Geographically Interleaved Broadcast Channels for 74 UK TV Stations

Final report by Arqiva

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Prepared for: Ofcom

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1. Summary

Arqiva, on behalf of Ofcom, has assessed the availability of geographically interleaved spectrum at 74 Digital Terrestrial Television (DTT) stations. The 74 stations were sorted into five groups, Group 0, A, B, C and D. Working through each group in turn, at each station where possible, a suitable channel has been identified and a template designed to minimise interference to the six DSO DTT multiplexes. Typically, the templates have been based on an Effective Radiated Power (ERP) of 10 kW at half the DSO DTT antenna height at main stations and an ERP of 1 kW and 5 m below the existing DTT antenna at relay stations. The templates, without further detailed work, represent the restrictions required on any given channel to protect the DSO multiplexes to specified levels.

As coverage based on templates typically represents the best possible and usually cannot be achieved by actual antennas, an estimate has also been made at each station of the coverage of the chosen channel for a 'practical solution'. These 'practical solutions' are based on a simple antenna and restrictions coming from a more detailed analysis. Whilst the rules used to derive the templates are designed to protect the coverage of a DSO multiplex at a station, on the channel of interest, they do not consider the interference on other channels in use at that station which may have a more significant affect on the core coverage of the DTT station; core coverage being the area where all the DSO DTT multiplexes from a station can be received. By considering the total interference to a station rather than that on a specific channel, the 'practical solutions' have, in some cases, been able to use relaxed restrictions.

The 'practical solutions' are generally based on a simple antenna, typically composed of small arrays of panels or log-periodics; the criteria for these antennas being that they are not complicated and are practical to install on the side of a broadcast structure. Where restrictions have permitted, 'practical solutions' have also been presented based on use of the main DTT antenna.

At a number of locations, solutions have been provided for split feeds to allow different content to different areas. For example, at Winter Hill, solutions have been provided for nominally covering the Granada service area as well as alternative solutions that allow independent services to be provided towards Liverpool, Manchester and Blackpool.

These 'practical solutions' serve only as a guide as to what could be achieved. Actual solutions will depend on obtaining access to the main broadcast infrastructure and can only be determined following consultation with Arqiva Managed Transmission Services and Arqiva Network Access. Access to the broadcast infrastructure is subject to regulation.

Of the 74 sites considered good solutions have been found at 67. At 6 sites, coverage of one or more of the identified target areas is marginal. In such cases, alternative sites closer to the target area, but on a radial between the

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main site and the target area, may provide better coverage. An example of this is provided for Sandy Heath where the requirement to serve Cambridge cannot be met. In this case, a better solution is to serve Cambridge from Madingley, a site located some 5 km from Cambridge. At one site, Sudbury, no viable channel was identified.

The predicted coverage of these 'practical solutions' has been assessed using a DVB-T QPSK 2/3 modulation scheme. In cases where the power of the Geographically Interleaved (GI) channel is more than 10 dB below that of the DSO multiplexes, the use of less robust modes (higher data rate modes) should be avoided, particularly at sites where the GI channel is adjacent to a DSO multiplex (35 sites).

Though coverage of the target population by the GI channels does vary from site to site, due to the restrictions on access to spectrum, the patterns and the relatively low powers, predicted overall coverage is good. The overall UK coverage of the 74 sites modelled is predicted as 61% of the UK's population.

Target Area	Population Served	% of Population served
England	13,726,738	60%
Wales	796,069	58%
Scotland	1,979,836	79%
Northern Ireland	340,489	50%
UK	16,843,132	61%

Population coverage of the 74 GI sites in the UK and its constituent countries

Whilst there may be, in some cases, a large impact to the gross coverage of individual multiplexes at particular stations, there is little impact to overall UK coverage of the DSO multiplexes. The introduction of the 74 GI stations is predicted to reduce overall 3PSB coverage by 161 households; falling from 27,156,045 to 27,155,884 households. Similarly, there is little impact to 6Core coverage which is predicted to drop by 343 households; from 24,977,461 to 24,977,118 households.

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2. Introduction

National Grid Wireless (now part of Arqiva) previously carried out a study on the availability of geographic interleaved (GI) spectrum. The findings of this study were summarised in a report "Interleaved Spectrum Planning Study" [1] which is available on Ofcom's website[1]. The study assessed the availability of interleaved spectrum for DTT applications at 71 post-Digital Switchover (DSO) broadcasting stations. The assessment was based on version 5.5 of the UK DSO plan and an interpretation of potential European interference based on information contained within the GE-06 frequency plan[2]. This earlier study was carried out before changes were made to the UK frequency plan to accommodate clearance of the 800 MHz band.

As part of the clearance process, there have been a number of changes to the frequency plans in the UK, Europe and Ireland. In the light of these changes, Ofcom has commissioned Arqiva to revisit their earlier work and confirm that the channels identified previously are still suitable. Ofcom has identified 74 sites where access to GI spectrum may be required.

This report builds on the earlier interim study and summarises the findings of the review of frequencies at 74 sites based on frequency use following clearance of the 800 MHz band.

[1] http://stakeholders.ofcom.org.uk/binaries/consultations/ddr/statement/NGW1.pdf

[2] The frequency plan enabling migration to digital transmission across Europe, agreed at the Regional Radio Conference held in Geneva in 2006

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3. Methodology

Access to UHF spectrum for GI channels is on the basis that coverage of the six UK-wide multiplexes (the DSO multiplexes) will not be compromised. As the introduction of any new service in the UHF band will introduce additional interference, a method was established, as part of Arqiva's earlier work, that maintained interference to prescribed levels. That methodology was based on protecting the service areas of stations based on analogue, digital and regional preferred service areas whilst also limiting interference to the Continent and Ireland to the co-ordination trigger threshold specified within the GE06 agreement. Since the earlier study, a number of changes have taken place to the UK network plan and the method of defining the coverage of stations has been modified. To accommodate these changes, the method used to assess impact has been adjusted appropriately.

UK clearance of the 800 MHz Band has been carried out in a systematic manner. Stations on clearance channels 61 and 62 have been moved to channels 49 and 50, and, in general, stations on channels 49 and 50 have been moved to channels 39 and 40. As such, the channel availability analysis carried out as part of the original investigation into the availability of GI channels is still, on the whole, valid apart from stations allocated channels 49 and 50. In a similar manner to the UK, Ireland and the Continent have been clearing the 800 MHz Band and changes they are planning could affect the choice of GI channel. Given these two factors, the choice of channel at each site has been reviewed and the most promising channel, typically the one subject to the least restriction, has been selected for further study.

3.1. Scenario Modelled

Modelling has been based on the UK's latest DSO clearance frequency plan version 6.014. Irish and Continental interference has been based on the planning assumptions used in assessing the coverage of the UK's 6.014 plan. These assumptions are based on the current status of bilateral clearance negotiations and represent negotiated Irish and Continental rights.

3.2. Planning Parameters

The planning parameters used for the modes modelled are summarised in Table 1.

	QPSK 2/3	
DVB Interfering Source	Co-channel	Adjacent n±1
Protection Ratio (dB)	8.4	-32

Table 1 : Protection Ratios used for assessing GI channel coverage

In line with the practice adopted by the Joint Planning Project (JPP), the study did not account for a change in protection ratio as a result of the use of an

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offset by a DSO multiplex. The consequences of this are discussed in section 5.2.

3.3. Protected Service Area

As any use of GI channels must protect the DSO multiplexes, templates detailing basic restrictions have been derived based on protection of the service area of the DSO multiplexes; the service area of a station being defined by its digital preferred service area (DPSA). For each station there are several DPSAs, each designed to protect a particular aspect of the coverage of a station. For this study the following DPSAs were used.

- A 3PSB DPSA to ensure that all stations carrying public service broadcasting multiplexes are protected.
- A 6Core DPSA to ensure that access to the station providing the greatest number of PSB and commercial multiplexes is protected.
- A Nations PSB DPSA to ensure that Welsh, Scottish, Northern Irish and English services are protected within the relevant nation.
- A modified analogue preferred service area (dAPSA) to recognise the fact that households may not realign their aerials at DSO if they continue getting a satisfactory service from the station that provided their analogue service.

The DPSA used were based on version 6.014 of UK DSO plan post clearance. To avoid unnecessary restrictions to unpopulated high ground only populated pixels within the DPSA are protected.

Apart from protecting UK stations, restrictions are also required on GI channels to limit interference to Ireland and the Continent. For the purpose of this study, interference to Ireland and the Continent has been limited to 29 dBμV/m. Whereas this level is higher than the ITU co-ordination notification level contained in the GE-06 agreement, it is in line with levels adopted on a bilateral basis between the UK and a number of its neighbours. It should be noted that agreement for these new services is still required with our neighbours and the outcome of such negotiations cannot be guaranteed.

3.4. Templates

For each station and chosen channel, templates have been calculated that limit the increase in interference towards PSB services to 0.5 dB and towards COM services to 1 dB where the service availability is less than 90% locations served. In areas where availability is greater than 90% locations higher levels of interference are permitted. The methodology used is similar to that adopted for the earlier study though the protected service areas have changed.

Templates have been generated at half structure height assuming an ERP of 10 kW at the main stations. At the smaller sites, templates have been generated assuming a height 5 m below the existing DTT antenna and an ERP of 1 kW. There are some exceptions to this rule. For instance, Bluebell Hill is a main station with a short structure so a height about 5 m below the

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DTT antenna has been used, Lancaster is a relay but on a tall structure so half structure height has been used.

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3.5. Practical Solutions

As the coverage achieved by a system based on a template is going to be optimistic, an attempt has been made at modelling practical solutions. These 'practical solutions' not only consider actual or implementable antennas, but an 'engineering judgement' has been made as to the actual restriction required.

The planning rules adopted provide a guide as to the restrictions required on a particular channel to limit damage to the DSO multiplexes to a known level. However, these rules consider channels in isolation. By considering existing interactions between stations, there maybe, subject to 'engineering judgement', scope for relaxing these UK restrictions.

In cases where there is an existing relationship between the GI station and the UK station suffering interference, the restrictions on the GI channel have been relaxed. An example of this is the restriction on the preferred GI channel at Mendip, ch51, towards Moel-y-Parc. Moel-y-Parc uses channels 48, 51 and 52 for COM services. Channels 48 and 52 are used by the DSO COM multiplexes at Mendip which operate at 100 kW ERP unrestricted. Consequently, whilst restricting Mendip GI channel 51 limits interference to that channel at Moel-y-Parc, it does not limit 6Core coverage of the station as this is limited by DSO multiplexes at Mendip that use channels 48 and 52. As such, the restriction on channel 51 at Mendip can be removed with arguably no impact on the core coverage of Moel-y-Parc; 6Core coverage being the predicted area over which all services from Moel-y-Parc can be received.

Using this approach based on 'engineering judgement' and selecting simple antenna designs to match the modified restrictions, a better indication of the coverage that could be achieved by GI channels is provided.

Based on these 'engineering judgements', 'practical solutions' have been derived for each of the sites and the resulting coverage based on a DVB-T QPSK 2/3 system has been calculated.

Actual solutions will depend on access to the main broadcast infrastructure and can only be determined following consultation with Arqiva Managed Transmission Services and Arqiva Network Access. Access to the broadcast infrastructure is subject to regulation.

3.6. Impact to the DSO Multiplexes

The impact of the network of the GI stations on the coverage of the DSO multiplexes has been assessed based on the 6.014 version of the UK plan; the GI stations adopting the parameters derived for the 'practical solution' with GI antennas typically mounted at half the height of the DSO DTT antennas or 5 metres below at relay sites.

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3.7. Coverage to Grouped Receive Aerials

Coverage calculations are based on the use of an appropriate receive aerial. In cases where the assigned GI channel is outside of the receive aerial group for the main multiplexes viewers without such an aerial may not be able to receive the GI service.

4. Results

The results of coverage runs for the scenarios modelled are presented in Annexes 1 to 5. Composite coverage plots for the whole of the UK and station groups are provided in Annex 6.

4.1. Templates & Practical Solutions

Templates detailing basic restrictions have been derived based on protection of the service area of the DSO multiplexes, the service area of a station being defined by its DPSA. Based on the derived templates and applying 'engineering judgement' possible 'practical solutions' have been derived. Details of these solutions, the channel, the suggested ERP, the template and a possible 'practical antenna' are provided in Annexes 1 to 5.

4.2. Impact to the DSO Multiplexes

The assessment of the impact to the coverage of the DSO multiplexes of the 74 GI stations, Group 0, A, B C & D based on the suggested 'practical solutions' has been carried out.

The impact to PSB coverage, based on the JPP cut-off method, was a drop in total UK coverage of 161 households; predicted coverage falling from 27,156,045 to 27,155,884 households.

The impact to 6 core coverage, based on the JPP cut-off method, was a drop in total UK coverage of 343 households; predicted coverage falling from 24,977,461 to 24,977,118 households.

5. Discussion

Apart from Scotland, access to GI spectrum is limited. In Scotland, clearance of the 800 MHz Band has had little impact and channels identified in NGW's study of 2009[3] [2], channels 30, 48, 51, 52 and 56 are still available. These five channels are the non-standard channels, i.e. ones that were not part of the nine standard analogue channel groups which have formed the basis of the DTT channel groups, see Annex 7. For DTT planning, with exceptions, channels 48, 51 and 52 have tended to be used as a tenth group in the north of England; channels 48, 52 and 56 have formed a tenth group in the south of England and in Wales. As such, channel 56 is relatively lightly used in the north of England and lends itself to use as a GI channel. On a similar basis channel 51 tends to be available in south-west England and parts of Wales.

[3] http://stakeholders.ofcom.org.uk/binaries/consultations/ddrinterleaved/scot.pdf

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Spectrum in central England is limited and available channels are restricted. Likewise the spectrum in the south-east of England is limited because of the non-standard use of spectrum to match Continental usage.

Not withstanding these restrictions, channels have been identified for seventy-three of the seventy-four sites that provide coverage of the primary population centres. At some of these sites, it may be possible to operate the GI channel, at a restricted ERP, out of the main DTT antenna. At one site, Sudbury, it has not been possible to identify a suitable channel. At a number of sites, restrictions on the power limit the possible coverage. As a consequence, coverage of the prime target areas from Waltham (Nottingham), Brougher Mountain (Omagh), Caradon Hill (Bodmin and Plymouth), Bilsdale (York), Sandy Heath (Cambridge) and from Belmont (Lincoln) is not ideal. For these target areas, a better solution may be obtained by finding a suitable transmitter site closer to the target area that lies on a radial between the main site and the target area. An example of such a site is Madingley which could be used to provide a service in Cambridge as that provided from Sandy Heath is marginal.

5.1. Access to Broadcast Infrastructure

The 'practical solutions' give an indication of possible coverage. However, given there is a degree of flexibility with respect to each of the identified GI channels, the implemented solution at any station will be a commercial judgement based on balancing cost against coverage. Within this equation, restrictions regarding access to existing infrastructure, the ability of the mast to support new antennas, space on the mast and access to the main DTT antenna, must be factored in. It is important that potential users of GI spectrum are aware of the costs and limitations imposed by the existing infrastructure. Such details can be obtained from Arqiva Managed Transmission Services and Arqiva Network Access. Arqiva's provision of Network Access and Transmission Services is a regulated business.

5.2. Adjacent Channel Interference

GI multiplexes could be susceptible to adjacent channel interference from the DSO multiplexes and hence have reduced or marginal coverage. Four mechanisms will contribute to the susceptibility of GI multiplexes.

- Low power level relative to the DSO multiplex
- Restricted antenna pattern relative to the DSO multiplex
- A significant difference in height relative to the DSO multiplex
- A DSO multiplex offset towards the GI channel in particular a DSO multiplex using extended carrier DVB-T2

To some extent, each of these can be managed. The main mitigation method is the choice of modulation scheme; the more robust the modulation scheme, the more resilient the service albeit at the cost of data capacity, i.e. lower bit rate.

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Other than modulation scheme, careful choice of antenna pattern and the position of the antenna can help mitigate interference. Where possible, the antenna pattern should match that of the DSO multiplex, at least over the primary service area of the local service. Also, the antenna height should be as close as possible to that used by the DSO multiplex, though the possibility of building an antenna close to that used by the DSO multiplex may be restricted by lack of space on the structure. In such a case, these two criteria could be met by sharing the same antenna as the DSO multiplex. However, the cost of doing so, or the restrictions required may preclude this.

5.2.1. Offset Channels

On occasion the main multiplexes use offsets, that is the centre frequency of the multiplex is moved up or down by 167 kHz. This has been done primarily to avoid the need for critical mask filtering, particularly at band edges, but also to help with adjacent channel transposition in the relay chain. Multiplexes offset into each other are subject to lower levels of protection. The standard planning criteria, used by the JPP, suggest that offsetting a DVB-T multiplex down can reduce the adjacent channel protection ratio by 11 dB. Information on the impact of offsetting DVB-T2 is presently not available. However, even though it occupies more bandwidth within the channel, because of the reduced emissions outside of the channel, it is thought that DVB-T2 will cause no more interference than DVB-T. However, DVB-T2 does have an extended carrier mode and an offset T2 extended carrier system will infringe on the adjacent channel. This may result in an increase in interference beyond that quoted for an offset DVB-T channel.

In the cases where GI channels are adjacent to an offset channel used by a DSO multiplex it has been assumed that the GI channel will need to employ a similar offset.

Channels at Band Edges, that is channels 21, 30, 39 and 60, will be subject to the requirements of IR2022[4] [3]. These channels can either be offset, where adjacent channel usage permits, or in the cases where an existing adjacent DSO multiplex is not offset, critical mask filtering will need to be applied.

It should be noted that the coverage calculations in this study have not considered offsets. A list of GI stations with adjacent channel relationships is given in Annex 8.

5.3. Impact to DTT

Whilst the impact to the gross coverage of individual channels is greater than the net loss to a station, this is generally overlap coverage or coverage in excess of that achieved by the other multiplexes. This is borne out by the fact that the overall impact to UK coverage of the DSO DTT multiplexes is minimal. Allowing a reduction in margin, even one as small as 0.5 dB, will

[4] http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/ir2022.pdf

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result in some locations falling below the JPP cut-off criteria for coverage of 70% locations served for 99% of time. Viewers will still be able to receive the affected service as the wanted signal levels remain the same. However, there will be a slight loss in time availability of the service.

5.4. Coordination

Interference towards the Continent and Ireland has generally been limited to 29 dBμV/m. However, whilst this level has been used as the basis of coordination of the main multiplexes, it exceeds the ITU trigger threshold (nominally about 23 dBμV/m). As such, GI channels at a number of sites that have restrictions towards the Continent and Ireland will need to be subject to the coordination process and will need to be agreed with the affected administrations.

6. Conclusion

The availability of GI channels at 73 of the 74 sites has been confirmed. In each case, other than at Sudbury, it should be possible to serve the main population areas associated with each site. However, at 6 sites coverage of the required target areas is not ideal and a better solution may be had by locating the GI service closer to the target area.

In all cases where restrictions are required towards Ireland and the Continent use of the GI channel will need to be coordinated.

Arqiva Managed Transmission Services and Arqiva Network Access should be consulted regarding possible implementation on Arqiva broadcast infrastructure.

7. References

1. Interleaved Spectrum Planning Study Final Report, 30 November 2007, National Grid Wireless

2. Spectrum Efficiency in Scotland Study Proposal, 26 March 2008, National Grid Wireless

3. UK Interface Requirement 2022 Broadcast Transmitters operating in frequency bands administered by Ofcom, July 2007 Ofcom

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Annex 0 : Templates & Practical Patterns

Templates are based on the UK DSO plan version 6.014 post-clearance. The permissible increase in interference towards PSB services is 0.5 dB and towards COM services 1 dB. At locations where the wanted service is more robust, higher levels of interference are permitted, the threshold for allowing higher levels of interference being limited to areas where a service is available at 90% locations or better for 99% time. Interference to Ireland and the Continent is limited to 29 dBμV/m.

The planning rules adopted provide a guide as to the restrictions which are required on a channel in order to limit damage to the main multiplexes to a known level. However, these rules consider channels in isolation. By considering existing interactions between stations there may be, subject to engineering judgement, scope for relaxing the basic UK restrictions.

Taking this approach, and to provide a better indication of the coverage that could be achieved by GI channels, an estimate has been made of possible implementations. The scenarios modelled have made assumptions about the restrictions required. In cases where there is an existing relationship between the GI station and the UK station suffering interference, the restrictions on the GI channel have been relaxed.

In each case, a simple antenna solution has been used. Typically, this is based on an antenna array composed of panel or log-periodic antennas, which would be suitable for mounting on the side of a broadcast mast. In the case where it is considered that there are no restrictions or the restrictions allow, it has been noted that the main DTT antenna could be used.

All patterns are shown on the horizon and take into account any anticipated reduction in the vertical radiation pattern. For example, the antenna at Bilsdale, which is subject to restrictions of up to 20 dB relative to 10 kW towards Fenham, could meet these by using a combination of reducing the ERP, making use of a beam tilt (electrical or mechanical) of the vertical radiation pattern and a reduction in the horizontal radiation pattern.

At a number of sites, solutions are provided for both wide area and directed solutions. An example of this is Winter Hill where both wide area solutions and beams directed towards Manchester, Liverpool and Blackpool are detailed. In such cases, the beams use the same channel but it is assumed they will carry different content. This is possible by making sure there is very little overlap between the beams and by using a robust modulation scheme such as QPSK 2/3.

The practical patterns provide an estimate of what could be achieved. Actual implementation will depend on the availability of access to any broadcast structure and the commercial viability.

Arqiva Managed Transmission Services and Network Access should be consulted regarding use of existing broadcast infrastructure

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Annex 1 : Group 0 Sites

The stations in Group 0 and their prime target areas are detailed in Table A1-1.

Station ID	Station Name	Area
10100	Crystal Palace	London
10200	Sutton Coldfield	Birmingham
10300	Winter Hill	Manchester and Liverpool
10400	Emley Moor	Leeds and Bradford
10500	Black Hill	Glasgow and West Edinburgh
10600	Wenvoe	Cardiff and Newport
10700	Divis	Belfast
10900	Pontop Pike	Newcastle and Sunderland
11100	Waltham	Nottingham
14700	Craigkelly	Edinburgh

Table A1-1 : 10 DTT Stations studied in Group 0

The predicted coverage of the stations using the suggested 'practical solutions' is summarised in Table A1-2.

		Households served				Households served	
Station	ch	Net	Gross	Station	ch	Net	Gross
Crystal Palace main	29	4,578,881	5,003,067	Black Hill Glasgow	51	663,886	749,813
Crystal Palace GI	29	3,128,044	3,183,363	Black Hill Edinburgh	51	106,358	356,026
Sutton Coldfield GI	51	1,114,273	1,177,209	Black Hill Falkirk	56	338,493	462,605
Winter Hill main	56	2,640,215	2,927,518	Wenvoe GI	51	351,072	499,072
Winter Hill GI	56	2,024,186	2,187,572	Divis GI	30	252,159	257,578
Winter Hill Manchester	56	1,053,691	1,125,686	Pontop Pike main	56	788,960	1,190,120
Winter Hill Liverpool	56	807,647	884,440	Pontop Pike GI	56	761,320	1,014,546
Winter Hill Blackpool	56	344,565	350,406	Waltham GI half ht	26	202,622	313,361
Emley Moor GI	56	1,008,560	1,063,567	Waltham GI full ht	26	282,083	534,696
Black Hill main	51	1,080,961	1,379,859	Craigkelly main	52	312,886	708,807
Black Hill GI	51	985,157	1,161,260	Craigkelly GI	52	287,927	605,103

Table A1-2: Predicted coverage (households) of Geographically Interleaved channels based on 'practical solutions' : DVB-T QPSK 2/3 for Group 0 stations.

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Crystal Palace 10100

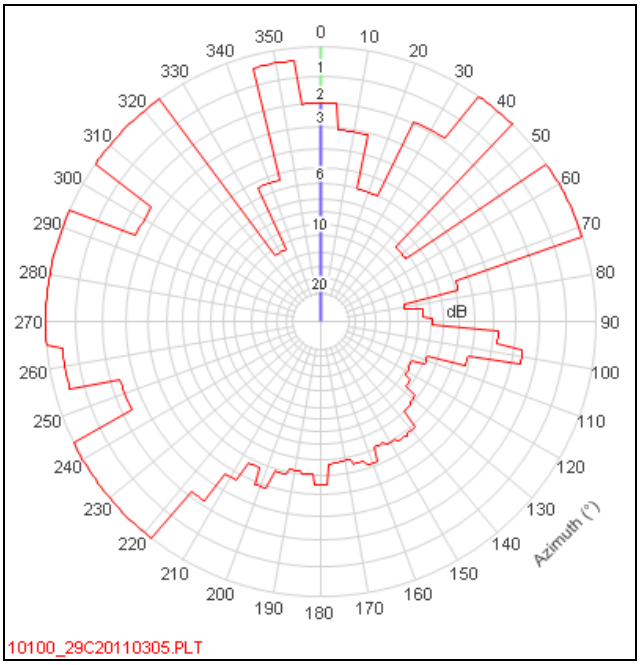

Figure A1 -1: Antenna Template : Crystal Palace channel 29

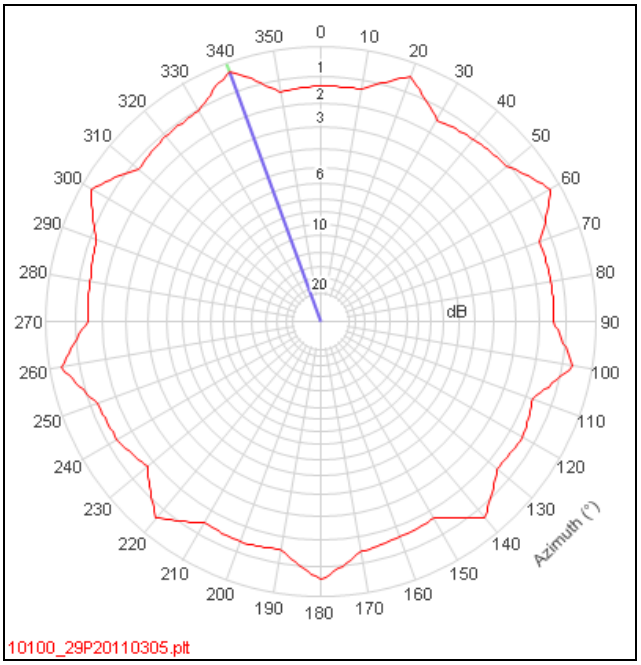

Figure A1-2 : Practical Pattern : Crystal Palace channel 29 – Main DTT Antenna

ERP	2 kW	Antenna Height	214 metres

Table A1-3 : Crystal Palace ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	4,578,881	5,003,067
90%	4,277,553	4,419,142

Table A1-4 : Crystal Palace ch29 : Population served based on Main antenna

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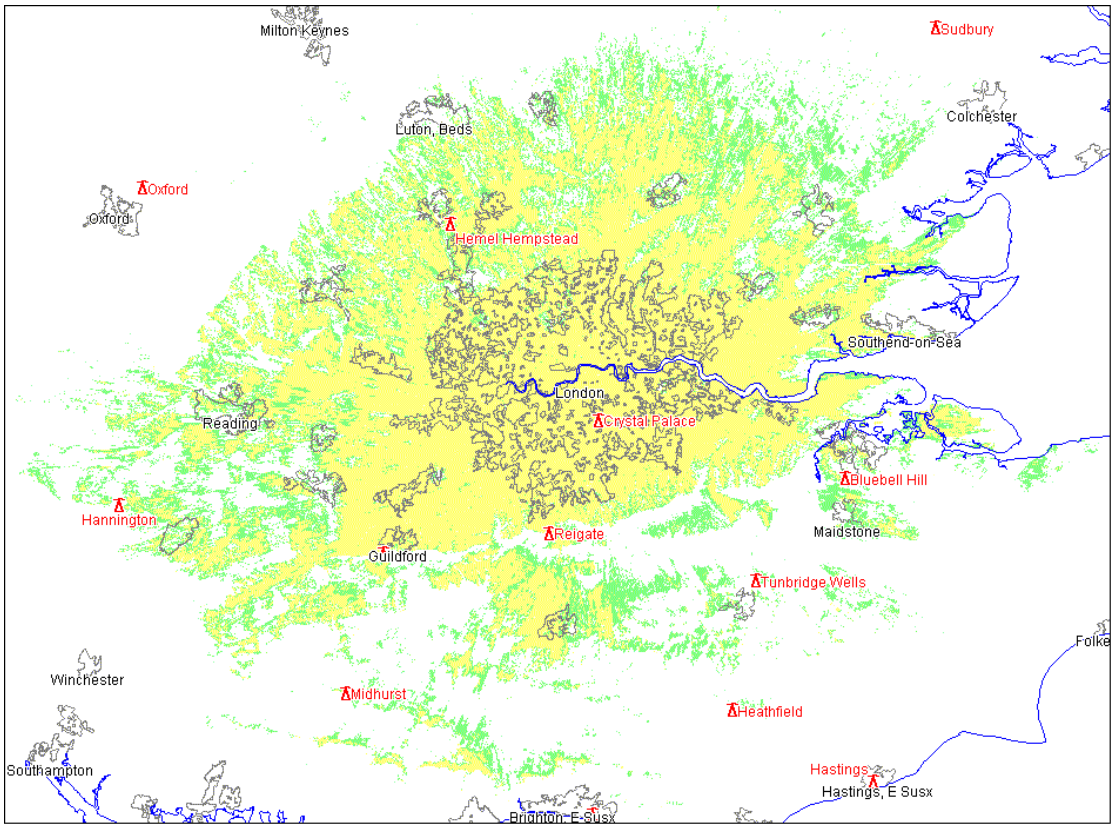

Figure A1-3: Crystal Palace: ch 29: 2 kW ERP: Main DTT antenna: 214m a.g.l

Practical Antenna:
The requirement is to serve London.

Restrictions are required towards PSB services at Stockland Hill (250º–260º ETN), Linnet Valley and Thetford (30º ETN) and Ipswich Stoke (50º ETN). As these stations are also co-channel with the 200 kW main multiplexes at Crystal Palace on channels 23 and 26 and it is these channels that will limit the coverage of the impacted stations. As such the restrictions on channel 29 do not protect the core service area of these stations and could be relaxed. Subject to negotiation, there may be some limited scope to relax the restriction towards the COM multiplex at Waltham (300º ETN to 20º ETN). Again, subject to negotiation, it may also be possible to relax the restrictions towards Belgium and Holland; however the restrictions towards France, particularly towards Boulogne, will need to be maintained. Anticipating that some limited relaxation might be allowed then it could be possible to operate channel 29 from the main DTT antenna at 2 kW.

Coverage of the channel, based on use of the main DTT antenna and a transmission system using a QPSK 2/3 mode, is comparable to that of the main PSB multiplexes.

As an alternative a side-mounted antenna firing north should easily meet restrictions towards France. However, operating power is still limited by the need to protect the coverage of the COM multiplex at Waltham. Anticipating that some limited relaxation might be allowed then it could be possible to operate channel 29 from the antenna shown in Figure A2-3 at 2 kW. Other antenna designs may permit different maximum operating powers and different coverage.

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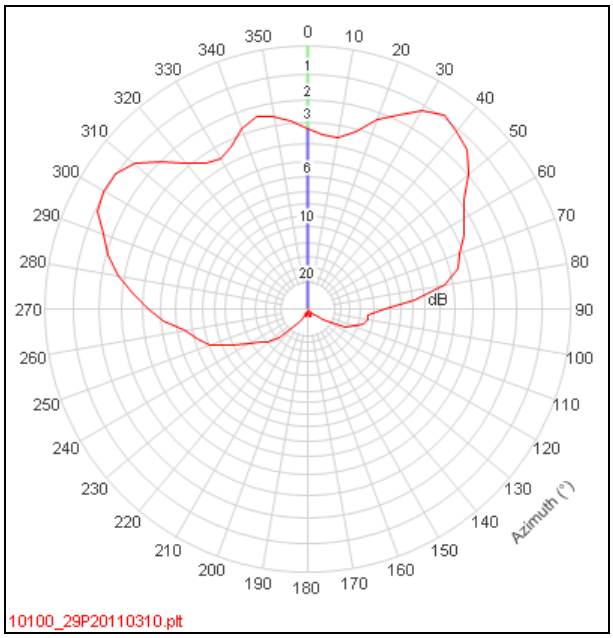

Figure A1-4 : Practical Pattern : Crystal Palace channel 29 : Sidemount

ERP	2 kW	Antenna Height	106 metres

Table A1-5 : Crystal Palace ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	3,128,044	3,183,363
90%	2,819,216	2,829,554

Table A1-6 : Crystal Palace ch29 : Population served based on side mount antenna

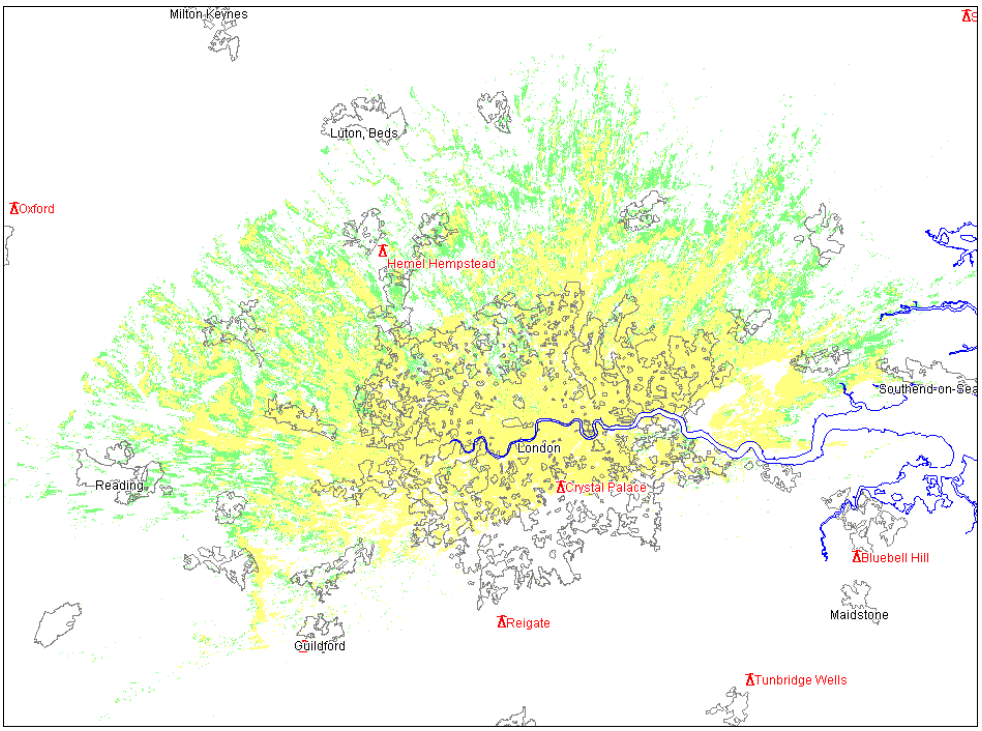

Figure A1-5: Crystal Palace: ch 29: 2kW ERP: Practical antenna: Side mount: 106 m a.g.l

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Sutton Coldfield 10200

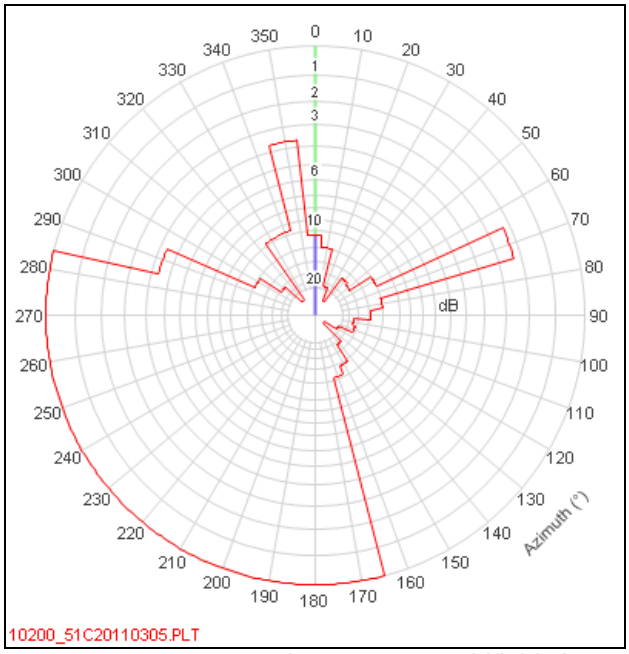

Figure A1-6 : Antenna Template : Sutton Coldfield channel 51

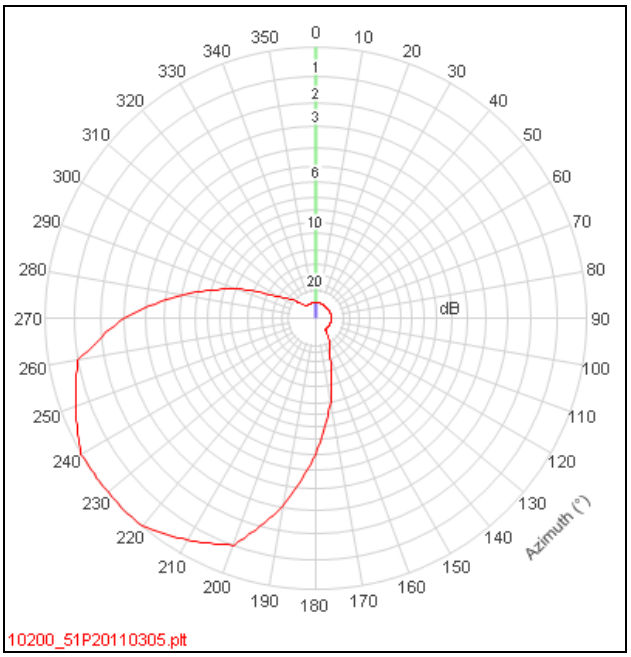

Figure A1-7 : Practical Pattern : Sutton Coldfield channel 51: Side Mount

ERP	10 kW	Antenna Height	132 metres

Table A1-7 : Sutton Coldfield ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	1,114,273	1,177,209
90%	890,025	898,536

Table A1-8 : Sutton Coldfield ch51 : Population served based on Side Mount Antenna

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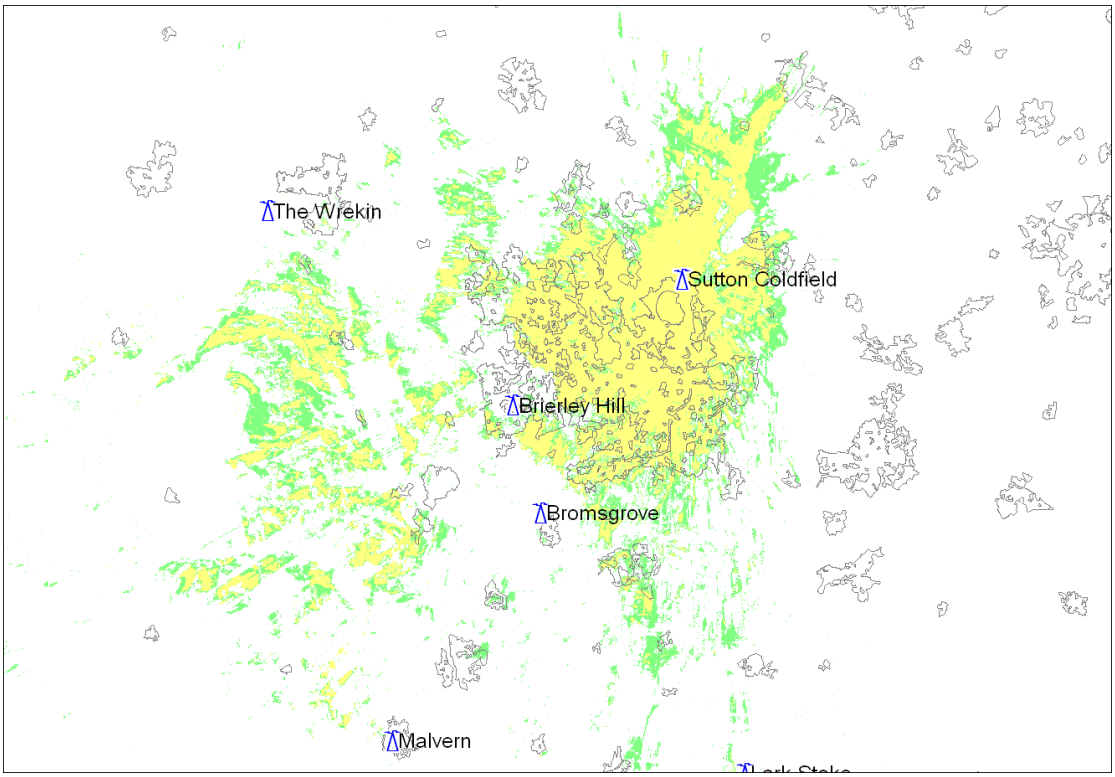

Figure A1-8: Sutton Coldfield: ch 51: 10kW ERP: Practical antenna: Side Mount : 132m a.g.l

Practical Antenna:
The requirement is to serve Birmingham.

Restrictions are required towards DTT services at Moel-y-Parc (290º–340º ETN). As the 200 kW COM multiplexes at Sutton Coldfield are co-channel with Moel-y-Parc there is scope for relaxing these restrictions. Sutton Coldfield has no existing relations ship with Derby (30º ETN), Nottingham (30º-50º ETN), Emley Moor (350º-70º ETN), and Sandy Heath (80º-160º ETN). Restrictions towards these stations will need to be maintained. Sutton Coldfield is not subject to any Continental restrictions. The extent of the required restrictions means that it is unlikely that use could be made of the existing DTT antennas; thus a new antenna will be required. Space on the structure is limited; there is the option of using the mast at Lichfield; though different restrictions would apply.

Particular care will be needed to protect the regional service transmitted from the Derby transmitter.

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Winter Hill 10300

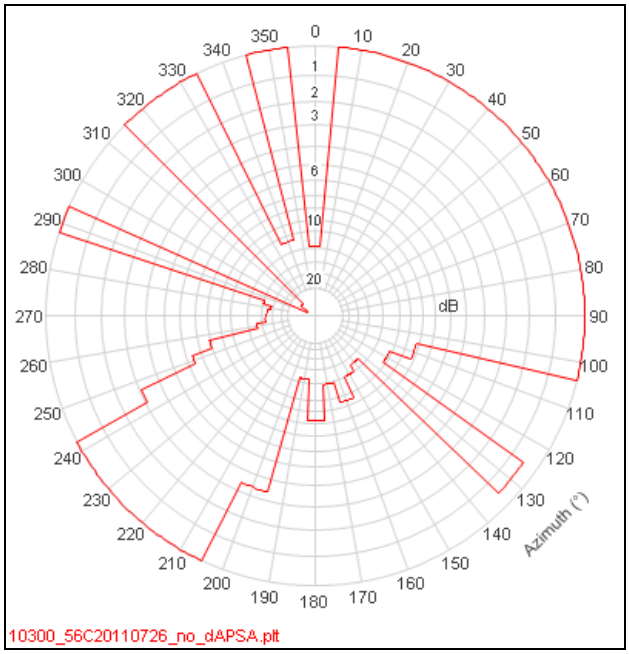

Figure A1-9: Antenna Template : Winter Hill channel 56

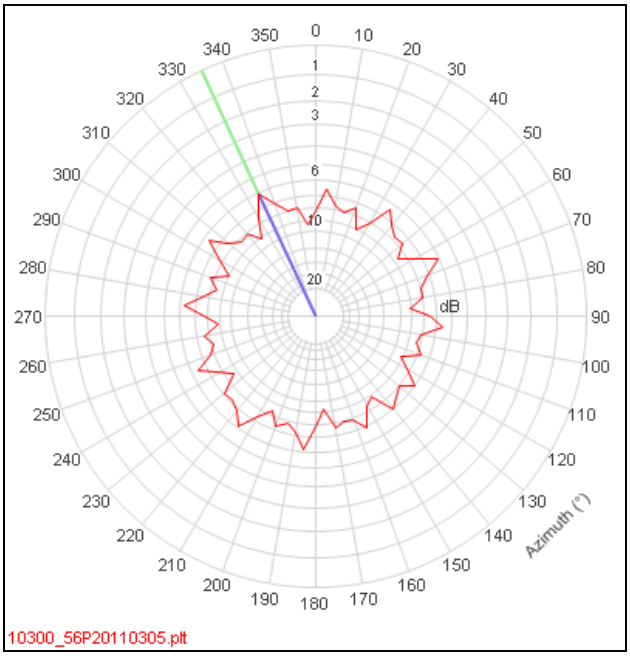

Figure A1-10 : Practical Pattern: Winter Hill channel 56 : Main DTT

ERP	1 kW	Antenna Height	288 metres

Table A1-9 : Winter Hill ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	2,640,215	2,927,518
90%	2,531,964	2,710,694

Table A1-10 : Winter Hill ch56 : Population served based on Main DTT antenna

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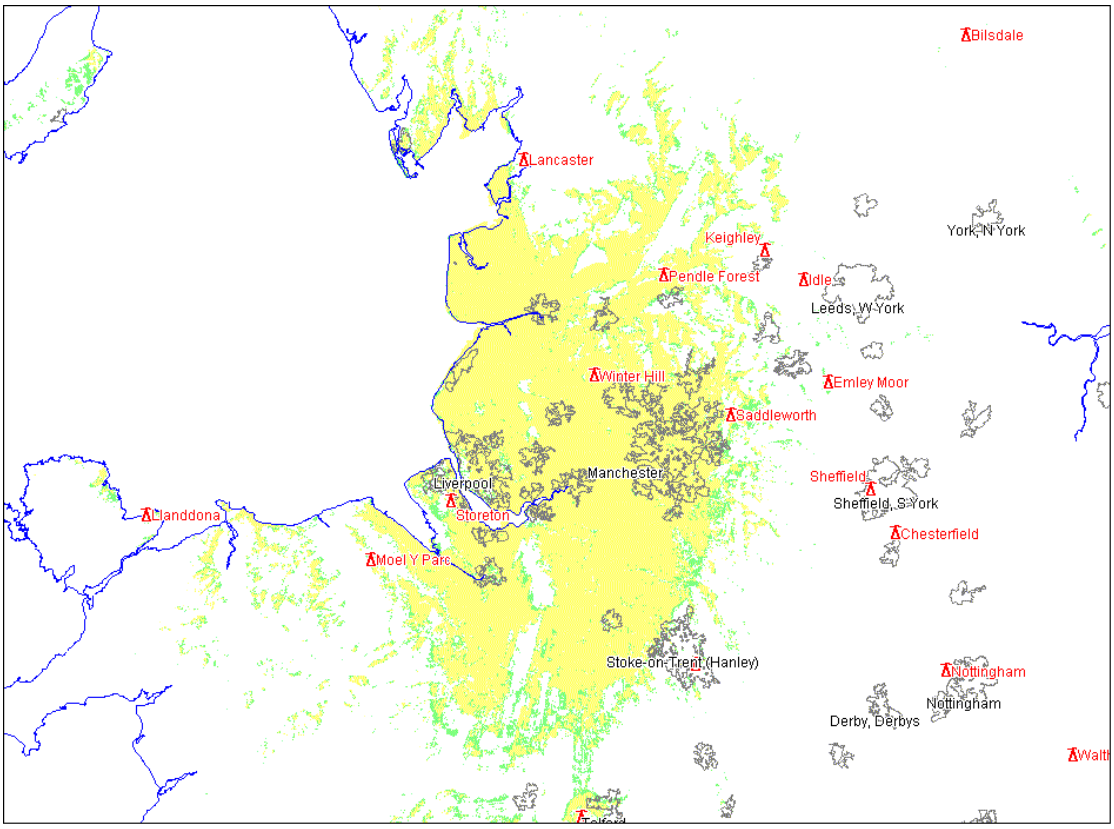

Figure A1-11 : Winter Hill: ch 56: 1kW ERP: Practical antenna: Main DTT 288 m a.g.l

Practical Antennas:

The requirement is to serve Manchester, Liverpool and Blackpool.

Restrictions are required towards Far Highfield (350°-0°), Millthrop (0°), Waltham (110°-160), Hartington (140), Cheadle (150-160), Rugeley (160°), Mendip (180°-200°), Kinver (170°), Huntshaw Cross (200°), Whitehead (300°), Bellair (310°) and Crosthwaite (340°).

The restrictions towards Waltham (90º - 160º ETN), Mendip (170º - 190º ETN) and Huntshaw Cross (200°) could be relaxed as there is an existing relationship between the main multiplexes at these stations and it is these, rather than the GI channel, which will limit core coverage.

There is no relationship with any of the other stations.

The worst affected Cheadle location (150°) is predicted to have 6 multiplex coverage from Sutton Coldfield but poor coverage from Cheadle

The worst affected Hartington location (140°) is predicted to have 6 multiplex coverage from Sutton Coldfield but poor coverage from Hartington.

The worst affected Crosthwaite location is predicted to have 6 multiplex coverage from both Winter Hill and Lancaster

The worst Whitehead location is an area of poor reception but Whitehead is predicted to be the best server.

The worst Bellair location is predicted to have coverage only from Bellair.

As an alternative, the three main targets could be served using separate antennas.

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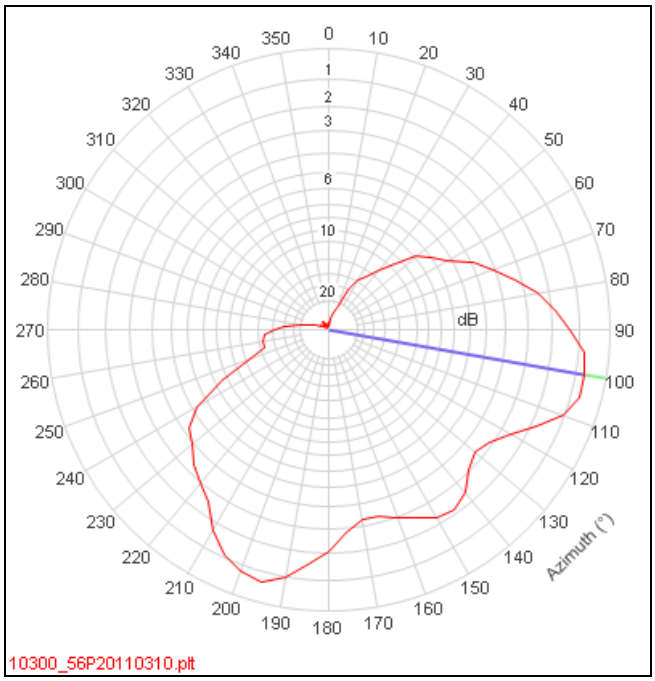

Figure A1-12 : Practical Pattern: Winter Hill channel 56 : Side Mount

ERP	1 kW	Antenna Height	144 metres

Table A1-11 : Winter Hill ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	2,024,186	2,187,572
90%	1,884,654	1,988,591

Table A1-12 : Winter Hill ch56 : Population served based on Side Mount Antenna

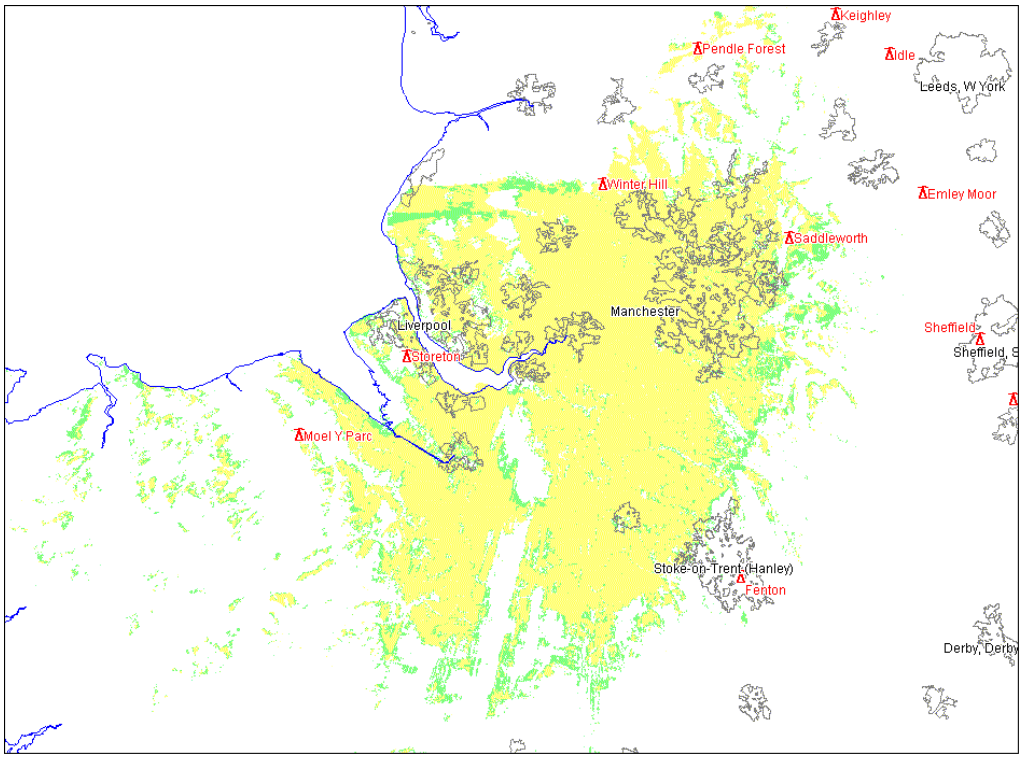

Figure A1-13: Winter Hill: ch 56: 1kW ERP: Practical antenna: Side Mount :144 m a.g.l

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Manchester

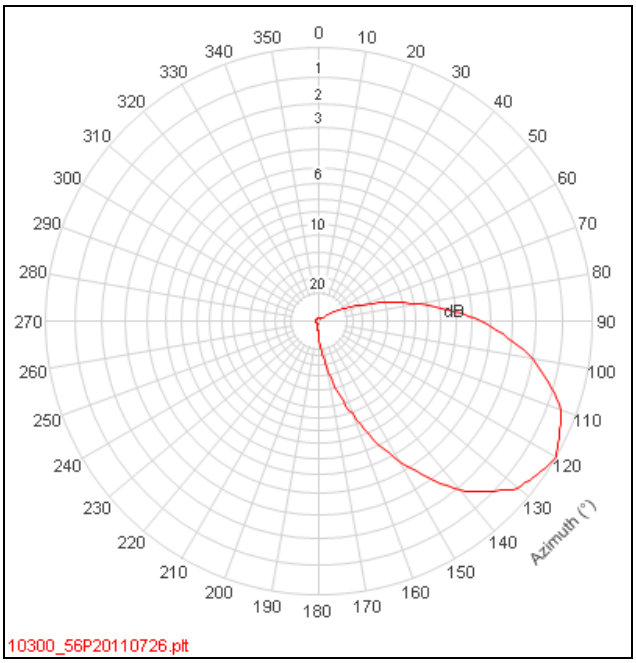

Figure A1-14 : Practical Pattern : Winter Hill channel 56 - Manchester

ERP	2 kW	Antenna Height	144 metres

Table A1-13 : Winter Hill ch56 : Parameters - Manchester

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	1,053,691	1,125,686
90%	1,024,805	1,080,552

Table A1-14 : Winter Hill ch56 : Population served based on antenna

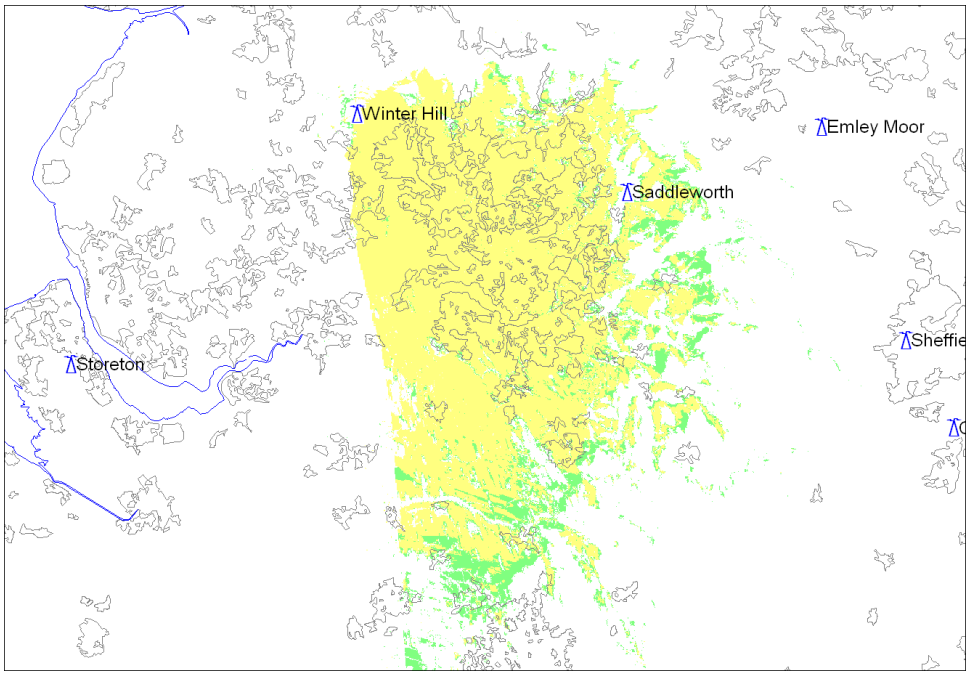

Figure A1-15: Winter Hill: ch 56: 2 kW ERP: Practical Manchester antenna: 144m a.g.l

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Liverpool

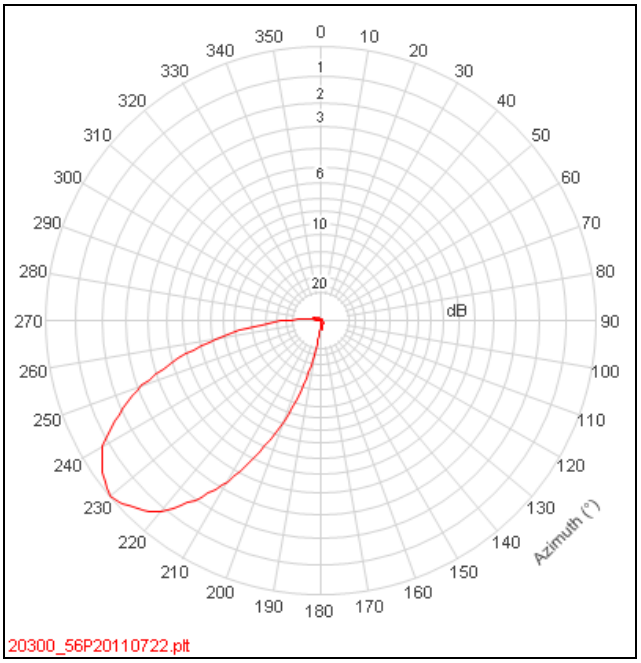

Figure A1-16 : Practical Pattern : Winter Hill channel 56 - Liverpool

ERP	2 kW	Antenna Height	144 metres

Table A1-15 : Winter Hill ch56 : Parameters - Liverpool

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	807,647	884,440
90%	732,373	777,388

Table A1-16 : Winter Hill ch56 : Population served based on Liverpool antenna

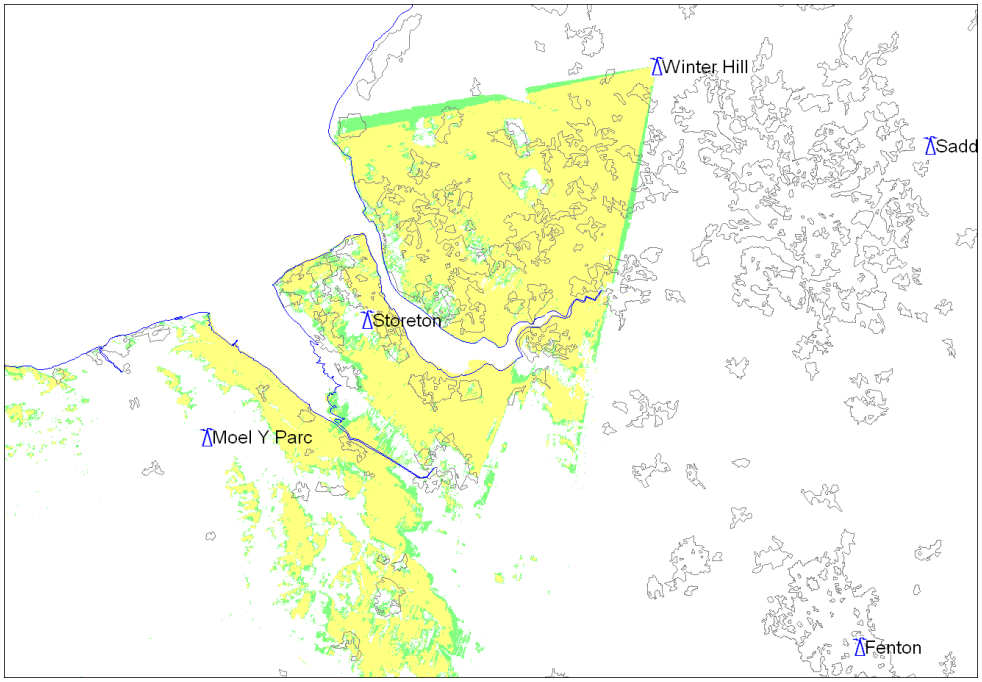

Figure A1-17: Winter Hill: ch 56: 2 kW ERP: Practical Liverpool antenna: 144m a.g.l

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Blackpool

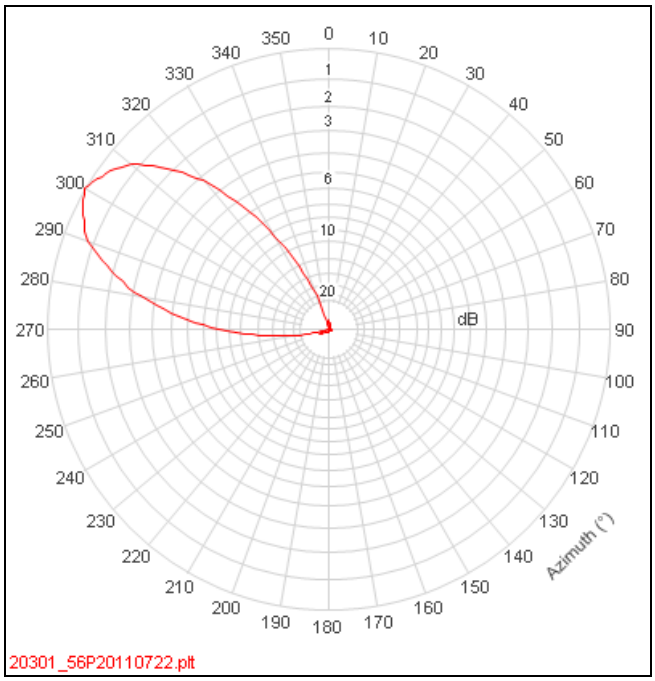

Figure A1-18 : Practical Pattern : Winter Hill channel 56 - Blackpool

ERP	1 kW	Antenna Height	144 metres

Table A1-17 : Winter Hill ch56 : Parameters - Blackpool

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	344,565	350,406
90%	312,912	315,703

Table A1-18 : Winter Hill ch56 : Population served based on Blackpool antenna

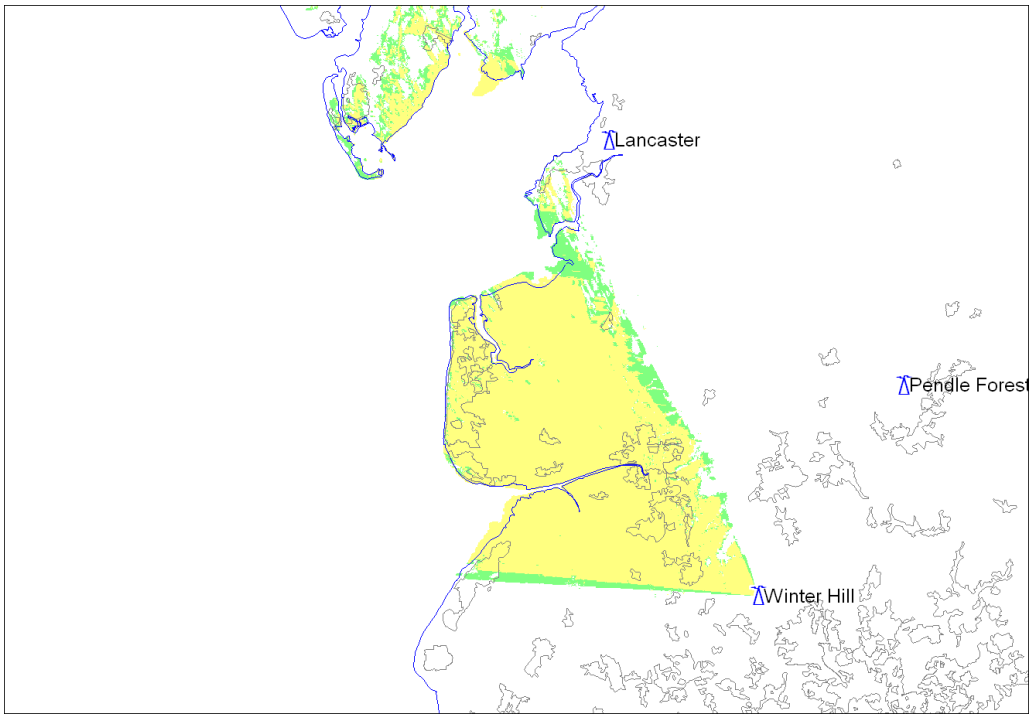

Figure A1-19: Winter Hill: ch 56: 1 kW ERP: Practical Blackpool antenna: 144m a.g.l

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Emley Moor 10400

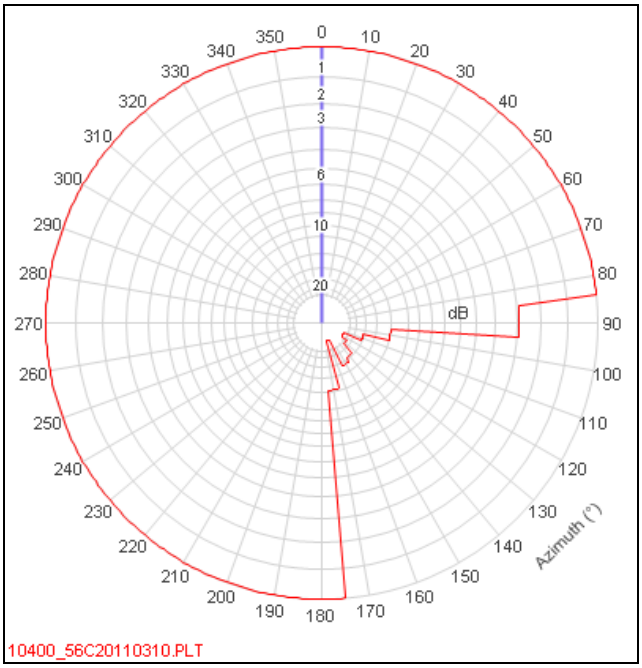

Figure A1-20: Antenna Template : Emley Moor channel 56 : Side Mount

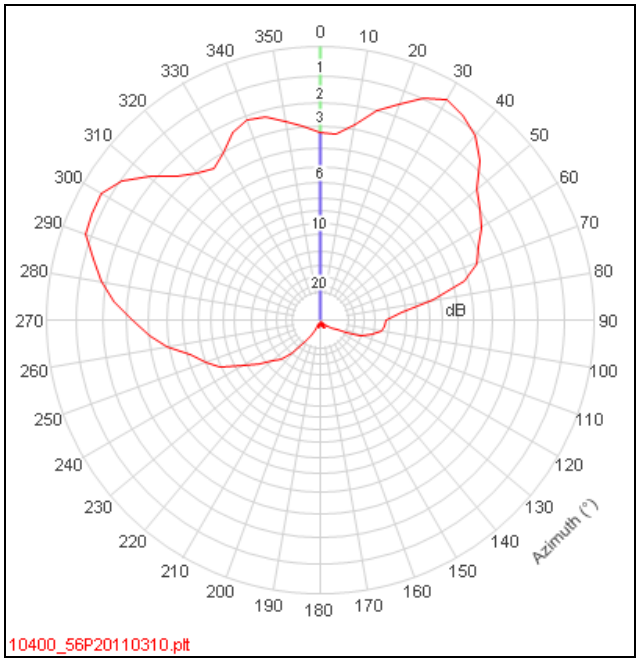

Figure A1-21 : Practical Pattern : Emley Moor channel 56

ERP	5 kW	Antenna Height	161 metres

Table A1-19 : Emley Moor ch56 : Practical parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	1,008,560	1,063,567
90%	819,327	837,173

Table A1-20 : Emley Moor ch56 : Population served based on Side Mount Antenna

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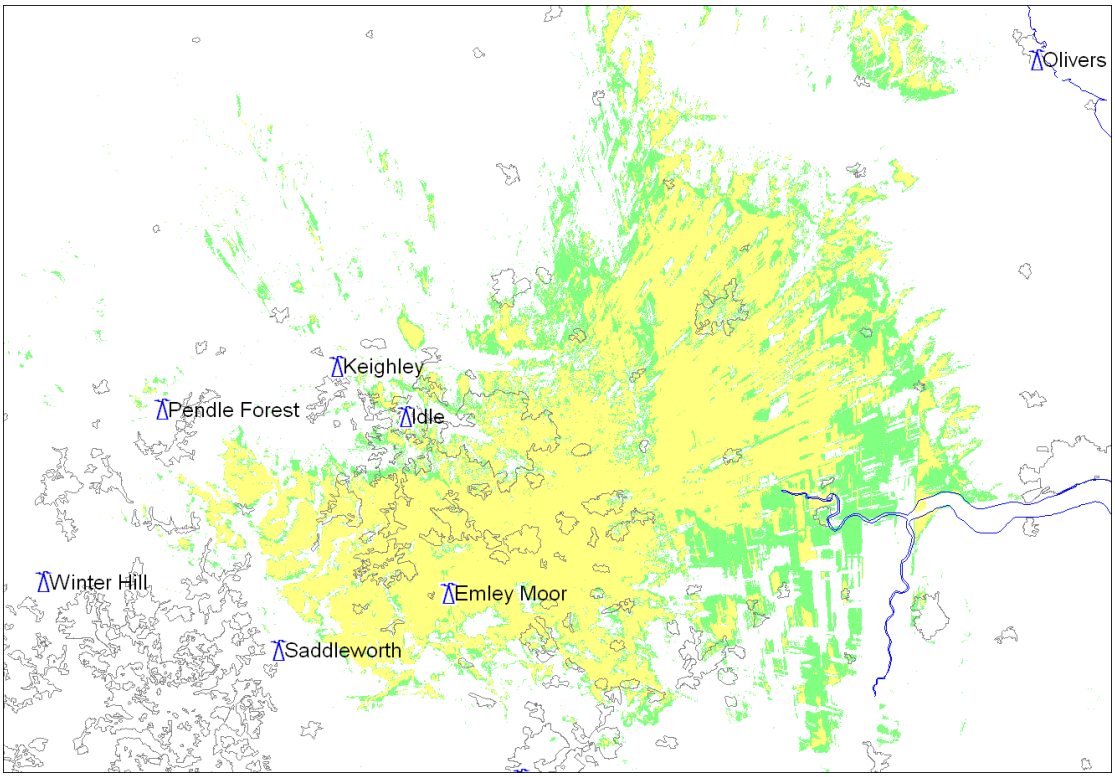

Figure A1-22 : Emley Moor : ch 56: 5kW ERP : Practical antenna : Side Mount :161 m a.g.l

Practical Antenna:
The requirement is to serve Leeds and Bradford.

Restrictions are required towards the COM service at Waltham (90º–170º ETN). There is no existing relationship between Emley Moor and Waltham so the restrictions should be maintained.

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Black Hill 10500

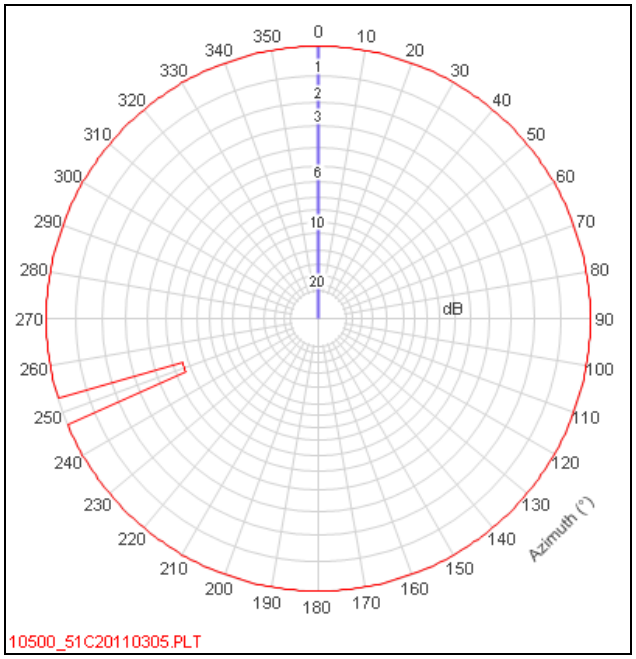

Figure A1-23: Antenna Template : Black Hill channel 51

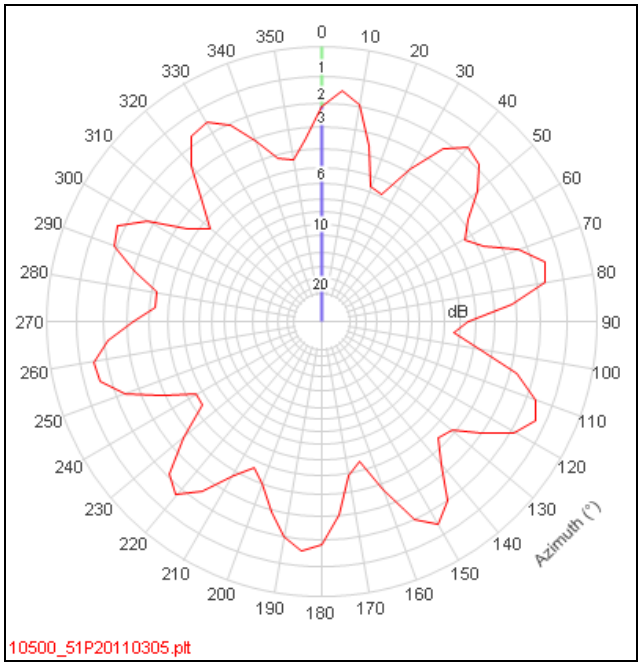

Figure A1-24 : Practical Pattern : Black Hill channel 51 – Main DTT

ERP	5 kW	Antenna Height	308 metres

Table A1-21 : Black Hill ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	1,080,961	1,379,859
90%	1,073,077	1,253,845

Table A1-22 : Black Hill ch51 : Population served based on Main DTT Antenna

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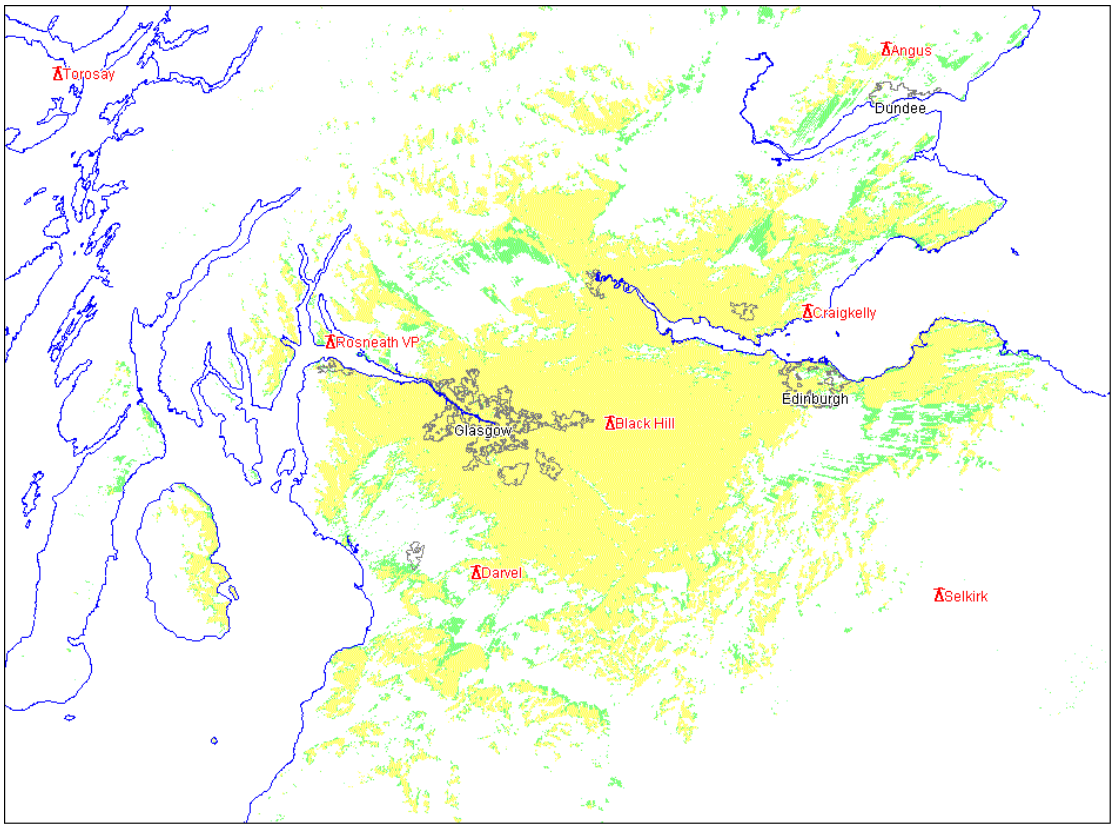

Figure A1-25: Black Hill: ch 51: 5kW ERP: Main DTT antenna: 308 m a.g.l

Practical Antenna:
The requirement is to serve Glasgow and West Edinburgh

The only restriction required at Black Hill is towards Ireland. With an ERP reduction this could be met by the existing DTT antenna.

