Small scale DAB:

Frequency planning feasibility study

Technical study: August 2015

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Summary

Ofcom is publishing this study to accompany our final report to Government on the small scale DAB trials. The technical work for this study was carried out during the second half of 2015, and the content of this document reflects the situation at that time.

Spectrum requirements for small scale DAB

To increase the opportunities for community radio and small scale analogue commercial radio services to join the DAB digital radio platform, 'small scale DAB' multiplexes are being considered.

UK DAB services are currently provided using spectrum within a part of VHF band III known as 'sub-band III'[1]. An initial study, carried out for the Manchester area, concluded that further spectrum beyond that available in sub-band III would be required to provide small scale multiplexes in any future wider roll-out of small scale DAB.

What we did

This study considers the technical feasibility of such a wider roll-out from a frequency availability and frequency planning perspective. The study contains details of a theoretical small scale DAB network which has been developed solely to assist with producing this feasibility study. These 'notional' networks are purely indicative, and more detailed frequency planning, international engagement and internal UK coordination work would be required before practical networks could be deployed.

We have identified six frequency blocks from another portion of VHF Band III, known as 'sub-band II'[2] that could potentially be used for small scale DAB. Sub-band II was previously allocated to business radio (or Private Mobile Radio - PMR) services. PMR has largely vacated this spectrum as a result of changes to international frequency plans following the ITU Regional Radio Conference held in Geneva in 2006, but some PMR services may remain in the sub-band until 2020.

Conclusions

Using this additional spectrum, we have developed a notional frequency plan for 192 small scale DAB multiplexes. Notional multiplexes have been formed from a selection of the transmitter sites that are currently used to provide existing community and small analogue commercial radio services.

As small scale DAB services are expected to operate at relatively low power levels, it will be necessary for their transmitter sites to be near to the target coverage area in order to provide robust 'indoor' coverage to urban areas. Existing community and small scale sites were not always found to be satisfactory.

[1] 210.8 MHz to 230 MHz (DAB blocks 10B to 12D)
[2] 193.2 MHz to 207.5 MHz (DAB blocks 7D to 9C)

The UK ‘mobile’ coverage achieved by the notional sub-band II plan developed in this study is shown in figure 1.1

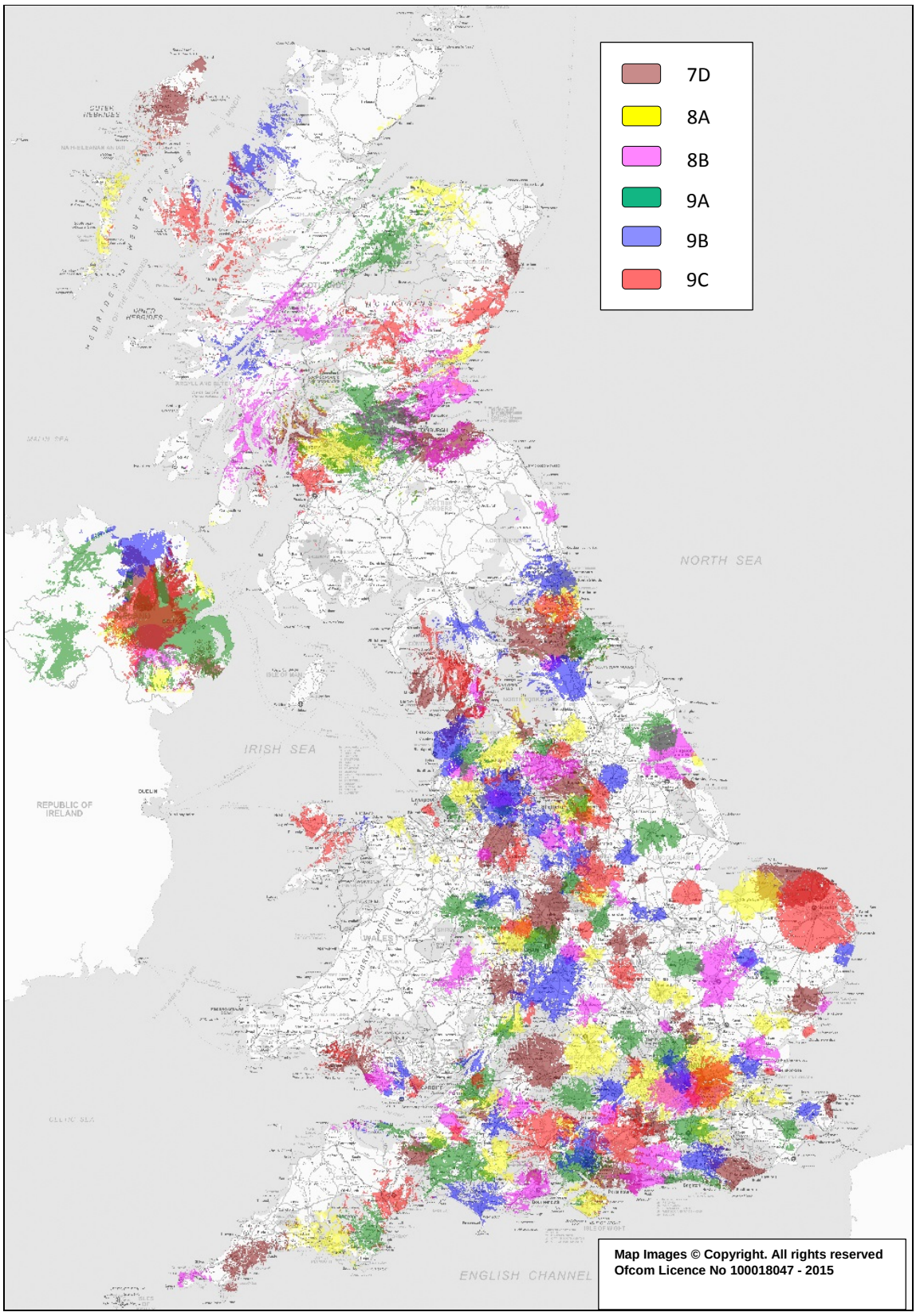


Figure 1.1 UK small scale DAB ‘mobile’ coverage, using six sub-band II blocks

We have found that in some areas, additional spectrum resource (beyond the six sub-band II frequency blocks) is likely to be required in order to avoid undue interference between the notional small scale DAB multiplexes. Therefore, we have also considered the use of sub-band III blocks (where these are available) to supplement the six sub band II blocks in areas of limited frequency availability.

We have concluded that small scale DAB multiplexes could be interleaved with local DAB services, although only one or two interleaved blocks may be available in each region. These blocks may assist where more than six blocks are needed, or where continental interference is problematic. However sufficient sub-band III spectrum would not available for mitigation against the interim PMR constraints (where these exist) in several areas.

Constraints

PMR services may continue to make use of sub-band II spectrum until 2020 in south Yorkshire, the east midlands, and in Merseyside. This is likely to prevent the comprehensive roll out of small scale DAB within the north of England, the English Midlands, the northern Home Counties and the north west of England in the short term. Analysis of the co-existence of PMR with the notional small scale DAB frequency plan developed during this study indicates that 59 of the 192 Small Scale DAB multiplexes would not be able to launch until PMR migrates from sub-band II.

In border or coastal regions, the plan has avoided frequency blocks planned to be used by Ireland, France, Belgium and The Netherlands where possible. The notional UK small scale DAB networks have been planned to operate at low powers, whilst the Irish and continental networks allocated in the band are planned to operate at substantially higher powers. The most dominant issues would be from incoming interference to the UK small scale DAB networks, rather than outgoing interference to the Irish and continental networks.

During this study more detailed information was supplied regarding the proposed usage of sub-band II by networks in France and Ireland. Analysis indicates that the majority of the notional UK small scale DAB multiplexes would remain viable, though at a reduced level of availability. There would be sufficient scope to adapt the plan where predicted interference is judged to be unacceptable.

Further work

Before any practical frequency plans for further small scale DAB networks can be developed, further information would be needed from the UK's neighbours, and the UK would need to seek international coordination for some transmitter proposals.

We also anticipate that we would engage with the business radio community to seek to ensure that the technical requirements for protecting PMR services remain appropriate and do not unduly constrain the roll-out of small scale DAB.

Contents

Section 1

Introduction

When Ofcom first considered the opportunities for implementing additional small DAB multiplexes in the UK, we carried out an initial study looking at frequency availability in the Manchester area. We concluded that it would be possible to make use of Band III, sub-band III blocks 10B, 11B and 11C. We looked at ways that the frequencies proposed could be used to allow those analogue radio services in the area which were not yet on DAB to be accommodated. We found that to achieve this, two DAB frequency blocks would be required over this relatively limited geographical area. If the plan were extended to serve other areas, it was apparent that additional spectrum, beyond that available in sub-band III, would be required.

This study considers the potential for additional spectrum to accommodate small scale DAB services. We conclude that it should be feasible to use blocks 7D, 8A, 8B, 9A, 9B and 9C (all in sub-band II), for small scale DAB services in certain areas of the UK. This spectrum was previously allocated to PMR services, but as part of the Ge06 Plan, the majority of the PMR services have migrated away from sub-band II. We expect some PMR usage to remain in these blocks in South Yorkshire, the English East Midlands, Merseyside and Aberdeen, perhaps until 2020. This will place a temporary limitation on the availability of the additional spectrum, and therefore implies a later deployment of small scale DAB within the north of England, the English Midlands, the northern Home Counties, and the north west of England.

This study finally considers the possible extension of small scale small scale DAB to the whole of the UK. Our approach has been to group existing analogue Community radio and small commercial radio services by area, with a view to examining the technical feasibility of developing a frequency plan which would allow them to be carried on small scale DAB multiplexes. Larger areas with many services (London, the English West Midlands, Manchester and Glasgow) have been split into smaller areas with the aim of ensuring sufficient capacity for current and future services. The plan has been developed around the use of six blocks, primarily the six sub-band II blocks mentioned above, supplemented with spectrum interleaved amongst the established DAB multiplexes where necessary.

A number of points have been identified in developing the notional six block plan. In particular, we note the following issues that are highlighted in this report:

- The importance of careful choice of transmission site to achieve ‘useful indoor’ coverage within the target area;
- In some areas, more than six blocks are required to avoid undue inter-block interference;
- Some areas under this notional plan would remain unserved;
- There would be temporary limitations on deployment of small scale services due to the need to protect the remaining PMR services in sub-band II;
- Where data is available, we examine the likely interactions between the proposed DAB networks and the continent and Ireland; and
- Challenges in finding interleaved spectrum in sub-band III to assist with the issues above.

Because the remaining PMR services within sub-band II need to be protected until 2020, the notional network developed in this study could not be fully implemented immediately. Analysis indicates that, of the 192 areas studied, 59 within the north of England, the English Midlands, the northern Home Counties and the north west of England would impact the remaining PMR services.

Additionally, it is likely that co-block interference from the continent and Ireland will further limit the coverage to adjacent areas in the south of England, East Anglia, and Northern Ireland.

Interleaved blocks may be used from sub-band III where required, although there is very limited capacity in many areas. There is a particular shortage of capacity in areas where it could help to avoid the impact on remaining PMR services within sub-band II.

Section 2

Methodology & Assumptions

DAB coverage analysis has been performed using the ICS telecom predictive planning tool, using a Fresnel/Deygout 94 method and 50m Infoterra Digital Terrain Model data, as used by Ofcom broadcast radio planners.

Unwanted interference has been calculated for 1% time by assuming an earth radius of 28,550 km rather than 8,550 km, assumed for 50% time. The wanted field strength level has also been calculated for 1% time availability. The wanted field strength for 1% availability makes very little difference over short (wanted) distances, and allows common field strength predictions to be used both for wanted and interference, simplifying the planning process within ICS telecom.

Although signal levels are log-normally distributed according to location, for practicality when using ICS telecom, a simple power sum has been assumed for both wanted and interfering signals. This will result, if anything, in the practical network having slightly increased location availability compared to that predicted.

A co-channel protection ratio of 25dB has been assumed. This is derived from a receiver protection ratio of 10dB and a margin to protect to 99% location availability of 15dB.[3] Field trials have indicated that it may be appropriate to use a protection ratio of 15dB. This reduction is largely attributed to a positive correlation between wanted and interfering field strengths. This difference in protection ratio does not generally impact upon planning decisions, but may result in practical coverage being slightly greater than predicted in interference limited areas. At the planning stage, the 25dB protection ratio is useful in understanding station interactions.

Coverage has been assessed to minimum field strengths of 54dBµV/m and 63dBµV/m, at 10m above ground level, corresponding to the accepted thresholds for ‘mobile’ and ‘useful indoor’ reception.

Each transmitter site has been nominally planned to operate at 100W ERP. In most cases, this nominal ERP is considered a good balance between the need to provide good coverage whilst limiting outgoing interference, thereby allowing reuse of channel blocks to serve adjacent areas. To improve coverage, in some cases, this ERP may be increased by 3dB or even 6dB, but generally has been adjusted downwards to meet coverage requirements or to limit outgoing interference.

[3] The planning margin is derived theoretically as (4.0 x 2.33 x √2) = 13.2 dB, assuming both wanted and unwanted signals are Gaussian distributed with standard deviations of 4.0 dB, and are uncorrelated.

Many antenna patterns are possible, but for the purposes of this study, a selection of standard transmit antenna patterns has been used, as shown in figure 2.1.

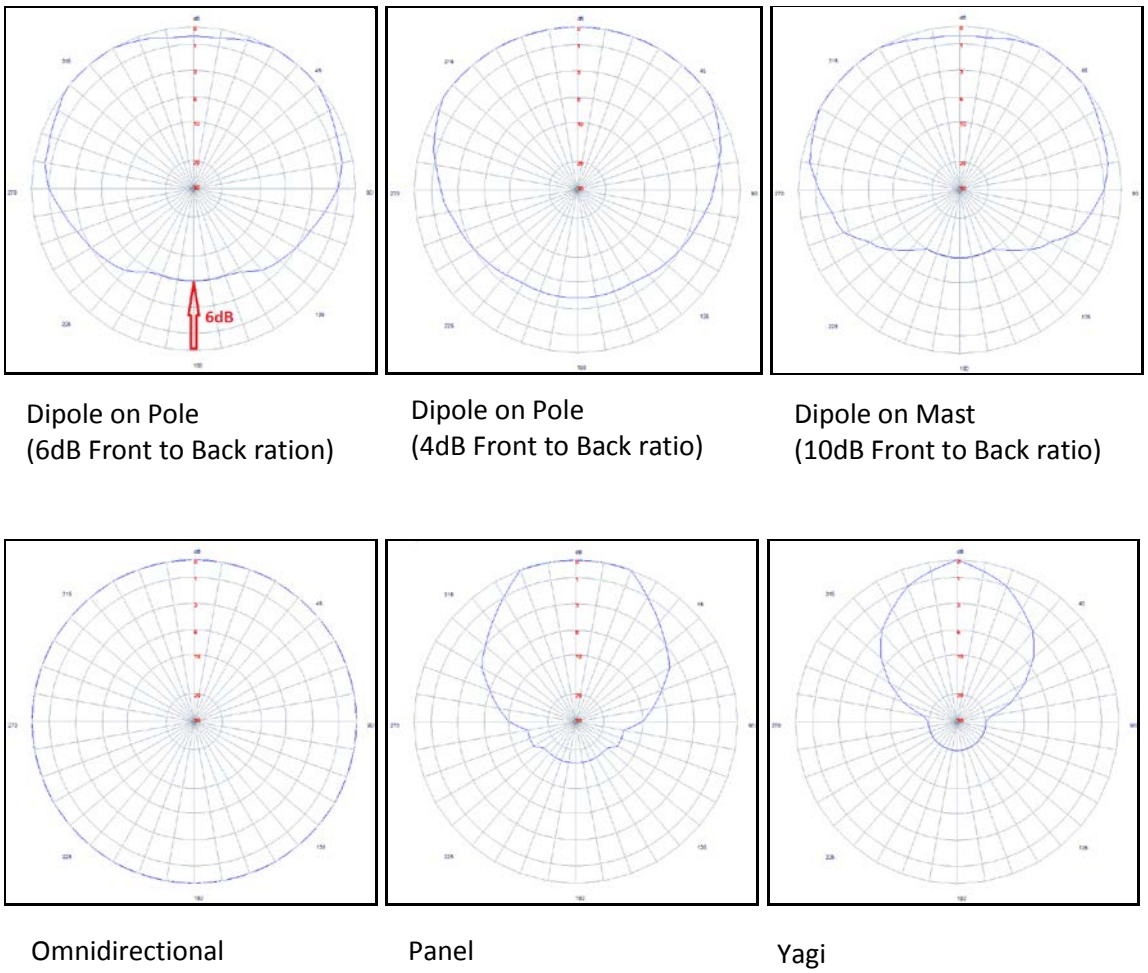


Figure 2.1 Standard Transmit Antennas, Horizontal Radiation Patterns

This study is primarily based around the use of six DAB channel blocks (7D, 8A, 8B, 9A, 9B and 9C), with the aim of identifying any particular difficulties associated with frequency reuse in a six block plan. It is recognised that some of these channel blocks cannot be utilised over the whole UK at present, due to the continued operation of co-channel PMR services in south Yorkshire, the English East Midlands, and Merseyside. Interleaved spectrum in sub-band III (blocks 10B to 12D) could be used to overcome difficulties in areas otherwise limited by UK or continental interference within the six block plan, or to allow additional small scale DAB service areas to be added. In a limited number of areas, the use of sub-band III blocks may allow implementation of small scale DAB where remaining PMR services require protection.

Adjacent channel interference (ACI) may create a ‘hole’ in coverage within a very short range of a transmitter site when attempting to receive services from other transmitter sites. Adjacent channel interference has not been specifically investigated when considering interactions between the six sub-band II blocks. Mitigation is frequently possible by careful selection of sites and antenna patterns, and this would need to be considered in the detailed planning and implementation phase.

Section 3

Service Selection

The candidate services for small scale DAB were identified by running a query within the Ofcom technical licensing database, to create list of all community radio and small scale radio services not currently on DAB (as of Spring 2015). The candidate services were mapped to allow service groups and areas (forming the notional small scale DAB multiplexes) to be identified. The grouping is notional so as to inform this spectrum planning study only and does not represent how multiplexes would be arranged in any formal deployment of small scale DAB in the future.

By creating more groups in areas where there is a requirement for a larger number of services, it is possible to limit the number of services per multiplex to fit within practical bit rate limits.[4] In these areas there is generally a large degree of coverage overlap.

Figure 3.1 gives an indication of the number of services per notional small scale DAB multiplex considered in this study, based on the number of analogue-only stations in each area.

[4] For a mix of bit rates up 128kbits at UEP3, it would be possible to implement up to nine stereo services per small scale DAB multiplex.

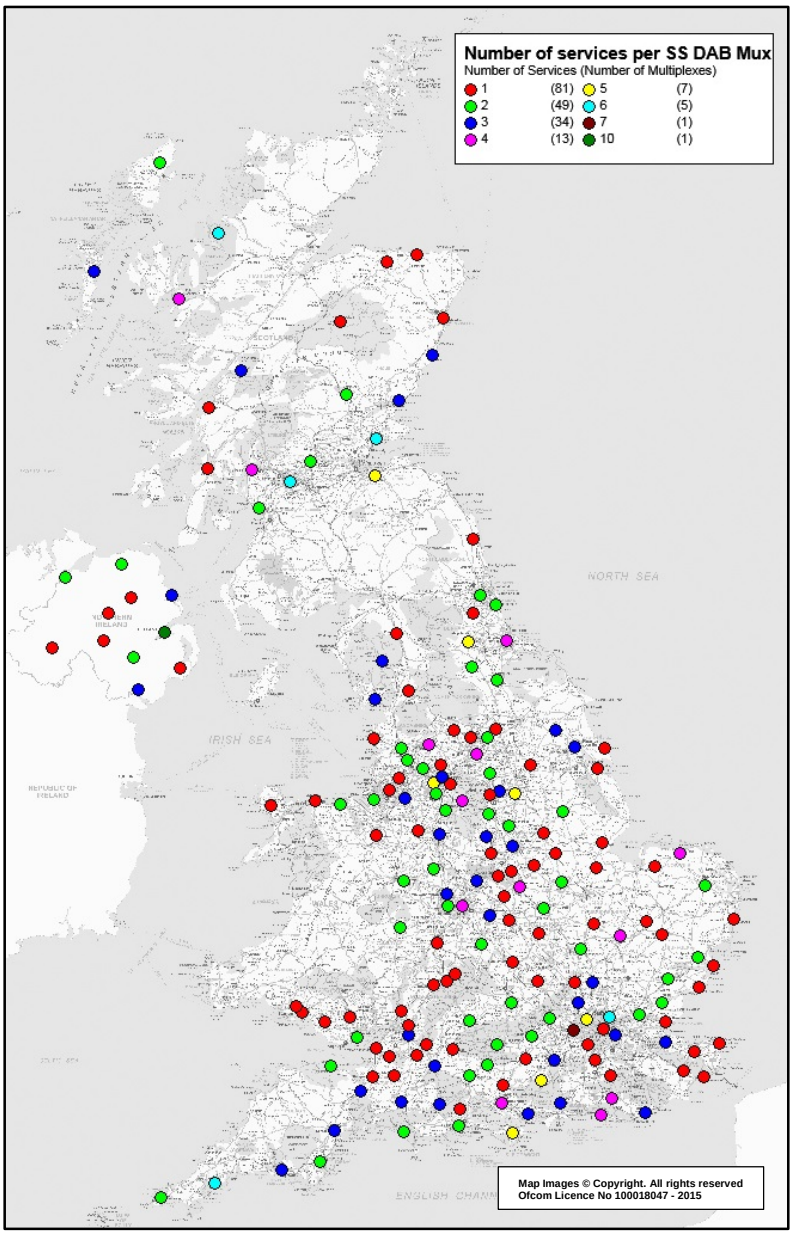
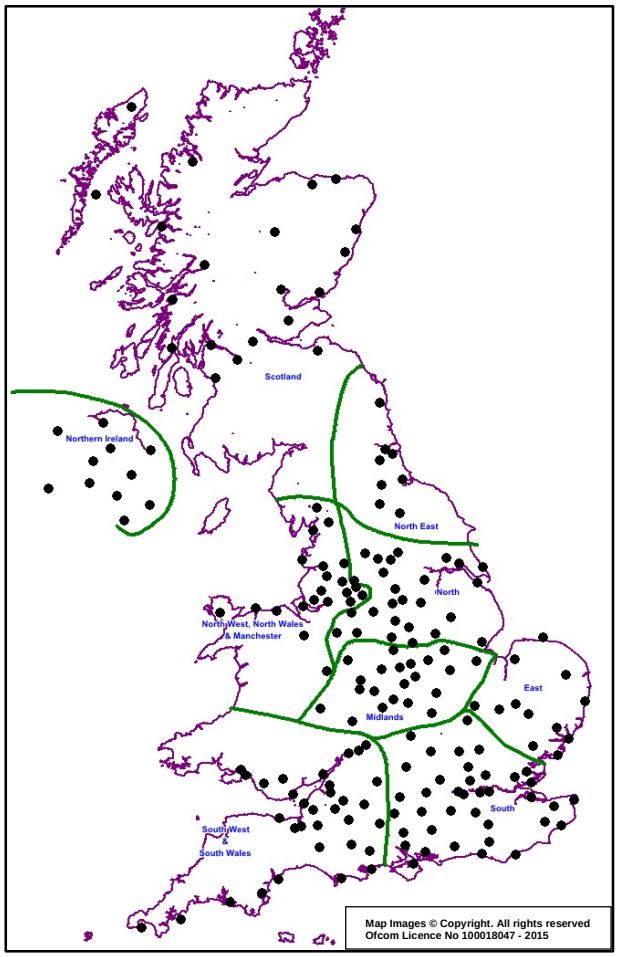


Figure 3.1: Number of services per notional multiplex

Section 4

The Planning



The UK was split into areas as the plan developed. These areas were based on the station grouping areas and regions that could be planned independently. The region boundaries were based upon maximum co-block interference within an area rather than any physical or political boundaries, hence services in Wales were grouped with the South West and North West areas.

The coverage of each transmitter site currently used to provide a small commercial or Community analogue radio service within a group was assessed, and the best combination of sites selected to provide the composite DAB service.

From the list of standard antennas shown in figure 2.1 the most appropriate transmit antenna was selected to provide coverage in the desired area whilst limiting out of area interference. The ERP selected was generally 100W, though this was adjusted in some instances to limit out of area coverage or outgoing interference.

Figure 4.1: The planning areas

As each group was planned, the coverage was compared with the published FM coverage maps for the constituent stations. The coverage was assessed against the requirements for both ‘mobile’ and ‘useful indoor’ reception (54dBµV/m and 63dBµV/m at 10m a.g.l.). This equates to the protected 64dBµV/m published coverage threshold for FM community radio services.

To ensure ‘useful indoor’ coverage whilst operating with a limited ERP, small scale DAB transmitter sites generally need to be close to the area to be served. The sites used for small scale DAB in this study were selected from those already used to provide small radio services, some of which are not close to the target area. It may be possible to identify more suitable sites in the detailed planning stage.

Locations where more suitable sites may need to be found (or added) in order to improve coverage include Dorchester, Salisbury, Aylesbury, Colchester, Banbury, Ludlow and Wigan.

This is illustrated in figure 4.2. The site for the Banbury area is midway between Banbury and Brackley. Although 'mobile' DAB coverage would be achieved over the whole area, two sites could be placed individually to provide both Banbury and Brackley with 'useful indoor' coverage.

