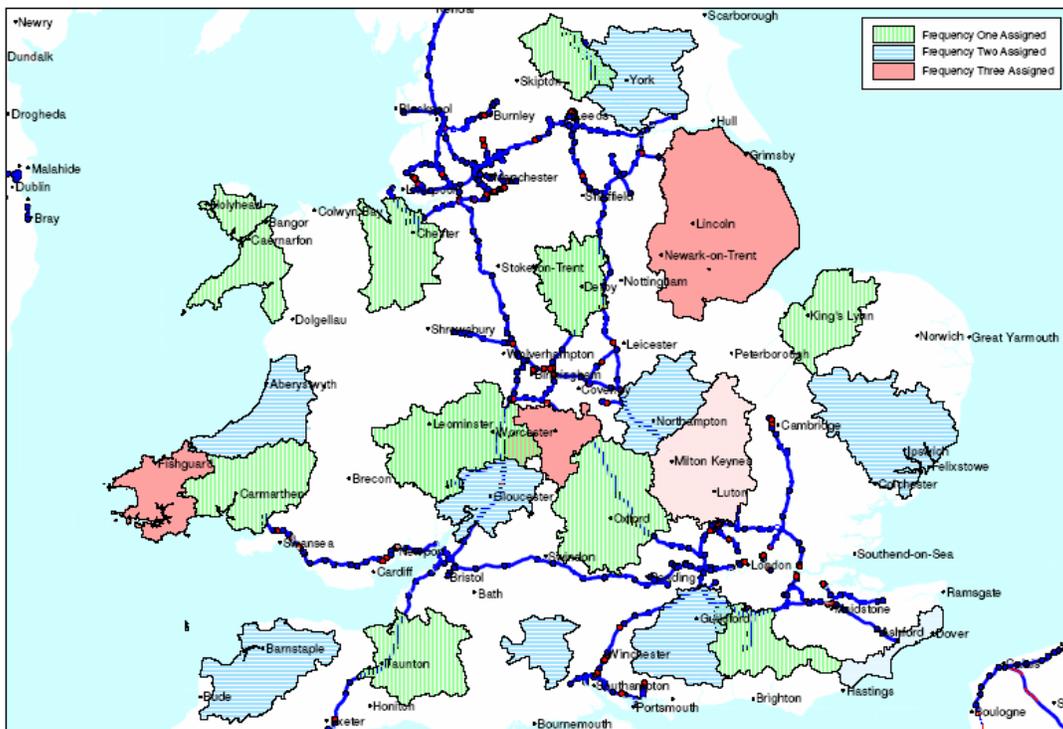


Figure 4: Location of proposed new local DAB multiplexes

⁷ ITU is the International Telecommunications Union, an international organisation within the United Nations System, responsible for co-ordination of telecommunications systems globally, including spectrum management and assignment for broadcast use.

3.2 International co-ordination

DAB transmitter parameters will in general need to be co-ordinated with neighbouring administrations to ensure continued compatibility of the framework plans and to control interference both into and out of the UK. The existing framework for DAB planning in Europe was agreed at a planning conference held in Wiesbaden in 1995. This constitutes a large-scale multilateral agreement rather than an ITU plan. In principle, much of the agreement is due for re-negotiation together with the plans for all Band III services in the ITU nations in Europe, Africa, the Middle East and large parts of Asia at the Regional Radiocommunications Conference (RRC-06) due to be held at Geneva in 2006. However, the Wiesbaden Agreement is binding on the participating parties and the UK will seek to maintain or improve those of its provisions needed to maintain its existing services. Any new Plan offers the opportunity to improve upon it.

The RRC-06 is broad in scope and will also cover agreements about the Band IV and V frequencies used in the UK and Europe for digital television broadcasting (DVB) , as well as the various plans for Band III (which for all countries, include DAB). The negotiation and agreements governing Band III are likely to be complex as these frequencies are to be put to different uses in the various neighbouring countries. In the UK the frequencies in channel 5 to 9 are used for DAB and Private Mobile Radio services (PMR), neighbouring countries propose use by DVB and DAB, with some other services also being relevant.