Coverage of the channel based on use of the main DTT antenna and a transmission system using a QPSK 2/3 mode is comparable to that of the main multiplexes.

An alternative antenna is also suggested.

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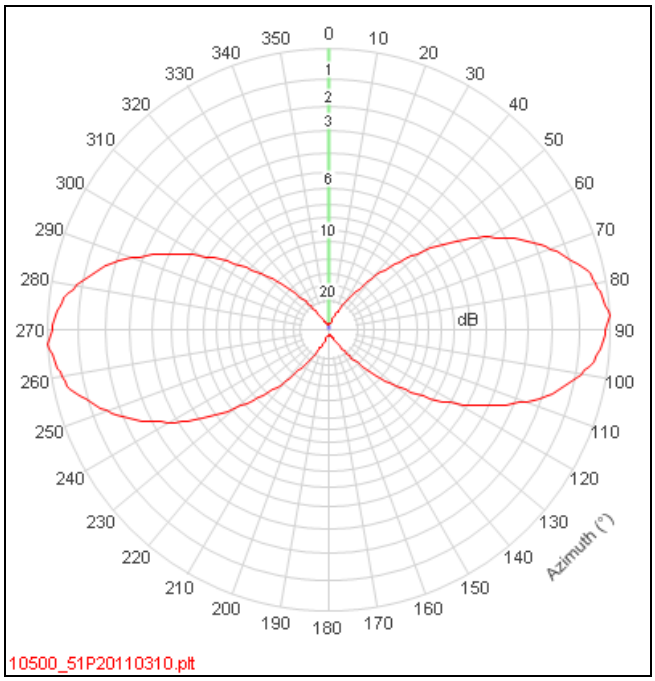

Figure A1-26 : Practical Pattern: Black Hill channel 51

ERP	5 kW	Antenna Height	154 metres

Table A1-23 : Black Hill ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	985,157	1,161,260
90%	964,031	1,055,488

Table A1-24 : Black Hill ch51 : Population served based on Antenna

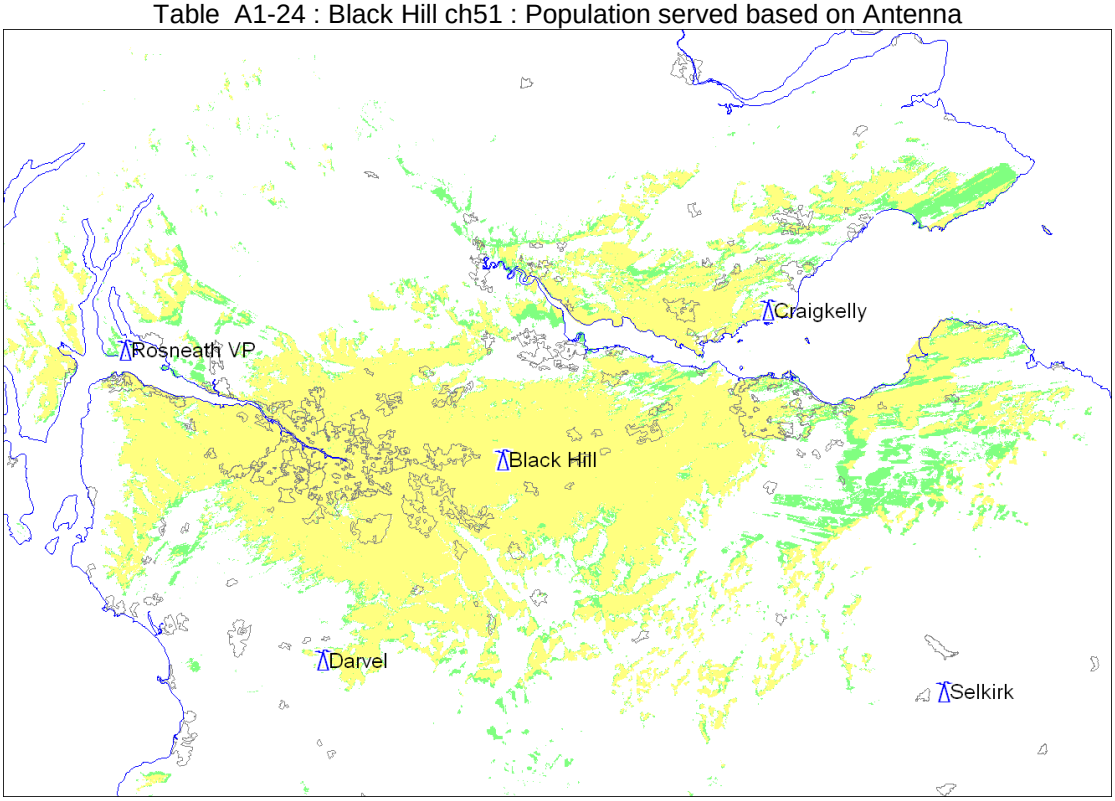

Figure A1-27: Black Hill: ch 51: 5kW ERP: Practical antenna: 154m a.g.l

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Glasgow:

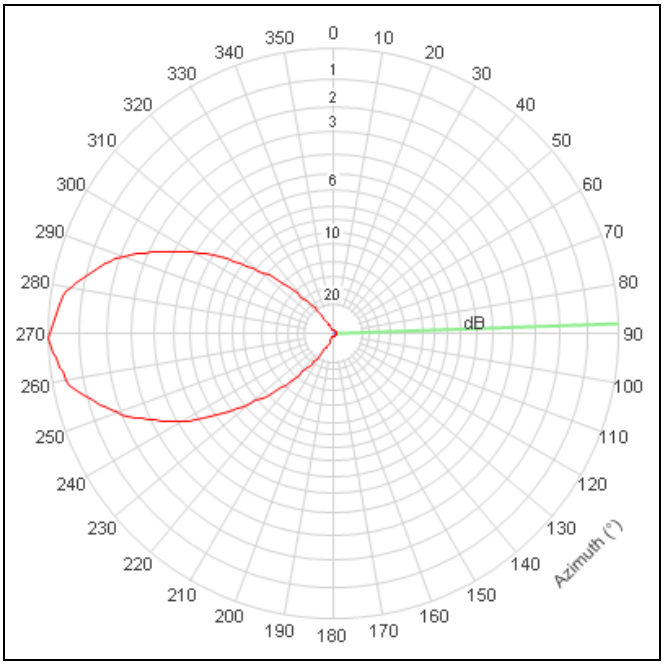

Figure A1-28 : Practical Pattern: Black Hill channel 51 - Glasgow

ERP	5 kW	Antenna Height	154 metres

Table A1-25 : Black Hill ch51 : Glasgow : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	663,886	749,813
90%	645,997	718,923

Table A1-26 : Black Hill ch51 : Population served based on Glasgow Antenna

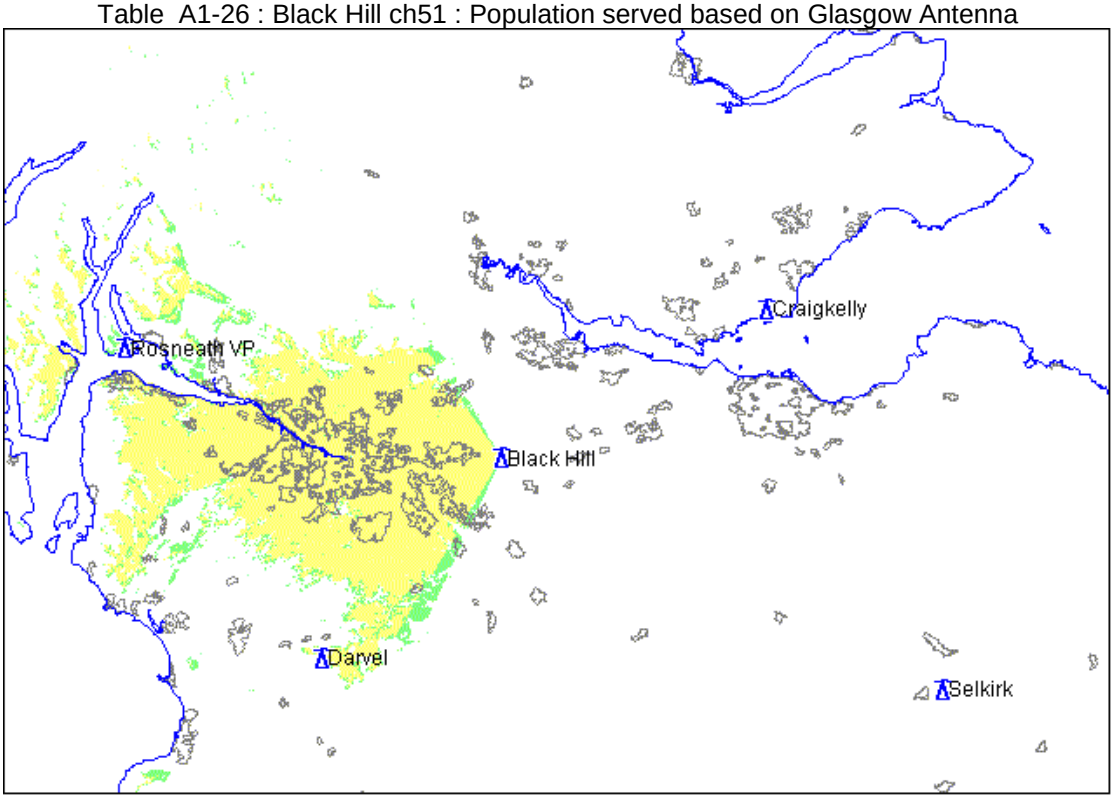

Figure A1-29: Black Hill: ch 51: 5kW ERP: Practical Glasgow antenna: 154m a.g.l

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Edinburgh:

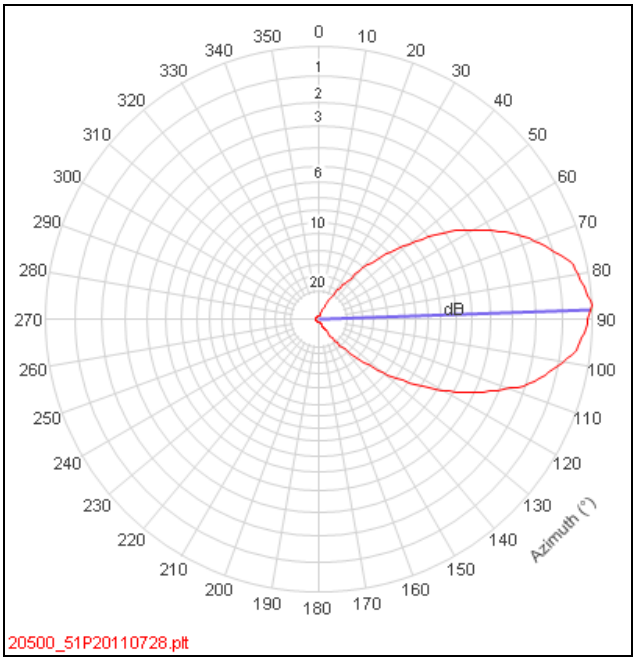

Figure A1-30 : Practical Pattern: Black Hill channel 51- Edinburgh

ERP	5 kW	Antenna Height	154 metres

Table A1-27 : Black Hill ch51 : Edinburgh: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	106,358	356,026
90%	101,160	273,212

Table A1-28 : Black Hill ch51 : Population served based on Edinburgh Antenna

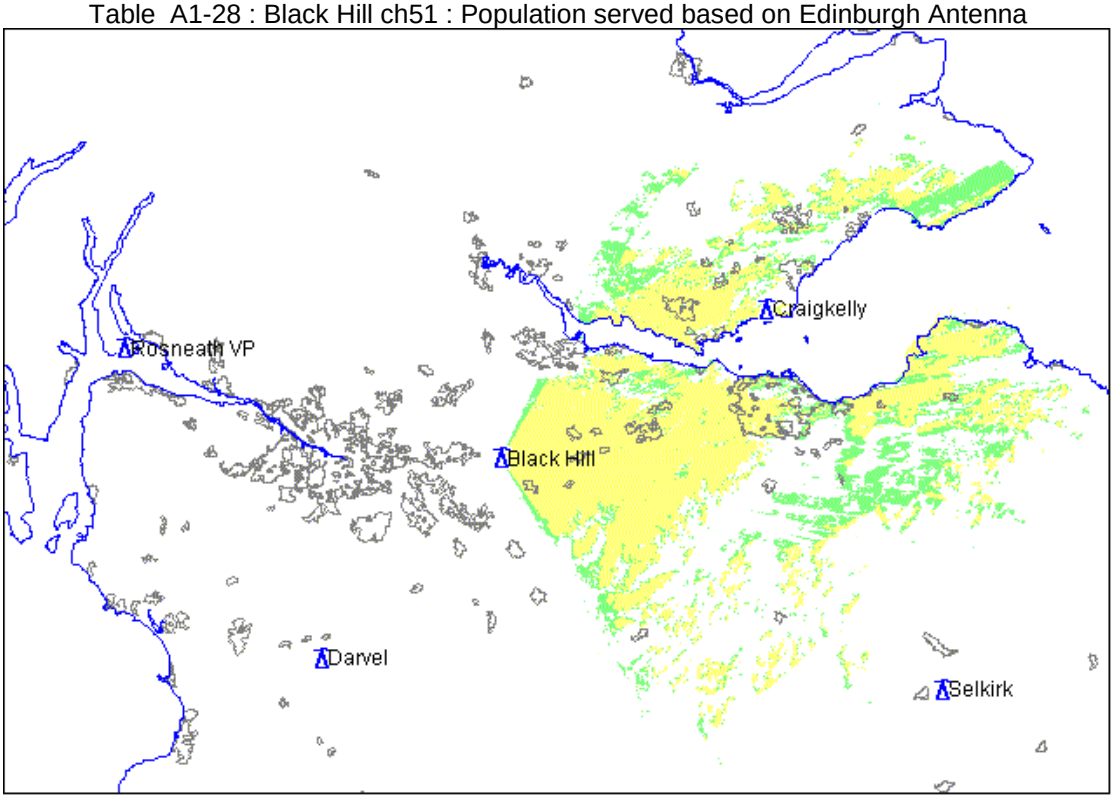

Figure A1-31: Black Hill: ch 51: 5kW ERP: Practical Edinburgh antenna: 154m a.g.l

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Falkirk:

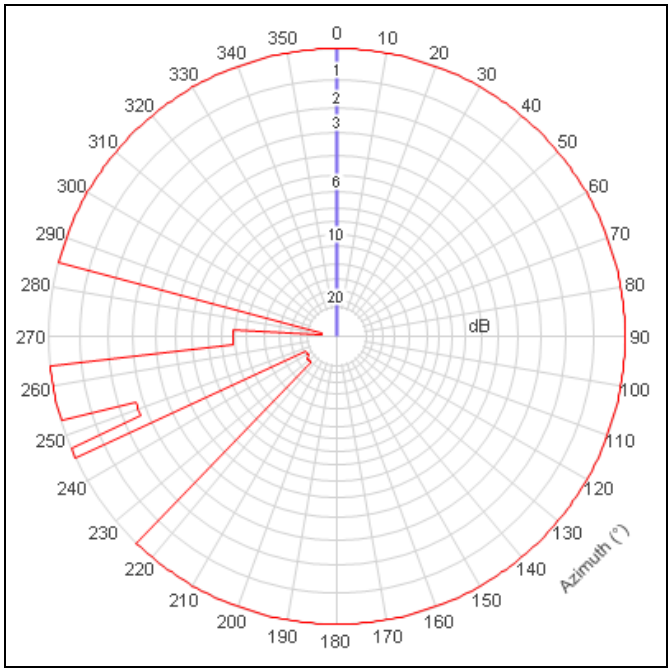

Figure A1-32: Antenna Template : Black Hill channel 56

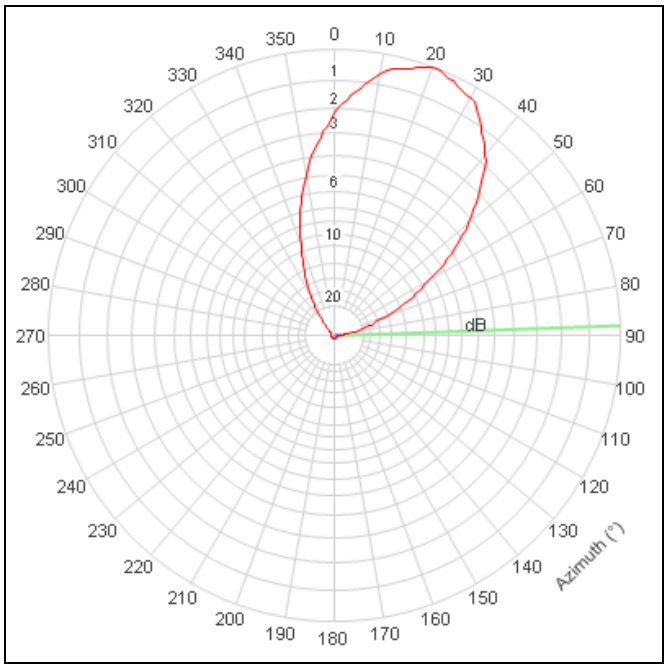

Figure A1-33 : Practical Pattern: Black Hill channel 56 - Falkirk

ERP	5 kW	Antenna Height	154 metres

Table A1-29 : Black Hill ch56 : Falkirk : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	338,493	462,605
90%	245,880	335,098

Table A1-30 : Black Hill ch56 : Population served based on Falkirk Antenna

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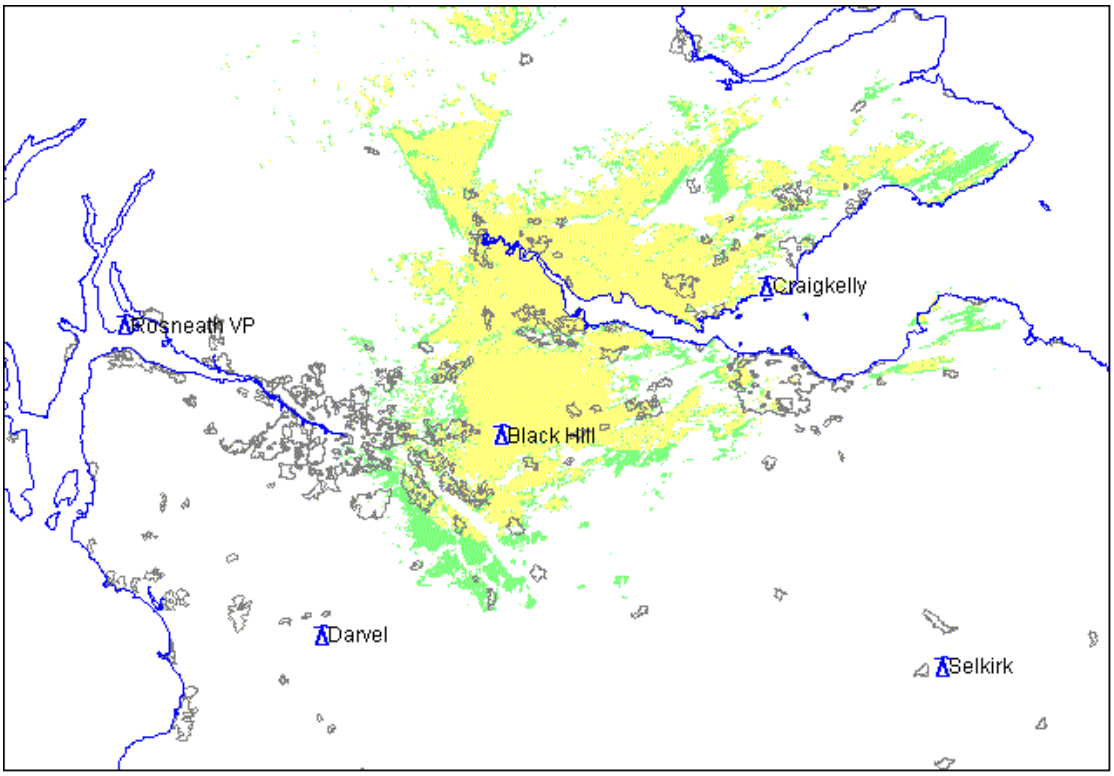

Figure A1-34: Black Hill: ch 56: 5kW ERP: Practical Falkirk antenna: 154m a.g.l:

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Wenvoe 10600

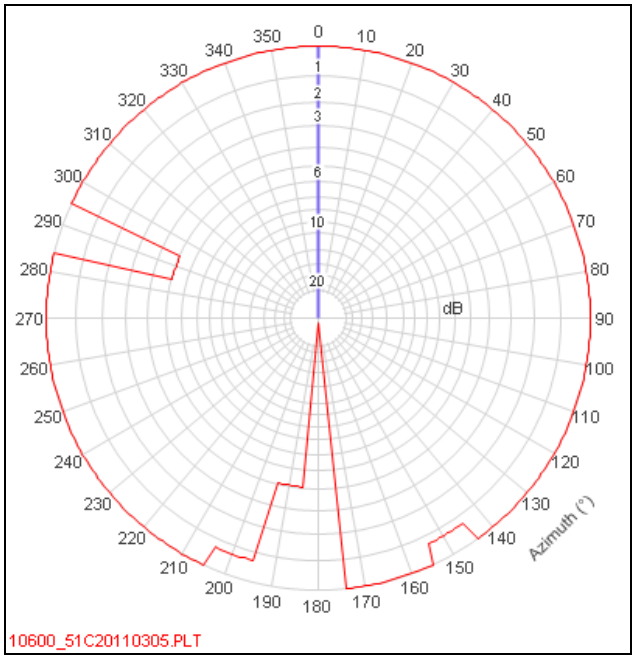

Figure A1-35: Antenna Template : Wenvoe channel 51

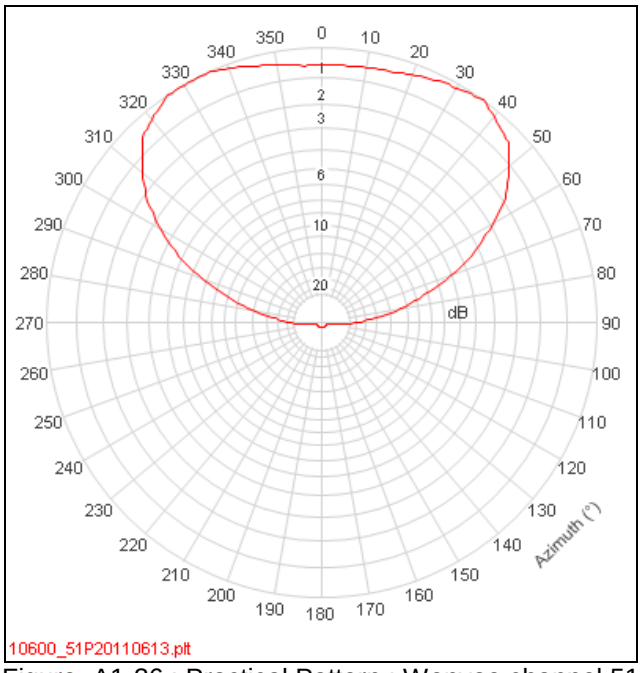

Figure A1-36 : Practical Pattern : Wenvoe channel 51

ERP	10 kW	Antenna Height	71 metres

Table A1-31 : Wenvoe ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	351,072	499,364
90%	311,633	401,882

Table A1-32 : Wenvoe ch51 : Population served based on antenna

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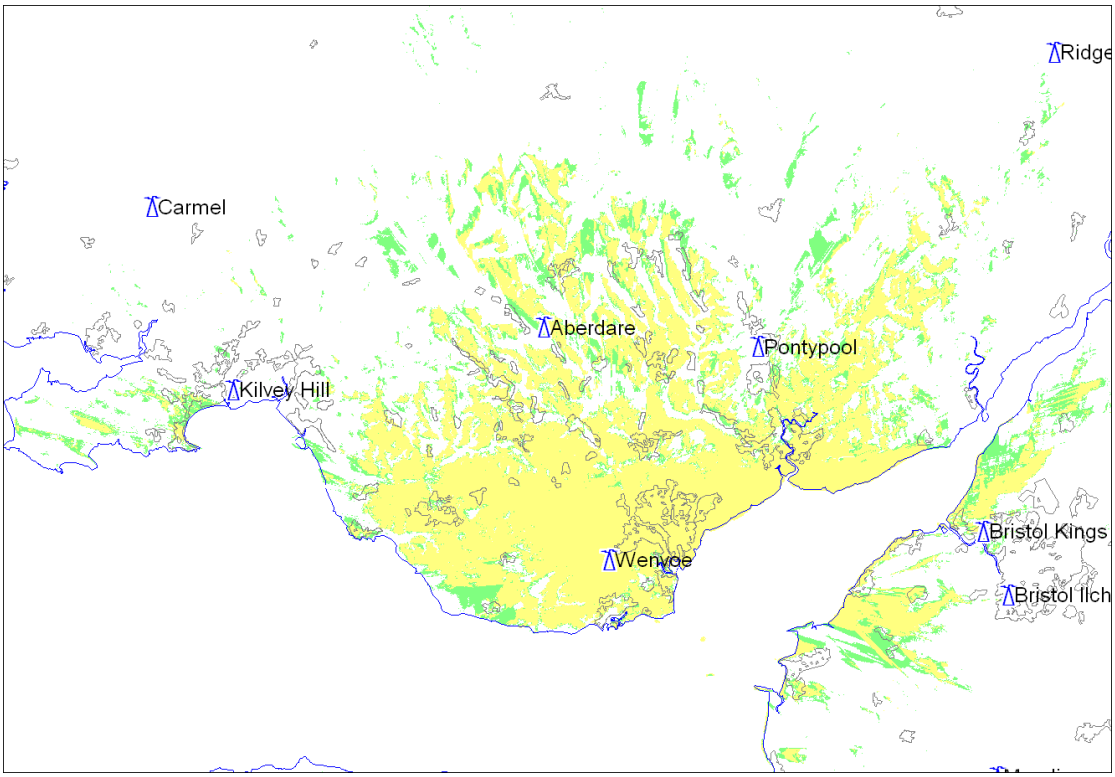

Figure A1-37: Wenvoe ch51 : 10kW ERP: Practical antenna : 71m a.g.l

Practical Antenna:
The requirement is to serve Cardiff and Newport.

Restrictions are required towards Beacon Hill (150º–200º ETN) and towards Broad Haven (290º ETN). Wenvoe has an existing relationship with Beacon Hill on channels 42 and 45 so the restriction on GI channel 51 could be relaxed. As part of clearance a non-systematic channel change has been adopted at Broad Haven and as there is no existing relationship between Wenvoe and Broad Haven the restriction should be maintained.

Channel 51 has also been suggested for use as the GI channel at Mendip. For these two services to co-exist the antenna pattern at Wenvoe should be designed to minimise radiation towards Bristol while still providing sufficient signal strength in Newport. Similarly the antenna at Mendip will need to be designed to protect the GI service from Wenvoe.

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Divis 10700

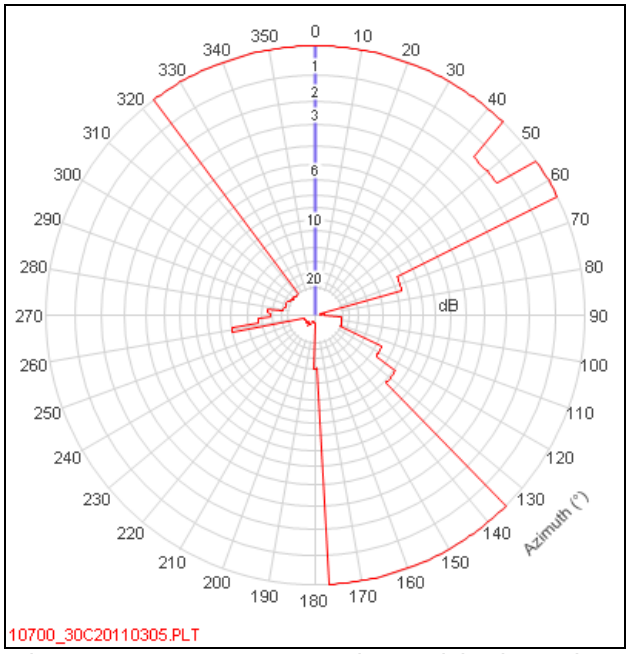

Figure A1-38: Antenna Template : Divis channel 30

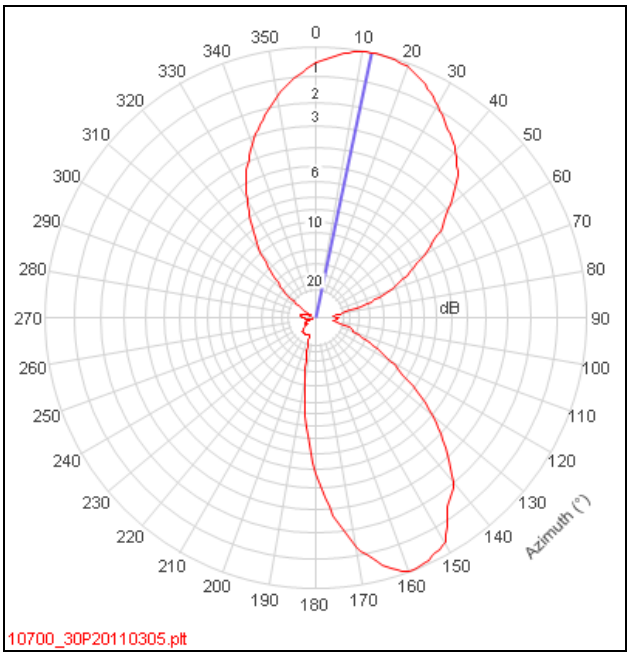

Figure A1-39 : Practical Pattern : Divis channel 30

ERP	5 kW	Antenna Height	93 metres

Table A1-33 : Divis ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	252,159	257,578
90%	226,693	228,209

Table A1-34 : Divis ch30 : Population served based on Antenna

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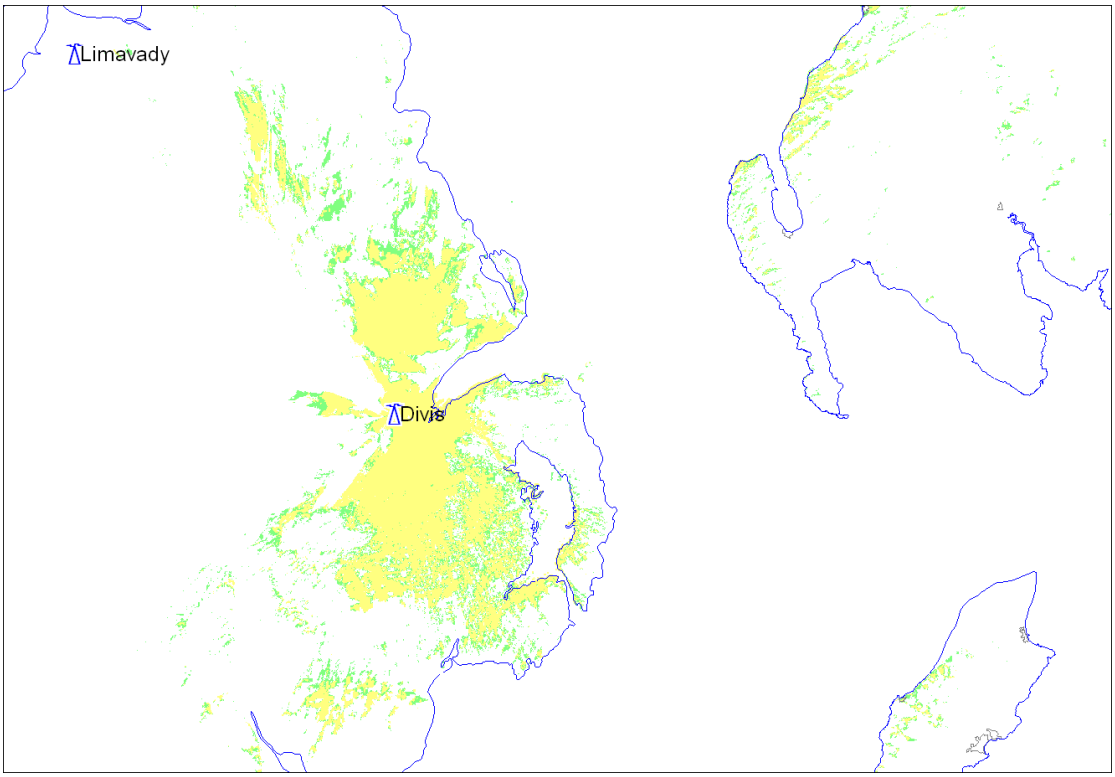

Figure A1-40: Divis: ch 30: 5kW ERP: Practical antenna: 93 m a.g.l

Practical Antenna:
The requirement is to serve Belfast.

Restrictions are required towards Caldbeck (50º–110º ETN) and The Wrekin (120º–130º ETN). There is an existing relationship between the main multiplexes at Divis and The Wrekin, so the restrictions towards The Wrekin on the GI channel can be relaxed. Whilst there is a relationship between Divis and Caldbeck this is to COM multiplexes and channel 30 at Caldbeck is a PSB multiplex. As such the restrictions towards Caldbeck need to be maintained.

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Pontop Pike 10900

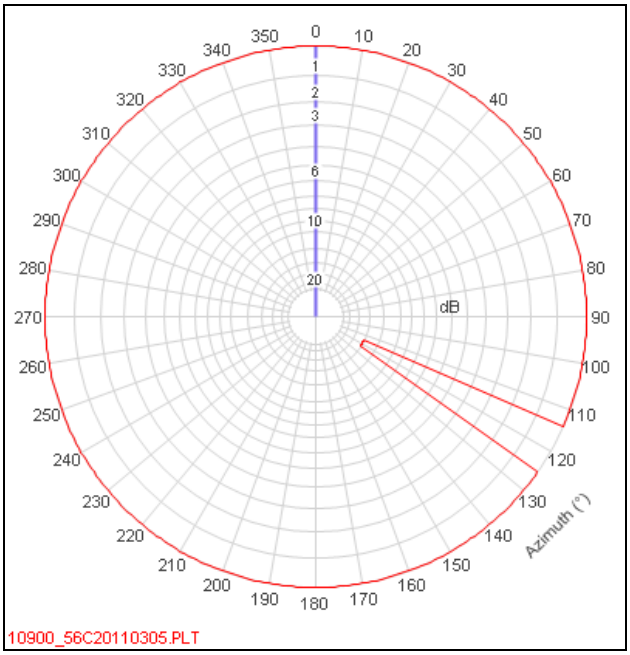

Figure A1-41: Antenna Template : Pontop Pike channel 56

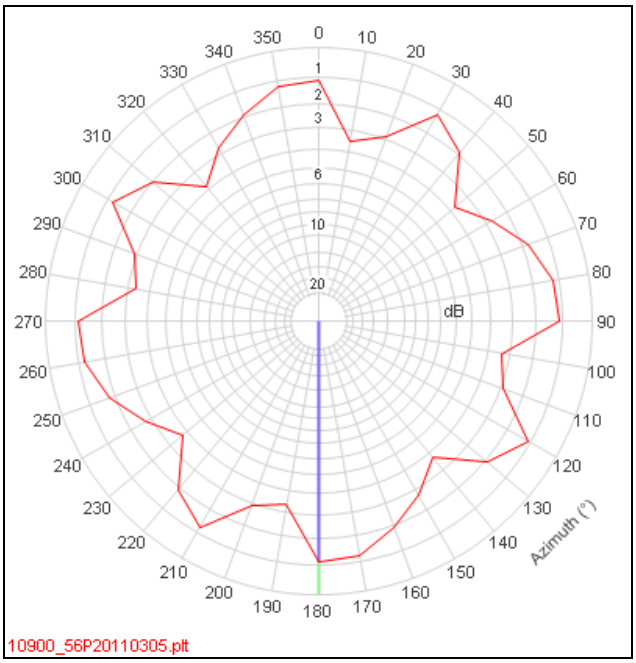

Figure A1-42 : Main Antenna Pattern on Horizon: Pontop Pike channel 56

ERP	5 kW	Antenna Height	146 metres

Table A1-35 : Pontop Pike ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	788,960	1,190,120
90%	787,467	1,115,320

Table A1-36 : Pontop Pike ch56 : Population served based on Main Antenna

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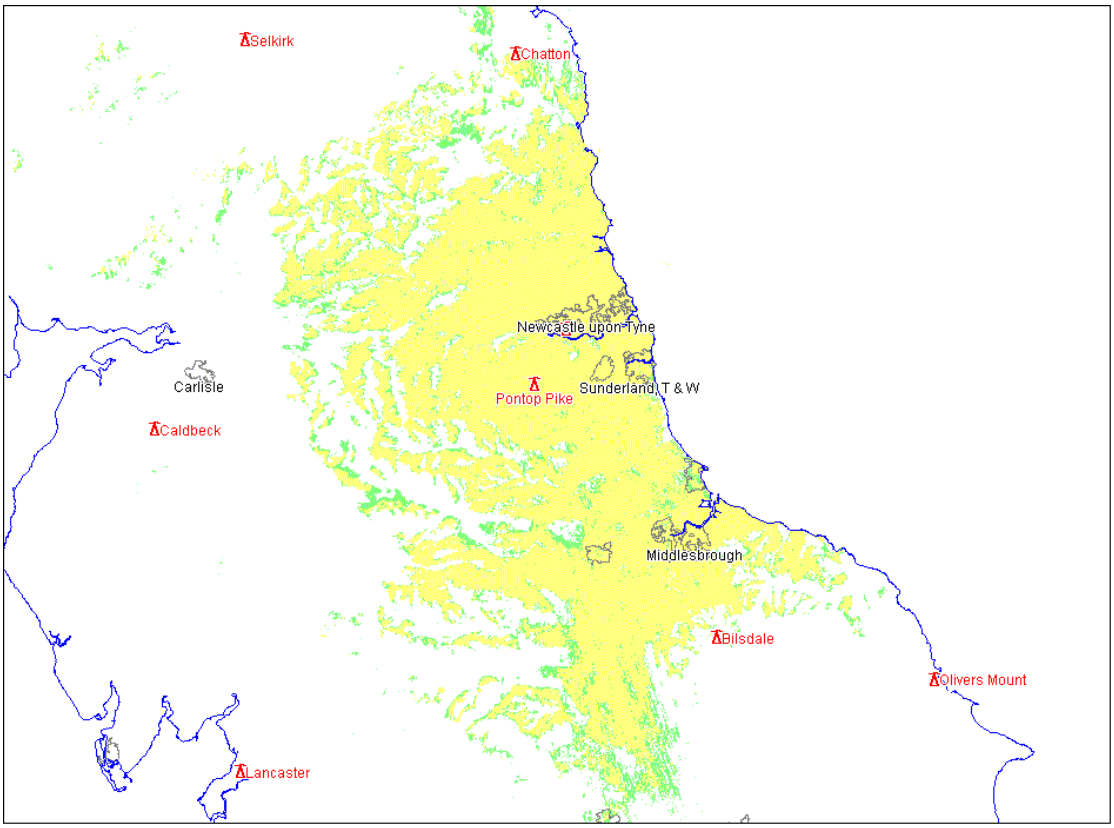

Figure A1-43: Pontop Pike: ch 56: 5kW ERP: Main DTT antenna: 146 m a.g.l

Practical Antenna:
The requirement is to serve Newcastle and Sunderland.

A restriction is required towards the PSB service at Ravenscar (120º ETN). This station is co-channel with the main multiplex at Pontop Pike on channel 58. Therefore core coverage will not be limited by the GI channel and the restriction could be relaxed.

Coverage of the channel based on use of the main DTT antenna and a transmission system using a QPSK 2/3 mode is comparable to that of the main multiplexes.

Good coverage of the primary target areas could be achieved by a simple side mounted arrangement of panels or log periodic antennas.

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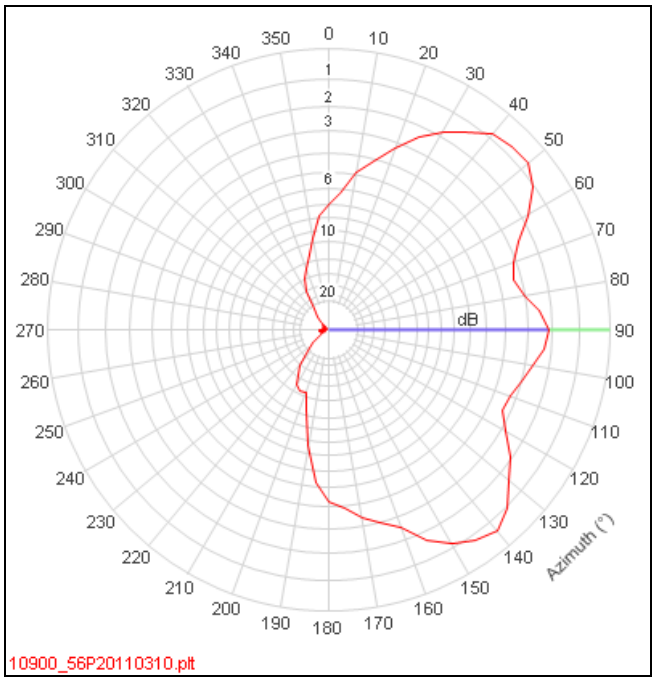

Figure A1-44 : Practical Antenna Pattern on Horizon: Pontop Pike channel 56 : Side Mount

ERP	5 kW	Antenna Height	73 metres

Table A1-37 : Pontop Pike ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	761,320	1,014,546
90%	752,242	912,551

Table A1-38 : Pontop Pike ch56 : Population served based on Practical Side Mount Antenna

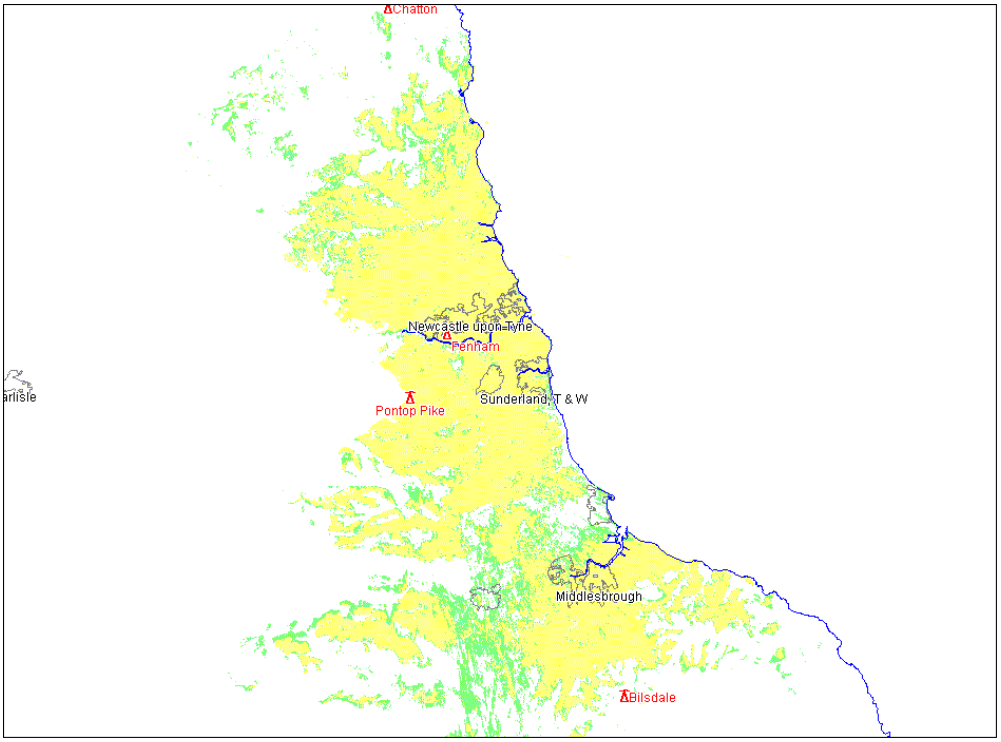

Figure A1-45: Pontop Pike: ch 56: 5kW ERP: Practical antenna: Side Mount : 73 m a.g.l

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Waltham 11100

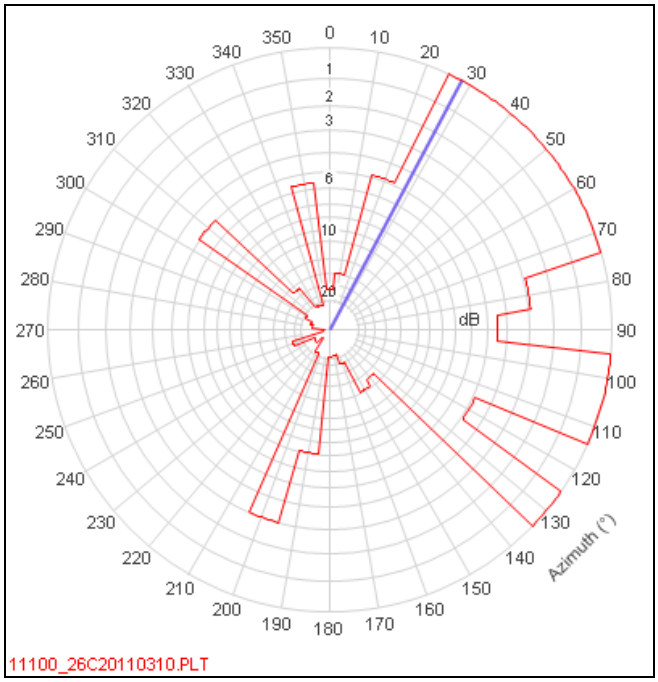

Figure A1-46: Antenna Template : Waltham channel 55

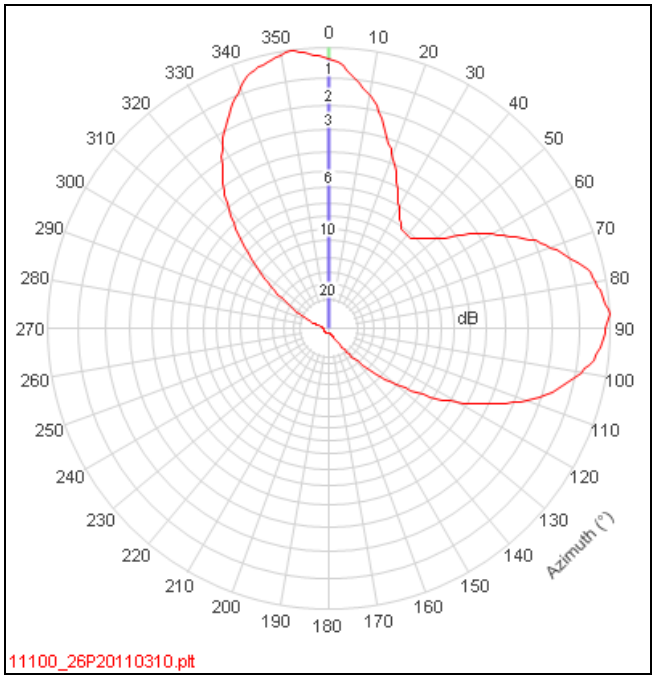

Figure A1-47 : Practical Pattern on Horizon: Waltham channel 26

ERP	5 kW	Antenna Height	151 metres

Table A1-39 : Waltham ch26 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	202,622	313,361
90%	125,901	165,623

Table A1-40 : Waltham ch26 : Population served based on Antenna

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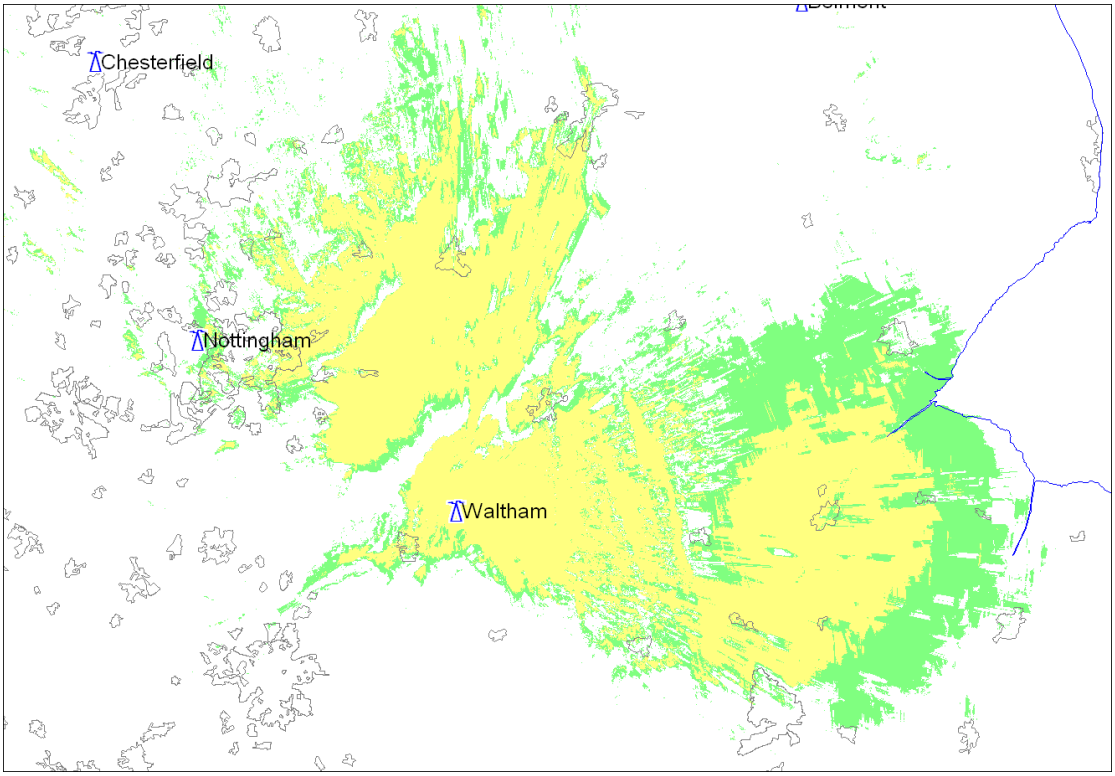

Figure A1-48: Waltham: ch 26: 5kW ERP: Practical antenna: 151 m a.g.l

Practical Antenna:
The requirement is to serve Nottingham.

Restrictions are required towards PSB services at Bilsdale (330º-20º ETN), West Runton (80º-90º ETN), Crystal Palace (140º-200º ETN), Lark Stoke, Bromsgrove and The Wrekin SFN (0º-20º ETN), Cerrigydrudion (280º ETN), Ladder Hill (310º ETN) and Chesterfield (320º ETN). Waltham has an existing relationship with the main multiplexes at Bilsdale, West Runton, Ladder Hill, Cerrigydrudion and Chesterfield so the restrictions towards these stations could be relaxed. Restrictions towards, Crystal Palace, Lark Stoke, The Wrekin, and Bromsgrove need to be maintained

Coverage from Waltham is sensitive to the height of the antenna and coverage could be improved by increasing the height of the GI antenna.

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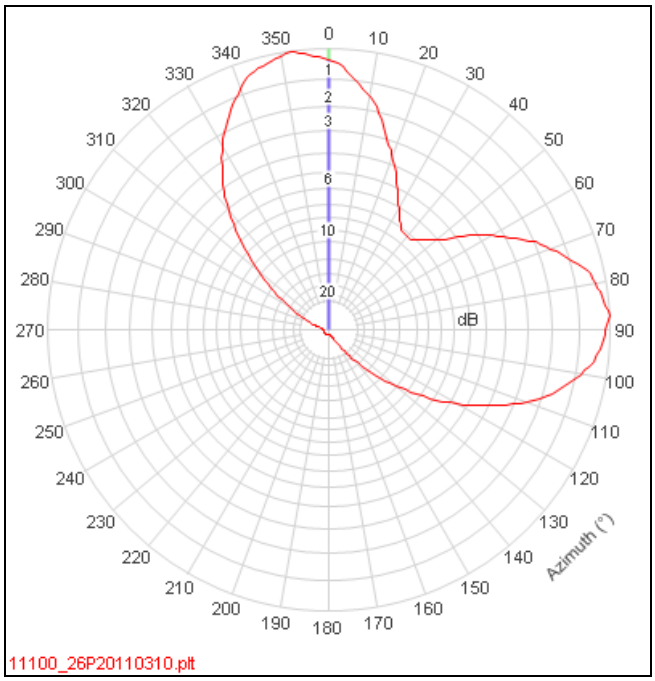

Figure A1-49 : Practical Pattern 1 on Horizon: Waltham channel 26

ERP	5 kW	Antenna Height	280 metres

Table A1-41 : Waltham ch26 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	282,083	534,696
90%	209,967	330,287

Table A1-42 : Waltham ch26 : Population served based on Antenna

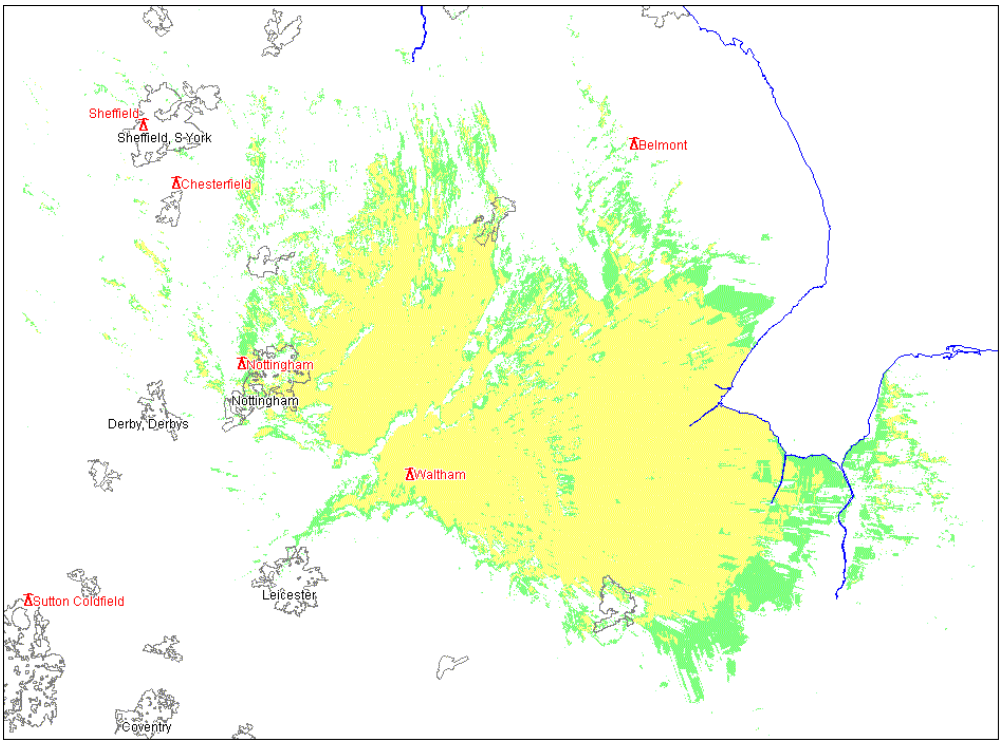

Figure A1-50: Waltham: ch 26: 5kW ERP: Practical antenna: 280 m a.g.l

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Craigkelly 14700

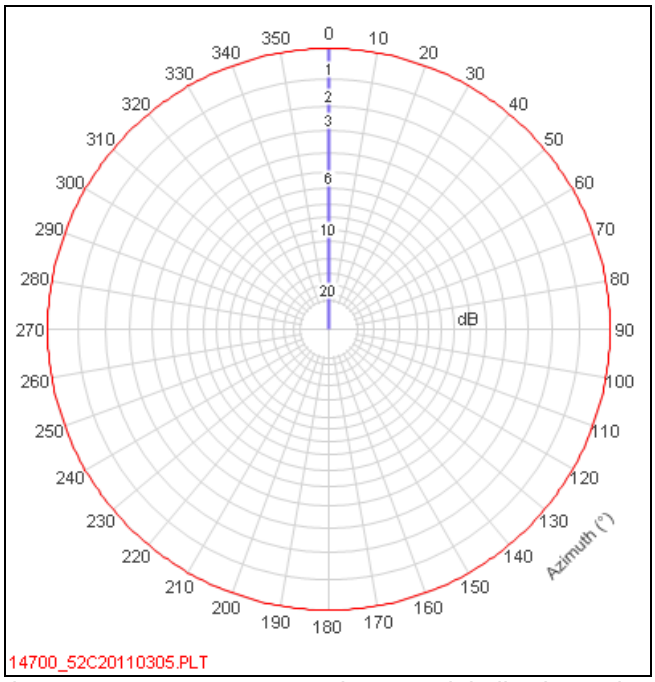

Figure A1-51: Antenna Template : Craigkelly channel 52

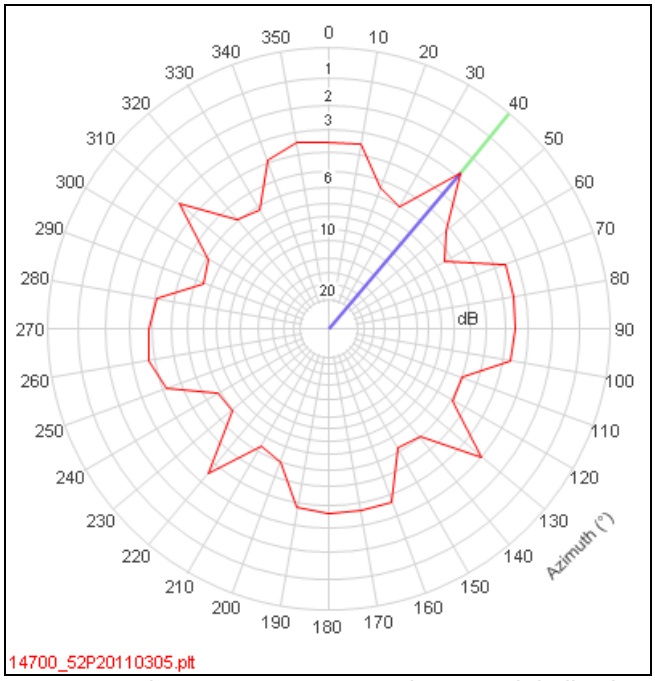

Figure A1-52 : Main DTT Pattern on Horizon: Craigkelly channel 52

ERP	5 kW	Antenna Height	130 metres

Table A1-43 : Craigkelly ch52 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	312,886	708,807
90%	311,679	648,404

Table A1-44 : Craigkelly ch52 : Population served based on Main Antenna

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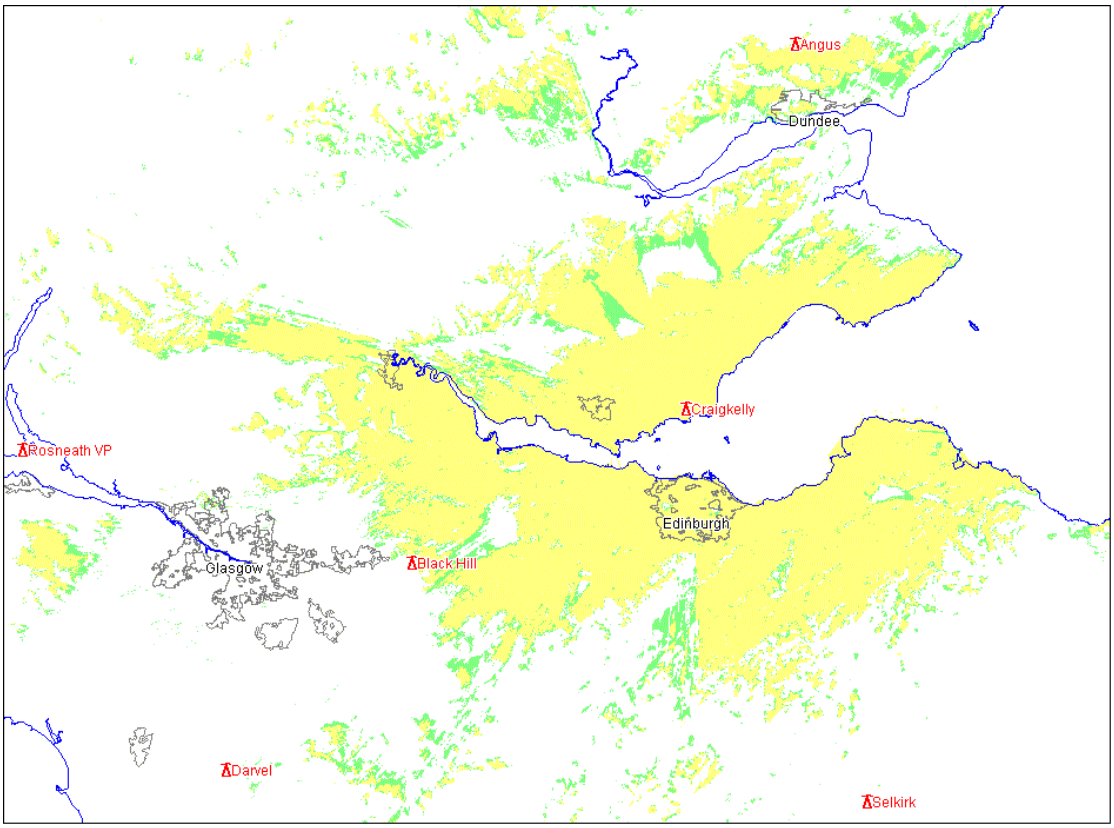

Figure A1-53 : Craigkelly: ch 52: 5kW ERP: Main DTT antenna: 130 m a.g.l

Practical Antenna:
The requirement is to serve Edinburgh.

Craigkelly is not subject to any restrictions.

Coverage of the channel based on use of the main DTT antenna and a transmission system using a QPSK 2/3 mode is comparable to that of the main multiplexes.

The target area could also be served by a simple side mounted antenna composed of panels or log-periodic antennas.

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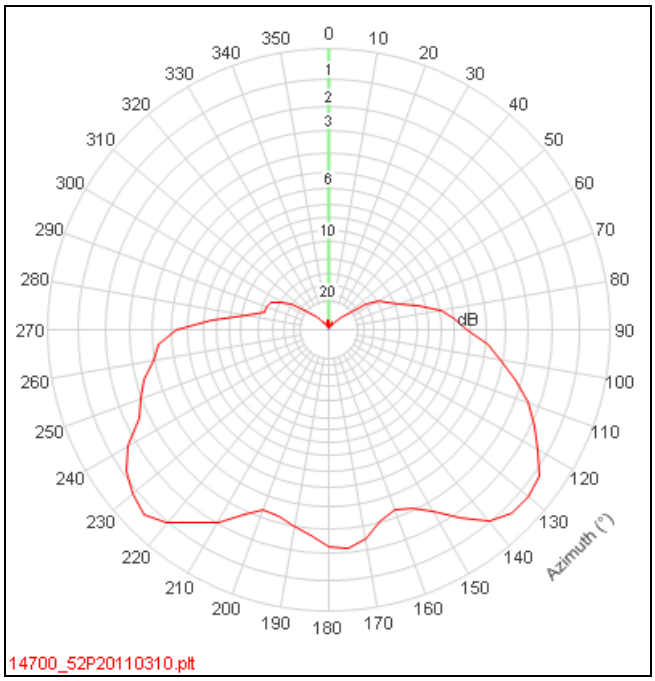

Figure A1-54 : Practical Pattern on Horizon: Craigkelly channel 52

ERP	5 kW	Antenna Height	65 metres

Table A1-45 : Craigkelly ch52 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	287,927	605,103
90%	278,276	562,264

Table A1-46 : Craigkelly ch52 : Population served based on Practical Antenna

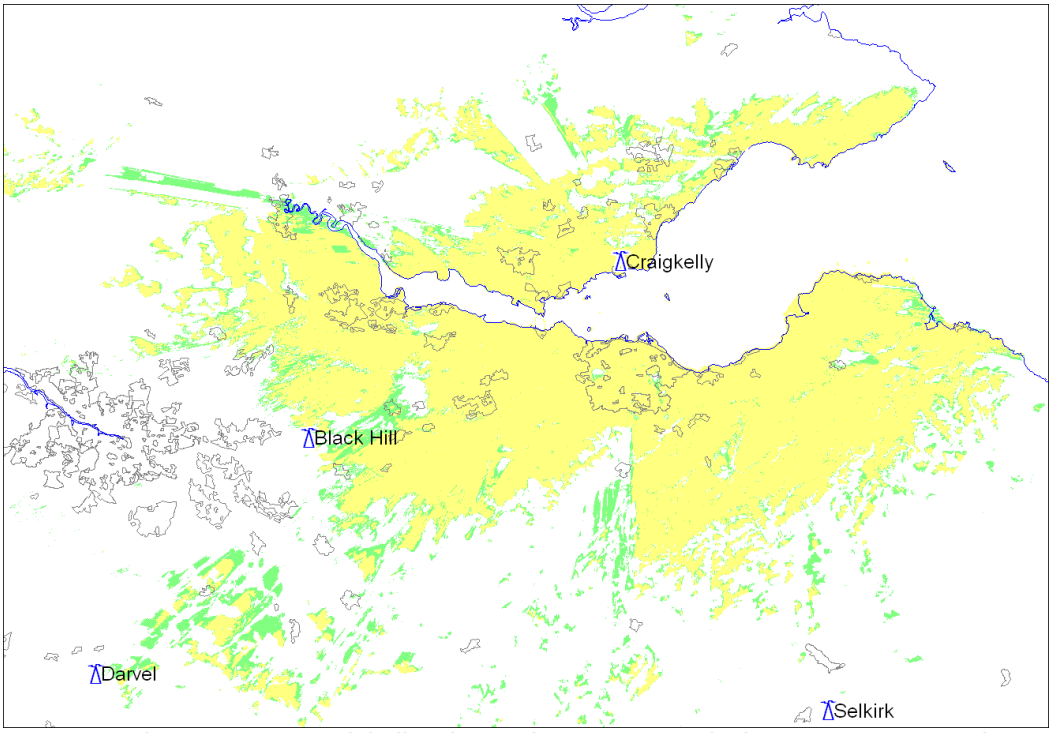

Figure A1-55: Craigkelly: ch 52: 5kW ERP: Practical Antenna: 65 m a.g.l

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Annex 2 : Group A Sites

The stations in Group A and their prime target areas are detailed in Table A2-1.

Station ID	**Transmitter Station**	**Target Urban area**
12400	Sandy Heath	Parts of Cambridgeshire, Northamptonshire and Bedfordshire
11000	Mendip	Potentially Bristol, and parts of Somerset
12000	Belmont	Kingston-upon-Hull and parts of Lincolnshire
10800	Rowridge	Portsmouth, Bournemouth and Southampton
11600	Bilsdale	Teesside and York
12600	Hannington	Reading, Newbury, Basingstoke
11500	Sudbury	Colchester and Sudbury
11700	Oxford	Oxford and immediately surrounding areas
11400	Tacolneston	Norwich and surrounds
14900	Ridge Hill	Hereford
12100	The Wrekin	Shrewsbury & Telford
11200	Durris	Aberdeen
15200	Darvel	Ayr, Kilmarnock and surrounding areas
14100	Redruth	Penzance, Truro
13600	Beacon Hill	Paignton, Torbay

Table A2-1 : 15 DTT Stations studied in Group A

The predicted coverage of the stations using the suggested 'practical solutions' is summarised in Table A2-2.

		Households served				Households served	
Station	ch	Net	Gross	Station	ch	Net	Gross
Bilsdale – Teesside	24	215,288	292,354	Ridge Hill – Gloucester	51	133,560	142,738
Bilsdale – York	24	71,398	145,989	Ridge Hill – Hereford	51	43,194	44,429
Belmont – Hull	27	266,886	269,129	Rowridge	29	245,004	459,810
Beacon Hill	39	53,572	68,686	Redruth	39	88,252	97,214
Durris	30	126,236	131,033	Sandy Heath	42	64,372	64,372
Darvel	30	107,406	165,779	Tacolneston	57	148,566	155,223
Hannington - Reading	51	142,576	364,951	Wrekin – Shrewsbury	51	43,813	45,679
Hannington-Basingstoke	51	63,846	88,368	Wrekin – Telford	51	73,417	144,578
Mendip	51	290,022	380,463	Madingley	40	83,440	83,739
Oxford	51	107,003	107,684				

Table A2-2: Predicted coverage (households) of Geographically Interleaved channels based on 'practical solutions' : DVB-T QPSK 2/3

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Bilsdale 11600

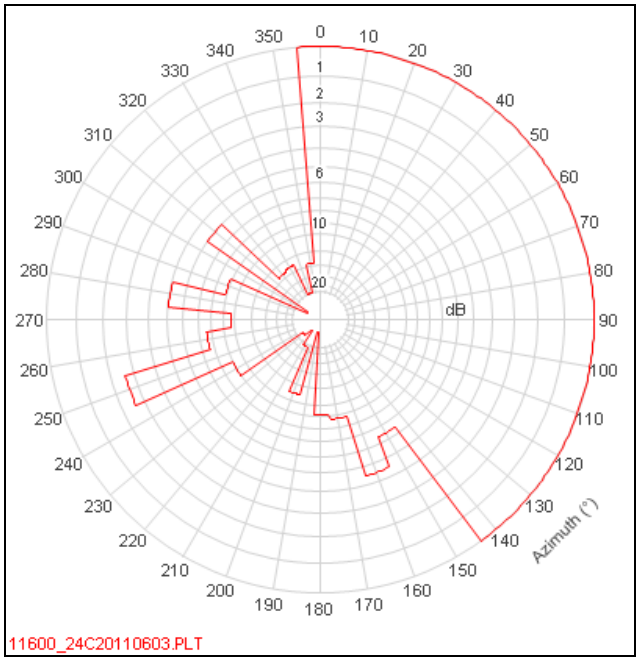

Figure A2 -1: Antenna Template : Bilsdale channel 24

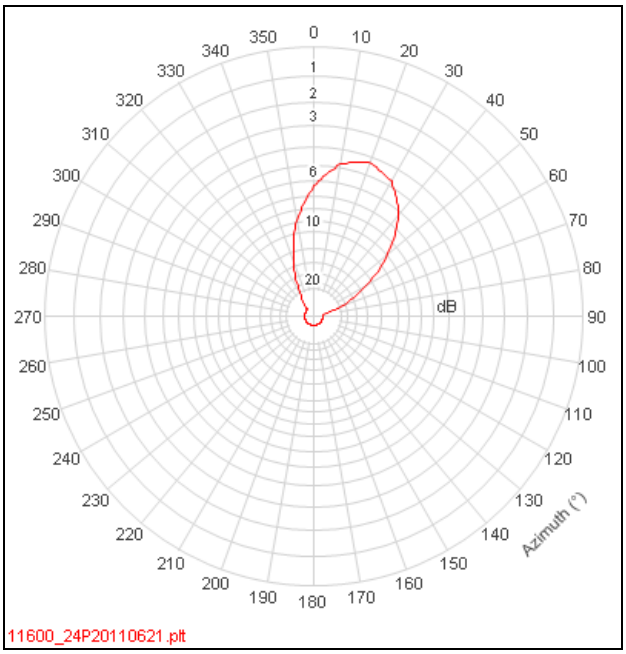

Figure A2-2 : Practical Pattern : Bilsdale channel 24 – Teesside

ERP	5 kW	Antenna Height	200 metres

Table A2-1 : Bilsdale ch24 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	215,288	292,354
90%	208,161	260,261

Table A2-2 : Bilsdale ch24 : Population served based on antenna

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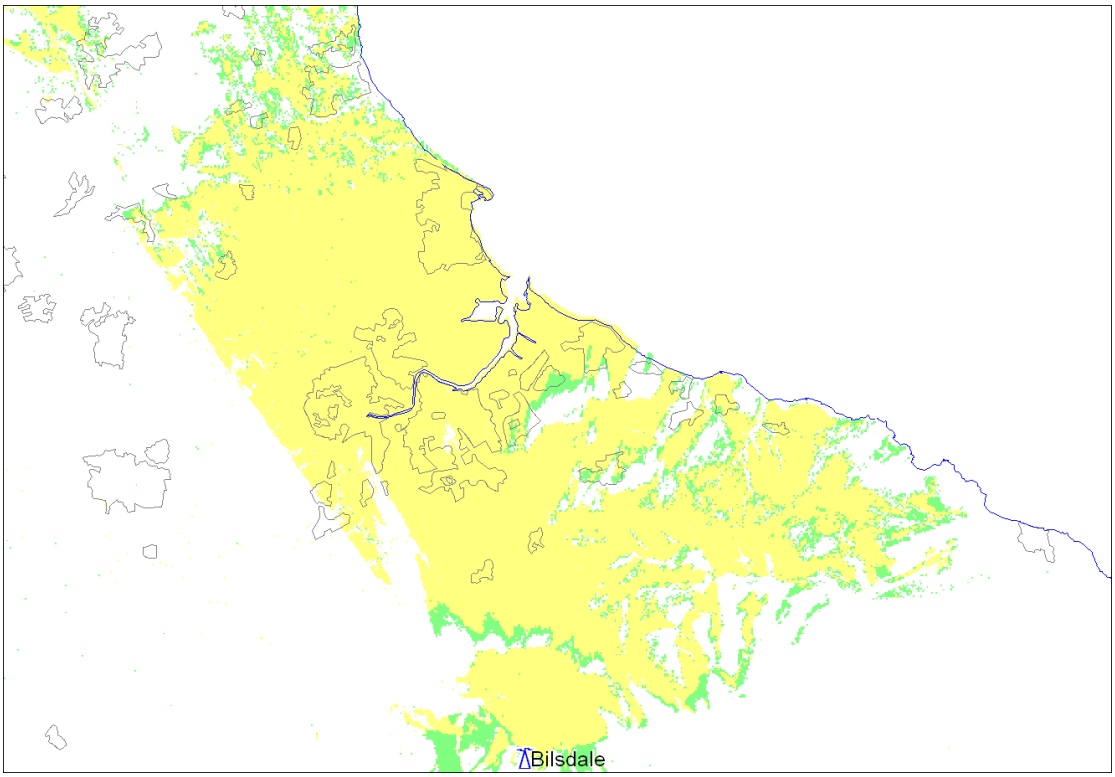

Figure A2-3: Bilsdale: ch 24: 5kW ERP: Practical antenna - Teesside: 200m a.g.l

Practical Antennas:
The requirement is to serve Teesside and York.

The chosen channel, channel 24 is subject to restrictions towards Sandy Heath (150°-180°), Nottingham (180°-190°), Matlock and Sheffield (190°), Buxton (200°), Halifax and Idle (200°-220°), Bollington and North Oldham (210°), Allenheads and Broughton (310°), Caldbeck Scotland and Bellingham (320°), Fenham (330°-350°), Eyemouth (330°-340°), Byrness and Craigkelly (330°) and Rumster Forest (350°). There are other restrictions in the arc 210°-310°.