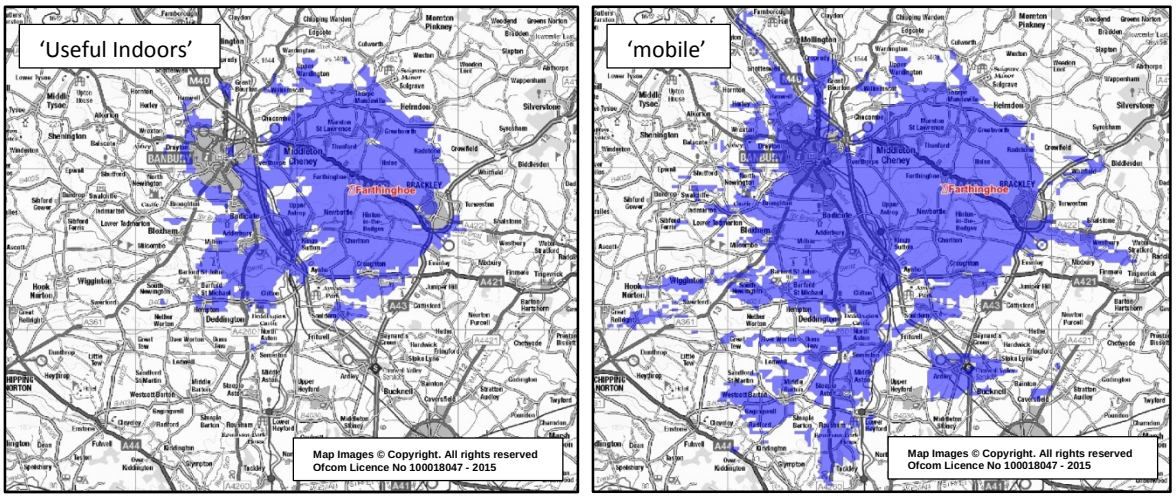
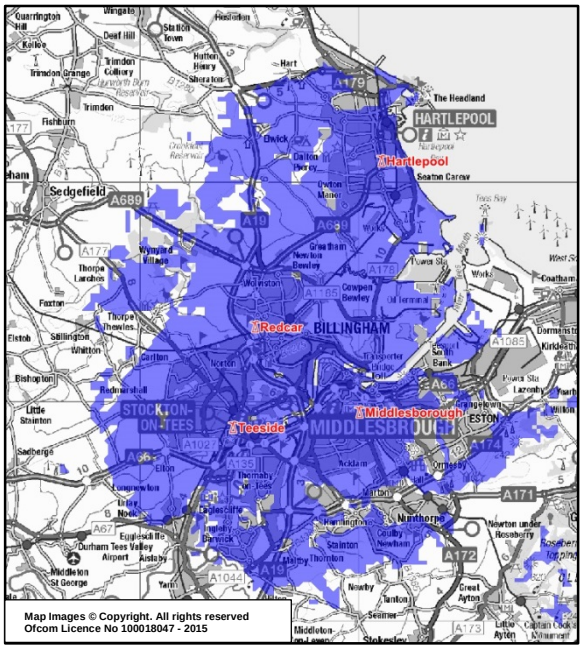


Figure 4.2: Banbury coverage ('Useful Indoors' and 'Mobile')



Community radio stations generally operate at a maximum of 25W ERP, whilst the majority of small FM radio services operate at 100W ERP or less. Individually, each station has limited coverage, but when combined together to create a small scale DAB multiplex, a larger aggregate area would be served. This is illustrated, for the Teesside area, in figure 4.3. In areas where more than one transmitter site contributes to DAB coverage, there is the additional benefit of a decrease in location variability (i.e. less need to move the receiver in order to achieve robust reception).

Figure 4.3: Combined sites - multiplex area

For the few small FM radio services that operate at ERPs greater than 100W, it may be necessary to add additional sites so that coverage can be maintained, whilst limiting each small scale DAB site to around 100W ERP. This is illustrated, for the King's Lynn area, in figure 4.4.

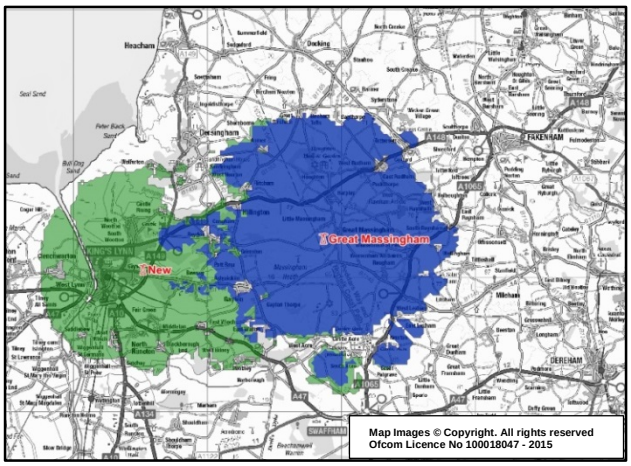
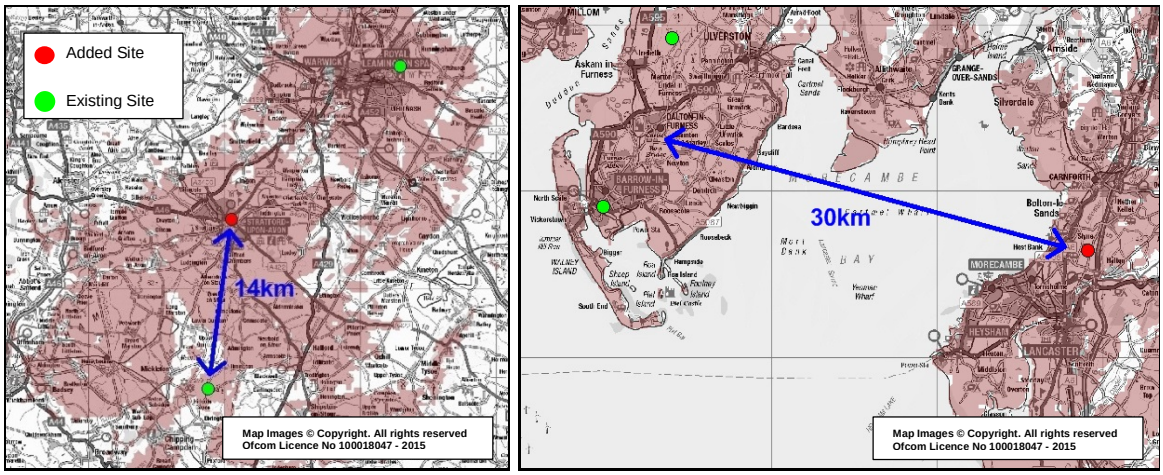


Figure 4.4: Additional site - King's Lynn

The FM service for King's Lynn operates at 2.1kW ERP. In the notional small scale DAB plan, the existing site at Great Massingham operates at 100W ERP and a new site is added, also operating at 100W ERP. Should it be desired to provide more 'useful indoor' coverage to Swaffham and Fakenham, additional sites could be added.

Similarly, within this study, additional sites have been added to serve Stratford upon Avon (FM service 1.5kW ERP, 14km to the south) and Lancaster/Morecambe (FM service 1.6kW ERP, 30km across Morecambe Bay), as shown in figures 4.5 and 4.6.



Figures 4.5 and 4.6: Additional Sites – Stratford upon Avon and Lancaster & Morecambe

In order to provide robust coverage within London, several additional sites have been added. Figure 4.7 shows the existing and added sites, to provide 'useful indoor' coverage. Further sites would need to be added to improve coverage within north-west London.

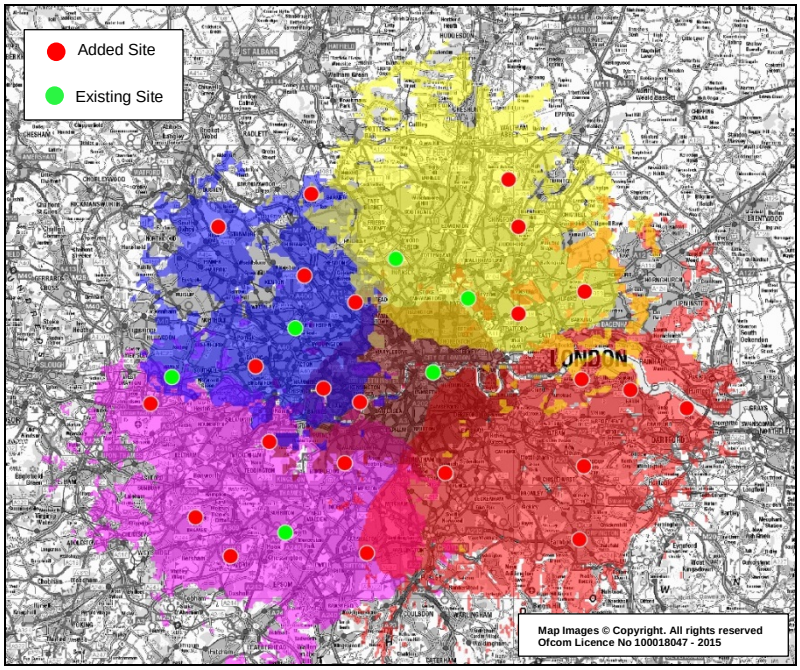


Figure 4.7: London 'Useful Indoor' Coverage - Added and Existing Sites

The sub-band II block selected for each multiplex was based on a judgement of the likely reuse distance, but taking advantage of the terrain to allow (where possible) blocks to be reused over shorter distances. Efficient use of spectrum is demonstrated by adequate coverage being achieved, whilst being slightly limited by co-block interference.

Most areas required two or three planning iterations, where block usage, ERP or transmit antenna patterns were adjusted, in order to achieve the desired predicted coverage.

To understand coverage interactions, and to be consistent in approach, a co-channel protection ratio of 25dB was assumed. Ofcom planning standards specify a protection ratio of 25dB but relaxes this by 10dB due to the expected correlation between wanted and unwanted signals. The ITU proposes a protection ratio of 15dB. Whilst such a relaxation to 15dB was considered when deciding whether some specific interactions could be tolerated, in general, the use of 25dB has not impacted upon planning decisions. Figure 4.8 shows predicted interference between multiplexes using block 9A, in the Midlands, considered with protection ratios of 25dB and 15dB.

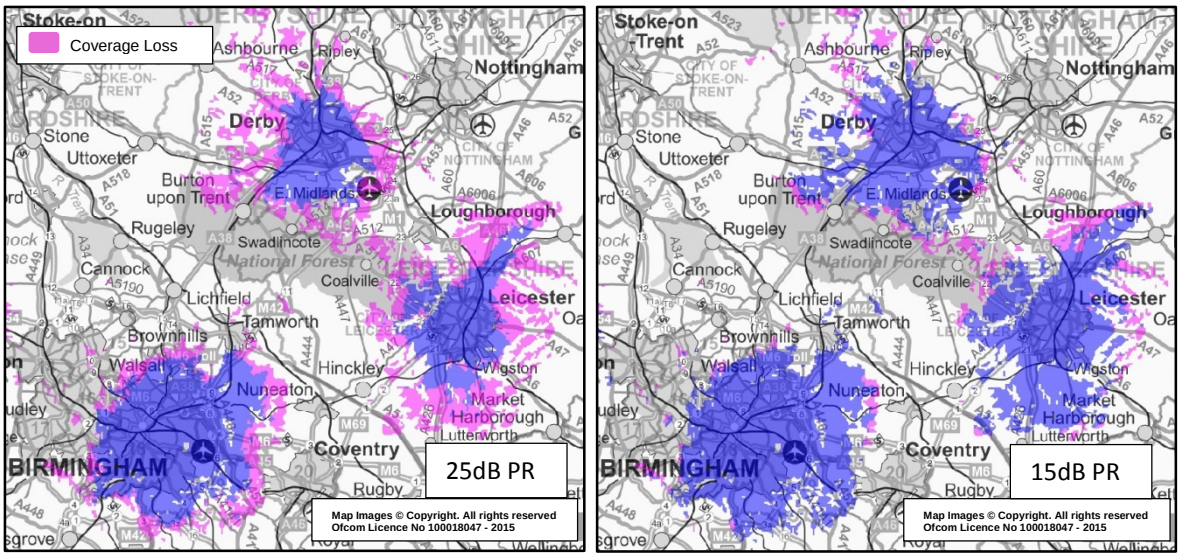
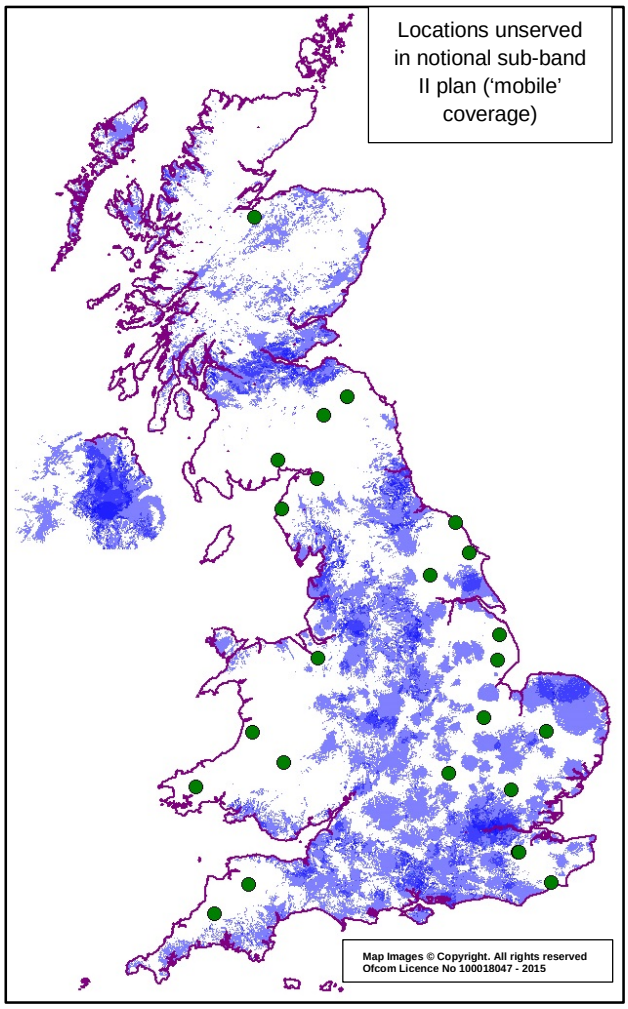


Figure 4.8 Co-channel interference considered at 25dB and 15dB protection ratio

In developing a notional frequency plan the whole UK, using six frequency blocks (7D, 8A, 8B, 9A, 9B and 9C), it has been found that there are a few areas where additional spectrum is required. Particularly 'congested areas' are found in the Bristol area, the region around Manchester, Cheshire, Merseyside and the English East Midlands.
Interleaved blocks in sub-band III may be used to ease this congestion in the following areas:

- It is assumed that block 11C is used to serve Weston-super-Mare. This is the block previously used for the Cardiff & Newport local multiplex.
- In line with the findings of the initial Manchester study, blocks 11B and 11C would be suitable to serve Warrington and Tameside following the planned frequency changes for the Liverpool and Manchester multiplexes.
- Ideally, an additional block is required in the East Midlands, for Coalville. An initial assessment indicates that block 10D may be suitable. This is the block used for the Herts, Beds and Bucks local multiplex.

If small scale small scale DAB services are to be launched in the English midlands and the north and north west of England whilst PMR usage continues within the same spectrum in south Yorkshire, the English East Midlands and Merseyside, then additional usage of available blocks within sub-band III may assist.



This Plan has been developed to address the question of whether existing community radio and small commercial services could be technically accommodated on DAB. However, no planning has been carried out in areas where such analogue services do not exist. Therefore the following areas are amongst those unserved by this notional sub-band II plan:

North Devon, Mid Wales, West Wales, Maidstone, Sevenoaks, Tonbridge, Tunbridge Wells, Rye, Dover, Chester, Bishop's Stortford, Milton Keynes, Thetford, Peterborough, Sleaford, Skegness, Louth, York, Scarborough, Bridlington, Whitby, Carlisle, West Cumbria, Melrose/Hawick, Dumfries, Northumberland & Inverness

These areas are shown in figure 4.9 as dots, along with the 'mobile' coverage achieved for the six block sub-band II plan. A future plan might be needed to identify how / if these areas might also be served by sub-band II if there is evidence of demand from potential services in these areas.

Figure 4.9 Areas unserved in the sub-band II plan

Section 5

Sub-Band II PMR Services

Under the terms of their licences, PMR services may continue to use the sub-band II blocks shown in table 5.1 until 2020.

Area	Use	DAB block
South Yorkshire & East Midland	Base Station Receive	7D, 8A, 8D
	Mobile Receive	9A, 9B
Merseyside	Base Station Receive	8B
	Mobile Receive	9B, 9C
Aberdeen	Base Station Receive	8B
	Mobile Receive	9B

Table 5.1: PMR SB II block usage until 2020

As part of this study, we assessed the likely restrictions to small scale DAB from the continued use of sub-band II blocks for PMR. For the basis of this assessment, we used ITU Rec R-1546 as the propagation model and assumed that the PMR base stations use omnidirectional transmit and receive antennas. This approach, which is based on exclusion distances, is recognised by the PMR community.

An alternative approach has been used in this study. This approach uses the same prediction model for PMR services as is currently used to predict the DAB coverage. The approach takes the likely base station transmit/receive antenna into account. This alternative approach, if acceptable, may result is less onerous restrictions to small scale DAB roll out, whilst providing the necessary protection to the remaining PMR services.

The assumed basis for the protection of PMR services is that the effective[5] interfering DAB field strength should not exceed 27dBµV/m, as seen by either the PMR base station or mobile antenna. A derivation of this limit is provided in Annex 3.

To protect PMR mobile reception, a combined DAB field strength of more than 27dBµV/m should not exist over the service area of the PMR service. Because several DAB signals may combine at any given location, the level of any individual component signal should be lower. Ideally, an appropriate statistical summation, taking into account location variability, should be used for this assessment.

As the service area details for the PMR services were not available, the transmitted (base station) service areas for the South Yorkshire/East Midlands and Merseyside networks have been predicted, based on the licence parameters, highlighted in Annex 3. The service area

[5] Taking the receiving antenna directivity into account.

would be within the region where the field strength delivered for 50% time, is predicted to be 19dBµV/m[6], at 1.5m above ground level.

Figure 5.1 shows the likely service areas for the South Yorkshire/East Midlands and Merseyside networks. Based on the prediction, possible areas to be protected have been identified, however further clarification should be sought from the PMR operators regarding the service area and the site technical parameters.

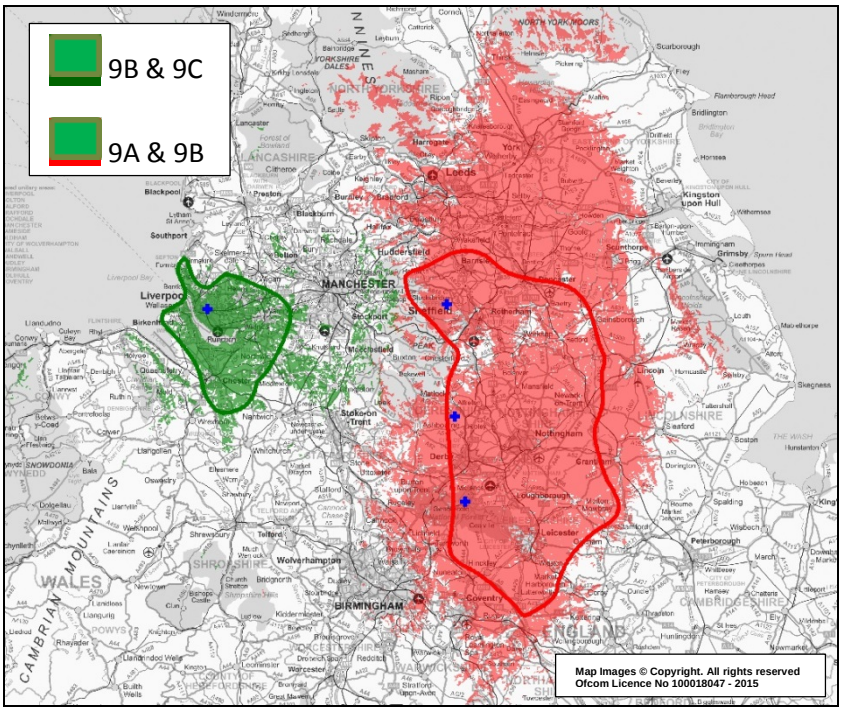


Figure 5.1 Likely areas for PMR mobile protection from DAB (power summation greater than 27dBµV/m)

To protect PMR base station reception, a combined effective DAB field strength (taking into account receiving antenna directivity) of more than 27dBµV/m should not exist at any receive site. Again, as several DAB signals may combine, the level of component signals must be lower than this value where more than one co-channel DAB signal contributes to the 'unwanted' field.

This is a point-to-point limitation (i.e. DAB transmitter to PMR base station) based on the DAB station parameters. Consequently, it is not possible to definitively calculate DAB transmitter exclusion areas. As a guide, predictions have been performed in the reverse direction to establish where 27dBµV/m is received, for 1% time, at a height of 60m a.g.l[7]., for 100W ERP[8] transmitted from each base station, using the base station antenna.

[6] 19dBµV/m, recognised service threshold by Ofcom.
[7] 90% of the antennas in the plan are at 60m or less.
[8] 100W being the maximum ERP used

Figure 5.2 shows the resulting possible exclusion areas to protect reception at base stations within the South Yorkshire/East Midlands and Merseyside PMR networks.

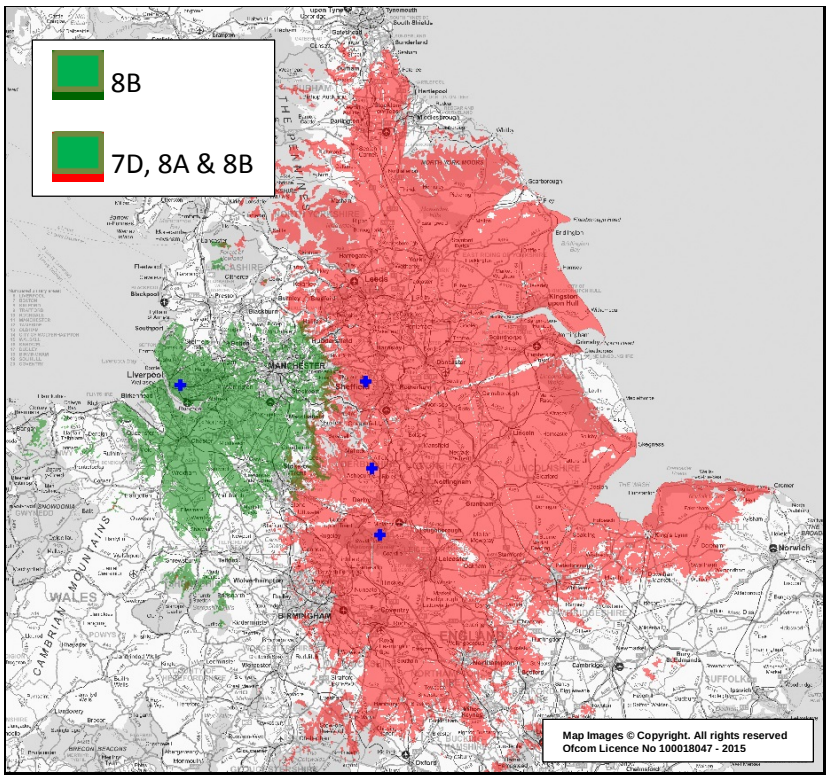


Figure 5.2: Possible areas for PMR base station protection from DAB (power summation greater than 27dBµV/m)

Comparing the predictions in figures 5.1 and 5.2, it is likely that the restrictions to protect reception at the PMR base stations within blocks 7D, 8A and 8B (i.e. to the base station receiver) will be most onerous, but will depend upon the actual small scale DAB site parameters. The acceptability of the possible interference to the PMR service can only be established at the detailed DAB site planning stage.

The same analysis could be applied to protecting the Aberdeen PMR services within blocks 8B and 9B; however it has been possible to avoid using these channels for small scale DAB in the east of Scotland as other frequencies are available. The terrain in Scotland allows these channels to be used by DAB to the west without interfering with PMR. Furthermore, sub-band III spectrum is available in most of the area.

For each small scale small scale DAB service on blocks relevant to the PMR services, the 1% time field strength over the PMR service area, or received by the PMR base stations, has been assessed against the likelihood of a combined 27dBµV/m being exceeded. As several DAB signals may combine, the level of component signals should typically be lower by up to 10dB.

Of the 192 notional small scale DAB networks planned as part of this study, it is estimated that 59 might in principle impact upon the South Yorkshire/East Midlands or Merseyside PMR networks. These numbers are summarised in Table 5.2.

PMR Network	**small scale DAB Networks**	**Total**	**Comment**
South Yorkshire/East Midlands Mobiles	21		One small scale DAB Network may impact both PMR Networks
South Yorkshire/East Midlands Base Stations	28	49	
Merseyside Mobiles	11		
Merseyside Base Stations	0	11	

Table 5.2 The number of small scale DAB Multiplexes Impacting PMR

The location of the notional small scale DAB networks that might have an impact on PMR networks are shown in figure 5.3.