The UK's PMR services require more protection from digital broadcast services than the broadcast services do from PMR; the band is planned for compatibility with analogue TV in neighbouring countries. Although analogue TV may persist, and need to be protected, for some time, it will be replaced by the less PMR-friendly DVB services. This therefore could place significant restrictions upon the broadcast services that the UK's neighbours can deploy close to their borders in these channels and could be seen as claiming an inequitable share of the available spectrum over that frequency range.

The UK's position for RRC-06 is principally to protect and improve on the rights of the existing DAB assignments (on channels 11B to 11D and 12A to 12D), but it is also aiming to obtain clearance to use five blocks of VHF-Band III spectrum for DAB broadcasting (channels 10A to 10D and 11A) over as much of the UK as possible. There are, however, a number of factors that complicate the negotiations.

The Irish administration has yet to make a firm declaration of intent regarding the future use of Band III which, with the exception of channel 12, is used for analogue television in

the Republic. In accordance with the Wiesbaden 95 agreement, TV channel 12 is shared between the Republic and Northern Ireland for DAB with two blocks allocated to DAB in Northern Ireland and two for DAB in the Republic. This limited range of available frequencies is the reason why it has only been possible to provide two DAB multiplexes in Northern Ireland.

Some of our European mainland neighbours have specified a requirement for Digital Video Broadcasting (DVB)⁸ in part of Band III, likely to include Channel 10, as a migration path to digital for their analogue television services. As with PMR there is a non-symmetrical protection requirement between the two services in which DAB is more damaging to DVB than the other way round. In order to accommodate continental DVB requirements it will be extremely difficult for any new UK national DAB multiplex using any of the blocks within channel 10 to provide coastal coverage and possibly precludes the use of channel 10 for local DAB along the south and east coasts. If channel 10 is allocated to coastal DVB use on the continent, only block 11A of the newly (intra-UK-) allocated spectrum would be able to deliver a fully national layer of DAB coverage within the UK.

A multi-lateral group consisting of delegations from the UK, France, Belgium, the Netherlands, Luxembourg, Germany and Switzerland has been set up to work towards a pre-co-ordinated Plan for Band III. Such a Plan would be submitted into the RRC06 process rather than allowing a computer generated Plan to form the basis of negotiations. The group has started by considering continental DVB first and is likely to allocating these services mainly in channels 6 to 10. This means that only channels 11 and 12 would be used specifically for DAB throughout the area, with some other use in Channel 5 on the mainland.

⁸ DVB or Digital Video Broadcasting is the European standard for broadcasting digital television services. It is the standard in use in the UK for broadcasting digital television.

Section 4

Replanning of DAB services

4.1 Options for replanning

There are a number of different ways in which a replan of DAB services could be approached. For simplicity, we have broken these down into three options, Options A and B are mutually exclusive, while Option C could be considered in addition to the other two options.

- A. Major re-plan of twelve blocks:** taking a clean sheet of paper and planning existing seven blocks and five additional blocks without the constraints of existing networks.
- B. Partial re-plan:** determining the benefits to existing muxes through limited frequency changes either with or without five new blocks across the UK.
- C. Indoor reception:** Re-plan of existing assignments at higher powers to allow for indoor reception

We will examine each of these options in turn

4.2 Option A: Complete re-plan of twelve blocks

As described previously, the UK's DAB network comprises two nationwide networks and a number of local multiplexes. Changing the frequencies of the national multiplexes could bring some benefits. For example, the occurrence of multiplexes causing interference to adjacent DAB services could be reduced if all of the national multiplexes were adjacent and broadcast from the same transmitter sites. However, to accommodate a change in frequency of the national multiplexes would also lead to widespread frequency changes for local multiplexes and some new adjacent channel relationships. A further consideration is that the ability to implement national networks has to be co-ordinated with neighbouring administrations up to the coast of the UK. To change these allotments would be very difficult (and probably impossible) to negotiate.

The disruption and costs to multiplex operators and broadcasters resulting from a complete replan of DAB transmitter networks, together with the low probability of achieving a favourable outcome in renegotiating potentially all of the UK's coastal assignments means that any complete replan of all DAB allotments is very unlikely to be practically realisable.