Arguably a number of these restrictions are not required as existing low-power DTT which operates on channel 24 is co-channel with either DTT services at stations that have switched or with analogue services at stations that have yet to switch. So as long as the GI system does not exceed levels of interference generated by the existing DTT system viewers will not be subject to degradation in service.

Teesside:
For Teesside, the antenna height has been increased to 200m to clear the ridge at Eston Nab which would otherwise impair coverage. The suggested antenna arrangement infringes the template at 340° and 350°. On these bearings, Fenham, Eyemouth and Rumster Forest could be affected but levels of interference are below those of existing DTT.

The station of prime concern is Fenham. A desk-top survey shows that, in the area predicted to experience the highest level of interference, antennas are

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HP directed towards Pontop Pike rather than VP towards Fenham. While we cannot infer from this that this is the case elsewhere, it suggests that actual numbers affected may be lower than predicted.

Regarding Rumster Forest, the worst affected pixel appears to be in an area expected to be served by Durris and our desk-top survey confirms that antennas are pointing towards Durris.

Bayed logs on 20° have been selected to minimise interference to coverage of Fenham and Rumster Forest on bearings of 330-0°ETN from Bilsdale.

York:
To serve York, bayed logs on 180° with beam tilt were selected with an ERP of 2kW to minimise the interference to existing coverage from Sheffield and Nottingham on bearings of 180°-190° from Bilsdale.

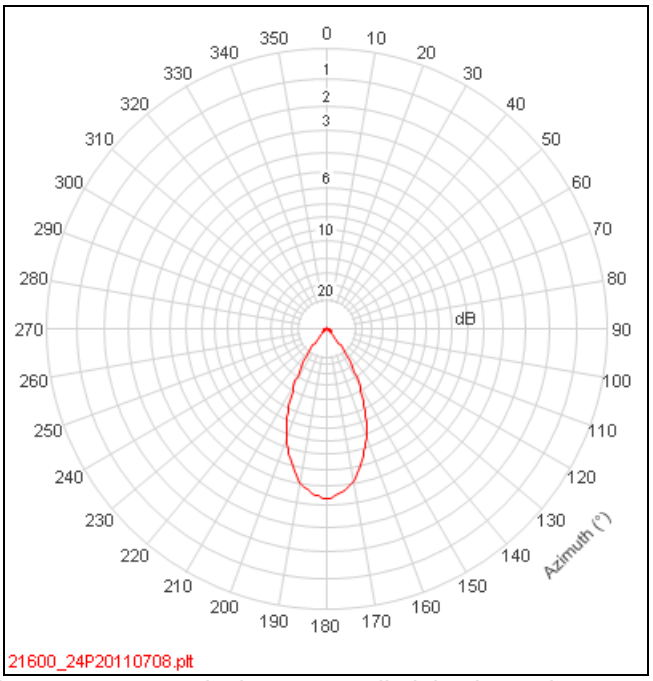

Figure A2-4 : Practical Pattern : Bilsdale channel 24 - York

ERP	2 kW	Antenna Height	148 metres

Table A2-3 : Bilsdale ch24 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	71,398	145,989
90%	30,857	46,619

Table A2-4 : Bilsdale ch24 : Population served based on antenna

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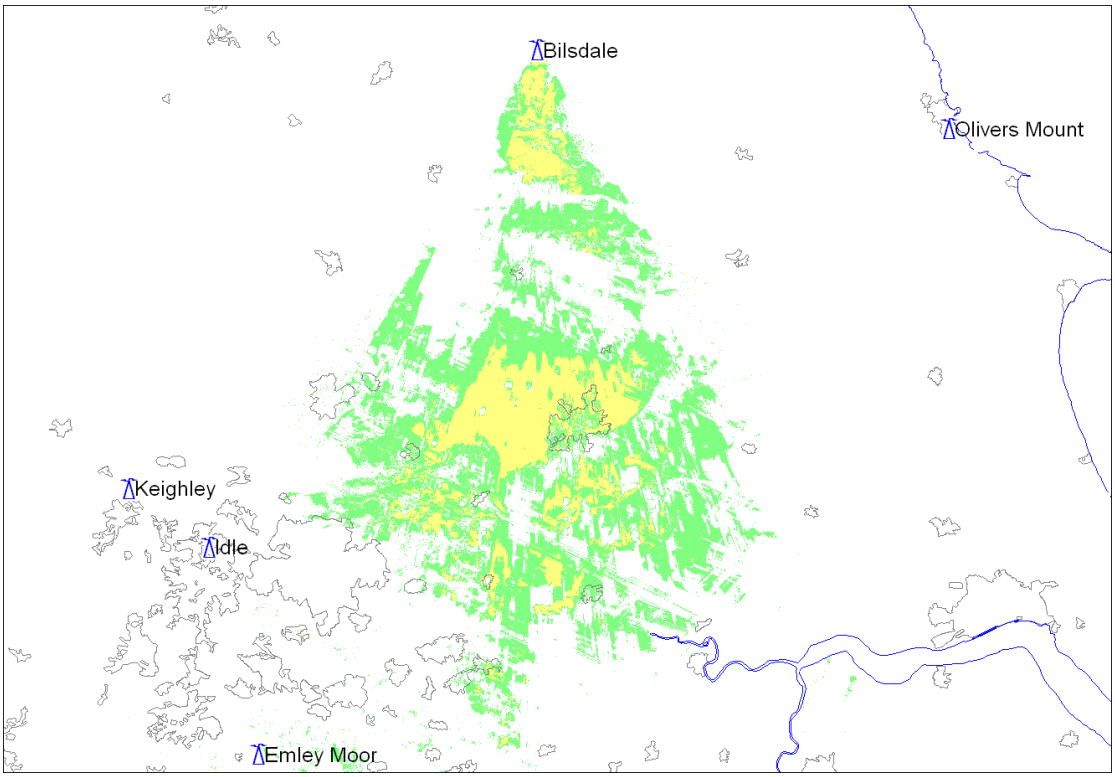

Figure A2-5: Bilsdale: ch 24: 2kW ERP: Practical antenna - York: 148m a.g.l

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Belmont 12000

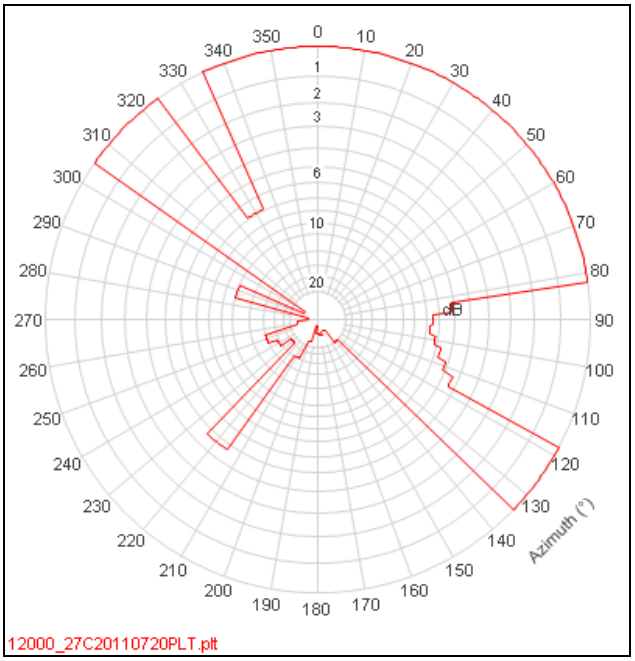

Figure A2 -1: Antenna Template : Belmont channel 27

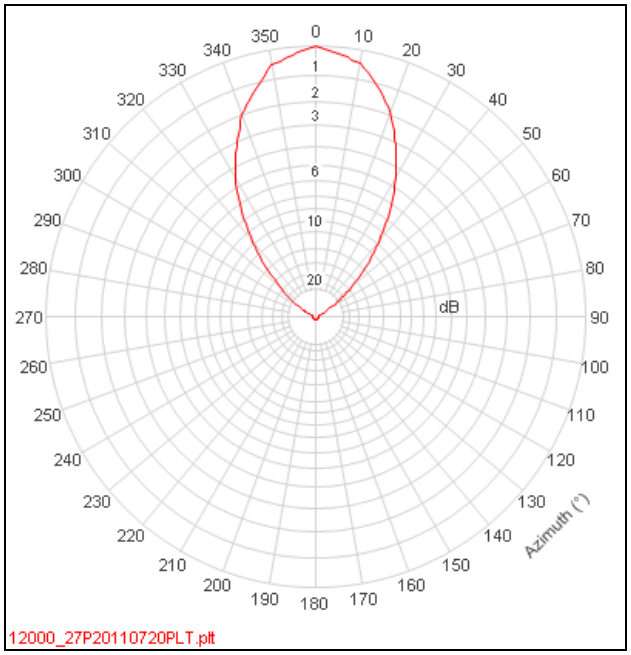

Figure A2-2 : Practical Pattern : Belmont channel 27 - Hull

ERP	10 kW	Antenna Height	222 metres

Table A2-1 : Belmont ch27 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	266,886	269,129
90%	198,278	198,876

Table A2-2 : Belmont ch27 : Population served based on antenna

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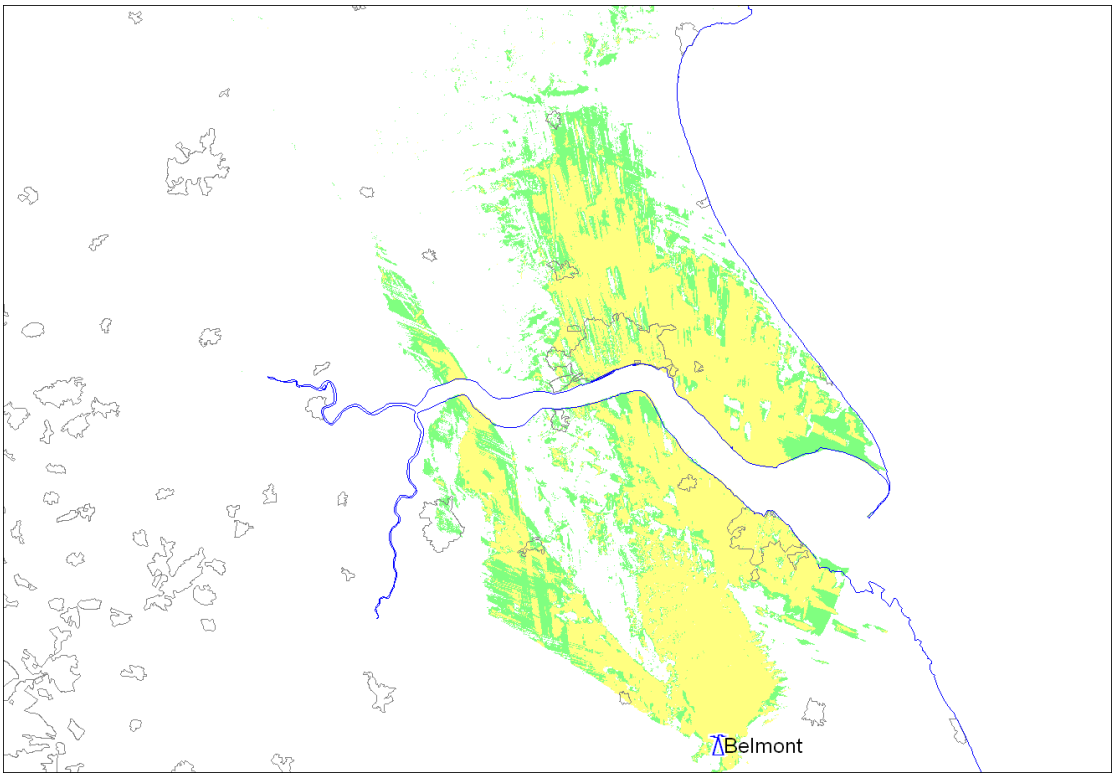

Figure A2-3 : Belmont ch27 : 10kW ERP: Practical antenna - Hull : 222m a.g.l

Practical Antennas:
The requirement is to serve Hull and towards Lincoln.

Restrictions are required towards Sandy Heath (140°-230°), Ridge Hill (220°-240°). Nottingham (230°-250°), Llyswen (240°), Llanwrtyd Wells (240°), Kerry, Moel y Sant and Oakamoor (250°), Fenton and Buxton (260°-270°), Matlock (260°), Sheffield (260°-290°,330°), Fenton and Langley (270°), Halifax (290°) and Idle (290°-300°).

Hull:
The requirement to serve Kingston-upon-Hull, can be met by a log-periodic on 0°. This will infringe the restriction at 330° required to protect Sheffield. However, this only protects two locations some 60km from Sheffield and a desk-top survey shows antennas HP directed towards Emley Moor. Clearly it is an area of poor reception as the antennas are large, high and with head-amps. Coverage in Hull was unsatisfactory at half structure height hence we have increased the height to obtain better coverage.

Lincoln:
Belmont is not a suitable location for serving Lincoln. All channels are subject to large restrictions and the distance from Belmont plus the fact that Lincoln is largely terrain screened means that no viable service can be achieved. The example shown of a 1kW service demonstrates the problem – it is not an example of a possible service as it breaches the required restrictions.

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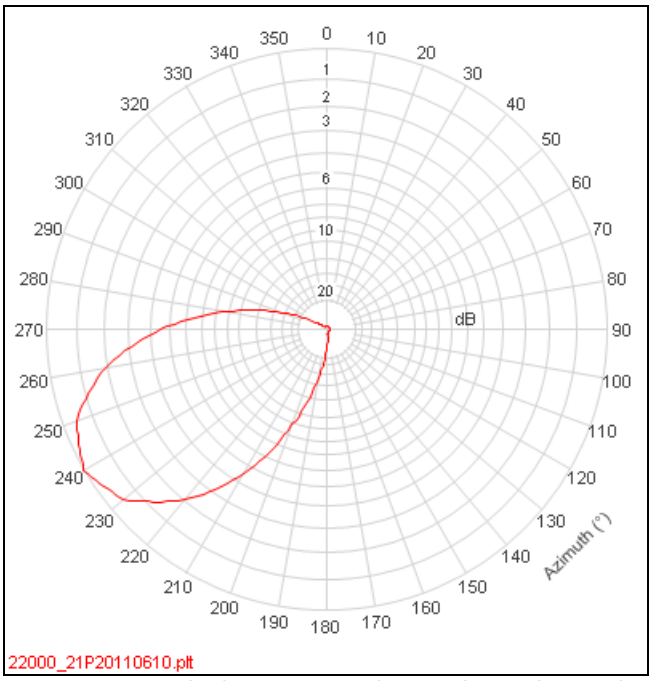

Figure A2-4 : Practical Pattern : Belmont channel 21 - Lincoln

ERP	1 kW	Antenna Height	171 metres

Table A2-3 : Belmont ch21 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	31,384	31,419
90%	18,464	18,464

Table A2-4 : Belmont ch21 : Population served based on antenna

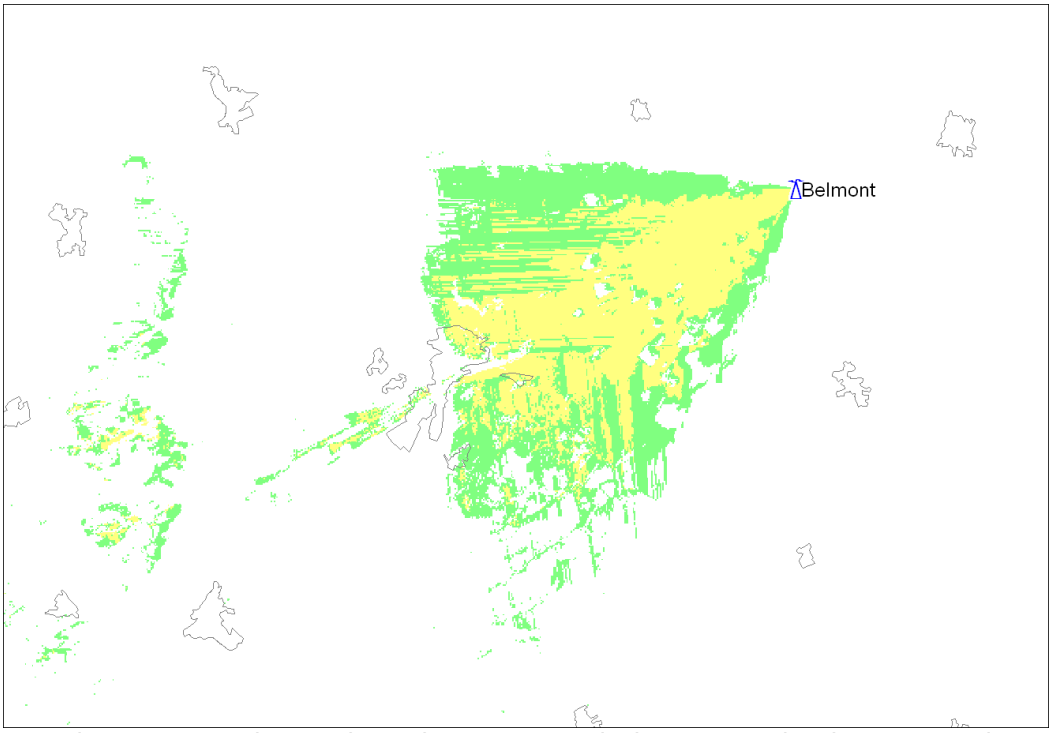

Figure A2-5 : Belmont: ch21: 1kW ERP: Practical antenna - Lincoln: 171m a.g.l

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Beacon Hill 13600

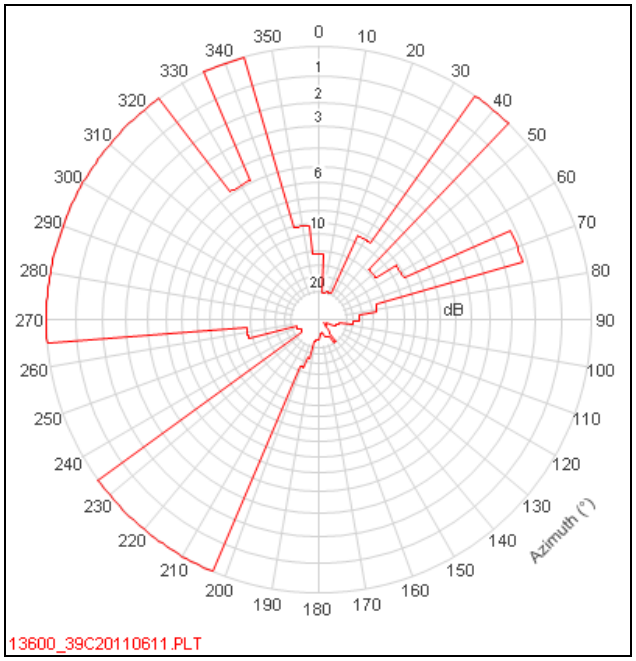

Figure A2-1: Antenna Template : Beacon Hill channel 39

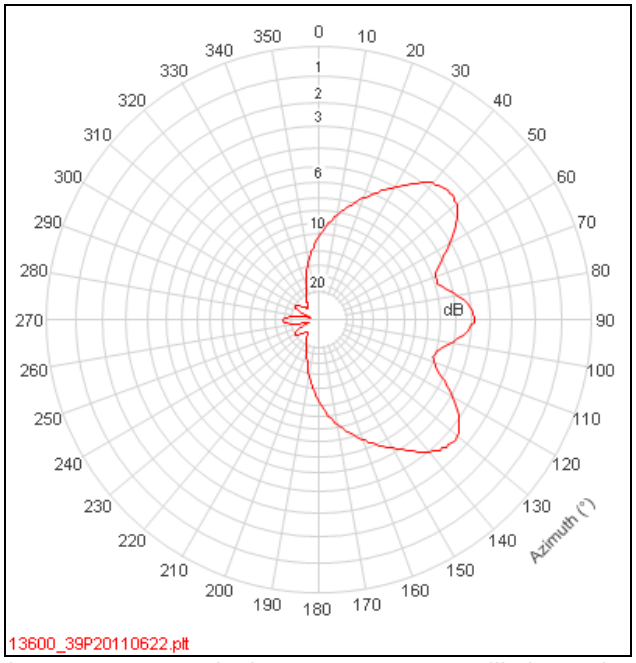

Figure A2-2 : Practical Pattern : Beacon Hill channel 39

ERP	0.2 kW	Antenna Height	61 metres

Table A2-1 : Beacon Hill ch39 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	53,572	68,686
90%	40,382	52,788

Table A2-2 : Beacon Hill ch39 : Population served based on antenna

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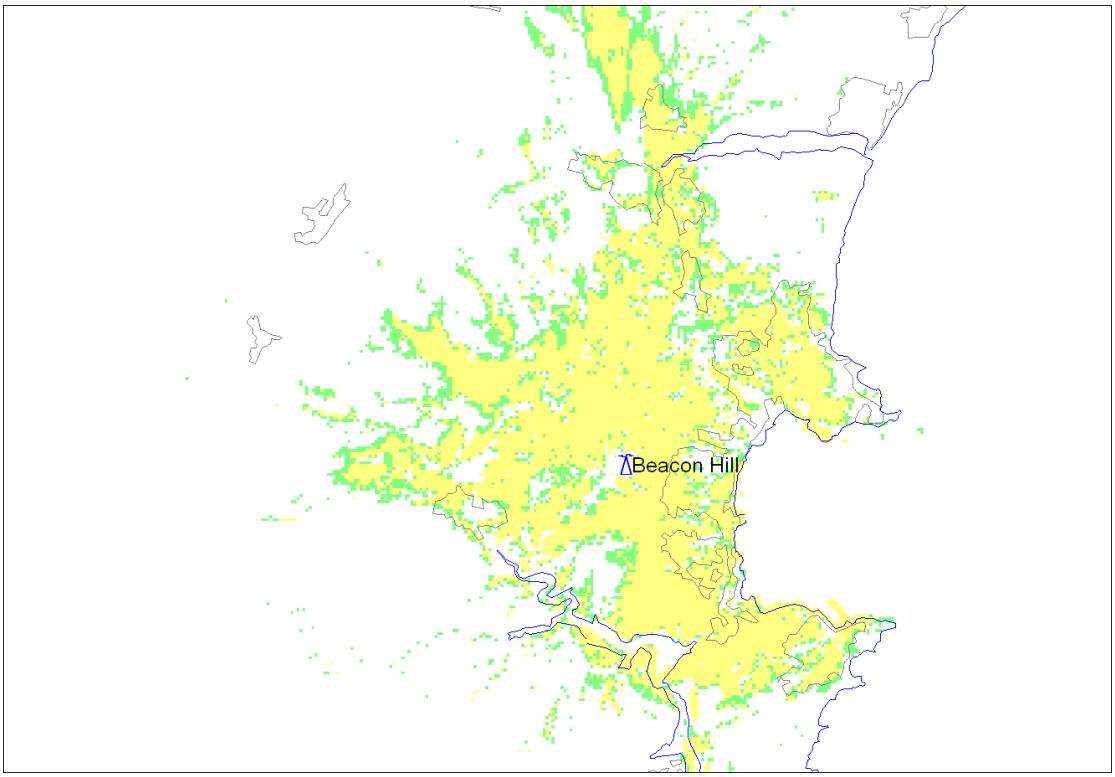

Figure A2-3: Beacon Hill: ch 39: 0.2 kW ERP: Practical antenna: 61m a.g.l

Practical Antenna:
The requirement is to serve Paignton and Torbay.

There is a requirement to protect France over the arc 78°-202°. There are restrictions toward Wenvoe (350°-50°), Llandrindod Wells (0°), Hannington (60°-80°) and Ivybridge (250°-260°)

Restrictions in the direction of Paignton and Torbay limit the ERP which can be used. Our suggested pattern exceeds the template protecting Hannington on 80°. There is an existing relationship with Hannington; Beacon Hill COM4 (10kW ERP) is co-channel with Hannington PSB2 (50kW ERP). Our proposed 200 watt service on channel 39 will have a much smaller effect on Hannington PSB3 which is also 50 kW ERP. Additionally, the area predicted to experience the highest level of interference is located some way south of Rowridge on the Isle of Wight and would appear to be within the Rowridge service area.

There is an existing relationship with Wenvoe COM on channels 42 and 45

The restriction towards France is exceeded between 83° and 106°. This will be reduced using beam tilt although it may be possible to reduce the restriction by negotiation using available envelope from the unused GE06 position at Redruth.

90° panels using a max ERP of 0.2 kW are proposed. The VRP will be shaped to provide additional rejection towards the restrictions.

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Durris 11200

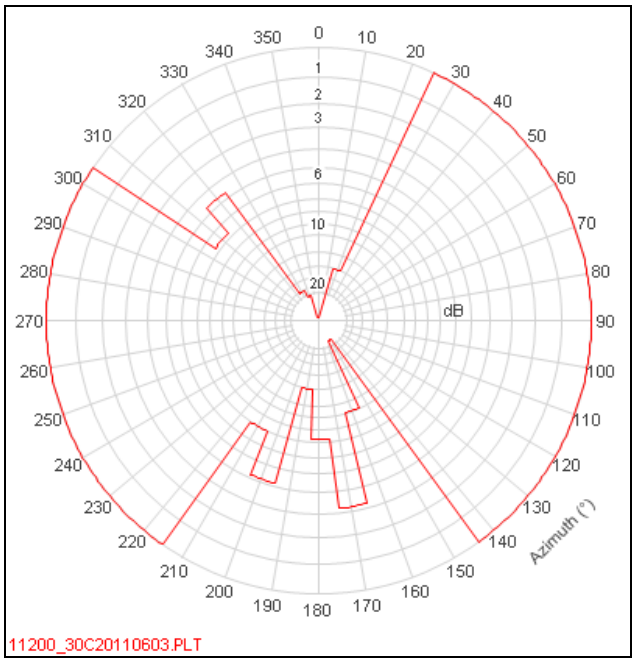

Figure A2-1: Antenna Template : Durris channel 30

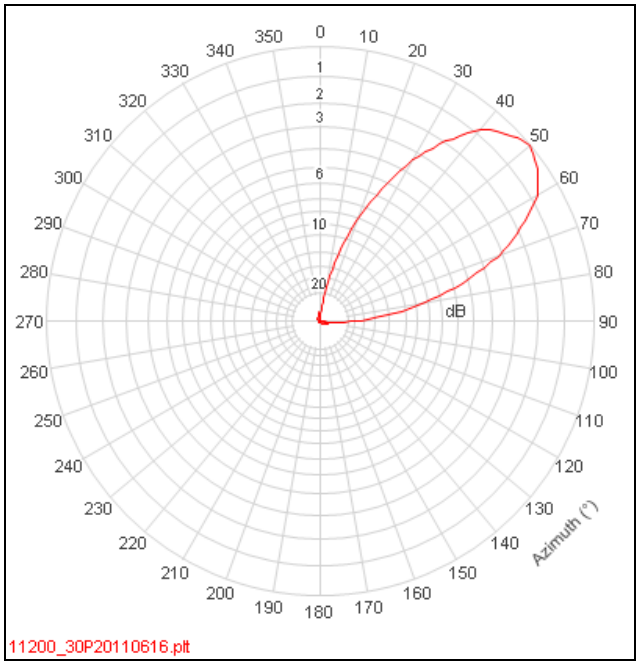

Figure A2-2 : Practical Pattern : Durris channel 30

ERP	10 kW	Antenna Height	157 metres

Table A2-1 : Durris ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	126,236	131,033
90%	119,021	121,932

Table A2-2 : Durris ch30 : Population served based on antenna

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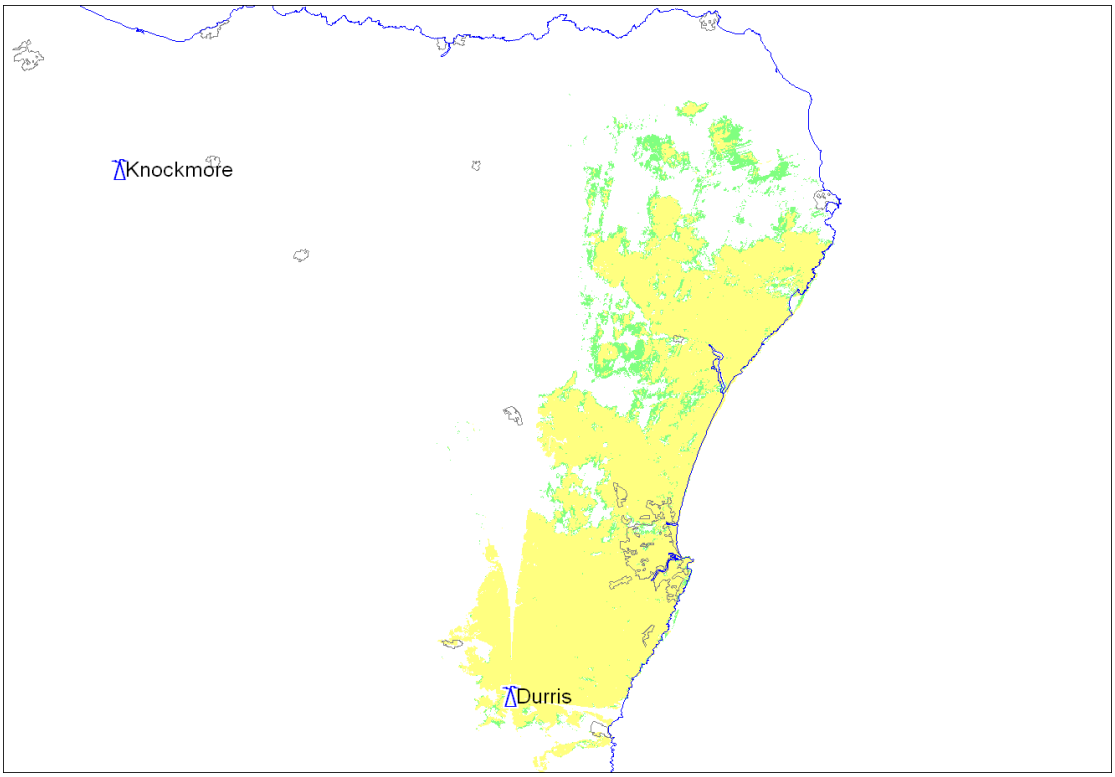

Figure A2-3: Durris ch30 : 10kW ERP: Practical antenna: 157m a.g.l

Practical Antenna:
The requirement is to serve Aberdeen.

Restrictions are required towards Rumster Forest (310°-20°), Belmont (150°-160°), and Caldbeck (170°-210°).

For a practical antenna bayed log-periodics on 50° are suggested, though this solution does infringe the restriction at 10°-20°.

The areas affected appear to have alternative services available from Durris, Rosehearty and Knockmore.

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Darvel 15200

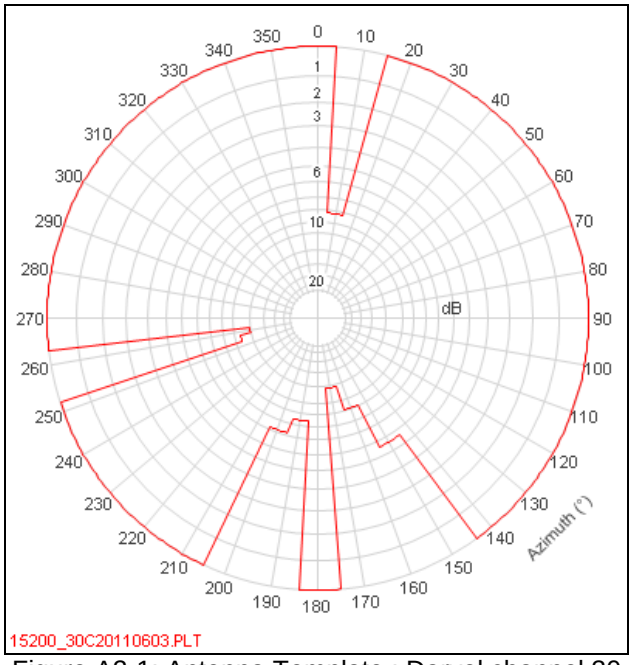

Figure A2-1: Antenna Template : Darvel channel 30

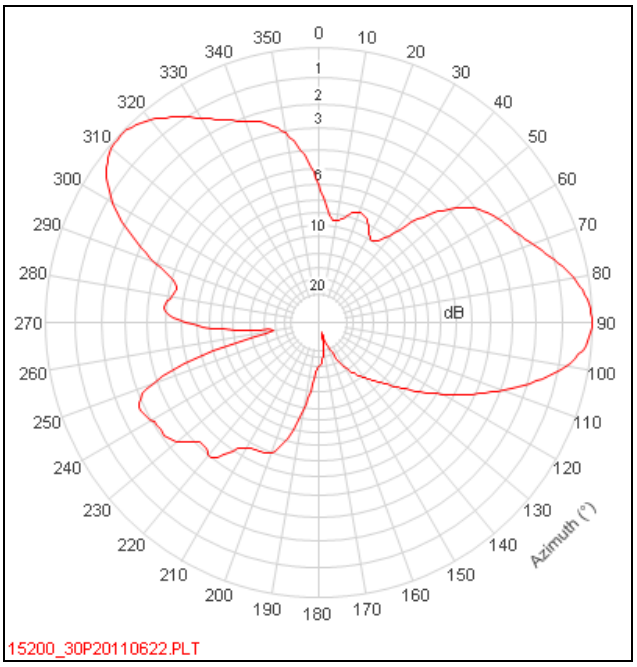

Figure A2-2 : Practical Pattern : Darvel channel 30

ERP	1 kW	Antenna Height	80 metres

Table A2-1 : Darvel ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	107,406	165,779
90%	95,668	132,796

Table A2-2 : Darvel ch30 : Population served based on antenna

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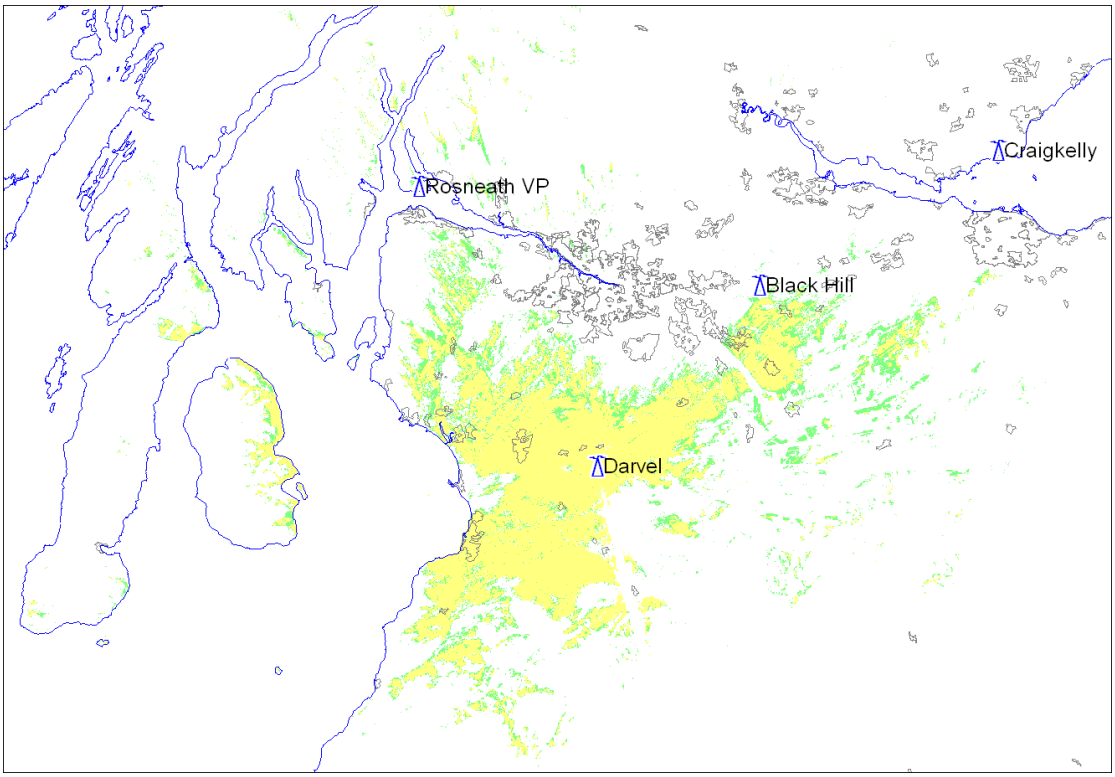

Figure A2-3: Darvel ch30 : 1kW ERP: Practical antenna: 80m a.g.l

Practical Antenna:
The requirement is to serve Ayr, Kilmarnock and surrounding areas.

There are restrictions towards Rumster Forest (10°), Caldbeck (150°-200°), The Wrekin (160°) and Ireland (253°-262°).

A possible antenna arrangement would comprise panels on three bearings with an ERP of 1kW. This would meet all the UK and Irish restrictions of the template.

It would also be possible to use the main DTT antenna at this ERP.

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Hannington 12600

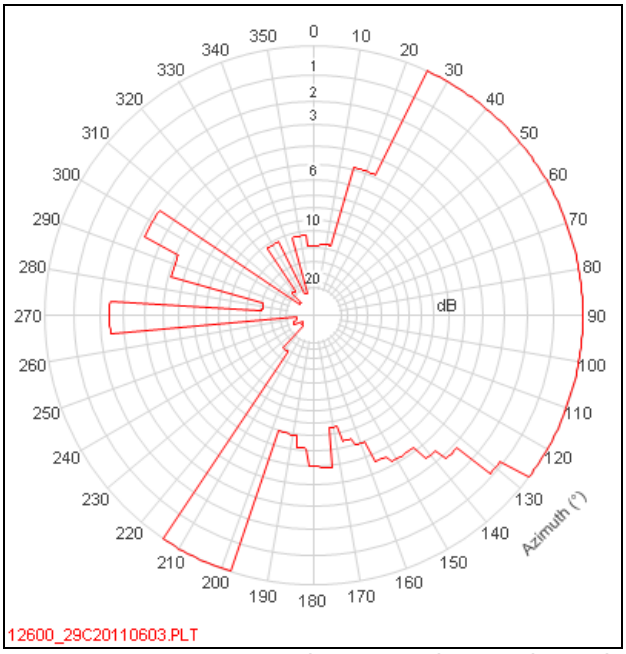

Figure A2-1: Antenna Template : Hannington channel 29

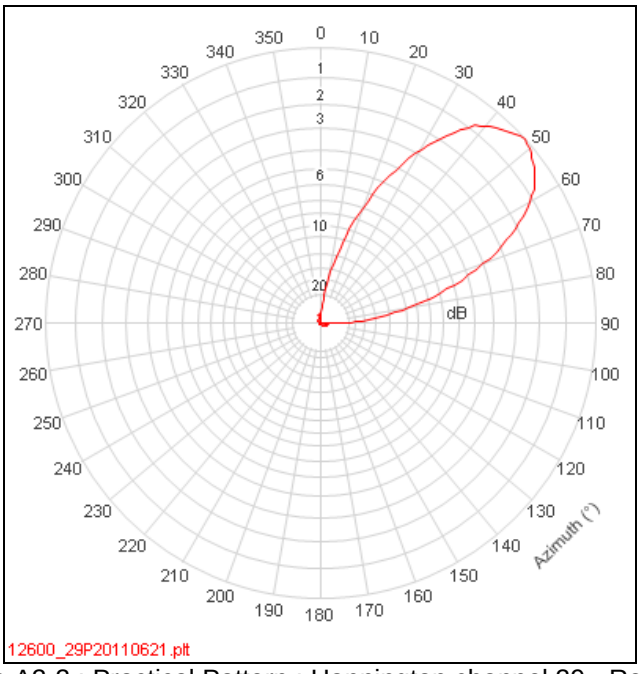

Figure A2-2 : Practical Pattern : Hannington channel 29 - Reading

ERP	10 kW	Antenna Height	71 metres

Table A2-1 : Hannington ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	142,576	364,951
90%	127,118	224,170

Table A2-2 : Hannington ch29 : Population served based on antenna

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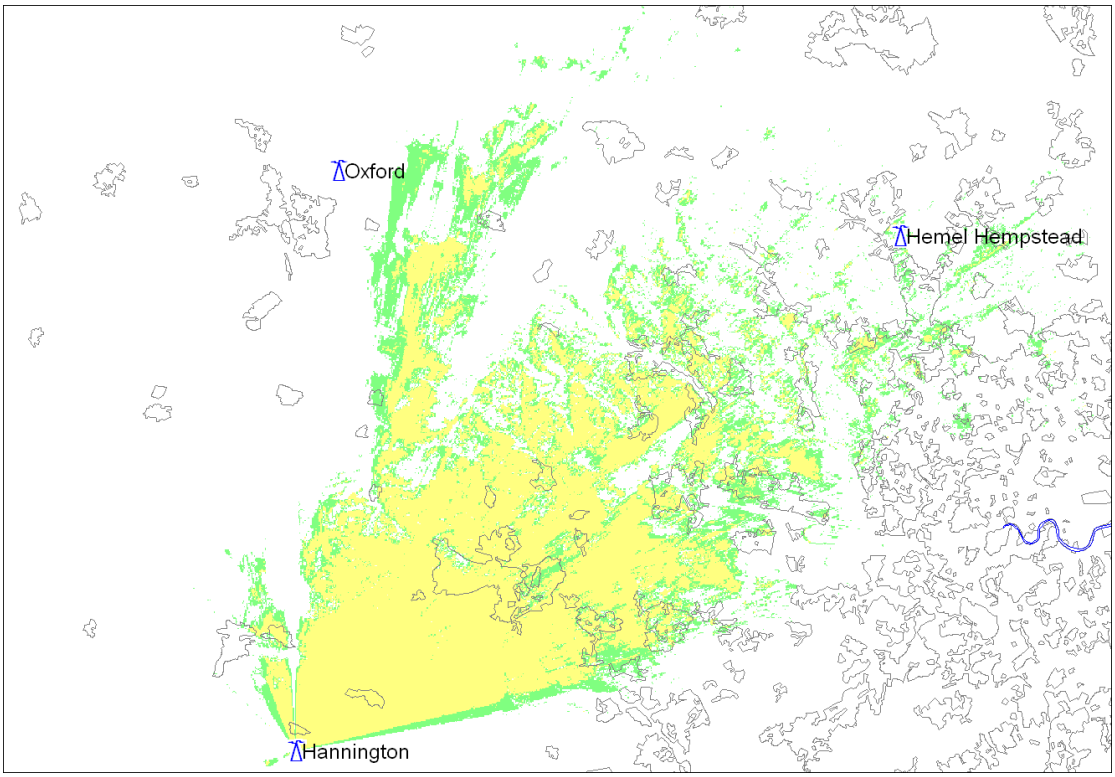

Figure A2-3: Hannington ch29 : 10kW ERP: Practical antenna - Reading: 71m a.g.l

Practical Antenna:
The requirement is to serve Reading, Newbury and Basingstoke.

Restrictions are required towards Waltham (330°-20°) and a number of stations over the arc 220°-320°

It is impractical to serve Newbury. Reading could be served using bayed logs on 48° at 10kW ERP and Basingstoke with bayed logs on 118° at 2kW ERP. These would provide a null toward Crystal Palace to protect the service area of the proposed interleaved service there although there is some interaction between the two services proposed from this site.

There are existing relationships with Waltham; Hannington ITV and BBC 2 (250kW) are co-channel with Waltham low-power DTT Multiplexes C and D (5kW). Additionally Channel 5 at Hannington (60kW) was co-channel with Channel 5 at Waltham (250kW)

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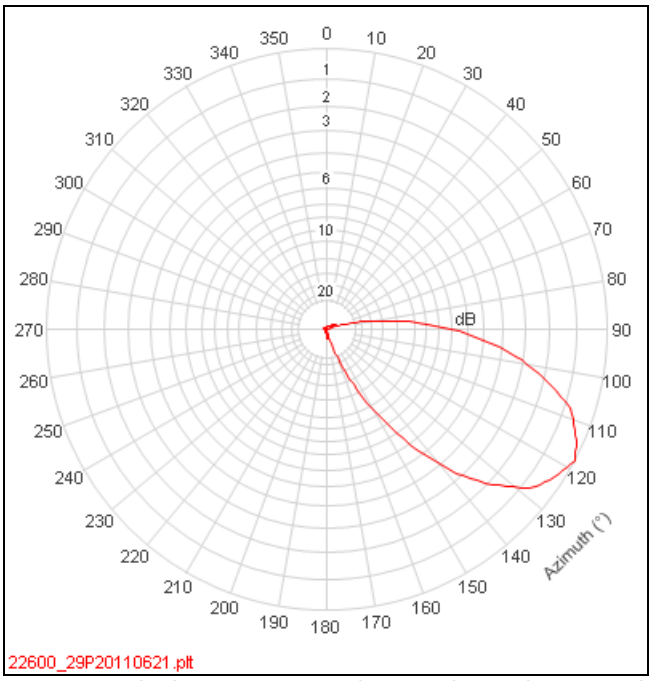

Figure A2-4 : Practical Pattern : Hannington channel 29 - Basingstoke

ERP	2 kW	Antenna Height	71 metres

Table A2-3 : Hannington ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	63,846	88,368
90%	55,791	59,477

Table A2-4 : Hannington ch29 : Population served based on antenna

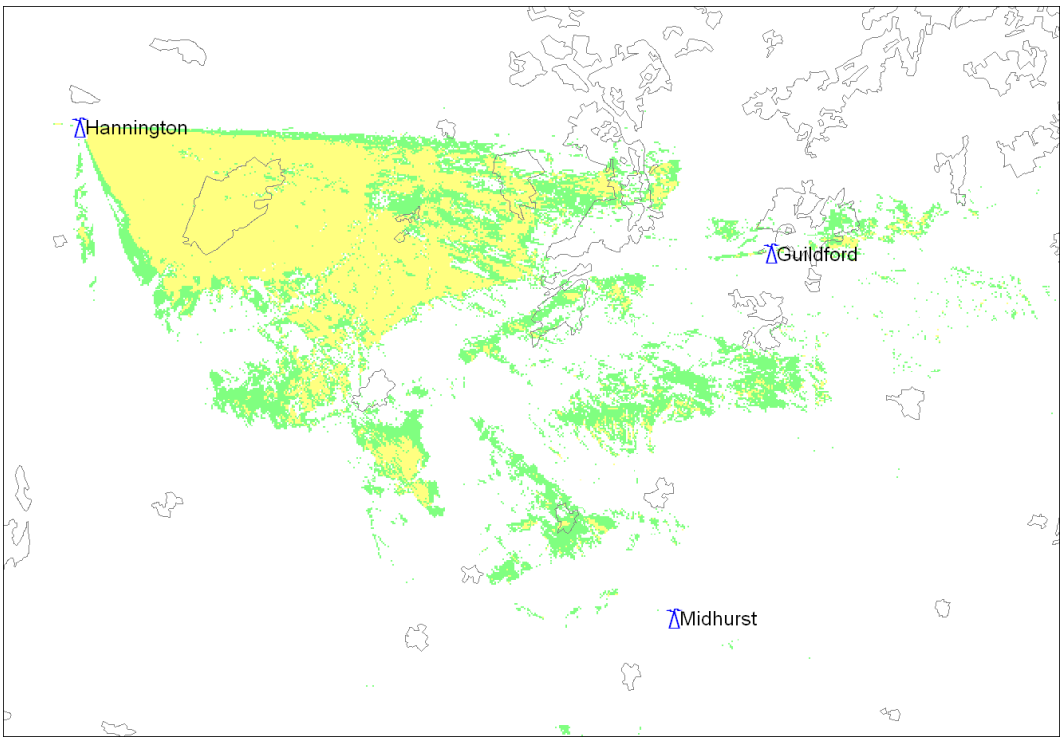

Figure A2-5: Hannington ch29 : 2kW ERP: Practical antenna - Basingstoke: 71m a.g.l

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Mendip 11000

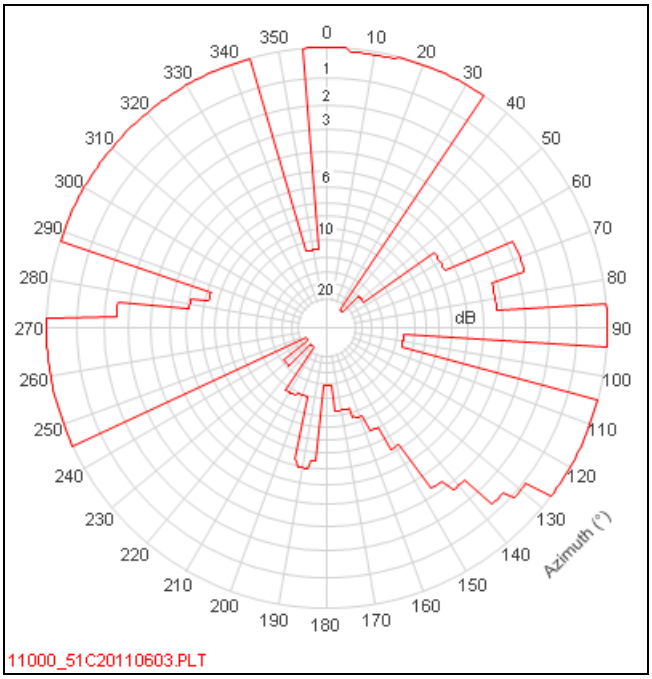

Figure A2-1: Antenna Template : Mendip channel 51

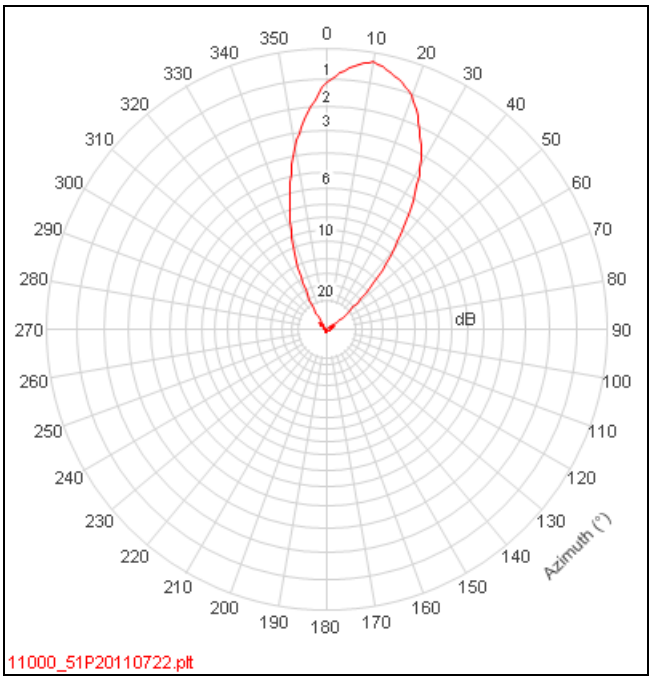

Figure A2-2 : Practical Pattern : Mendip channel 51

ERP	10 kW	Antenna Height	144 metres

Table A2-1 : Mendip ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	290,022	380,463
90%	268,012	327,665

Table A2-2 : Mendip ch51 : Population served based on antenna

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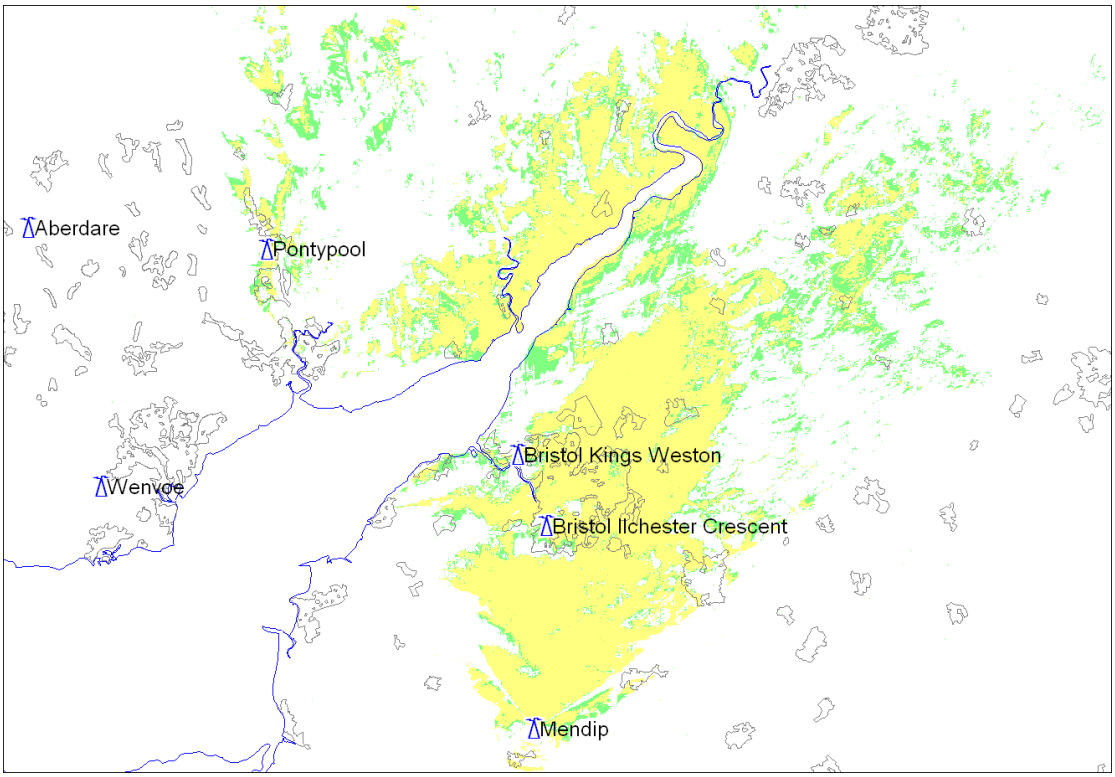

Figure A2-3: Mendip ch51 : 10kW ERP: Practical antenna: 144m a.g.l

Practical Antenna:
The requirement is to serve Bristol and parts of Somerset.

There are restrictions towards Emley Moor (10°), Sandy Heath (40°-80°) and Moel-y-Parc (350°). There are other restrictions to the south to protect France and Beacon Hill.

The restrictions to the north towards Moel-y-Parc, Emley Moor and Sandy Heath can be ignored as 6Core coverage of these stations will be limited by the existing co-channel relationship between the main multiplexes at Mendip on channels 48 and 52 operating at 100 kW ERP, and not by any interference from a GI channel 51 operating at 10 kW ERP.

Bayed log-periodics on 10° would minimise the signal levels towards the service area of the co-channel GI channel identified for use at Wenvoe.

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Oxford 11700

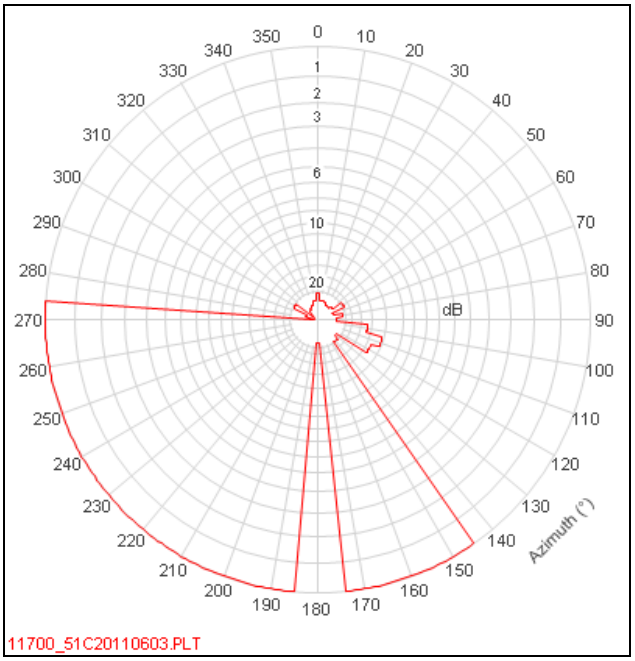

Figure A2-1: Antenna Template : Oxford channel 51

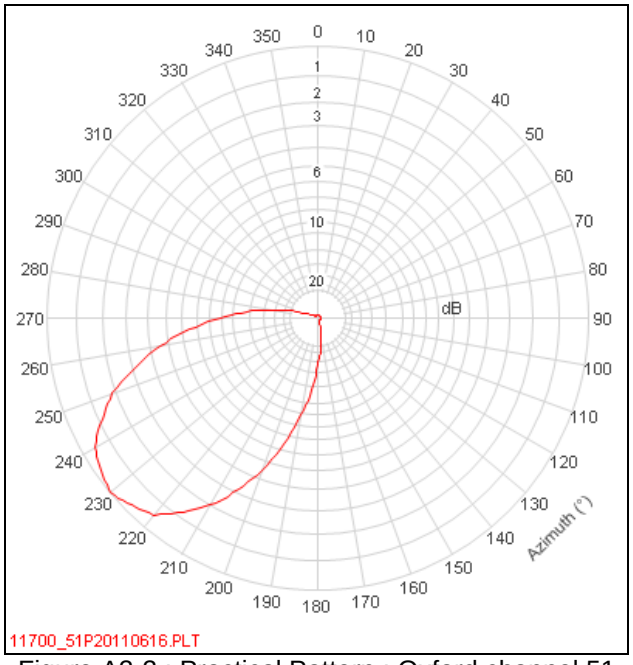

Figure A2-2 : Practical Pattern : Oxford channel 51

ERP	10 kW	Antenna Height	80 metres

Table A2-1 : Oxford ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	107,003	107,684
90%	80,807	80,994

Table A2-2 : Oxford ch51: Population served based on antenna

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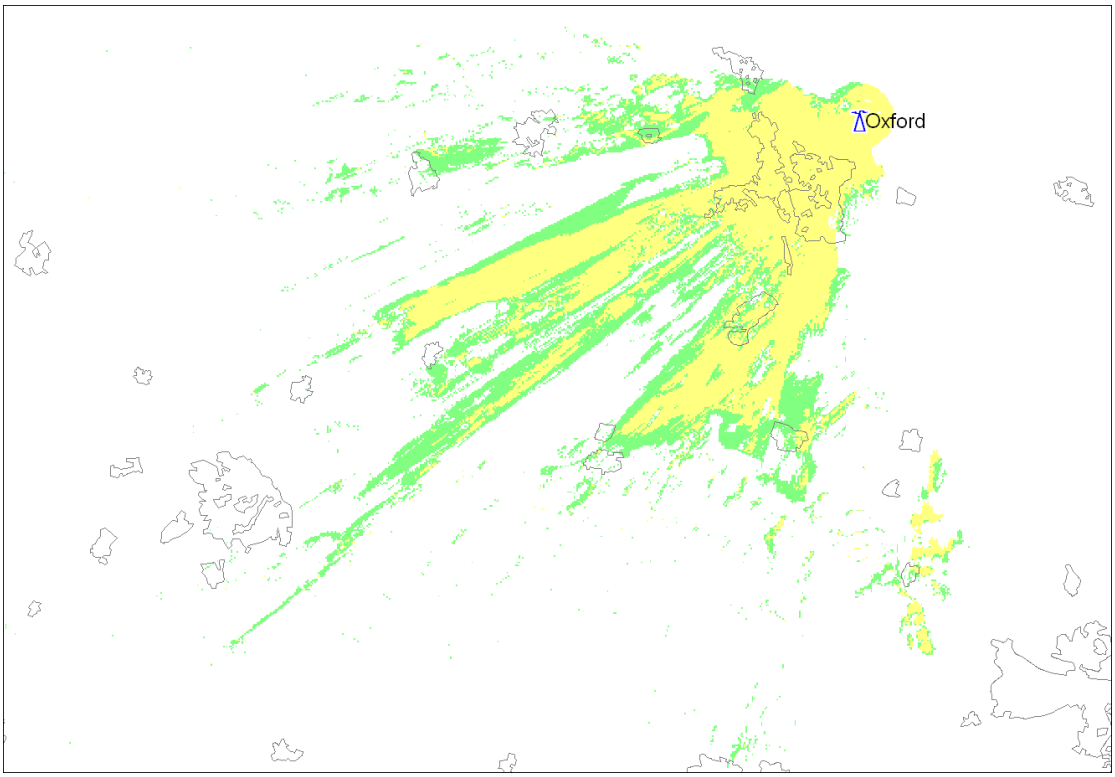

Figure A2-3: Oxford ch51: 10kW ERP: Practical antenna: 80m a.g.l

Practical Antenna:

The requirement is to serve Oxford and the immediately surrounding areas.

There are restrictions towards Sandy Heath (280°-140° and 180°) and Emley Moor (350°-0°).

There are no existing relationships with Sandy Heath but a desk-top survey indicates that it is unlikely that there are any Sandy Heath viewers within the 180° restriction.

A log-periodic on 230° is proposed. This infringes the template slightly at 180° and 280°. The areas concerned are both well within the Oxford service area and hence can be expected to receive a service from there.

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Ridge Hill 14900

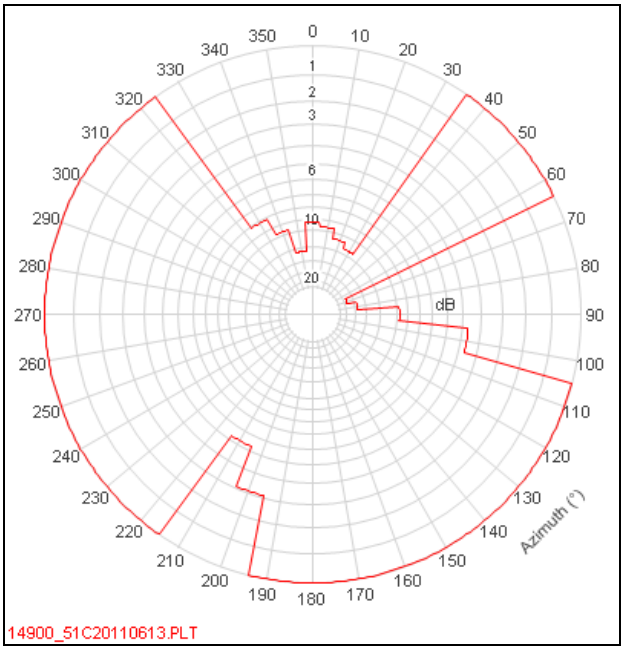

Figure A2-1: Antenna Template : Ridge Hill channel 51

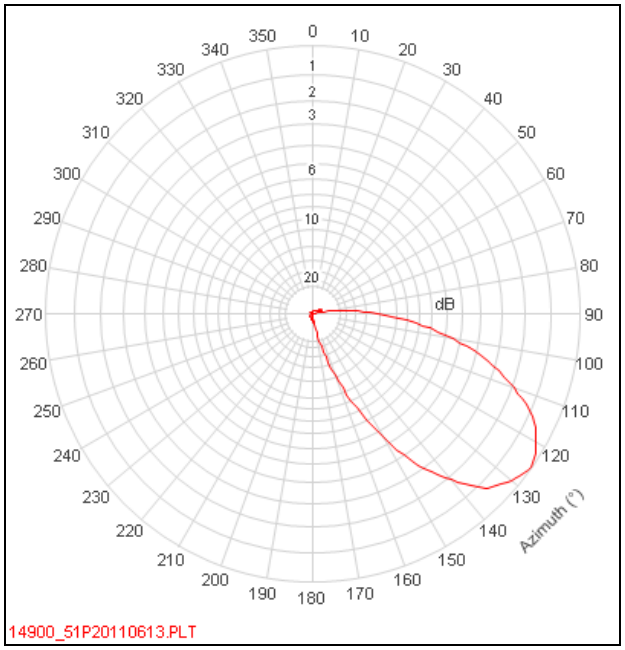

Figure A2-2 : Practical Pattern : Ridge Hill channel 51 – Cheltenham/Gloucester

ERP	2 kW	Antenna Height	79 metres

Table A2-1 : Ridge Hill ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	133,560	142,738
90%	123,735	129,783

Table A2-2 : Ridge Hill ch51 : Population served based on antenna

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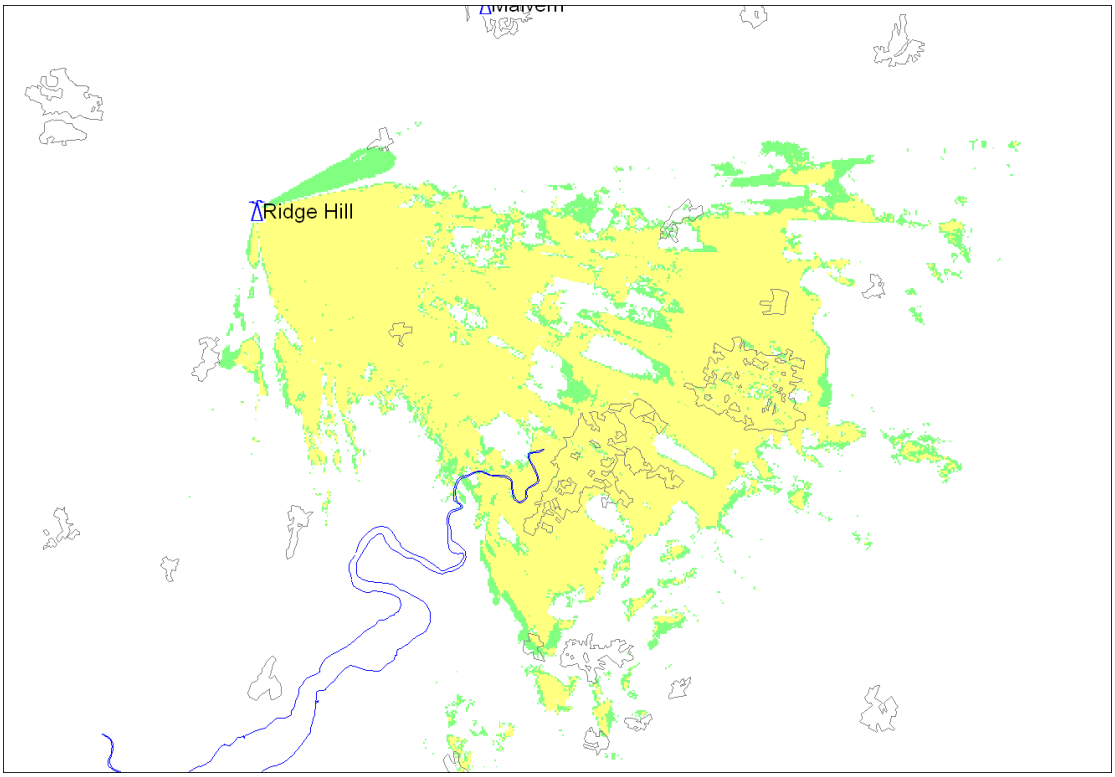

Figure A2-3: Ridge Hill ch51 : 2kW ERP: Practical antenna – Cheltenham/Gloucester : 79m a.g.l

Practical Antennas:
The requirement is to serve Cheltenham, Gloucester and Hereford. Two separate antennas are suggested.

Restrictions are required towards Sandy Heath (70°-100°), Beacon Hill (200°-210°), Moel-y-Parc (330°-20°) and Emley Moor (10°-30°).

Cheltenham and Gloucester:
Cheltenham and Gloucester could be served with bayed logs on 125°. This pattern meets the template.

Hereford:
Hereford could be served with bayed logs on 310° at 2kW ERP. This pattern meets the template at this ERP.

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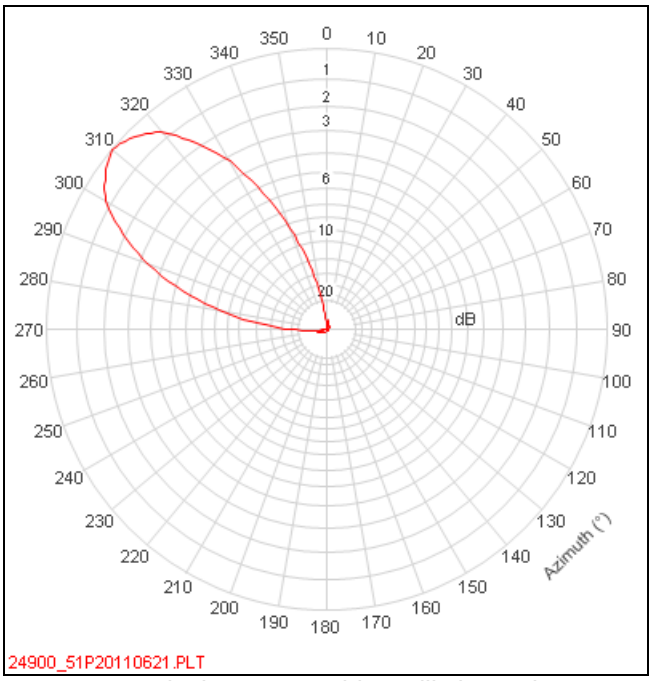

Figure A2-4 : Practical Pattern : Ridge Hill channel 51 – Hereford

ERP	1 kW	Antenna Height	79 metres

Table A2-3 : Ridge Hill ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	43,194	44,429
90%	39,376	39,812

Table A2-4 : Ridge Hill ch51 : Population served based on antenna

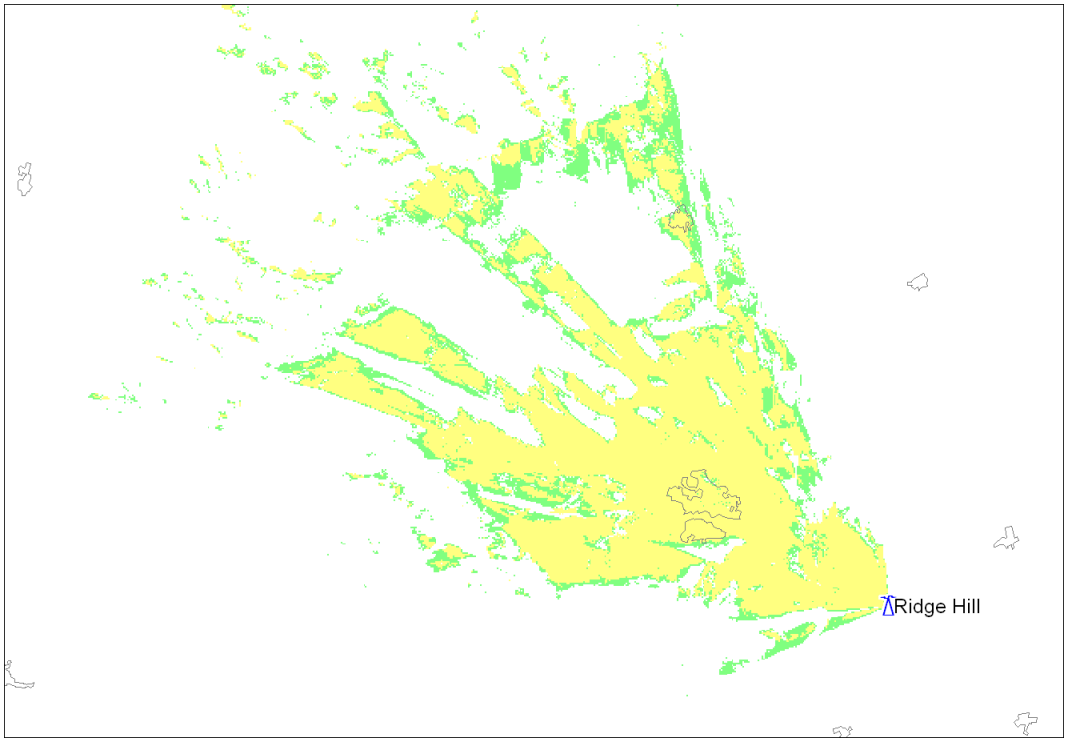

Figure A9-5: Ridge Hill ch51 : 1kW ERP: Practical antenna - Hereford: 79m a.g.l

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Rowridge VP 10860

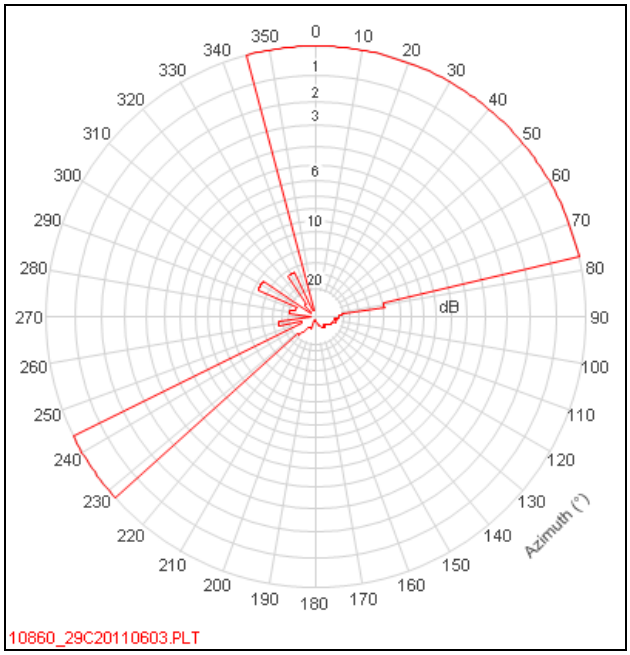

Figure A10 -1: Antenna Template : Rowridge VP channel 29

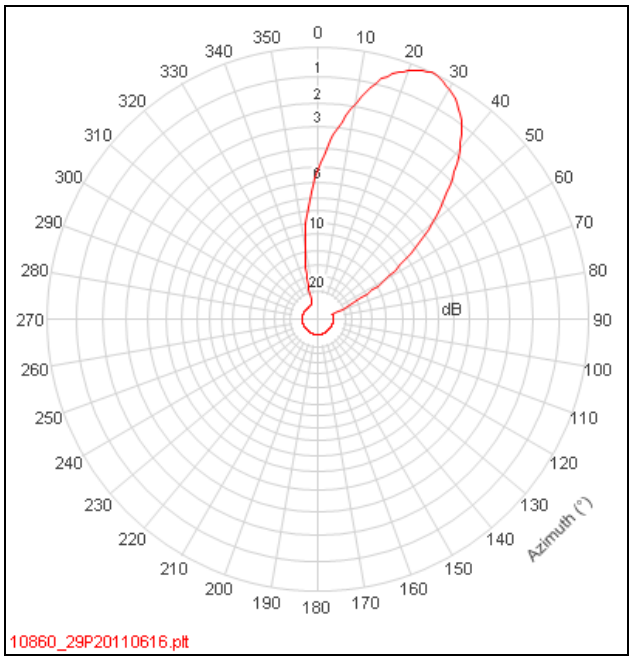

Figure A2-2 : Practical Pattern : Rowridge VP channel 29

ERP	10 kW	Antenna Height	89 metres

Table A2-1 : Rowridge VP ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	245,004	459,810
90%	204,964	394,852

Table A2-2 : Rowridge VP ch29 : Population served based on antenna

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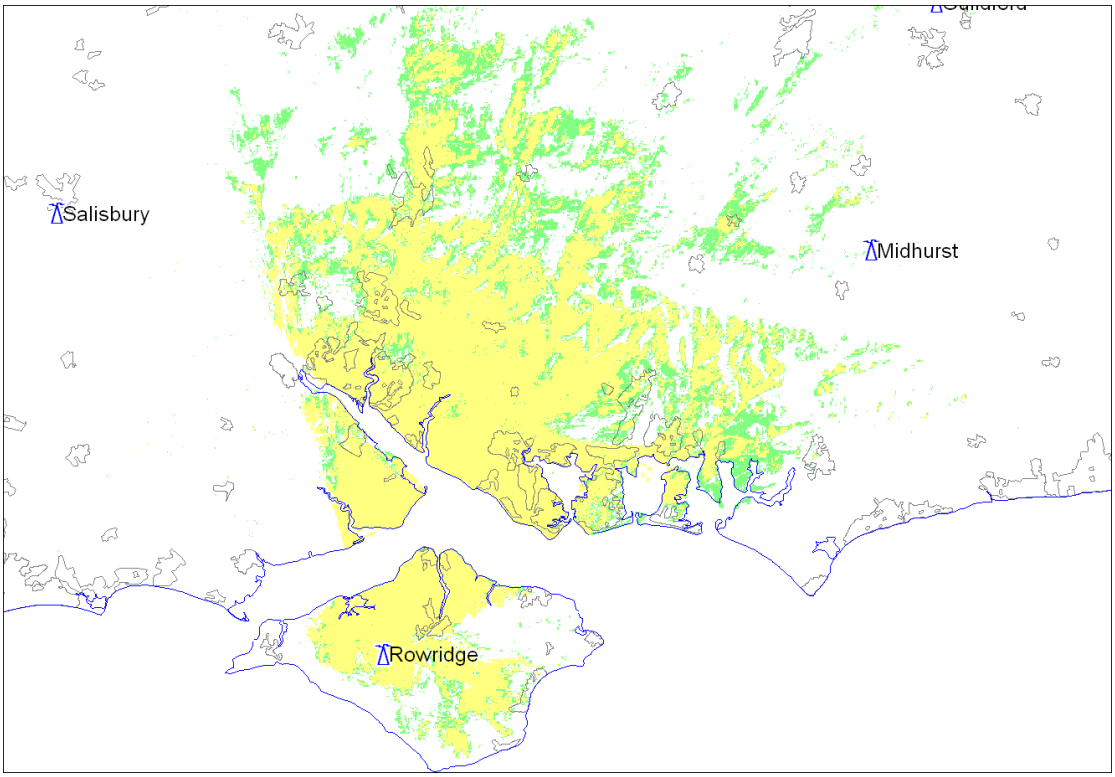

Figure A2-3: Rowridge VP ch29 : 10kW ERP: Practical antenna: 89m a.g.l

Practical Antenna:
The requirement is to serve Portsmouth, Bournemouth and Southampton. It is impractical to serve Bournemouth.