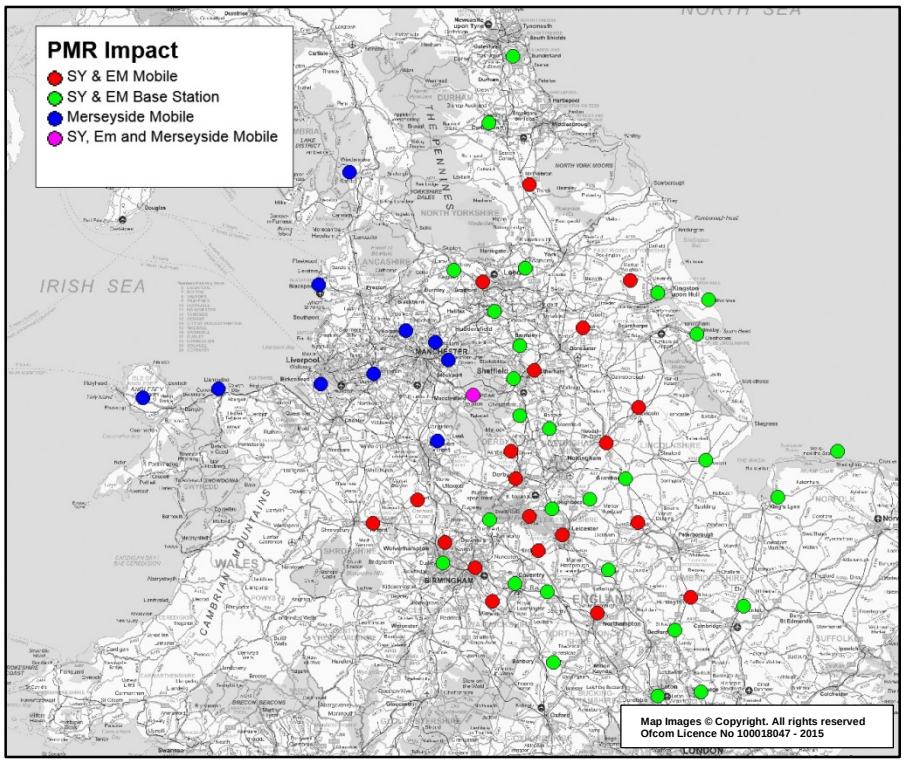


Figure 5.3 small scale DAB Multiplexes Notionally Impacting PMR

The notional small scale DAB areas that might have an impact on the remaining PMR services are outlined in the site data, provided in Annex 2.

Section 6

International Considerations

General

International DAB frequency coordination is governed by the ITU Geneva 2006 agreement (Ge06). This contains allocated rights for DAB and Digital Terrestrial Television (DTT) for the UK and neighbouring administrations. It also allows for the use of other services such as PMR in VHF Band III.

The six DAB blocks being considered for small scale DAB are all allocated in Ireland and the continent for DAB or DTT in Ge06. At the time of writing, very few of these services have been implemented. However, any UK small scale DAB implementation would need to protect these allocations, and would not be able to restrict their implementation. This will generally mean that small scale DAB services located near to the UK coast and Northern Ireland border will be subjected to higher levels of incoming interference than in other parts of UK.

At the present time, the UK has no international rights to implement small scale DAB services and in order to do this would need to seek agreement from neighbouring countries where those services might put more than a defined signal level into those countries. The Ge06 agreement was formulated on the basis of equitable access to spectrum. As a consequence, it is likely that our neighbours would also wish to negotiate agreement for their own layer of small scale DAB or similar applications.

Due to the limited amount of sub-band II spectrum, and the number of administrations requiring services within it, it may be difficult to achieve the desired number of small scale DAB services in some areas of the UK. This is particularly so in Kent (and to a slightly lesser extent Essex, Sussex and Suffolk) where the UK would be seeking use of the same spectrum as France, Belgium and the Netherlands. The short distance between borders and unobstructed sea path means that frequency reuse is extremely difficult.

Outgoing Interference to France, Belgium and The Netherlands

To assess the acceptability of the notional UK small scale DAB network to the French, Belgian and Dutch administrations, ITU Rec R-1546 calculations have been performed, to assess the power sum[9] of the UK signals for each sub-band II block (7D, 8A, 8B, 9A, 9B & 9C) at test points along the continental coast. The test points are shown in figure 6.1.

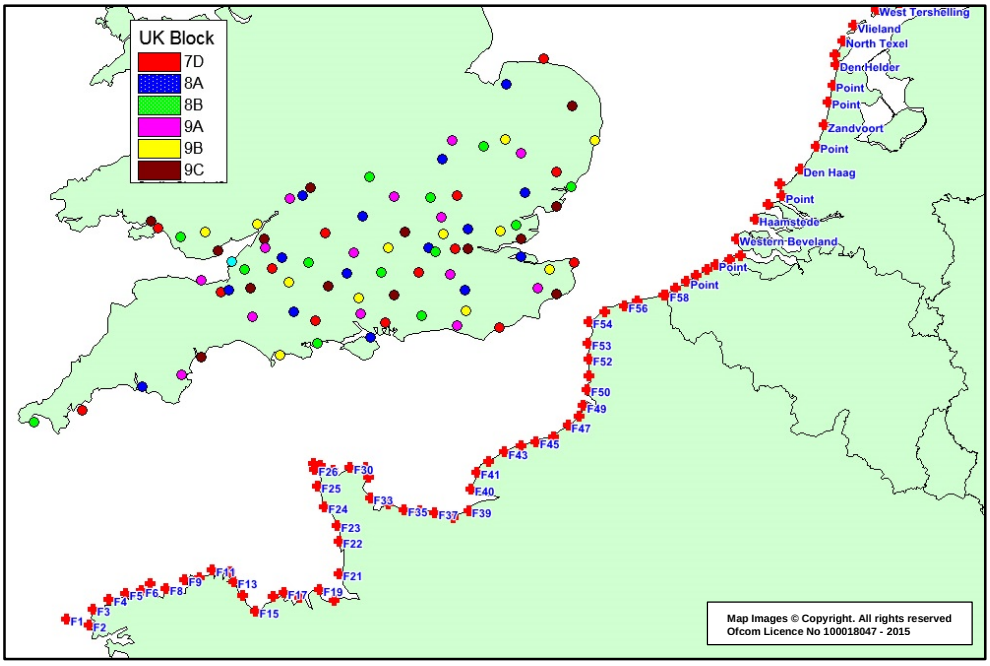


Figure 6.1 Continental coastal test Points

Although the ITU coordination trigger limit[10] is 12dBµV/m, coordination agreements with French, Belgian and Dutch administrations could be sought for power sums less than 39dBµV/m (for coordination with other DAB services) or 33dBµV/m (where coordination is sought with DTT services). This approach is consistent with that adopted in other bands, and would reduce the number of small scale multiplexes that we would need to coordinate with our neighbours.

Nevertheless, several locations within our notional network would still exceed these levels and may require some mitigating measures. Table 6.1 summarises the locations where this might be necessary, and some potential mitigating measures.

[9] Bonn Summation as detailed in the Weisbaden 1995 Agreement, whereby interferers, to one decimal point, are power summed in order of magnitude, until a change of less than 0.5dB is detected. 0.5dB is then added to the resulting power sum.

[10] The trigger limit is the level below which we do not need to seek coordination with neighbouring countries

Block/Test Point	Summation dBµV/m	Cause: and possible migitation
7D		
F41	39.04	Portsmouth: Change from Omni to Directional Aerial. Eastbourne: 2dB reduction in power. Hastings: 2dB reduction in power.
F44	39.6	
F46	40.15	
8A		
F30	38 (Maximum)	
8B		
F30	40.08	Poole: Change from Omni to Directional Aerial
F31	40.05	
9A		
F26	40.19	Torbay: Change from Omni to Directional Aerial
F27	41.19	
9B		
F26	41.17	Dorchester: 7dB reduction by combination of Omni to Directional aerial and power reduction.
F27	45.13	
F28	40.18	
F29	41.79	
F30	41.77	
9C		
F27	40.77	Exmouth: Change from Omni to Directional Aerial
F54	41.07	Folkstone: Change from Omni to Directional Aerial

Table 6.1 Bonn 1546 Power Sum to continental coastal Test Points

Constraints from France

To reduce continental interactions, frequency blocks have, where possible, been avoided for UK coastal sites that are likely to be heavily used in adjacent locations by France, Belgium and the Netherlands[11]. Because all six sub-band II blocks are required in the notional UK small scale DAB plan, the continental co-channel blocks have been used further along the coast or inland. During this study we have obtained more detailed information regarding France's Band III frequency requirement, although the details of the French plans are subject to change and further development. The information currently available covers one of two regional networks, two national networks and one local layer (Lille, Haute Normandie, Basse Normandie, and Bretagne). All are using sub-band II & sub-band III blocks in areas adjacent to the UK. We currently have no information on the planned second regional network or second local layer in France. However the majority of proposed French DAB sites proposed have an ERP of around 10kW. Therefore, it is likely that the main issues would be from incoming interference to the UK small scale DAB networks, rather than outgoing interference to the French networks.

The site locations of sub-band II frequency blocks proposed for the French networks, and the UK blocks proposed within this study, are shown in Figure 6.2. The UK locations and French sites with significant interactions are named.

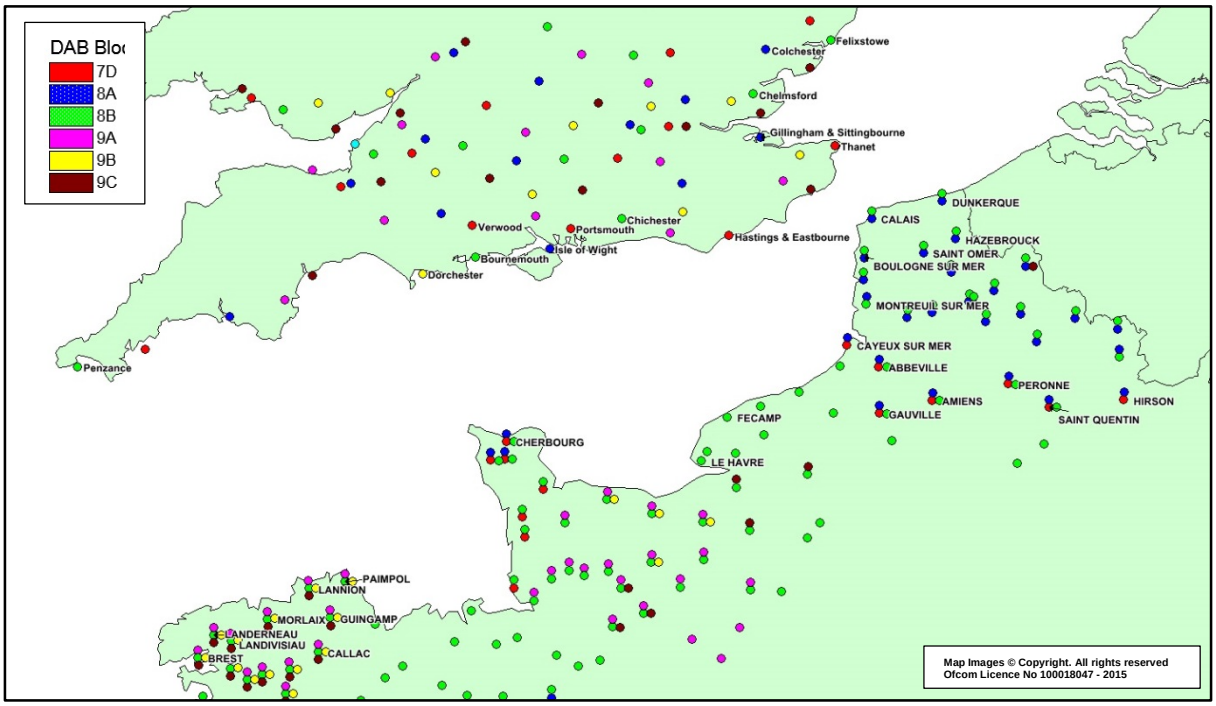


Figure 6.2 France to UK Interference and Block Usage

From Figure 6.2, it can be seen that use of blocks 8A and 8B for small scale DAB has been avoided in the Strait of Dover area, whilst blocks 9A, 9B and 9C have been avoided along

[11] Likely continental DAB block usage taken from 'Sub-CNG 1-1 Iteration4: planning results. Confédération Suisse'

the south Cornwall coast. As these blocks cannot be completely avoided, they have been used at greater distances or where terrain protection may assist in interference mitigation.

The small scale DAB networks in this study have been intentionally planned to be interference limited, considering a co-block protection ratio of 25dB. This has been done to ensure that blocks are used optimally, but with the expectation that 'mobile' coverage in outlying areas may actually be better, when considering the relaxed 'real world' protection ratio of 15dB.

Based on our current understanding of proposed French networks, only blocks 7D, 8A and 8B are predicted to be significantly impacted in the UK. The continental networks considered are based on currently anticipated requirements, and it may be possible to negotiate further restrictions. Where this is not possible, practical transmitter antenna patterns actually used in France may offer some mitigation that could reduce the impact of interference on the UK small scale multiplexes.

Constraints from, and to, the Republic of Ireland

The implications of the UK's notional small scale DAB network to - and from - the Republic of Ireland have been assessed against DAB 'requirement' files submitted by the Irish administration.

The site locations and sub-band II frequency blocks planned for the UK and Irish networks are shown in Figure 6.7. Sites where notable interactions are predicted are named.

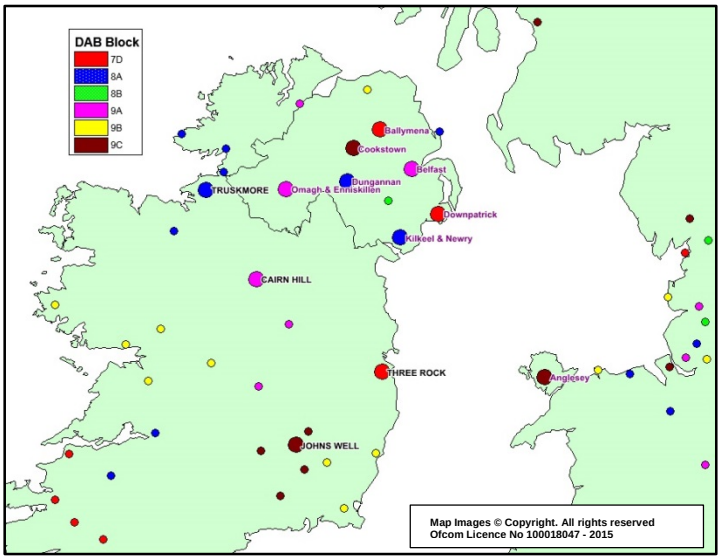


Figure 6.7 UK / Ireland Interactions

The Irish network operates from main station and smaller sites, with ERPs ranging from 100W to 25kW. Predictions indicate that the notional small scale DAB network would cause only minimal impact upon the Irish network, though this would need to be considered further at the detailed planning and implementation phase.

Interference to the UK networks has been considered at 1% time for a protection ratio of 25dB. With a protection ratio of 15dB, in some instances, the impact on coverage of incoming interference may be acceptable. For lower time availability, coverage (generally 'mobile') often increases, which suggests that the 'real world' coverage would be somewhat better than our predictions. For example, in figure 6.8 the interference from Ireland's Cairn Hill allocation to sites in Northern Ireland using block 9A is assessed with protection ratios of 15dB or 25dB, and with 99% or 50% time availability.

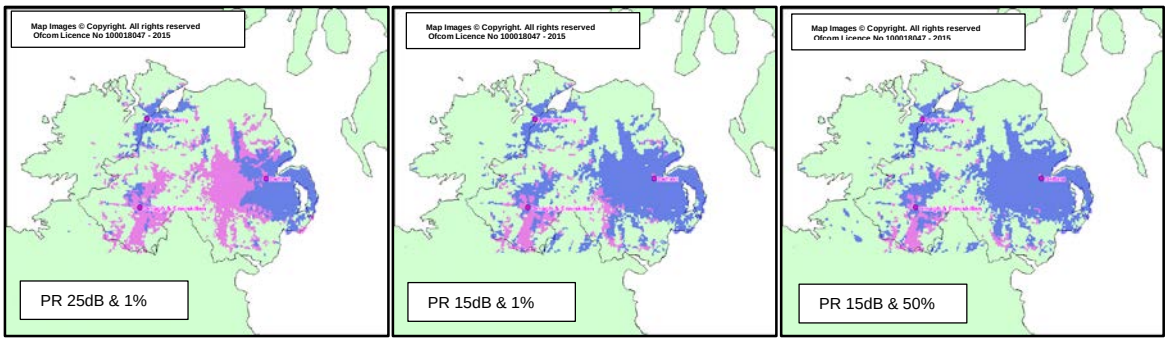


Figure 6.8 Cairn Hill interference with Protection Ratio of 15dB or 50% time availability

Figure 6.8 shows that whilst the time-varying incoming interference to the notional small scale DAB multiplex for Belfast may be acceptable, the interference to the Omagh and Enniskillen networks is unlikely to be acceptable, and alternative solutions would need to be identified.

Our initial study suggests that the use of sub-band II frequencies will be challenging in Northern Ireland, and we may need to use alternative spectrum. PMR services do not operate within sub-band I (channels 5 & 6) in Northern Ireland. Therefore it may be possible to use this spectrum to overcome interference or to provide additional services. Interleaved capacity with sub-band III might also be used in addition to, or in place of, sub-band II.

Constraints from Belgium and The Netherlands

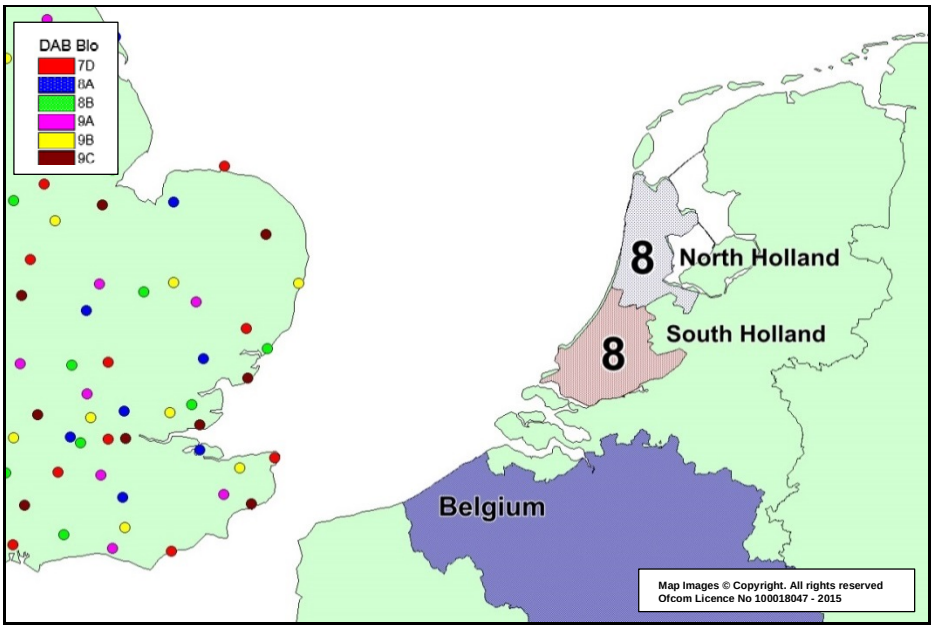


Figure 6.9 Sub-Band II usage in The Netherlands and Belgium

The Netherlands presently has a number of DTT allocations on their coast. Channel 8 is planned for the North Holland and South Holland provinces. Channel 9 is allocated to the coastal areas between Belgium and South Holland and north of North Holland. These allocations will place significant constraints on the use of these blocks in the east of the UK. Channel 7 is allocated to an inland area of the Netherlands that is not expected to be problematic. Any interference from The Netherlands would be in addition to that previously discussed from France. Due to its proximity, it is anticipated that French interference will generally dominate. The situation will need to be analysed once more definite information becomes available.

Based on current information, it is understood that channels 7, 8 and 9 may not be widely used for high power services in Belgium. Although this will also need to be considered further when more detailed information becomes available.

Section 7

Sub-Band III Channel Availability

In developing our notional small scale DAB network, we have concluded that it will be necessary to use interleaved spectrum from sub-band III (which is also used to provide local DAB services) in some areas. Our notional plan makes use of sub-band III blocks for north Somerset, south Manchester and the English East Midlands (where six blocks are not sufficient). We expect that additional sub-band III blocks will be required where additional small scale DAB areas are required, continental limitations are imposed, or where there is an ongoing requirement to share the sub-band II spectrum with the remaining PMR services.

Although it is subject to change, the planned usage of sub-band III for the local DAB networks is shown in figure 7.1.

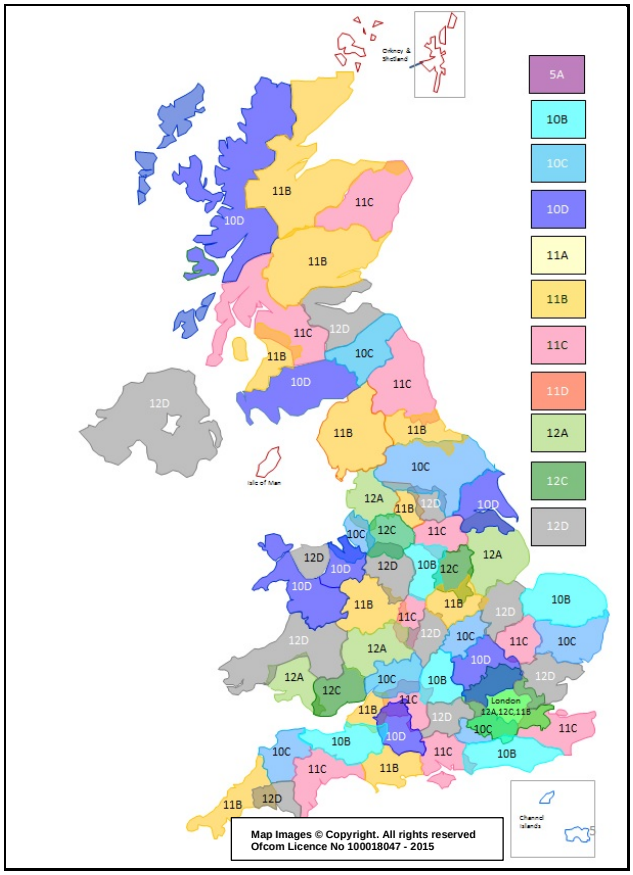


Figure 7.1: Sub-band III block usage for local DAB networks

When developing the notional six block plan for small scale DAB, we assessed the extent of potentially interfering field strengths in order to establish which sub-band III blocks might be available.

This assessment was carried out for interfering field strengths of 29dBµV/m (i.e. a protected wanted field strength of 54dBµV/m with a 25dB protection ratio) or 39dBµV/m (protected field strength of 54dBµV/m with a 15dB 'real world' or relaxed protection ratio). From this, a judgement was made of the interleaved usage which was likely to be acceptable. However, before more firm decisions of acceptability can be made, a more rigorous assessment of the compatibility with existing local DAB services would need to be carried out.

As an example, figure 7.2 and table 7.1 highlight the selection of a possible sub-band III channel for a notional Wetherby small scale DAB multiplex. The maps illustrates the area over which the Wetherby small scale multiplex would put down more than 29dBµV/m, and the areas where the multiplex could cause interference to co-channel multiplexes elsewhere.

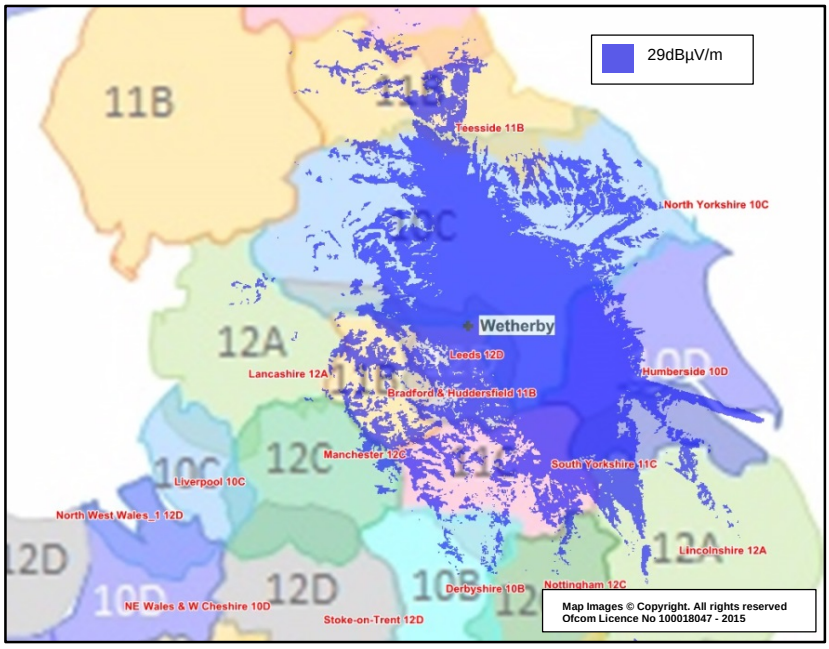


Figure 7.2 Selection of sub-band III block for Wetherby small scale DAB

SBIII Block	Usage	Comment
10B	Derbyshire	*** Possible ***
10C	North Yorkshire	Not available
10D	Humberside	Not available
11B	Bradford/Teesside	Not available
11C	South Yorkshire	Not available
12A	Lincolnshire/Lancashire	Not available
12C	Nottingham	Possible, but adjacent to the local block within Leeds Area
12D	Leeds	Not available

Table 7.1 Selection of Sub-Band III Block for Wetherby small scale DAB

Note: Blocks 11A, 11D and 12B are used for national DAB services, so are not available for small scale DAB.

Table 7.1 suggests that block 10B may be available for use in Wetherby. This potential allocation would need to be investigated further to ensure that the existing Derbyshire DAB multiplex, which uses the same frequency, would be sufficiently protected. This assessment would also need to take into account any further expansion of the Derbyshire local multiplex into areas such as Chesterfield.

Our analysis suggests that in many areas, a sub-band III block would potentially be available for small scale DAB to use. The exceptions are the English East Midlands, Berkshire, Bedfordshire and Buckinghamshire, where we could not identify any sub-band III spectrum.

While PMR services continue to operate in sub-band II, any interim use of available sub-band III frequencies in the English Midlands and the north of England which would limit frequency availability elsewhere until PMR services have vacated this spectrum.