4.3 Option B: Partial re-plan

If the frequencies of the current national multiplexes are taken as fixed, what benefits can be realised in replanning the remaining frequency blocks?

4.3.1 Relaxation of co-frequency interactions

As presently defined the UK DAB frequency plan depends on the intensive re-use of a small number of frequencies. The availability of five blocks of additional spectrum for DAB does offer an opportunity to re-plan, and possibly relax, the co-frequency interactions between the existing multiplexes and allow them to increase transmitter power. However it should be noted that frequency interactions are not the only restrictions on the transmission network of a multiplex and account needs to be taken of both the editorial restrictions defined in the multiplex's licence and any international constraint that might apply. The first can be adjusted to correspond to any increased norm of required signal strength, whereas the second is not under the UK's control. Power increases are explored more fully under '4.3.3 Indoor reception' below.

Virtually by definition, any relaxation of the present frequency plan would, be less spectrally efficient. This means that a number of additional layers of coverage which could be added to the existing plan may be lost. However, benefits arising from relaxing the limits on the amount of power that multiplexes are able to put towards others on the same frequency are that co-frequency re-use will be easier allowing less restrictive transmitter networks.

There are a number of local areas yet to be served by a digital multiplex. Relaxing restrictions between existing multiplexes is likely to make it more difficult to serve those areas yet to get coverage at the present granularity. Also, because of international co-ordination considerations, the implementation of new services or changes to existing ones may be affected by the timing of changes to services in adjacent countries, especially in coastal areas. This may lead to delays well beyond 2010.

Some other, non-broadcast, services will continue to exist or be replaced by others in the Band. For example the French military services which occupy blocks 12B, 12C and 12D, for which there is presently no intention to withdraw. The present UK Wiesbaden allocations have been negotiated to use these frequency blocks and if the allocations are changed it may be difficult to maintain the rights of implementation held by them (although they might also be improved). A secondary effect is that where multiplexes operate in the same area on adjacent channels, transmitter networks have been designed to minimise interference between them

4.3.2 Reallocation of assignments

A number of co-ordinated allocations have yet to be implemented, principally due to economic constraints hitherto (see Figure 5). Increasing adoption of digital radio in the UK will change this equation for many such areas. However, as with FM, DAB (or rather, the frequencies it uses) is not the ideal transmission system for areas where there is a low population density and difficult terrain where providing contiguous coverage at VHF frequencies would require a large and costly number of transmitters. These two problems are usually compounded by (and will be partly responsible for) the presence of few local radio services within the multiplex service area. This can mean that demand for capacity within a multiplex could therefore be low and make the multiplex unviable. Indeed, the Radio Authority did not advertise some licences (such as for the Borders area) as feedback from industry suggested that there would be no applicants at that time. Other areas that potentially fall into this category would include mid-Wales, the Highlands & Islands of Scotland and the Yorkshire Dales