There are restrictions towards Stockland Hill (250°-310°), Upavon (330°-340°), Tidworth and Cirencester (340°). There are other restrictions to the west.

There is a relationship between Rowridge low-power DTT on channels 23 and 26 and analogue TV at Upavon and Cirencester. There is no relationship with Tidworth and there are Tidworth viewers within the worst affected areas.

We propose a single antenna to serve both Southampton and Portsmouth. A suitable practical antenna, comprising bayed log-periodics on 25°, would meet the template.

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Redruth 14100

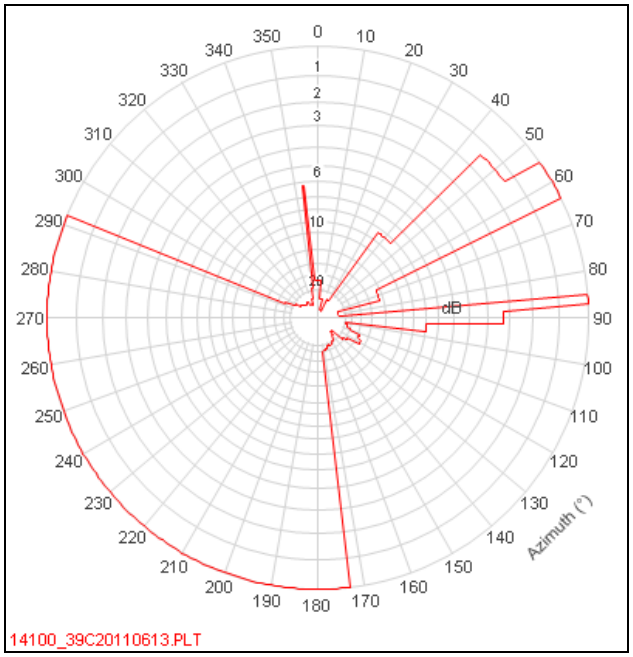

Figure A2-1: Antenna Template : Redruth channel 39

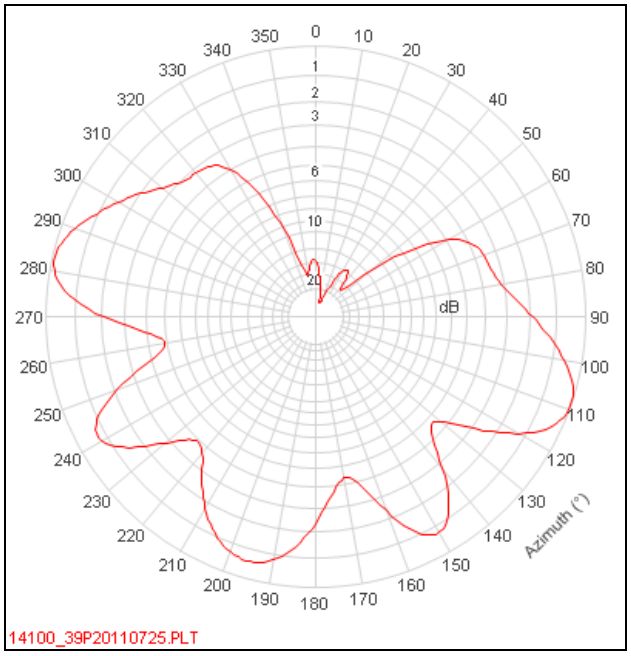

Figure A2-2 : Practical Pattern : Redruth channel 39

ERP	2 kW	Antenna Height	134 metres

Table A11-1 : Redruth ch39 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	88,252	97,214
90%	73,201	78,152

Table A2-2 : Redruth ch39 : Population served based on antenna

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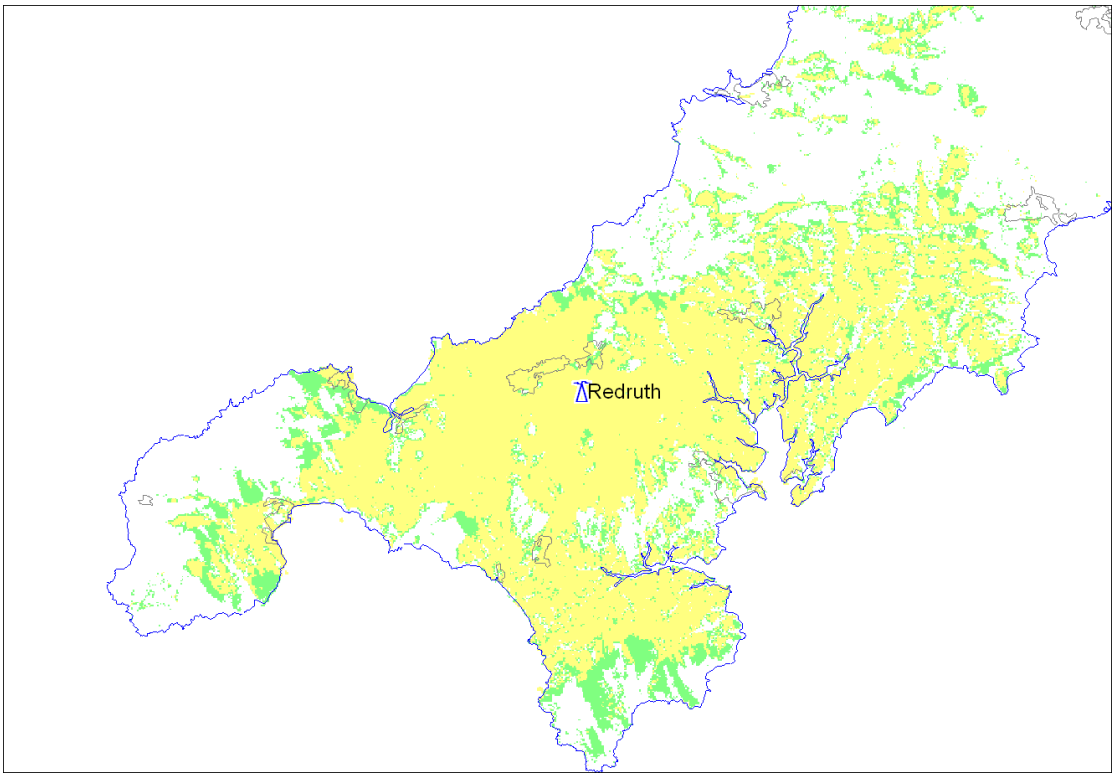

Figure A2-3: Redruth ch39 : 2kW ERP: Practical antenna: 134m a.g.l

Practical Antenna:
The requirement is to serve Penzance and Truro.

There are restrictions toward Presely (0°-30°), Wenvoe (20°-50°), Ystalyfera (30°) Plymouth Weston mill (70°) and Ivybridge (80°). There are other, less onerous, restrictions between 350° and 40°. Restrictions are required towards France between 100° and 170° and towards Ireland between 300° and 350°.

There is an existing relationship between the PSB services at Redruth and the PSB services at Wenvoe, as such core coverage of Wenvoe would be limited by this relationship and not interference from a GI channel at Redruth.

There is an existing relationship between Ivybridge and the main multiplexes at Redruth on channels 48 and 52. It is interference from this interaction that will limit the core coverage of Ivybridge and as such the restriction towards Ivybridge could be relaxed.

There is no relationship with Plymouth Weston Mill however a desk-top survey shows that viewers in the area predicted as being subject to the greatest interference have HP antennas. The proposed pattern meets the template towards Plymouth Weston Mill.

Terrain limits coverage towards Truro so we suggest an antenna height greater than half structure height is used.

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Though the proposed pattern meets the UK template it exceeds the 29dBμV/m limit to France and Ireland. However, as ch39 is a GE06 position at Redruth there is scope for negotiating levels of interference above 29dBμV/m with both countries.

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Sandy Heath 12400

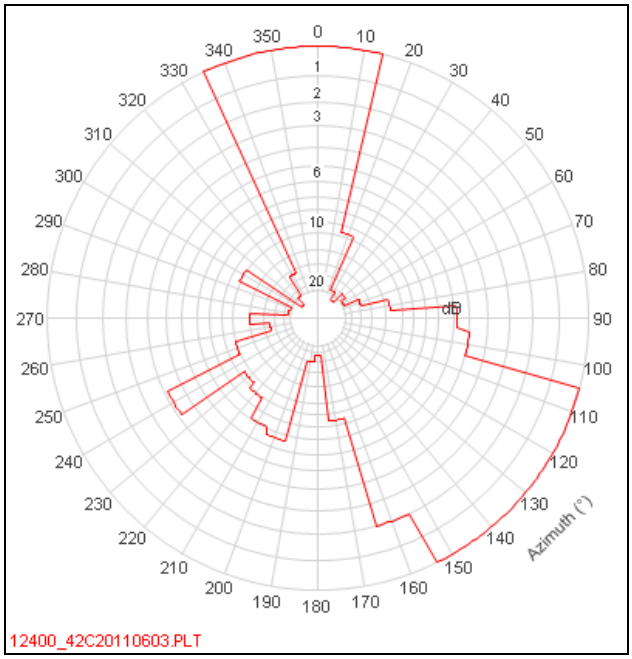

Figure A2-1: Antenna Template : Sandy Heath channel 42

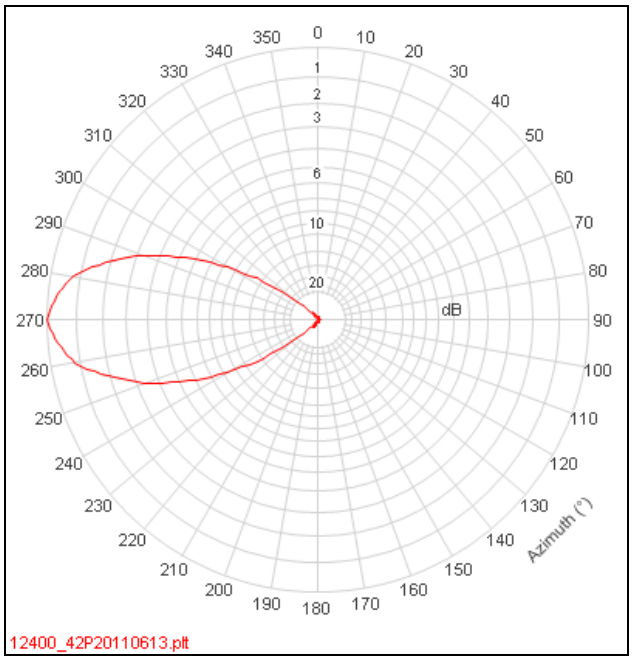

Figure A2-2 : Practical Pattern : Sandy Heath channel 42

ERP	2 kW	Antenna Height	119 metres

Table A2-1 : Sandy Heath ch42 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	64,372	64,372
90%	50,296	50,296

Table A2-2 : Sandy Heath ch42: Population served based on antenna

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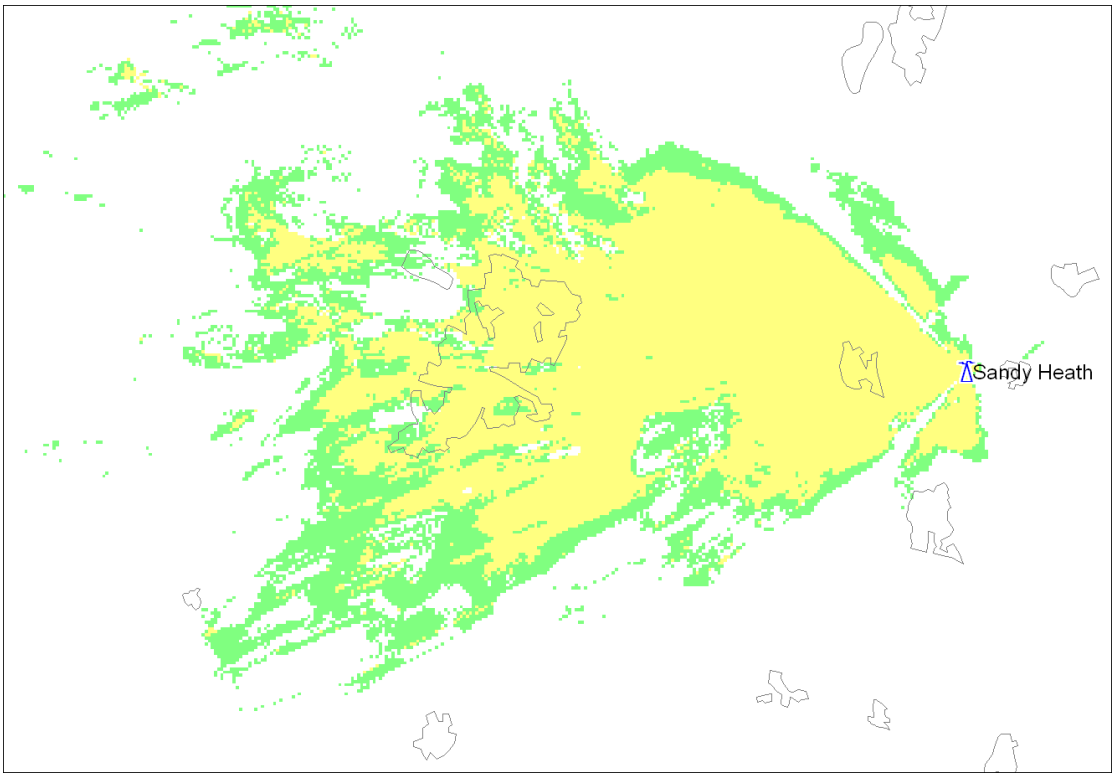

Figure A2-3: Sandy Heath ch42: 2kW ERP: Practical antenna: 119m a.g.l

Practical Antenna:
The requirement was to serve parts of Cambridgeshire, Northamptonshire and Bedfordshire.

There are restrictions towards Tacolneston (20°-100°), Heathfield (160°, 180°), Hannington (170°-260°), Biggin Hill and Poplar (170°) and Sutton Coldfield (250°-330°)

Many of the population centres that Sandy Heath serves lie on the edge of coverage and are only reached reliably by a high power service operating in clear channels broadcast from the top of the structure. As GI spectrum is not of the same quality as that used by the main multiplexes its reach is lower and realistically only Bedford can be served from Sandy Heath. An alternative broadcast site at Madingley is recommended for use to serve Cambridge.

Sutton Coldfield and Hannington are the limiting factors on ERP. The antenna beamwidth has been made as narrow as possible to minimise interference.

There is an existing relationship between the low-power DTT at Sandy Heath (20kW ERP) and analogue services at Sutton Coldfield (1000kW ERP) on channels 40, 43 and 46. In the worst affected pixels no antennas can be seen directed towards Sutton Coldfield on our desk-top survey. Additionally alternative services appear to be available from Oxford or Waltham.

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Sudbury 11500

Practical Antenna:
The requirement is to serve Colchester and Sudbury. It was not possible to provide coverage of either town from Sudbury and this site has been dropped.

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Tacolneston 11400

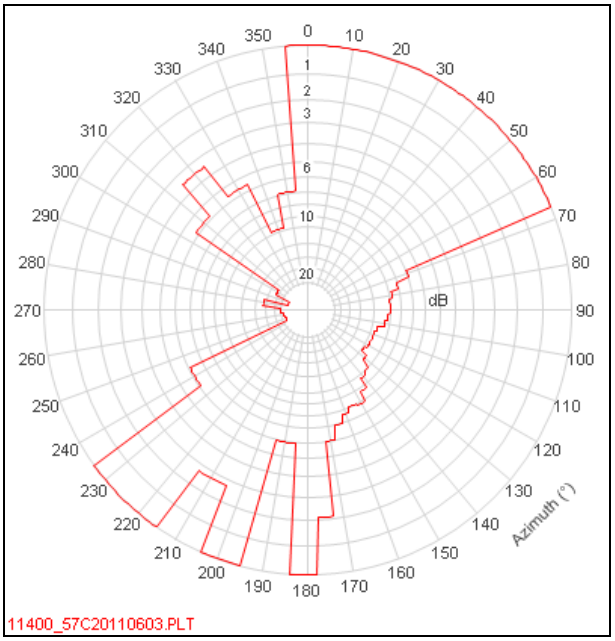

Figure A2-1: Antenna Template : Tacolneston channel 57

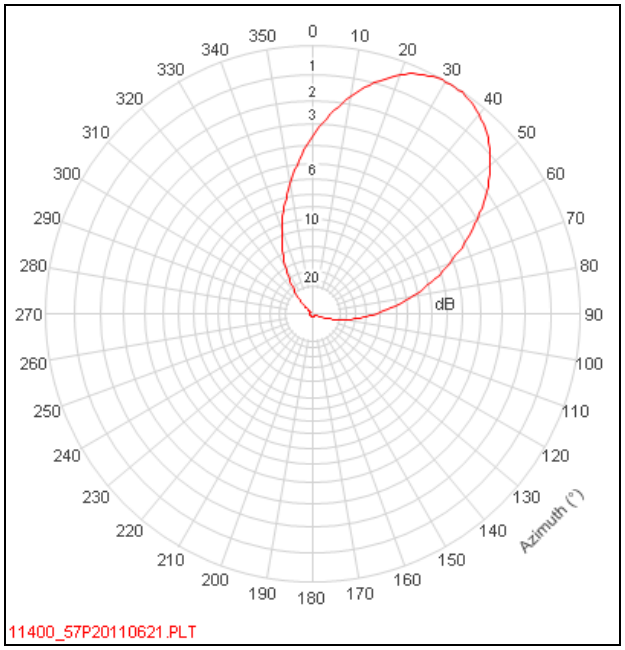

Figure A2-2 : Practical Pattern : Tacolneston channel 57

ERP	10 kW	Antenna Height	100 metres

Table A2-1 : Tacolneston channel 57: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	148,566	155,223
90%	130,568	136,340

Table A2-2 : Tacolneston channel 57 : Population served based on antenna

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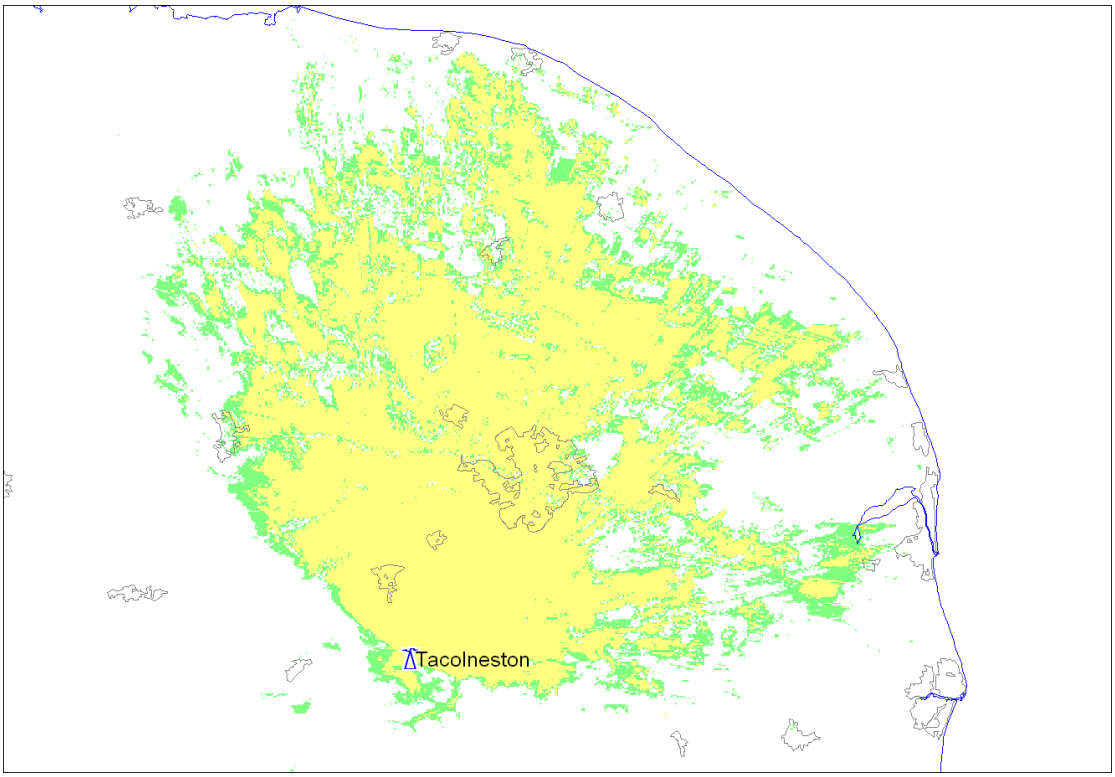

Figure A2-3: Tacolneston channel 57 : 10kW ERP: Practical antenna: 100m a.g.l

Practical Antenna:
The requirement is to serve Norwich and the surrounding area.

There are restrictions towards Oxford (240°-260°), Waltham (250°-320°) and Wells-next-the-Sea (330°-350°). There is a restriction toward The Netherlands from 68° to 177°.

There is no relationship with Wells-next-the-Sea.

In the worst affected areas no VP receiving antennas could be seen on a desk-top survey. Antennas were all HP directed mostly at Tacolneston and, occasionally, Belmont.

The suggested pattern slightly infringes the Dutch restriction but it may be possible to resolve this by negotiation.

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The Wrekin 12100

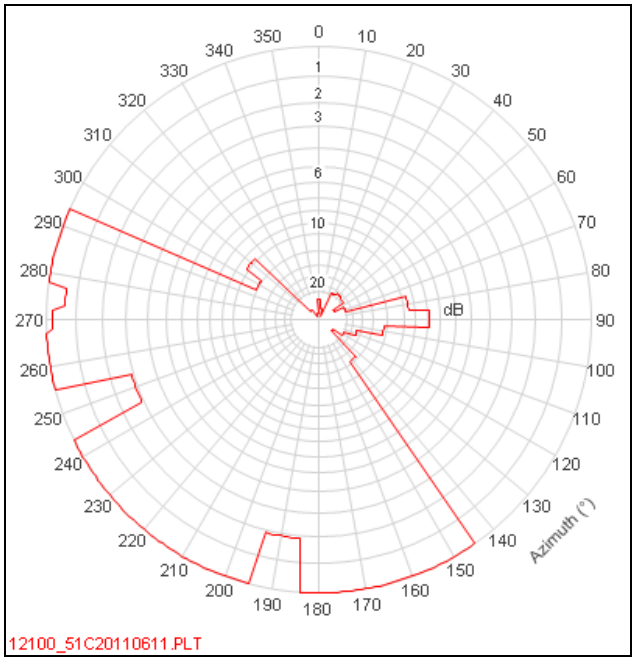

Figure A2-1: Antenna Template : The Wrekin channel 51

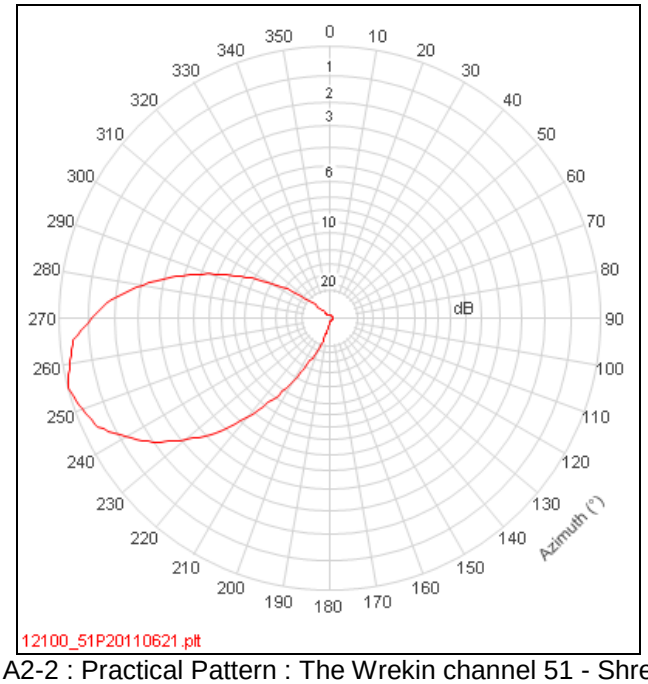

Figure A2-2 : Practical Pattern : The Wrekin channel 51 - Shrewsbury

ERP	1 kW	Antenna Height	54 metres

Table A2-1 : The Wrekin ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	43,813	45,679
90%	40,397	41,108

Table A2-2 : The Wrekin ch51 : Population served based on antenna

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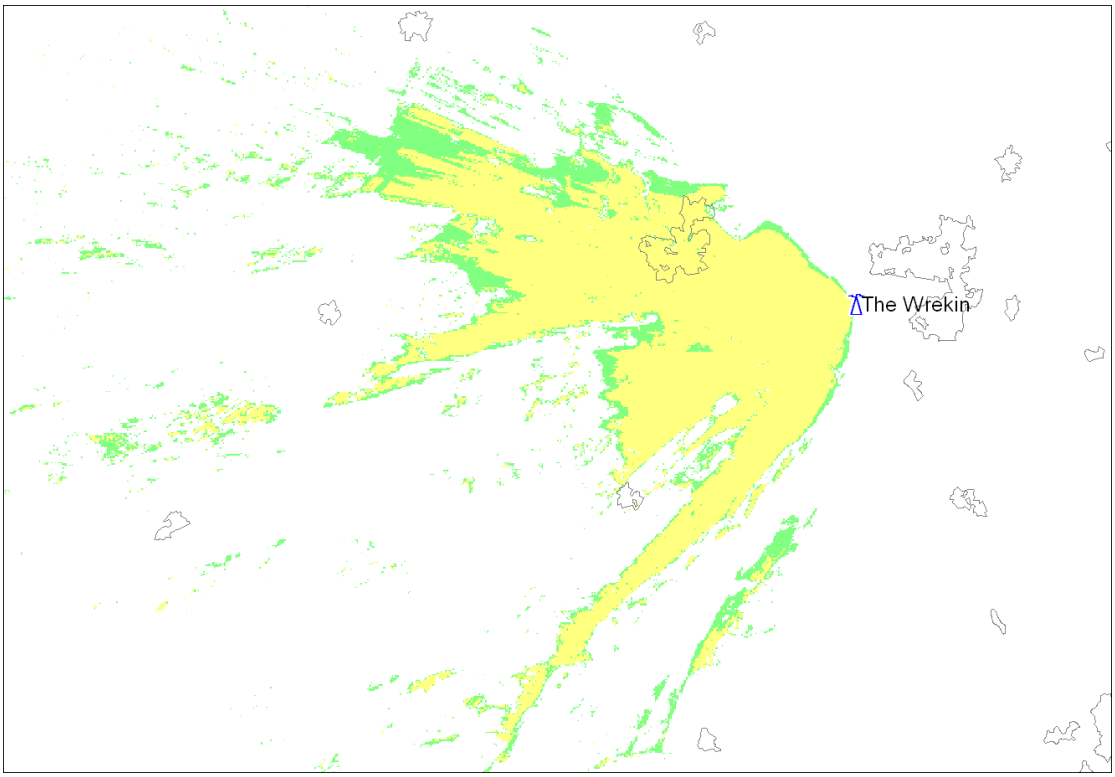

Figure A2-3: The Wrekin ch51 : 1kW ERP: Practical antenna - Shrewsbury: 54m a.g.l

Practical Antenna:

The requirement is to serve Shrewsbury and Telford.

There are restrictions towards Moel-y-Parc (300°-30° & 250°), Emley Moor (0°-80°, 300° & 320°), Saddleworth (10°-30°), Nottingham (60°-80°), Derby (70°), Sandy Heath (90°-140°) and Beacon Hill (190°)

There is an existing relationship between The Wrekin COM (10kW ERP) and Emley Moor PSB (175kW) on channels 41, 44 and 47. The proposed service will not affect Emley Moor channel 51 any more than the PSB channels are already being affected.

There are existing relationships with Nottingham which are summarised in the table below:

channel	21	24	27	31	34	39
The Wrekin	Mux 1 (East)	Mux A (East)	Mux B (East)	Mux 2 (East)	C5	Mux 1 (West)
ERP (kW)	2	2	2	2	100	2
Nottingham	BBC1	ITV	BBC2	C4	C5	Mux 1
ERP (kW)	2	2	2	2	2	0.04

The proposed pattern meets the restrictions towards Nottingham.

There is an existing relationship between The Wrekin low-power DTT (East) (2kW ERP) and Sandy Heath ATV (1000kW ERP) on channels 21, 24, 27 and 31.

There is an existing relationship between The Wrekin low-power DTT (East) (2kW ERP) and Moel-y-Parc ATV (100kW ERP) on channels 42, 45 and 49.

There is no existing relationship with Derby. To meet the restriction towards Derby, ERP must be restricted to 0.5kW.

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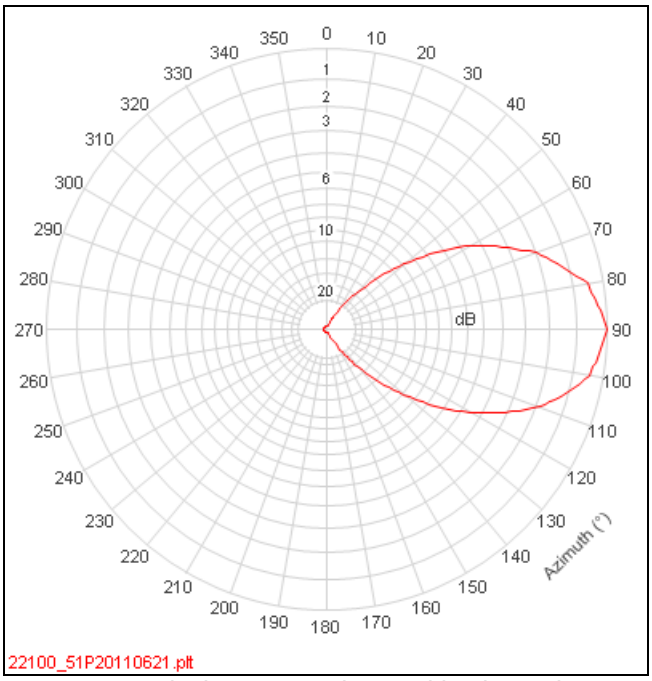

Figure A2-4 : Practical Pattern : The Wrekin channel 51 - Telford

ERP	0.5 kW	Antenna Height	54 metres

Table A2-3 : The Wrekin ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	73,417	144,578
90%	58,419	90,610

Table A2-4 : The Wrekin ch51 : Population served based on antenna

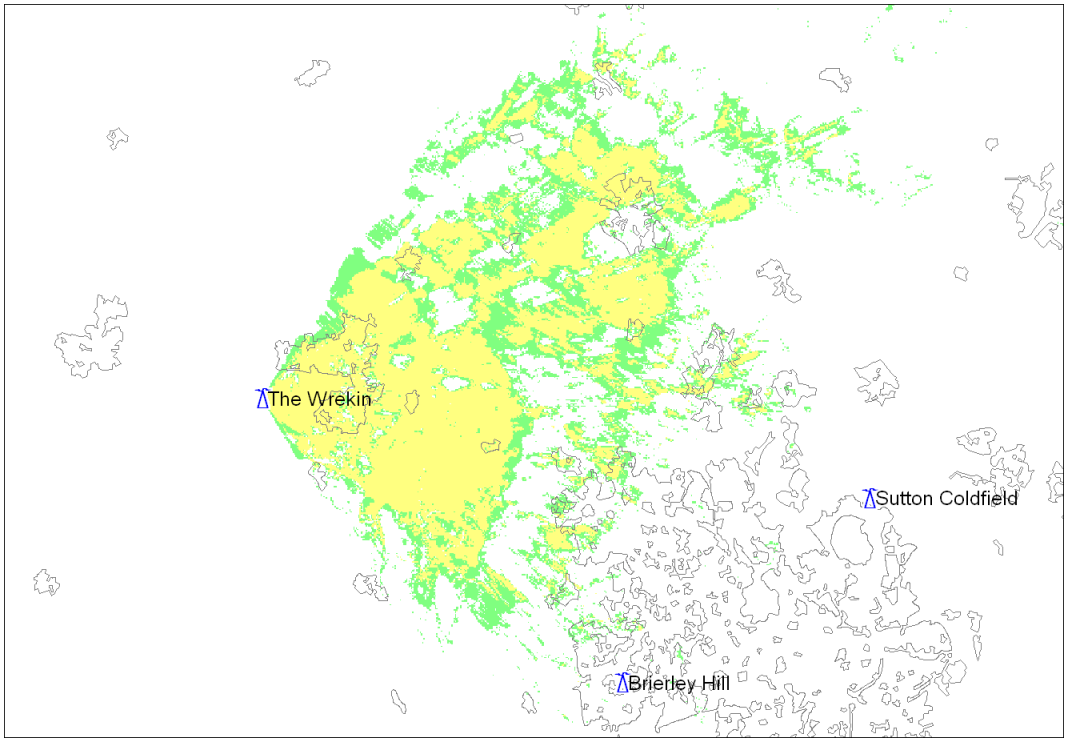

Figure A2-5: The Wrekin ch51 : 0.5kW ERP: Practical antenna - Telford: 54m a.g.l

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Madingley 18241

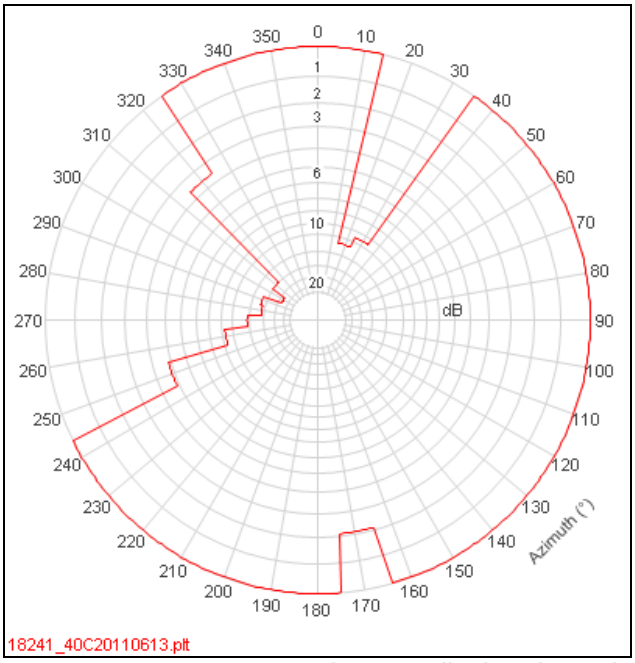

Figure A15 -1: Antenna Template : Madingley channel 40

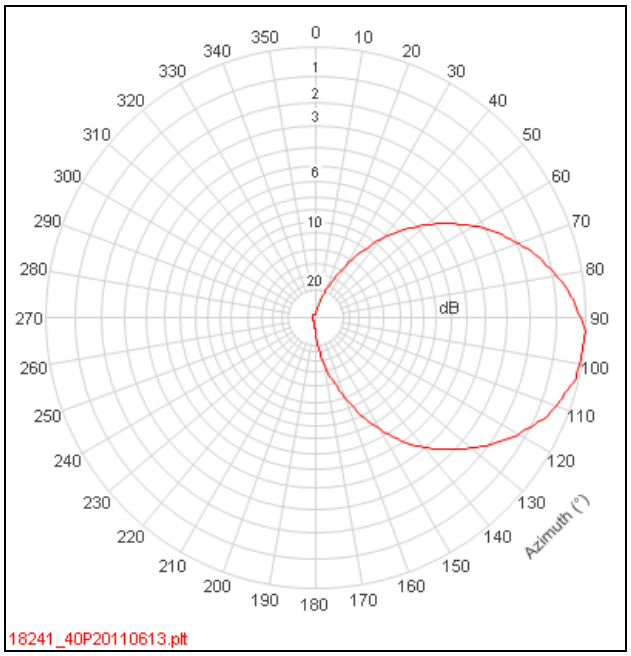

Figure A2-2 : Practical Pattern : Madingley channel 40

ERP	1 kW	Antenna Height	45 metres

Table A2-1 : Madingley ch40 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	83,440	83,739
90%	68,604	68,658

Table A2-2 : Madingley ch40 : Population served based on antenna

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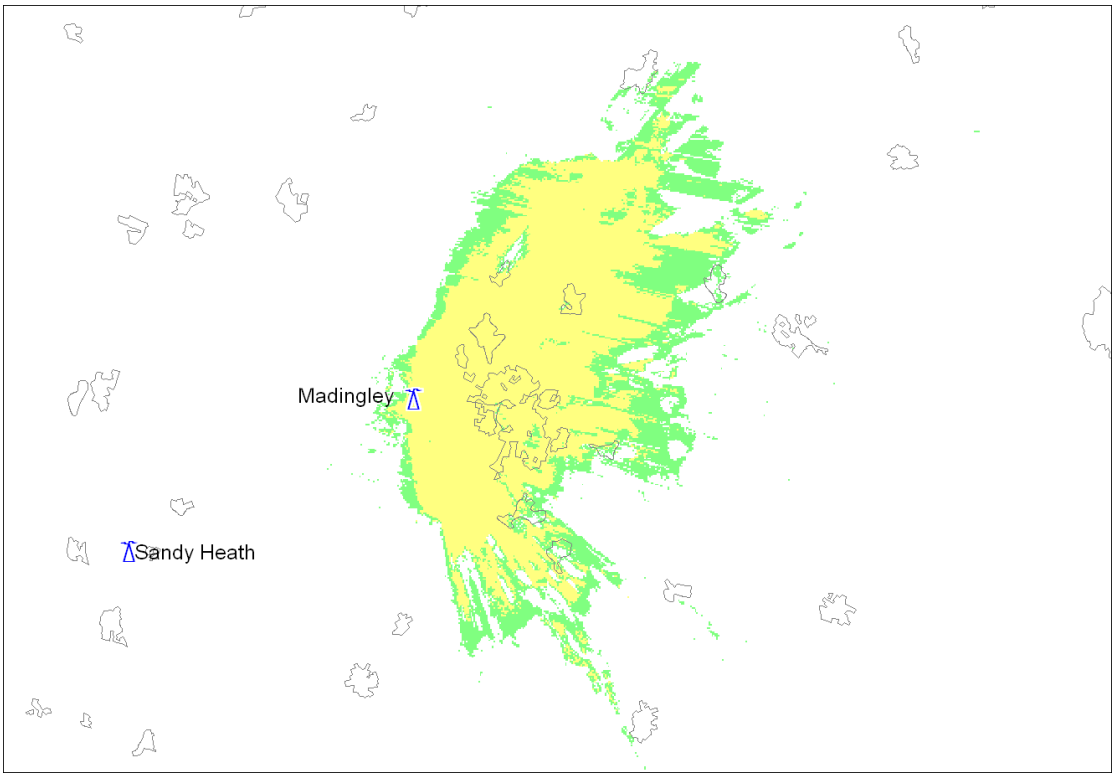

Figure A2-3: Madingley ch40 : 1 kW ERP: Practical antenna: 45m a.g.l

Practical Antenna:
There is a requirement to serve Cambridge and its environs. The main station that serves the area is Sandy Heath. However, as Cambridge is on the edge of Sandy Heath's coverage, it has not been possible to identify a GI channel suitable for use at Sandy Heath that serves Cambridge. The alternative is to use the broadcast site at Madingley just west of Cambridge and approximately in line with Sandy Heath. This site was previously used to provide a C5 analogue service in the Cambridge area and it is proposed that it is used for any GI service designed to serve Cambridge.

Channel 40 has been identified as suitable for use at Madingley and the channel at 1 kW would be subject to restrictions towards Kings Lynn (20°-30°), Bluebell Hill (170º) and Sutton Coldfield (250°-320°).

A suitable practical antenna to serve the area would be 50° crossed log-periodics. Such an antenna at 1 kW ERP would meet the template.

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Annex 3 : Templates & Practical Patterns – Group B

The stations in Group B and their prime target areas are detailed in Table A3-1.

Station ID	Transmitter Station	Target Urban area	Comment
10415	Beecroft Hill	Leeds	Emley Moor Filler
10206	Bromsgrove	Bromsgrove	Sutton Coldfield Filler
10203	Brierley Hill	Dudley	Sutton Coldfield Filler
11007	Bristol KW	N Bristol	Mendip Filler
11008	Bristol Ilchester Cres	W Bristol	Mendip Filler
13700	Caldbeck	Carlisle	
13100	Caradon Hill	Bodmin	Also augments coverage in Plymouth
10903	Fenham	Newcastle	
10211	Fenton	Stoke	
10202	Kidderminster	Kidderminster	Sutton Coldfield Filler
10601	Kilvey Hill	Swansea	
13000	Limavady	Limavady	
10207	Malvern	Great Malvern	
11101	Nottingham UHF	W Nottingham	Waltham Filler
13105	Plympton	Plymouth	
10103	Reigate	Reigate	
10307	Storeton	Birkenhead	Winter Hill Filler
10403	Sheffield	Sheffield	
10306	Saddleworth	Saddleworth	Winter Hill Filler
10805	Whitehawk Hill	Brighton	

Table A3-1 : 20 DTT Stations studied in Group B

The predicted coverage of the stations using the suggested 'practical solutions' is summarised in Table A3-2.

Station	ch	Net	Gross	Station	ch	Net	Gross
Beecroft Hill	56	37,347	66,047	Kilvey Hill	30	72,722	116,053
Bromsgrove	29	28,700	82,998	Limavady	48	35,989	54,814
Brierley Hill	29	77,992	153,139	Malvern	51	50,314	79,269
Bristol KW	30	15,541	144,137	Nottingham UHF	50	84,957	238,296
Bristol Ilch Cres	30	26,739	89,464	Plympton	39	37,726	58,160
Caldbeck	56	91,254	118,328	Reigate	51	73,945	117,828
Caradon Hill - Bodmin	30	28,511	41,187	Storeton	30	58,271	117,436
Caradon Hill - Plymouth	30	65, 959	93,612	Sheffield	55	123,759	192,880
Fenham	30	141,437	335,630	Saddleworth	30	14,821	20,540
Fenton	29	122,959	151,409	Whitehawk Hill	54	97,878	151,137
Kidderminster	51	21,858	35,233				

Table A3-2: Predicted coverage (households) of Geographically Interleaved channels based on 'practical solutions' : DVB-T QPSK 2/3

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Beecroft Hill 10415

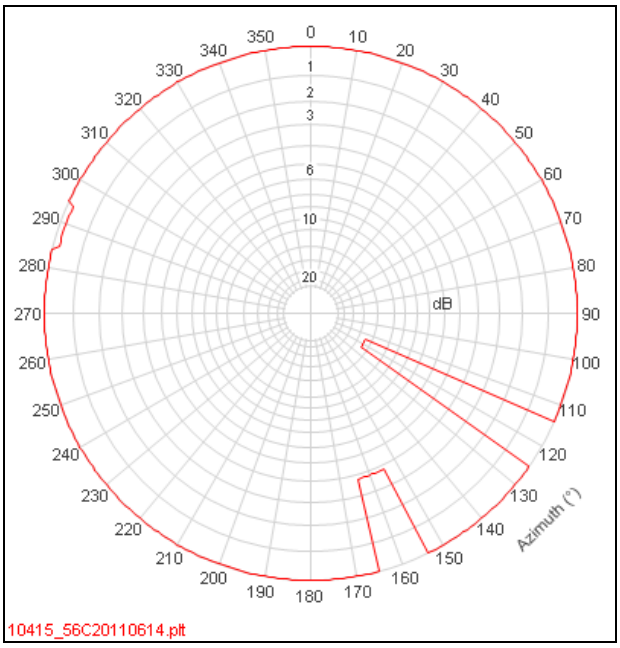

Figure A3-1: Antenna Template : Beecroft Hill channel 56

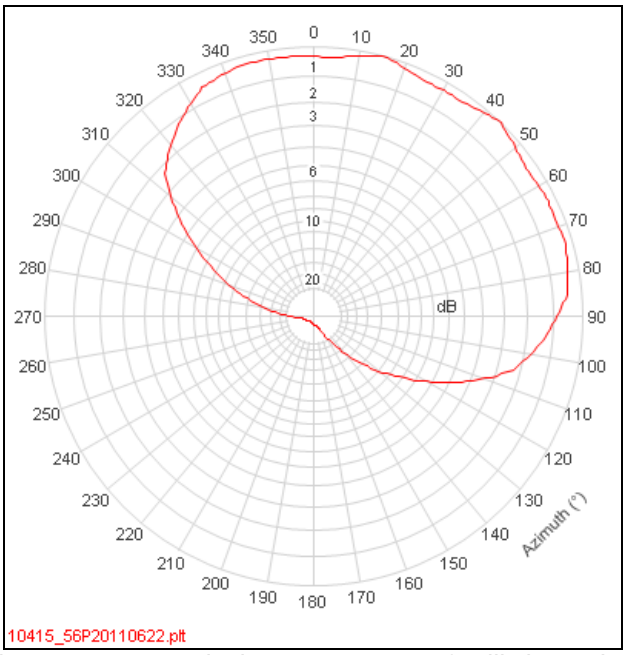

Figure A3-2 : Practical Pattern : Beecroft Hill channel 56

ERP	0.02 kW	Antenna Height	43 metres

Table A3-1 : Beecroft Hill ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	37,347	66,047
90%	28,850	42,156

Table A3-2 : Beecroft Hill ch56 : Population served based on antenna

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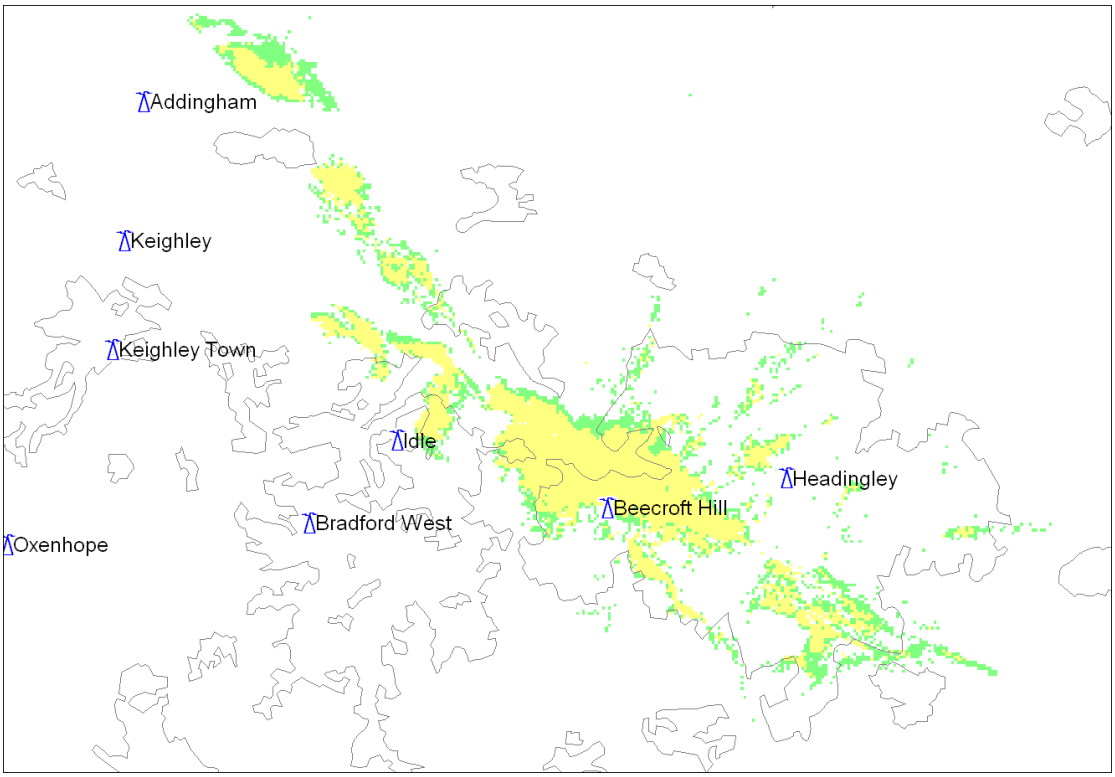

Figure A3-3: Beecroft Hill: ch 56: 0.02 kW ERP: Practical antenna: 43m a.g.l

Practical Antenna:
The requirement is to augment the coverage of Emley Moor in Leeds.
.
There are restrictions towards Waltham (120° & 160°). There is no existing relationship between the main DTT channels at Beecroft Hill and those at Waltham.

Crossed log-periodics would provide a suitable pattern. The GI channel could also use the main DTT antenna.

The suggested arrangement at an ERP of 20 watts meets the restrictions of the template.

The proposed channel, channel 56, is co-channel with the GI channel proposed for Emley Moor. The predicted coverage shown in figure B1-3 and in table B1-2 does not have the stations working as part of an SFN. As a consequence there will be some impact to the coverage of Emley Moor. This could be avoided and coverage could be enhanced by operating the two stations as part of a SFN.

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Bromsgrove 10206

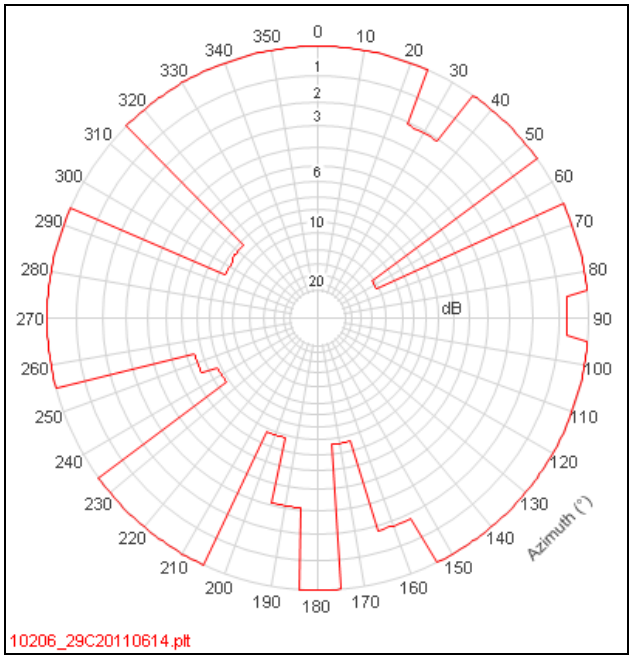

Figure A3-1: Antenna Template : 1 kW : Bromsgrove channel 29

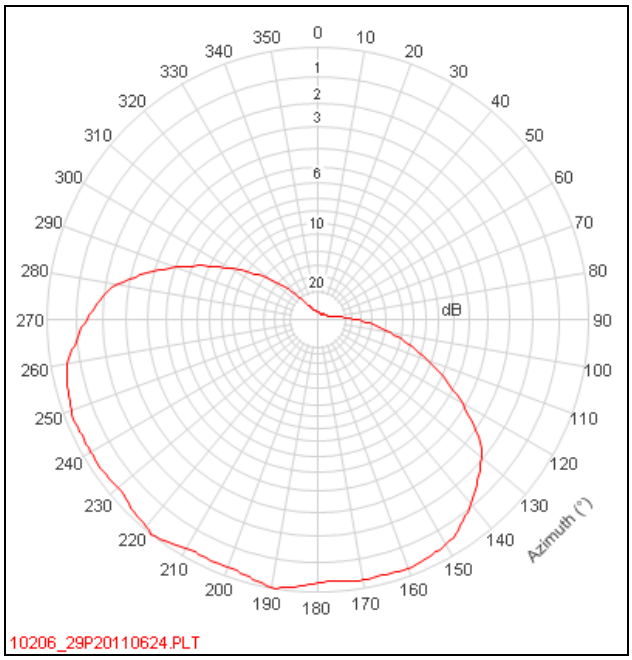

Figure A3-2 : Practical Pattern : Bromsgrove channel 29

ERP	0.04 kW	Antenna Height	43 metres

Table A3-1 : Bromsgrove ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	28,700	82,998
90%	26,093	53,905

Table A3-2 : Bromsgrove ch29 : Population served based on antenna

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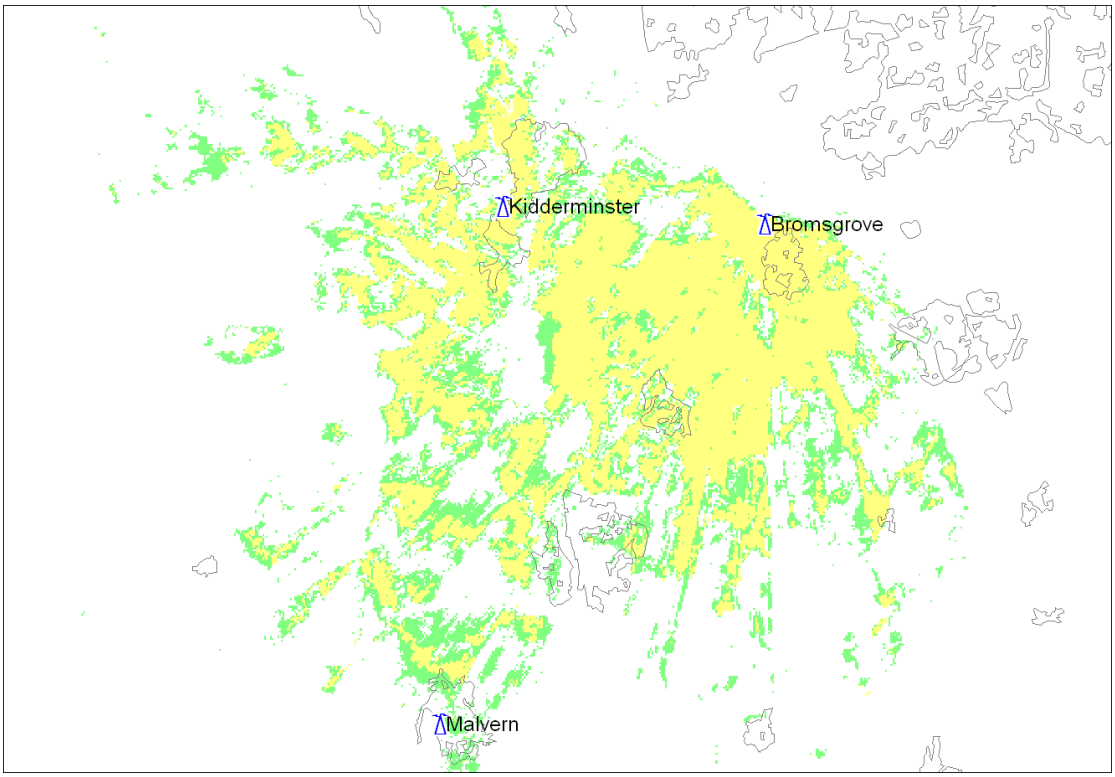

Figure A3-3: Bromsgrove: ch29: 0.04 kW ERP: Practical antenna: 43m a.g.l

Practical Antenna:
The requirement is to serve Bromsgrove.

There are restrictions towards Waltham (30°, 60° & 90°), Cirencester (160°-170°), Nailsworth (190°), Siston (200°), Pennorth (240°-250°), Bala (300°) and Cerrigydrudion (310°). The regional service from Ridge Hill West is also on channel 29 and serves to the south-east of Ridge Hill; it should not be impacted by this proposal.

There is an existing relationship between low-powered DTT at Bromsgrove (25w ERP) and Waltham (8kW).

There is a relationship with all the other stations on channels 23 and 26. Our proposal for channel 29 will have no worse an effect than already exists on the other channels.

A suitable antenna solution would be 90° crossed log-periodics at 44m with an ERP of 40 Watts.

An alternative solution would be to use the existing PSB antenna at this ERP.

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Brierley Hill 10203

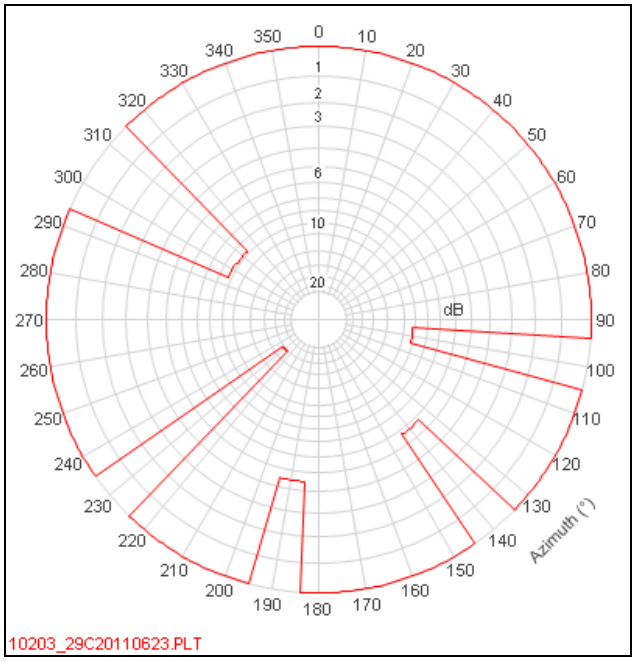

Figure A3-1: Antenna Template : 1 kW : Brierley Hill channel 29

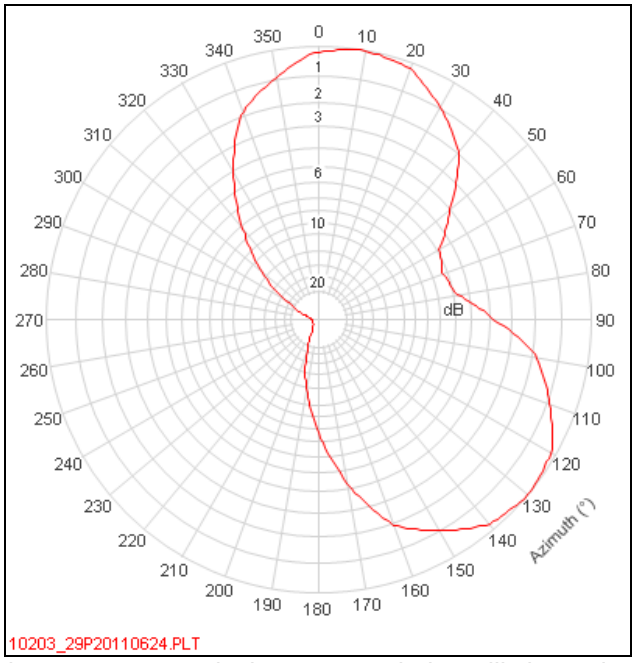

Figure A3-3 : Practical Pattern : Brierley Hill channel 29

ERP	0.2 kW	Antenna Height	44 metres

Table A3-1 : Brierley Hill ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	77,992	153,139
90%	75,416	131,077

Table A3-2 : Brierley Hill ch29 : Population served based on antenna

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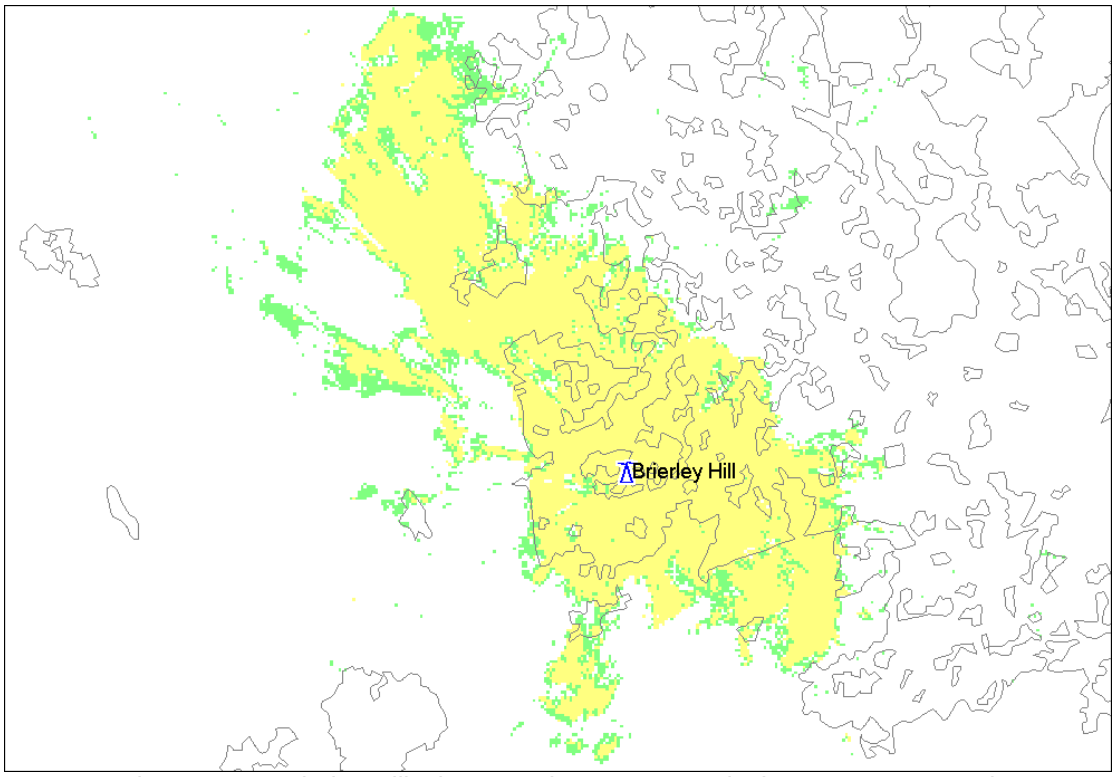

Figure A3-3: Brierley Hill: ch 29: 0.2 kW ERP: Practical antenna: 44m a.g.l

Practical Antenna:
The requirement is to serve Dudley.

There are restrictions towards Waltham (100 & 140°), Siston (190°), Pennorth (230°), Bala and Cerrigydrudion (300°) and Pwll Glas (310°).

There is an existing relationship with Waltham on channel 57. As the main multiplexes at Brierley Hill operate at 2 kW ERP, this will have a greater effect on Waltham COM6 than the proposed GI service at 200 Watts will have on Waltham COM4.

A solution based on 120° crossed log-periodics meets all the other restrictions of the template.

The regional service from Ridge Hill West is also on channel 29.The regional DPSA has not yet been agreed but it serves to the south-east of Ridge Hill and should not be impacted by this proposal.

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Bristol : Kings Weston 11007

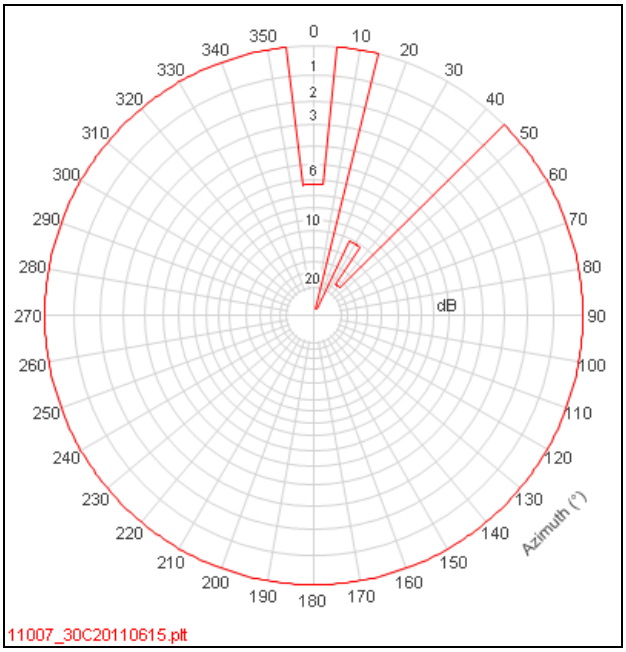

Figure A3-1: Antenna Template : 1 kW : Bristol Kings Weston channel 30

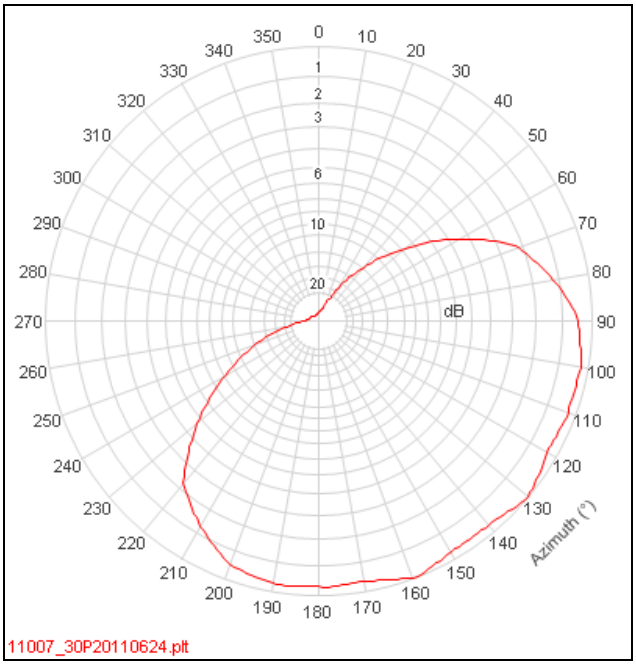

Figure A3-2 : Practical Pattern : Bristol Kings Weston channel 30

ERP	0.02 kW	Antenna Height	43 metres

Table A3-1 : Bristol Kings Weston ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	15,541	144,137
90%	15,239	102,417

Table A3-2 : Bristol Kings Weston ch30 : Population served based on antenna

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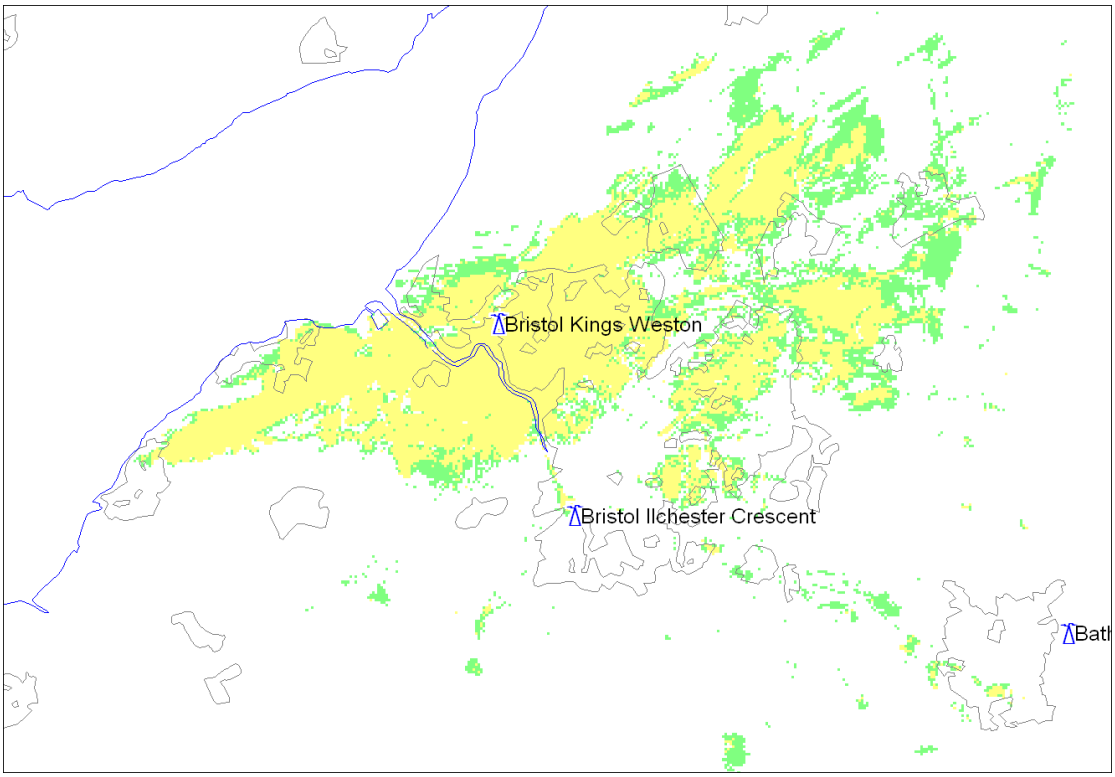

Figure A3-3: Bristol Kings Weston ch30 : 0.02 kW ERP: Practical antenna: 43m a.g.l

Practical Antenna:
The requirement is to serve North Bristol.

There are restrictions towards The Wrekin (0° & 20-40°), Lark Stoke (20-40°) and Bromsgrove (20-30°).

To protect the service areas of these stations and to be compatible with the Cardiff GI service on channel 30 an antenna such as 90° crossed log-periodics would be required. The existing antennas at Bristol Kings Weston do not offer sufficient protection.

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Bristol Ilchester Crescent 11008

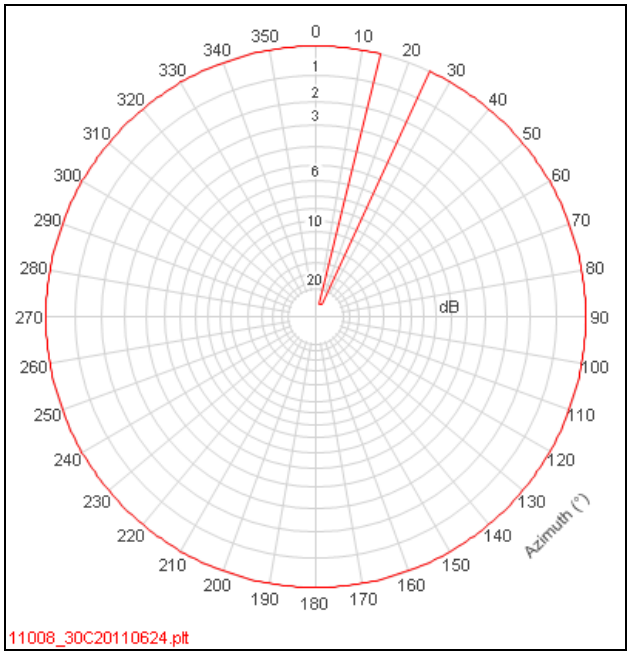

Figure A3-1: Antenna Template : 1 kW : Bristol Ilchester Crescent channel 30

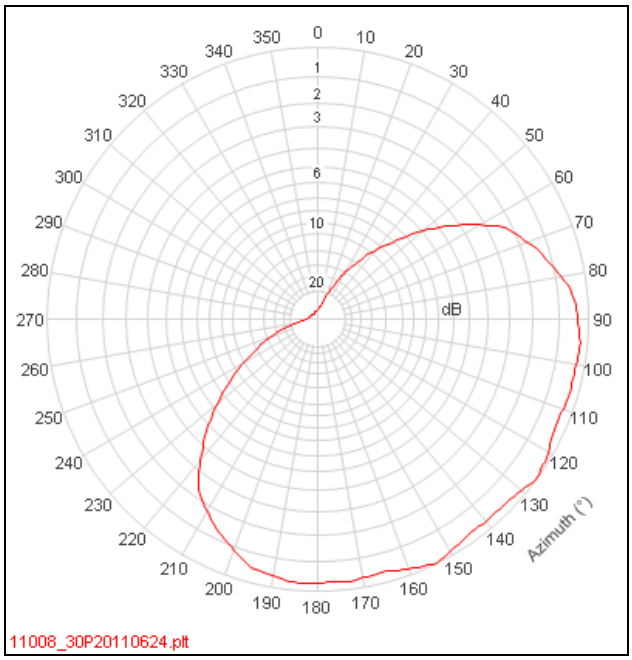

Figure A3-2 : Practical Pattern : Bristol Ilchester Crescent channel 30

ERP	0.02 kW	Antenna Height	42 metres

Table A3-1 : Bristol Ilchester Crescent ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	26,739	89,464
90%	24,397	66,187

Table A3-2 : Bristol Ilchester Crescent ch30 : Population served based on antenna

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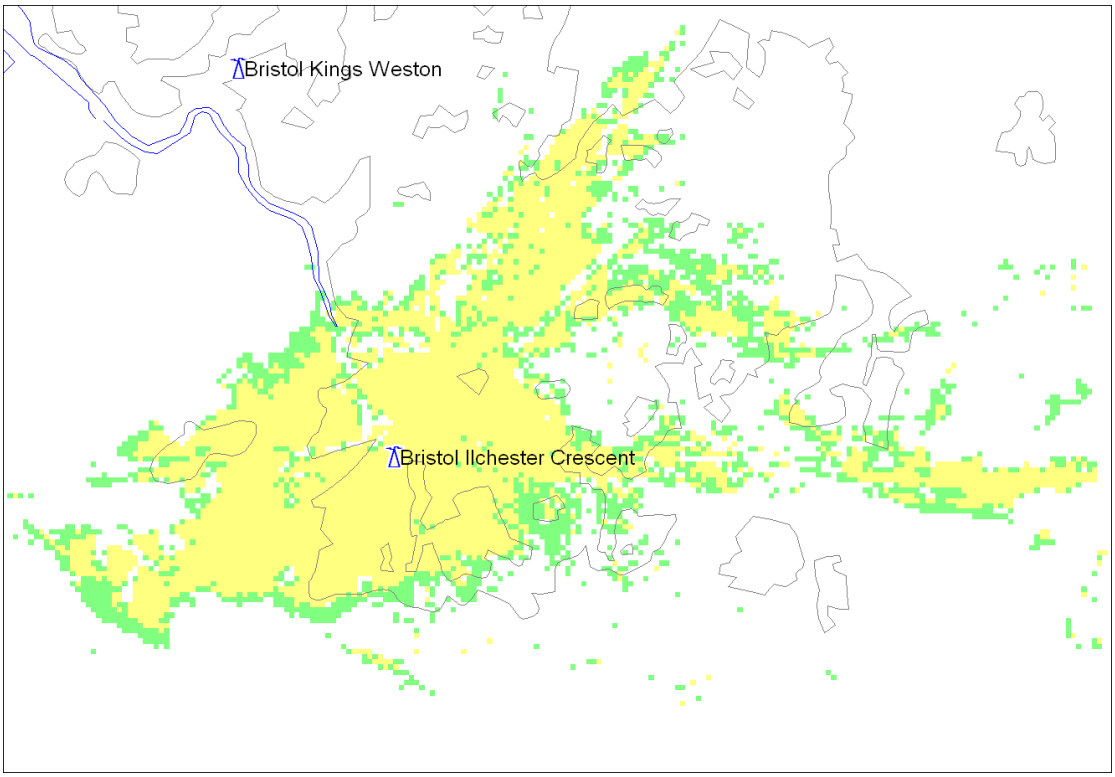

Figure A3-3: Bristol Ilchester Crescent ch30 : 0.02kW ERP: Practical antenna: 42m a.g.l

Practical Antenna:
The requirement is to serve west Bristol. There is a restriction towards Bromsgrove (20°).

Our suggested antenna meets the template restriction. Although we meet the template, it must be remembered that other GI services use this channel including Bristol Kings Weston.

A suitable antenna would be 90° crossed log-periodics at 42m.