In the English East Midlands, Bedfordshire, Buckinghamshire and Hertfordshire, no sub-band III capacity can be found without impacting upon local DAB services.

Section 8

Discussion & Conclusions

Assumptions

The notional small scale DAB multiplexes described in this study have been planned around the use of sites currently used to provide community and small commercial radio services. Rather than using all sites, the best technical combination of sites has been selected to provide the required composite DAB service.

Our starting assumption is that the small scale DAB sites would typically operate at up to 100W ERP. This is sufficient to provide good coverage over a range of about five kilometres which is similar to that provided by the majority of community services. To achieve 'useful indoor' coverage, it is necessary for the sites to be near to the centre of the service area. Whilst the majority of low power FM sites are suitable, in some areas more suitable sites would ideally need to be found or additional sites provided. In intersection areas, where more than one transmitter provides coverage, an additional advantage would be gained through a reduction in location variability (which should improve reliability of reception).

Results

Using six blocks (sub-band II block 7A, 8A, 8B, 9A, 9B and 9C) to serve many distinct areas over the extent of the UK and Northern Ireland is generally successful. 'Congested' areas have been identified (North Somerset, South Manchester and the East Midlands) where additional spectrum (sub-band III) would be required.

The notional small scale DAB plan has been based around current low power FM requirements. Many areas are not covered by these analogue services and therefore have not been considered in this study. The 'six block plan' could be extended to many of these and other areas, though in congested areas, the use of sub-band III spectrum would also need to be investigated.

Temporary PMR constraints

Although the majority of PMR services have migrated away from sub-band II, any future deployment of small scale DAB will need to take into account the presence of PMR in south Yorkshire, the east midlands, Merseyside and Aberdeen until perhaps 2020. This will place a temporary limitation on sub-band II spectrum availability, placing constraints on the roll out of small scale DAB within the North of England, the English midlands, the northern home counties and north west England. The limitations imposed by PMR in the Aberdeen area should not impact upon small scale DAB roll out. Analysis within this study indicates that a third of areas investigated may not be compatible with the remaining PMR services.

The approach traditionally taken to ensure compatibility with PMR services, including the methods employed and areas to be protected, may benefit from review.

International compatibility and coordination

Because the notional small scale DAB sites operate at low power, interference to the continent and Ireland should be minimal. Analysis of the power sum from each sub-band III block (7D, 8A, 8B, 9A, 9B & 9C) to test points along the continental coast, indicate that coordination agreements for outgoing interference with French, Belgian and Dutch administrations could be possible.

Where possible, blocks have been avoided for UK coastal sites that are planned to be used in adjacent locations by France, Belgium and The Netherlands. As the proposed continental and Irish networks are planned to operate at considerably higher powers, the impact upon the small scale DAB networks may be significant, although much will depend on what is actually implemented in other countries.

From the proposed French network, blocks 7D, 8A and 8B are significantly impacted on the south and south east coast if we use traditional DAB planning parameters. We plan to carry out further work to assess what planning parameters, such as location variability, are appropriate for small scale DAB.[12]. We also plan to engage in more detail with neighbouring administrations about their plans to implement DAB or other networks in Band III. By negotiating restrictions, especially for French coastal transmitter sites, the French interference constraints may be improved. Information is yet to be received regarding the second regional and local French networks.

The proposed Irish networks operate on four of the sub-band II blocks (7D, 8A, 9A 9C) as well as DTT. By amending our planning parameters to take 'real world' conditions into account (i.e. considering a reduction in location availability) and negotiating further restrictions, the majority of small scale DAB proposals in challenging areas could be viable[13]. As PMR services do not operate within sub-band I (channels 5 & 6) in Northern Ireland, this capacity could be considered for use to overcome interference or to provide additional services.

Detailed information is not available from Belgium or The Netherlands. However, it is understood that channel 8 would be used by the Dutch adjacent to the coast and channels 7, 8 and 9 may not be widely used for high power services in Belgium. Where possible, channel 8 has been avoided in the east of England region. The situation will need to be analysed when more detailed information becomes available.

It is possible that neighbouring administrations will wish to implement their own small scale DAB services. While this will place an extra demand on spectrum, it might allow a common group of blocks be to agreed, where low power implementation is simplified.

Indoor coverage is generally protected against interference and this should not change. The need to use spectrum efficiently means that mobile coverage is often limited by co-block interference. This will result in coverage changes occurring as more multiplexes come on air over time. This coverage 'breathing' cannot be avoided, so the detailed frequency planning

[12] The small scale DAB proposal in this study for Chichester would need to be re-addressed.
[13] The small scale DAB proposal in this study for Omagh & Enniskillen and Downpatrick would need to be re-addressed.

will need to establish that the worst case mobile coverage (modelled at 1% time) is acceptable. Analysing coverage with two co-block protection ratios or relaxing the time availability would allow the extent of interference to be understood and accepted.

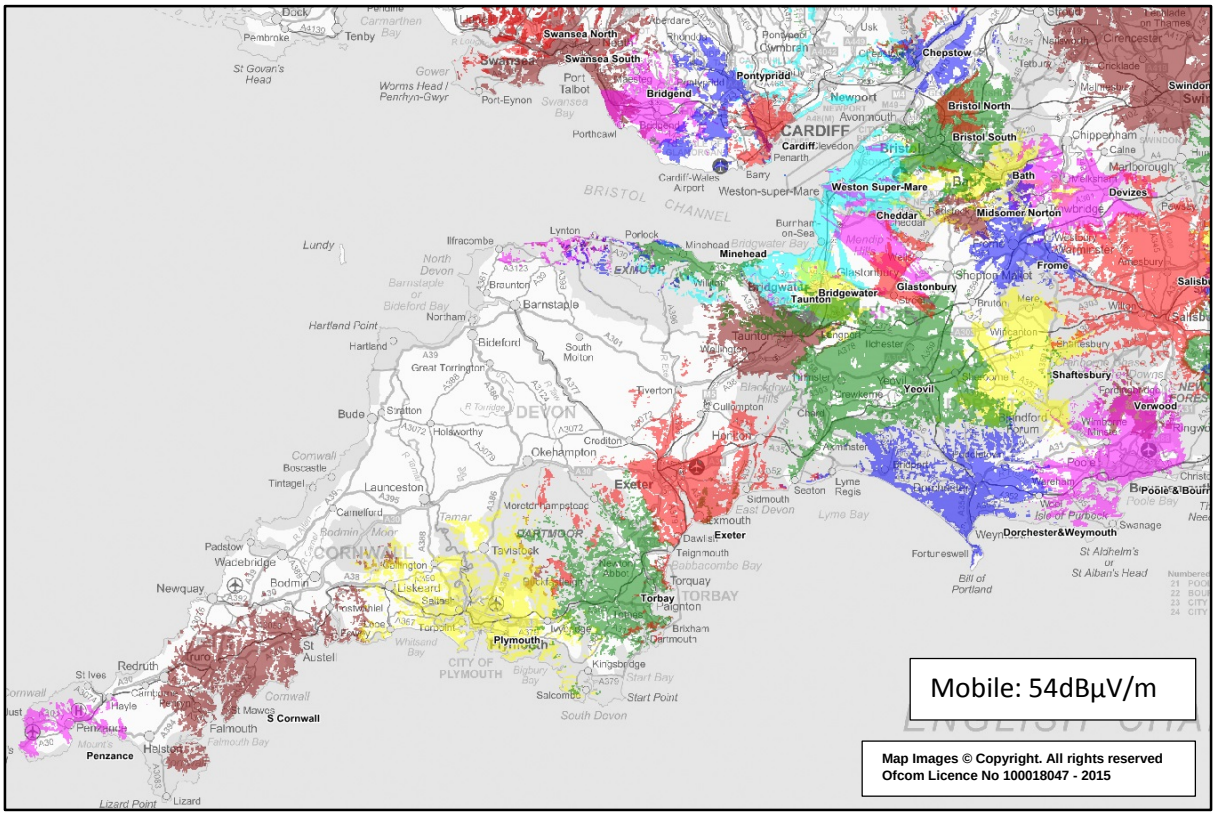
Additional spectrum in sub-band III is available in many areas

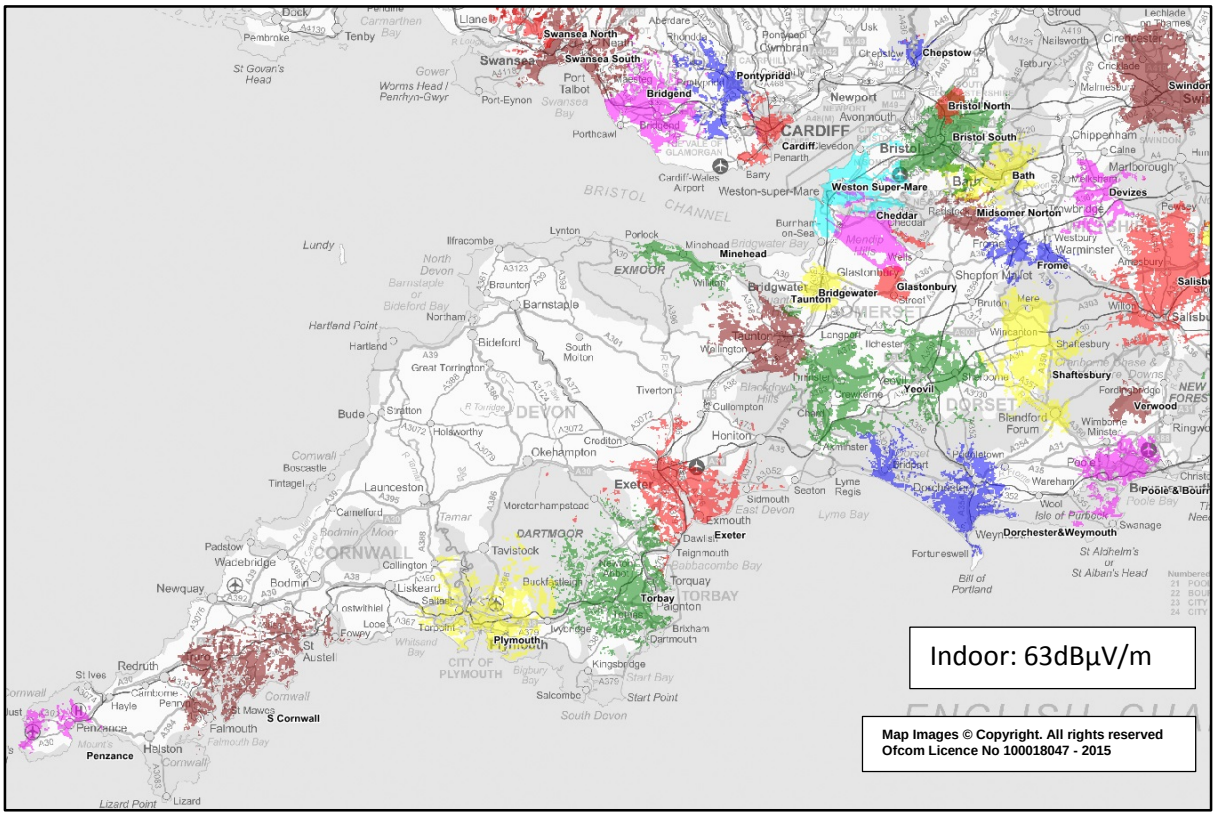
In developing the six block plan, the availability of sub-band III blocks has been investigated. Whilst in many areas a possible sub-band III block can be found, in areas such as the English east midlands, Bedfordshire, Buckinghamshire and Hertfordshire, no sub-band III capacity can be found.

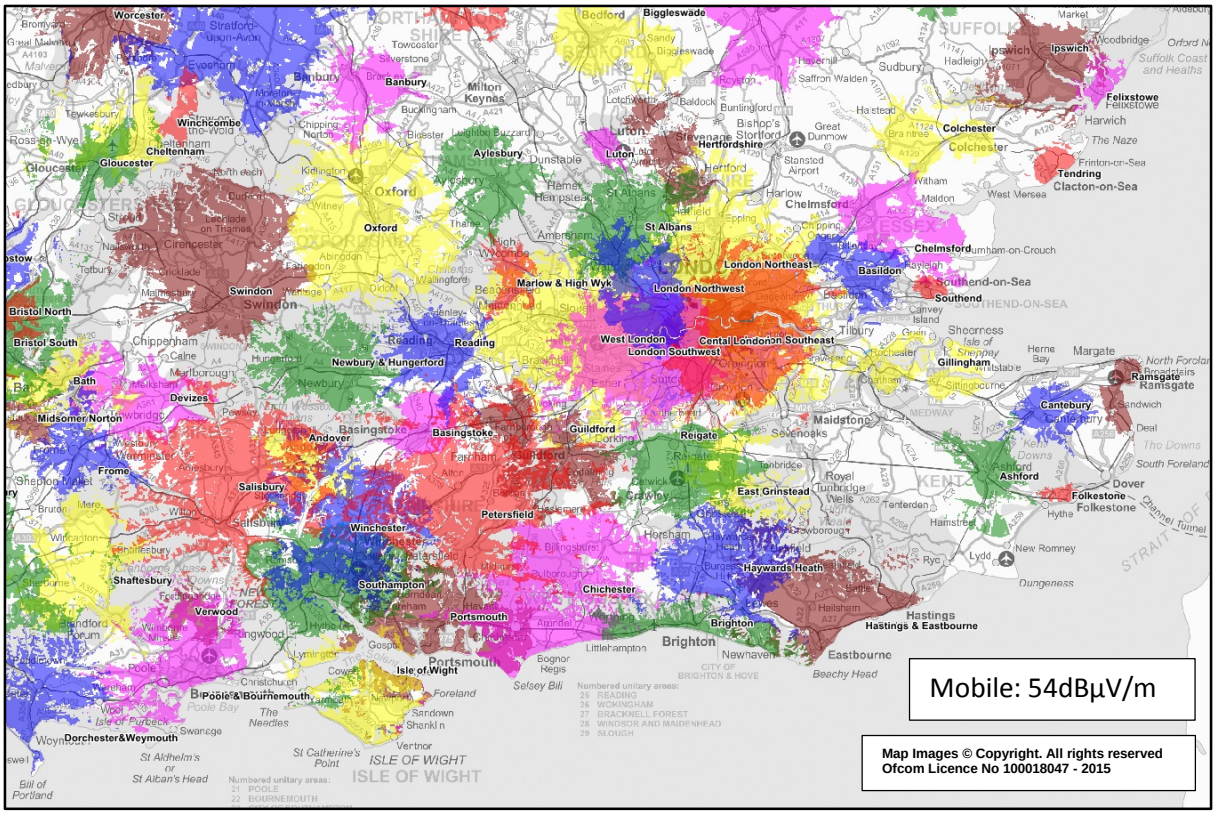
While PMR services are still present in sub-band II, we would need to make use of sub-band III frequencies in many adjacent areas. Sub-band III blocks may provide a solution in areas of congestion, but can only provide a limited solution until the remaining PMR services have vacated the sub-band II spectrum. In more detailed investigations into sub-band III availability, the operators of existing services may need to be consulted on the acceptability of specific proposals.