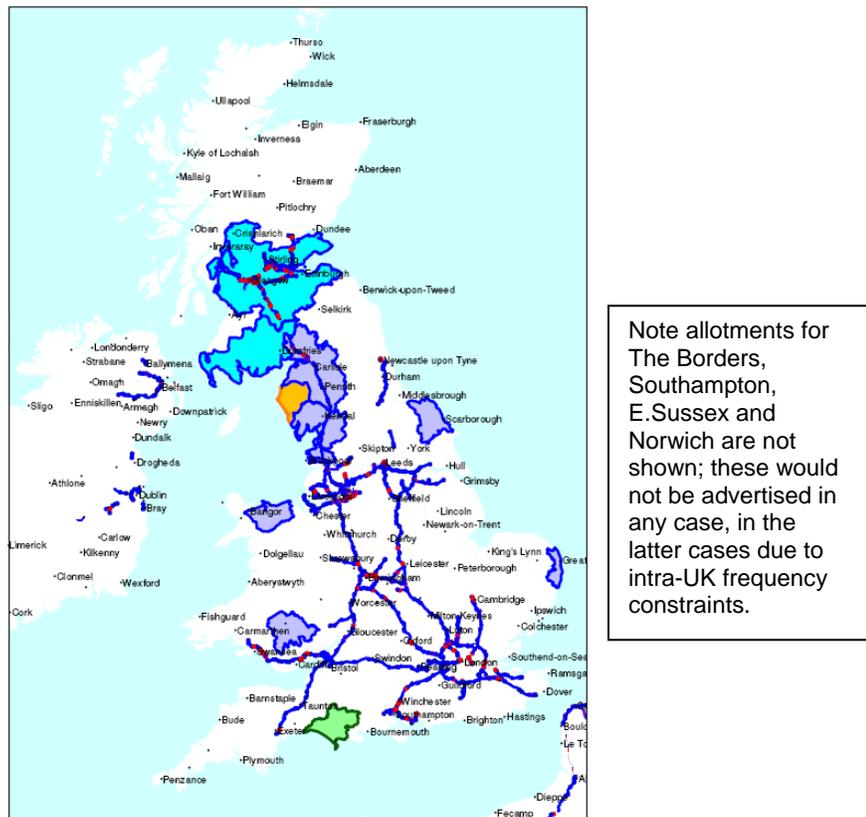


Figure 5: Co-ordinated local DAB multiplexes not yet advertised

It would be worth considering what benefit could be gained by re-planning or in some cases removing some of these unused co-ordinated allocations altogether. The frequencies could be allocated to other areas either to provide additional multiplexes, or be removed to ease co-channel relationships with other multiplexes and thereby

facilitate a limited number of power increases.

It would be technically possible for Digital One to use block 11D in Scotland. The present situation is that in England & Wales the service uses block 11D whereas in Scotland it uses block 12A. Having the same block in all areas would give network planning advantages in the border area. It would also allow the provision of a Scottish national network on the vacated 12A frequency block. However, such a change would stop any Scottish opt-out for the existing Digital One service.

Unfortunately, there is a “Catch 22” situation in that until the Final Acts of the RRC-06 are available in June 2006 it will be difficult to predict which frequencies will be available for DAB use and where in the UK they may be used. However, the Final Acts will be based on our input requirements and the negotiations that flow from them.

4.4 Option C: Indoor reception

At present, the existing DAB assignments (after Wiesbaden 95) are planned on the basis of outdoor mobile reception. However, it is portable receivers which have been the driving force behind DAB receiver take-up. As the numbers of DAB receivers has increased, there is evidence to suggest that existing field strengths are insufficient to permit reliable indoor reception. A significant increase in either transmitter power (of the order of 9dB), additional transmitters or a combination of both is generally expected to be required to allow for indoor portable reception.

4.4.1 International considerations

Another potential area for re-negotiation at RRC-06 would be to plan more fully for indoor reception. The UK is proposing to co-ordinate the five new frequency blocks for indoor reception and also to re-negotiate the existing allotments at higher powers. In principle it should be possible to negotiate power increases, but neighbouring administrations would need to be willing to increase their transmitter powers, or to suffer increased incoming interference from UK transmitters. Conversely, once increases of the powers of allotments have been agreed with the UK's neighbours, continental transmitters could increase their powers. If the UK transmitters did not do so at the same time, the UK multiplexes would suffer increased levels of interference (leading to a decrease in coverage). Timing issues and the implementation of power increase are dealt with in more detail in the Case Studies section below.

A further consideration is that no decisions have been made with regards to the date when analogue Band III television services in other European countries will be converted

to digital. Continental analogue television services require a higher level of protection from UK DAB services than do digital (DVB) services. Until digital switchover occurs on the continent there may be additional restrictions on the implementation of new DAB services or the ability of existing ones changing to indoor portable mode.

In France, the military uses a number of frequencies within the upper part of channel 12 (blocks 12B to 12D) This will place serious restrictions upon some DAB services in southern England and Wales increasing power to adopt the portable indoor mode of operation. Due to this restriction it will make it more difficult for multiplexes further inland to alter reception mode without impacting on the coastal ones. That in turn is likely to lead to a stepped improvement across the country

The multi-lateral group mentioned above is presently progressing - for the sake of simplicity as much as anything else - on the basis that all existing DAB services will migrate to the indoor portable mode. However, a more detailed outcome may emerge once a basic draft plan is settled.