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Caldbeck 13700

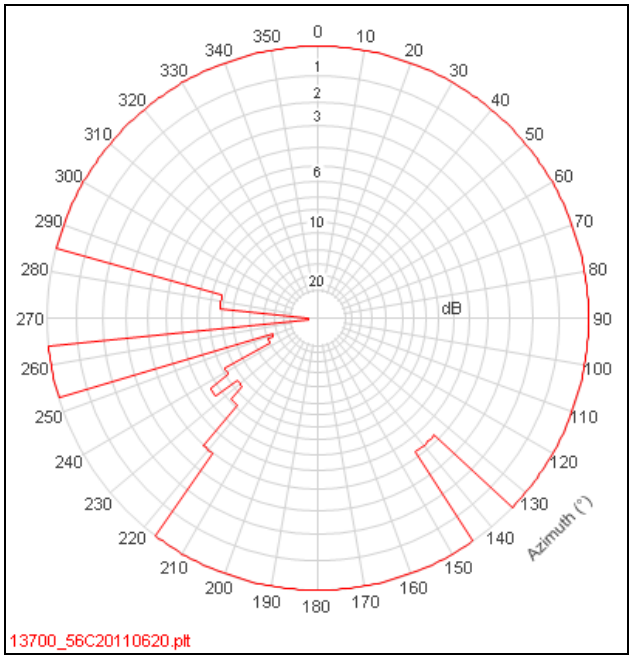

Figure A3-1: Antenna Template : 10kW : Caldbeck channel 56

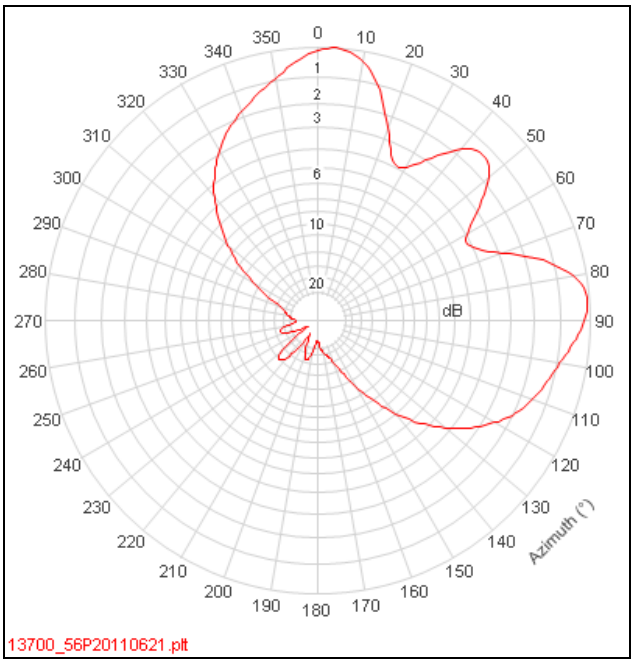

Figure A3-2 : Practical Pattern : Caldbeck channel 56

ERP	5 kW	Antenna Height	165 metres

Table A3-1 : Caldbeck ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	91,254	118,328
90%	87,244	112,074

Table A3-2 : Caldbeck ch56 : Population served based on antenna

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Figure A3-3: Caldbeck ch56 : 5kW ERP: Practical antenna: 165m a.g.l

Practical Antenna:
The requirement is to serve Carlisle.

There are restrictions towards Millthrop (140°), Whitehead (270°) and Bellair (280°). There is also a restriction towards the Irish Republic over the arc 218°-252°.

Though channel 56 is out of the present DTT aerial group viewers in the area should have suitable aerials as prior to DSO used at Caldbeck for C5 at 10 kW ERP. Also there was an existing relationship between Caldbeck on channel 56 and the three stations mentioned when all operated as analogue.

A suitable antenna would be 90° UHF panels.

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Caradon Hill 13100

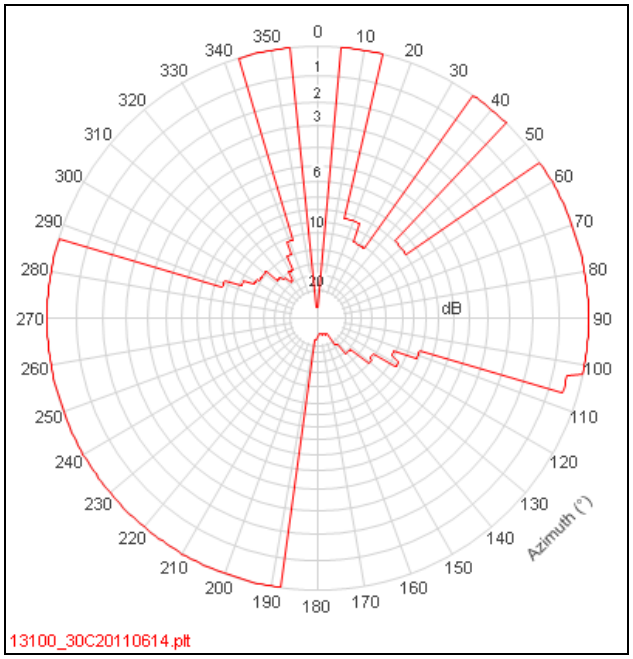

Figure A3-1: Antenna Template : 10 kW : Caradon Hill channel 30

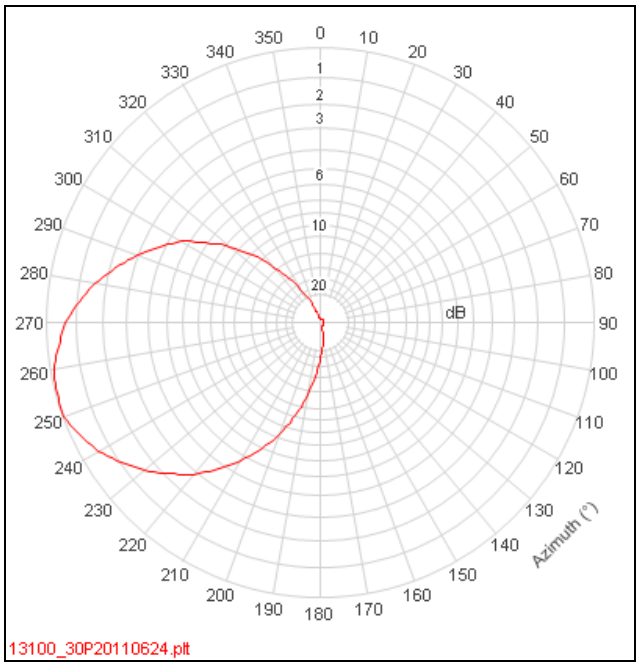

Figure A3-2 : Practical Pattern : Caradon Hill channel 30 - Bodmin

ERP	2 kW	Antenna Height	182 metres

Table A3-1 : Caradon Hill ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	28,511	41,187
90%	20,770	26,690

Table A3-2 : Caradon Hill ch30 : Population served based on antenna

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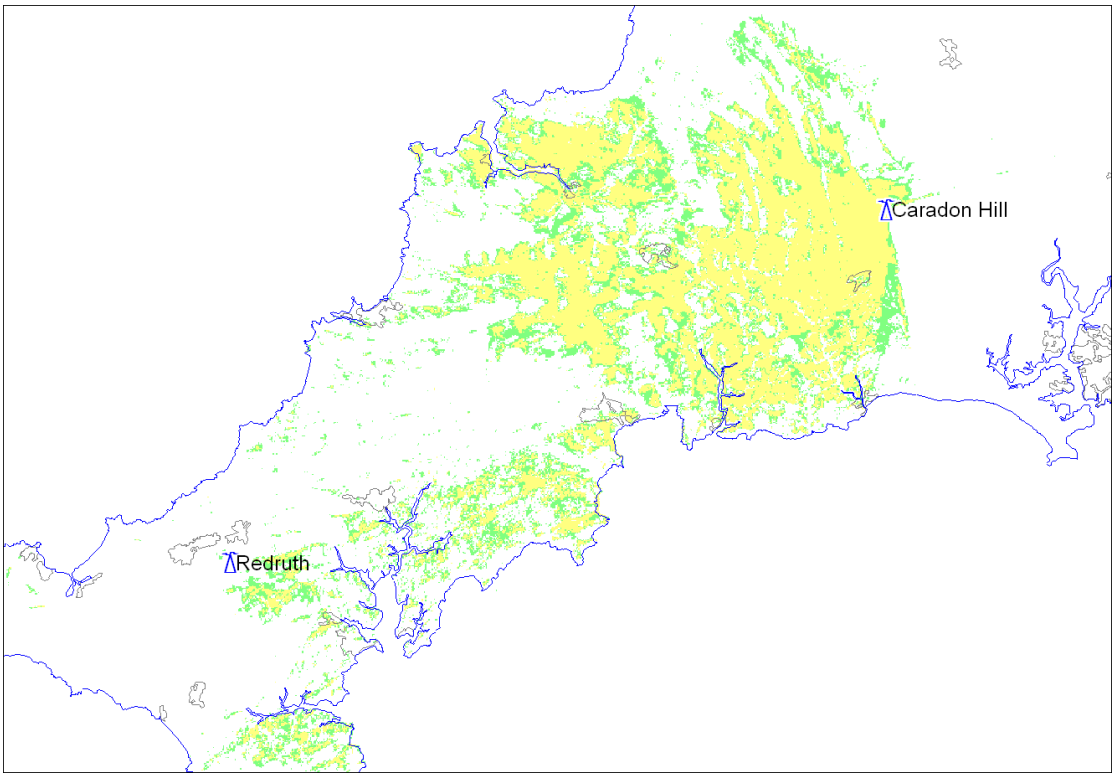

Figure A3-3: Caradon Hill ch30 : 2kW ERP: Practical antenna - Bodmin: 182m a.g.l

Practical Antenna:
The requirement is to serve Bodmin and Plymouth.

There are restrictions towards Ferryside (0°), The Wrekin (20°-30° & 50°). There are also restrictions towards Ireland and France.

There is a relationship with Ferryside on channels 21, 24 and 27. It is these channels, used by the main commercial multiplexes, which will limit core coverage of Ferryside.

The main restrictions are towards Ireland and France. A possible solution is to use 50° crossed log-periodics orientated on a bearing of 255° ETN for the service towards Bodmin and bayed logs on 90° for Plymouth. Both of these antennas would meet all restrictions when used at an ERP of 2kW.

Despite using an antenna height in excess of the usual half main antenna height, coverage of both Bodmin and Plymouth is still patchy.

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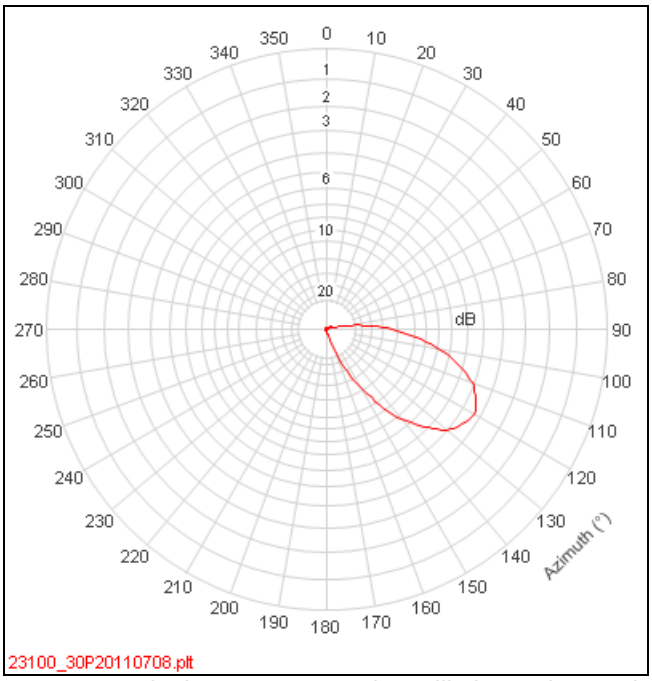

Figure A3-2 : Practical Pattern : Caradon Hill channel 30 - Plymouth

ERP	2 kW	Antenna Height	182 metres

Table A3-1 : Caradon Hill ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	65,959	93,612
90%	48,975	68,121

Table A3-2 : Caradon Hill ch30 : Population served based on antenna

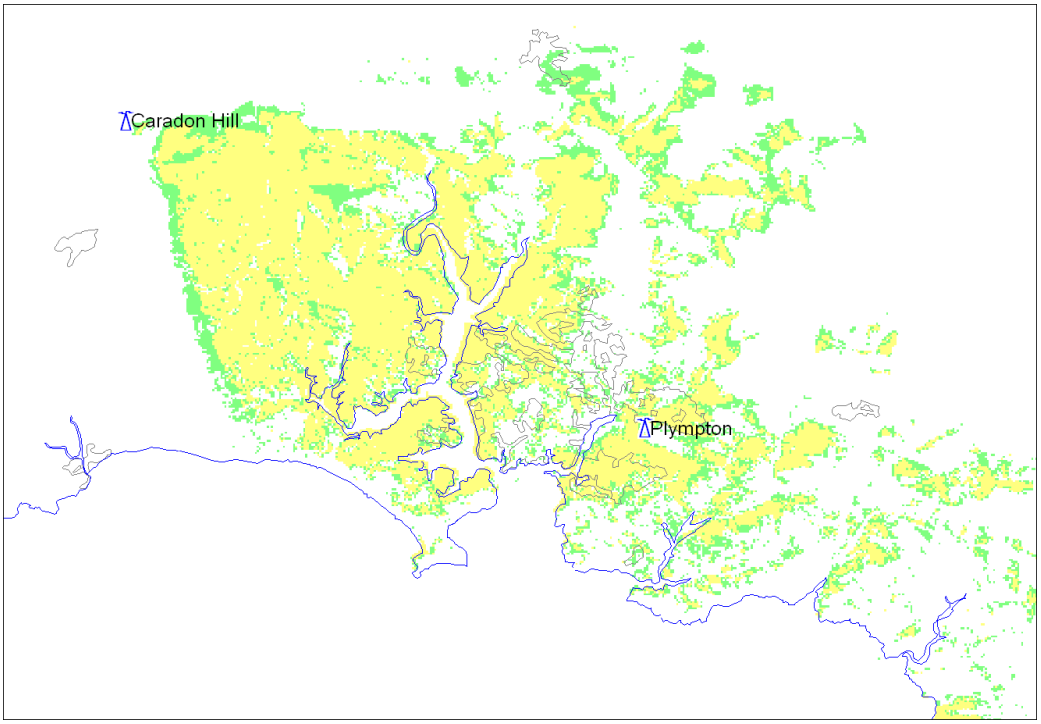

Figure A3-3: Caradon Hill ch30 : 2kW ERP: Practical antenna - Plymouth: 182m a.g.l

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Fenham 10903

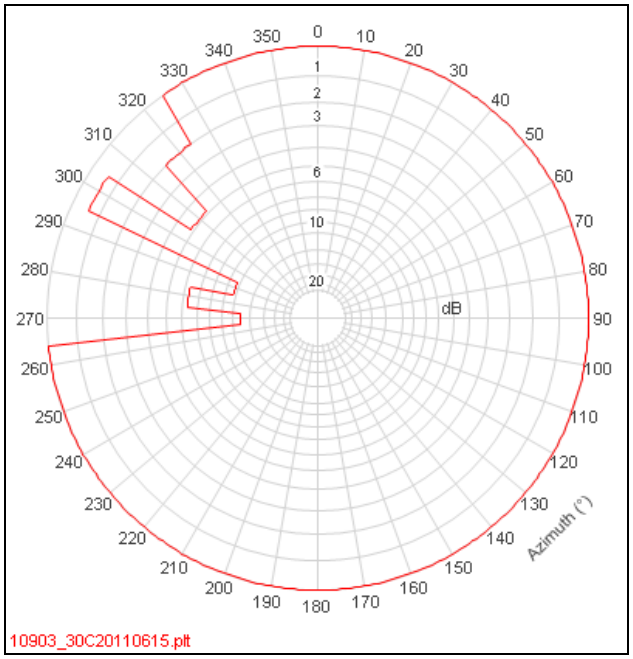

Figure A3-1: Antenna Template : 1 kW : Fenham channel 30

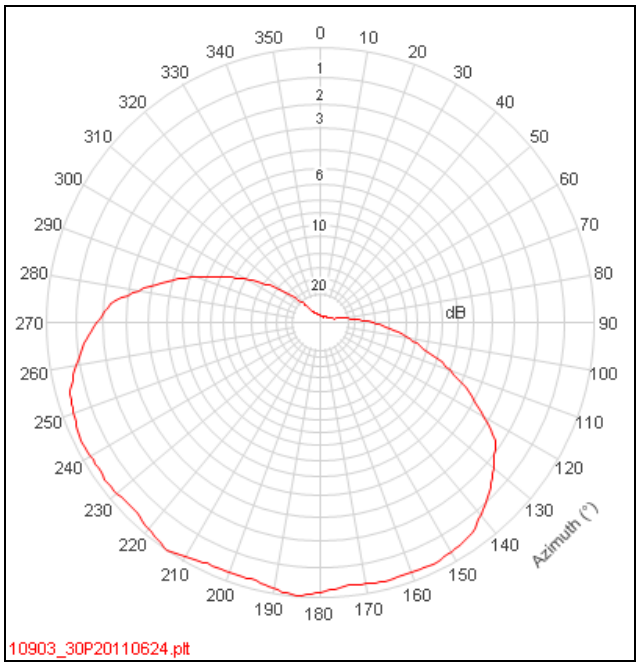

Figure A3-2 : Practical Pattern : Fenham channel 30

ERP	0.04 kW	Antenna Height	44 metres

Table B8-1 : Fenham ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	141,437	335,630
90%	135,144	265,032

Table A3-2 : Fenham ch30: Population served based on antenna

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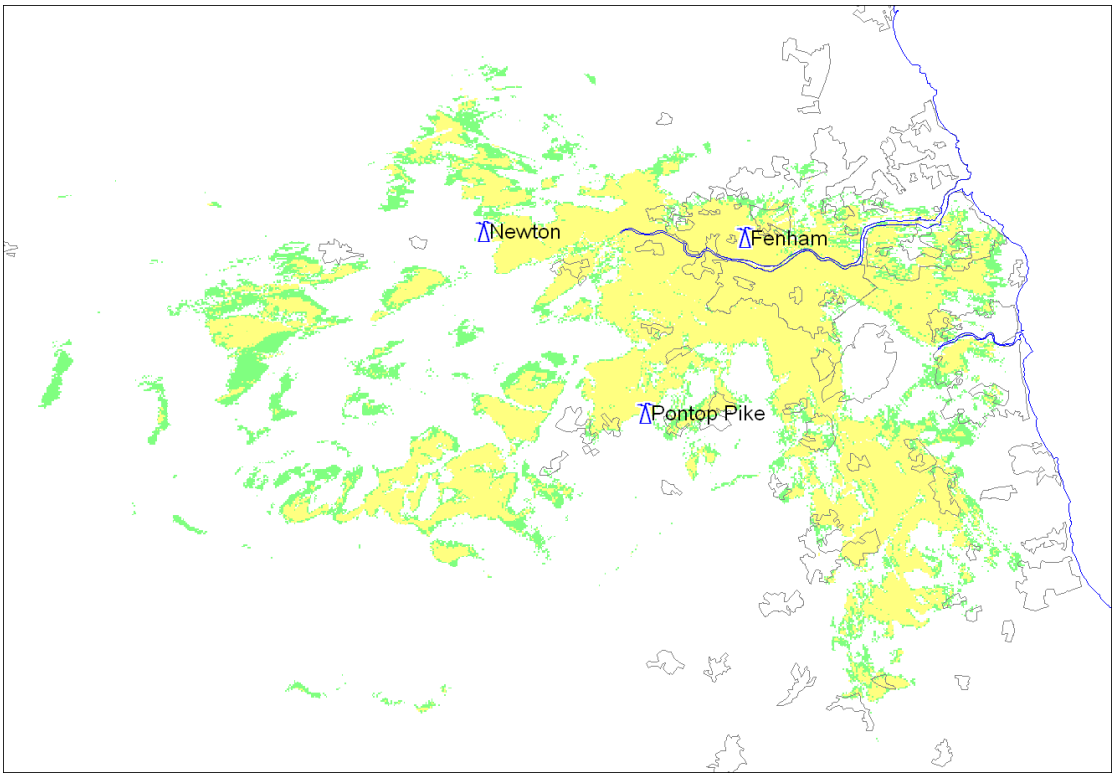

Figure A3-3: Fenham ch30: 0.04 kW ERP: Practical antenna: 44m a.g.l

Practical Antenna:
The requirement is to serve Newcastle-upon-Tyne.

There are restrictions towards Caldbeck (270-320°).

Five of the main multiplexes at Fenham are co-channel with either Caldbeck Scottish or Caldbeck English services. It is this relationship that would be expected to limit core coverage from Caldbeck rather than the lower power GI service on channel 30.

A suitable solution would be to use the 90° crossed log-periodics with an ERP of 40 watts

An alternative solution would be to use the main DTT antenna.

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Fenton 10211

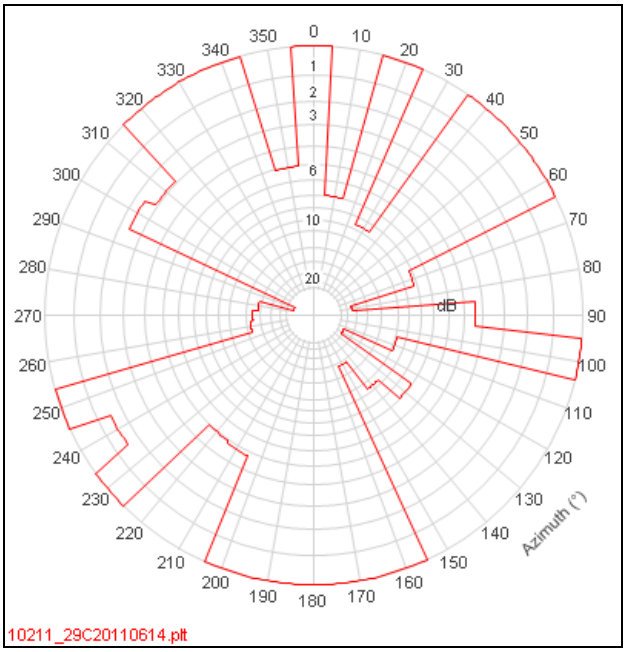

Figure A3-1: Antenna Template : 1 kW : Fenton channel 29

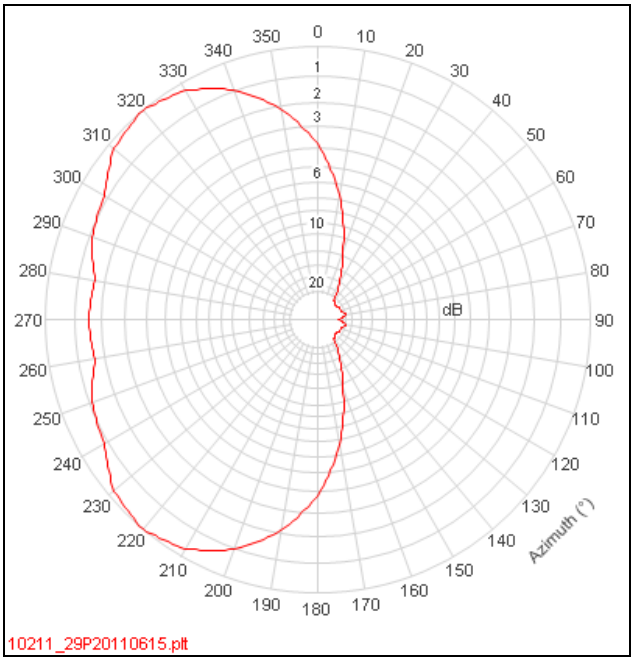

Figure A3-2 : Practical Pattern : Fenton channel 29

ERP	0.05 kW	Antenna Height	45 metres

Table A3-1 : Fenton ch29 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	122,959	151,409
90%	120,659	141,880

Table A3-2 : Fenton ch29 : Population served based on antenna

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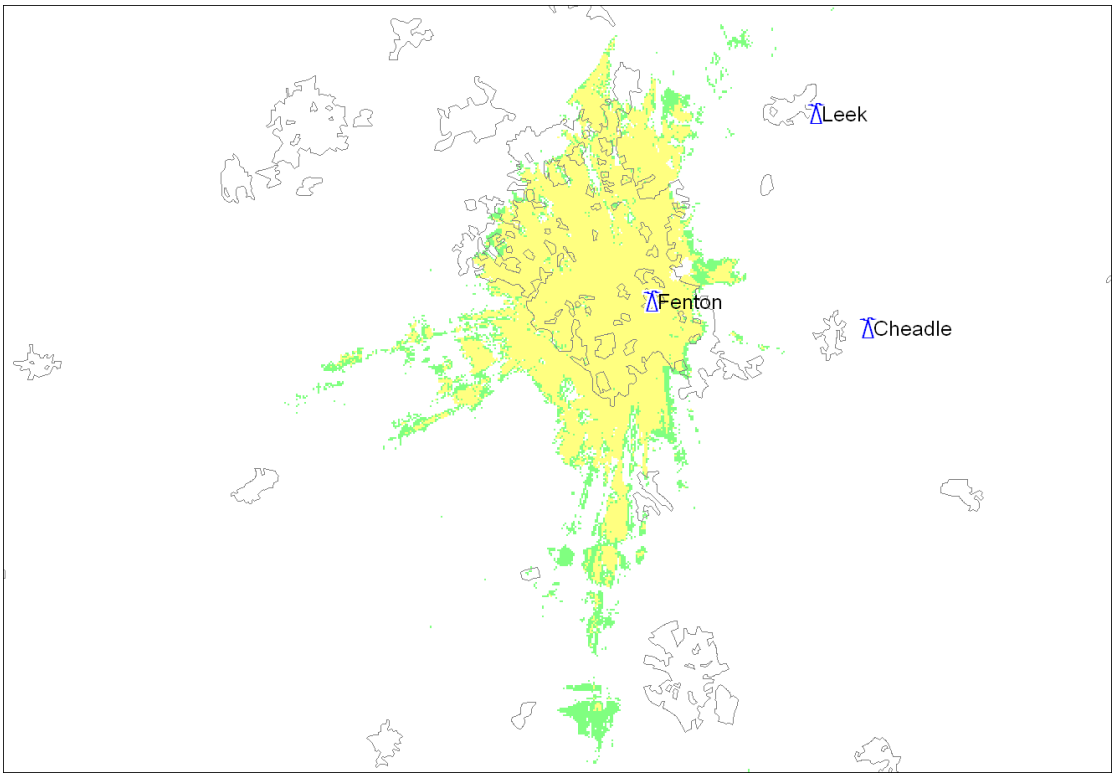

Figure A3-3: Fenton ch29 : 0.05 kW ERP: Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve Stoke-on-Trent.

There are restrictions towards Ladder Hill (10°), Waltham (30°, 70°-90°, 110°-150°), Kilvey Hill (210°), Pennorth (220°), Llangurig UHF (240°), Bala (260°-270°), Cerrigydrudion (270°), Llanddulas (290°), Storeton (300°), Foxdale (310°) and Haslingden (350°).

There are existing relationships between the main multiplexes at Fenton and those at Kilvey Hill and Storeton. The COM multiplexes at Fenton are on the same channels as the COM multiplexes at Kilvey Hill and the PSB multiplexes at Storeton.

There is no relationship with Llanddulas, Bala or Cerrigydrudion and as these are in the direction of the primary target area it is proposed to limit the max ERP to 50 Watts to protect these stations.

A suitable antenna solution could be 100° crossed log-periodics on 270°. It should be noted that this is a busy site and it may no be possible to provide suitable aperture for a new antenna.

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Kidderminster 10202

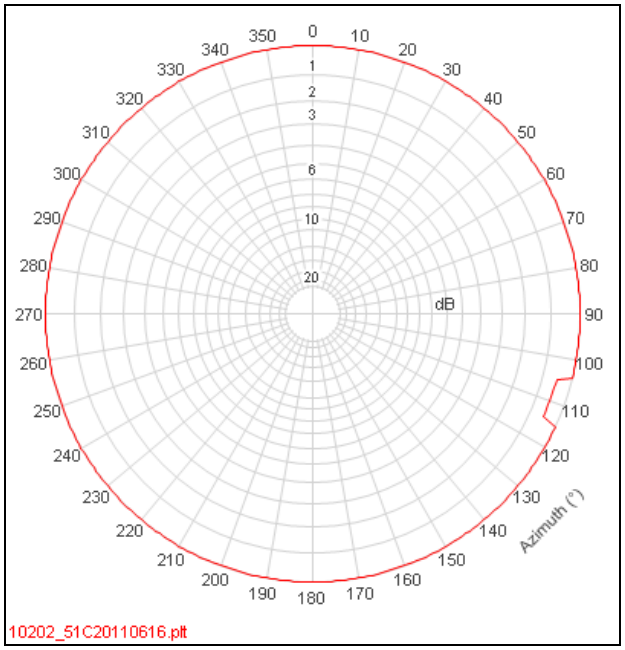

Figure A3-1: Antenna Template : 1kW : Kidderminster channel 51

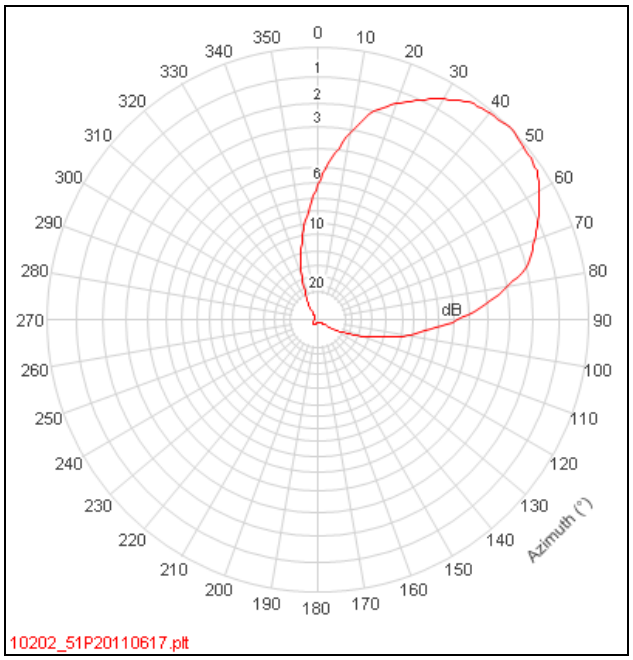

Figure A3-2 : Practical Pattern : Kidderminster channel 51

ERP	0.04 kW	Antenna Height	45 metres

Table A3-1 : Kidderminster ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	21,858	35,233
90%	19,636	28,160

Table A3-2 : Kidderminster ch51 : Population served based on antenna

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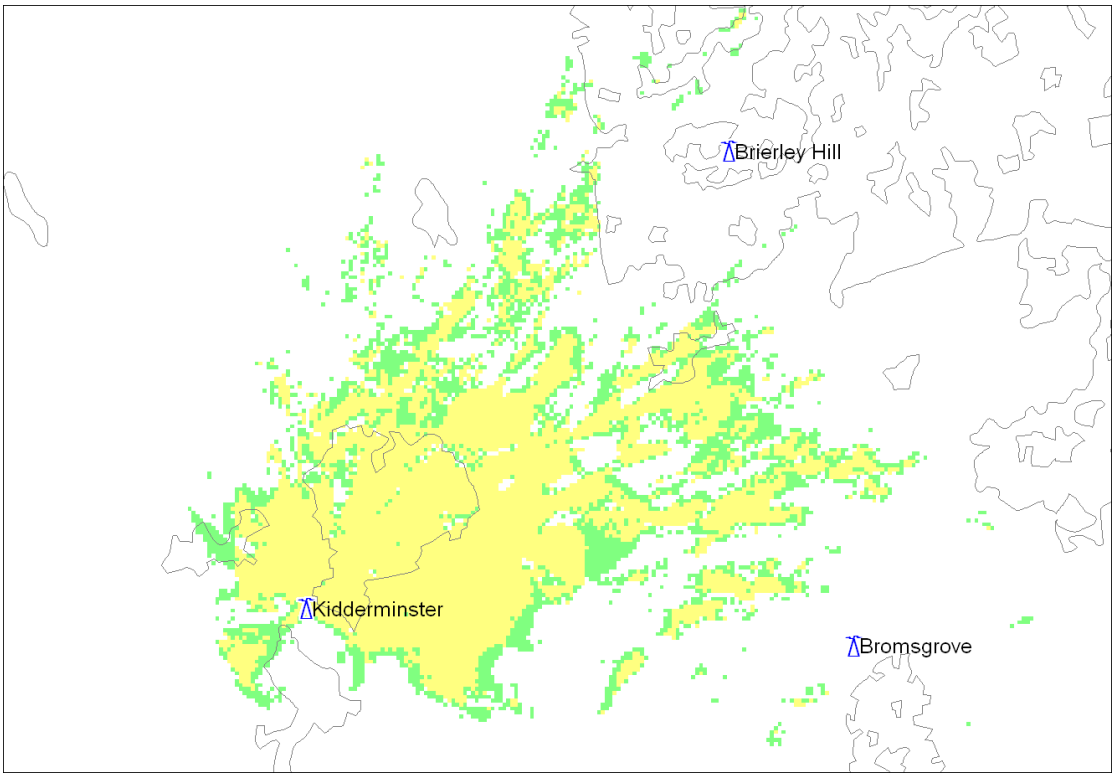

Figure A3-3: Kidderminster ch51 : 0.04kW ERP: Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve Kidderminster.

There is a small restriction towards Sandy Heath (110°). Channel 51 is proposed at other GI stations including Sutton Coldfield.

A suitable antenna solution would be log-periodics on 45° at 40 Watts ERP. It should also be possible to use the main DTT antenna at this ERP.

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Kilvey Hill 10601

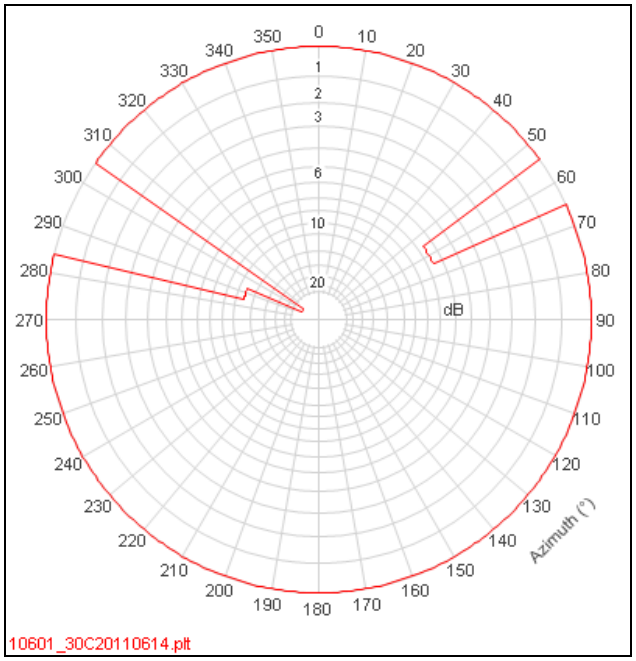

Figure A3-1: Antenna Template : 1 kW : Kilvey Hill channel 30

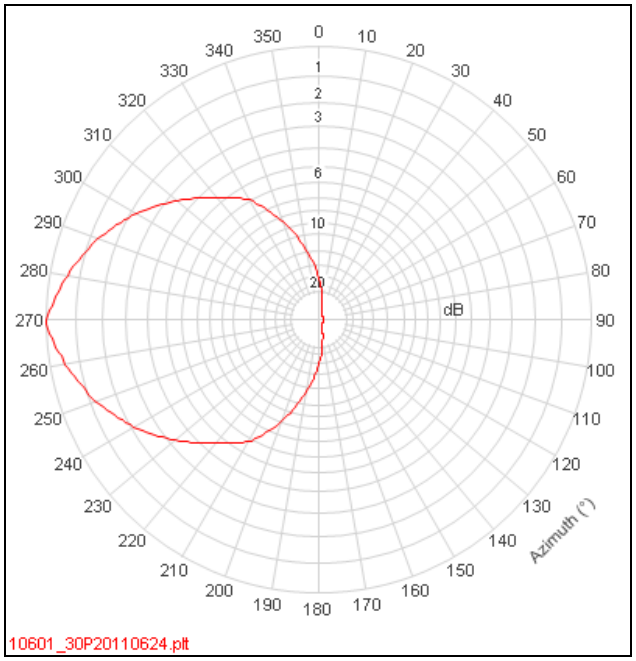

Figure A3-2 : Practical Pattern : Kilvey Hill channel 30

ERP	100 Watts	Antenna Height	45 metres

Table A3-1 : Kilvey Hill ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	72,722	116,053
90%	72,447	106979

Table A3-2 : Kilvey Hill ch30 : Population served based on antenna

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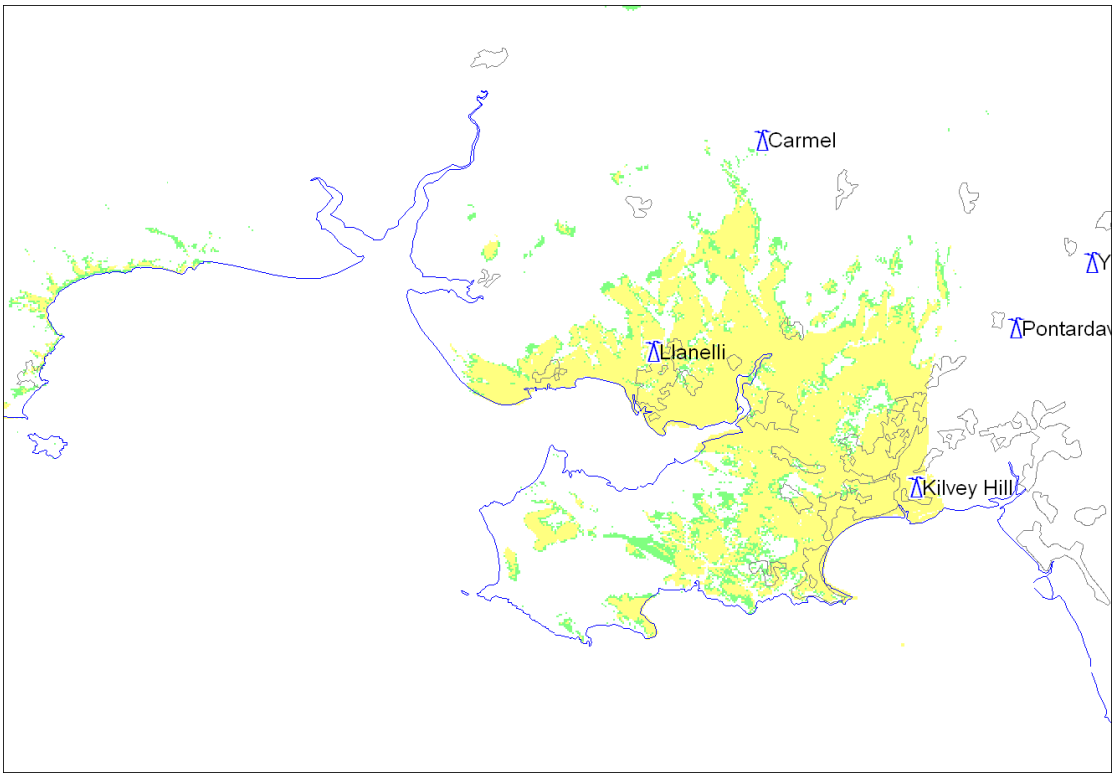

Figure A3-3: Kilvey Hill ch30 : 100 Watts ERP: Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve Swansea.

There are restrictions towards Bromsgrove (60°), and Ferryside (290°-300°).

Prior to DSO there was a relationship between the low-power DTT services at Kilvey Hill (100 Watts) and the analogue services at Ferryside on channels 21 and 31. A desk-top survey showed that, in the worst affected location, all antennas are HP directed towards Presely.

A suitable antenna solution could be 60° crossed logs-periodics.

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Limavady 13000

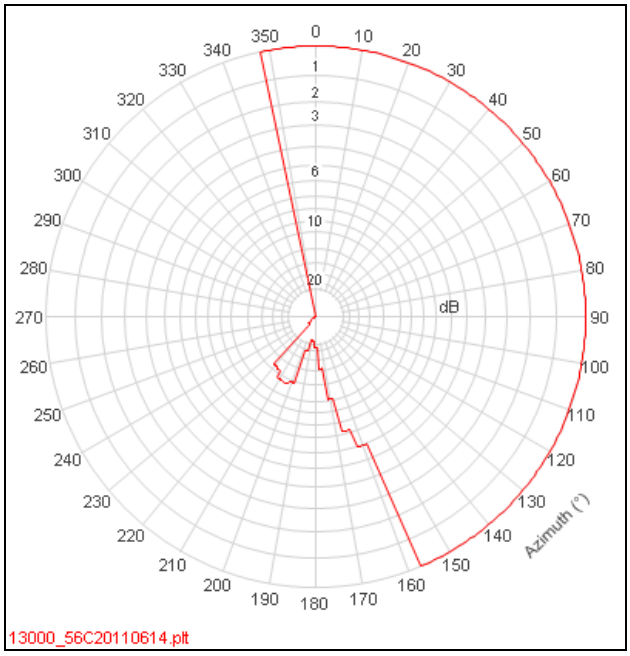

Figure A3-1: Antenna Template : 10 kW : Limavady channel 48

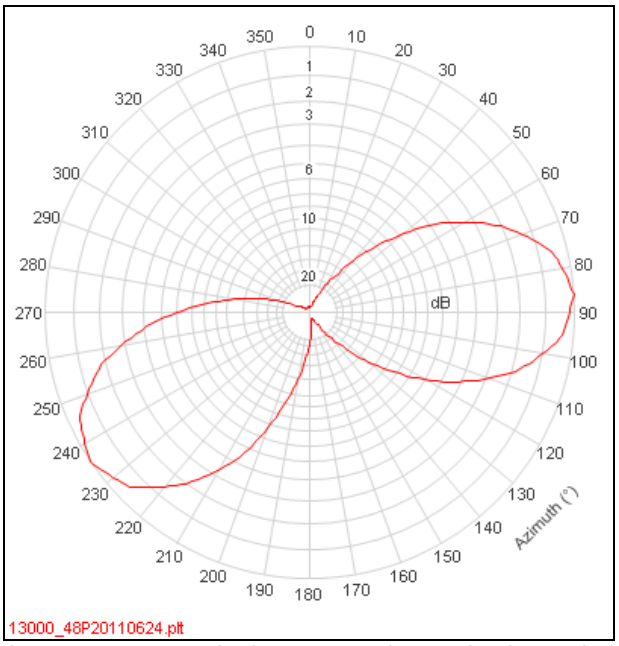

Figure A3-2 : Practical Pattern : Limavady channel 48

ERP	2 kW	Antenna Height	35 metres

Table A3-1 : Limavady ch48 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	35,989	54,814
90%	28,019	41,887

Table A3-2 : Limavady ch48: Population served based on antenna

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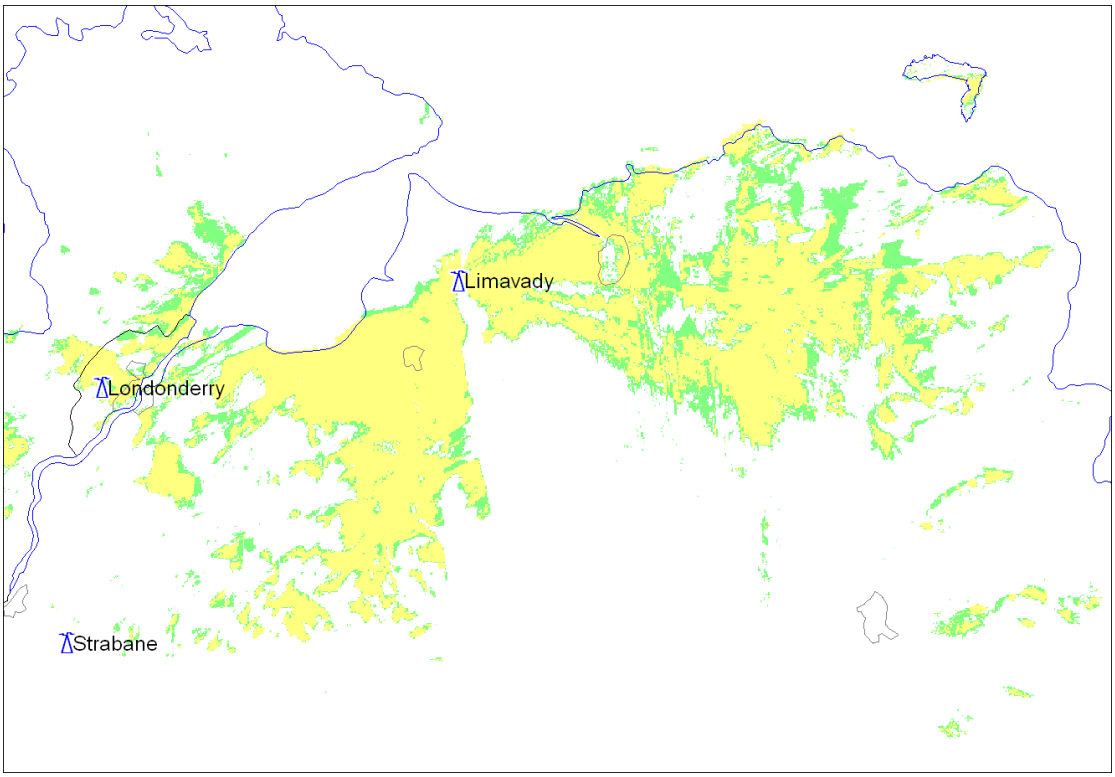

Figure A3-3: Limavady ch48: 2kW ERP: Practical antenna: 35m a.g.l

Practical Antenna:
The requirement is to serve Limavady and Coleraine

There are no UK restrictions. All the restrictions are to protect the Irish Republic. However, as part of the negotiations for the Northern Ireland Mini-Mux use of channel 48 at Limavady was agreed at 20 kW subject to a maximum power towards Letterkenny 235° – 290° of 2 kW. As the channel is no longer required for the Northern Ireland Mini-Mux it could be used for a GI channel.

A suitable solution would be a log-periodic aimed towards Limavady on 240° and another on 90° aimed towards Coleraine. Unfortunately this does not provide complete coverage of Coleraine. An alternative solution may be to use the facilities previously used by the Limavady and Coleraine RSL which used two sites, both on channel 48 to serve both Limavady and Coleraine.

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Malvern 10207

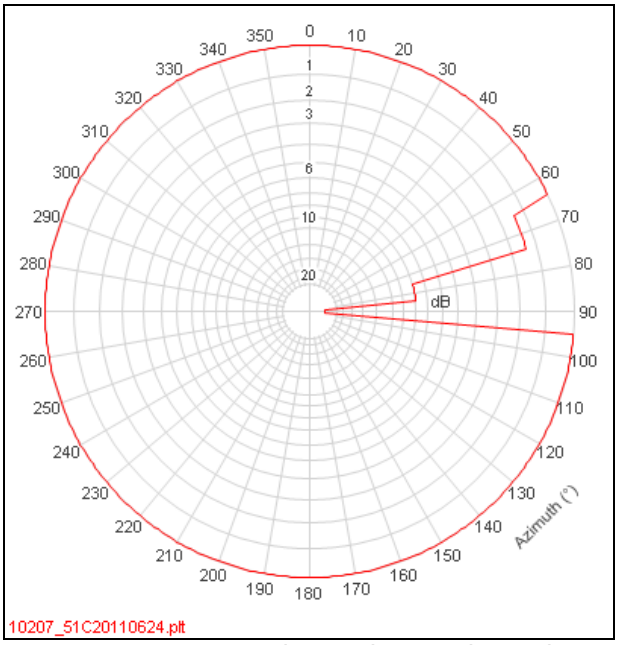

Figure A3-1: Antenna Template : 1 kW : Malvern channel 51

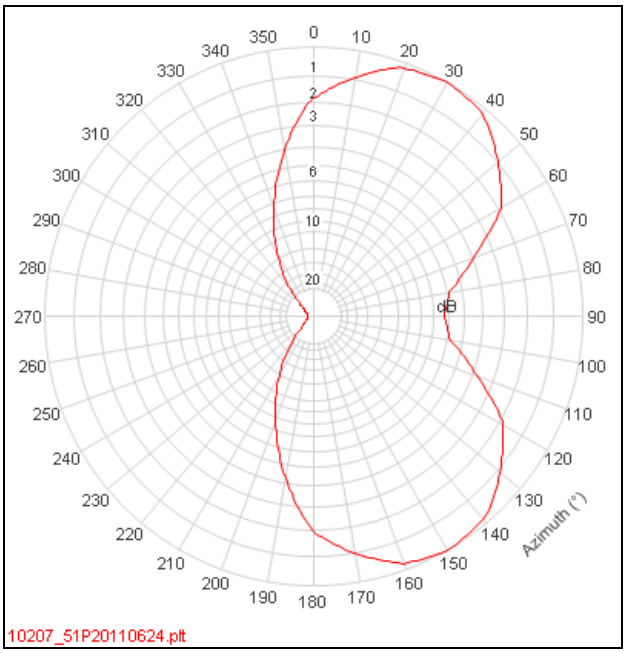

Figure A3-2 : Practical Pattern : Malvern channel 51

ERP	0.04 kW	Antenna Height	38 metres

Table A3-1 : Malvern channel 51: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	50,314	79,269
90%	44,262	58,518

Table A3-2 : Malvern channel 51 : Population served based on antenna

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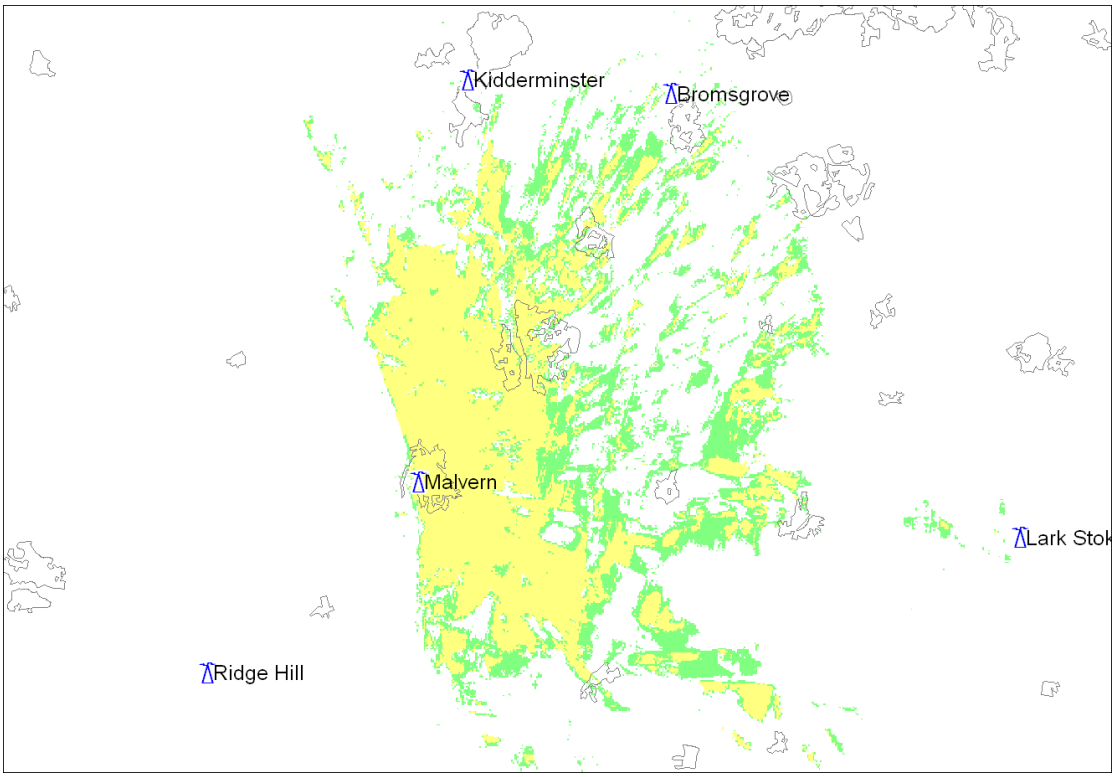

Figure A3-3: Malvern ch51: 0.04 kW ERP: Practical antenna: 38m a.g.l

Practical Antenna:
The requirement is to serve Malvern and the surrounding area.

There are restrictions towards Sandy Heath (70-90°). In the worst affected locations a desk-top survey showed all antennas HP on Oxford.

A suitable antenna solution could be 120°crossed log-periodics at 50w ERP to give some protection towards any Sandy Heath viewers.

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Nottingham 11101

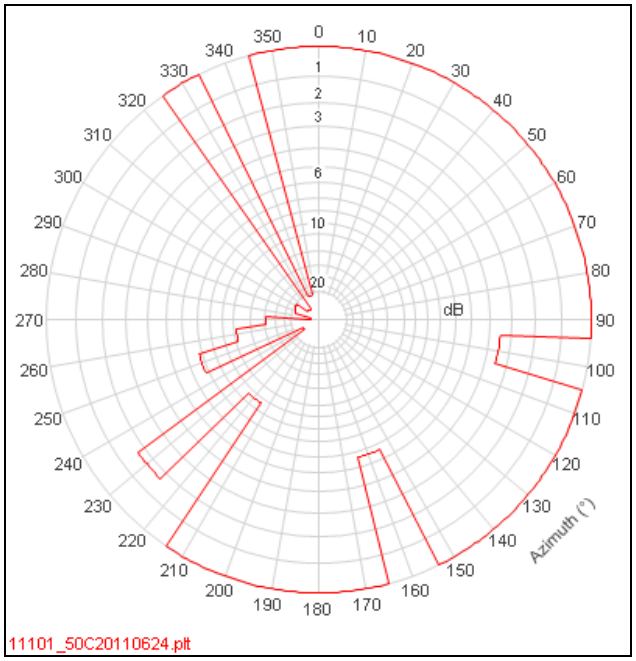

Figure A3-1: Antenna Template : 1 kW : Nottingham channel 50

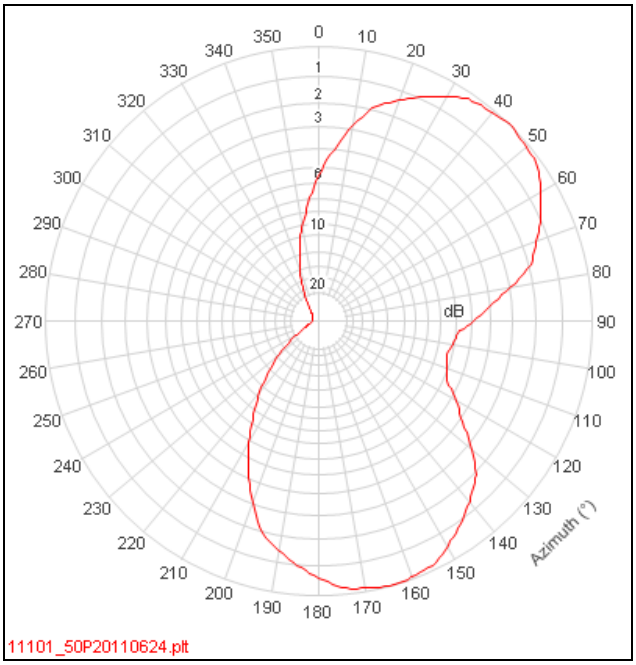

Figure A3-2 : Practical Pattern : Nottingham channel 50

ERP	0.1 kW	Antenna Height	41 metres

Table A3-1 Nottingham ch50 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	84,957	238,296
90%	79,916	189,263

Table A3-2 : Nottingham ch50: Population served based on antenna

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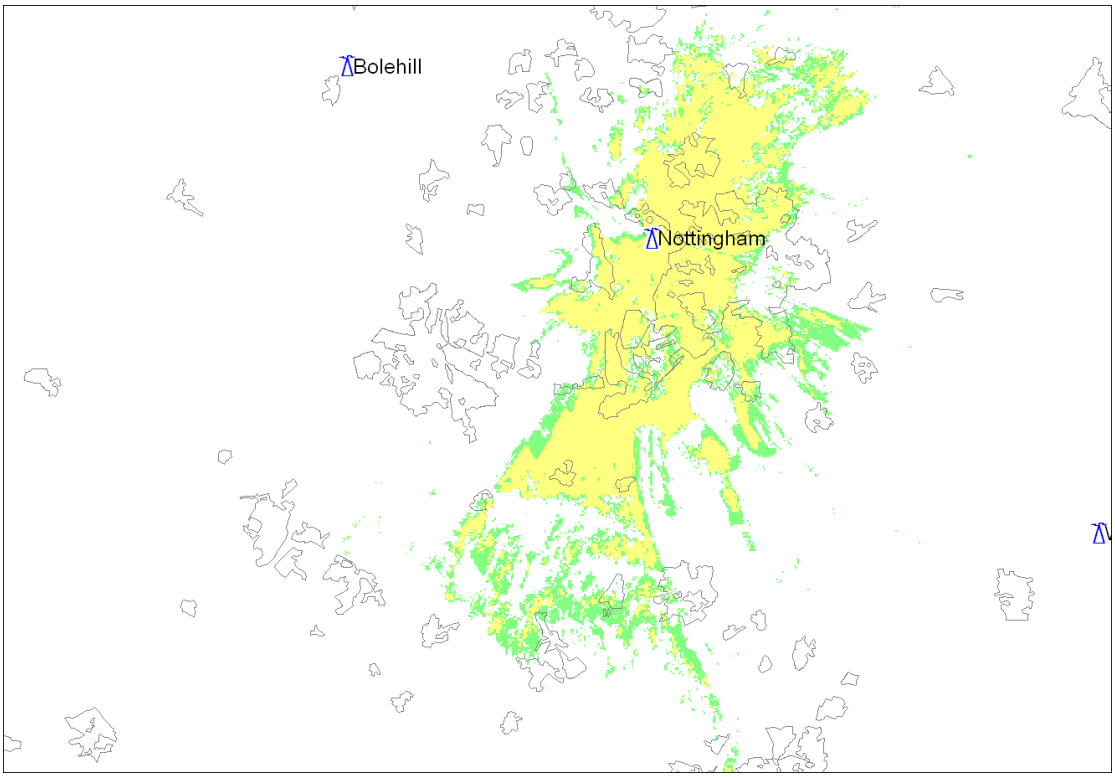

Figure A3-3: Nottingham ch50: 0.1 kW ERP: Practical antenna: 41m a.g.l

Practical Antenna:
The requirement is to serve west Nottingham.

There are restrictions towards Tacolneston (90°-100°), Dallington Park (160°), Monmouth (220°), Brierley Hill (220-230°), Rheola (230°), Clun (240°), Winter Hill (250°-280°), Belper (270°-320°) Dronfield and Oughtibridge (340°).

There are no relationships with the worst affected stations so to meet the required restriction the ERP will need to be limited to 200 Watts and the antenna pattern selected to provide the protection required.

A suitable antenna solution would be 120° crossed logs.

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Plympton 13105

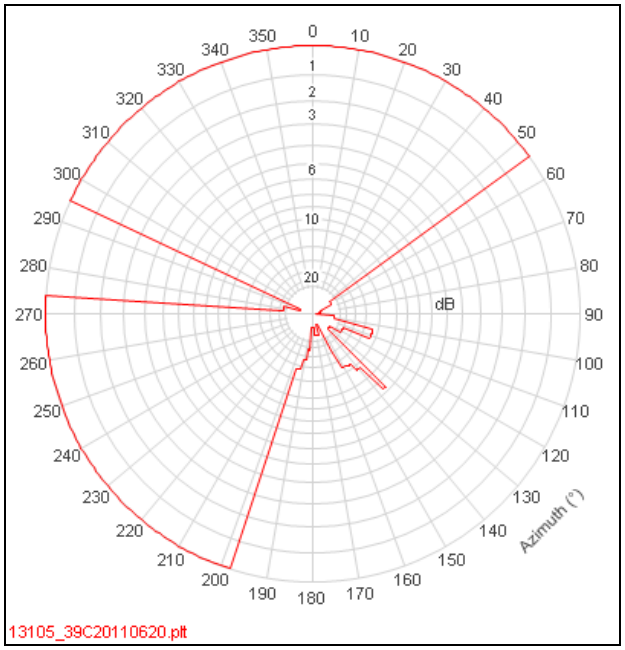

Figure A3-1: Antenna Template : 1 kW : Plympton channel 39

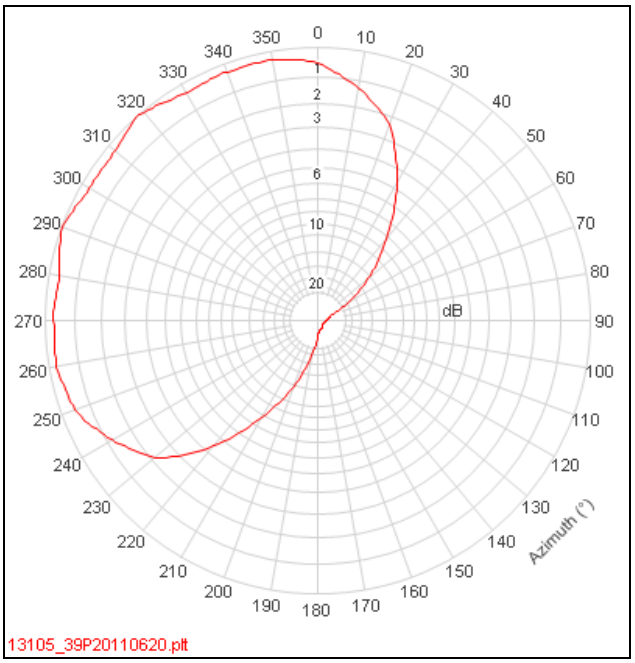

Figure A3-2 : Practical Pattern : Plympton channel 39

ERP	0.1 kW	Antenna Height	45 metres

Table A3-1 : Plympton ch39 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	37,726	58,160
90%	30,601	38,875

Table A3-2 : Plympton ch39 : Population served based on antenna

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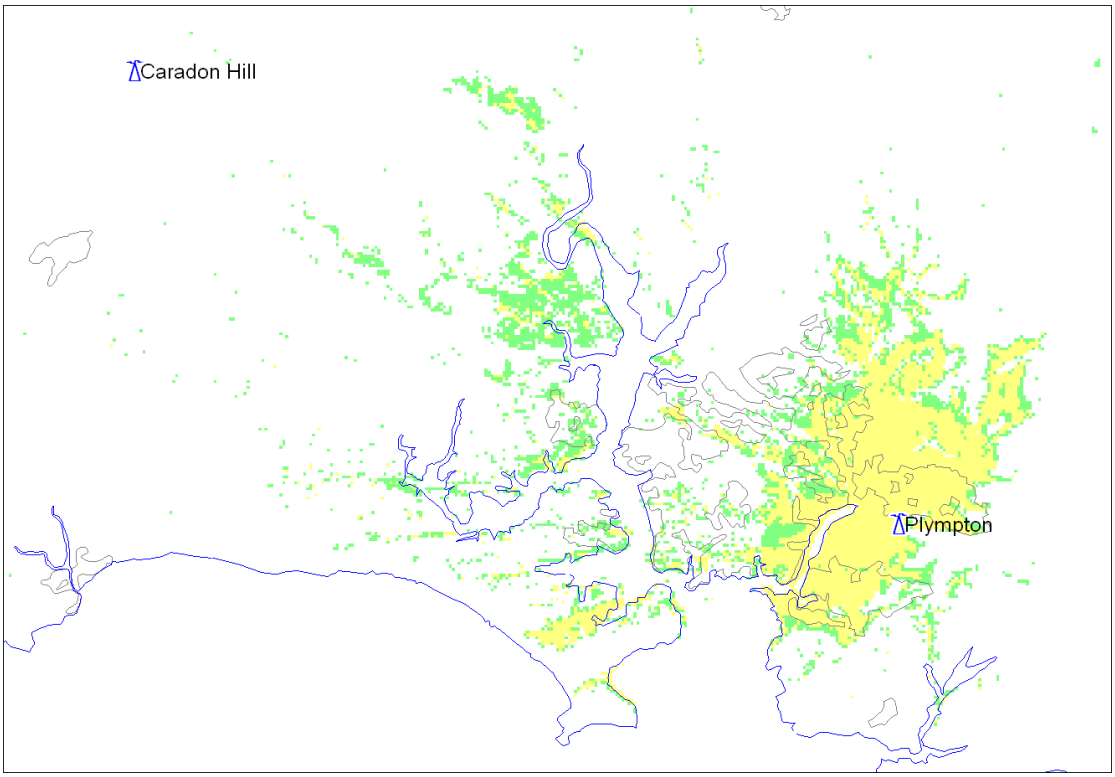

Figure A3-3: Plympton ch39 : 0.1 kW ERP: Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve Plymouth.

There are restrictions towards Ivybridge (60°-130° & 160°-180°) and Plymouth Weston Mill (280°-290°)

There is an existing relationship between the main commercial multiplexes at Plympton on channels 42 and 45 and the PSB services at Plymouth Weston Mill. The use of channel 39 will have the same effect as already exists on the other two. There is no existing relationship with Ivybridge.

A suitable antenna solution could be crossed log-periodics.

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Reigate 10103

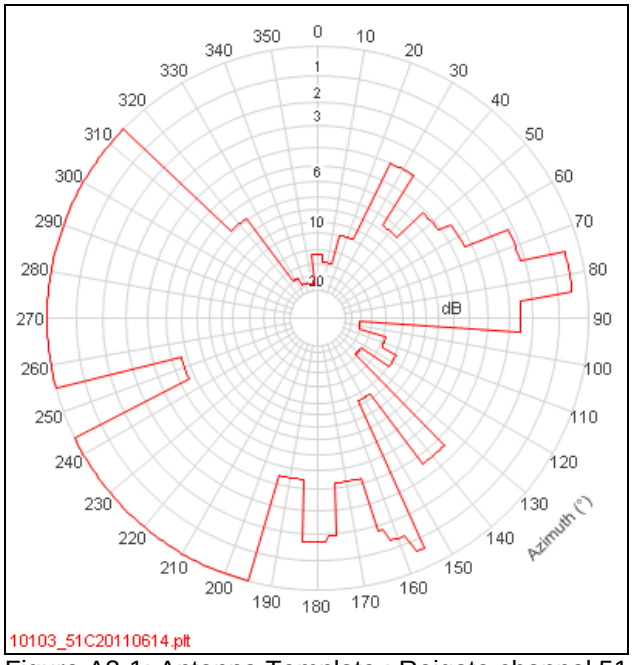

Figure A3-1: Antenna Template : Reigate channel 51

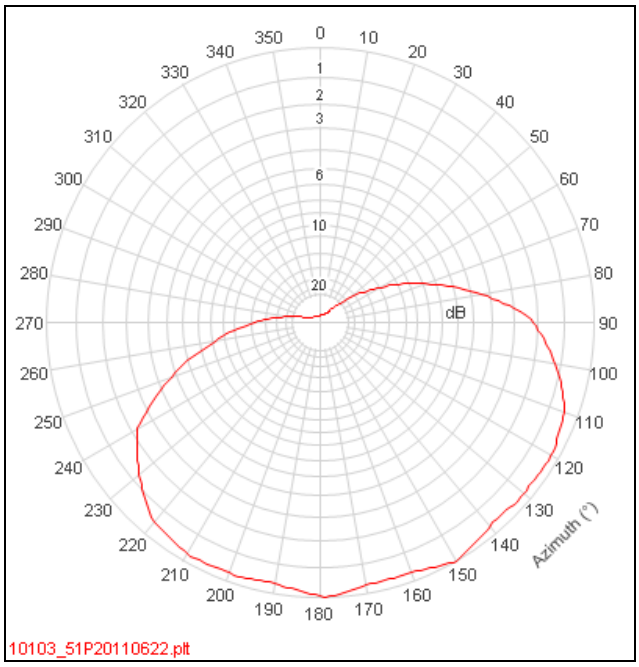

Figure A3-2 : Practical Pattern : Reigate channel 51

ERP	0.2 kW	Antenna Height	58 metres

Table A3-1 : Reigate ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	73,945	117,828
90%	71,830	100,756

Table A3-2 : Reigate ch51: Population served based on antenna

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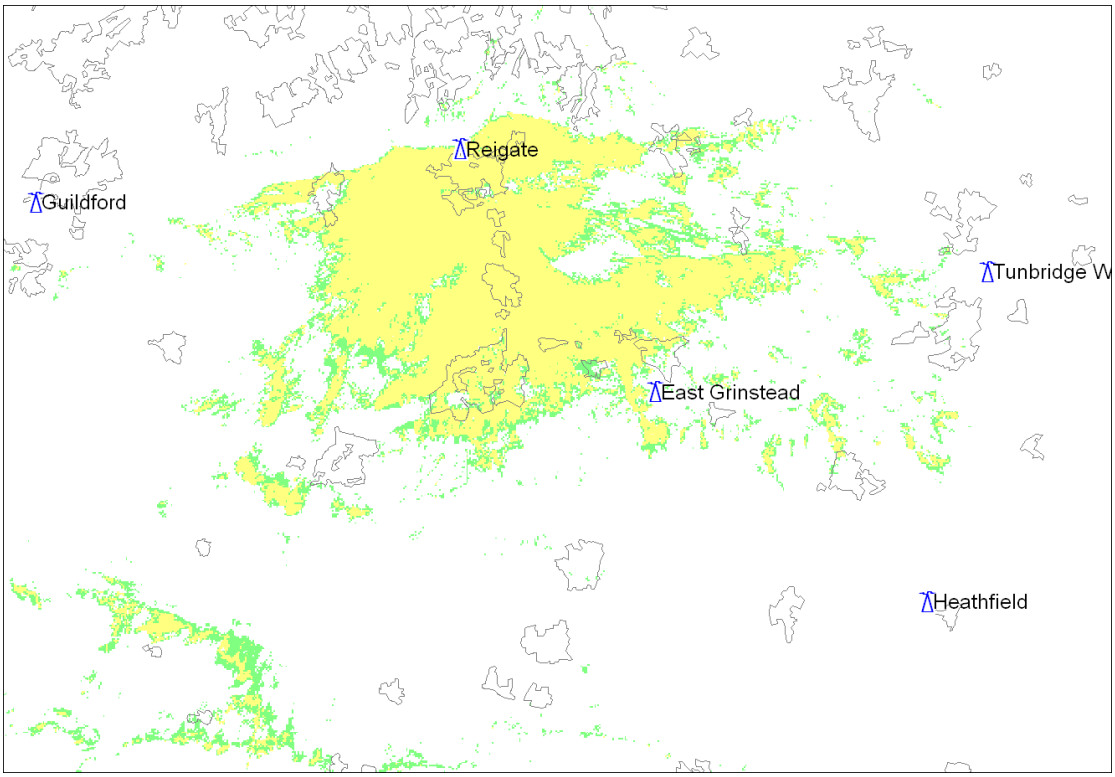

Figure A3-3: Reigate ch51: 0.2kW ERP: Practical antenna: 58m a.g.l

Practical Antenna:
The requirement is to serve Reigate.

There are restrictions towards Dover (50°-60° & 90°-130°), Whitehawk Hill (140°-190°) and Sandy Heath (250°, 320°-50°, 70° & 90°). Additionally there are restrictions towards France of up to 2.1dB over the arc 153°-192°

There is an existing relationship between the main multiplexes at Reigate and those at Whitehawk Hill on channels 53, 57 and 60. The proposed GI service on channel 51 operating at an ERP of 1 kW should have less impact than the main multiplexes and hence the restrictions could be relaxed.

There is an existing relationship between the main multiplex on channel 53 at Reigate and the PSB service at Dover.

There is an existing relationship between Reigate commercial multiplexes and Sandy Heath PSB services on channels 21, 24 and 27. The restriction on 250° is towards Dorking.

At Reigate an antenna solution could either be based on a separate antenna using crossed log-periodics mounted on the south side of the structure or on the main DTT antenna. Within the target area (DPSA) both give similar coverage.

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Storeton 10307

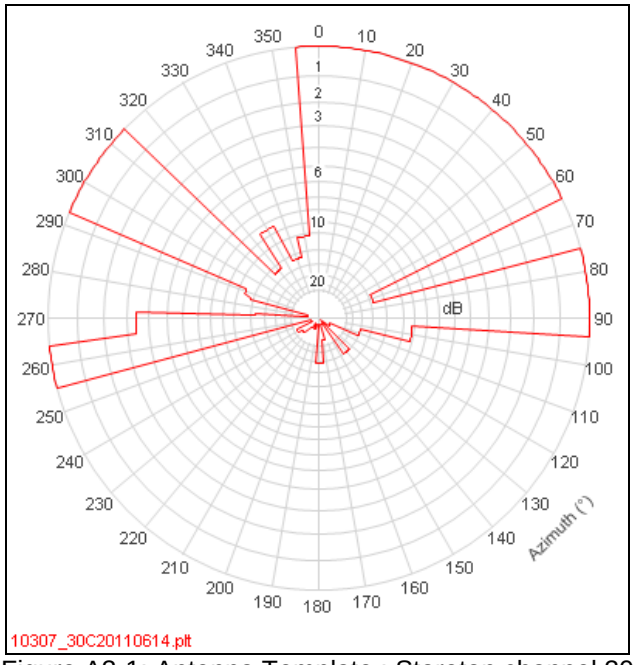

Figure A3-1: Antenna Template : Storeton channel 30

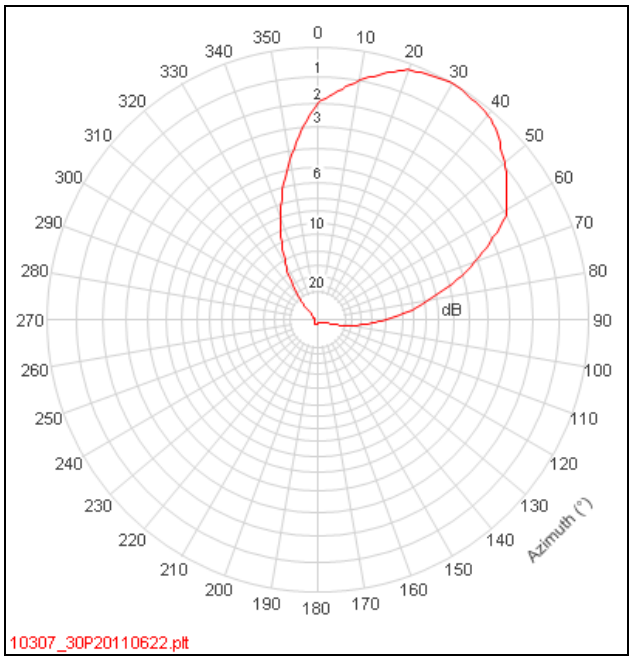

Figure A3-2 : Practical Pattern : Storeton channel 30

ERP	0.06 kW	Antenna Height	43 metres

Table A3-1 : Storeton ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	58,271	117,436
90%	41,511	64,239

Table A3-2 : Storeton ch30: Population served based on antenna main DTT antenna

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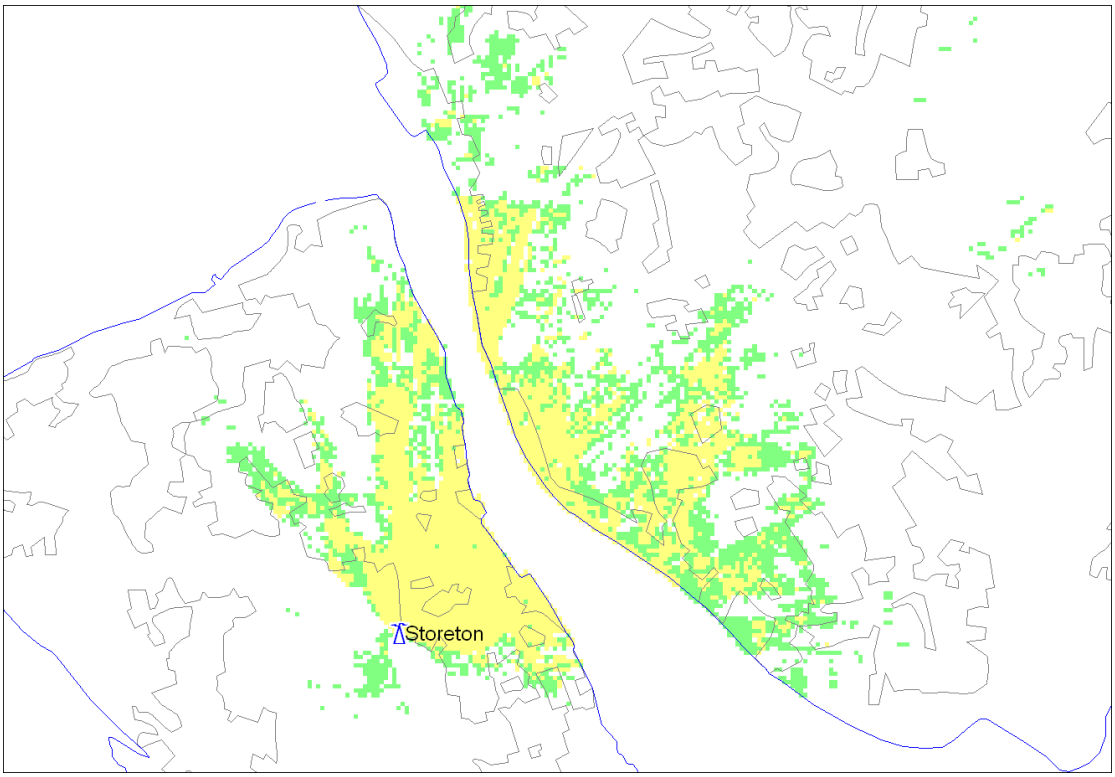

Figure A3-3: Storeton ch30: 0.06kW ERP: Practical antenna: 43m a.g.l

Practical Antenna:
The requirement is to serve Birkenhead.