Annex 1

Indicative coverage maps



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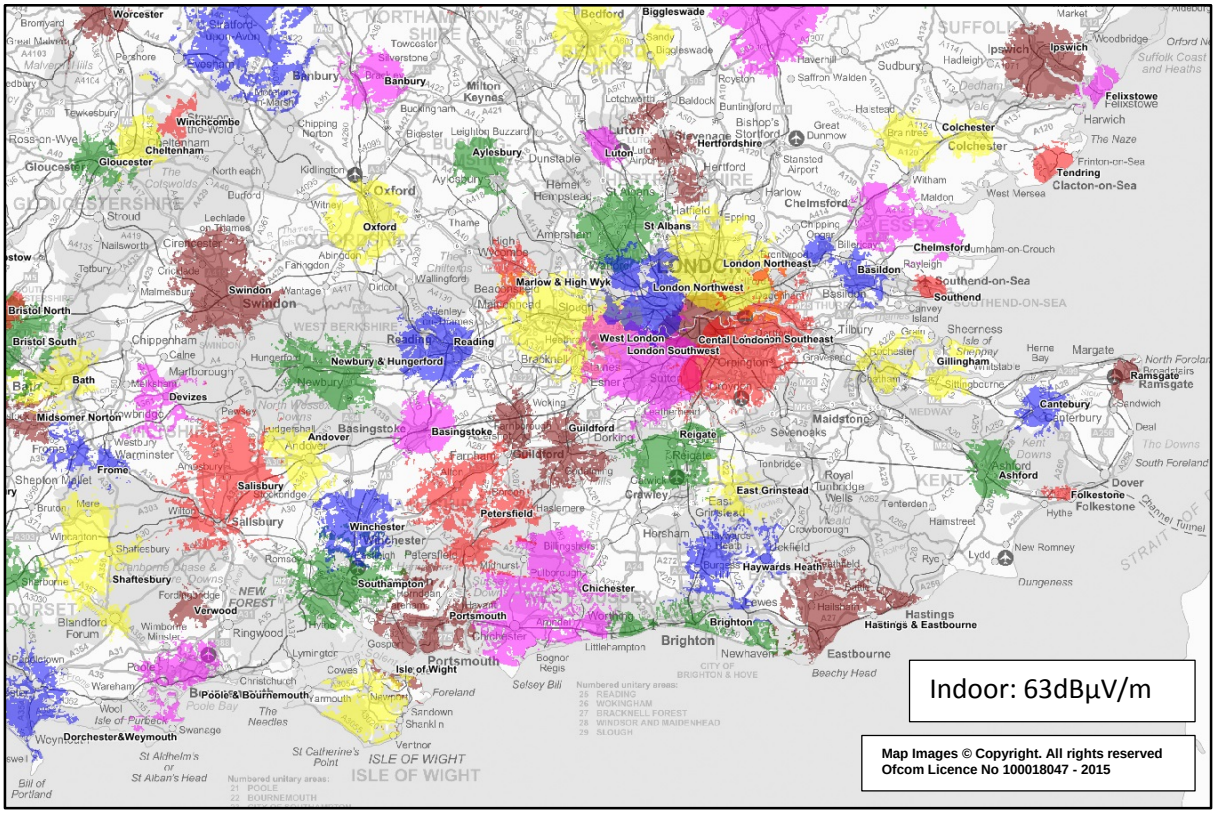
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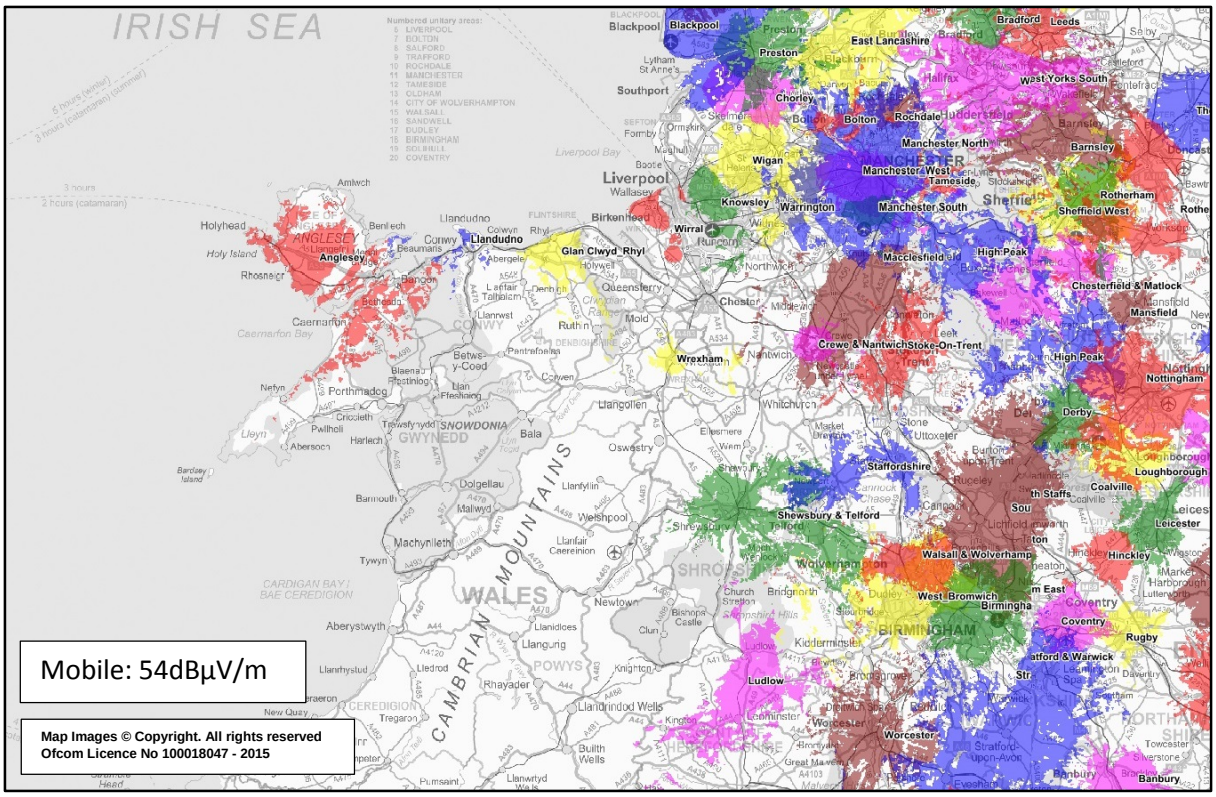
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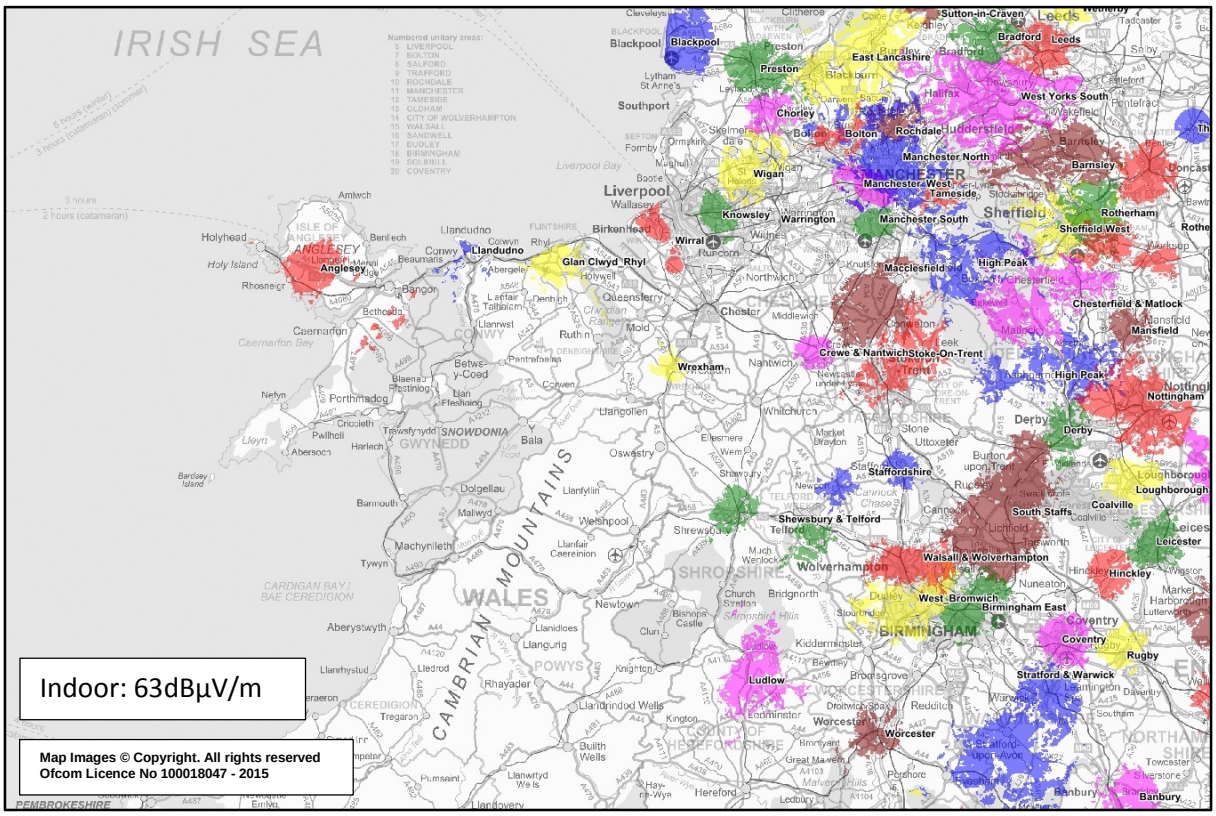
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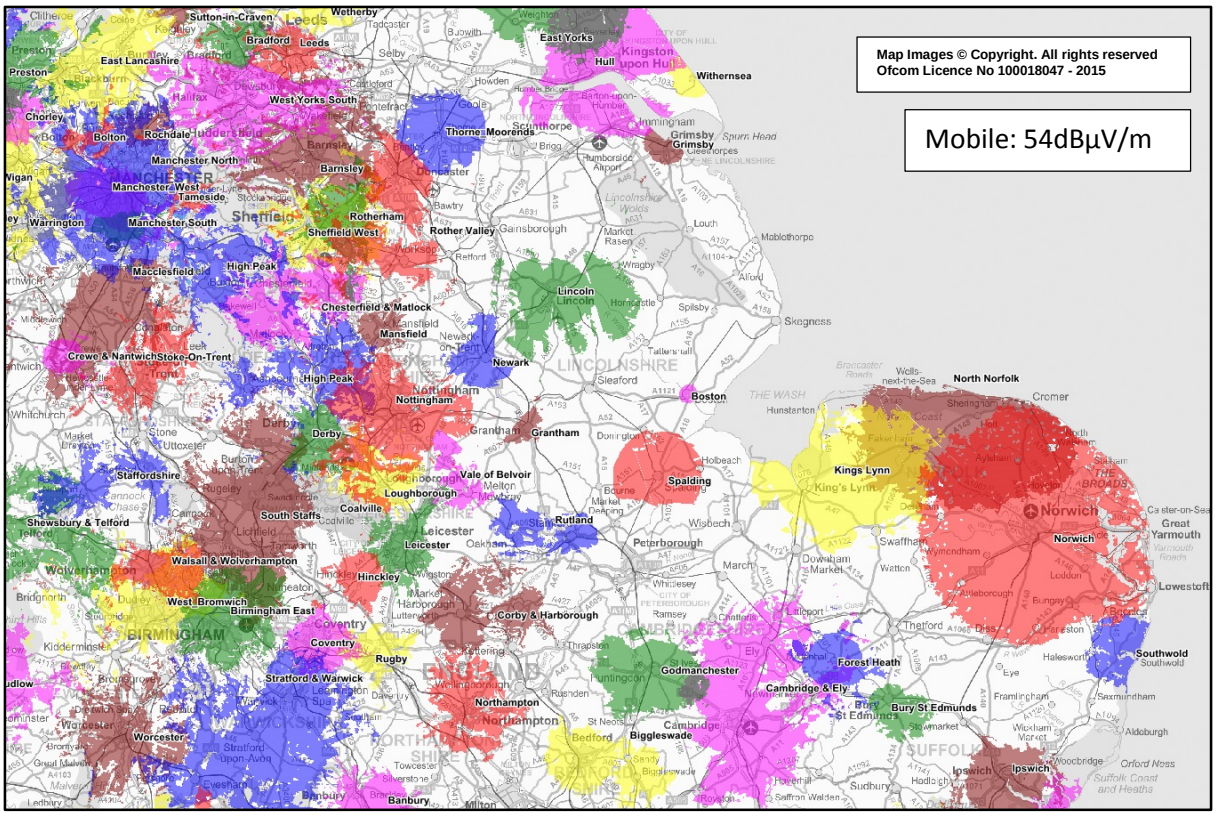
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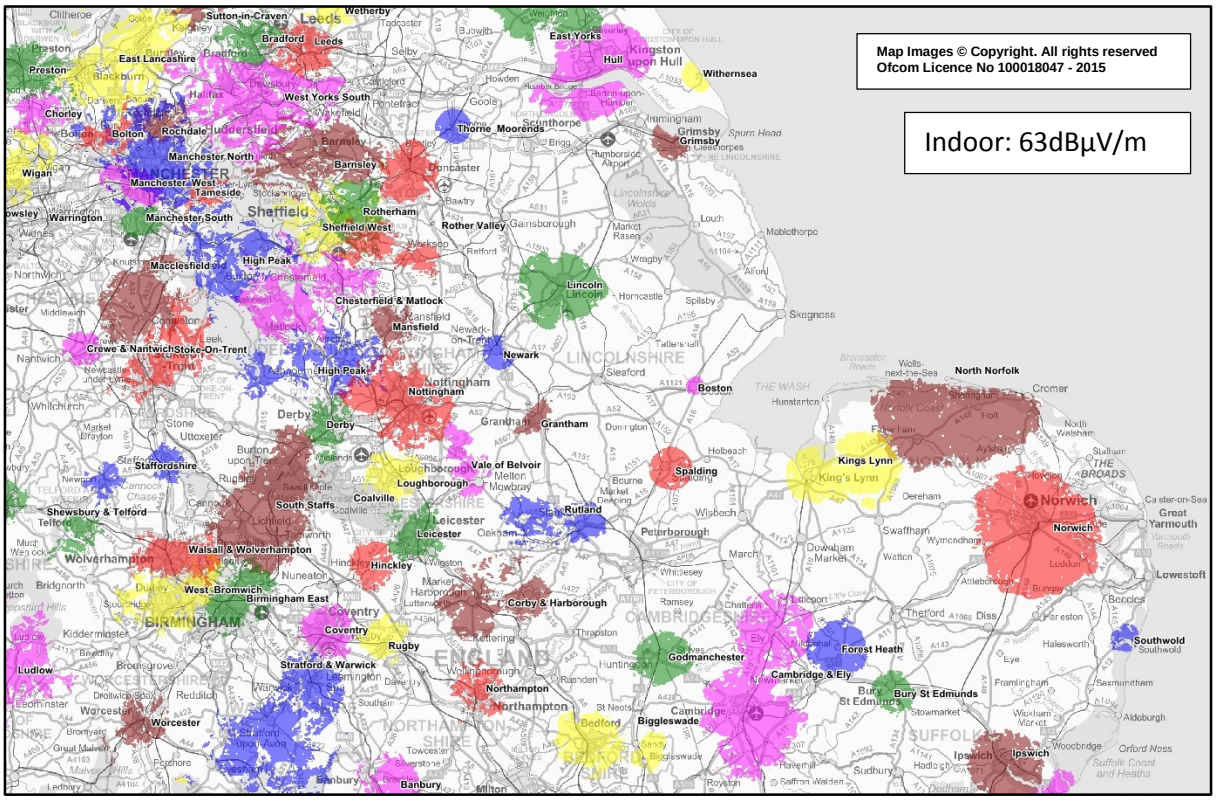
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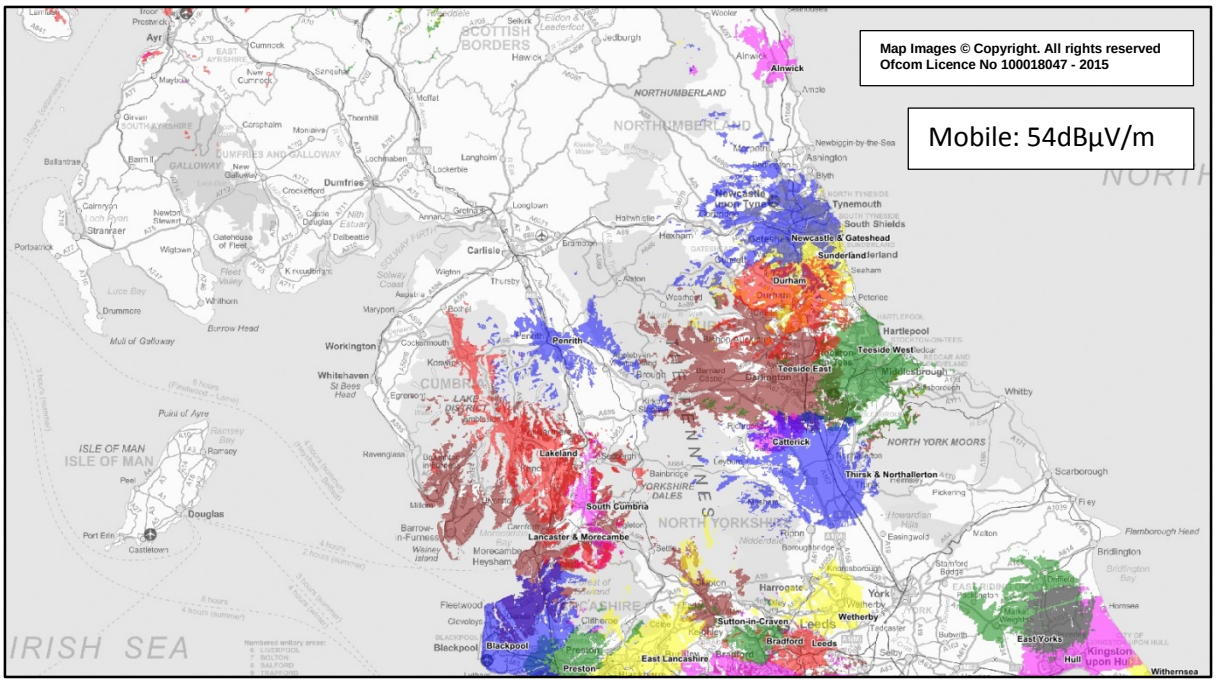
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NORTH YORKSHIRE
LANCASHIRE
PENNINES
Ayr
Dumfries
Carlisle
Workington
Whitehaven
Penrith
Lakeland
South Cumbria
Lancaster & Morecambe
Blackpool
Preston
East Lancashire
Newcastle upon Tyne
Tynemouth
South Shields
Newcastle & Gateshead
Sunderland
Durham
Hartlepool
Teeside West
Teeside East
Middlesbrough
Whitby
Catterick
Thirsk & Northallerton
Scarborough
Harrogate
York
Wetherby
Leeds
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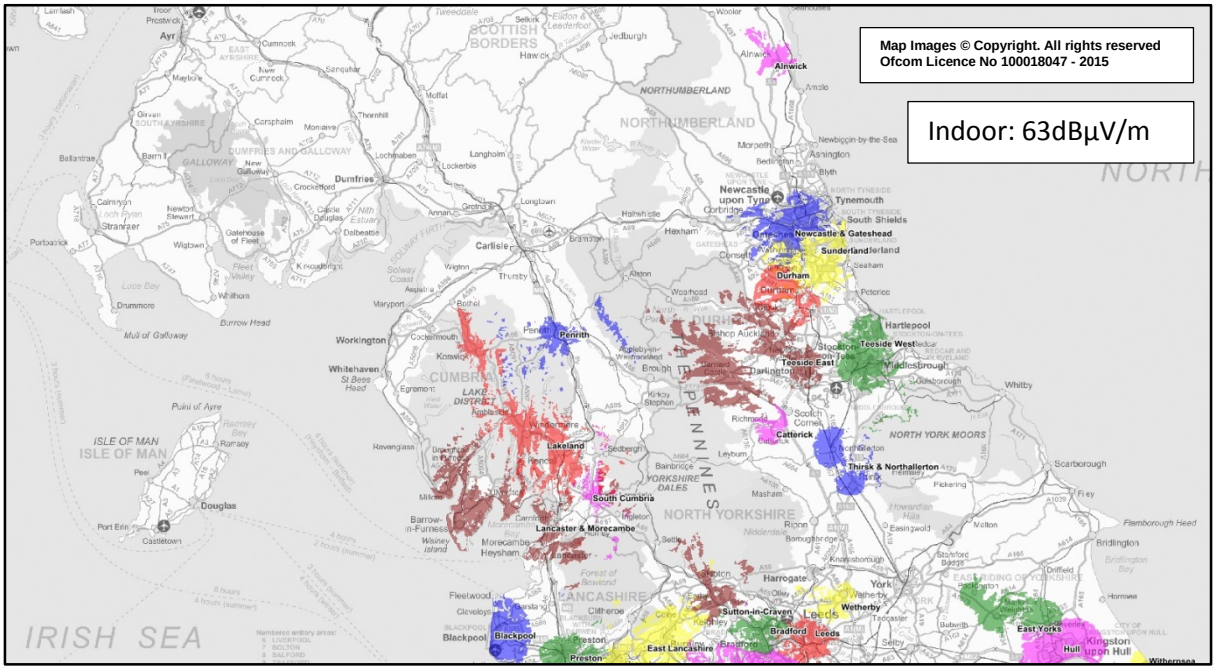
Berwick-upon-Tweed
Withernsea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LANCASHIRE
PENNINES
Ayr
Dumfries
Carlisle
Workington
Whitehaven
Penrith
Lakeland
South Cumbria
Lancaster & Morecambe
Blackpool
Preston
East Lancashire
Newcastle upon Tyne
Tynemouth
South Shields
Newcastle & Gateshead
Sunderland
Durham
Hartlepool
Teeside West
Teeside East
Middlesbrough
Whitby
Catterick
Thirsk & Northallerton
Scarborough
Harrogate
York
Wetherby
Leeds
Bradford
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East Yorks
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Kingston upon Hull
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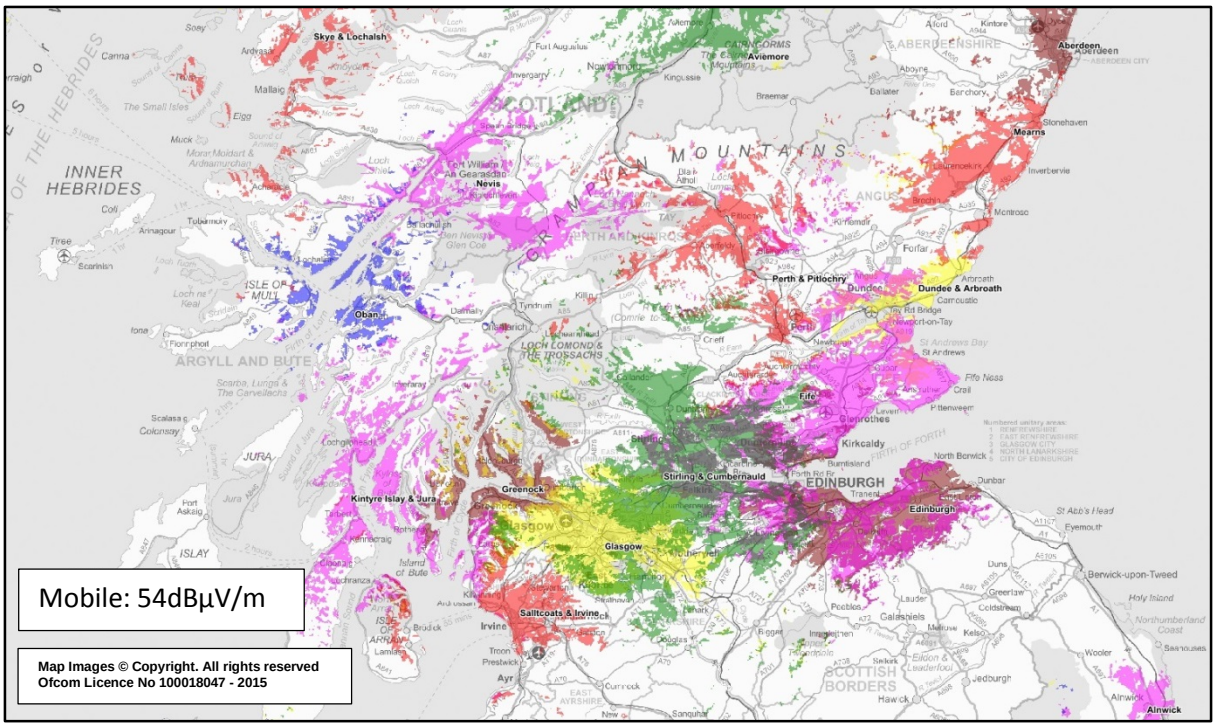
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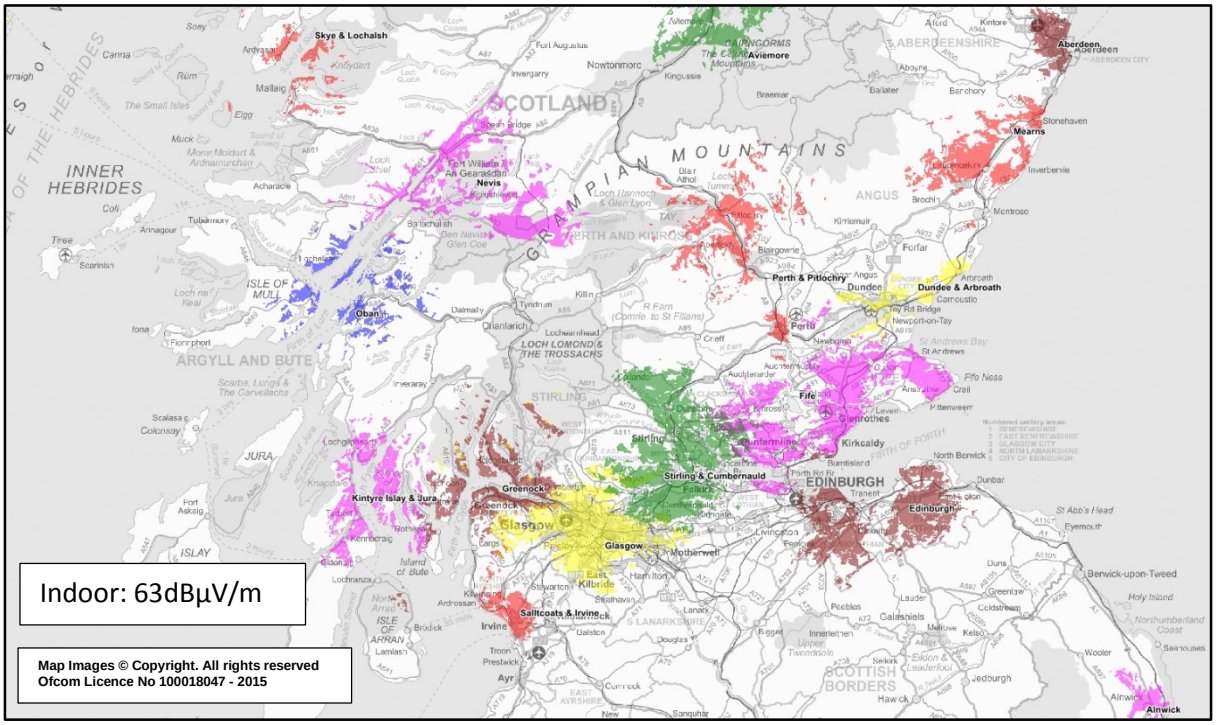
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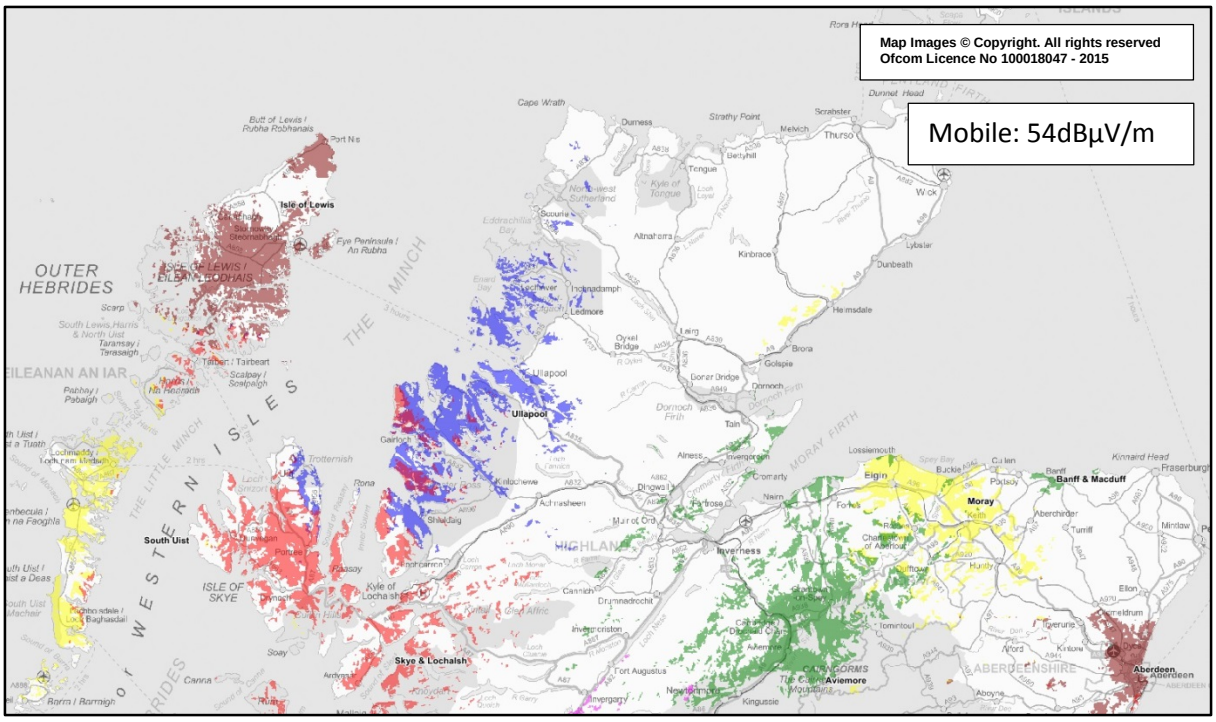
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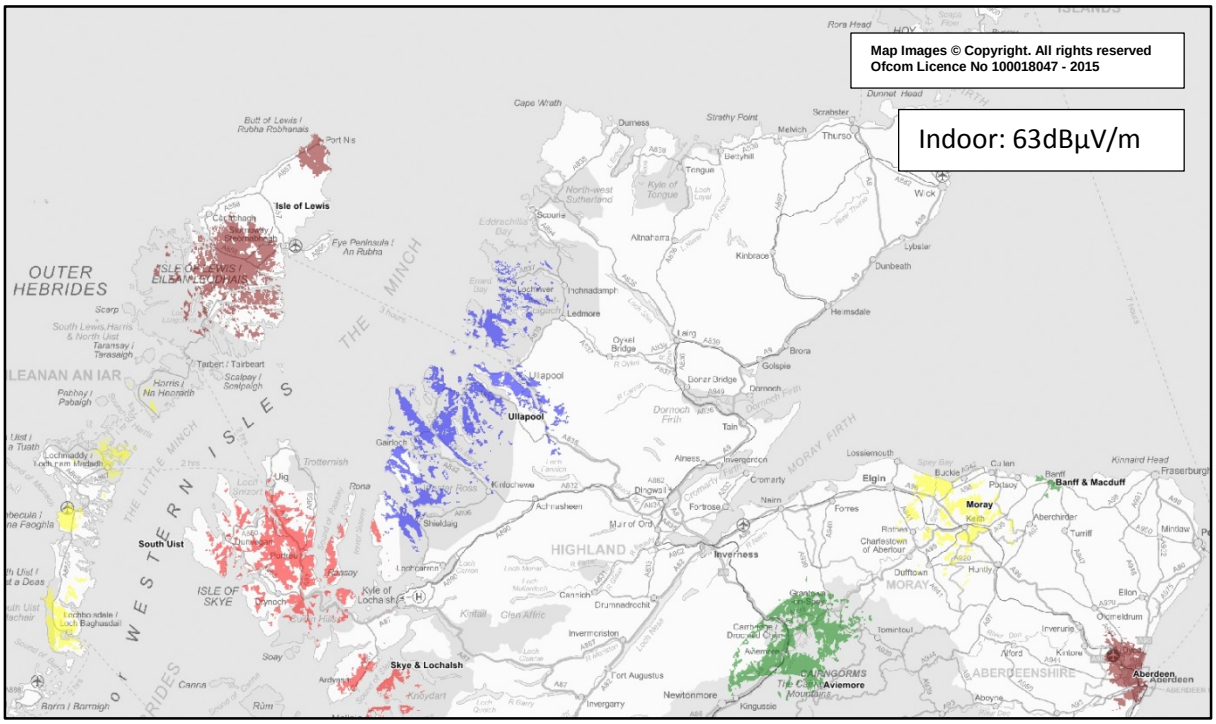
Ullapool
HIGHLAND
Inverness
Aviemore
CAIRNGORMS
ABERDEENSHIRE
Aberdeen
Elgin
Moray
Banff & Macduff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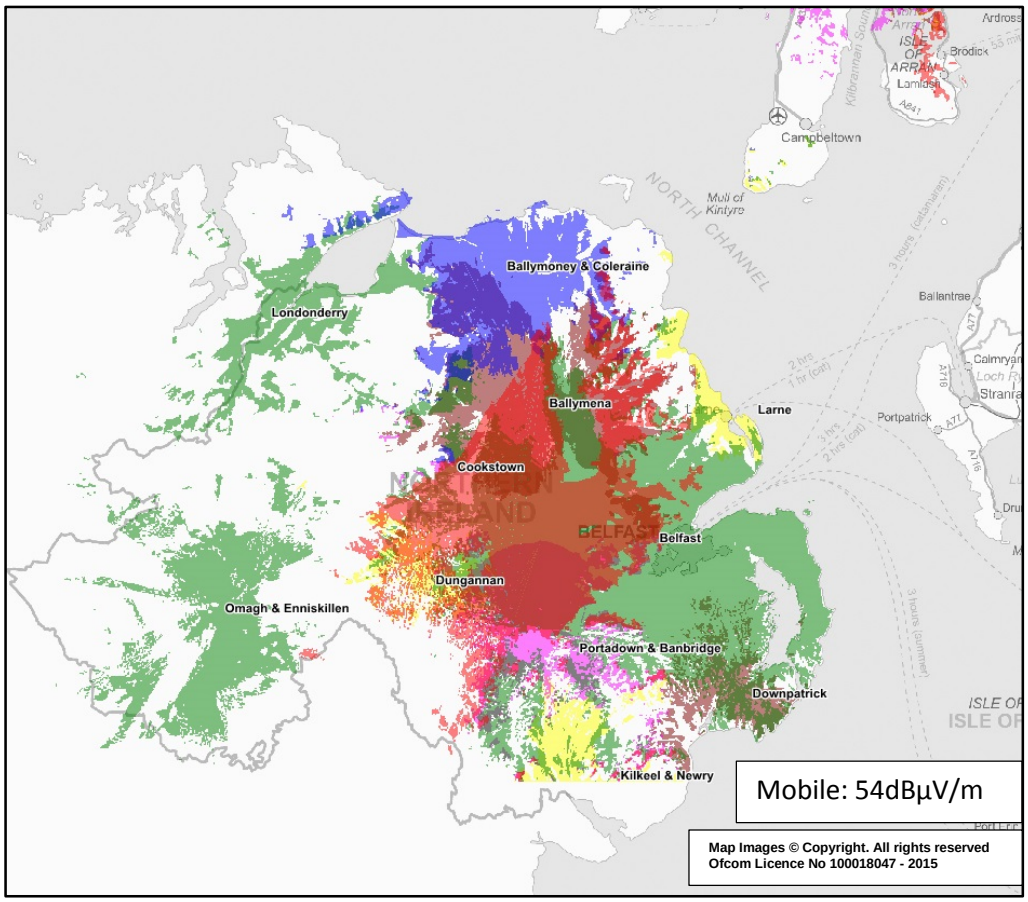
Indoor: 63dBµV/m
OUTER HEBRIDES
THE MINCH
THE WESTERN ISLES
Isle of Lewis
South Uist
ISLE OF SKYE
Skye & Lochalsh
Ullapool
HIGHLAND
Inverness
Aviemore
CAIRNGORMS
ABERDEENSHIRE
Aberdeen
Elgin
Moray
Banff & Macduff