4.4.2 UK considerations

Even if it proves possible to negotiate power increases, there are issues associated with the implementation and timing of the increases. Case Study 1 in the section below explores the practical aspects of increasing the power of multiplexes, and the impact on real multiplexes if not all of them increase power.

Section 5

Case Studies

5.1 Case Study 1: Cardiff/Newport, Swindon, South Hampshire multiplexes

The three local multiplexes covering Cardiff/Newport, Swindon and South Hampshire all use frequency block 11C and are therefore subject to restrictions in order to limit the effects of mutual interference. Figure 6 indicates the relative locations of these three multiplexes.



Figure 6: Locations of the three studied 11C multiplexes (all shown in orange)

Arqiva has studied these three multiplexes to determine whether their powers could be increased to improve service to indoor portable receivers. The specific aspects they considered were:

- What effect would increasing transmitter powers by 9dB have on multiplex coverage?
- What is the effect if only some multiplexes increase their power?
- Can transmitter powers be increased above current levels without international co-ordination?

5.1.1 UK considerations

Each multiplex is allowed to broadcast to defined parameters that specify maximum power levels, transmitter height and the direction of any particular restrictions to limit the

effect of interference to the other co-channel multiplexes. Nevertheless, the presence of the other co-channel multiplexes does still reduce the number of listeners that can receive the service by a significant percentage, and this reduced coverage is termed 'interference limited coverage'.

If one multiplex were to increase its power and the others did not, that multiplex would increase its coverage. Arqiva modelled the situation where each of the three multiplexes increased their power by 9dB while the other two did not. They found that increases in coverage (as defined by current outdoor coverage) increased by approximately 10 to 15% of the PPA population.

If the converse were to happen and the other multiplexes were to increase their powers while one does not, they found that the effect of incoming interference would reduce coverage of the lower power multiplex by 11 to 13%. It is worth noting that the South Hampshire multiplex is less affected throughout by its co-channel relationship than the other two multiplexes. This is because the Swindon multiplex does not broadcast much power in its direction as it uses a second non co-channel frequency (Bath and West Wilts 12D) to serve listeners in that direction. Also the effect from the Cardiff multiplex is less significant as it is some distance away.

If all multiplexes were to increase their power and therefore keep the relative levels of mutual interference constant, each multiplex would still make a net coverage gain of between 1% and 4% of PPA population. Table 2 summarises the gains and losses for various scenarios.

Table 2: Effect of power increases upon coverage

	Reference multiplex		
	Swindon	Cardiff & Newport	South Hants
Reference multiplex increases power, other two do not	+14.4%	+10.5%	+2.2
Reference multiplex does not increase power, other two do	-11.4%	-12.9%	-3.8%
All multiplexes increase power	+3.1%	+4.0%	+1.1%

Notes:

Power increase in all cases is +9dB. Coverage variations are expressed as the change in proportion of population within the PPA classed as receiving an outdoor mobile service.

5.1.2 International considerations

As well as in-UK restrictions, there are limits set for the amount of power that each of the multiplexes in the UK is permitted to transmit towards neighbouring countries to protect spectrum users there from experiencing unacceptable interference. For DAB, these international limits are defined in terms of the amount of signal the UK services are permitted to reach at defined 'test points'. The position of the test points is reached through agreement between the UK and the relevant foreign administrations in accordance with the Wiesbaden Agreement. Once co-ordinated, changes to UK services are permitted without re-coordination so long as the changes do not result in an increase in signal level at the test points. A reciprocal arrangement applies for the levels of interference into the UK from non-UK services.

Arqiva has modelled the three multiplexes and the signal levels put to the international test points. Their analysis shows that the test point levels are already at the agreed maximum levels. Any power increases for the multiplexes will require international re-coordination.

5.1.3 Summary

What this case study highlights is that power increases for existing multiplexes will in many cases not be possible without obtaining international clearance. If this agreement can be secured, the implementation of any power increases will need to be carefully managed or multiplexes risk suffering significant losses of coverage if they do not increase power at the time that others do. This would be particularly difficult to co-ordinate with power increases to multiplexes outside the UK.