There are restrictions towards The Wrekin (70°, 100°-250° & 270°-280°) and Caldbeck (320°-350°). Additionally there are restrictions of up to 13dB over the arc 268°-292° to limit signal levels to the Irish Republic.

All the main multiplexes at Storeton have a relationship with the main multiplexes at Caldbeck, either with the Scottish service on channel 22 or the English services on channels 23, 25, 26, 28 and 29.

There is an existing relationship between the main multiplexes at The Wrekin PSB on channels 23 and 26 and Storeton main multiplexes.

As such the main multiplexes at Storeton will limit coverage of The Wrekin and Caldbeck and the restrictions on the proposed GI service on channel 30 can be relaxed.

A suitable antenna would be a log-periodic on a bearing of 30° ETN. The main DTT antenna could also be used.

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Sheffield 10403

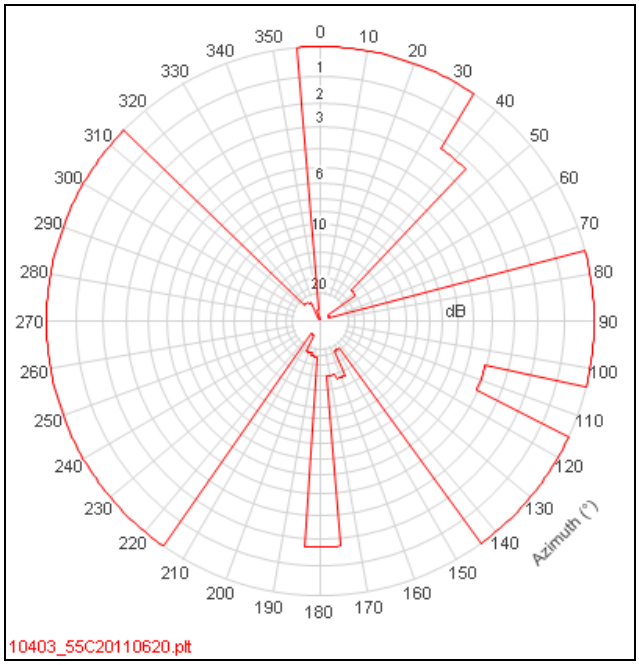

Figure A3-1: Antenna Template : 1 kW : Sheffield channel 55

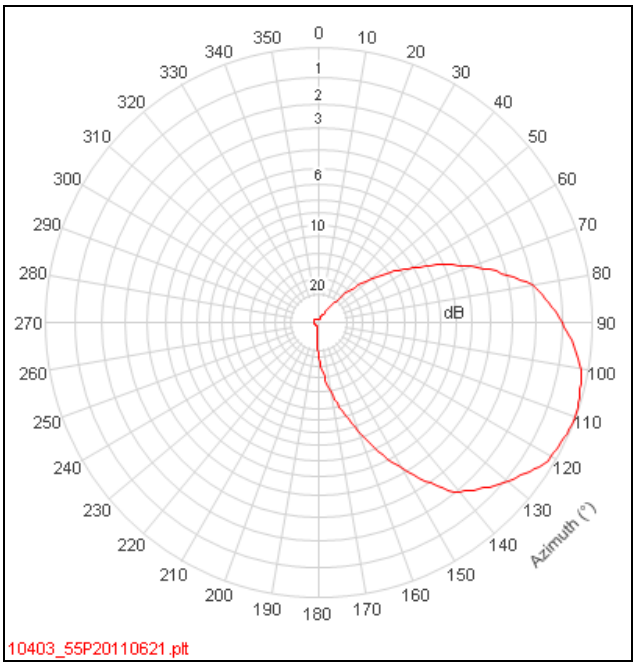

Figure A3-2 : Practical Pattern : Sheffield channel 55

ERP	0.1 kW	Antenna Height	43 metres

Table A3-1 : Sheffield ch55 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	123,759	192,880
90%	109,557	145,952

Table A3-2 : Sheffield ch55: Population served based on antenna

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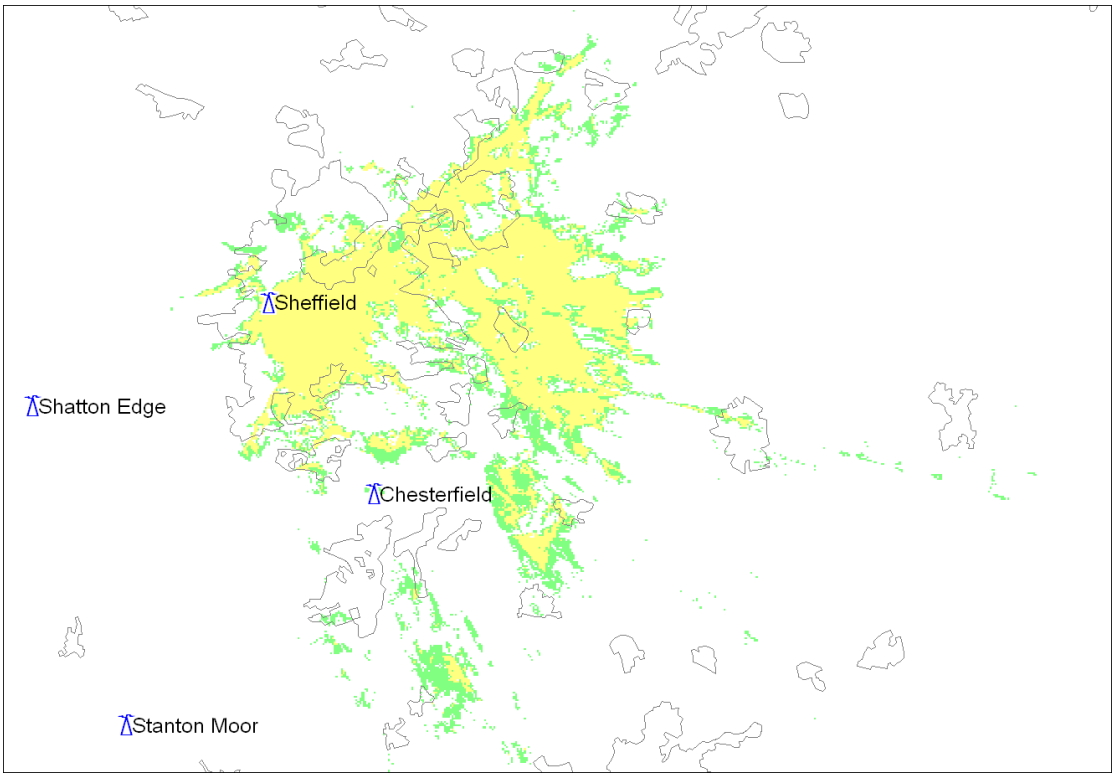

Figure A3-3: Sheffield ch55: 0.1kW ERP: Practical antenna: 43m a.g.l

Practical Antenna:
The requirement is to serve Sheffield. No in-band channel could be found.

There are restrictions towards Winter Hill (40°), Wincobank (50°-70°), Tacolneston (110°), Dronfield (150°-160°), Belper (170°-180°), Stanton Moor (180°-210°) and Oughtibridge (320°-350°)

There is a relationship between Sheffield COM (1kW) and Tacolneston (100kW) on channels 39, 42 and 45. Interference to Tacolneston PSB1 on channel 55 from our proposed service will be no worse than that currently experienced on the COM channels.

There is no relationship with Dronfield or Wincobank.

A desk-top survey did not identify any viewers on Wincobank in the most affected areas. Viewers were seen to be using a variety of sources such as Sheffield, Emley Moor and Belmont. Towards Dronfield, the viewers in the worst affected areas appeared to be watching Chesterfield. In our desk-top survey it was not possible to view the most affected Belper area however viewers in surrounding areas appear to use only Sutton Coldfield or Waltham.

A possible solution is to use a log-periodic on 110°. This infringes the restrictions towards Wincobank, Dronfield and Belper though the desk-top study suggests few if any of the predicted viewers may be using these services. However a site survey may be needed to confirm this.

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Saddleworth 10306

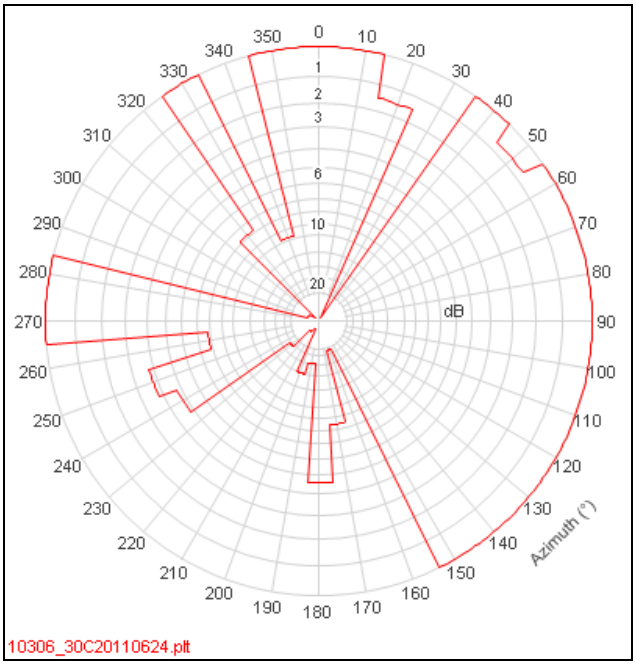

Figure A3-1 : Antenna Template : 1 kW : Saddleworth channel 30

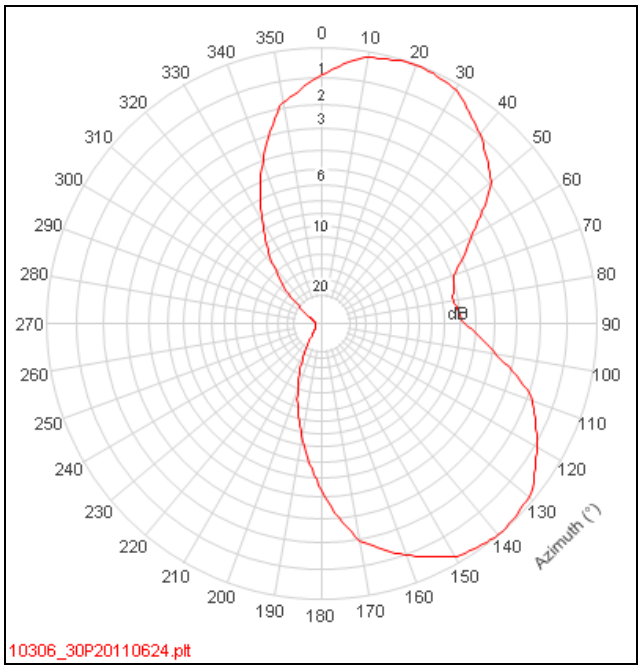

Figure A3-2 : Practical Pattern : Saddleworth channel 30

ERP	40 Watts	Antenna Height	46 metres

Table A3-1 : Saddleworth ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	14,821	20,540
90%	13,826	16,308

Table A3-2 : Saddleworth ch30 : Population served based on antenna

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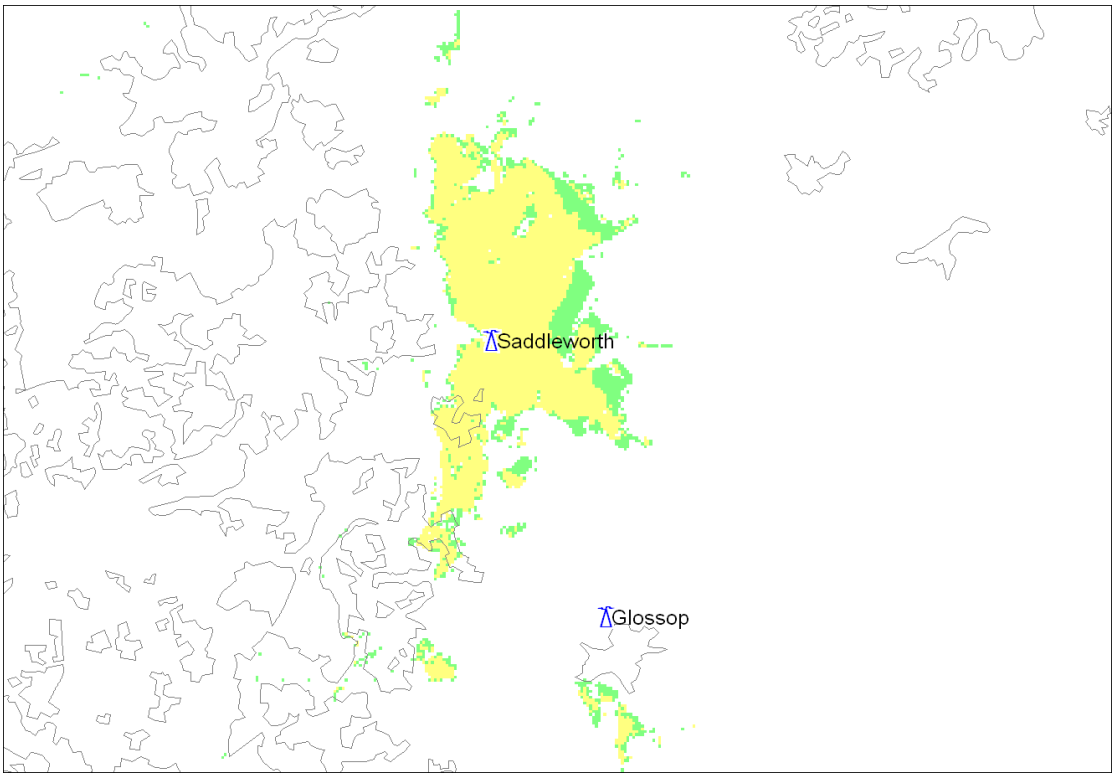

Figure A3-3 : Saddleworth ch30 : 40 Watts ERP: Practical antenna : 46m a.g.l

Practical Antenna:
The requirement is to serve Saddleworth.

There are restrictions towards Belmont (20°, 50°, 160°-170°), The Wrekin (30°, 180°-260°, 290°-320° & 340°)

The worst affected Belmont area on 20° is within the Saddleworth service area and no HP antennas were seen on a desk-top survey. On 160° viewers are watching Buxton.

On 190°, where it was predicted that there may be viewers of The Wrekin, a desk-top survey shows that viewers have antennas directed towards Fenton, Sutton Coldfield and Over Biddulph.

A suitable antenna would be 120° crossed log-periodics on 90°.

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Whitehawk Hill 10805

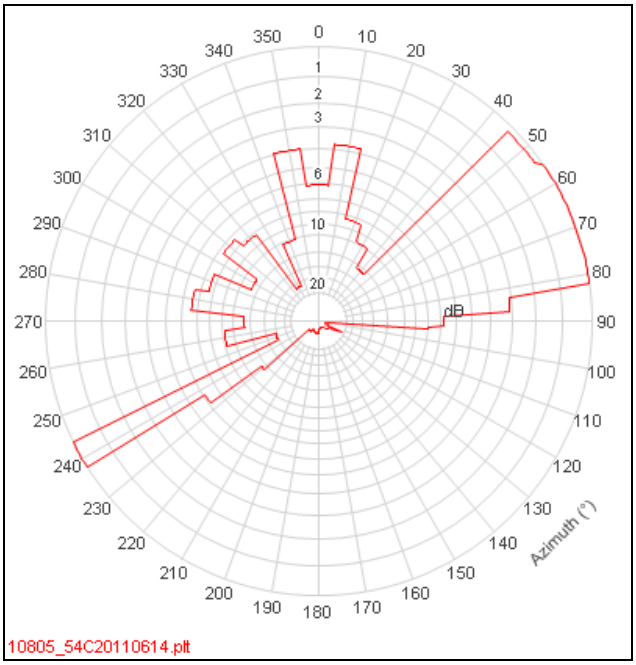

Figure A3-1 : Antenna Template : 1 kW : Whitehawk Hill channel 54

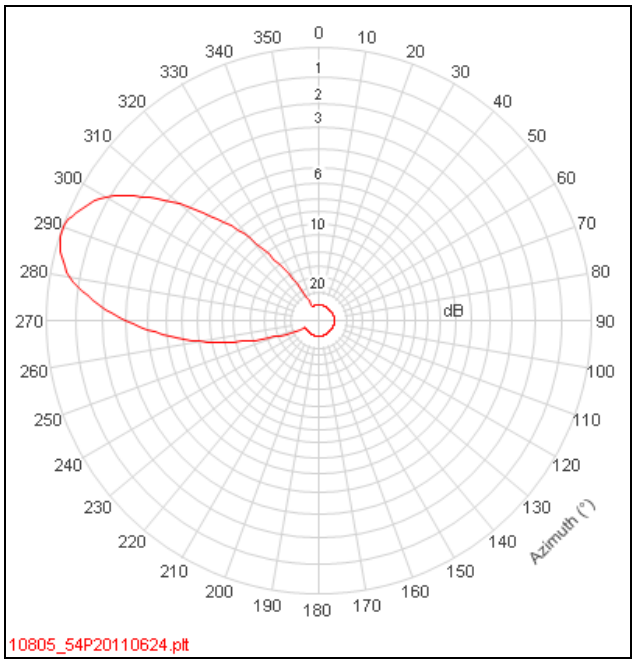

Figure A3-2 : Practical Pattern : Whitehawk Hill channel 54

ERP	0.4 kW	Antenna Height	39 metres

Table A3-1 : Whitehawk Hill ch54 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	97,878	151,137
90%	94,833	128,824

Table A3-2 : Whitehawk Hill ch54 : Population served based on antenna

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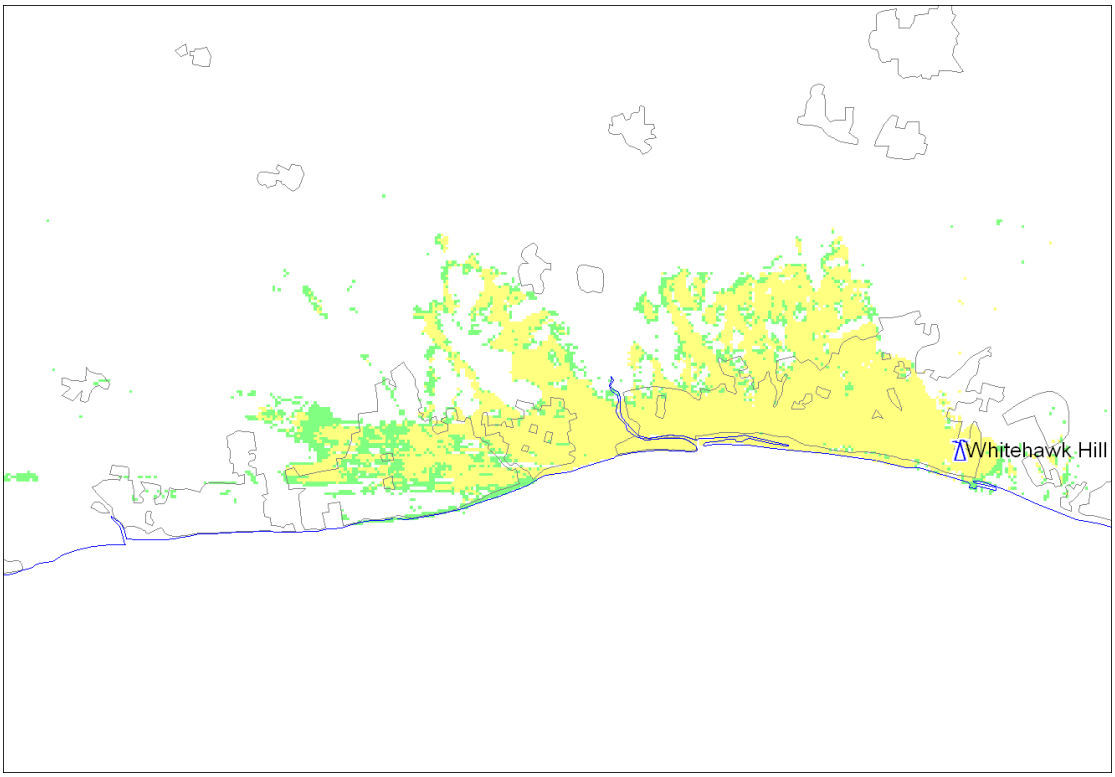

Figure A3-3 : Whitehawk Hill ch54 : 0.4kW ERP : Practical antenna : 39m a.g.l

Practical Antenna:
The requirement is to serve Brighton.

There are restrictions towards Midhurst (260°-30°), Bluebell Hill (0° & 40°-50°), Saltdean (100°-120°), Ventnor (250°-260°), Luccombe (250°) and Mendip (260°-270°). Additionally there are restrictions towards France of up to 13dB over the arc 83°-237°

There is a relationship between the main multiplex at Whitehawk Hill and Midhurst PSB2 on channel 56. The proposed GI service on channel 54 will have less impact on Midhurst on channel 54 than that from channel 56. As such the restrictions on the GI service towards Midhurst could be relaxed.

There is a relationship between Whitehawk Hill and the commercial multiplexes at Mendip on channels 48 and 56.

There is no relationship with Bluebell Hill, Ventnor, Luccombe or Saltdean.

A possible solution would be bayed log-periodics on 290°. These meet the template restrictions towards Bluebell Hill, Saltdean, Ventnor and Luccombe.

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Annex 4 : Templates & Practical Patterns – Group C

The stations in Group C and their prime target areas are detailed in Table A4-1.

Station ID	Transmitter Station	Target Urban area	Comment
11300	Dover	Dover, Folkestone & surrounds	
13900	Heathfield	Heathfield, Hailsham, Haywards Heath	
15800	Bluebell Hill	Maidstone	
12300	Angus	Dundee	
10105	Hemel Hempstead	Hemel Hempstead	
11900	Carmel	Carmarthen	
15600	Rosemarkie	Inverness	
12900	Presely	Parts of Pembrokeshire	
11800	Llanddona	Bangor	
10335	Lancaster	Lancaster, Morecambe	
10101	Guildford	Guildford	
13001	Londonderry	Londonderry	
13800	Huntshaw Cross	Barnstaple	
12308	Tay Bridge relay	Parts of Dundee	Angus Filler
13815	Barnstaple relay	Barnstaple	Huntshaw Cross Filler

Table A4- 1 : 15 DTT Stations studied in Group C

The predicted coverage of the stations using the suggested 'practical solutions' is summarised in Table A4-2.

		Households served				Households served	
Station	ch	Net	Gross	Station	ch	Net	Gross
Angus	48	133,362	393,233	Heathfield	29	63,534	94,686
Bluebell Hill	27	142,573	219,830	Lancaster	30	41,672	142,362
Barnstaple	49	8,330	15,227	Londonderry	51	36,475	40,030
Carmel	55	39,684	50,744	Llanddona	51	16,948	21,500
Dover	57	42,325	52,308	Presely	30	23,860	24,813
Guildford	51	52,969	175,600	Rosemarkie	52	49,806	71,689
Huntshaw Cross	51	23,803	34,352	Tay Bridge relay	51	15,762	88,263
Hemel Hempstead	42	37,068	110,366				

Table A4-2: Predicted coverage (households) of Geographically Interleaved channels based on 'practical solutions' : DVB-T QPSK 2/3

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Angus 12300

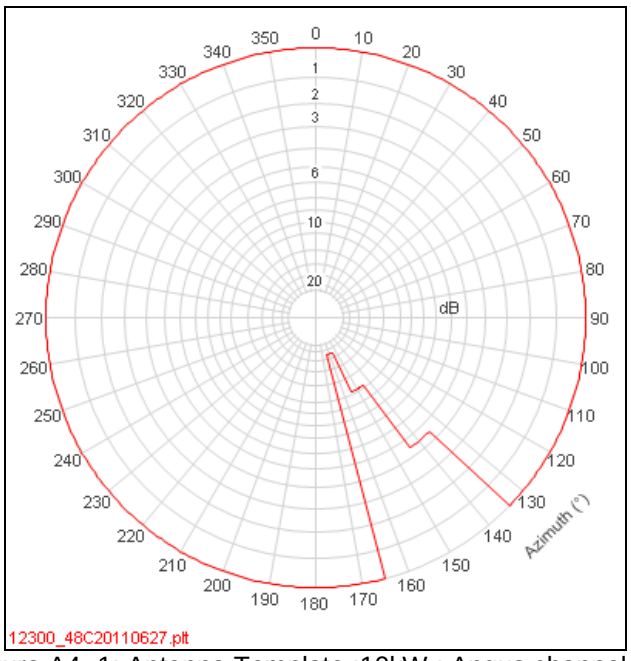

Figure A4 -1: Antenna Template :10kW : Angus channel 48

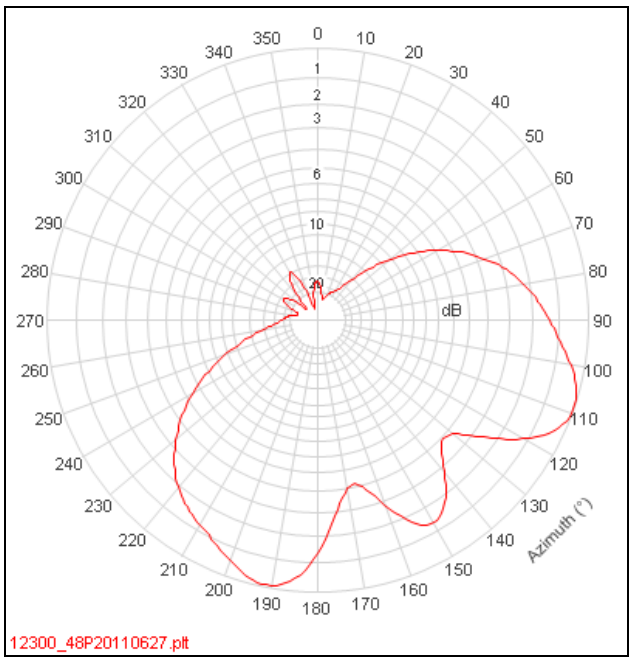

Figure A4-2 : Practical Pattern : Angus channel 48

ERP	1 kW	Antenna Height	117 metres

Table A4-1 : Angus ch48 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	133,362	393,233
90%	129,952	305,732

Table A4-2 : Angus ch48: Population served based on antenna

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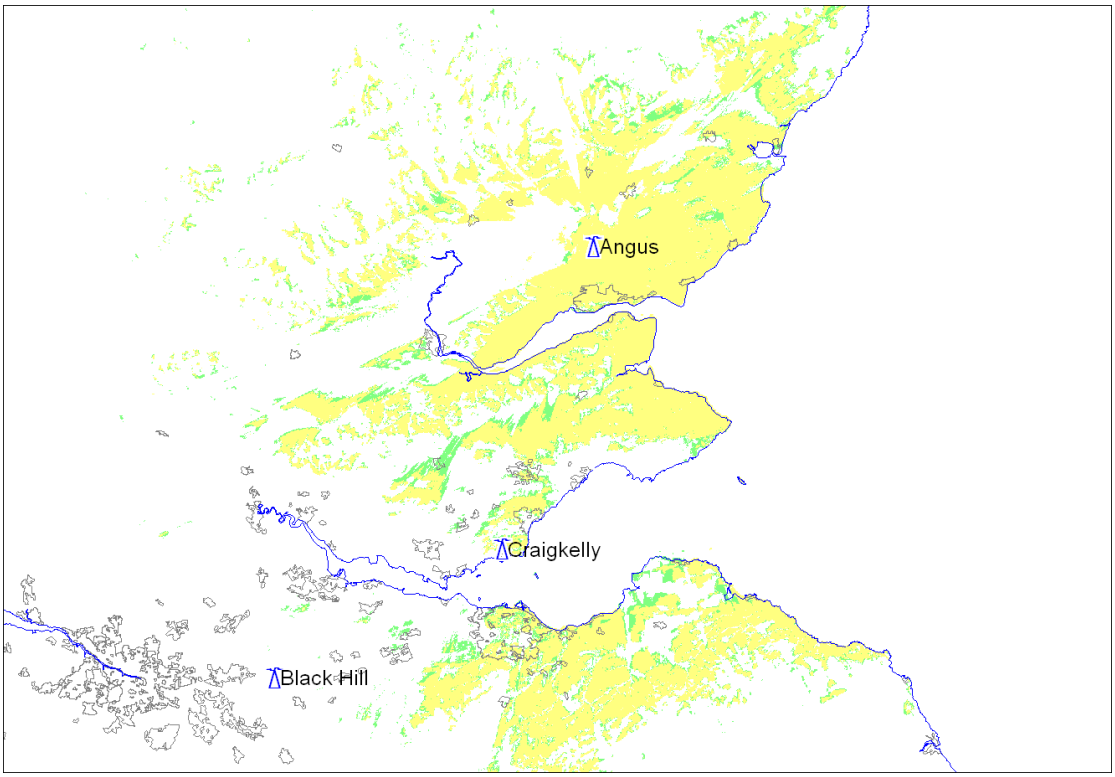

Figure A4-3: Angus ch48: 1 kW ERP: Practical antenna: 117m a.g.l

Practical Antenna:
The requirement is to serve Dundee.

There are restrictions towards Overstrand (140°), Skinningrove and Staithes (150°) and Wall (160°).

There are no relationships with any of these stations.

The worst affected Wall location is predicted to have good service from both Pontop Pike and Newton. The location is assigned to Newton in the 3PSB DPSA and Pontop Pike in the 6COM DPSA. It is only the dAPSA that assigns it to Wall. Our desk-top survey shows that all antennas in that location are directed towards Pontop Pike. It is therefore very unlikely that anyone there would be using Wall as a service.

Though the worst affected Staithes location is relatively close to the Staithes transmitter, because of terrain it is right on the edge of service. The area is not predicted to be served by any other transmitter so the restriction must be maintained.

A possible solution would be to use 90° panels to serve Dundee and Broughty Ferry.

It is possible to use the existing antenna with an ERP of 0.5kW and protect all restrictions.

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Bluebell Hill 15800

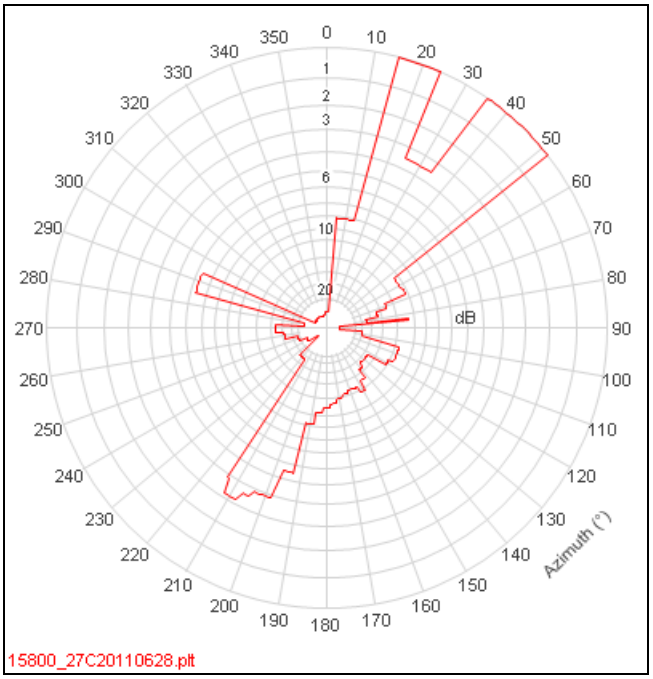

Figure A4-1: Antenna Template : 10kW : Bluebell Hill channel 27

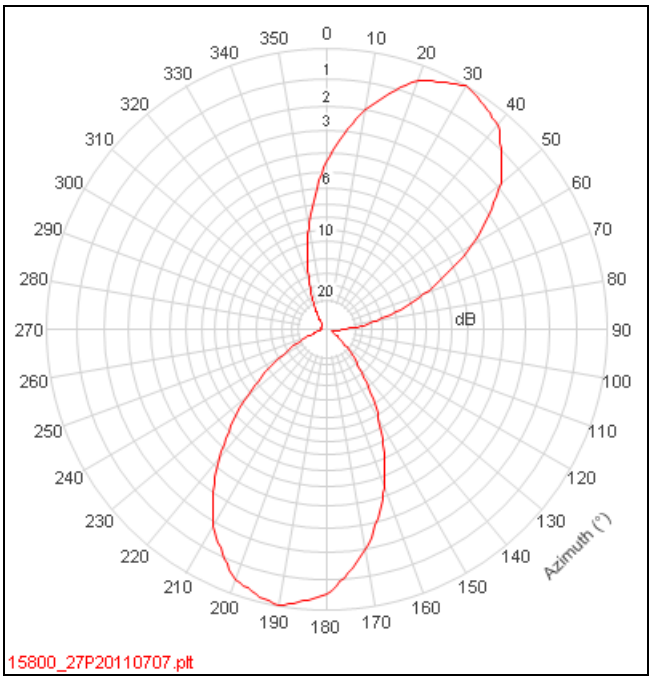

Figure A4-2 : Practical Pattern : Bluebell Hill channel 27

ERP	1kW	Antenna Height	44 metres

Table A4-1 : Bluebell Hill ch27: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	142,573	219,830
90%	106,072	141,957

Table A4-2 : Bluebell Hill ch27: Population served based on antenna

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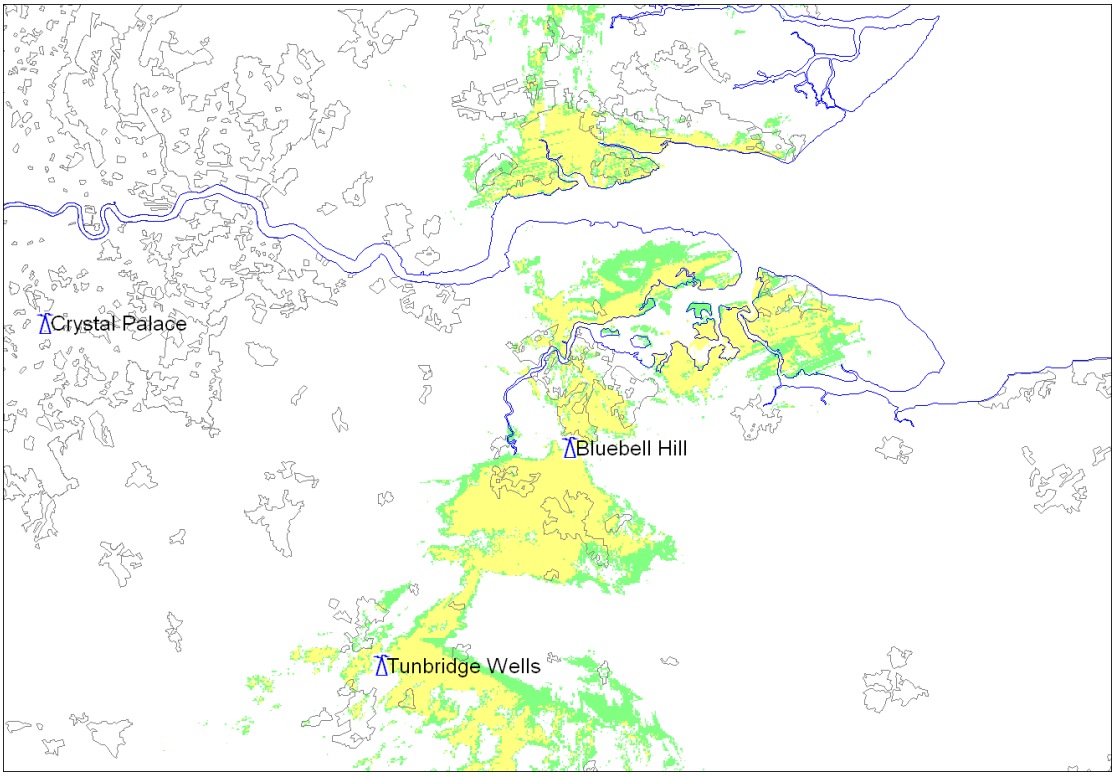

Figure A4-3: Bluebell Hill ch27: 1kW ERP: Practical antenna: 44m a.g.l

Practical Antenna:
The requirement is to serve Maidstone.

There are restrictions towards Sandy Heath (250°-10°), Bramford (30°), Faversham (90-100°), Chartham (90°-110°), Newnham (100°), Rowridge VP(200°, 220° & 240°-270°), Rowridge (220°, 240°-260°), Reigate (220°-270°).

There was an existing relationship between low-power DTT at Bluebell Hill and Sandy Heath pre-DSO as shown in the table below:

channel	24	27	39	40	42	43	45	46
Bluebell Hill	D3/5	Mux A	Mux D	BBC1	Mux C	C3	D4	BBC2
ERP (kW)	2	2	3	30	3	30	3	30
Sandy Heath	C3	BBC2	C5	D5	Mux BBC	Mux A	D3/4	Mux D
ERP (kW)	1000	1000	10	20	20	20	20	20

Sandy Heath has switched and during the transition period between Sandy Heath DSO and Bluebell Hill DSO there will be a relationship between Sandy Heath DTT on channels 24 and 27 and low-power DTT at Bluebell Hill.

Prior to 800 MHz clearance Sandy Heath and Bluebell Hill were both scheduled to operate co-channel on channel 48, i.e. a relationship between the two stations was deemed acceptable by planners.

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There is an existing relationship with Bramford; Bluebell Hill low-power DTT D2 and Bramford C3 share channel 24 although the Bluebell hill channel 24 HRP was about 6dB below maximum ERP in the direction of Bramford.

There is a relationship with Chartham and Newnham. All four analogue channels at these stations are co-channel with low-power DTT at Bluebell Hill. There is a deep null in the Bluebell Hill low-power DTT antenna pattern in the direction of these sites. Hence the restriction towards them must be maintained for GI.

There is an existing relationship with Reigate low-power DTT as summarised in the table below:

channel	24	27	39
Bluebell Hill	D3/4	Mux A	Mux D
ERP (kW)	2	2	3
Reigate	Mux A	Mux B	Mux C
ERP (kW)	0.2	0.2	0.1

There is an existing relationship with Rowridge; Rowridge has analogue TV on channels 24 and 27 which are used by low-power DTT at Bluebell Hill.

There is no relationship with Faversham or Rowridge VP.

A possible solution comprises log-periodics to serve parts of Chatham, Gillingham and Maidstone. The 190° log-periodic slightly infringes the restrictions towards France but these could be overcome by using beam tilt.

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Barnstaple 13815

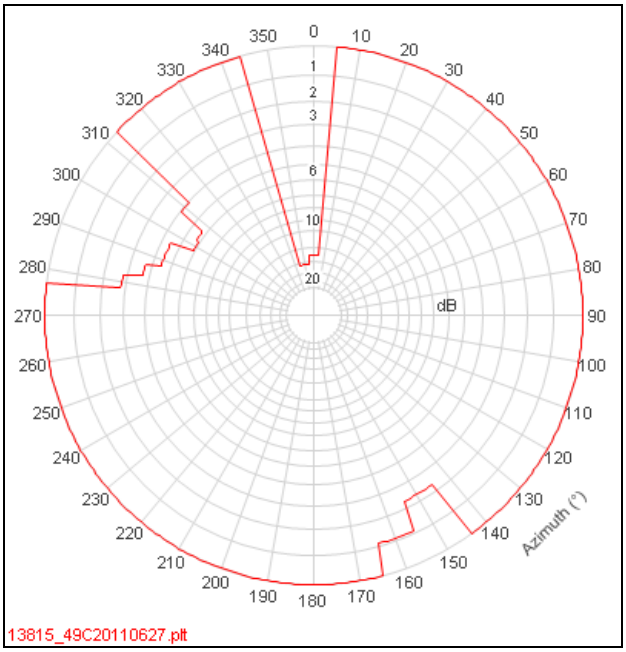

Figure A4-1: Antenna Template : 1 kW : Barnstaple channel 49

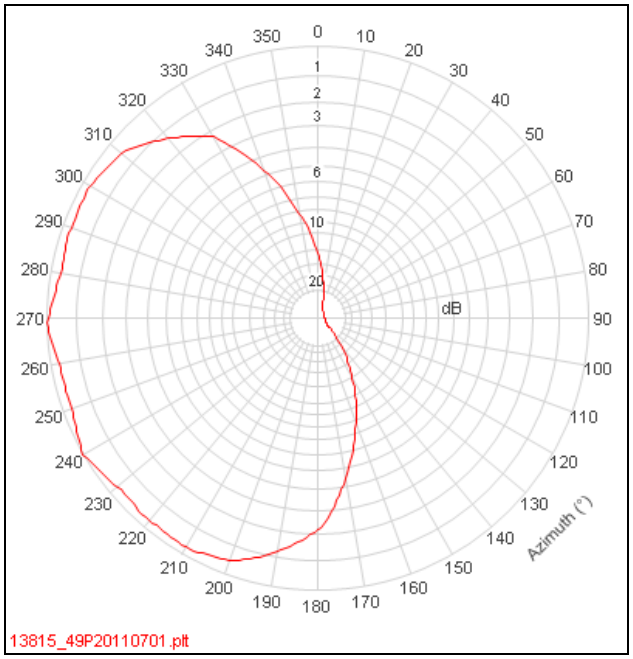

Figure A4-2 : Practical Pattern : Barnstaple channel 49

ERP	1 Watts	Antenna Height	25 metres

Table A4-1 : Barnstaple ch49 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	8,330	15,227
90%	8,020	13,192

Table A4-2 : Barnstaple ch49 : Population served based on antenna

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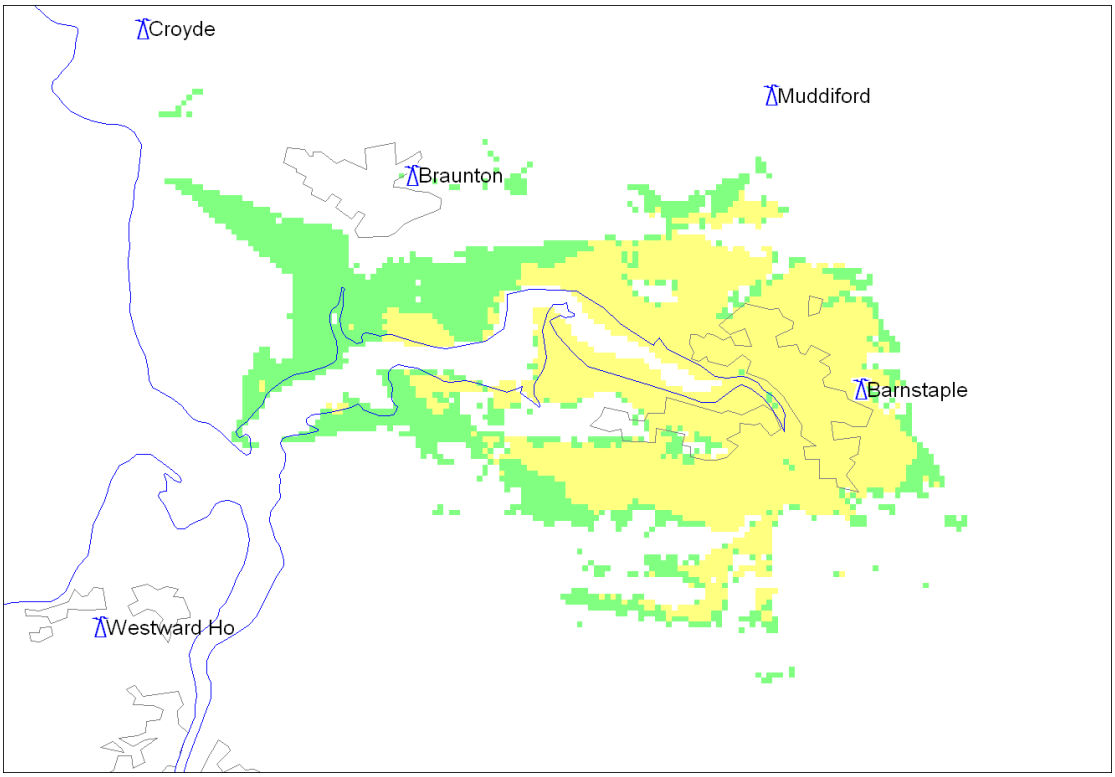

Figure A4-3: Barnstaple: ch 49: 1 W ERP: Practical antenna: 28m a.g.l

Practical Antenna:
The requirement is augment the coverage of Huntshaw Cross in Barnstaple.

There are restrictions towards Ilfracombe (350°-0°) and Mendip (150°-160°). There is also a restriction towards Ireland over the arc 278°-312°.

There are no relationships with Ilfracombe or Mendip. However, if we operate at the same power as the existing services, 8 watts ERP, or less then there are no restrictions.

A possible antenna arrangement would comprise 90° crossed log-periodics.

At the proposed power it would be possible to use the main DTT antenna.

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Carmel 11900

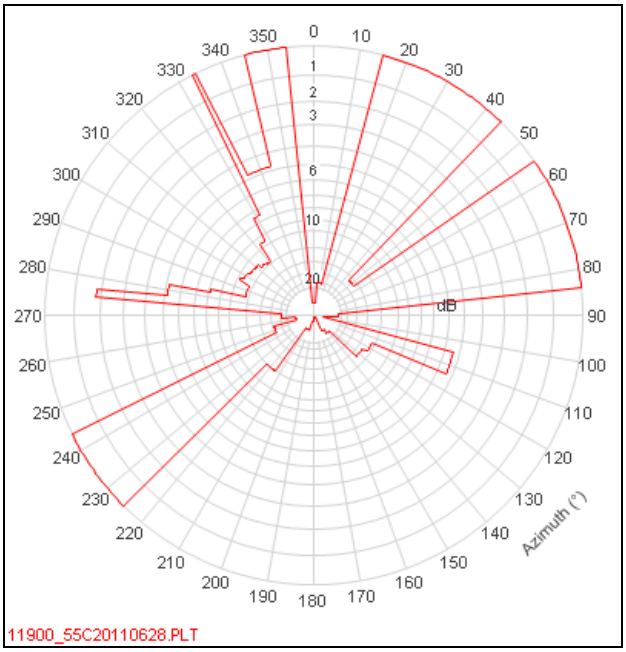

Figure A4-1: Antenna Template: 10kW: Carmel channel 55

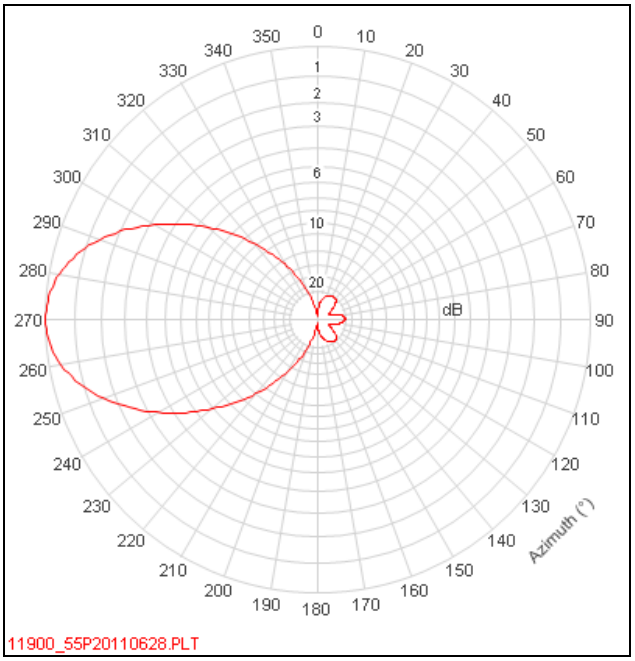

Figure A4-2 : Practical Pattern : Carmel channel 55

ERP	2kW	Antenna Height	65 metres

Table A4-1 : Carmel ch55 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	39,684	50,744
90%	33,483	39,072

Table A4-2 : Carmel ch55 : Population served based on antenna

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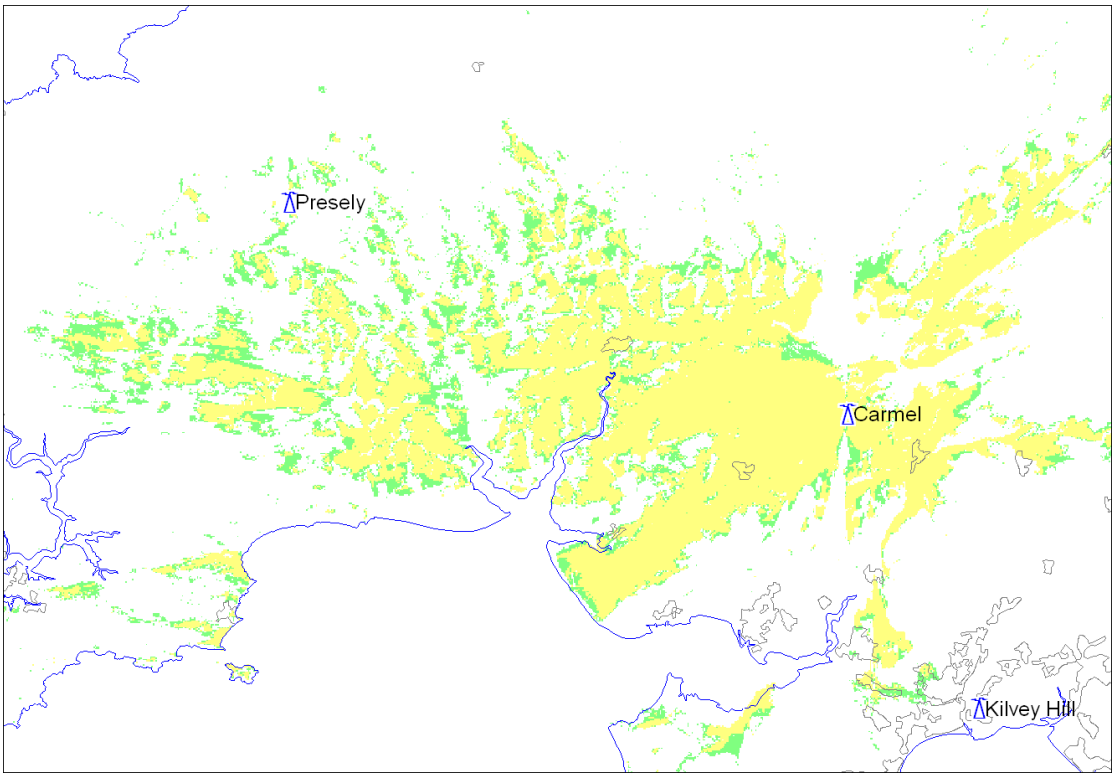

Figure A4-3: Carmel ch55 : 2kW ERP: Practical antenna: 65m a.g.l

Practical Antenna:
The requirement is to serve Carmarthen.

There are restrictions towards Tregarron (0°-10°), Clun (50°), Rheola (90°-110° &130°), Huntshaw Cross (110°-120°, 140°-220°, 250°-270° & 290°), Countisbury (160°-170°) and Port Isaac (200°). There are also restrictions towards Ireland over the arc 268°-332°.

There were low-power DTT relationships between Carmel and Huntshaw Cross which are set out in the table below. As Huntshaw Cross analogue and Carmel low-power DTT operated co-channel for over ten years it would be reasonable to assume that there are no viewers in the affected areas.

channel	53	55	57	59	62	65
Carmel	C4	D1	BBC1	D3	D6	D2
ERP (kW)	100	2.5	100	5	100	2.5
Huntshaw Cross	D5	BBC1	D6	C3	BBC2	C4
ERP (kW)	4	100	4	100	100	100

A possible antenna arrangement would be to use UHF panels on 270° at 2kW ERP to serve Carmarthen while minimising radiation to foreign test points. Should additional suppression towards these test points be required this could be implemented with beam tilt.

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Dover 11300

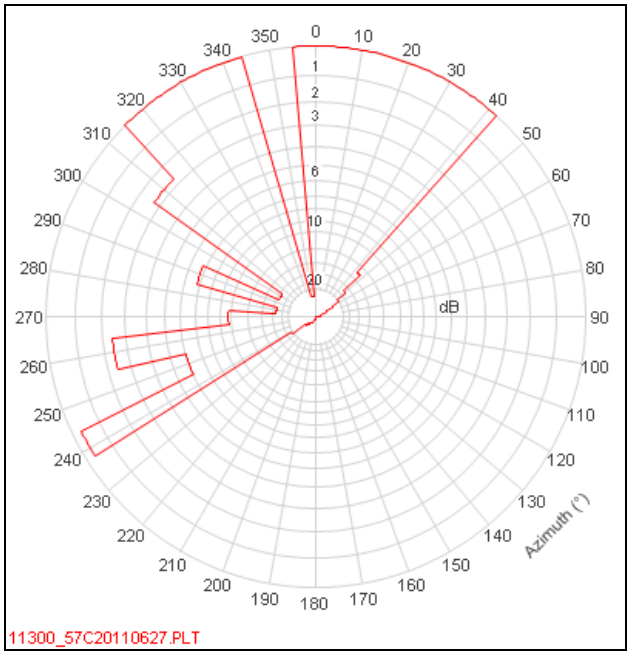

Figure A4-1: Antenna Template : 10kW : Dover channel 57

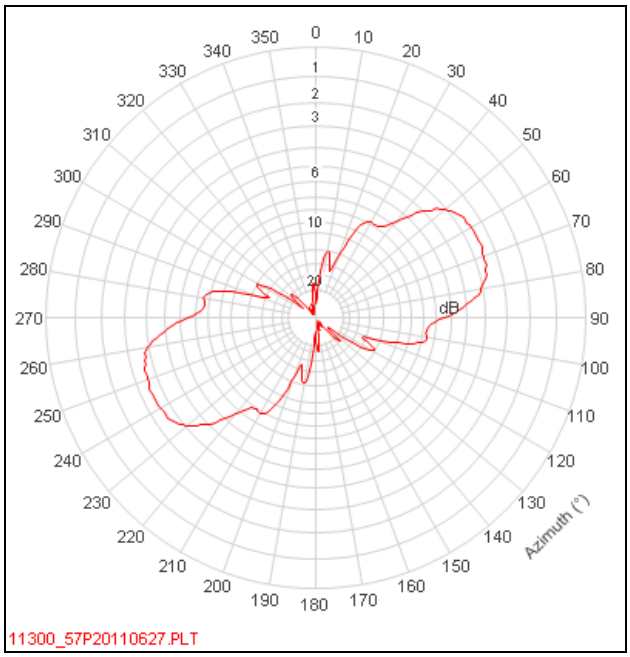

Figure A4-2 : Practical Pattern : Dover channel 57

ERP	1kW	Antenna Height	170 metres

Table A4-1 : Dover ch57 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	42,325	52,308
90%	28,221	36,803

Table A4-2 : Dover ch57: Population served based on antenna

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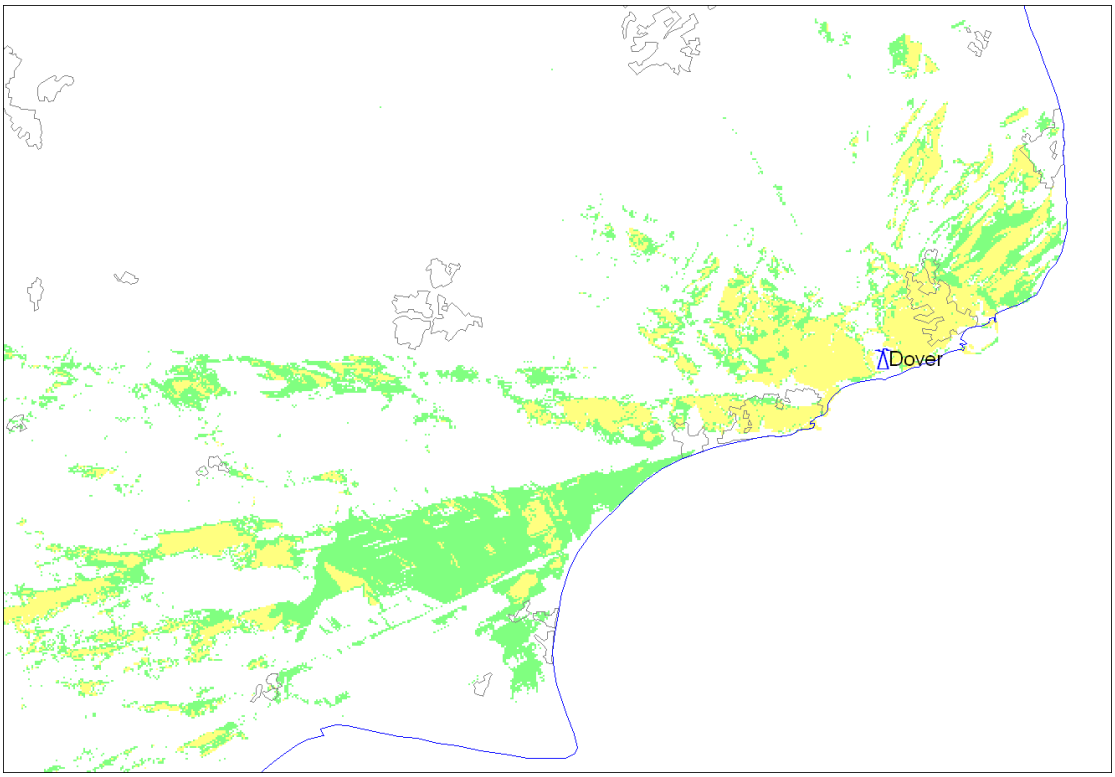

Figure A4-3: Dover channel 57: 1kW ERP: Practical antenna: 170m a.g.l

Practical Antenna:

The requirement is to serve Dover, Folkestone and surrounding area.

There are restrictions towards Whitehawk Hill (240°-260°), Reigate (260°-280°), Oxford (290°-310°), Otford (290°), Chatham Town (300°) and Wivenhoe Park (350°). Additionally there are foreign restrictions over the arc 43°-237°.

There is an existing relationship between Dover and both Reigate and Otford on channel 53; all three stations use this for PSB3.

There is an existing relationship with Whitehawk Hill on channels 51 and 53 (PSB) and 48 (COM). There is a relationship with Oxford on channels 50, 53, 55 and 59.

There is no relationship with Chatham Town or Wivenhoe Park.

In the worst affected Wivenhoe Park location our desk-top survey shows that virtually all antennas are directed towards Sudbury which is predicted to give analogue but not digital coverage in that area. Dover and Wivenhoe Park are predicted to give the best digital coverage here. The restriction to Wivenhoe Park needs to be maintained.

In the worst affected Chatham Town location, our desk-top survey shows all viewers watching Bluebell Hill or Crystal Palace both of which are predicted to give good coverage on all 6 multiplexes.

Hence the limiting factor for any antenna pattern appears to be the foreign restriction. To allow us to cover the required service area, VRP shaping will be needed to reduce outgoing levels to foreign testpoints. A possible design could use UHF panels pointing towards Dover and Folkestone. Coverage into Folkestone is poor at half main antenna height suggested due to local terrain. Increasing the antenna height to 170m improves coverage.

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Guildford 10101

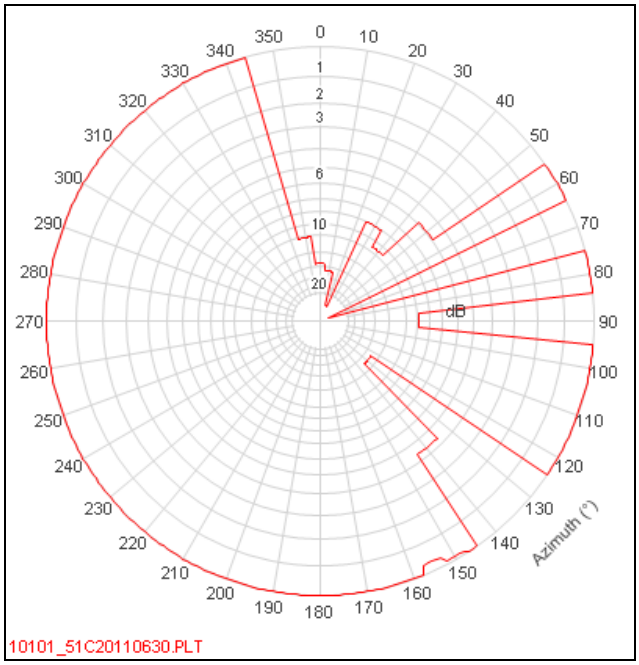

Figure A4-1: Antenna Template : 1kW : Guildford channel 51

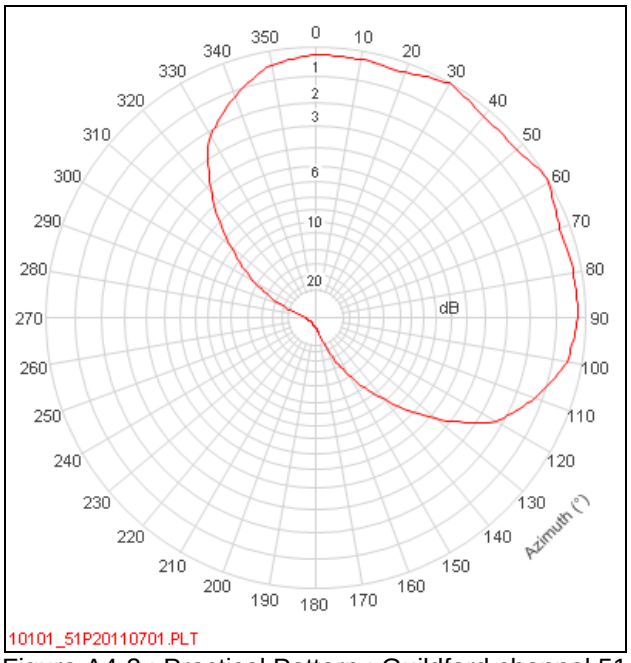

Figure A4-2 : Practical Pattern : Guildford channel 51

ERP	100 watts	Antenna Height	45 metres

Table A4-1 : Guildford ch51: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	52,969	175,600
90%	49,377	91,415

Table A4-2 : Guildford ch51 : Population served based on antenna

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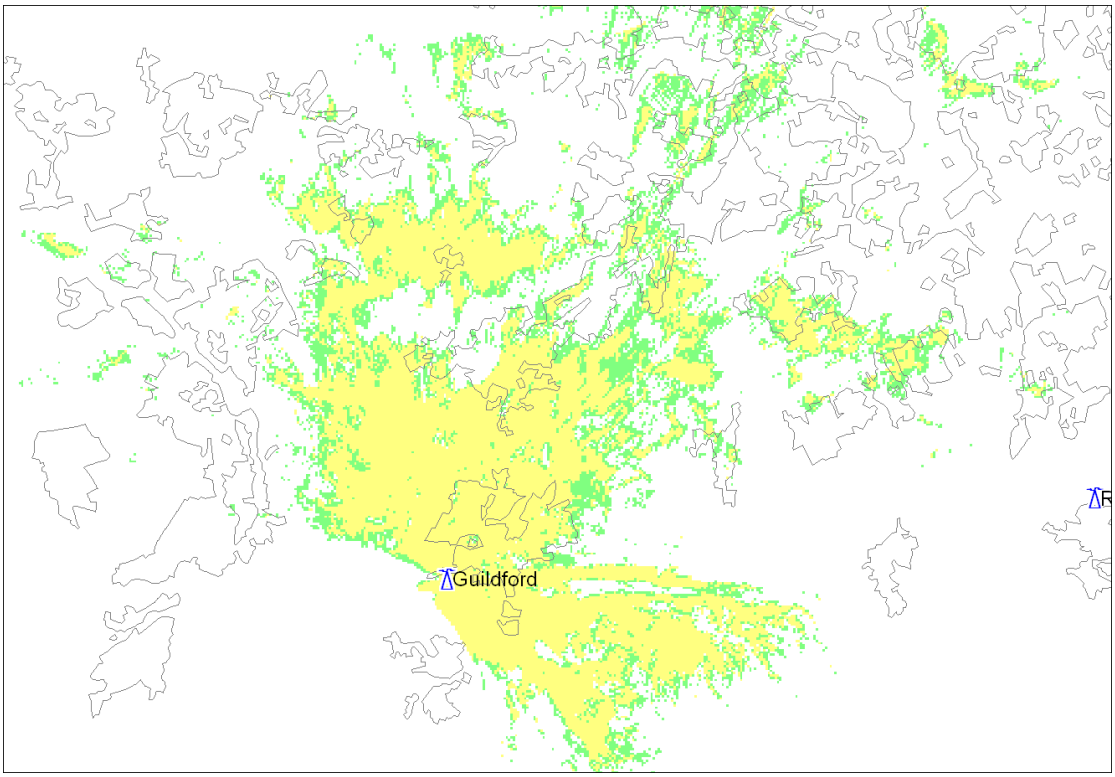

Figure A4-3: Guildford ch51 : 0.1kW ERP: Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve Guildford.

There are restrictions towards Sandy Heath (350°-50°, 70° & 90°), Whitehawk Hill (130°-140°) and Dover (140°).

There is a relationship with Sandy Heath; both Guildford and Sandy Heath use channels 48 and 52 for COM multiplexes.

There is a relationship with both Dover and Whitehawk Hill. Both use channel 48 for COM6 which is used at Guildford for COM4.

The most onerous Sandy Heath location (on 70°) is only 5km from Guildford. Reception from several stations is predicted here and a desk-top survey shows houses receiving Hannington or Crystal Palace.

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Huntshaw Cross 13800

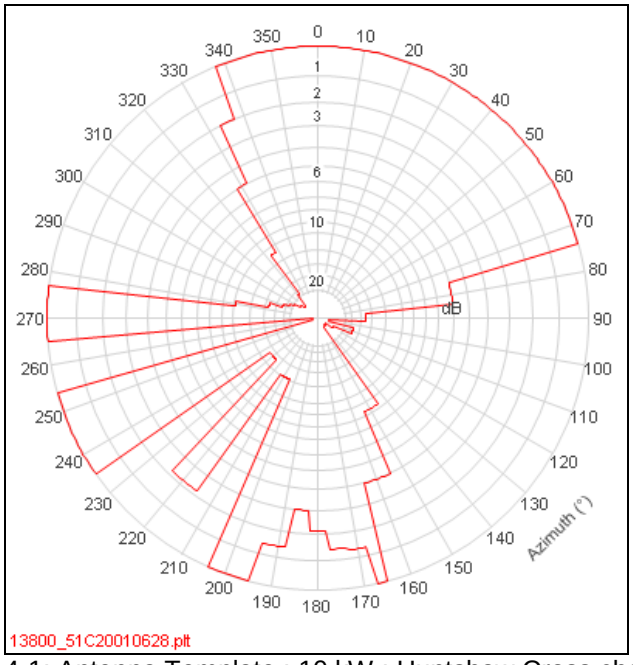

Figure A4-1: Antenna Template : 10 kW : Huntshaw Cross channel 51

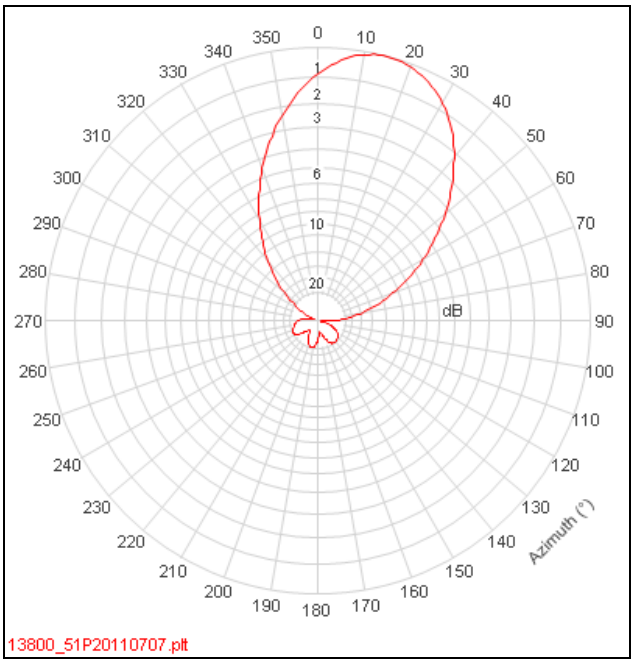

Figure A4-2 : Practical Pattern : Huntshaw Cross channel 51

ERP	2 kW	Antenna Height	79 metres

Table A4-1 : Huntshaw Cross ch 51: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	23,803	34,352
90%	22,634	32,137

Table A4-2 : Huntshaw Cross ch 51: Population served based on antenna

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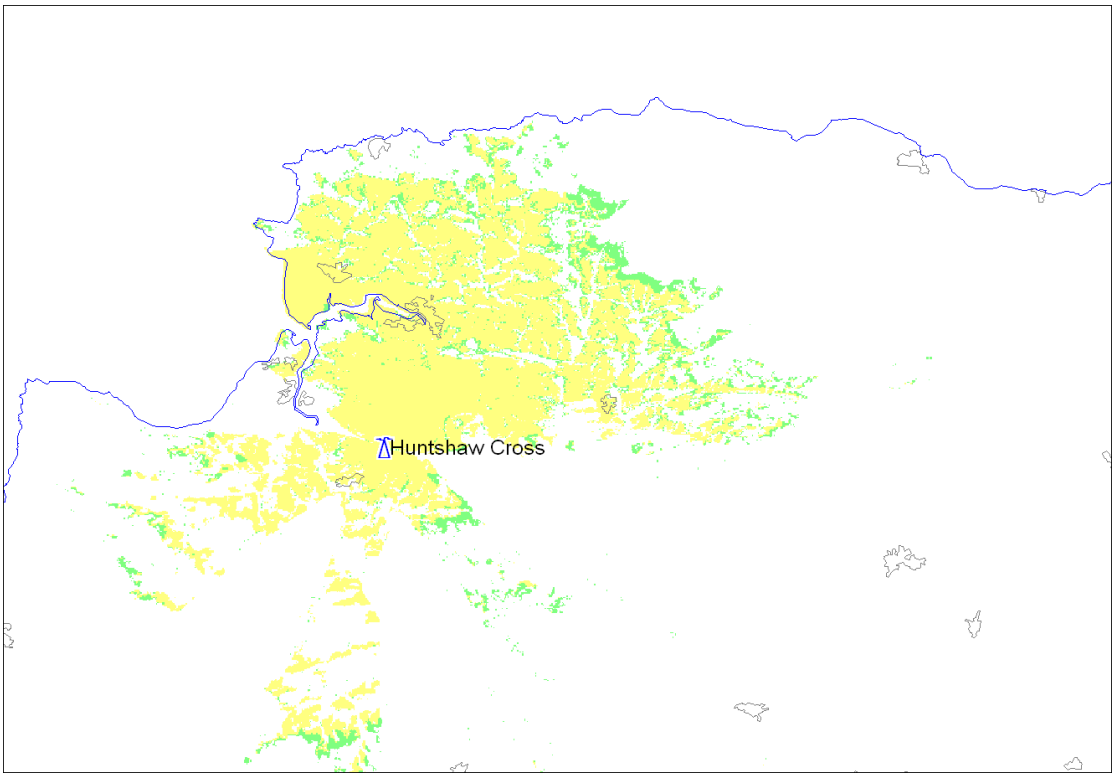

Figure A4-3: Huntshaw Cross ch 51: 2kW ERP: Practical antenna: 79m a.g.l

Practical Antenna:
The requirement is to serve Barnstaple.

There are restrictions towards Beacon Hill (80°-160° & 180°), Redruth (180°-190°, 210°-230° & 260°) and Broad Haven (320°). There are also foreign restrictions over the arcs 123°-142°, 168°-192° and 278°-337°

There is a relationship with Redruth on channels 48 and 52 which are used for COM4 and COM5 at both sites.

There were low-power DTT relationships between Huntshaw Cross and Beacon Hill which are set out in the table below.

channel	53	54	57	58	61	64
Huntshaw Cross	Mux C	Mux BBC	Mux D	D3/4	Mux A	Mux B
ERP (kW)	4	4	4	4	4	4
Beacon Hill	C4	Mux B	BBC1	Mux A	D3/4	Mux D
ERP (kW)	100	2	100	2	2	1

There were low-power DTT relationships between Huntshaw Cross and Broad Haven which are set out in the table below.

channel	54	58	61	64
Huntshaw Cross	Mux BBC	D3/4	Mux A	Mux B
ERP (kW)	4	4	4	4

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Broad Haven	C4	BBC1	C3	BBC2
ERP (kW)	0.006	0.006	0.006	0.006

Additionally, the restriction towards Ireland is more onerous than that towards Broad Haven.

A possible arrangement would be panels with an ERP of 2kW. This infringes the Irish restriction slightly but additional suppression could be obtained by using beam tilt.

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Hemel Hempstead 10105

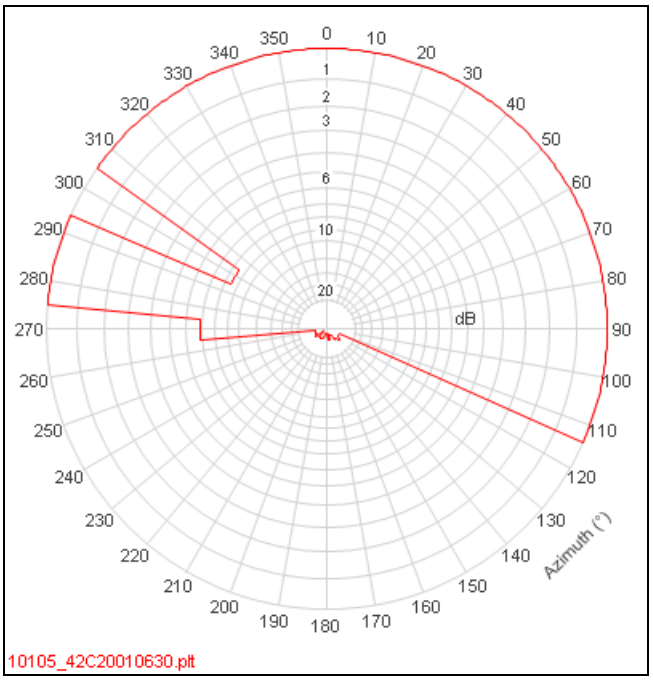

Figure A4-1: Antenna Template : 1 kW : Hemel Hempstead channel 42

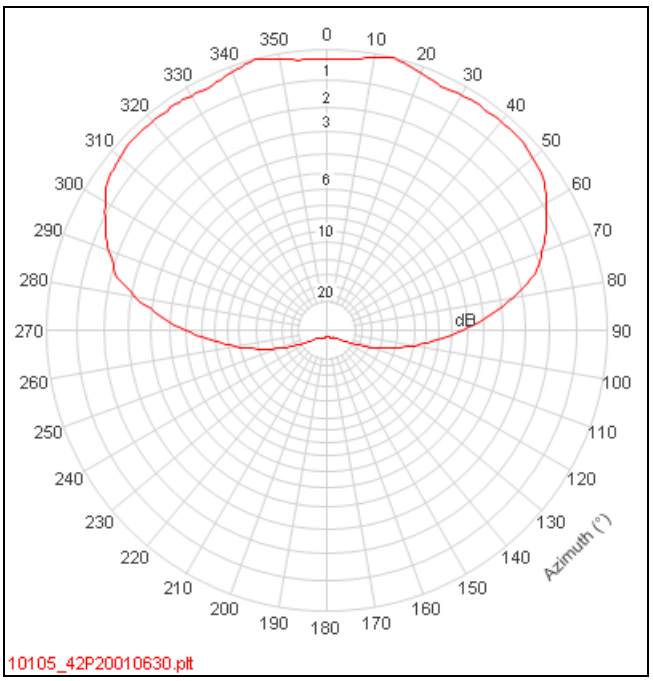

Figure A4-2 : Practical Pattern : Hemel Hempstead channel 42

ERP	100 Watts	Antenna Height	68 metres

Table A4-1 : Hemel Hempstead ch42 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	37,068	110,366
90%	35,030	76,419

Table A4-2 : Hemel Hempstead ch42 : Population served based on antenna

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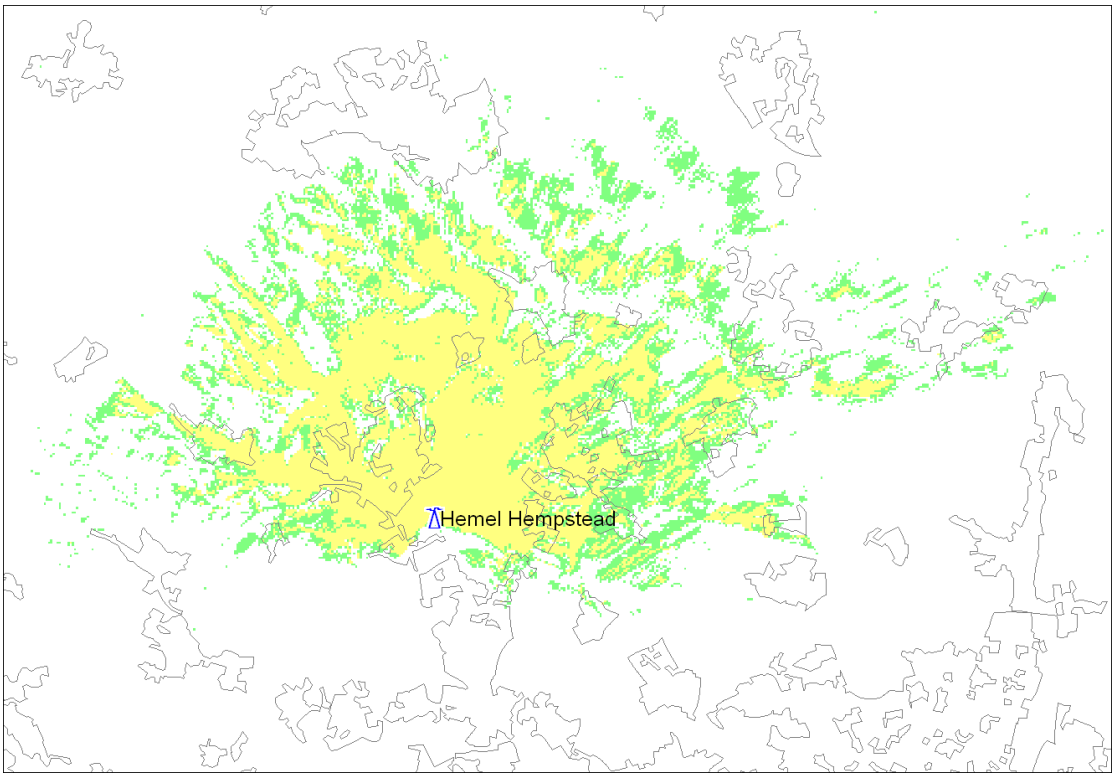

Figure A4-3: Hemel Hempstead ch42 : 100 Watts ERP: Practical antenna: 68m a.g.l

Practical Antenna:
The requirement is to serve Hemel Hempstead.