Ballymoney & Coleraine
Londonderry
Ballymena
Larne
Cookstown
BELFAST
Belfast
Dungannon
Omagh & Enniskillen
Portadown & Banbridge
Downpatrick
Kilkeel & Newry
Campbeltown
Ballantrae
Portpatrick
Mobile: 54dBµV/m
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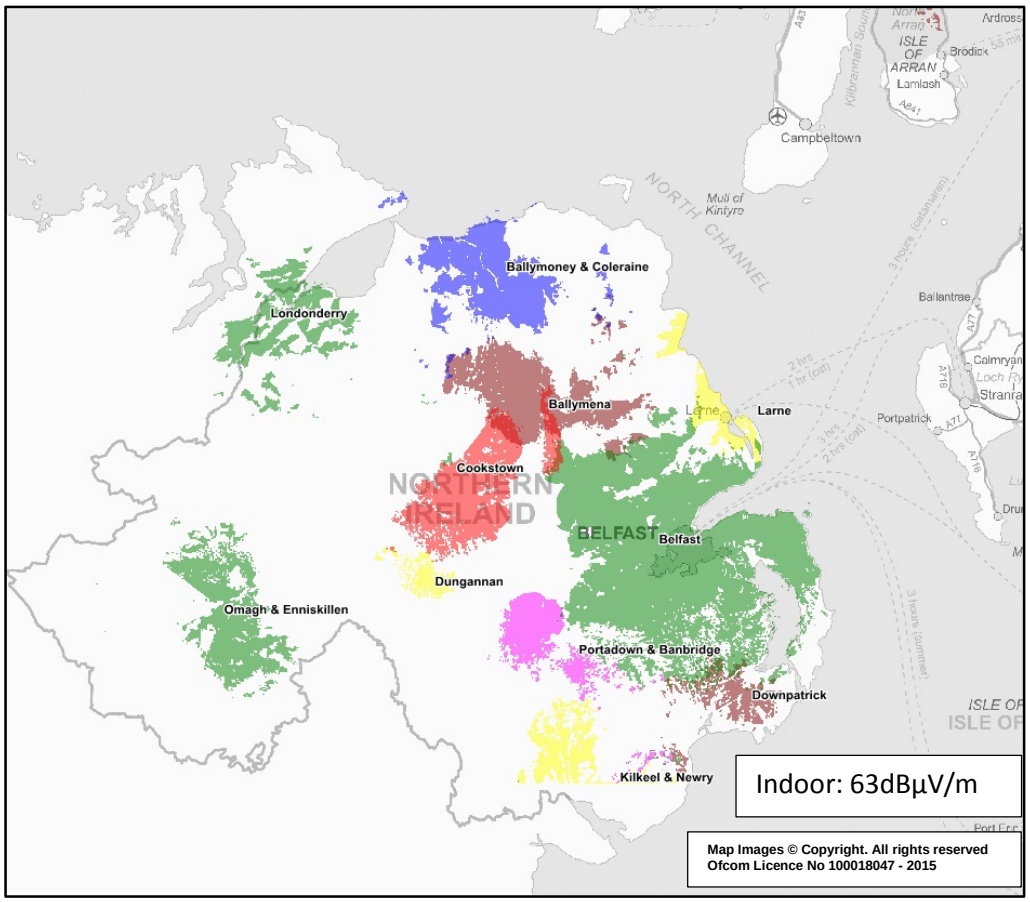
Ballymoney & Coleraine
Londonderry
Ballymena
Larne
Cookstown
NORTHERN IRELAND
BELFAST
Belfast
Dungannon
Omagh & Enniskillen
Portadown & Banbridge
Downpatrick
Kilkeel & Newry
Campbeltown
Ballantrae
Portpatrick
Indoor: 63dBµV/m
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Annex 2

Site data for a notional small scale DAB network

ICS Stn	Callsign	Multiplex	Service Area	TX Site	Service	X	Y	Site Hgt m a.s.l.	Antenna Hgt m	ERP W	Omni/Dir	Block	Frequency MHz	Network ID	Comment	PMR Impact
1	SW2_CR114	S Cornwall	Falmouth	Penryn	The Source	176900	34700	110	20	100	Dir	7D	194.064	SS_Southwest_2		
2	SW2_CR248	S Cornwall	Truro	Truro	CHBN	179800	45300	93	25	100	Dir	7D	194.064	SS_Southwest_2		
3	SW2_CR252H	S Cornwall	South Cornwall	Tregony	The Hub	191250	45650	89	15	100	Omni	7D	194.064	SS_Southwest_2		
4	SW2_CR252M	S Cornwall	Mevagissey	Mevagissey	The Hub	201440	45593	74	8	100	Dir	7D	194.064	SS_Southwest_2		
5	SW2_CR252S	S Cornwall	ST Mawes	St Mawes	The Hub	184992	33598	59	12	100	Dir	7D	194.064	SS_Southwest_2		
6	SW2_CR115	S Cornwall	S. Cornwall	St Austell RFC	Radio St Austell	202500	51100	77	15	100	Dir	7D	194.064	SS_Southwest_2		
8	SW1_CR249S	Penzance	St Just	St Just	Penwith Radio	137900	30800	156	12	100	Dir	8B	197.648	SS_Southwest_1		
9	SW1_CR249P	Penzance	Penzance	Penzance	Penwith Radio	147350	29350	0	22	100	Dir	8B	197.648	SS_Southwest_1		
12	SW3_AL328	Plymouth	Plymouth	Plymouth	Radio Plymouth	249700	51700	116	66	100	Dir	8A	195.936	SS_Southwest_3	Extra site for Saltash needed	
15	SW5_AL303	Torbay	Torbay	Totnes	Palm FM	285700	61900	175	80	100	Omni	9A	202.928	SS_Southwest_5		
17	SW4_CR236	Exeter	Exmouth	Exmouth	Bay FM Radio	303441	83891	123	30	100	Omni	9C	206.352	SS_Southwest_4		
18	SW4_AL318	Exeter	Exeter	Exmouth	Radio Exeter	289800	92200	92	40	100	Omni	9C	206.352	SS_Southwest_4		
20	SW32_AL260P	Minehead	Porlock	Porlock	The Breeze	288300	146200	174	21	100	Dir	9A	202.928	SS_Southwest_32		
21	SW32_AL260M	Minehead	Minehead	Minehead North	The Breeze	296500	147200	159	15	100	Dir	9A	202.928	SS_Southwest_32		
23	SW6_CR109	Taunton	Wiveliscombe	Wiveliscombe	10Radio	310600	126250	147	10	100	Omni	7D	194.064	SS_Southwest_6		
24	SW6_CR241	Taunton	Taunton	Musgrove Park Hospital	Apple	321500	124100	20	26	100	Dir	7D	194.064	SS_Southwest_6		
27	SW7_CR240	Bridgewater	Bridgewater	Westfield House	Access FM	329350	136750	10	38	100	Dir	8A	195.936	SS_Southwest_7		
28	SW17_AL249	Weston Super-Mare	Weston Super-Mare	Weston Super-Mare	The Breeze	332507	162678	105	42	100	Dir	11C	220.352	SS_Southwest_17	SB III Block	
29	SW16_CR239	Cheddar	Cheddar	Fry's Hill	Pulse	343600	155700	234	20	50	Dir	8B	197.648	SS_Southwest_16		
30	SW15_CR117	Glastonbury	Glastonbury	Glastonbury	Glastonbury FM	348600	138100	9	12	100	Omni	9C	206.352	SS_Southwest_15		
31	SW10_CR235Y	Yeovil	Yeovil	Charlock Hill	The Breeze	361404	117882	144	17	100	Dir	9A	202.928	SS_Southwest_10		
33	SW10_CR235S	Yeovil	Sherborne	Sherborne	Radio Sherborne	364000	117900	115	17	100	Omni	9A	202.928	SS_Southwest_10		
35	SW8_AL154R	Dorchester&Weymouth	Dorchester & Weymouth	Bridport	Wessex FM	345305	91484	68	35	100	Dir	9B	204.64	SS_Southwest_8		
36	SW8_AL154B	Dorchester&Weymouth	Dorchester & Weymouth	Bincombe	Wessex FM	368703	84785	148	45	100	Omni	9B	204.64	SS_Southwest_8	Better site serving Dorchester 'indoors' needed	
38	SW21_CR232	Bristol North	Bristol North	Bradley Stoke	Bradley Stoke	361204	182477	67	14	100	Omni	9C	206.352	SS_Southwest_21		
39	SW20_AL247	Bristol South	Bristol	Pur Down	The Breeze	361004	176377	82	65	100	Omni	9A	202.928	SS_Southwest_20		
40	SW20_CR116	Bristol South	Bristol	Bristol	Ujima Radio	360300	174000	13	51	100	Omni	9A	202.928	SS_Southwest_20		
43	SW19_AL248	Bath	Bath	Bath	The Breeze	376902	165478	177	41	100	Dir	8A	195.936	SS_Southwest_19		
44	SW18_CR113	Midsomer	Midsomer	Midsomer	Somer Valley FM	368103	156279	152	17	100	Omni	7D	194.064	SS_Southwest_18		
45	SW9_CR230	Frome	Frome	Frome	Frome FM	377400	147800	107	12	100	Dir	9B	204.64	SS_Southwest_9		
47	SW9_CR229	Frome	Warminster	Warminster	WCR	387300	145100	111	19	100	Omni	9B	204.64	SS_Southwest_9		
49	SW11_AL179B	Shaftesbury	Blandford	North Dorset	The Breeze	388799	107100	64	15	100	Omni	8A	195.936	SS_Southwest_11		
51	SW11_AL179S	Shaftesbury	Shaftesbury	Shaftesbury	The Breeze	386401	123481	211	35	100	Dir	8A	195.936	SS_Southwest_11		
53	SW13_CR063	Verwood	Verwood	Cranevalley Golf	Forest FM	406699	108983	58	15	100	Omni	7D	194.064	SS_Southwest_13		

ICS Stn	Callsign	Multiplex	Service Area	TX Site	Service	X	Y	Site Hgt m a.s.l.	Antenna Hgt m a.g.l.	ERP W	Omni/Dir	Block	Frequency MHz	Network ID	Comment	PMR Impact
54	SW12_CR120	Poole & Bournemouth	Poole	Poole	Hot Radio	403400	93300	64	25	100	Omni	8B	197.648	SS_Southwest_12		
55	SW12_CR086	Poole & Bournemouth	Bournemouth	Poole House_Universit	Hope FM	407300	93700	50	31	100	Omni	8B	197.648	SS_Southwest_12		
57	SW14_AL145	Salisbury	Salisbury	Camp Hill	Spire FM	411199	133681	135	21	100	Omni	9C	206.352	SS_Southwest_14	Better site serving Salisbury 'indoors' needed	
58	SW14_CR092	Salisbury	Bulford	Bulford	Salisbury Plain	419498	142880	194	24	100	Omni	9C	206.352	SS_Southwest_14		
60	SW23_CR231	Devizes	Devizes	Devizes	Fantasy Radio	400600	161300	128	20	100	Omni	8B	197.648	SS_Southwest_23		
61	SW22_AL304	Swindon	Swindon	Blunsdom	Jack FM	414299	189976	146	45	100	Omni	7D	194.064	SS_Southwest_22		
62	SW22_CR119	Swindon	Swindon	Brunel Tower	Swindon FM	414899	184676	100	89	100	Omni	7D	194.064	SS_Southwest_22		
63	SW24_CR054	Gloucester	Gloucester	Clapham Court	Gloucester FM	383502	218873	15	36	100	Omni	9A	202.928	SS_Southwest_24		
64	SW25_AL225	Cheltenham	Cheltenham	Cheltenham	The Breeze	394800	221673	68	57	100	Omni	8A	195.936	SS_Southwest_25		
65	SW26_CR233	Winchcombe	Winchcombe	Winchcombe	Radio	402300	228573	96	13	100	Omni	9C	206.352	SS_Southwest_26		
1	S1_AL317	Andover	Andover	Andover	The Breeze	437200	144550	118	10	100	Omni	8A	195.936	SS_South_1		
2	S1_CR093	Andover	Ludgershall	Tidworth	Castledown	425300	150200	135	9	100	Omni	8A	195.936	SS_South_1		
4	S4_AL1104V	Isle of Wight	IOW	Ventnor	Isle of Wight	456700	78300	208	40	40	Dir	8A	195.936	SS_South_4		
5	S4_AL1104R	Isle of Wight	IOW	Ryde Pier	Isle of Wight	459300	93700	0	13	50	Dir	8A	195.936	SS_South_4		
6	S4_AL1104C	Isle of Wight	IOW	Cowes	Isle of Wight	449600	96300	4	10	100	Dir	8A	195.936	SS_South_4		
7	S4_AL1104H	Isle of Wight	IOW	Chillerton Down	Isle of Wight	447500	83500	165	140	25	Omni	8A	195.936	SS_South_4		
10	S3_AL239	Southampton	Southampton	Chilworth	The Breeze	440600	118000	85	24	100	Dir	9A	202.928	SS_South_3		
11	S3_CR008	Southampton	Southampton	Midanbury	Unity 101	444700	114200	59	14	100	Omni	9A	202.928	SS_South_3		
12	S3_CR213	Southampton	Southampton	Southampton_Solent_Uni	VOICE FM	442200	112200	10	33	100	Omni	9A	202.928	SS_South_3		
13	S3_CR009	Southampton	Southampton	Hedge End	Skyline Gold	448000	112800	49	20	100	Dir	9A	202.928	SS_South_3	Better site serving Fareham needed ?	
15	S2_AL241	Winchester	Winchester	Crabwood Farm II	The Breeze	444950	129450	150	42	100	Omni	9B	204.64	SS_South_2		
16	S10_AL256H	Newbury & Hungerford	Hungerford	Hungerford	The Breeze	433800	167401	128	17	100	Omni	9A	202.928	SS_South_10		
17	S10_AL256N	Newbury & Hungerford	Newbury	Newbury	The Breeze	445250	164800	126	46	100	Omni	9A	202.928	SS_South_10		
19	S5_AL238	Portsmouth	Portsmouth	Fort Southwick	The Breeze	462600	106900	117	18	100	Omni	7D	194.064	SS_South_5		
20	S5_CR006	Portsmouth	Portsmouth	Ladywood House	Express FM	464500	99900	4	79	100	Omni	7D	194.064	SS_South_5		
21	S5_CR002	Portsmouth	Havant	Havant	Angel Radio	472593	106983	14	30	30	Omni	7D	194.064	SS_South_5		
23	S12_AL146H	Petersfield	Hindhead	Hindhead	The Breeze	488600	135600	242	15	100	Dir	9C	206.352	SS_South_12		
24	S12_AL145A	Petersfield	Haslemere	Haslemere	The Breeze	488500	133150	169	30	100	Dir	9C	206.352	SS_South_12		
25	S12_AL146P	Petersfield	Petersfield	Petersfield	The Breeze	474800	123300	61	20	100	Omni	9C	206.352	SS_South_12		
26	S12_AL146F	Petersfield	Four_Marks	Four Marks	The Breeze	466500	136600	214	16	100	Dir	9C	206.352	SS_South_12		
27	S12_AL146L	Petersfield	Alton I	Brockham Hill	The Breeze	472300	142800	211	28	100	Dir	9C	206.352	SS_South_12		

ICS Stn	Callsign	Multiplex	Service Area	TX Site	Service	X	Y	Site Hgt m a.s.l.	Antenna Hgt m a.g.l.	ERP W	Omni/Dir	Block	Frequency MHz	Network ID	Comment	PMR Impact
29	S6_AL182M	Chichester	Midhurst	Midhurst	Spirit FM	491100	125000	180	81	100	Dir	8B	197.648	SS_South_6		
30	S6_AL182C	Chichester	Chichester	The Trundle	Spirit FM	487600	111100	197	30	100	Dir	8B	197.648	SS_South_6		
31	S6_AL182L	Chichester	Littlehampton	Hammerpot	Spirit FM	507190	105483	36	21	100	Dir	8B	197.648	SS_South_6		
33	S15_CR210	Guildford	Farnborough	Farnborough	BGWS	486100	157300	62	10	100	Omni	7D	194.064	SS_South_15		
34	S15_CR096	Guildford	Aldershot	Aldershot	BFBS	486400	151200	100	20	100	Omni	7D	194.064	SS_South_15		
35	S15_CR220	Guildford	Guildford	Hoggs Back	Kane FM	497500	148600	138	30	100	Omni	7D	194.064	SS_South_15		
37	S11_AL212	Basingstoke	Basingstoke	Fanum House	The Breeze	464900	152701	87	88	100	Dir	8B	197.648	SS_South_11		
38	S14_AL273	Reading	Reading	Park Royal Water Tower	Jack FM	466450	172900	100	48	100	Omni	9B	204.64	SS_South_14		
39	S14_CR214	Reading	Reading	Reading	One Ummah FM	474000	172500	58	20	100	Dir	9B	204.64	SS_South_14		
41	S13_AL193	Oxford	Oxford	Boars Hill	Jack FM	448250	203000	162	51	100	Dir	8A	195.936	SS_South_13		
43	S24_AL159	Aylesbury	Aylesbury	Quainton Hill	Mix 96	474993	221273	183	40	100	Dir	9A	202.928	SS_South_24	Better site serving Aylesbury 'indoors' needed	
44	S23_CR208	Marlow & High Wyk	High Wycombe	High Wycombe	High Wycombe_CR	485039	192646	145	38	100	Dir	9C	206.352	SS_South_23		
45	S23_CR209	Marlow & High Wyk	Marlow	Handy Cross Fm	Marlow FM	486000	185700	27	15	100	Dir	9C	206.352	SS_South_23		
47	S47_AL299	Banbury	Banbury	Farthinghoe	Touch FM	453350	238700	156	46	100	Omni	8B	197.648	SS_South_47	Extra site serving Banbury 'indoors' needed	Zycomm BS
48	S25_AL148	West London	Slough	Slough	Time 106	495391	181377	34	110	100	Omni	8A	195.936	SS_South_25		
50	S25_CR217	West London	Egham	Egham	INSANITY	499800	170700	53	15	100	Omni	8A	195.936	SS_South_25		
51	S25_CR073	West London	Hayes	St. Anselms	Hayes FM	509800	179600	32	40	100	Omni	8A	195.936	SS_South_25		
52	S25_CR061	West London	West_London	Glade Lane	Desi Radio	513989	179577	27	42	50	Dir	8A	195.936	SS_South_25		
55	S17_CR223	Reigate	Reigate	Reigate	Susy Radio	525800	152100	221	15	100	Dir	9A	202.928	SS_South_17		
56	S16_CR206	East Grinstead	East Grinstead	East Grinstead	Meridian FM	539786	138480	131	16	100	Omni	8A	195.936	SS_South_16		
57	S8_AL263H	Haywards Heath	Haywards Heath	Haywards Heath	Bright FM	533800	122950	77	35	100	Omni	9B	204.64	SS_South_8		
58	S8_AL263L	Haywards Heath	Lewes	Lewes County	Bright FM	540800	109900	25	26	100	Dir	9B	204.64	SS_South_8		
59	S8_CR207	Haywards Heath	Uckfield	Uckfield	Uckfield FM	548300	120700	35	17	100	Omni	9B	204.64	SS_South_8		
60	S9_AL206	Hastings & Eastbourne	Eastbourne	Butt's Brow	Sovereign Radio	558000	101500	184	20	100	Dir	7D	194.064	SS_South_9		
61	S9_AL210	Hastings & Eastbourne	Hastings	Hastings	Arrow FM	580701	110000	70	39	100	Dir	7D	194.064	SS_South_9		
62	S9_COMB	Hastings & Eastbourne	Hastings & Eastbourne	Hastings & Eastbourne	Arrow FM	571100	105400	0	15	100	Dir	7D	194.064	SS_South_9		
63	S8_COMB	Haywards Heath	Haywards Heath	S8_Comb	S8_Comb	541250	119650	20	15	100	Dir	9B	204.64	SS_South_8		
64	S7_AL278	Brighton	Worthing	Guildbourne	Splash FM	514900	102700	4	32	100	Dir	9A	202.928	SS_South_7		
65	S7_CR211	Brighton	Seahaven	Newhaven Fort	Seahaven FM	544600	100100	49	20	100	Dir	9A	202.928	SS_South_7		
67	S7_CR057W	Brighton	Brighton	Whitehawk Hill	Radio Reverb	533000	104500	111	32	100	Dir	9A	202.928	SS_South_7		

ICS Stn	Callsign	Multiplex	Service Area	TX Site	Service	X	Y	Site Hgt m a.s.l.	Antenna Hgt m a.g.l.	ERP W	Omni/Dir	Block	Frequency MHz	Network ID	Comment	PMR Impact
69	S27_AL170	St Albans	ST Albans	Hemel Hempsted	Heart	508800	204400	140	40	100	Dir	9A	202.928	SS_South_27		
70	S27_CR090	St Albans	St Albans	St Albans	Radio Verulan	515000	207600	119	30	100	Dir	9A	202.928	SS_South_27		
71	S27_CR216	St Albans	Watford	Watford	The Vibe	511000	196500	74	54	100	Dir	9A	202.928	SS_South_27		
72	S28_AL259L	Hertfordshire	Letchworth	Letchworth	Bob FM	520850	231350	95	10	100	Dir	7D	194.064	SS_South_28		Zycomm BS
73	S28_AL259S	Hertfordshire	Stevenage	Old Knebworth	Bob FM	523100	220800	121	23	100	Dir	7D	194.064	SS_South_28		Zycomm BS
74	S28_AL259H	Hertfordshire	Hertford	Cole Green	Bob FM	528700	211550	68	20	100	Dir	7D	194.064	SS_South_28		Zycomm BS
77	S26_CR198	Luton	Luton	Luton	Inspire FM	507500	221100	172	45	100	Dir	8B	197.648	SS_South_26	10dB restriction NW may mitigate PMR	Zycomm BS
78	S36_CR200	Biggleswade	Bedford	Bedford	In2beats FM	504500	251600	76	33	100	Omni	8A	195.936	SS_South_36	10dB restriction NW may mitigate PMR	Zycomm BS
79	S36_CR196	Biggleswade	Biggleswade & Sandy	Potton	Biggles FM	521600	249000	46	30	100	Dir	8A	195.936	SS_South_36		Zycomm BS
81	LNW_CR068	London Northwest	Harlesden	Stonebridge	Bang Radio	520700	183900	33	28	100	Omni	9B	204.64	SS_South_LNW		
82	LNW_CR073	London Northwest	Hayes	St. Anselms Church	London NW	509800	179600	32	40	100	Dir	9B	204.64	SS_South_LNW		
83	LNW_DL011H	London Northwest	Harrow	Harrow Weald	London NW	513889	192876	126	45	100	Dir	9B	204.64	SS_South_LNW		
84	LNW_DL011A	London Northwest	Arkley	Arkley	London NW	522088	195775	142	30	100	Dir	9B	204.64	SS_South_LNW		
85	LNW_DL011M	London Northwest	Hampstead	Hampstead	London NW	526025	186250	115	30	100	Dir	9B	204.64	SS_South_LNW		
87	LNE_AL175	London Northeast	Walthamstow	Lea Bridge Rd	Sunrise radio	535987	186576	4	15	100	Omni	8A	195.936	SS_South_LNE		
88	LNE_AL200L	London Northeast	Haringey	Alexandra Palace	London Greek Radio	529550	190050	90	97	100	Dir	8A	195.936	SS_South_LNE		
89	LNE_CR069	London Northeast	Newham	Forest Gate	Nusoundradio	540400	185200	10	19	100	Omni	8A	195.936	SS_South_LNE		
91	LNE_CR007X	London Northeast	Goodmayes	Goodmayes	Ex Radio Ummah	546286	187176	13	15	100	Omni	8A	195.936	SS_South_LNE		
92	LNE_CR007X	London Northeast	Chingford South	New	New	540438	192888	69	15	100	Omni	8A	195.936	SS_South_LNE		
93	LNE_CR007X	London Northeast	High Beach	ching	Ex Radio Ummah	539513	197075	92	30	100	Dir	8A	195.936	SS_South_LNE		