5.2 Case Study 2: Northern Ireland

The implementation of DAB in Northern Ireland is particularly constrained by the presence of analogue television in Band III in the Republic of Ireland. After the Wiesbaden Agreement in 1995, one channel (Channel 12) was made available for DAB and its use is shared between Northern Ireland and the Republic. A consequence of this is that only two multiplexes are broadcast in Northern Ireland, the BBC's multiplex and the Northern Ireland 'local' multiplex, operated by Score Digital.

The BBC multiplex on block 12B is part of a UK-wide single frequency network, so could in principle cover the whole of Northern Ireland, subject to restrictions towards the Republic of Ireland to protect their adjacent channel allocations on blocks 12A and 12C. The Northern Ireland local multiplex is more constrained as it shares block 12D with local multiplexes in other parts of the UK. Some of these multiplexes are in service (for example Stoke) while others are planned but not yet implemented (for example Carlisle, Morecambe Bay and Colwyn Bay). Figure 8 indicates the locations of the areas to which Block 12D has been allocated.

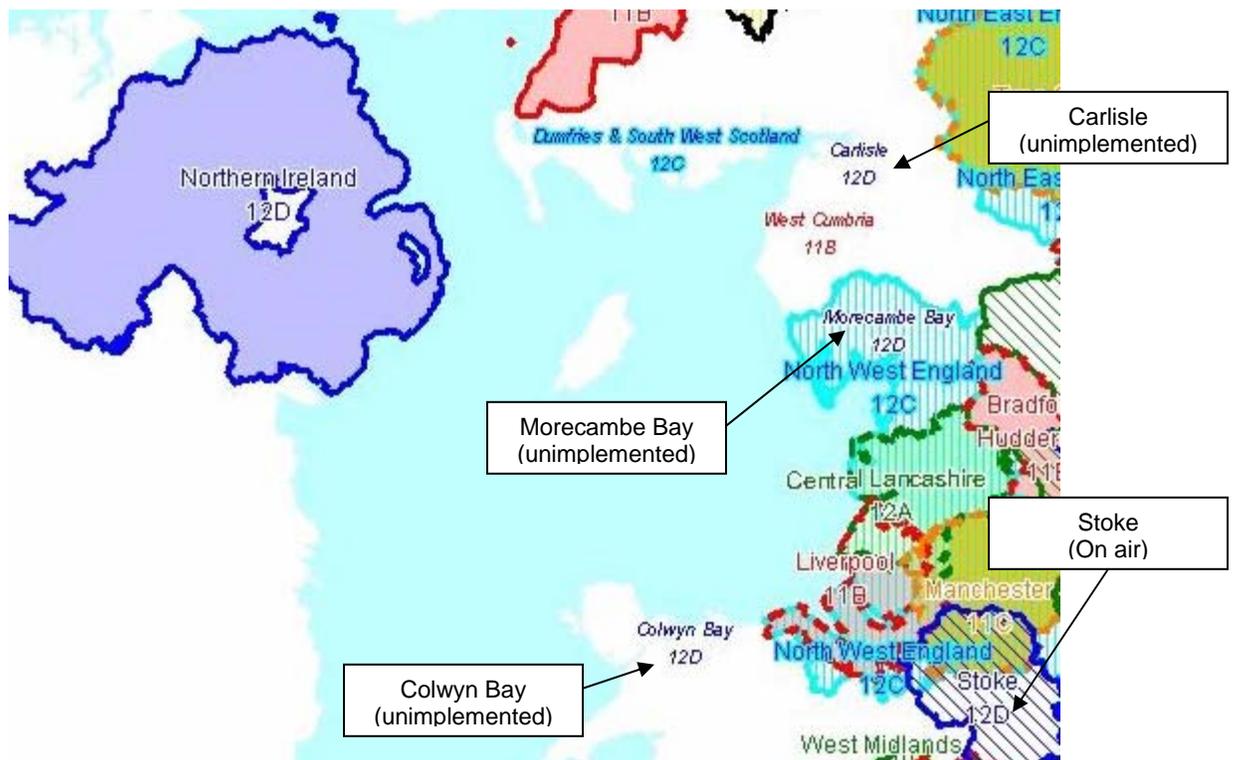


Figure 8: Allocation of Block 12D in Wales and NW England

Arqiva studied the constraints upon the Northern Ireland local multiplex and considered what benefits could arise if there were no co-channel relationships with the multiplexes in England and Wales.