There are restrictions towards Hannington (120°-270°), Walthamstow North (120°), Biggin Hill (150°), and Hazler Hill (300°) and Sutton Coldfield (300°).

There is an existing relationship with Hannington; Hemel Hempstead PSB channels are co-channel with Hannington COM channels.

There was a relationship with Hazler Hill; all four analogue channels were co-channel with the ATV from Hemel Hempstead

There was a relationship with Sutton Coldfield; Hemel Hempstead ATV was co-channel with low-power DTT from Sutton Coldfield.

There is no relationship with Walthamstow North or Biggin Hill.

The worst affected location for Hazler Hill is not predicted to be served by DTT but a desk-top survey shows some viewers watching Hazler Hill with high-gain antennas.

Our suggested antenna pattern is intended to serve Hemel Hempstead and St Albans while protecting the Hazler Hill restriction.

The structure at Hemel Hempstead is not owned by Arqiva and the landlord may not permit additional antennas.
Due to the relationship with Hannington it may be possible to use the existing main DTT antenna which has a south-firing component.

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Heathfield 13900

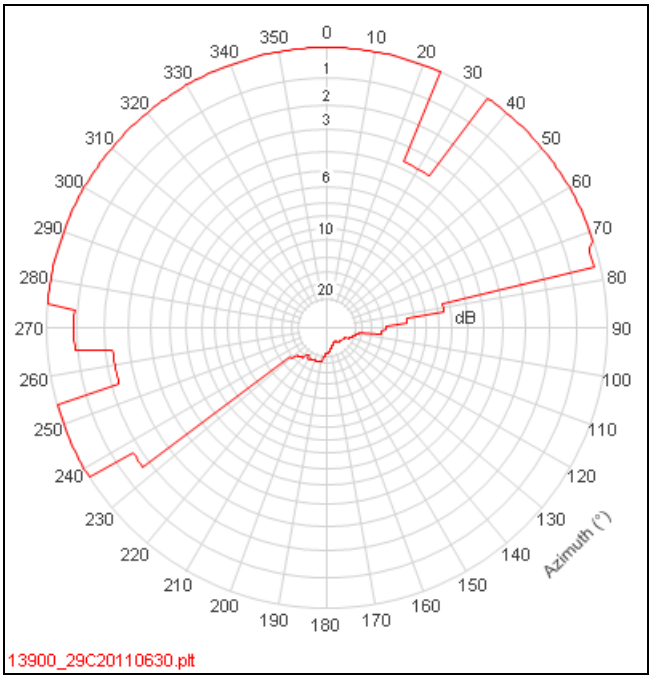

Figure A4-1: Antenna Template : 10 kW : Heathfield channel 29

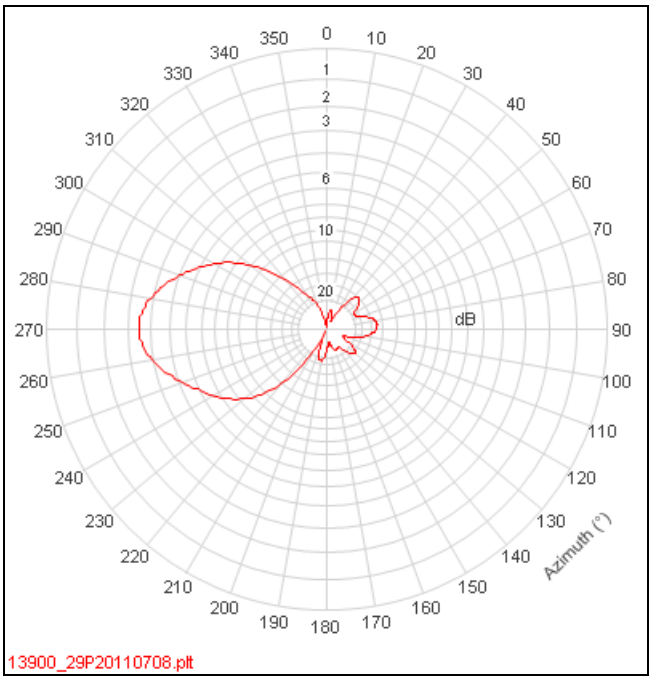

Figure A4-2 : Practical Pattern : Heathfield channel 29

ERP	2kW	Antenna Height	107 metres

Table A4-1 : Heathfield ch29: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	63,534	94,686
90%	47,794	63,125

Table A4-2 : Heathfield ch29 : Population served based on antenna

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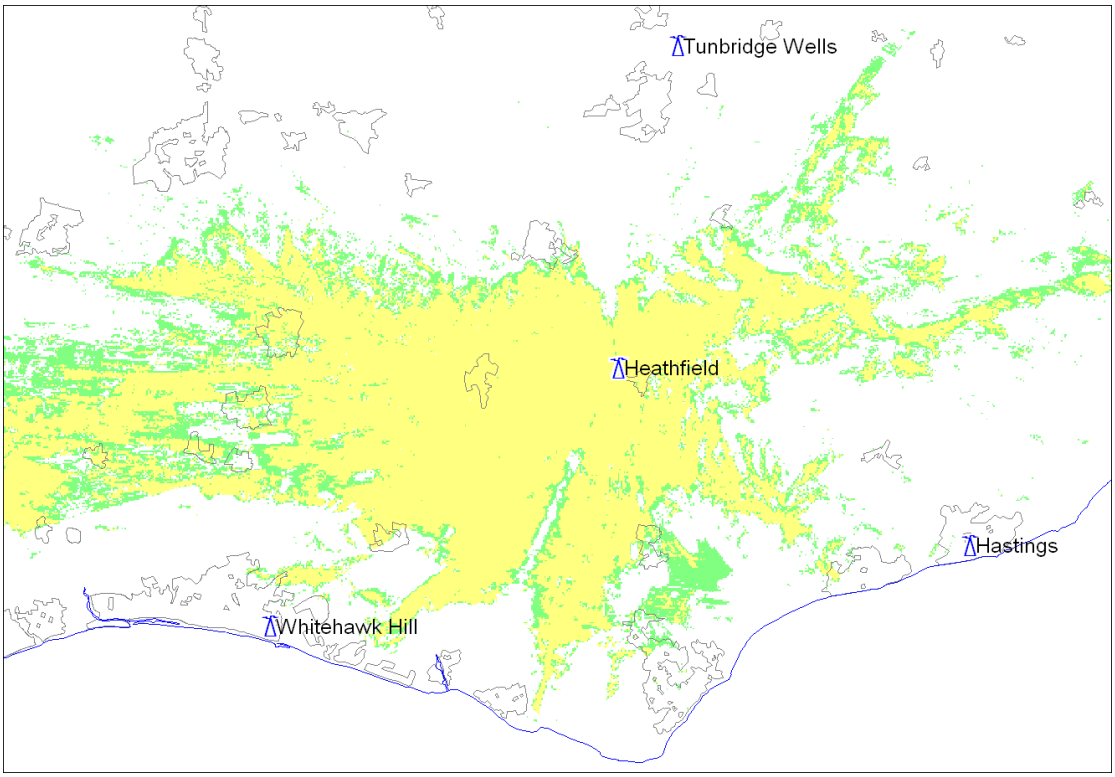

Figure A4-3: Heathfield ch29 : 2kW ERP: Practical antenna: 107 a.g.l

Practical Antenna:
The requirement is to serve Heathfield, Hailsham and Haywards Heath.

There are restrictions towards Ipswich Stoke (30°), Stockland Hill (260°-270°) and Sutton Row (270°). There are also foreign restrictions over the arc 73°-237°.

The foreign restrictions are the most onerous. A possible solution would be an antenna comprising panels directed towards each of the three main towns with a maximum ERP of 2kW.

Parts of Heathfield would be shielded from the transmitter if we used an antenna at half the main antenna height. Hence we suggest using a height around 107m with beam tilt to minimise signal levels towards France.

An alternative option is to use the main DTT antenna at an ERP of 100 Watts.

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Lancaster 10335

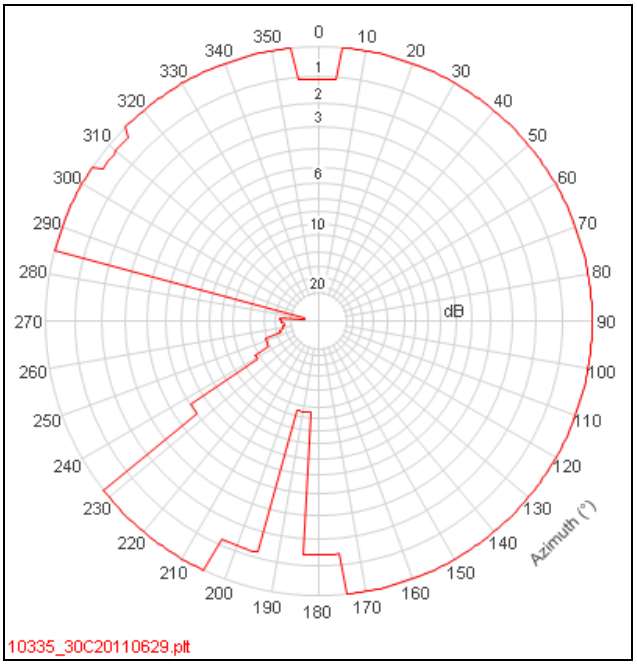

Figure A4-1: Antenna Template : 1kW : Lancaster channel 30

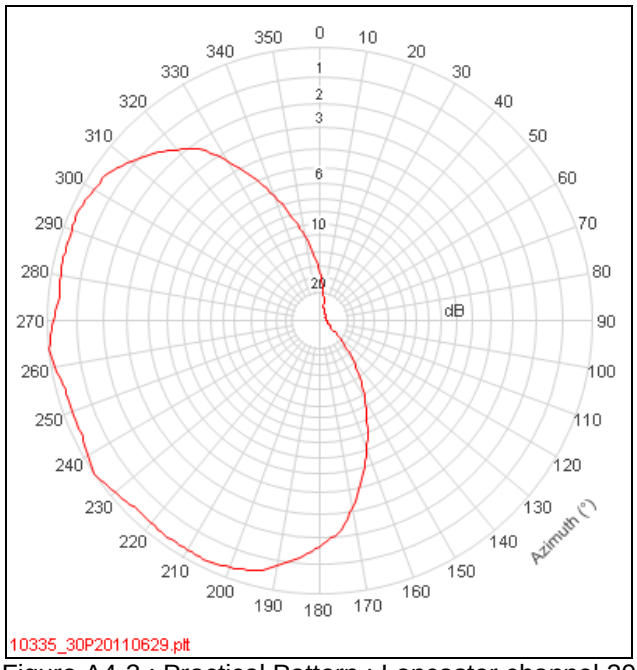

Figure A4-2 : Practical Pattern : Lancaster channel 30

ERP	100 Watts	Antenna Height	46 metres

Table A4-1 : Lancaster ch30: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	41,672	142,362
90%	36,229	97,415

Table A4-2 : Lancaster ch30: Population served based on antenna

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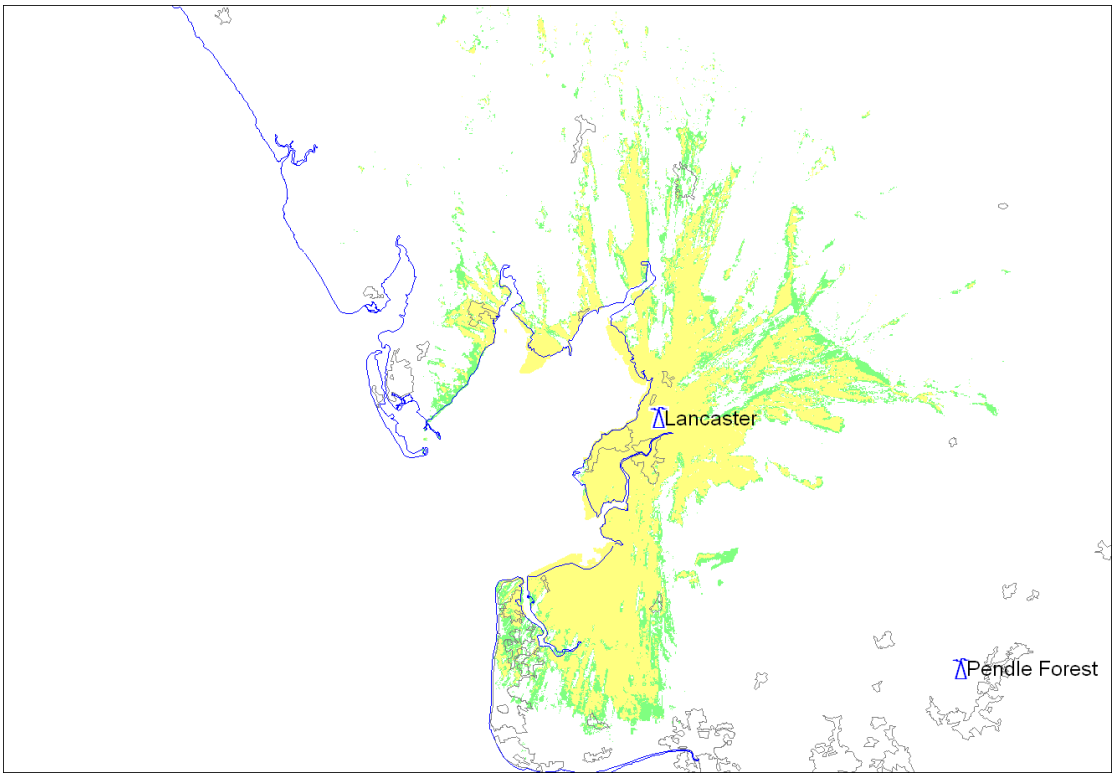

Figure A4-3: Lancaster ch30: 0.1kW ERP: Practical antenna: 46m a.g.l

Practical Antenna:
The requirement is to serve Lancaster and Morecambe.

There are restrictions towards Caldbeck (0°-10°, 270°-280° & 310°) and The Wrekin (180°-200°). There is also a restriction towards Ireland over the arc 233°-272°.

There is a relationship with Caldbeck; Lancaster COM4 and 5 (2kW) are co-channel with Caldbeck PSB1 and 2 (100kW) on channels 25 and 28.

There was a relationship with The Wrekin on low-power DTT as shown in the table below:

channel	21	24	27	31	34
Lancaster	C4	C3	BBC2	BBC1	Mux C
ERP (kW)	10	10	10	10	0.2
The Wrekin	Mux BBC	Mux A	Mux B	D3/4	BBC2
ERP (kW)	2	2	2	2	100

The areas we are required to serve are in the direction of the restriction towards Ireland. It may be possible to modify the restriction by negotiation but beam tilt could also be used to reduce signal levels to foreign test points.

A possible arrangement would comprise 90° crossed log-periodics.

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Londonderry 13001

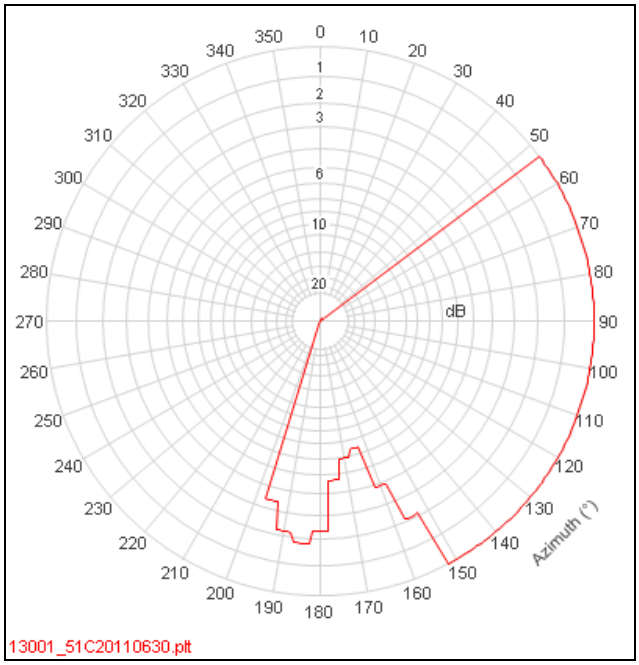

Figure A4-1: Antenna Template : 1 kW : Londonderry channel 51

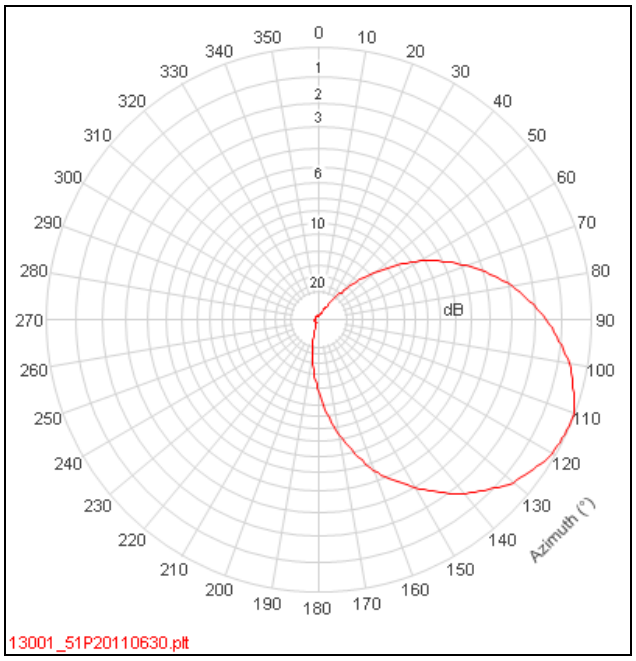

Figure A4-2 : Practical Pattern : Londonderry channel 51

ERP	1 kW	Antenna Height	59 metres

Table A4-1 : Londonderry ch 51: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	36,475	40,030
90%	34,740	36,763

Table A4-2 : Londonderry ch51: Population served based on antenna

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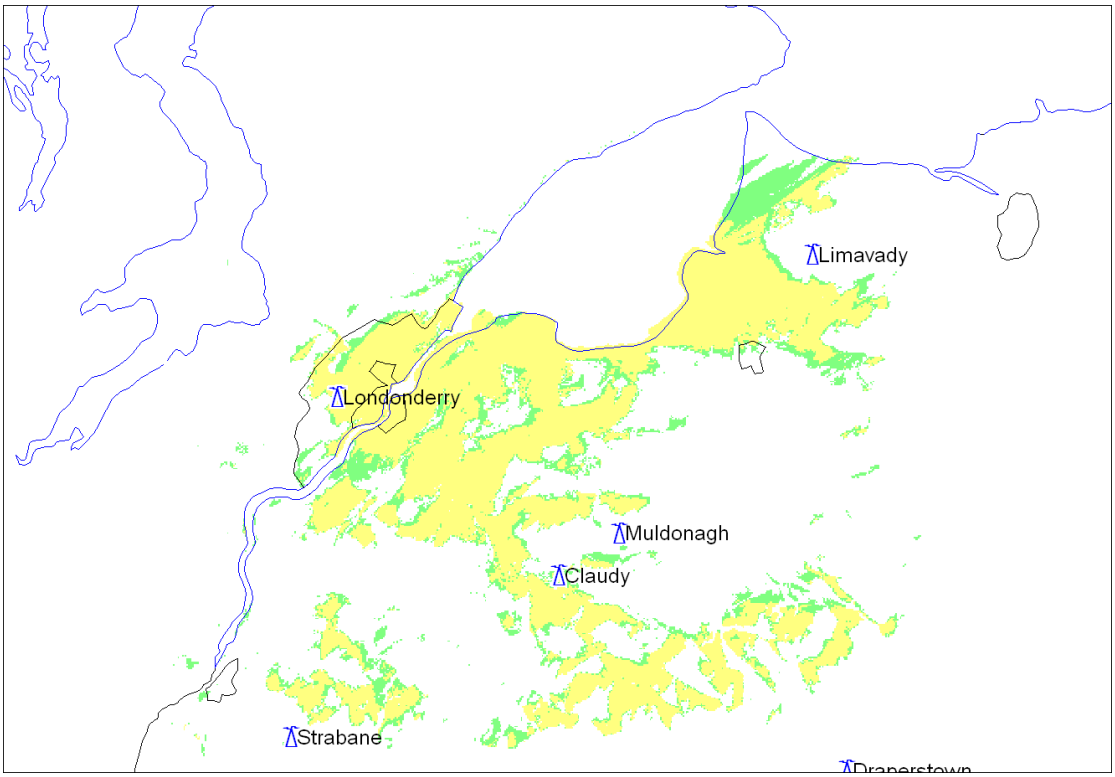

Figure A4-3: Londonderry ch51: 1kW ERP: Practical antenna: 59m a.g.l

Practical Antenna:
The requirement is to serve Londonderry.

There are restrictions no UK restrictions. The only restrictions are towards Ireland. Channel 51 is a GE06 position and as such is cleared at 2kW omni-directional with respect to Ireland

A possible solution would be crossed log-periodics on 115°.

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Llanddona 11800

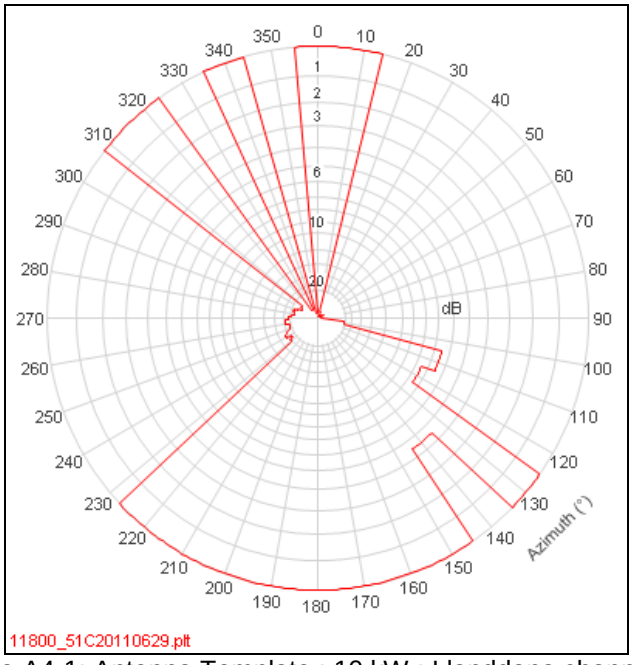

Figure A4-1: Antenna Template : 10 kW : Llanddona channel 51

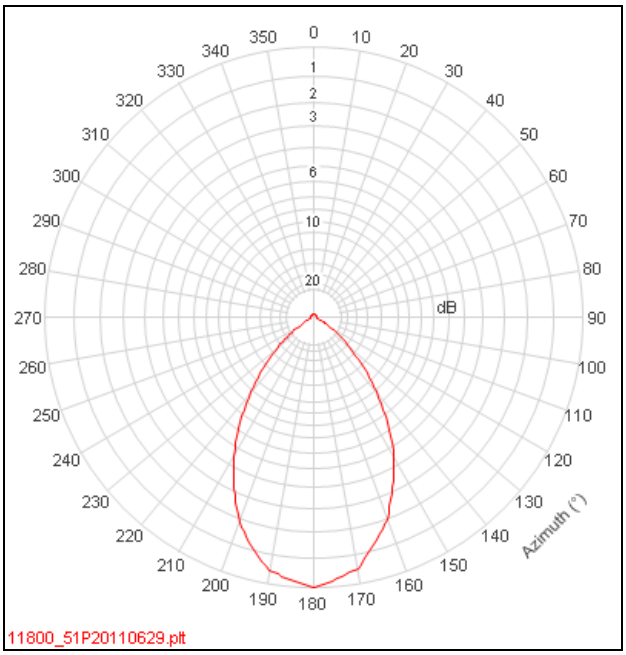

Figure A4-2 : Practical Pattern : Llanddona channel 51

ERP	1 kW	Antenna Height	56 metres

Table A4-1 : Llanddona ch51: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	16,948	21,500
90%	14,095	15,964

Table A4-2 : Llanddona ch51: Population served based on antenna

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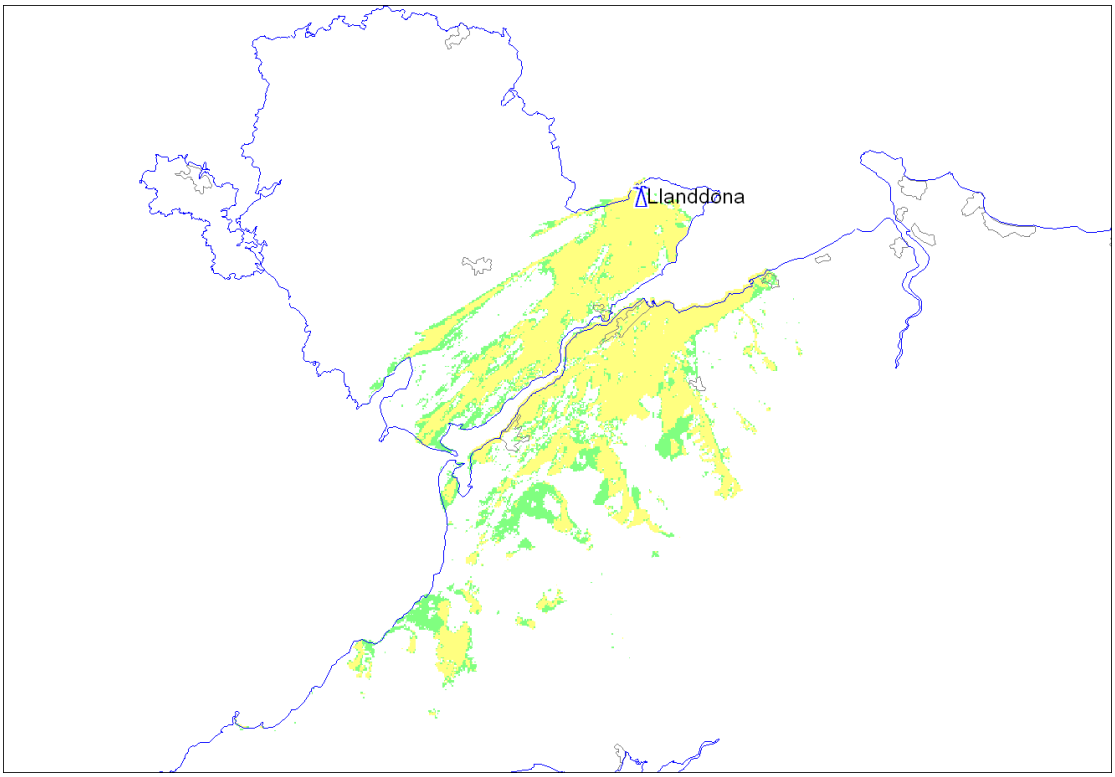

Figure A4-3: Llanddona ch51: 1kW ERP: Practical antenna: 56m a.g.l

Practical Antenna:
The requirement is to serve Bangor

There are restrictions towards Moel-y-Parc (20°-120°, 140° & 350°), Emley Moor (60°-90°), Saddleworth (80°) and Whitehead (330°). There is also a restriction towards Ireland over the arc 228°-307°

There was a relationship with Moel-y-Parc; low-power DTT at both stations used channels 54, 58, 61 and 65 with an ERP of 1kW at each station.

There was a relationship with Emley Moor; low-power DTT at both stations used channels 46 and 50. Emley Moor had an ERP of 10kW.

There was a relationship with Saddleworth; low-power DTT at both stations used channel 54. Saddleworth had an ERP of 40 watts.

There is no relationship with Whitehead. A desk-top survey shows viewers in the worst affected location watching Divis, Larne and Whitehead.

A possible arrangement would be log-periodics on 180° which meet the Irish restrictions.

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Presely 12900

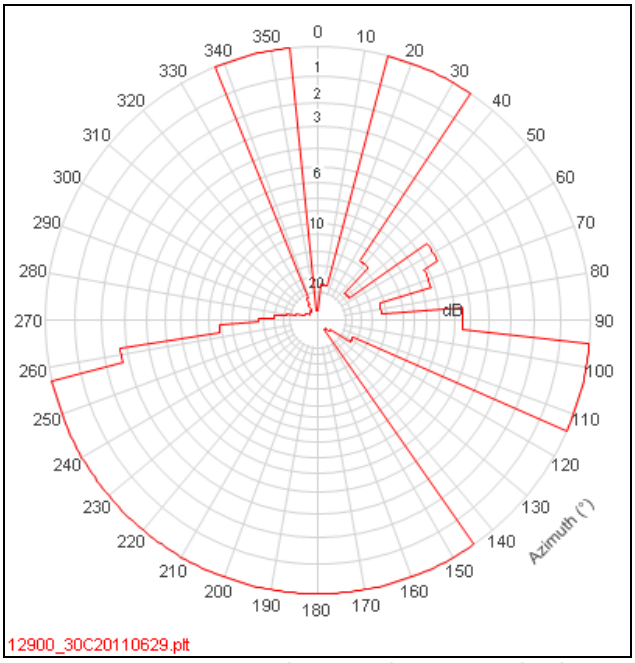

Figure A4-1: Antenna Template : 10 kW : Presely channel 30

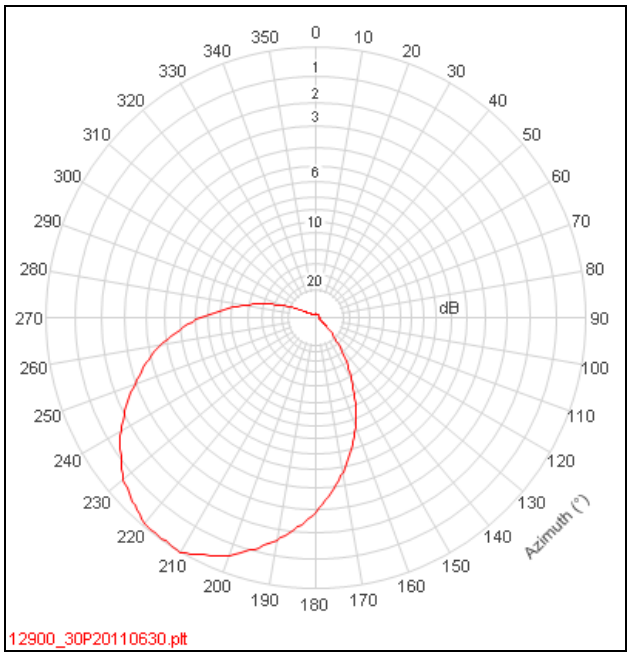

Figure A4-2 : Practical Pattern : Presely channel 30

ERP	2kW	Antenna Height	120 metres

Table A4-1 : Presely ch30: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	23,860	24,813
90%	16,331	16,662

Table A4-2 : Presely ch30 : Population served based on antenna

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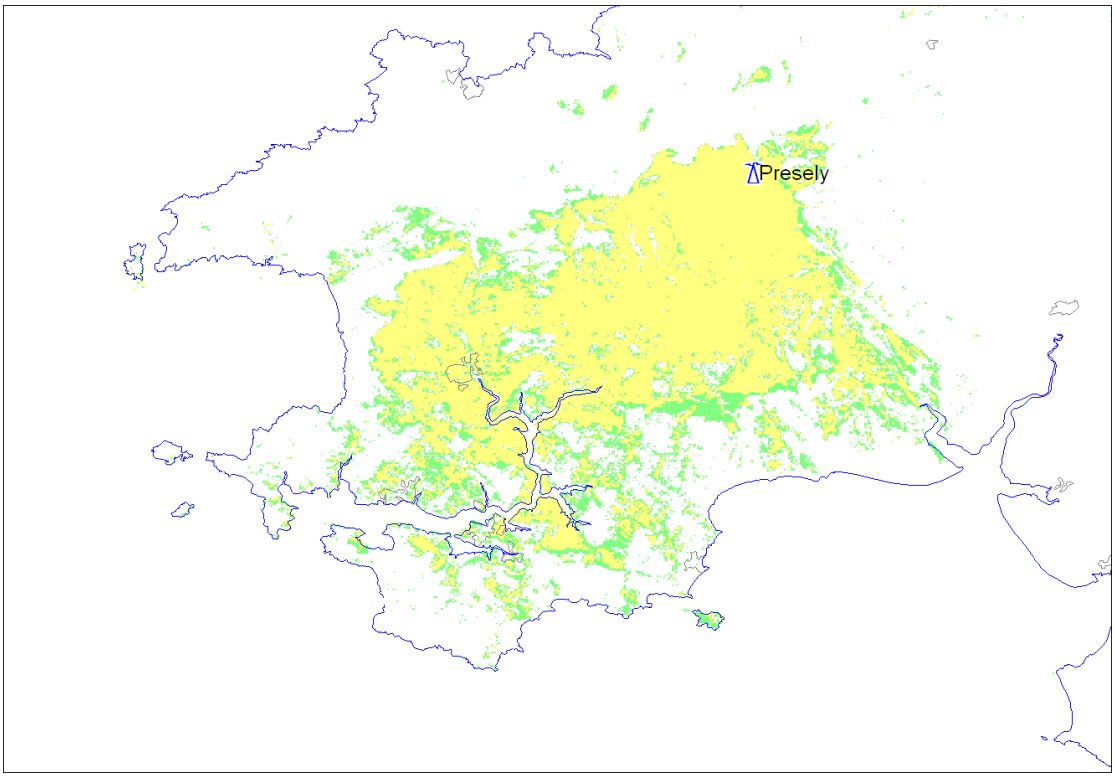

Figure A4-3: Presely ch30 : 2kW ERP: Practical antenna: 120m a.g.l

Practical Antenna:
The requirement is to serve Parts of Pembrokeshire.

There are restrictions towards Caldbeck (0°-10°), the Wrekin (40°-90°), Bromsgrove (70°-80°), and Ferryside (120°-140°). There is also a restriction towards Ireland over the arc 258°-337°

There was a relationship with low-power DTT at Caldbeck on channels 39, 42 and 45.

There is no relationship with Ferryside. In the worst affected Ferryside locations, Presely is predicted to be the best server.

A possible arrangement could comprise 50° crossed log-periodics on a bearing of 215° which, at an ERP of 2kW, offer protection to Ferryside while meeting the Irish restriction.

There is a relationship with Mount Leinster in Ireland. Three channels used at Mount Leinster are already in use at Presely. On the basis of existing interference it may be possible to negotiate some relaxation towards Ireland.

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Rosemarkie 15600

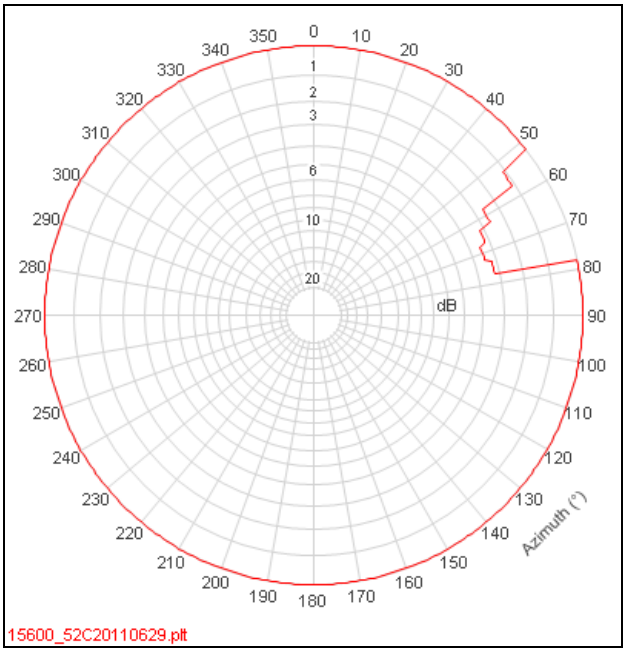

Figure A4-1: Antenna Template : 10 kW : Rosemarkie channel 52

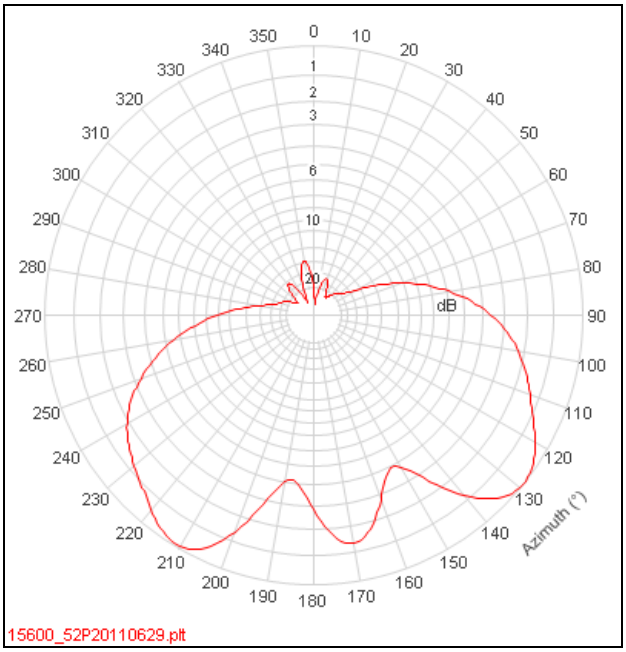

Figure A4-2 : Practical Pattern : Rosemarkie channel 52

ERP	1kW	Antenna Height	60 metres

Table A4-1 Rosemarkie ch52: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	49,806	71,689
90%	48,893	65,175

Table A4-2 : Rosemarkie ch52: Population served based on antenna

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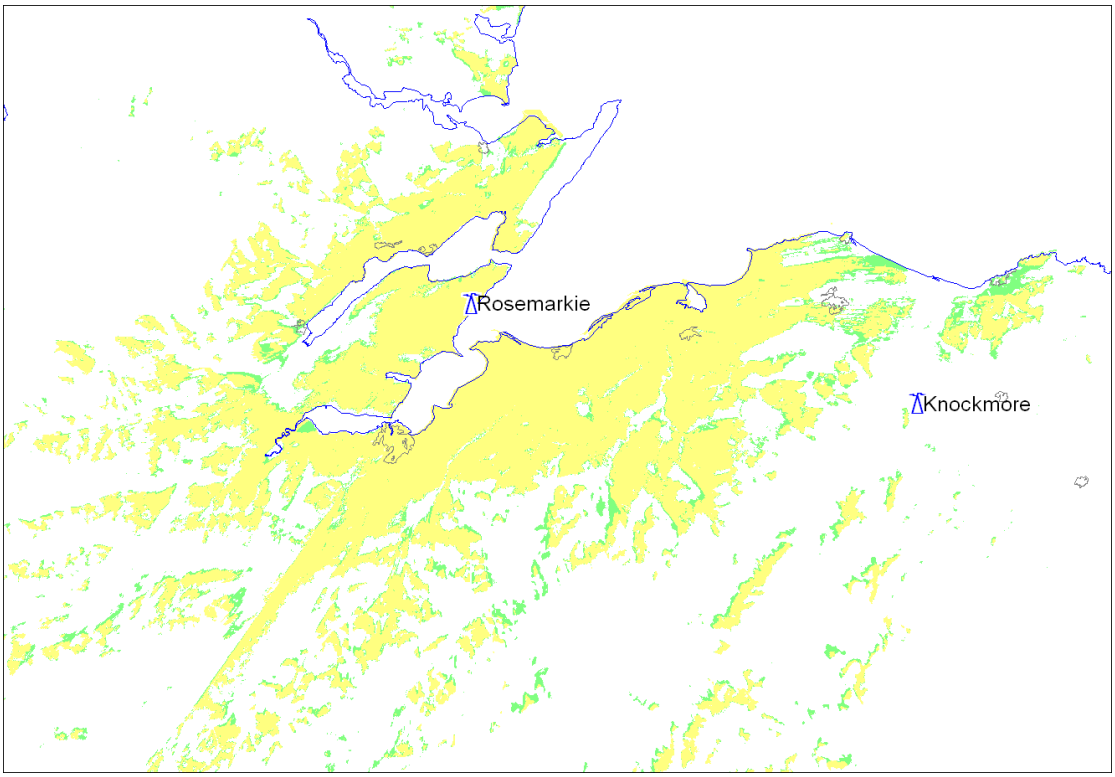

Figure A4-3: Rosemarkie ch52: 1kW ERP: Practical antenna: 60m a.g.l

Practical Antenna:
The requirement is to serve Inverness.

The only restriction is towards Norway over the arc 53°-77°

An arrangement of 90° Panels would serve Inverness and the north Morayshire coast.

An alternative antenna solution would be to share the main DTT antenna.

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Tay Bridge 12308

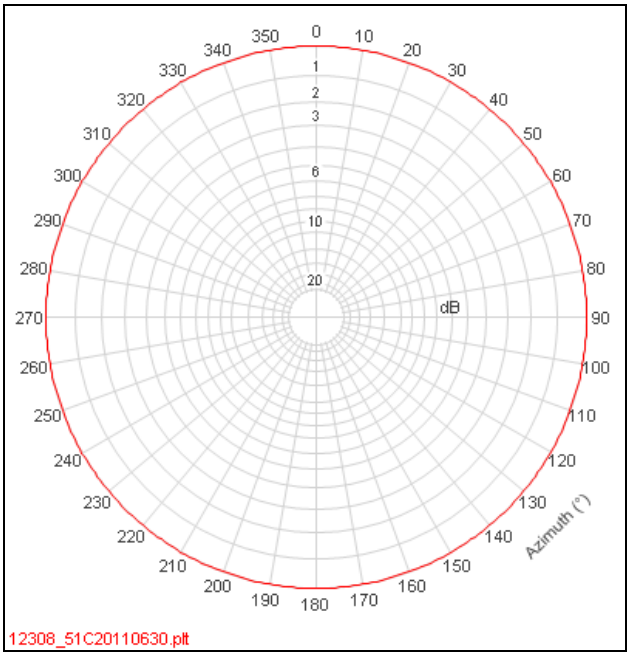

Figure A4-1: Antenna Template : 1 kW : Tay Bridge channel 51

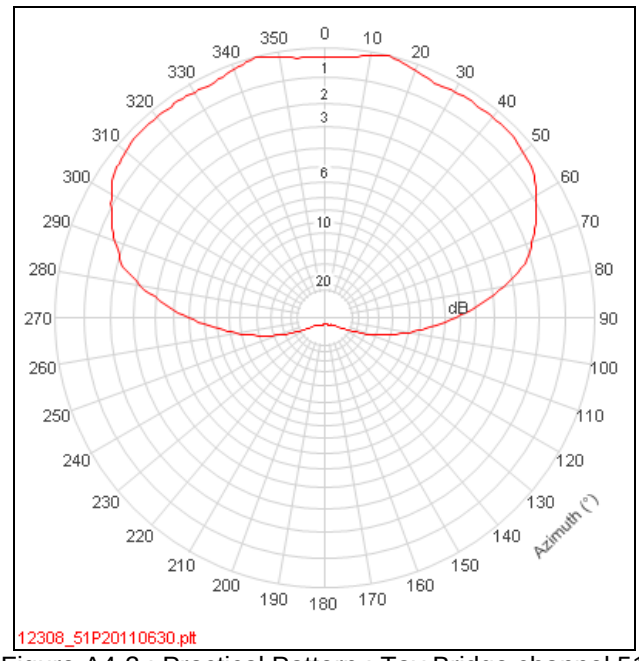

Figure A4-2 : Practical Pattern : Tay Bridge channel 51

ERP	10 Watts	Antenna Height	43 metres

Table A4-1 : Tay Bridge ch51: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	15,762	88,263
90%	15,693	80,143

Table A4-2 : Tay Bridge ch51: Population served based on antenna

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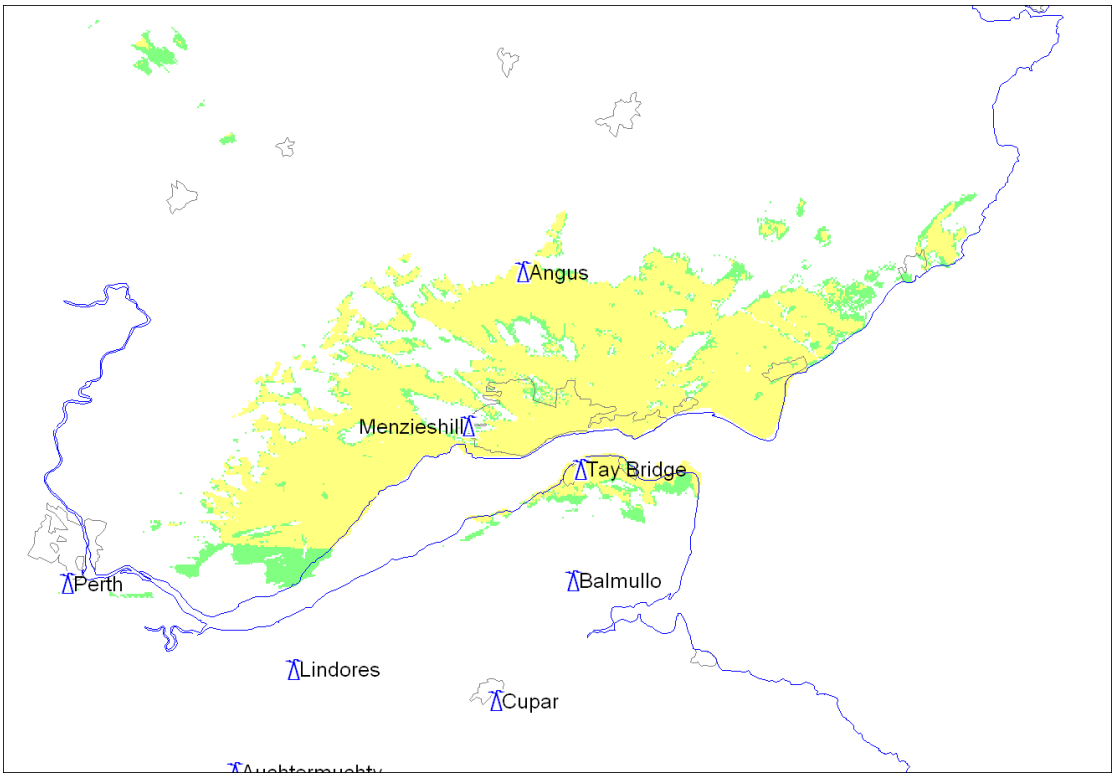

Figure A4-3: Tay Bridge ch51: 10 Watts ERP: Practical antenna: 43m a.g.l

Practical Antenna:
The requirement is to augment coverage of Dundee.

There are no restrictions on this channel.

The existing services at Tay Bridge operate with an ERP of 10 watts. A possible arrangement would be 90° crossed log-periodics to cover Dundee and Broughty Ferry. As there are no restrictions the main DTT antenna could be used.

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Annex 5 : Templates & Practical Patterns – Group D

The stations in Group D and their prime target areas are detailed in Table A5-1.

Station ID	Transmitter Station	Target Urban area	Comment
13200	Stockland Hill	Exeter, Honiton	
14500	Moel-y-Parc	Ruthin, Mold	
12500	Midhurst	Horsham, Petersfield	
10104	Tunbridge Wells	North parts of Tunbridge Wells	
15100	Brougher Mountain	Omagh	
10302	Pendle Forest	Burnley and surrounding areas	
15211	Rosneath VP	Greenock	
10208	Lark Stoke	Stratford-upon-Avon	
10407	Keighley	Keighley	
10804	Poole	Poole	
15300	Knockmore	Elgin	
12002	Olivers Mount	Scarborough	
10801	Salisbury	Salisbury	
12402	Luton	Luton	

Table A5-1 : 14 DTT Stations studied in Group D

The predicted coverage of the stations using the suggested 'practical solutions' is summarised in Table A5-2.

		Households served				Households served	
Station	ch	Net	Gross	Station	ch	Net	Gross
Brougher Mountain	26	10,975	13,012	Olivers Mount	56	33,376	44,426
Keighley	56	34,473	78,570	Pendle Forest	30	82,374	119,515
Knockmore	56	28,722	49,938	Poole	50	20,864	50,652
Lark Stoke	48	28,828	68,289	Rosneath VP	48	33,530	45,620
Luton	45	22,936	80,931	Salisbury	51	30,573	41,796
Midhurst	51	62,987	90,379	Stockland Hill	39	43,202	85,359
Moel-y-Parc	56	25,194	88,868	Tunbridge Wells	51	44,835	62,311

Table A5-2: Predicted coverage (households) of Geographically Interleaved channels based on 'practical solutions' : DVB-T QPSK 2/3

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Brougher Mountain 15100

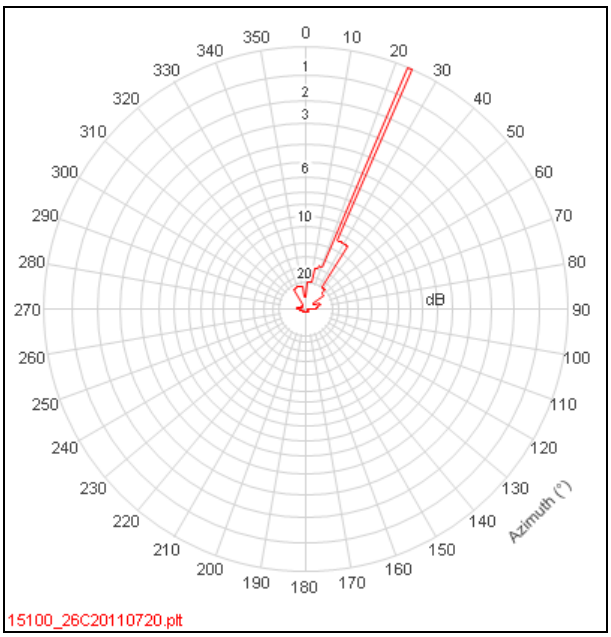

Figure A5 -1: Antenna Template :10kW : Brougher Mountain channel 26

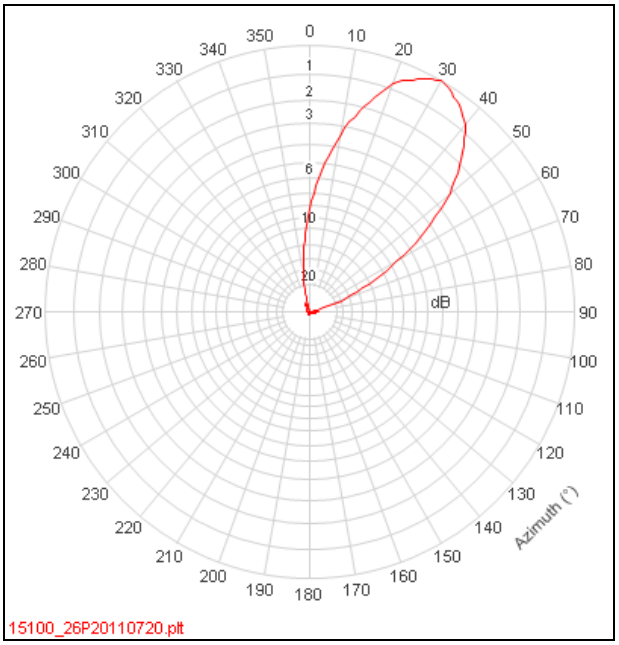

Figure A5-2 : Practical Pattern : Brougher Mountain channel 26

ERP	1 kW	Antenna Height	50 metres

Table A5-1 : Brougher Mountain ch26 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	10,975	13,012
90%	9,410	10,395

Table A5-2 : Brougher Mountain ch26 : Population served based on antenna

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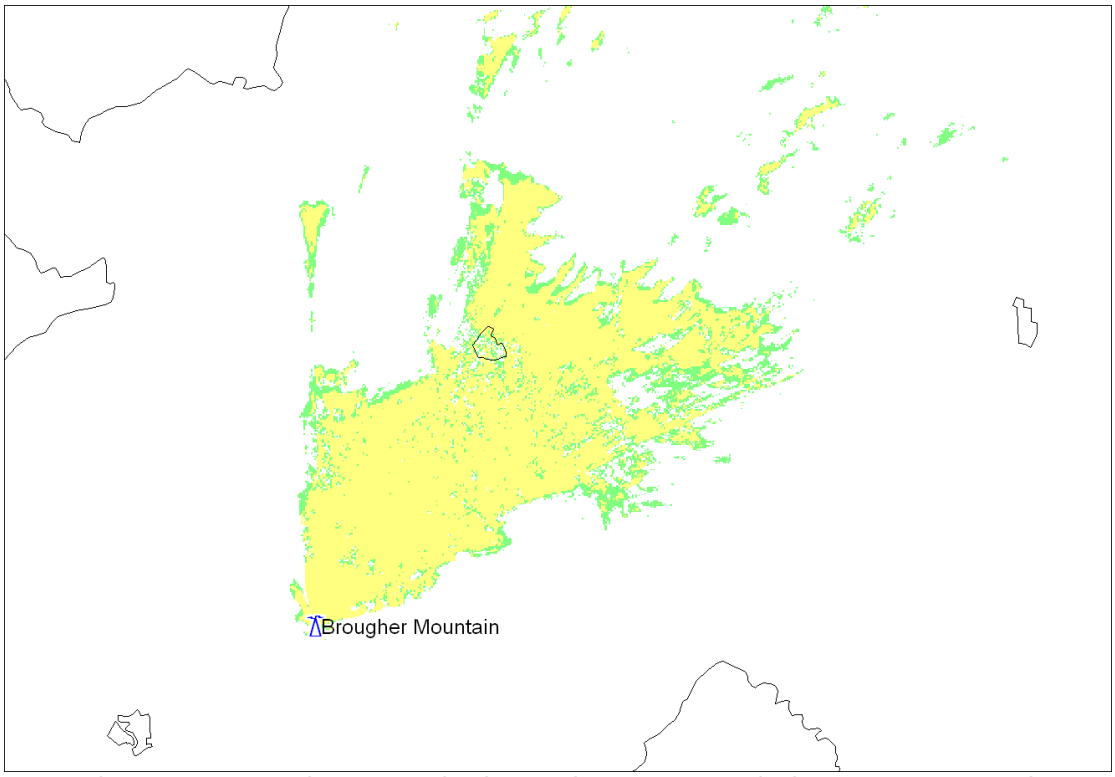

Figure A5-3: Brougher Mountain ch26 : 1 kW ERP : Practical antenna : 50m a.g.l

Practical Antenna:
The requirement is to serve Omagh.
.
There are restrictions towards Divis (10°, 30°-120°, 140°-160°), Eitshal (10°), Torosay (30°), Darvel (50°-60°) and Caldbeck (80°-90°) .There is also a restriction towards Ireland over the arc 88°-22°.

There are relationships with all these stations. Brougher Mountain's COM channels are co-channel with Divis, Darvel and Torosay PSB channels and Eitshal COM channels. Caldbeck PSD1 and PSB 2 are co-channel with two of Brougher Mountain's PSB services on channels 25 and 28.

Bayed log-periodics could provide area coverage while meeting the Irish restrictions but Omagh itself is poorly served. Increasing antenna height or ERP within limits does not appear to make a significant difference to coverage in Omagh. The GI channel operating with the parameters proposed offers coverage comparable to, or better in Omagh than, that of the commercial multiplexes.

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Keighley 10407

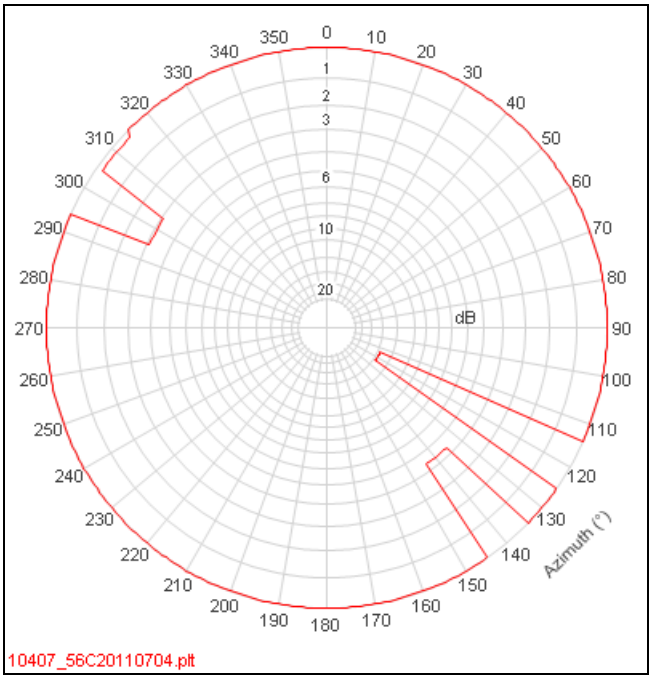

Figure A5-1: Antenna Template : 1kW : Keighley channel 56

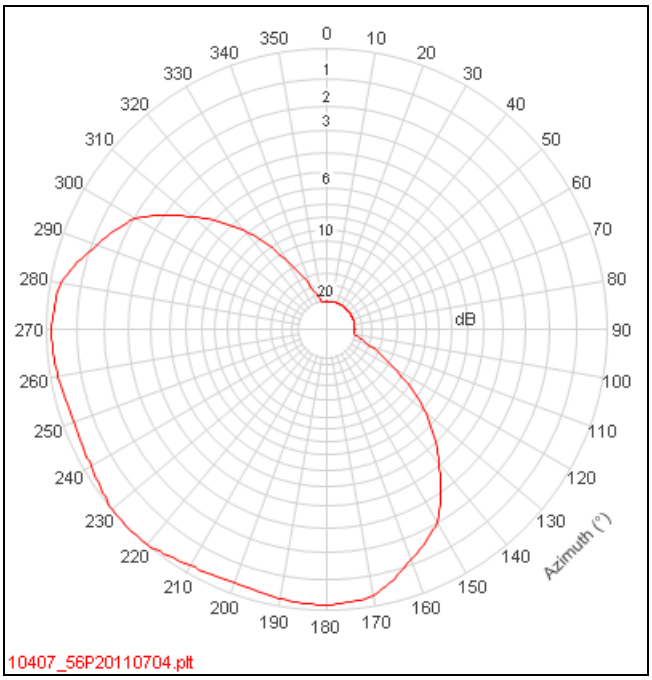

Figure A5-2 : Practical Pattern : Keighley channel 56

ERP	0.1kW	Antenna Height	42 metres

Table A5-1 : Keighley ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	34,473	78,570
90%	34,159	64,542

Table A5-2 : Keighley ch56 : Population served based on antenna

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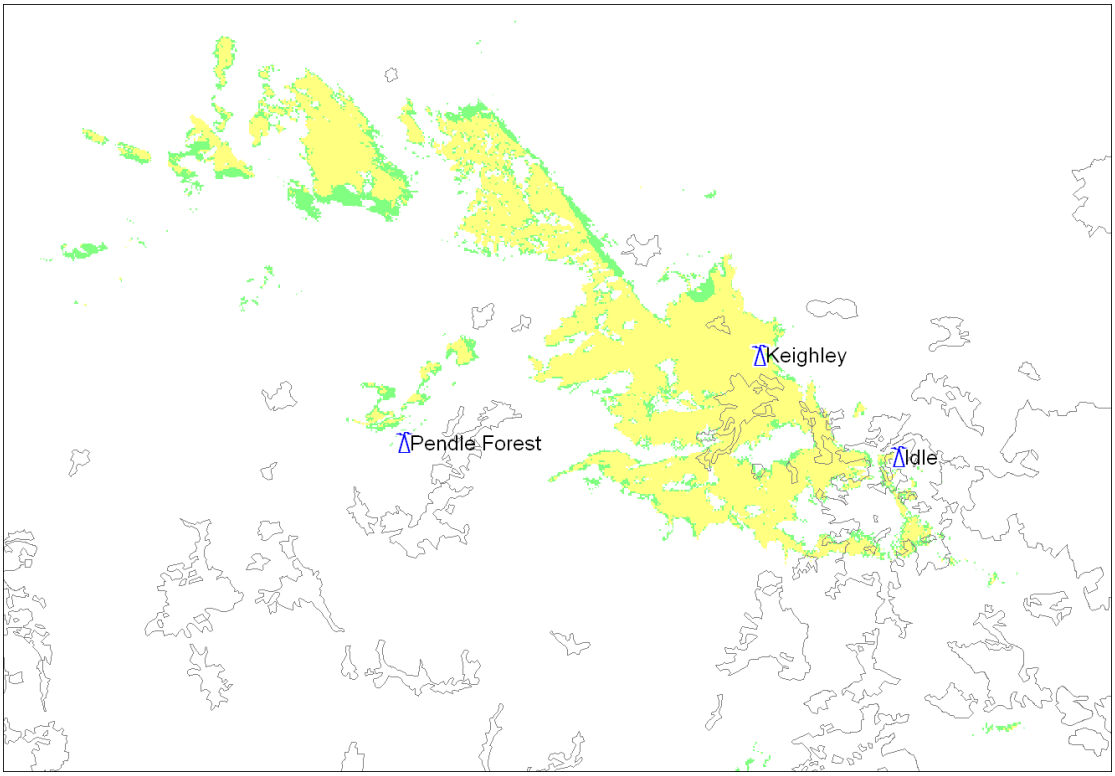

Figure A5-3: Keighley ch56 0.1kW ERP : Practical antenna : 42m a.g.l

Practical Antenna:
The requirement is to serve Keighley.

There are restrictions towards Waltham (120° & 140°) and Crosthwaite (300°-310°)

There is a relationship with Waltham; it is co-channel with Keighley on all PSBs and one COM channel. As such this relationship on the main channels rather than the GI channel will determine core coverage at Waltham and thus the restrictions on the GI channel can be relaxed.

There was a relationship with Crosthwaite and Keighley low-power DTT (0.1kW).

Crossed log-periodics on 225° would give a pattern similar to the DTT antennas.

Operating at 100 Watts provides comparable coverage to the main multiplexes and meets all the restrictions, bar the one towards Waltham on 120° which can be relaxed because of existing relationships between the stations.

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Knockmore 15300

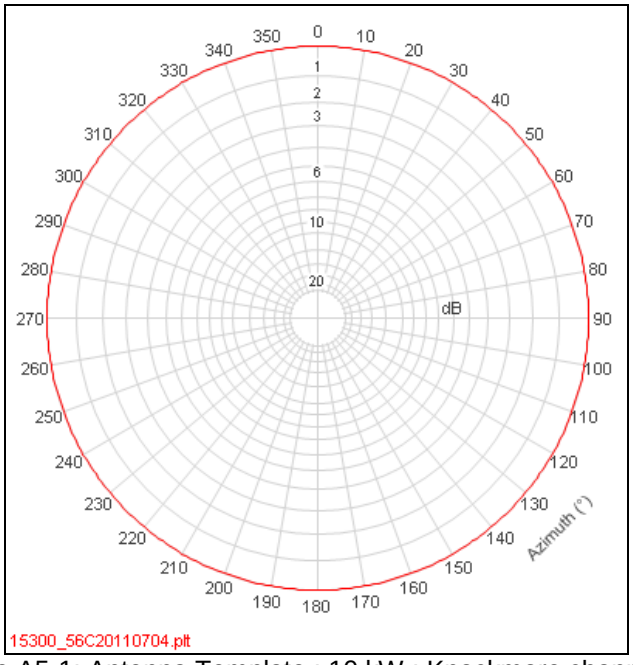

Figure A5-1: Antenna Template : 10 kW : Knockmore channel 56

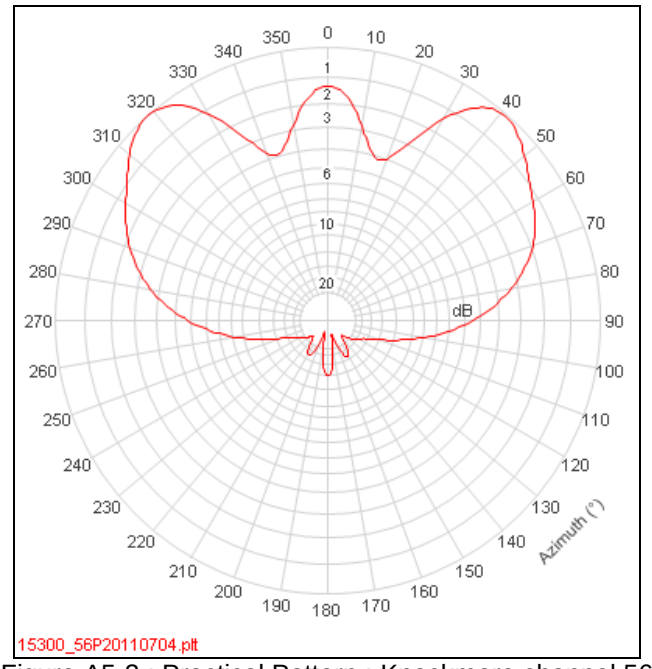

Figure A5-2 : Practical Pattern : Knockmore channel 56

ERP	2 kW	Antenna Height	56 metres

Table A5-1 : Knockmore ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	28,722	49,938
90%	28,313	41,740

Table A5-2 : Knockmore ch56 : Population served based on antenna

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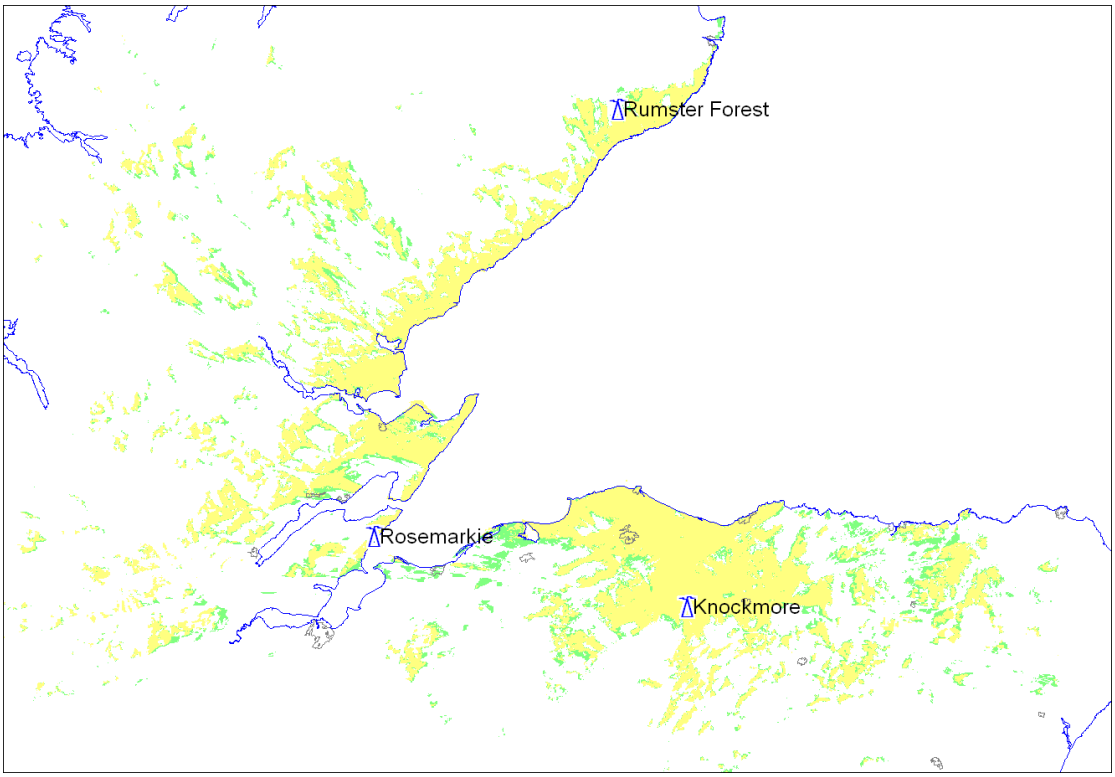

Figure A5-3: Knockmore ch56 : 2kW ERP: Practical antenna: 56m a.g.l

Practical Antenna:
The requirement is to cover Elgin.

There are no restrictions either national or international.

A possible design to serve Elgin, Keith and the surrounding area could comprise 90° panels on a bearing of 0° ETN.

As there are no restrictions it would be also possible to share the main DTT antenna.

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Lark Stoke 10208

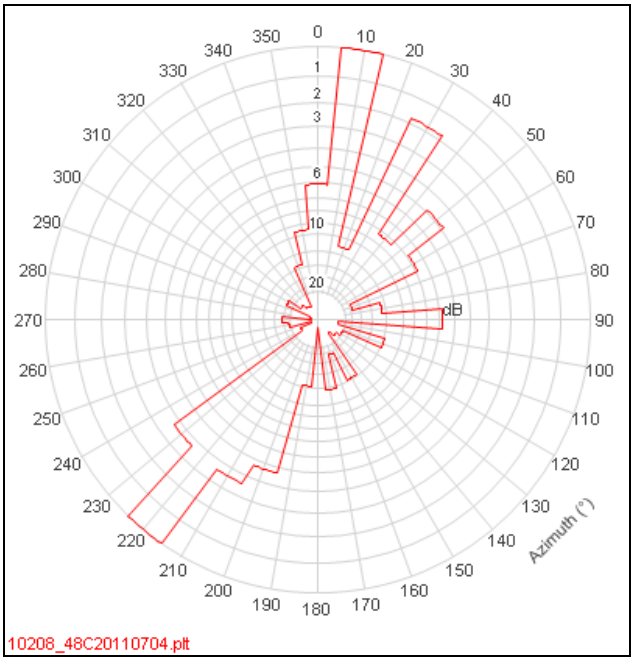

Figure A5-1: Antenna Template: 1kW : Lark Stoke channel 48

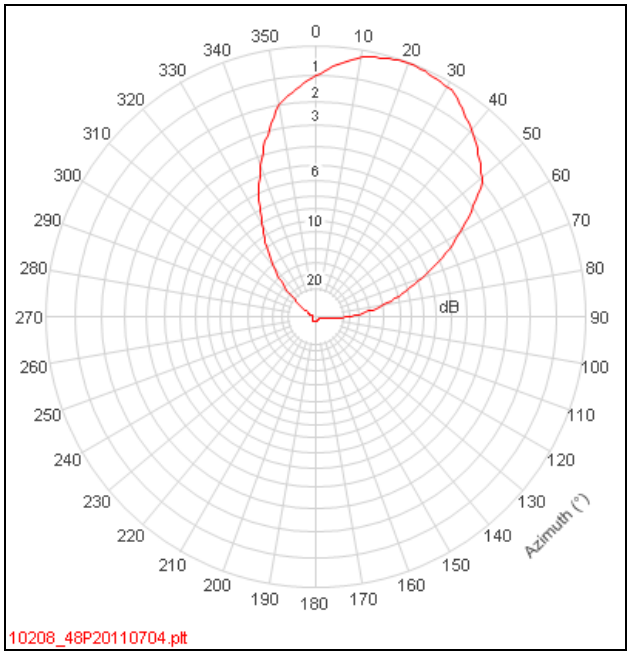

Figure A5-2 : Practical Pattern : Lark Stoke channel 48

ERP	0.1kW	Antenna Height	10 metres

Table A5-1 : Lark Stoke ch48 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	28,828	68,289
90%	25,635	42,750

Table A5-2 : Lark Stoke ch48 : Population served based on antenna

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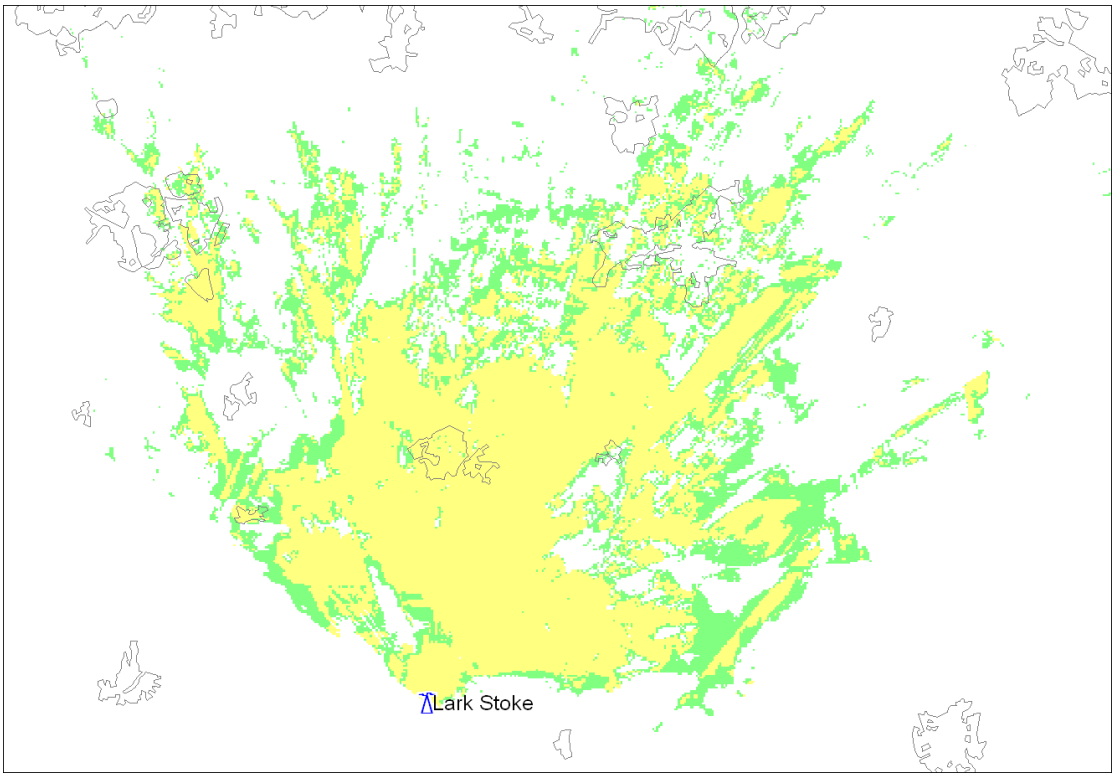

Figure A5-3: Lark Stoke ch48 : 0.1kW ERP : Practical antenna: 10m a.g.l

Practical Antenna:
The requirement is to serve Stratford-upon-Avon.