ICS Stn	Callsign	Multiplex	Service Area	TX Site	Service	X	Y	Site Hgt m a.s.l.	Antenna Hgt m	ERP W	Omni/Dir	Block	Frequency MHz	Network ID	Comment	PMR Impact
95	LNW_CR074X	London Northwest	Hammersmith	Hammersmith	OnFM	523200	178600	2	54	100	Dir	9B	204.64	SS_South_LNW		
96	LNW_CR074X	London Northwest	Ealing	Ealing	Archive Svc	517189	180577	29	63	100	Dir	9B	204.64	SS_South_LNW		
97	LNW_DL011	London Northwest	Hendon	Hendon	London II site	521488	188576	50	50	100	Omni	9B	204.64	SS_South_LNW		
98	LSW_AL191	London Southwest	Kingston	Tolworth Tower	107.8 Radio Jackie	519800	165900	27	75	100	Omni	8B	197.648	SS_South_LSW		
99	LSW_AL176H	London Southwest	Heathrow	Heathrow	Premier	507890	177277	27	42	100	Dir	8B	197.648	SS_South_LSW		
100	LSW_DL011R	London Southwest	Richmond	Richmond	London II	518389	173877	40	19	100	Omni	8B	197.648	SS_South_LSW		
103	LSW_DM001E	London Southwest	Esher	Esher TE	National DAB I	514989	163778	29	20	100	Omni	8B	197.648	SS_South_LSW		
104	LSW_NEW2	London Southwest	Walton on Thames	Walton on Thames	Walton on Thames	511900	167250	23	25	100	Omni	8B	197.648	SS_South_LSW		
105	LSW_NEW3	London Southwest	Sutton	Sutton	New 3	527000	164050	66	25	100	Omni	8B	197.648	SS_South_LSW		
106	LSW_NEW4	London Southwest	Wimbledon	Wimbledon	New 4	525050	172025	40	25	100	Omni	8B	197.648	SS_South_LSW		
108	LSE_AL173	London Southeast	Crystal Palace	London	London	533950	171150	100	149	100	Dir	9C	206.352	SS_South_LSE		
109	LSE_CR077X	London Southeast	Bexley	London	London	550285	178477	21	30	100	Omni	9C	206.352	SS_South_LSE		
110	LSE_DM001X	London Southeast	Sidcup	Sidcup	London	546186	171777	62	30	100	Omni	9C	206.352	SS_South_LSE		
111	LSE_WOO	London Southeast	Woolwich	Woolwich	TV Site	546000	179400	4	30	100	Omni	9C	206.352	SS_South_LSE		
112	LSE_AL176D	London Southeast	Dartford	Dartford	Premier	555285	176877	1	36	100	Dir	9C	206.352	SS_South_LSE		
113	LSE_OPR	London Southeast	Orpington	Orpington	TV Site	545800	165300	73	35	100	Omni	9C	206.352	SS_South_LSE		
115	LCE_CR060	Cental London	Cental London	Guys Hospital	Resonance fm	532900	180000	2	95	100	Omni	7D	194.064	SS_South_LCS		
116	LCE_WOR	Cental London	Cental London	Worlds End	TV Site	526400	177400	2	60	100	Omni	7D	194.064	SS_South_LCS		
118	S21_CR201	Ashford	Ashford	William Harvey	AHBS Community	604100	142100	62	37	100	Omni	9A	202.928	SS_South_21		
119	S19_CR203	Folkestone	Folkestone	Folkestone	AcademyFM	621800	137300	43	20	100	Omni	9C	206.352	SS_South_19	Coverage needs extending to Dover ?	
120	S18_CR202	Ramsgate	Ramsgate	Thanet	Academy FM	636300	166600	49	25	100	Omni	7D	194.064	SS_South_18		
121	S20_CR066	Cantebury	Cantebury	Eliot College	CSR	614100	159600	60	20	100	Omni	9B	204.64	SS_South_20		
122	S22_CR204	Gillingham	Gillingham	Gillingham	Radio Sunlight	578000	166800	88	25	100	Omni	8A	195.936	SS_South_22		
123	S22_CR219	Gillingham	Sittingbourne	Sittingbourne	SFM	590600	163700	20	20	100	Omni	8A	195.936	SS_South_22		
124	S22_CR107	Gillingham	Sheppy	Sheppy	BRFM Bridge	596800	173300	49	30	100	Omni	8A	195.936	SS_South_22		
126	S34_CR075	Basildon	Brentwood	Brentwood	Phoenix FM	559200	195400	79	20	100	Omni	9B	204.64	SS_South_34		
127	S34_CR218	Basildon	Basildon	Southernhay	Gateway FM	570700	188400	30	42	100	Omni	9B	204.64	SS_South_34		

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129	S35_AL313X	Southend	Southend	Southend	Southend FM	588200	185700	24	58	100	Dir	9C	206.352	SS_South_35		
130	S33_AL221X	Chelmsford	Chelmsford	Church Green	Dream 107.7	577883	204975	104	30	100	Omni	8B	197.648	SS_South_33		
131	S33_CR106	Chelmsford	Burnham-on-Crouch	Mayland Hill	Saint FM	592281	200275	39	20	100	Omni	8B	197.648	SS_South_33		
1	E31_AL128	Tendring	Tendring	Clackton	Dream 100 FM	618279	216274	6	43	100	Dir	9C	206.352	SS_East_31		
2	E30_CR190	Felixstowe	Felixstowe	Felixstowe	Felixstowe Radio	630278	235072	22	14	100	Dir	8B	197.648	SS_East_30		
3	E32_CR195	Colchester	Coggeshall	Pattiswick	Leisure FM	581382	224073	63	22	100	Omni	8A	195.936	SS_East_32		
4	E32_CR058	Colchester	Colchester	Colchester Garrison	BFBS	598900	224200	33	16	100	Omni	8A	195.936	SS_East_32	Extra site serving Braintree needed	
5	E29_AL308	Ipswich	Ipswich	Warren Heath	Town 102	619579	242471	33	45	100	Dir	7D	194.064	SS_East_29		
6	E29_CR087	Ipswich	Ipswich	Chantry High School	Ipswich Community Radio	614579	243171	45	13	100	Omni	7D	194.064	SS_East_29		
7	E37_AL194C	Cambridge & Ely	Cambridge	Gog Magog	STAR FM	549085	253270	69	29	100	Omni	8B	197.648	SS_East_37		Zycomm BS
8	E37_AL194E	Cambridge & Ely	Ely	Ely Cathedral	Star FM	554085	280068	13	66	100	Omni	8B	197.648	SS_East_37		Zycomm BS
9	E37_CR193	Cambridge & Ely	Cambridge	University Library	CAM FM	544086	258370	8	48	100	Omni	8B	197.648	SS_East_37		Zycomm BS
14	E45_CR199	Godmanchester	Godmanchester	Huntingdon	HCR	524788	272569	18	28	100	Omni	9A	202.928	SS_East_45		Zycomm Mob
15	E43_CR191	Forest Heath	Forest Heath	Mildenhall St Mary's Chu	Zack FM	571000	274600	8	43	100	Omni	9B	204.64	SS_East_43		
16	E38_CR189	Bury St Edmunds	Bury St Edmunds	Bury St Edmunds	RWS	585000	262700	59	31	100	Omni	9A	202.928	SS_East_38		
17	E39_CR188	Southwold	Southwold	Reydon	Blyth Valley radio	648976	276968	10	10	100	Dir	9B	204.64	SS_East_39		
18	E40_AL300	Norwich	Norwich	Stoke Holy Cross	Norwich Radio	625778	302566	67	105	100	Omni	9C	206.352	SS_East_40		
19	E40_CR192	Norwich	Norwich	Markham Tower	Future FM	621278	310866	22	63	100	Omni	9C	206.352	SS_East_40		
21	E42_AL134	Kings Lynn	Kings Lynn	Great Massingham	KLFM 96.7	578783	322865	92	45	100	Omni	8A	195.936	SS_East_42		Zycomm BS
22	E42_NEW	Kings Lynn	Kings Lynn	New	New	565150	320650	12	20	100	Omni	8A	195.936	SS_East_42	New site added to serve Kings Lynn	Zycomm BS
24	E41_AL285B	North Norfolk	North Norfolk	Bunkers Hill	North Norfolk Radio	590281	338763	71	30	100	Omni	7D	194.064	SS_East_41		Zycomm BS
25	E41_AL285F	North Norfolk	North Norfolk	Fakenham	North Norfolk Radio	592581	330164	51	20	100	Omni	7D	194.064	SS_East_41		Zycomm BS
26	E41_AL285S	North Norfolk	North Norfolk	Stody	North Norfolk Radio	607280	333264	61	40	100	Omni	7D	194.064	SS_East_41		Zycomm BS
27	E41_AL285A	North Norfolk	North Norfolk	Aylmerton	North Norfolk Radio	615400	339100	87	33	100	Omni	7D	194.064	SS_East_41		Zycomm BS

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1	M49_AL330	Coventry	Coventry	Samuel Vale House	Touch FM	433150	279700	91	58	100	Omni	8B	197.648	SS_Mid_49		Zycomm BS
4	M48_AL309	Stratford & Warwick	Warwick	Leamington Spa	Touch Radio	432900	266450	90	39	100	Dir	9B	204.64	SS_Mid_48		Zycomm Mob
5	M48_AL185	Stratford & Warwick	Stratford	Lark Stoke	Touch	418700	242600	257	12	100	Omni	9B	204.64	SS_Mid_48		Zycomm Mob
6	M48_NEW	Stratford & Warwick	Stratford	Stratford	New	420450	255100	35	24	100	Omni	9B	204.64	SS_Mid_48		Zycomm Mob
8	M50_AL331	Rugby	Rugby	Royal Court Rounds Garde	Rugby FM	449950	275500	108	45	100	Omni	8A	195.936	SS_Mid_50		Zycomm BS
11	M62_CR039	Birmingham East	Birmingham East	Birmingham East	Unity FM	408300	285600	123	60	100	Omni	9A	202.928	SS_Mid_62		Zycomm Mob
12	M62_CR174	Birmingham East	Castle Vale	Castle Vale	Vale FM	414000	291400	88	40	100	Omni	9A	202.928	SS_Mid_62		Zycomm Mob
13	M61_CR177	West_Bromwich	Sandwell & West Bromwich	Sandwel	Raaj FM	400800	290800	161	50	100	Omni	8A	195.936	SS_Mid_61		Zycomm BS
14	M61_CR041	West_Bromwich	Stourbridge	Brierley Hill	The 'Bridge	391601	286768	149	45	100	Omni	8A	195.936	SS_Mid_61		Zycomm BS
17	M60_AL199	Walsall & Wolverhampton	Wolverhampton	Mander House	Signal 107	391501	298567	155	53	100	Omni	9C	206.352	SS_Mid_60		Zycomm Mob
19	M60_CR175X	Walsall & Wolverhampton	Walsall	Walsall	Ambur Radio	401100	298667	121	48	100	Omni	9C	206.352	SS_Mid_60		Zycomm Mob
21	M58_CR053	Worcester	Worcester	Worcester	Youth Community Radio	386800	255100	72	18	100	Omni	7D	194.064	SS_Mid_58		
22	M46_CR184	Northampton	Northampton	University of Northampto	Insperation FM	476200	264300	121	17	100	Omni	9C	206.352	SS_Mid_46		Zycomm Mob
23	M51_CR013	Corby & Harborough	Market Harborough	Little Oxendon Farm	Harborough FM	472700	284000	153	35	100	Omni	7D	194.064	SS_Mid_51		Zycomm BS
24	M51_CR185	Corby & Harborough	Corby	Corby	Corby Radio	488100	288500	115	35	100	Omni	7D	194.064	SS_Mid_51		Zycomm BS
26	M54_AL231	Hinckley	Hinckley	Barwell	Oak FM	445350	297000	118	30	100	Omni	9C	206.352	SS_Mid_54		Zycomm Mob
27	M55_CR010	Leicester	Leicester	Gorse Hill Farm	Take Over Radio	456900	306200	79	6	100	Omni	9A	202.928	SS_Mid_55		Zycomm Mob
28	M55_CR178	Leicester	Leicester	Central Leicester	EAVA FM	459200	306300	52	30	100	Omni	9A	202.928	SS_Mid_55		Zycomm Mob
30	M55_CR179	Leicester	Leicester	Leicester	Demon FM	458200	303800	56	48	100	Omni	9A	202.928	SS_Mid_55		Zycomm Mob
32	M66_AL230	Loughborough	Loughborough	Loughborough University	Oak FM	452400	319000	50	68	100	Dir	8A	195.936	SS_Mid_66		Zycomm BS
33	M65_CR012	Vale of Belvoir	Vale of Belvoir	White Lodge Farm	The Eye	472100	323800	167	20	100	Omni	8B	197.648	SS_Mid_65		Zycomm BS
34	M67_CR181	Coalville	Coalville	Hoo Ash Farm	Hermitage FM	440800	314900	161	14	100	Omni	9B	204.64	SS_Mid_67		Zycomm Mob
35	M64_CR011	Derby	Derby	Normanton	Radio Iklhas	433500	334500	94	15	100	Omni	9A	202.928	SS_Mid_64		Zycomm Mob

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36	M63_AL217L	South Staffs	Southeast Staffordshire	Lichfield	Touch FM	416398	304266	149	100	100	Dir	7D	194.064	SS_Mid_63		Zycomm BS
37	M63_AL217B	South Staffs	Southeast Staffordshire	Burton	Touch FM	426597	322665	122	30	100	Omni	7D	194.064	SS_Mid_63		Zycomm BS
40	M52_AL229R	Rutland	Rutland	Burley Water Tower	Rutland FM	489191	311166	144	27	100	Dir	9B	204.64	SS_Mid_52		Zycomm Mob
41	M52_AL229S	Rutland	Stamford	New Stamford College	Rutland FM	503490	307766	41	25	100	Omni	9B	204.64	SS_Mid_52		Zycomm Mob
43	M53_CR172	Spalding	Spalding	Fulney	Tulip Radio	526588	322265	4	32	100	Omni	9C	206.352	SS_Mid_53		
44	M68_CR168	Grantham	Grantham	Springfield Road	Gravity FM	490891	334664	62	52	100	Omni	7D	194.064	SS_Mid_68		Zycomm BS
45	M57_AL138	Ludlow	Ludlow	Woofferton	Sunshine Radio	351105	269069	79	105	100	Omni	8B	197.648	SS_Mid_57	Need site near to Ludlow rather than MF site	
47	M59_CR1005	Staffordshire	Stafford	Stafford	Stafford FM	392001	323265	76	20	100	Omni	9B	204.64	SS_Mid_59		Zycomm Mob
48	M59_CR1052	Staffordshire	Newport	Newport	Newport CR	374403	319165	70	16	100	Omni	9B	204.64	SS_Mid_59		Zycomm Mob
1	NW6_AL237	Shewsbury & Telford	Telford	Heath Hill	Telford FM	368100	307703	192	42	50	Dir	9A	202.928	SS_NW_6		Zycomm Mob
2	NW6_AL310	Shewsbury & Telford	Shewsbury	Shelton	Signal_107	346505	313465	90	27	100	Dir	9A	202.928	SS_NW_6		Zycomm Mob
4	NW5_CR091	Wrexham	Wrexham	Wrexham	Calon FM	332600	351100	86	19	100	Omni	8A	195.936	SS_NW_5		
5	NW1_CR245	Anglesey	Anglesey	Cwalchmai	Mon FM	238955	376737	85	35	100	Omni	9C	206.352	SS_NW_1		Merseyside Mob
6	NW2_CR156	Llandudno	Llandudno	Llandudno	Tudno FM	278512	381560	5	26	100	Dir	9B	204.64	SS_NW_2		Merseyside Mob
7	NW3_CR157	Glan Clwyd_Rhyl	Rhyl	Rhyl	Point FM	300500	381100	1	17	100	Dir	8A	195.936	SS_NW_3		
8	NW3_CR244	Glan Clwyd_Rhyl	Glan Clwyd	Glan Clwyd Hosp	Glan Clwyd AM	300300	376000	11	10	100	Omni	8A	195.936	SS_NW_3		
10	NW17_AL267	Lakeland	Windermere	Windermere	Lakeland Radio	338300	498003	222	30	100	Dir	9C	206.352	SS_NW_17		Merseyside Mob
11	NW17_AL267	Lakeland	Kendal	Kendal	Lakland Radio	354000	491300	172	44	100	Dir	9C	206.352	SS_NW_17		Merseyside Mob
13	NW16_AL147	Lancaster & Morecambe	Morecambe Bay	Morecambe Bay	The Bay	323950	479250	254	68	100	Dir	7D	194.064	SS_NW_16		
14	NW16_CR213	Lancaster & Morecambe	Morecambe Bay	Morecambe Bay	Barrow CR	319808	469052	10	15	100	Omni	7D	194.064	SS_NW_16		
15	NW16_CRNEW	Lancaster & Morecambe	Lancaster_Morecambe	Lancaster_Morecambe	Barrow CR	349033	466417	81	20	100	Omni	7D	194.064	SS_NW_16	New site added to serve Morecambe. Need site for Lancaster	
17	NW15_CR051	South Cumbria	South Cumbria	Kirkby Lonsdale	Indigo Radio	361100	478500	68	12	100	Omni	8B	197.648	SS_NW_15		
18	NW14_AL137	Blackpool	Blackpool	Blackpool Tower	The Wave 96.5	330600	436050	9	135	100	Dir	9B	204.64	SS_NW_14		Merseyside Mob
19	NW13_CR158	Preston	Preston	Preston	Preston FM	354200	429100	32	55	100	Omni	9A	202.928	SS_NW_13		
21	NW12_AL292	East Lancashire	Blackburn	Blackburn	The Bee	369550	426750	198	34	100	Dir	8A	195.936	SS_NW_12		
22	NW12_AL183	East Lancashire	East Lancs	Haslingden	Asian Sound	379550	423600	341	43	50	Dir	8A	195.936	SS_NW_12		
23	NW12_AL258	East Lancashire	Burnley	Pendle Forest	2BR	382500	438403	273	35	50	Dir	8A	195.936	SS_NW_12		
24	NW12_CR099	East Lancashire	Nelson	Brierfields	Pendle CR	386101	436155	262	23	100	Omni	8A	195.936	SS_NW_12		
25	NW10_CR025	Chorley	Chorley	Chorley	Chorley FM	358404	417357	86	30	100	Omni	8B	197.648	SS_NW_10		
29	NW11_AL234	Bolton	Bolton	Tottington	Tower FM	376300	412104	224	25	100	Dir	9C	206.352	SS_NW_11		Merseyside Mob

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30	NW9_AL189	Wigan	Wigan	Billinge Hill	Wish 102	352300	401604	169	30	100	Dir	8A	195.936	SS_NW_9	Not seving Wigan 'indoor' but good area coverage	
31	NW7_CR162	Knowsley	Knowsley	Knowsley	KCC	344205	390759	31	57	100	Omni	9A	202.928	SS_NW_7		
32	NW8_CR102H	Warrington	Halton	Halton	Halton CR	353700	381900	79	10	100	Omni	9B	204.64	SS_NW_8		Merseyside Mob
33	NW8_AL214	Warrington	Warrington	High Warren Reservoir	Wire FM	361450	384300	86	14	100	Omni	9B	204.64	SS_NW_8		Merseyside Mob
34	NW8_CR137	Warrington	Warrington	Warrington	Radio Warrington	358450	385900	6	14	100	Omni	9B	204.64	SS_NW_8	Need SB III Block !	Merseyside Mob
36	NW4_CR100	Wirral	Wirral	Bidston Lighthouse	Wirral Radio	328000	387100	20	46	100	Omni	9C	206.352	SS_NW_4		Merseyside Mob
37	NW4_CR155	Wirral	Wirral	Willaston	Flame CR	332800	377017	50	10	100	Omni	9C	206.352	SS_NW_4		Merseyside Mob
39	NW81_CR035	Manchester_West	Salford	Swinton Civic Centre	Salford CR	377500	401600	63	30	25	Omni	8B	197.648	SS_NW_81		
40	NW81_CR187	Manchester_West	Manchester	Portland Tower	Unity radio	384200	397900	40	85	25	Omni	8B	197.648	SS_NW_81		
42	NW81_CR023	Manchester_West	Manchester	Longsight	All FM	387500	395100	54	40	25	Omni	8B	197.648	SS_NW_81		
45	NW83_CR033	Tameside	Tameside	Harrop Edge	Tameside Community Radio	398400	396400	299	10	50	Dir	9C	206.352	SS_NW_83	Need SB III Block !	Merseyside Mob
46	NW82_CR235	Manchester North	Oldham	The Civic Centre	Idham Community Radio	392300	405100	201	65	100	Omni	9B	204.64	SS_NW_82		Merseyside Mob
47	NW82_CR165	Manchester North	Manchester North	Maston	North Manchester FM	386700	401700	80	40	100	Omni	9B	204.64	SS_NW_82		Merseyside Mob
48	NW82_AL183	Manchester North	Manchester North	Ashton Moss	Asian Sound	392501	399358	101	40	100	Omni	9B	204.64	SS_NW_82		Merseyside Mob
50	NW84_CR034	Manchester South	Stockport	Ratcliffe Towers	Pure FM	387700	388400	51	25	100	Omni	9A	202.928	SS_NW_84		
51	NW84_CR024	Manchester South	Manchester South	Wythenshawe	Wythenshawe FM	382700	387100	59	30	100	Omni	9A	202.928	SS_NW_84		
53	NW17_CR267	Lakeland	Keswick	Keswick Forest	Lakeland Radio	322350	524400	202	18	100	Dir	9C	206.352	SS_NW_17		Merseyside Mob
54	NW18_CR181	Penrith	Penrith	Penrith	Eden Radio	350905	529347	148	30	100	Omni	9B	204.64	SS_NW_18		
1	N1_CR148	Sutton-in-Craven	Sutton-in-Craven	Sutton-in-Craven	Drystone Radio	401300	443354	270	20	100	Omni	7D	194.064	SS_North_1		Zycomm BS
2	N8_CR026	Rochdale	Rochdale	Stoneyfield	Crescent Radio	389600	412600	142	20	100	Omni	7D	194.064	SS_North_8		
3	N17_CR160	Macclesfield	Macclesfield	Bollington	The Thread	393400	378100	150	34	100	Dir	7D	194.064	SS_North_17		
4	N17_AL213	Macclesfield	Macclesfield	Sutton Common	Silk FM	393400	367750	400	5	100	Dir	7D	194.064	SS_North_17		
6	N18_CR1013	Crewe & Nantwiche	Crewe & Nantwiche	Crewe	The Cat	369603	354662	51	26	100	Omni	8B	197.648	SS_North_18		
7	N19_CR161	Stoke-On-Trent	Biddulph	Rails Farm	Moorlands Radio	391500	358500	325	20	100	Dir	9C	206.352	SS_North_19		Merseyside Mob
8	N19_CR003	Stoke-On-Trent	Stoke On Trent	Stoke on Trent	Cross Rhythms City Radio	391800	349650	211	30	100	Omni	9C	206.352	SS_North_19		Merseyside Mob
9	N19_CR003	Stoke-On-Trent	Stoke On Trent	Stoke on Trent	Cross Rhythms City Radio	381102	347962	207	18	100	Omni	9C	206.352	SS_North_19		Merseyside Mob

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11	N16_AL286B	High Peak	High Peak	Buxton	High Peak Radio	405850	375300	429	22	100	Omni	9B	204.64	SS_North_16		Zycomm & Merseyside Mob
12	N16_AL286C	High Peak	High Peak	Chapel-en-le-Frith	High Peak Radio	406200	380800	221	10	100	Omni	9B	204.64	SS_North_16		Zycomm & Merseyside Mob
13	N16_AL286H	High Peak	High Peak	Hope Valley	High Peak Radio	417700	384204	217	15	100	Omni	9B	204.64	SS_North_16		Zycomm & Merseyside Mob
14	N16_AL286U	High Peak	High Peak	Buxworth	High Peak Radio	402600	383304	288	25	100	Dir	9B	204.64	SS_North_16		Zycomm & Merseyside Mob
16	N26_CR015	Nottingham	Nottingham	Mapperley	Dawn FM	458200	342800	120	20	100	Omni	9C	206.352	SS_North_26		
17	N26_CR171	Nottingham	Ilkeston	Ilkeston	Erewash Sound	446400	341600	93	28	100	Omni	9C	206.352	SS_North_26		
18	N26_CR016	Nottingham	Nottingham	Nottingham	Kemet Radio	455700	340600	52	63	100	Dir	9C	206.352	SS_North_26		
20	N21_AL286A	High Peak	Ashbourne	Ashbourne	High Peak Radio	418150	347350	162	15	100	Omni	9B	204.64	SS_North_21		Zycomm Mob
21	N21_AL286W	High Peak	Wirksworth	Hardhurst Fm	High Peak Radio	429697	352862	241	10	100	Omni	9B	204.64	SS_North_21		Zycomm Mob
22	N21_CR170	High Peak	Ripley	Ripley	Amber Sounds FM	440000	350300	155	34	100	Omni	9B	204.64	SS_North_21		Zycomm Mob
24	N22_AL226	Mansfield	Mansfield	Fishpond Hill	Mansfield 103.2	451150	360650	172	46	100	Dir	7D	194.064	SS_North_22		Zycomm BS
26	N20_AL227C	Chesterfield & Matlock	Chesterfield	Chesterfield	Peak 107 FM	438200	376404	145	43	100	Dir	8B	197.648	SS_North_20		Zycomm BS
27	N20_AL227M	Chesterfield & Matlock	Chesterfield	Chesterfield	Peak 107 FM	424598	363661	305	45	100	Omni	8B	197.648	SS_North_20		Zycomm BS
29	N24_CR523	Newark	Newark	Newark	Radio Newark	480792	353162	17	10	100	Omni	9B	204.64	SS_North_24		Zycomm Mob
31	N23_CR166	Lincoln	Lincoln	Lincoln Cathedral	Lincoln City Radio	497690	371760	60	85	100	Omni	9A	202.928	SS_North_23		Zycomm Mob
32	N25_CR530	Boston	Boston	Boston	Endeavour FM	532687	344263	1	25	50	Dir	8B	197.648	SS_North_25		Zycomm BS
34	N13_AL224X	Rother Valley	Worksop	Worksop	TRAX FM	459494	377460	68	20	100	Dir	9C	206.352	SS_North_13		
35	N13_AL224D	Rother Valley	Doncaster	Clifton	TRAX FM	451900	395950	135	36	100	Dir	9C	206.352	SS_North_13		
36	N13_CR150	Rother Valley	Doncaster	Doncaster	Sine FM	457700	403000	16	27	100	Omni	9C	206.352	SS_North_13		
37	N13_CR151	Rother Valley	Rother Valley	Wales	Redroad FM	447700	382600	120	20	100	Omni	9C	206.352	SS_North_13		
40	N14_AL314	Rotherham	Rotherham	Rotherham	Rother FM	443250	391300	116	53	100	Dir	9A	202.928	SS_North_14		Zycomm Mob
42	N15_CR083	Sheffield West	Sheffield West	Tapton Hill	Sheffield Live!	432400	387000	230	28	100	Omni	8A	195.936	SS_North_15		Zycomm BS
43	N7_AL280A	Barnsley	Barnsley	Ardsley	Dearne FM	439000	406104	94	44	100	Omni	7D	194.064	SS_North_7		Zycomm BS
44	N7_AL280P	Barnsley	Barnsley	Ardsley	Dearne FM	425897	404458	269	15	100	Omni	7D	194.064	SS_North_7		Zycomm BS
46	N9_CR154	Thorne_Moorends	Thorne_Moorends	Thorne	TMCR	468500	413400	2	15	100	Omni	9B	204.64	SS_North_9		Zycomm Mob
47	N5_AL242	West Yorks South	Wakefield	Birkwood Farm	Ridings FM	436097	423356	35	19	100	Dir	8B	197.648	SS_North_5		Zycomm BS
48	N5_CR085	West Yorks South	Dewsbury	Dewsbury	Branch FM	425200	423000	133	12	100	Omni	8B	197.648	SS_North_5		Zycomm BS
49	N5_CR022	West Yorks South	Halifax	Halifax	Phoenix FM	410300	424200	245	40	100	Omni	8B	197.648	SS_North_5		Zycomm BS
50	N5_CR136Y	West Yorks South	Huddersfield	Ainley Top	Huddersfield CR	412399	419656	246	67	100	Omni	8B	197.648	SS_North_5		Zycomm BS