5.2.1 UK considerations

Arqiva found that there would be benefits to DAB coverage in Northern Ireland if the as yet unimplemented multiplexes at Carlisle, Morecambe Bay and Colwyn Bay could be assigned alternative frequencies from the new five blocks (10A to 11A). This would allow the Northern Ireland multiplex to broadcast more power to the east. However, there still remains a major restriction in the direction of the multiplex at Stoke which is already on-air, and this too would need to be assigned a new frequency for maximum benefits to be realised.

The benefit that would be realised by making changes to the Northern Ireland multiplex depends upon the actual transmitter configuration that would be adopted. On the assumption that no new transmitters are built, but that the restrictions on the Northern Ireland multiplex to the east were to be removed, the population gain to the Northern Ireland local multiplex would be of the order of 3%.

5.2.2 International considerations

Northern Ireland's position means that it is particularly important to consider the international restrictions. As the multiplexes in Northern Ireland and the Republic are adjacent, there are particular limits on the levels that services from each territory are permitted to develop at the border. The multiplexes in Northern Ireland are already broadcasting at the maximum level permitted by the UK's agreement with the Republic of Ireland. Any power increases for the multiplexes would therefore require clearance with the Irish Administration.

5.2.3 Summary

By allocating frequencies from the 'new' five blocks to the proposed and unimplemented multiplexes a small improvement could be made to the coverage achieved by the Northern Ireland local multiplex. For maximum benefit, the frequency used by the multiplex at Stoke would also need to be changed.

However, for the power levels of either of the two Northern Ireland multiplexes to be significantly increased such as to would be required to account for indoor coverage would require international re-negotiation.

Section 6

Conclusions

1. UK plans for Band III are to a very great extent constrained by international issues which limit the uses that the spectrum can usefully be used for, and also the timing of any changes in the UK. Because of this interdependence it is unlikely to be possible to co-ordinate or to realise a plan that made radical changes to the coastal assignments within the UK.
2. Until the RRC-06 negotiations are complete there can be little certainty about the use of any frequency in any particular part of the UK, but particularly towards the coast.
3. Knowing boundary conditions is important when planning where frequencies may be used in the UK and at what powers. We cannot at this stage be certain what outcome the RRC in 2006 will yield, and current plans have to be based on assumptions about what will be possible. Any detailed replan carried out prior to the RRC-06 will merely be based upon a different set of assumptions.
4. Due to the uses to which some Band III frequencies are put in other countries, it may not be possible to increase the power of existing transmitters using those frequencies in the UK in coastal areas. Also international considerations (including the protection of analogue TV for a number of years) may prevent certain new frequencies being used for DAB in the UK in some areas for some years, or even indefinitely.
5. Existing mux power levels are general already at internationally agreed limits. Not all of these limits will increase with the RRC. Where existing limits remain, an alternative approach to coverage improvement (such as adding a number of smaller transmitters) which does not increase levels of outgoing interference, will be necessary. However, the UK may attempt to agree (wherever possible) an increase in maximum permitted powers to improve indoor portable reception.
6. The timing of any power increases that can be agreed will need careful managing to prevent interference causing damage to multiplexes that do not increase at the same time. This therefore constrains power increases for inland multiplexes to avoid affecting the service area of coastal multiplexes that are subject to international restrictions, unless those coastal multiplexes implement new and more expensive transmitter networks.

7. Within existing constraints, there is some scope for re-allocation of frequencies, perhaps from areas where the viability of a multiplex proposed under the current plan is questionable. The gains (in terms of population gained), may actually be quite modest and will depend upon the transmitter configuration put in place by the multiplex operator.