ICS Stn	Callsign	Multiplex	Service Area	TX Site	Service	X	Y	Site Hgt m a.s.l.	Antenna Hgt m a.g.l.	ERP W	Omni/Dir	Block	Frequency MHz	Network ID	Comment	PMR Impact
52	N2_CR021	Bradford	Bradford	Idle	BCB	416400	437400	216	43	100	Dir	9A	202.928	SS_North_2		Zycomm Mob
54	N3_CR031	Leeds	Leeds	Potternewton Lane	Asian fever	430200	436600	107	52	100	Omni	9C	206.352	SS_North_3		
55	N4_CR064	Wetherby	Wetherby	Collingham	Tempo 107.4	438500	444700	94	10	100	Omni	8A	195.936	SS_North_4		Zycomm BS
56	N6_CR152	East Yorks	Market Weighton	Market Weighton	Vixen FM	490300	442100	120	27	100	Omni	9A	202.928	SS_North_6		Zycomm Mob
57	N6_CR133Y	East Yorks	Pocklington	Pocklington	West Wolds Radio	480292	448954	35	14	100	Omni	9A	202.928	SS_North_6		Zycomm Mob
58	N6_CR138Y	East Yorks	Beverley	Beverley	Beverley FM	501990	440254	31	16	100	Omni	9A	202.928	SS_North_6		Zycomm Mob
60	N10_AL315	Hull	Hull	Humber Bridge - North Pi	KCFM	502300	425300	0	164	100	Dir	8B	197.648	SS_North_10		Zycomm BS
61	N10_CR056	Hull	West Hull	Hull Royal Infirmary	West Hull Community Radi	508400	428700	2	65	100	Omni	8B	197.648	SS_North_10		Zycomm BS
62	N10_CR147Y	Hull	East Hull	Muswell Court	Hull Kingston Radio	513289	432355	4	49	100	Omni	8B	197.648	SS_North_10		Zycomm BS
64	N11_CR052	Withernsea	Withernsea	Withernsea	Seaside FM	534187	427956	8	20	100	Dir	8A	195.936	SS_North_11		Zycomm BS
65	N12_AL266	Grimsby	Grimsby	Bevan House	Compass FM	527900	410200	4	55	100	Dir	7D	194.064	SS_North_12		Zycomm BS
1	NE5_AL307C	Thirsk & Northallerton	Thirsk	Calvert's Carpets	Star Radio	442900	481903	30	15	100	Dir	9B	204.64	SS_Northeast_5		Zycomm Mob
2	NE5_307N	Thirsk & Northallerton	North Allerton	North Allerton	Star Radio	436500	494300	36	43	100	Omni	9B	204.64	SS_Northeast_5		Zycomm Mob
4	NE4_AL181	Catterick	Catterick	Catterick Garrison	BFBS	418100	498400	152	20	50	Dir	8B	197.648	SS_Northeast_4		
6	NE6_CR098	Teeside West	Teeside	Stockton_on_Tees	Cross Rythms	444200	518800	14	12	100	Omni	9A	202.928	SS_Northeast_6		
7	NE6_CR144	Teeside West	Middlesborough	Middlesborough	Community Voice	450000	519500	7	12	100	Omni	9A	202.928	SS_Northeast_6		
8	NE6_CR123	Teeside West	Redcar	Park Fm Dunsdale	Radio Zetland	445200	523400	22	15	100	Omni	9A	202.928	SS_Northeast_6		
9	NE6_CR145	Teeside West	Hartlepool	Hartlepool	Radio Hartlepool	451000	531000	9	14	100	Dir	9A	202.928	SS_Northeast_6		
11	NE3_CR082	Teeside East	Teesdale	Mickleton	Radio Teesdale	397400	522000	352	15	100	Omni	7D	194.064	SS_Northeast_3		Zycomm BS
12	NE3_CR082	Teeside East	Teesdale	Barnard Castle	Radio Teesdale	405700	517200	192	20	100	Omni	7D	194.064	SS_Northeast_3		Zycomm BS
13	NE3_CR146	Teeside East	Southwest Durham	High Etherley	Bishop FM	416300	528100	200	10	100	Dir	7D	194.064	SS_Northeast_3		Zycomm BS
14	NE3_AL181	Teeside East	Darlington	Darlington	Star Radio	428350	518900	82	38	100	Dir	7D	194.064	SS_Northeast_3		Zycomm BS
17	NE8_AL297B	Durham	Durham	Burnhope	Star Radio	418300	547650	238	125	50	Dir	9C	206.352	SS_Northeast_8		
18	NE7_AL126	Sunderland	Sunderland	Haining	Sun FM	435500	550903	160	32	100	Omni	8A	195.936	SS_Northeast_7		Zycomm BS
19	NE7_CR143	Sunderland	Sunderland	Monkswearmouth	Spark FM	440000	557900	20	45	100	Dir	8A	195.936	SS_Northeast_7		Zycomm BS
21	NE9_CR050	Newcastle & Gateshead	Gateshead	Gateshead	NE1 FM	426600	561500	140	13	100	Omni	9B	204.64	SS_Northeast_9		
22	NE9_CR142	Newcastle & Gateshead	Newcastle	West Road	Spice FM	422200	564400	105	16	100	Omni	9B	204.64	SS_Northeast_9		
24	NE10_CR049	Alnwick	Alnwick	Alnwick Moor	Lionheart CR	417700	612700	133	20	100	Omni	8B	197.648	SS_Northeast_10		

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1	SC16_CR080	Edinburgh	Leith	Leith FM	Castle FM	327000	676000	9	60	100	Omni	7D	194.064	SS_Scot_16		
2	SC16_CR079	Edinburgh	Edinburgh South	Edinburgh Garrison FM	BFBS	322700	668300	162	20	100	Omni	7D	194.064	SS_Scot_16		
3	SC16_CR258	Edinburgh	Penicuik	Penicuik	Crystal FM	323750	660250	200	16	100	Omni	7D	194.064	SS_Scot_16		
4	SC16_CR081	Edinburgh	Midlothian	Newton Grange	Black Diamond FM	334100	662800	158	21	100	Omni	7D	194.064	SS_Scot_16		
5	SC16_CR259	Edinburgh	Haddington	Garleton Hills	East Coast FM	351350	676000	176	15	100	Dir	7D	194.064	SS_Scot_16		
7	SC15_CR020	Stirling & Cumbernauld	Cumbernauld	Cumbernauld	Revival FM	276500	675000	140	71	100	Omni	9A	202.928	SS_Scot_15		
8	SC15_AL047	Stirling & Cumbernauld	Stirling	Earls Hill	Central FM	272000	688500	422	36	100	Dir	9A	202.928	SS_Scot_15		
10	SC13_CR017	Glasgow	Glasgow West	Glasgow West	Insight Radio	254700	668800	27	74	100	Omni	8A	195.936	SS_Scot_13		
11	SC13_CR018	Glasgow	Glasgow	Glasgow	Sunny Govan	253736	664051	42	60	100	Omni	8A	195.936	SS_Scot_13		
12	SC13_CR138	Glasgow	Barrhead	Barrhead	Pulse FM	250500	657700	105	20	100	Omni	8A	195.936	SS_Scot_13		
14	SC13_CR257	Glasgow	Glasgow	Glasgow	Celtic Music Radio	259514	665635	28	84	100	Dir	8A	195.936	SS_Scot_13		
15	SC13_CR256	Glasgow	Glasgow	Glasgow	Celtic Music Radio	261614	661535	36	84	100	Dir	8A	195.936	SS_Scot_13		
17	SC11_CR141	Salltcoats & Irvine	Saltcoats	Saltcoats	3FTM CR	225500	642600	43	3	100	Dir	9C	206.352	SS_Scot_11		
18	SC11_CR263	Salltcoats & Irvine	Irvine	Irvine	Irvine beat FM	232100	638500	2	50	100	Dir	9C	206.352	SS_Scot_11		
20	SC12_AL287	Greenock	Helensburgh	Rosneath	Your Radio	225850	681200	103	38	100	Omni	7D	194.064	SS_Scot_12		
21	SC12_AL264	Greenock	Dumbarton	Dumbarton Castle	Your Radio	239101	675401	10	48	100	Omni	7D	194.064	SS_Scot_12		
22	SC12_CR124	Greenock	Isle of Bute	Rothsay Town	Bute FM	208919	664435	18	15	100	Omni	7D	194.064	SS_Scot_12		
23	SC12_CR136	Greenock	Dunoon	Dunoon	Dunoon CR	217218	676934	24	15	100	Omni	7D	194.064	SS_Scot_12		
25	SC14_AL251	Kintyre Islay & Jura	Kintyre Islay & Jura	South Knapdale	Argyll FM	183750	674850	447	45	100	Dir	8B	197.648	SS_Scot_14		
26	SC27_AL223D	Fife	Dunfermline	Knock Hill	Kingdom FM	305400	693702	344	40	100	Dir	8B	197.648	SS_Scot_27		
27	SC27_AL223K	Fife	Kirkcaldy	Kirkcaldy	Kingdom FM	328900	692602	32	50	100	Dir	8B	197.648	SS_Scot_27		
28	SC27_AL223G	Fife	Glenrothes	Purin Hill	Kingdom FM	325200	705902	336	22	100	Omni	8B	197.648	SS_Scot_27		
29	SC27_AL223F	Fife	Fife	East Neuk	Kingdom FM	356800	708800	99	17	100	Omni	8B	197.648	SS_Scot_27		
30	SC27_AL223A	Fife	Fife	Allanhill Farm	Kingdom FM	352000	714102	96	20	100	Dir	8B	197.648	SS_Scot_27		
33	SC28_AL322	Perth & Pitlochry	Perth	Kinnoull Hill	Heartland FM	312400	723350	15	25	100	Dir	9C	206.352	SS_Scot_28		
34	SC28_AL113	Perth & Pitlochry	Pitlochry	Faire Mhor	Heartland Radio	299300	758301	481	34	100	Omni	9C	206.352	SS_Scot_28		
36	SC29_AL232	Dundee & Arbroath	Dundee	Dundee Law	Wave 102	339200	731302	142	12	100	Dir	8A	195.936	SS_Scot_29		
37	SC29_AL233A	Dundee & Arbroath	Arbroath	Infirmary	Radio North Angus	363400	740402	10	15	100	Dir	8A	195.936	SS_Scot_29		
38	SC29_AL233C	Dundee & Arbroath	Carnoustie	Carnoustie High School	Radio North Angus	355404	735029	12	15	100	Dir	8A	195.936	SS_Scot_29		
40	SC26_CR262G	Nevis	Glencoe	Glencoe	Nevis Radio	226017	751427	719	10	100	Omni	8B	197.648	SS_Scot_26		
41	SC26_CR262L	Nevis	Loch Leven	Glenachulish	Nevis Radio	203419	759027	314	8	100	Omni	8B	197.648	SS_Scot_26		
42	SC26_CR262F	Nevis	Fort William	Trislaig	Nevis Radio	208619	774825	245	15	100	Omni	8B	197.648	SS_Scot_26		

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44	SC30_AL187	Oban	Oban	Pulpit Hill	Oban FM	185000	729000	127	25	100	Omni	9B	204.64	SS_Scot_30		
45	SC25_CR134L	Mearns	Laurencekirk	Laurencekirk	Mearns FM	374700	771000	242	25	100	Omni	9C	206.352	SS_Scot_25		
46	SC25_CR134I	Mearns	Inverbervie	Inverbervie	Mearns FM	382800	771700	41	10	100	Dir	9C	206.352	SS_Scot_25		
47	SC25_CR134S	Mearns	Stonehaven	Stonehaven	Mearns FM	387500	784600	68	7	100	Dir	9C	206.352	SS_Scot_25		
49	SC24_CR028	Aberdeen	Aberdeen	Aberdeen	Shmu	391700	808200	96	48	100	Dir	7D	194.064	SS_Scot_24		
50	SC22_CR265	Banff & Macduff	Banff & Macduff	Banff	Deveron Radio	368850	864500	15	18	100	Dir	9A	202.928	SS_Scot_22		
51	SC21_CR264	Moray	Moray	Tor Sliasg	KCR	342506	858018	291	25	100	Omni	8A	195.936	SS_Scot_21		
52	SC23_CR133	Aviemore	Aviemore	Cairngorm	Speysound Radio	300500	804800	1109	10	100	Dir	9A	202.928	SS_Scot_23		
53	SC18_CR262	Skye & Lochalsh	Mallaig	Cnoc Malagan	Nevis Radio	165400	808100	181	25	100	Omni	9C	206.352	SS_Scot_18		
54	SC18_AL279	Skye & Lochalsh	Skye	Portree	Cuillin FM	148200	844001	42	10	100	Omni	9C	206.352	SS_Scot_18		
56	SC18_279SC	Skye & Lochalsh	Skye & Lochalsh	Skraig	Cuillin FM	145125	840719	372	60	100	Omni	9C	206.352	SS_Scot_18		
58	SC17_AL202E	Isle of Lewis	Isle of Lewis	Eitshall	Isles FM	130627	930411	206	24	100	Omni	7D	194.064	SS_Scot_17		
59	SC17_AL202N	Isle of Lewis	Isle of Lewis	Ness	Isles FM	152624	960909	69	40	100	Omni	7D	194.064	SS_Scot_17		
61	SC20_AL282S	Ullapool	Shieldaig	Shieldaig	Two Lochs Radio	182121	853418	228	12	100	Omni	9B	204.64	SS_Scot_20		
62	SC20_AL282G	Ullapool	Gairloch	Port Henderson	Two Lochs Radio	176322	873917	37	19	100	Omni	9B	204.64	SS_Scot_20		
63	SC20_AL282L	Ullapool	Lock Ewe	Cliff Hill	Two Lochs Radio	185021	879816	179	18	100	Omni	9B	204.64	SS_Scot_20		
64	SC20_AL282B	Ullapool	Badcaul	Badcaul	Two Lochs Radio	198920	892215	234	15	100	Omni	9B	204.64	SS_Scot_20		
65	SC20_AL198U	Ullapool	Ullapool	Ullapool	Lochbroom FM	214218	893415	101	20	100	Omni	9B	204.64	SS_Scot_20		
66	SC20_AL198P	Ullapool	Ullapool	Polbain	Lochbroom	199920	910813	149	25	100	Omni	9B	204.64	SS_Scot_20		
68	SC19_CR254M	South Uist	Benbecula	Muir of Ard	An Radio	78550	854100	12	12	100	Dir	8A	195.936	SS_Scot_19		
69	SC19_CR254L	South Uist	North Uist	Loch Portain	An Radio	94950	872800	41	12	100	Omni	8A	195.936	SS_Scot_19		
70	SC19_CR254A	South Uist	South Uist	Askernish	An Radio	75750	823500	111	15	100	Dir	8A	195.936	SS_Scot_19		

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1	NI2_CR139	Belfast	Lisburn	Lisburn	Lisburn City Radio	138500	520600	42	30	100	Omni	9A	202.928	SS_NI_2		
2	NI2_CR045	Belfast	Lisburn	BFBS Lisburn	BFBS Lisburn	137938	522052	70	58	100	Omni	9A	202.928	SS_NI_2		
3	NI2_AL295	Belfast	Belfast	Black Mountain	U105	140112	528693	287	190	100	Dir	9A	202.928	SS_NI_2		
6	NI2_CR129	Belfast	Aldergrove & Antrim	RAF Aldergrove	Aldergrove & Antrim FM	128392	536663	83	21	100	Omni	9A	202.928	SS_NI_2		
7	NI2_CR127	Belfast	Bangor	Conlig	Bangor FM	162200	531900	101	16	100	Omni	9A	202.928	SS_NI_2		
8	NI2_AL042N	Belfast	Newtownabbey	Carnmoney Hill	City Beat	146763	538362	202	50	100	Omni	9A	202.928	SS_NI_2		
10	NI2_CR062	Belfast	Belfast	Europa Hotel	Belfast FM	144067	529405	10	49	100	Omni	9A	202.928	SS_NI_2		
12	NI1_CR060G	Larne	Larne	Glenarm	Chaine FM	146141	572045	93	10	100	Dir	8A	195.936	SS_NI_1		
13	NI1_CR060B	Larne	Larne	Balleygalley	Chaine FM	153142	562408	67	9	100	Dir	8A	195.936	SS_NI_1		
14	NI1_CR060L	Larne	Larne	Balleylumford	Chaine FM	156848	556469	0	53	100	Dir	8A	195.936	SS_NI_1		
16	NI3_CR047	Downpatrick	Downpatrick	Downpatrick	Down FM	159600	498320	60	20	100	Omni	7D	194.064	SS_NI_3		
18	NI4_CR046	Kilkeel & Newry	Newry	Newry Golf Club	IUR	115900	481700	159	12	100	Omni	8A	195.936	SS_NI_4		
19	NI4_AL316K	Kilkeel & Newry	Kilkeel	Kilkeel	Q100.5	135759	474153	0	33	100	Dir	8A	195.936	SS_NI_4		
21	NI5_CR048	Portadown & Banbridge	Banbridge	Scarva Street	Shine FM	121277	503297	97	15	100	Omni	8B	197.648	SS_NI_5		
22	NI5_CR059X	Portadown & Banbridge	Portadown	Portadown	Bridge FM	114259	512832	59	15	100	Omni	8B	197.648	SS_NI_5		
24	NI6_AL275	Cookstown	Cookstown	Tulnagee Quarry	Mid Ulster FM	96064	547273	272	12	100	Dir	9C	206.352	SS_NI_6		
25	NI7_AL301	Ballymena	Ballymena	Portglenone	Q107	115775	561000	189	18	100	Dir	7D	194.064	SS_NI_7		
26	NI8_AL254	Ballymoney & Coleraine	Coleraine	Maddybenny More	Q97.2	102711	597071	63	51	100	Dir	9B	204.64	SS_NI_8		
27	NI8_CR061	Ballymoney & Coleraine	Ballymoney	Ballymoney	fUSe FM	111740	584142	37	43	100	Omni	9B	204.64	SS_NI_8		
29	NI9_AL155	Londonderry	Londonderry	Minkey Hill	Q 102.9 FM	56100	580601	197	25	100	Dir	9A	202.928	SS_NI_9		
31	NI10_AL270	Omagh & Enniskillen	Omagh & Enniskillen	Brougher Mountain II	Q101.2 FM West	46100	516848	269	39	100	Omni	9A	202.928	SS_NI_10		
32	NI11_AL275	Dungannan	Dungannan	Dungannan	Q106/7	91400	522700	111	20	100	Dir	8A	195.936	SS_NI_11		
1	WA32_CR999	Chepstow	Chepstow	Chepstow	Chepstow	354800	195600	69	15	100	Dir	9B	204.64	SS_Wales_32		
2	WA27_CR122	Cardiff	Barry	Barry	BRO Radio	311900	169700	60	20	100	Dir	9C	206.352	SS_Wales_27		
3	WA27_CR094	Cardiff	Cardiff	Butetown	Radio Cardiff	318700	175200	4	48	100	Dir	9C	206.352	SS_Wales_27		
5	WA28_CR004	Pontypridd	Pontypridd	Bryn Tail Farm	GTFM Pontypridd	309309	189876	252	15	100	Dir	9B	204.64	SS_Wales_28		
6	WA29_AL257	Bridgend	Bridgend	Mynydd Baedan	Bridge FM	287211	185476	242	30	100	Dir	8B	197.648	SS_Wales_29		
7	WA30_AL306	Swansea South	Swansea South	Kilvey Hill	Swansea Bay Radio	267200	194050	189	20	100	Dir	7D	194.064	SS_Wales_30		
8	WA31_CR111	Swansea North	Swansea North	Tircoed	Radio Tircoed	262000	200100	67	18	100	Dir	9C	206.352	SS_Wales_31		

Notes on site data table

ICS Telecom Call sign

Each transmitter site in the plan has a unique reference, used as the ICS Telecom 'Call Sign'.

e.g. SW2_CR114 — Station in group/multiplex 2 of South West planning area, with the Community Radio Licence CR000114.

CR: Community Radio

AL: Small Scale/Low Power FM Radio

The Licence Number (taken from the Ofcom technical licensing database) has been shortened by not including the leading digits (generally 000 or 100). Where several transmitter sites form a service, an additional letter has been added to differentiate between sites. Because the leading digits have been dropped, the 'call sign' can only be indicative.

Code	Region	Planning Area
SW	South West	South West
S	South	South
LNE	London: North East	South
LNW	London: North West	South
LSE	London: South East	South
LSW	London: South West	South
LCE	London: Central	South
E	East	East
M	Midlands	
NW	North West, Manchester & North Wales	North West
N	North	North
NE	North East	North East
SC	Scotland	Scotland
WA	Wales	South West
NI	Northern Ireland	Northern Ireland

Table A3.1 Planning Areas Codes

ICS Stn

If the stations within a region were loaded into ICS Telecom, this would be the transmitter number.

ICS Telecom EWF Files

ICS Telecom File	Planning Area
SS_SW_V1.EWF	South West
SS_W_V1.EWF	Wales (South Wales)
SS_S_V1.EWF	South (Including London)
SS_E_V1.EWF	East
SS_M_V1.EWF	Midlands
SS_NW_V1.EWF	North West (Including Manchester)
SS_N_V1.EWF	North
SS_NE_V1.EWF	North East
SS_SC_V1.EWF	Scotland
SS_NI_V1.EWF	Northern Ireland

Table A3.2 ICS Telecom Planning Area Files

Within the ICS Telecom (.EWF) files, sites are listed that are not used. The best combination of sites, used to provide existing services, have been selected to provide the composite DAB service. The 'User/Infra' category has been assigned '1', if the site is actually used.

Where several sites operate together to form a group, in ICS Telecom a nominal site has been created to model the combined coverage. The call sign of this nominal site includes the characters 'COMP'.

e.g. SW2_COMP

Single sites or a composite nominal site forming a multiplex area have the ICS Telecom 'Link' category assigned as '1'.

Sites list or multiplex areas list can be created within ICS Telecom (.EWF files) by filtering on the 'User/Infra' and 'Link' categories.

Network ID

Each multiplex area in the plan has a unique reference, used as the ICS Telecom 'Network ID'.

e.g. SS_Southwest_2 Station Group/Multiplex 2 in the South West area.

Annex 3

PMR Protection Calculations

Maximum DAB Field Strength at PMR Receive Antenna

Assuming:

- Noise floor of the PMR receiving system, referred to the receiver input is -111dBm within a 12.5 kHz bandwidth.
- Receive antenna gain 0dBd
- Feeder Loss 4dB

We do not want to increase the noise floor by more than 1dB.

Consequently, the DAB power at the receiver input within a 12.5 kHz bandwidth should be 6dB less *(10 Log (1 + ¼) = 0.97)*

So maximum DAB power at receiver input should be -111dBm – 6dB = -117dBm

Referred to the receive antenna this would be -117dBm + 4dB = -113dBm

For a 50Ω system, this would be a voltage of -6dBµV at receive antenna output.

The receive antenna is assumed to have no gain relative to a dipole, so the antenna factor (terminated dipole) is 20*Log $\left(\frac{2\pi}{\lambda}\right)$, where λ = f/300 (frequency f in MHz)

At 200MHz the antenna factor (terminated dipole) is approximately 12.4dB

Maximum allowed DAB field strength in 12.5 kHz bandwidth would be -6dBµV + 12.4dB/m = 6.4dBµV/m.

Within the 1536 kHz DAB bandwidth, this would be 6.4µV/m + 10*Log$\left(\frac{1536}{12.5}\right)$dB = 27.3dBµV/m.

Rounded:

Maximum (effective) [14] DAB Field Strength at PMR Receive Antenna = 27dBµV/m

[14] For base station reception, the directional receive antenna discrimination is also taken into account.

PMR Base Station Parameters

Operator	Site	NGR	TX in Blocks	Rx in Blocks	ERP	Ae Height	Pattern
Zycomm	High Bradfield	SK278933	9A, 9B	7D, 8A, 8B	15W	30m	Dir 20º
Zycomm	Alport Height	SK306516	9A, 9B	7D, 8A, 8B	25W	30m	Dir 100º
Zycomm	Zycomm Radio Site	SK346199	9A, 9B	7D, 8A, 8B	25W	35m	Dir 135º
Merseyside Transport	Hatton Green	SJ345909	9B, 9C	8B	25W	27m	Dir 110º