There are restrictions towards Hartington (0°), Sandy Heath (20°-130° &150-160°), Nottingham and Emley Moor (20°), Bretch Hill (90°-100°), Mendip (100°, 140°-210° & 230°-330°), Over Norton (140° & 160°), Guildford & Hemdean VP (140°), Kinver (320°), Harborne (340°) and Cheadle (350°). There was a relationship between Low-power DTT at Lark Stoke and ATV at Sandy Heath and Nottingham as shown in the table below:

channel	21	24	27	31
Lark Stoke	D1	D3	D4	D2
ERP (kW)	0.025	0.025	0.025	0.025
Sandy Heath	C4	C3	BBC2	BBC1
ERP (kW)	1000	1000	1000	1000
Nottingham	BBC1	C3	BBC2	C4
ERP (kW)	2	2	2	2

There is a relationship with Emley Moor; Lark Stoke COM services are co-channel with Emley Moor PSB services. There is no relationship with Mendip. In the worst affected locations on 320° and 330°, Mendip is not predicted to give a good service. Our desk-top study shows antennas directed towards Sutton Coldfield and Ridge Hill.

Log-periodics on 20° would serve Stratford-upon-Avon. The structure at Lark Stoke is very crowded and it may be difficult to find an aperture for a new antenna. An alternative would be to use the mast at Ilmington located about 2km East of Lark Stoke.

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Luton 12402

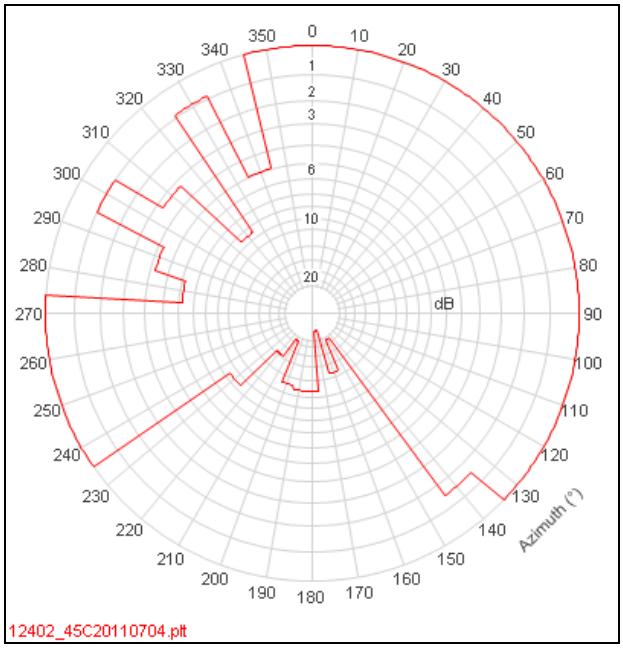

Figure A5-1: Antenna Template : 1kW : Luton channel 45

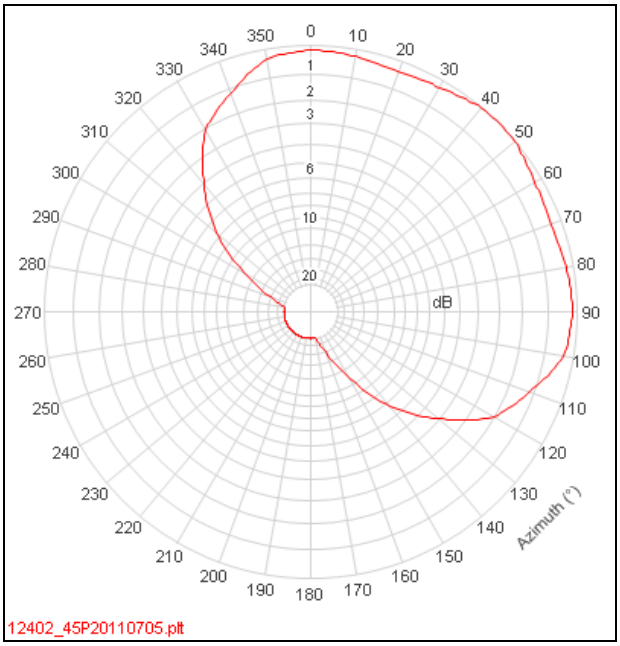

Figure A5-2 : Practical Pattern : Luton channel 45

ERP	0.05 kW	Antenna Height	42 metres

Table A5-1 : Luton ch45 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	22,936	80,931
90%	22,936	70,347

Table A5-2 : Luton ch45 : Population served based on antenna

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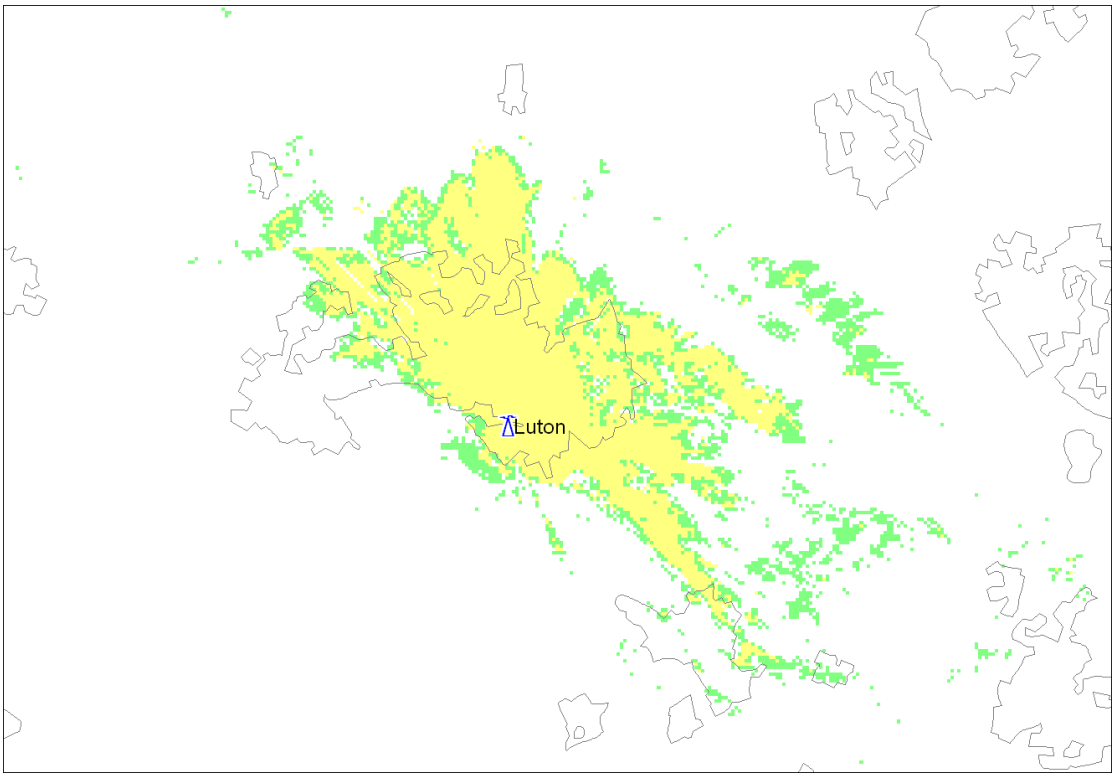

Figure A5-3: Luton ch45: 0.05 kW ERP : Practical antenna: 42m a.g.l

Practical Antenna:

The requirement is to serve Luton.

There are restrictions towards Walthamstow North (140°), Hannington (150°-230°), Biggin Hill and Poplar (150°) and Sutton Coldfield (280°-340°).

There was a relationship with Sutton Coldfield; Luton ATV BBC1 (0.08kW) used channel 55 which was co-channel with Sutton Coldfield D6 (8kW).

A possible antenna comprises 90° crossed log-periodics. Operated at 50w ERP, this antenna meets the template. At this ERP it would also be possible to use the main DTT antenna.

The Luton site is a sensitive one. It is very close to neighbouring properties and relations with neighbours and the landlord may preclude the use of a separate antenna.

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Midhurst 12500

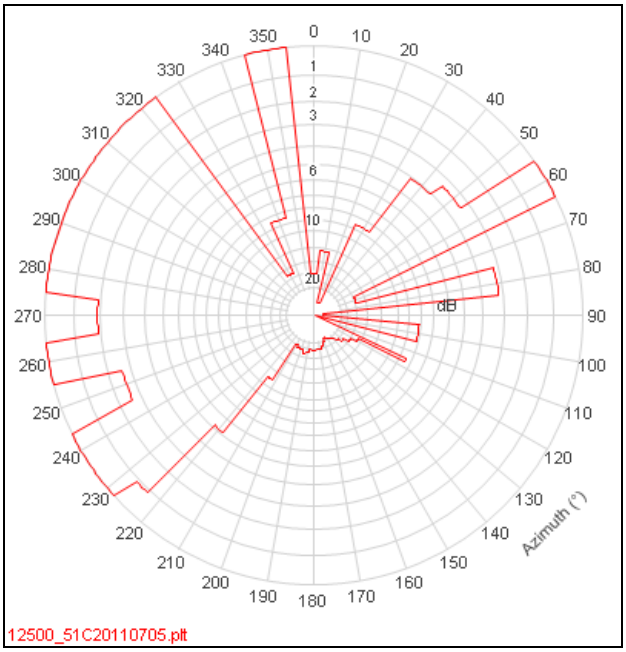

Figure A5-1: Antenna Template : 10kW : Midhurst channel 51

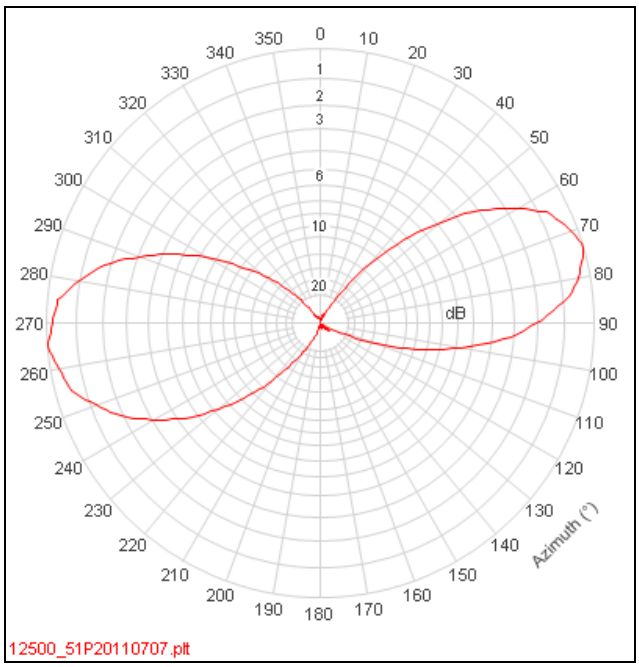

Figure A5-2 : Practical Pattern : Midhurst channel 51

ERP	1kW	Antenna Height	57 metres

Table A5-1 : Midhurst ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	62,987	90,379
90%	57,144	74,960

Table A5-2 : Midhurst ch51 : Population served based on antenna

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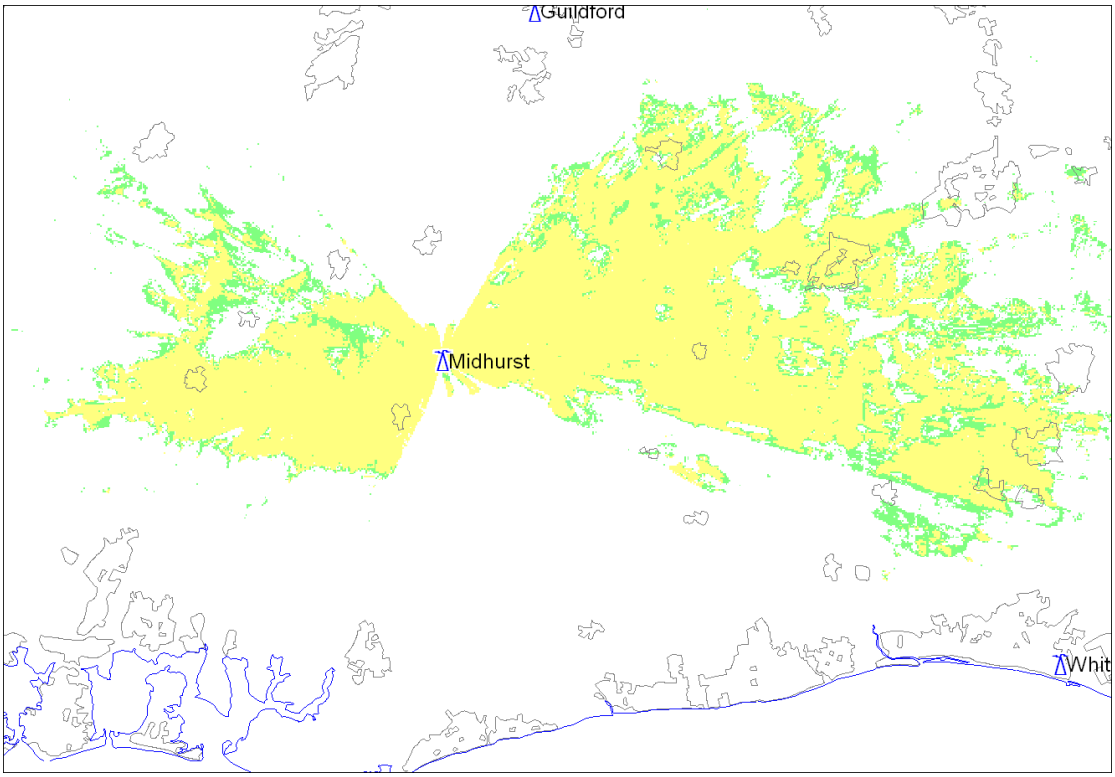

Figure A5-3: Midhurst ch51 : 1kW ERP: Practical antenna: 57m a.g.l

Practical Antenna:
The requirement is to serve Horsham and Petersfield.

There are restrictions towards Sandy Heath (0°-50° & 330°-340°), Dover (70°-110°), Whitehawk Hill (90°-150°) and Beacon Hill (250° & 270°). There are also foreign restrictions over the arc 88°-227°.

There is a relationship with Dover. Channels 50, 55 and 59 are used at both sites.

There is a relationship with Whitehawk Hill. Channel 56 is used for COM5 at Whitehawk Hill and PSB2 at Midhurst.

There were relationships with low-power DTT at Beacon Hill as outlined in the table below:

channel	56	58	61	65
Midhurst	Mux BBC	C3	BBC1	Mux B
ERP (kW)	2	100	100	2.5
Beacon Hill	Mux B	Mux A	D3/4	Mux D
ERP (kW)	1	2	2	1

There is no relationship with Sandy Heath.

A possible arrangement would be bayed logs on 74° towards Horsham with logs on 265° towards Petersfield which protects Sandy Heath while meeting the continental restrictions.

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Moel-y-Parc 14500

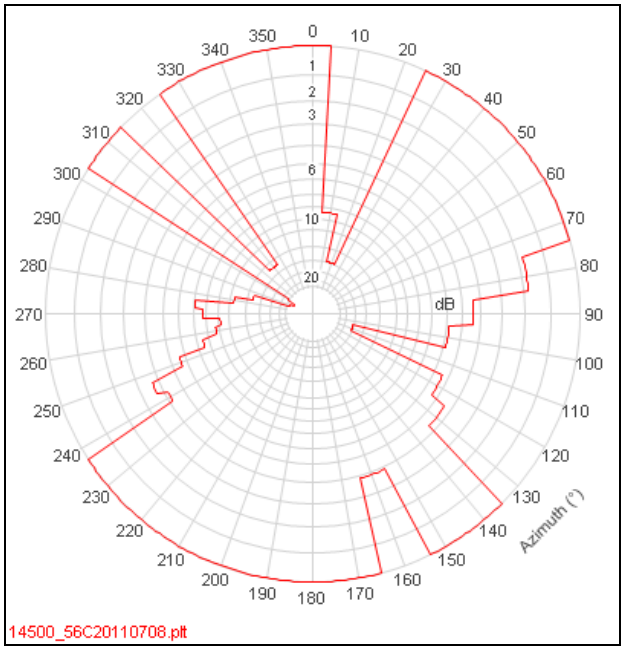

Figure A5-1 : Antenna Template : 10 kW : Moel-y-Parc channel 56

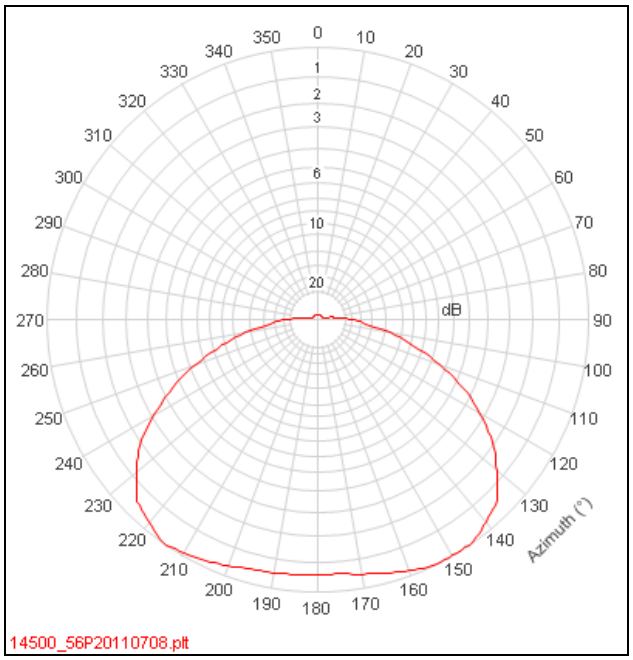

Figure A5-2 : Practical Pattern : Moel-y-Parc channel 56

ERP	2 kW	Antenna Height	118 metres

Table A5-1 : Moel-y-Parc ch 56: Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	25,194	88,868
90%	22,526	50,186

Table A5-2 : Moel-y-Parc ch56 : Population served based on antenna

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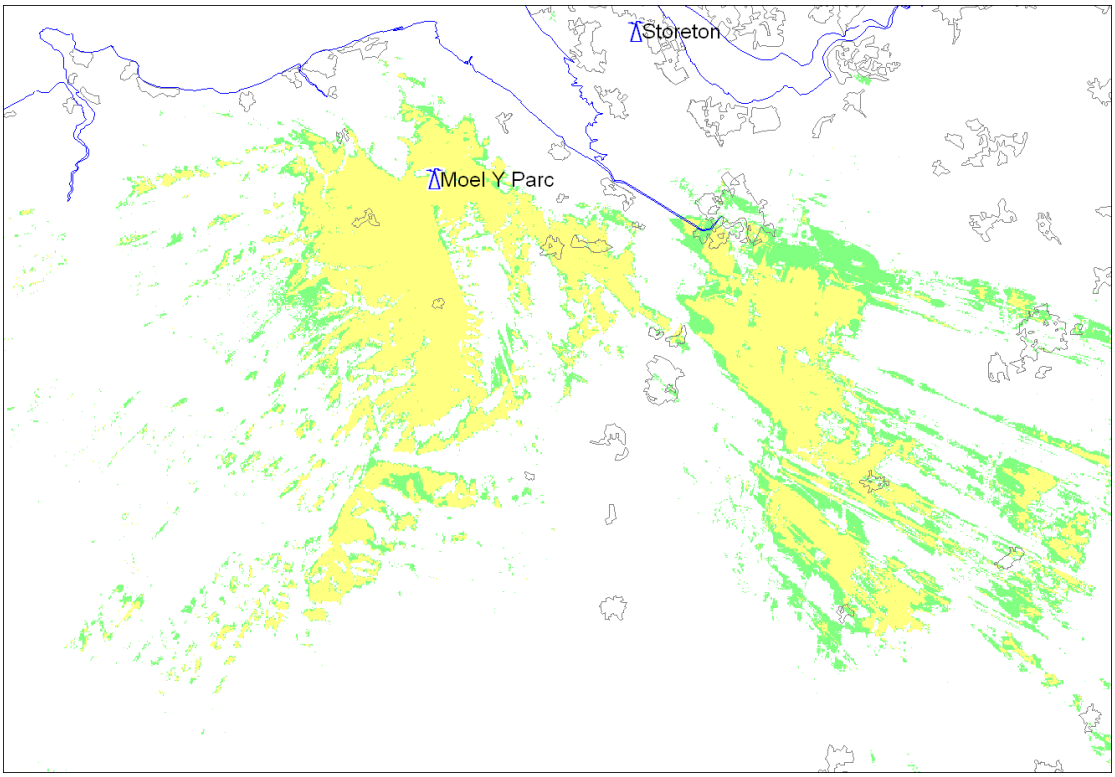

Figure A5-3 : Moel-y-Parc ch56: 2kW ERP : Practical antenna: 118m a.g.l

Practical Antenna:
The requirement is to serve Ruthin and Mold.

There are restrictions towards Crosthwaite (10°), Far Highfield (20°), Millthrop (20°), Waltham (80°-130°), Cheadle (100°-110°), Hartington (100°), Mendip (160°), Whitehead (320°) and Bellair (320°). There is also a restriction towards Ireland over the arc 238°-302°.

There is a relationship between Moel-y-Parc and Mendip. Both sites use channels 48 and 52 for COM services. Using channel 56 for a GI service at Moel-y-Parc would have a lesser effect on Channel 56 at Mendip than is already being experienced on channels 48 and 52.

There is a relationship between Moel-y-Parc and Cheadle. Both sites use channels 48 and 52, Moel-y-Parc for COM services and Cheadle for PSB. Using channel 56 for a GI service at Moel-y-Parc would have a lesser effect on Channel 56 at Cheadle than is already being experienced on channels 48 and 52.

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Olivers Mount 12002

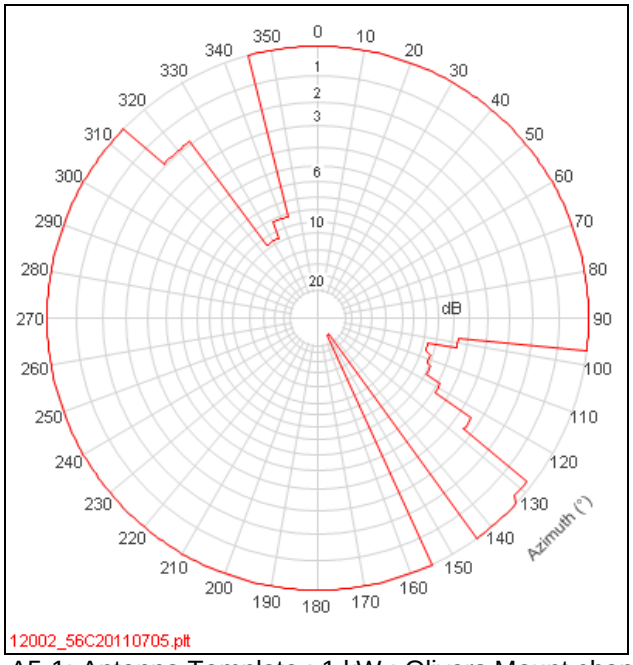

Figure A5-1: Antenna Template : 1 kW : Olivers Mount channel 56

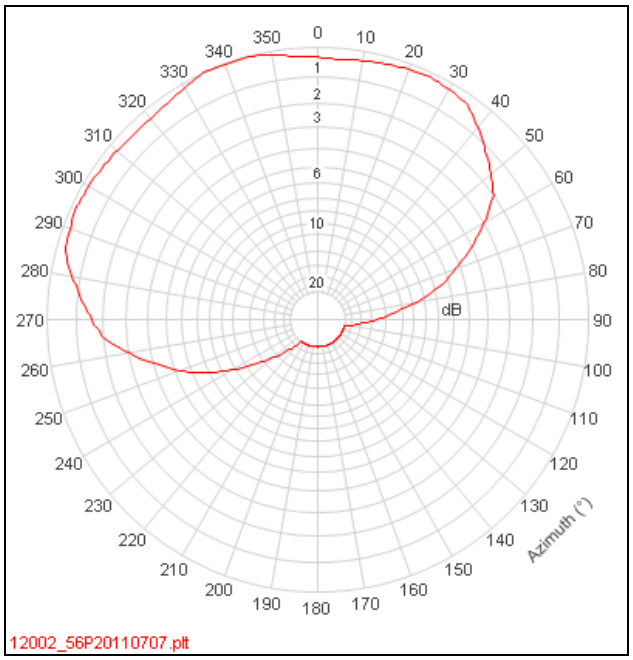

Figure A5-2 : Practical Pattern : Olivers Mount channel 56

ERP	0.2 kW	Antenna Height	33 metres

Table A5-1 : Olivers Mount ch56 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	33,376	44,426
90%	33,280	39,597

Table A5-2 : Olivers Mount ch56 : Population served based on antenna

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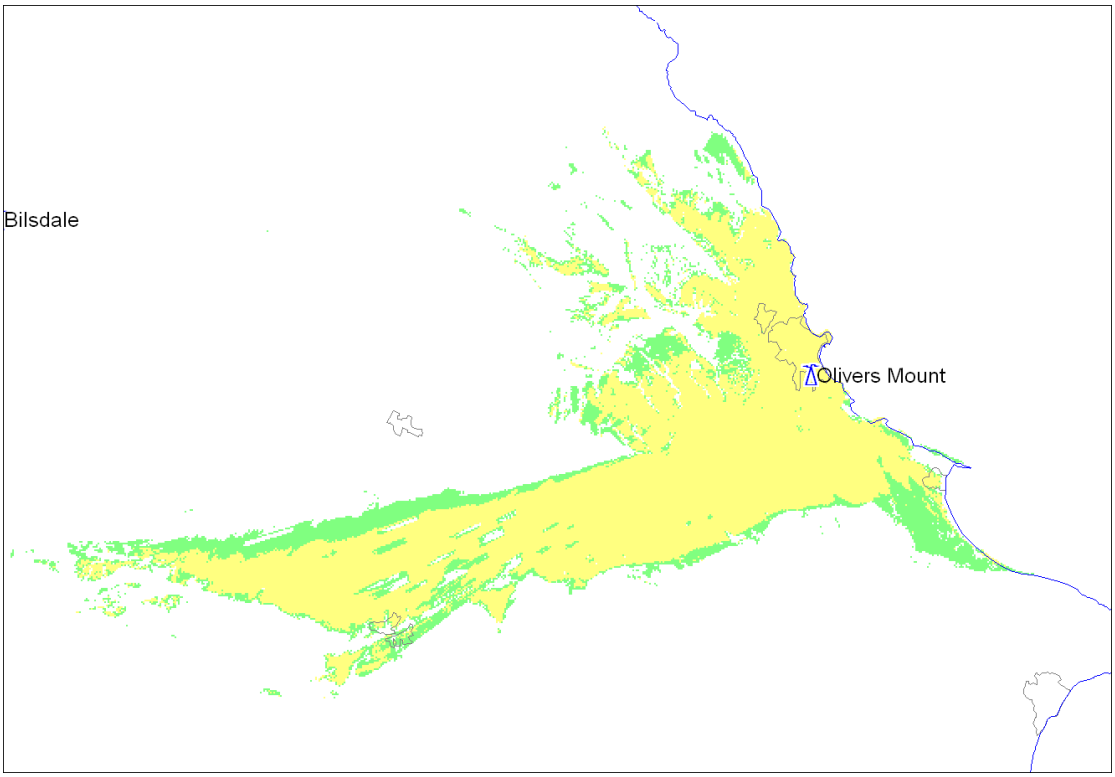

Figure A5-3 : Olivers Mount ch56 : 0.2 kW ERP : Practical antenna: 33m a.g.l

Practical Antenna:
The requirement is to serve Scarborough.

There are restrictions towards Wells-next-the-sea and Creake (150°) and Ravenscar (320°-340°). There is also a foreign restriction over the arc 90°-132°.

There are relationships with all three of these stations. All have one service co-channel with an Olivers Mount multiplex.

A possible antenna arrangement would be 90° crossed log periodics on a bearing of 340° to give a pattern similar to the main antenna.

It would be possible to share the existing antenna and meet the foreign restrictions.

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Pendle Forest 10302

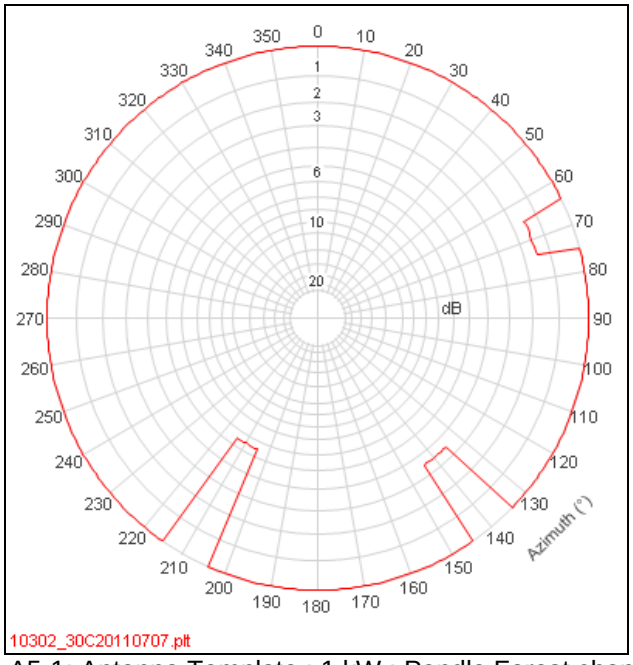

Figure A5-1: Antenna Template : 1 kW : Pendle Forest channel 30

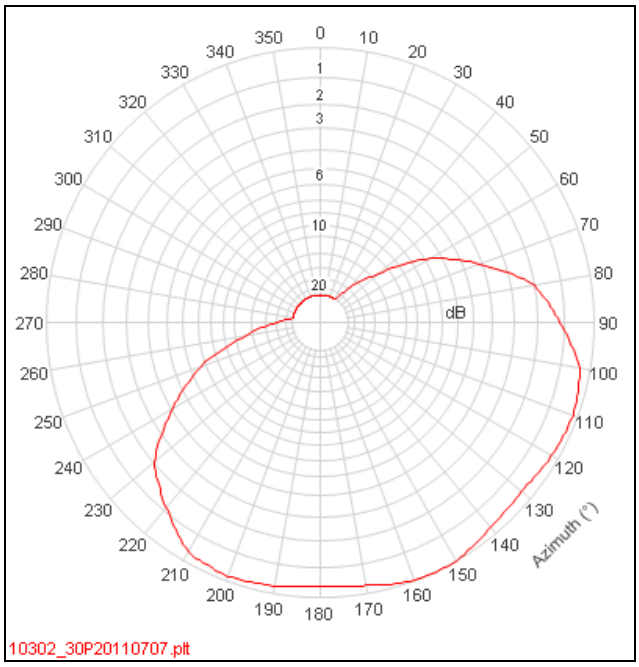

Figure A5-2 : Practical Pattern : Pendle Forest channel 30

ERP	0.1 kW	Antenna Height	45 metres

Table A5-1 : Pendle Forest ch30 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	82,374	119,515
90%	80,577	104,864

Table A5-2 : Pendle Forest ch30 : Population served based on antenna

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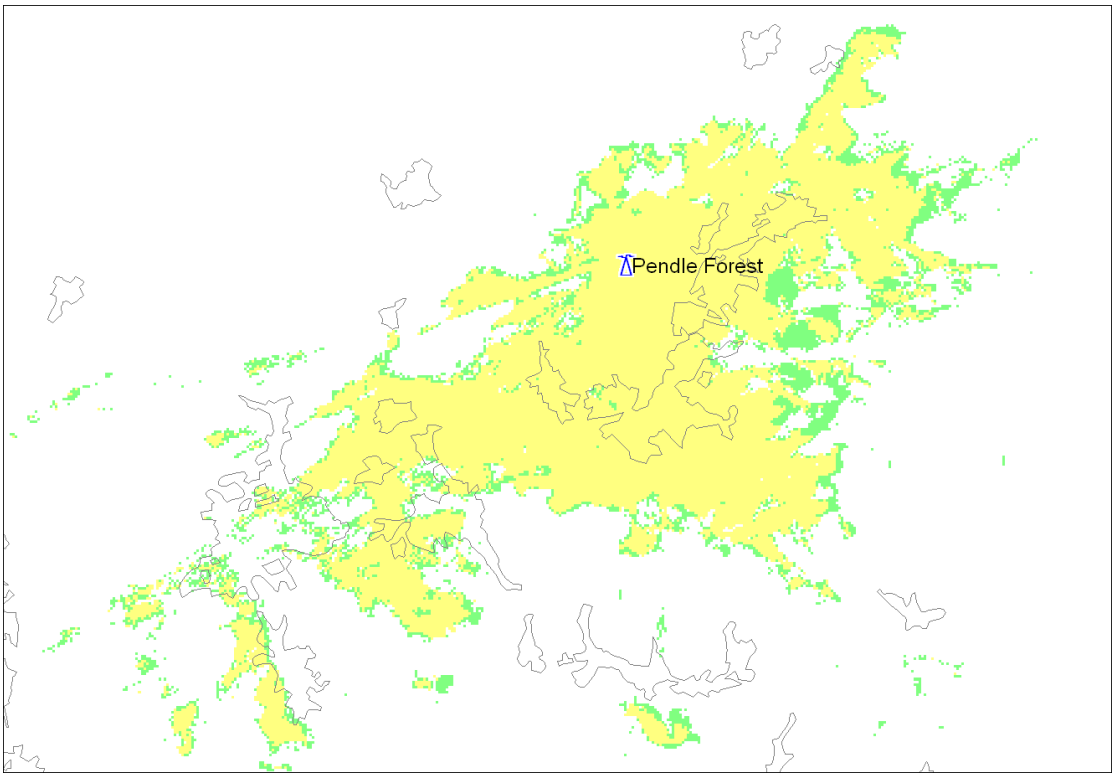

Figure A5-3 : Pendle Forest ch30 : 0.1 kW ERP : Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve Burnley and surrounding areas
.
There are restrictions towards Belmont (70°) and The Wrekin (140° & 210°). At the ERP proposed, the same as the existing DTT services, all of these restrictions are met.

A possible antenna arrangement could comprise 90° crossed logs on a bearing of 155°.

The existing main antenna could also be used at the same ERP.

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Poole 10804

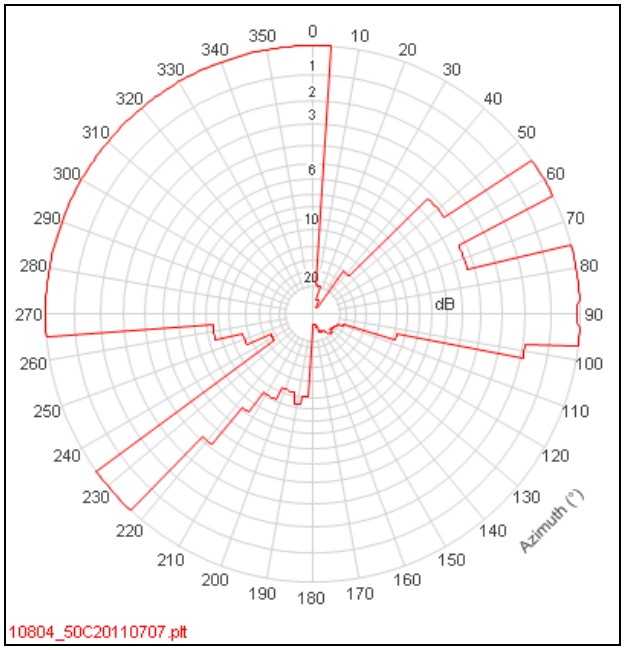

Figure A5-1: Antenna Template : 1kW : Poole channel 50

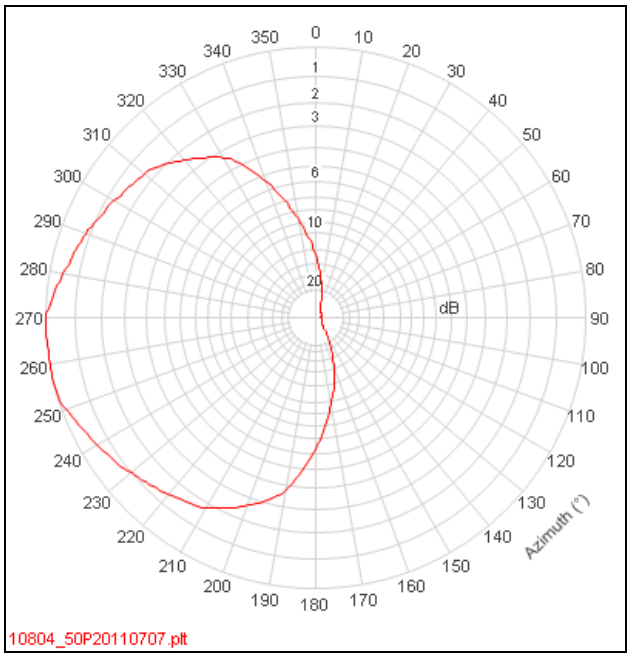

Figure A5-2 : Practical Pattern : Poole channel 50

ERP	0.01 kW	Antenna Height	42 metres

Table A5-1 : Poole ch50 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	20,864	50,652
90%	20,216	45,796

Table A5-2 : Poole ch50 : Population served based on antenna

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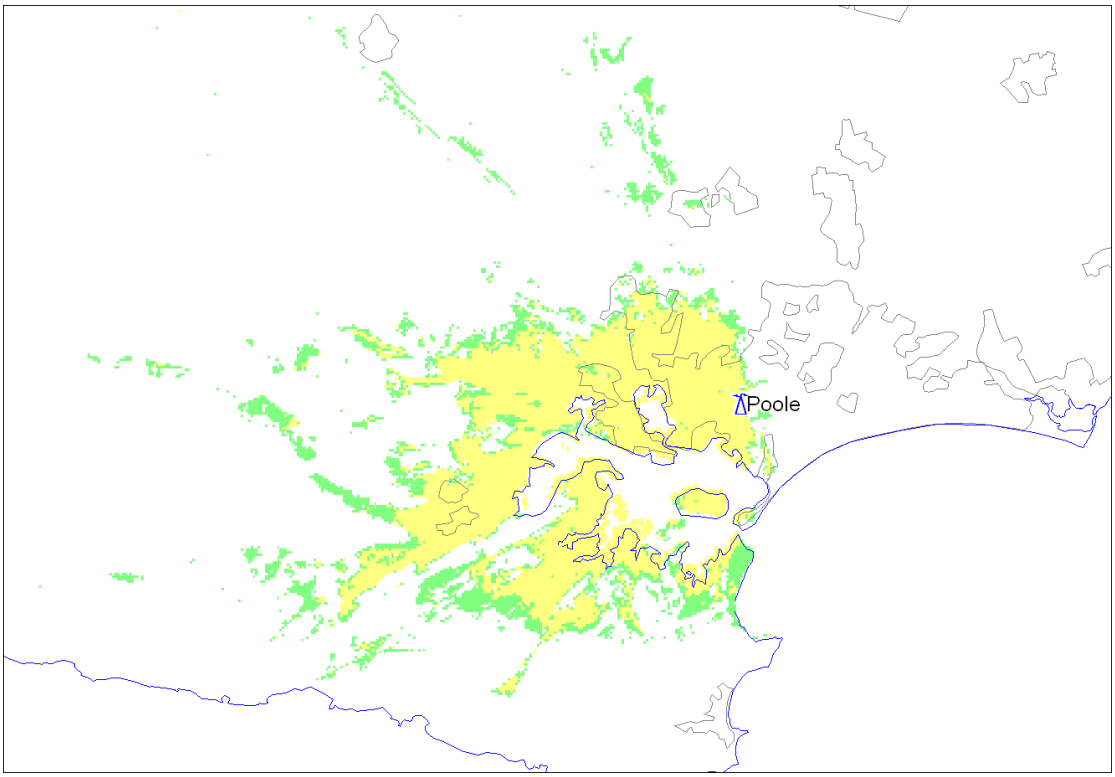

Figure A5-3: Poole ch50 : 0.01 kW ERP : Practical antenna: 42m a.g.l

Practical Antenna:
The requirement is to serve Poole.

There are restrictions towards Salisbury (10°-50°), Horndean (70°), Lulworth (240°), Bincombe Hill (250°-260°) and Newton Abbot VP (260°). There is also a foreign restriction over the arc 88°-222°.

There is a relationship with Salisbury; all three multiplexes at Poole are co-channel with Salisbury's PSB multiplexes.

There are no relationships with the other stations. However, at the power we suggest, only the foreign restriction needs to be considered. Because of this restriction it is not possible to use the existing antenna.

A possible antenna arrangement comprises 80° crossed log-periodics on 222° to meet the foreign restriction.

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Rosneath VP 15211

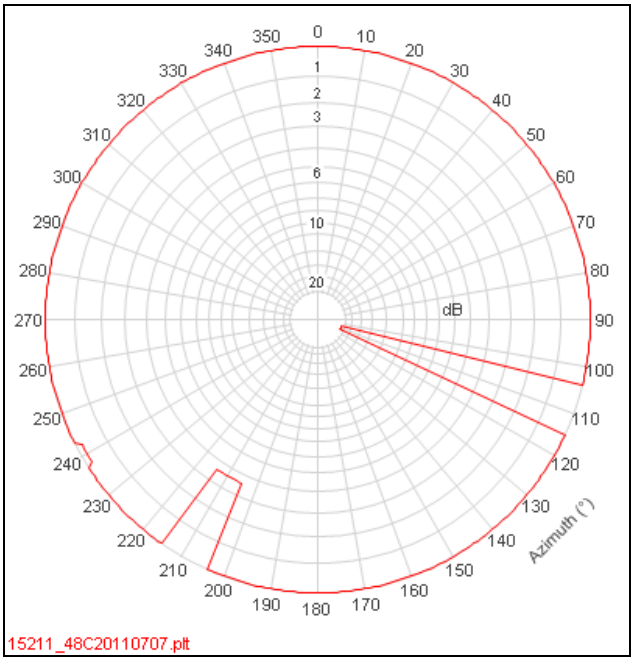

Figure A5-1: Antenna Template : 1 kW : Rosneath VP channel 48

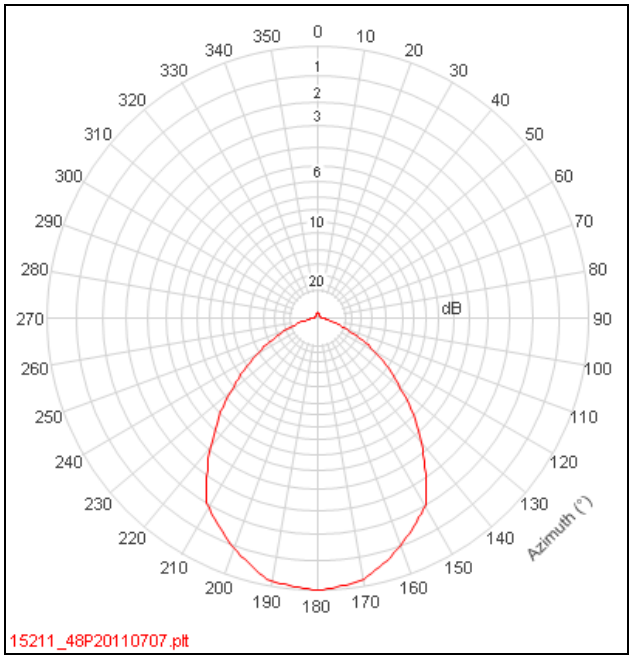

Figure D11-2 : Practical Pattern : Rosneath VP channel 48

ERP	0.2 kW	Antenna Height	56 metres

Table A5-1 : Rosneath VP ch48 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	33,530	45,620
90%	32,810	40,563

Table A5-2 : Rosneath VP ch48 : Population served based on antenna

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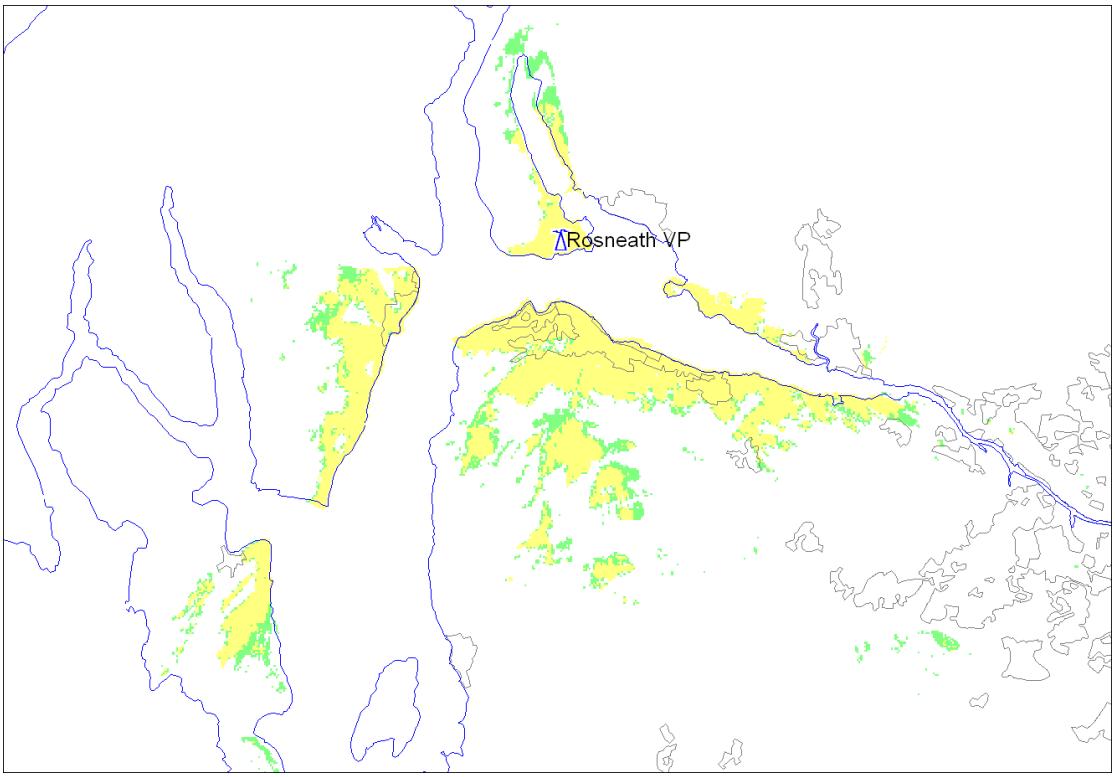

Figure A5-3 : Rosneath VP ch48 : 0.2kW ERP : Practical antenna: 56m a.g.l

Practical Antenna:
The requirement is to serve Greenock.

There are restrictions towards Kelvindale (110°) and Bellair (210°)

There was a relationship with Bellair. Low-power DTT at Rosneath on channel 67 was co-channel with Channel 4 ATV at Bellair.

There is no relationship with Kelvindale. In the worst affected Kelvindale location, several stations are predicted to give coverage, all 6 multiplexes in the case of black Hill. A desk-top survey shows houses in the area receiving Darvel, Black Hill and/or what appears to be Glasgow West Central. No antennas were seen directed to Kelvindale but the area should be protected.

Because of the Kelvindale restriction is it not possible to match the existing coverage and a log-periodic on 180° is suggested to cover Greenock.

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Salisbury 10801

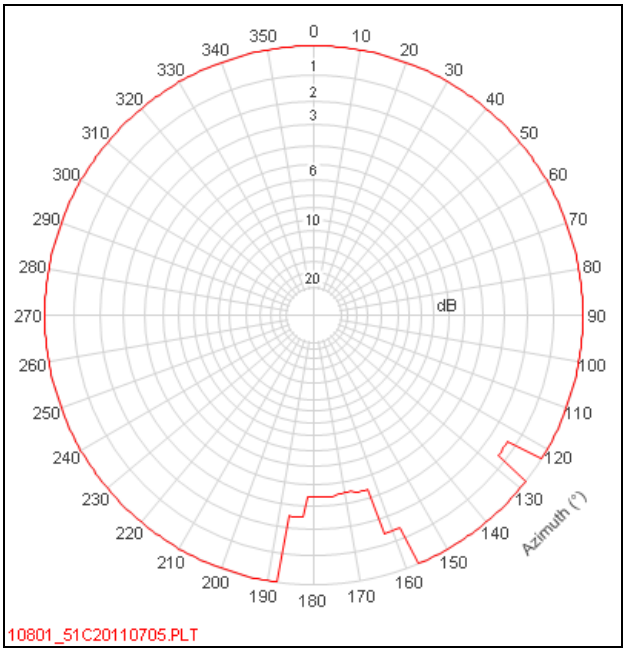

Figure A5-1 : Antenna Template : 1 kW : Salisbury channel 51

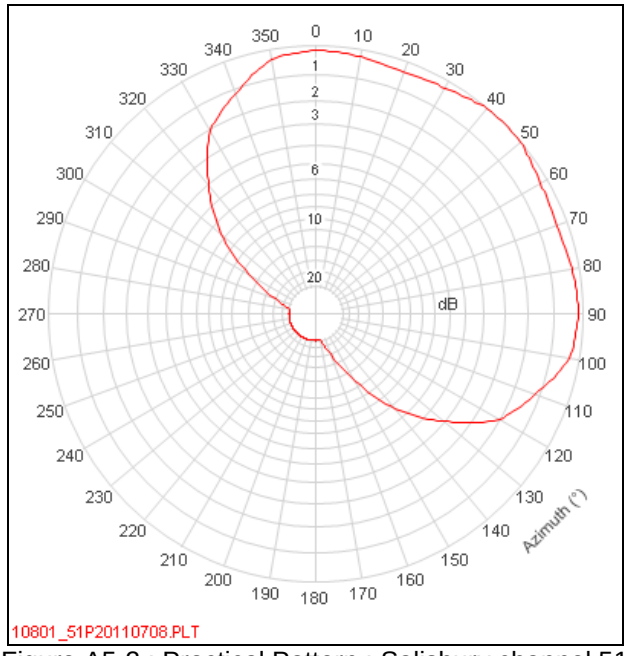

Figure A5-2 : Practical Pattern : Salisbury channel 51

ERP	0.2 kW	Antenna Height	45 metres

Table A5-1 : Salisbury ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	30,573	41,796
90%	30,129	36,468

Table A5-2 : Salisbury ch51 : Population served based on antenna

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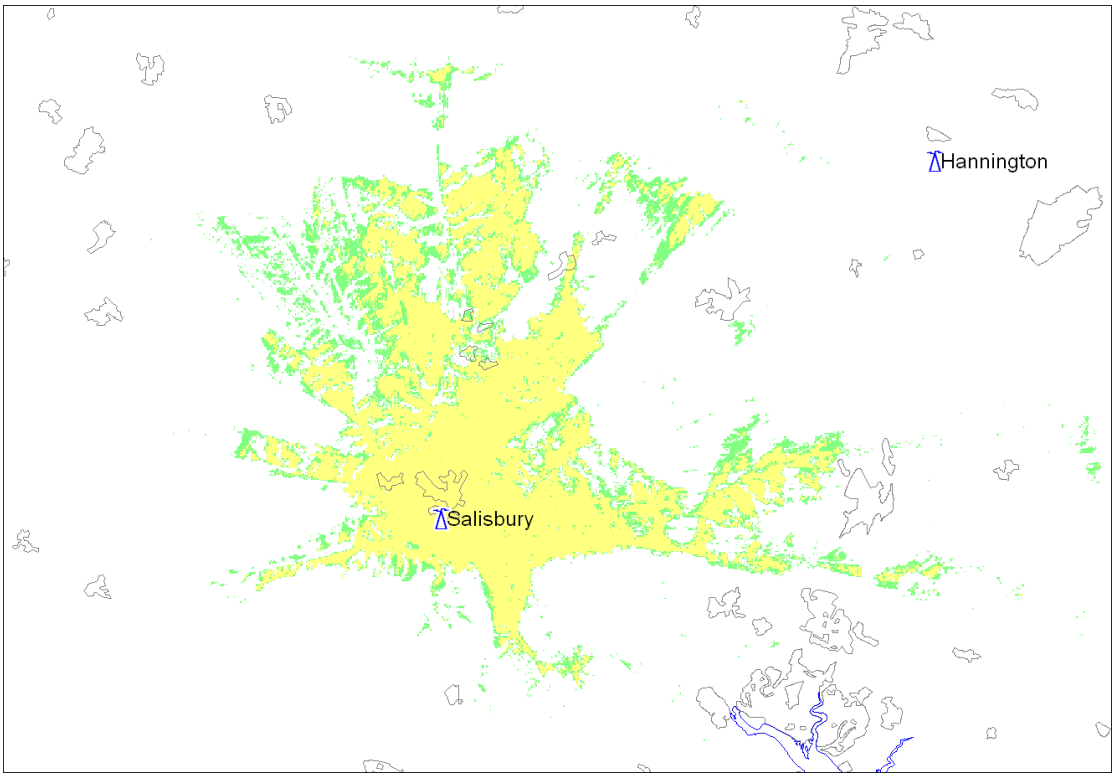

Figure A5-3 : Salisbury ch51 : 0.2kW ERP : Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve Salisbury

There are no UK restrictions. There are foreign restrictions over the arcs 123°-127° and 158°-187°.

An antenna comprising 90° crossed log-periodics would cover Salisbury and provide similar coverage to the existing services.

It would also be possible to share the main antenna at 0.2 kW ERP.

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Stockland Hill 13200

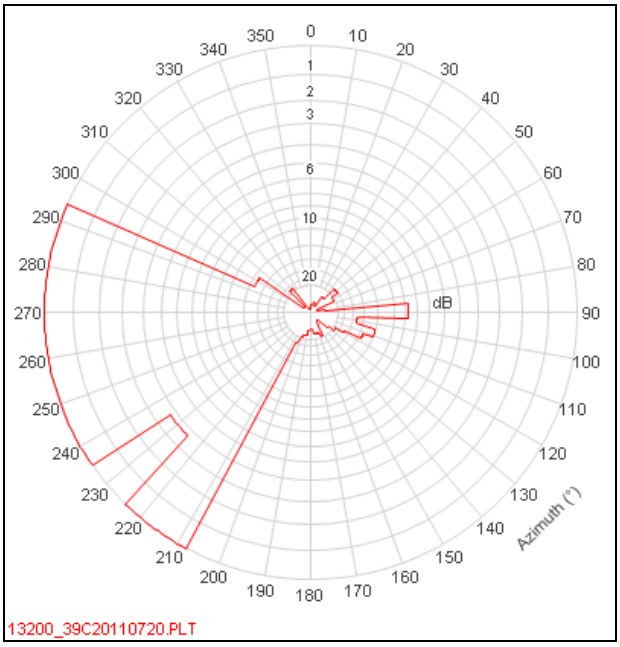

Figure A5-1 : Antenna Template : 10 kW : Stockland Hill channel 39

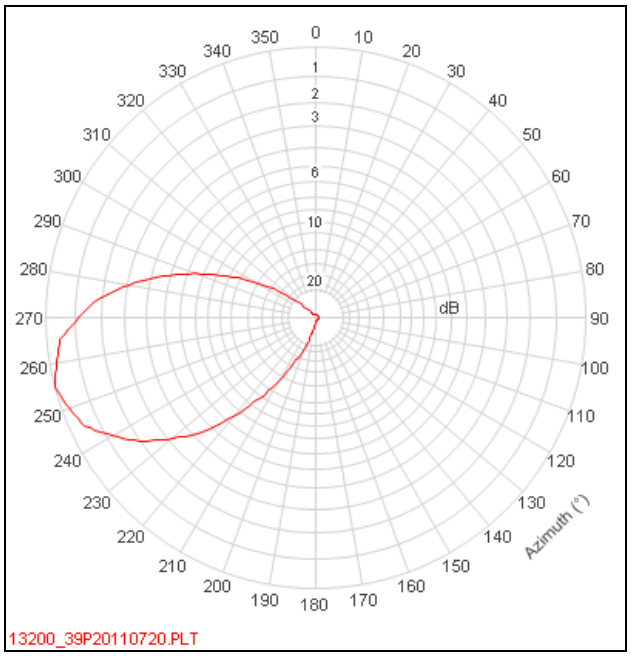

Figure A5-2 : Practical Pattern : Stockland Hill channel 39

ERP	5kW	Antenna Height	118 metres

Table A5-1 : Stockland Hill ch39 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	43,202	85,359
90%	36,374	67,126

Table A5-2 : Stockland Hill ch39 : Population served based on antenna

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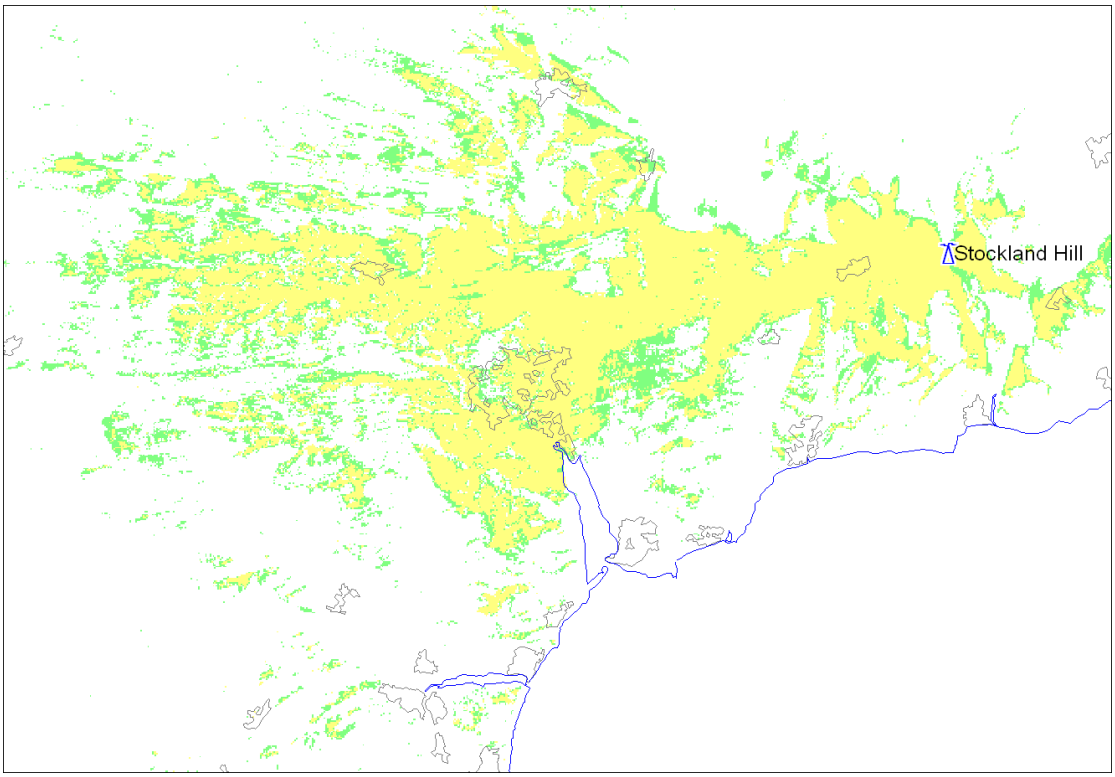

Figure A5-3 : Stockland Hill ch39 : 5kW ERP : Practical antenna: 118m a.g.l

Practical Antenna:
The requirement is to serve Exeter and Honiton.

The use of offsets on the main multiplexes at Stockland Hill means that there are no in group Band IV channels available. Channel 39 is out of group high and coverage to existing receive aerials is likely to be worse than that shown.

There are restrictions towards Ivybridge (230°), Wenvoe (300°-80°). There are other restrictions to the north and east. There is also a foreign restriction over the arc 108°-207°.

Our suggested antenna meets all the restrictions at an ERP of 5kW. The foreign restriction precludes the use of the existing DTT antenna.

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Tunbridge Wells 10104

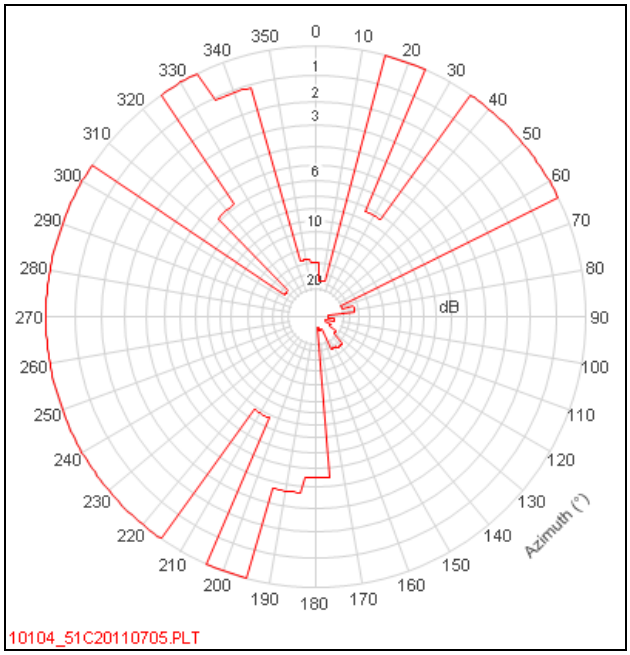

Figure A5-1: Antenna Template : 1 kW : Tunbridge Wells channel 51

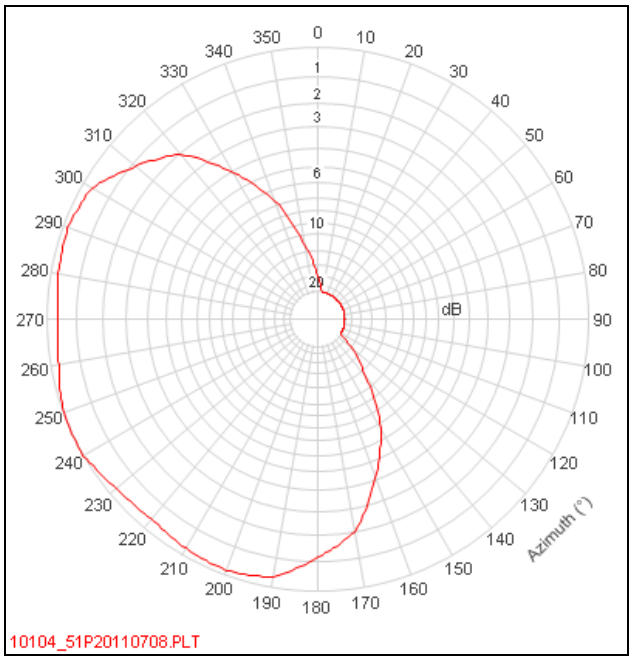

Figure A5-2 : Practical Pattern : Tunbridge Wells channel 51

ERP	0.4kW	Antenna Height	45 metres

Table A5-1 : Tunbridge Wells ch51 : Parameters

	QPSK 2/3	
Percentage Locations	Within DPSA	Gross
70%	44,835	62,311
90%	38,051	47,455

Table A5-2 : Tunbridge Wells ch51: Population served based on antenna

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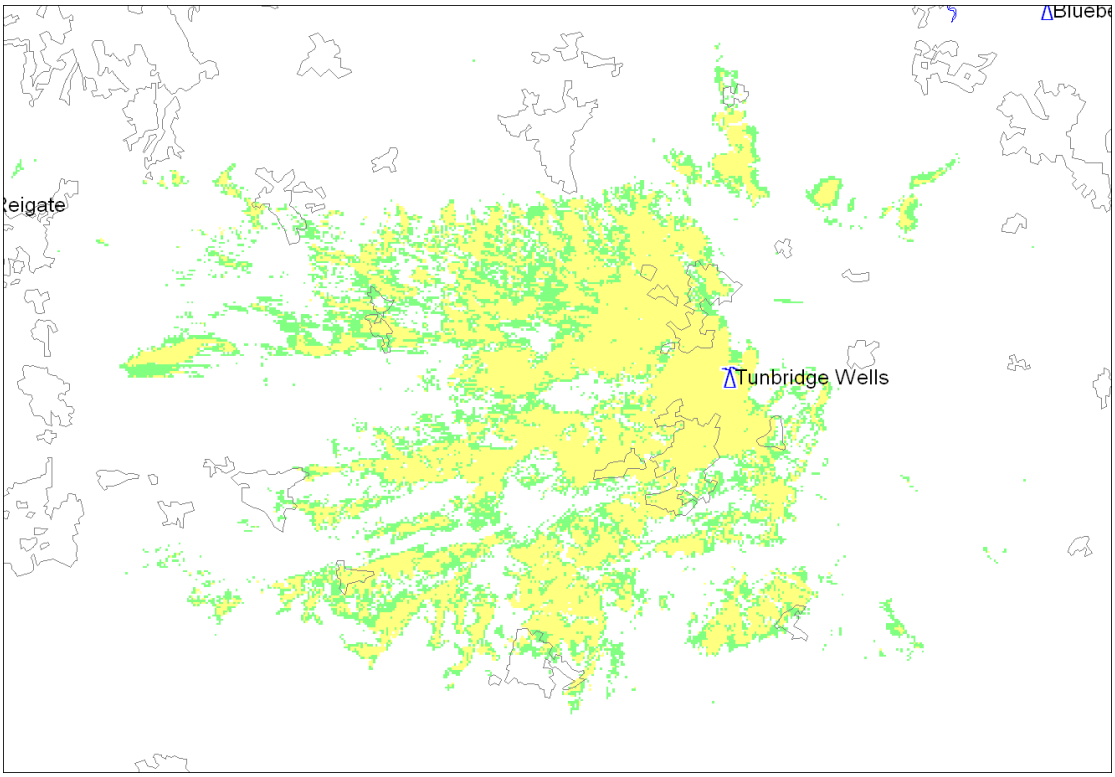

Figure A5-3 : Tunbridge Wells ch51 : 0.4kW ERP : Practical antenna: 45m a.g.l

Practical Antenna:
The requirement is to serve northern parts of Tunbridge Wells.

There are restrictions towards Dover (340°-10°, 20°-30°, 70°-190° & 310°), Whitehawk Hill (210°) and Sandy Heath (320°). There is also a foreign restriction over the arc 98°-182°.

There was a relationship with Dover. Low-power DTT used channels 55 and 61 at both stations with ERPs of 0.1kW at Tunbridge Wells and 2kW at Dover.

There was a low-power DTT relationship with Whitehawk Hill as shown in the table below:

channel	55	61
Tunbridge Wells	Mux BBC	D3/4
ERP (kW)	0.1	0.1
Whitehawk Hill	Mux A	Mux D
ERP (kW)	0.2	0.4

There is a relationship with Sandy Heath; Tunbridge Wells PSB1 and Sandy Heath COM5 both use channel 52.

A suggested antenna arrangement would be 90° crossed log-periodics to give a similar pattern to the main antenna. At 400 watts ERP this meets the foreign restrictions.

The main antenna could also be used at 0.4 kW ERP.

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Annex 6 : Composite coverage Plots

Though coverage of the target population by the GI channels does vary from site to site due to the restrictions on access to spectrum, the patterns and the low powers, predicted coverage is good. The overall UK coverage of the 74 sites modelled is predicted as 61% of the UK's population.

Target Area	Population Served	% of Population served
England	13,726,738	60%
Wales	796,069	58%
Scotland	1,979,836	79%
Northern Ireland	340,489	50%
UK	16,843,132	61%

Table 1: 74 Site GI coverage of the UK and its constituent countries

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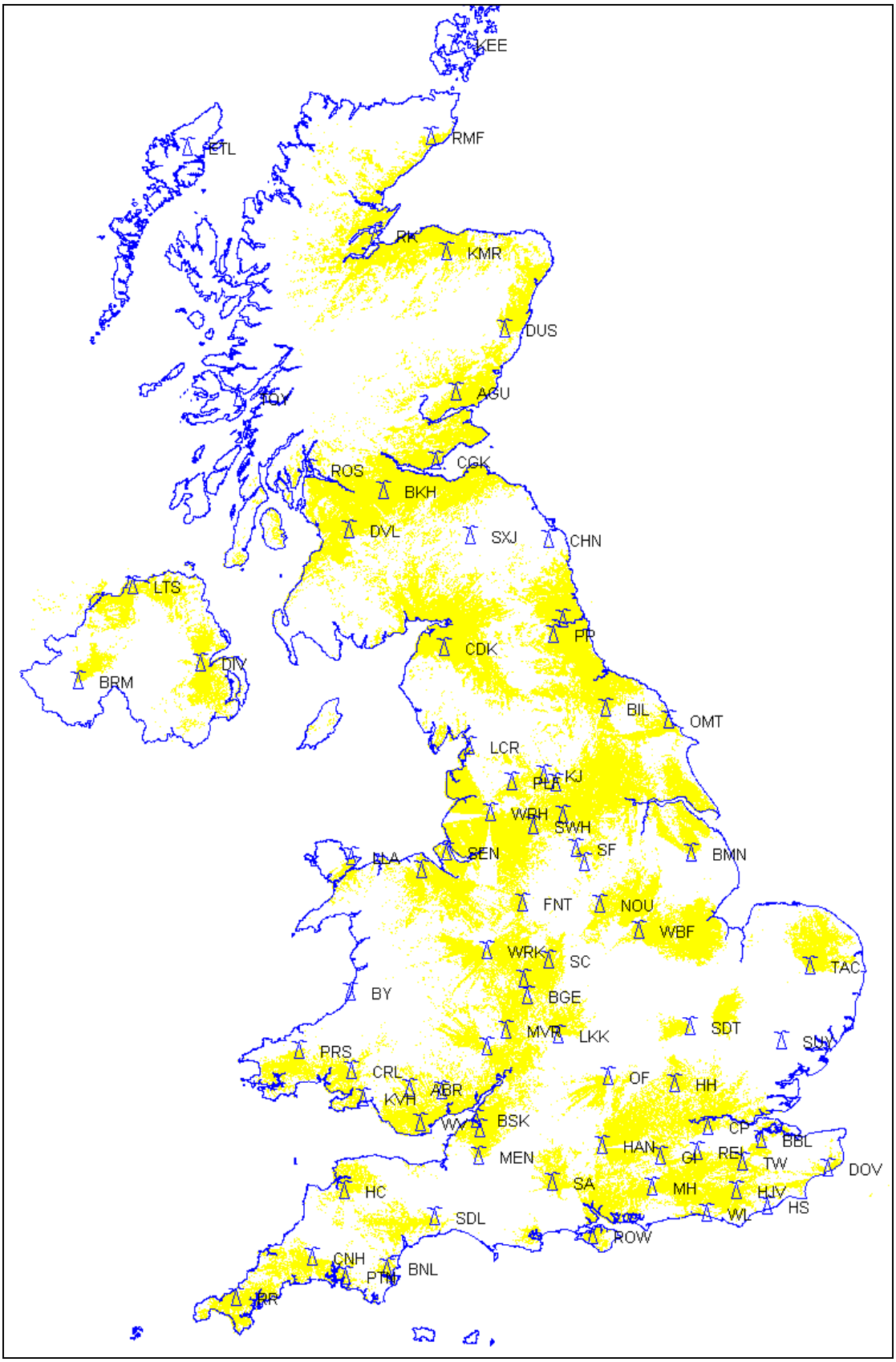

Figure A6-1 : Composite of 74 GI stations

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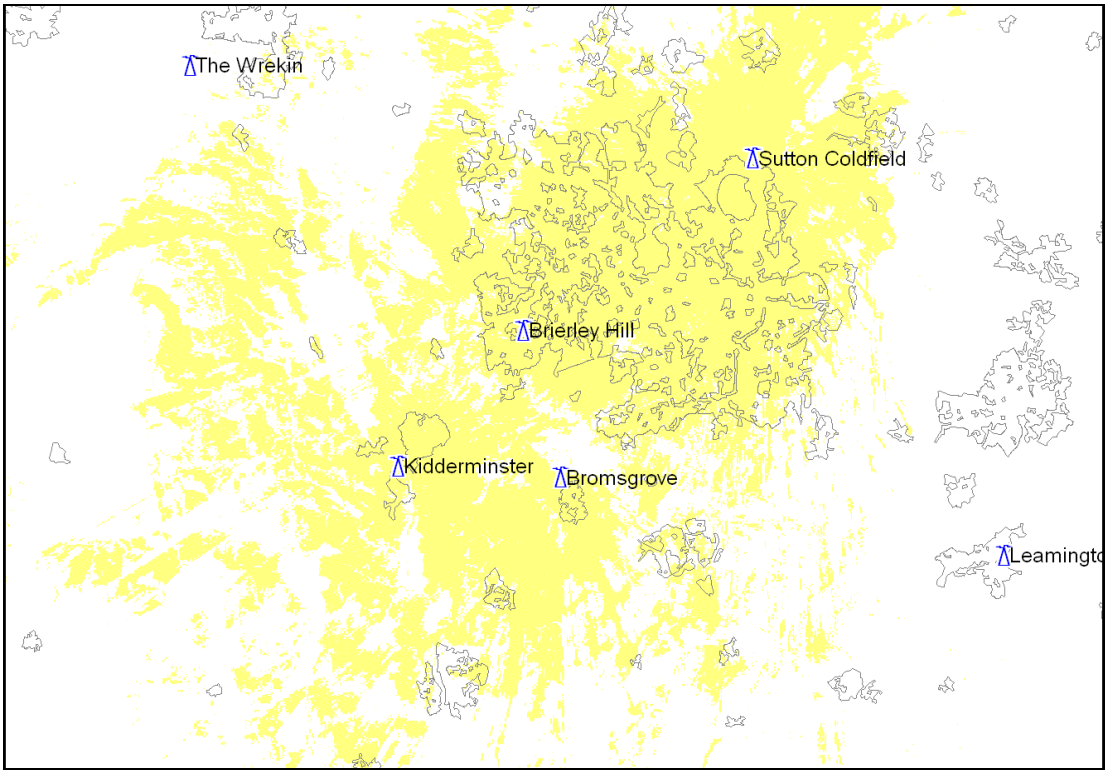

Figure A6-2 : Composite of Sutton Coldfield, Bromsgrove, Brierley Hill and Kidderminster operating as an MFN

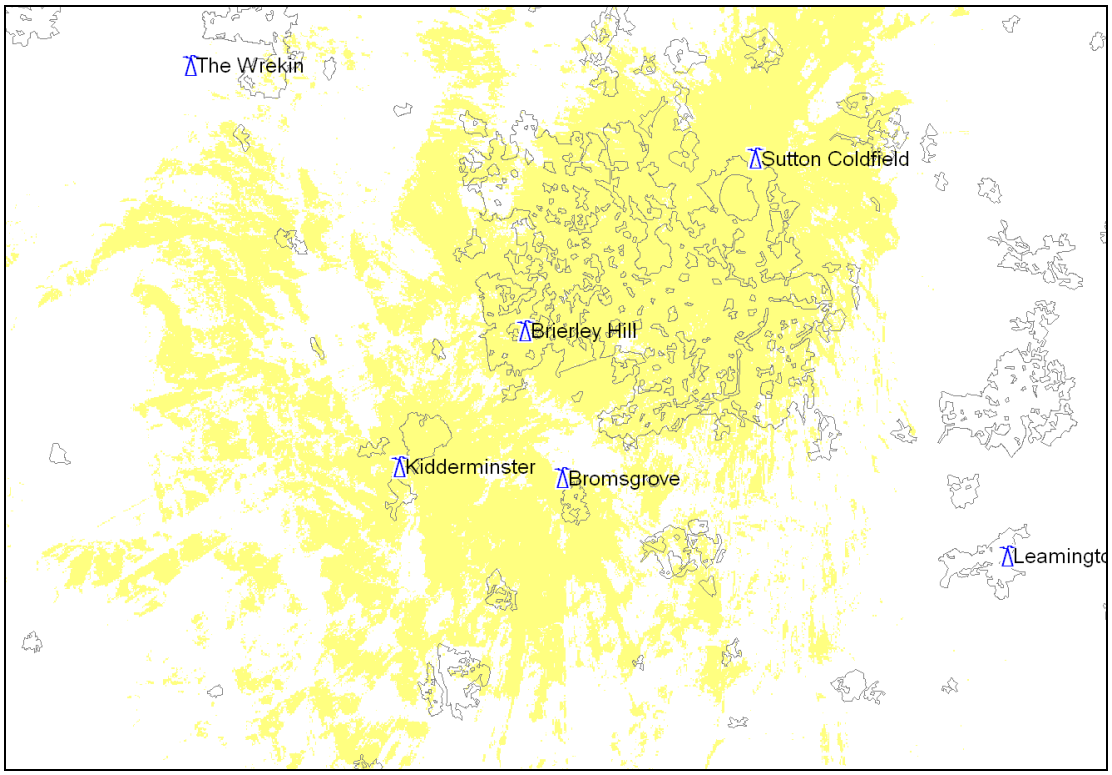

Figure A6-3 : Composite of Sutton Coldfield, Bromsgrove, Brierley Hill and Kidderminster with co-channel sites operating as an SFN

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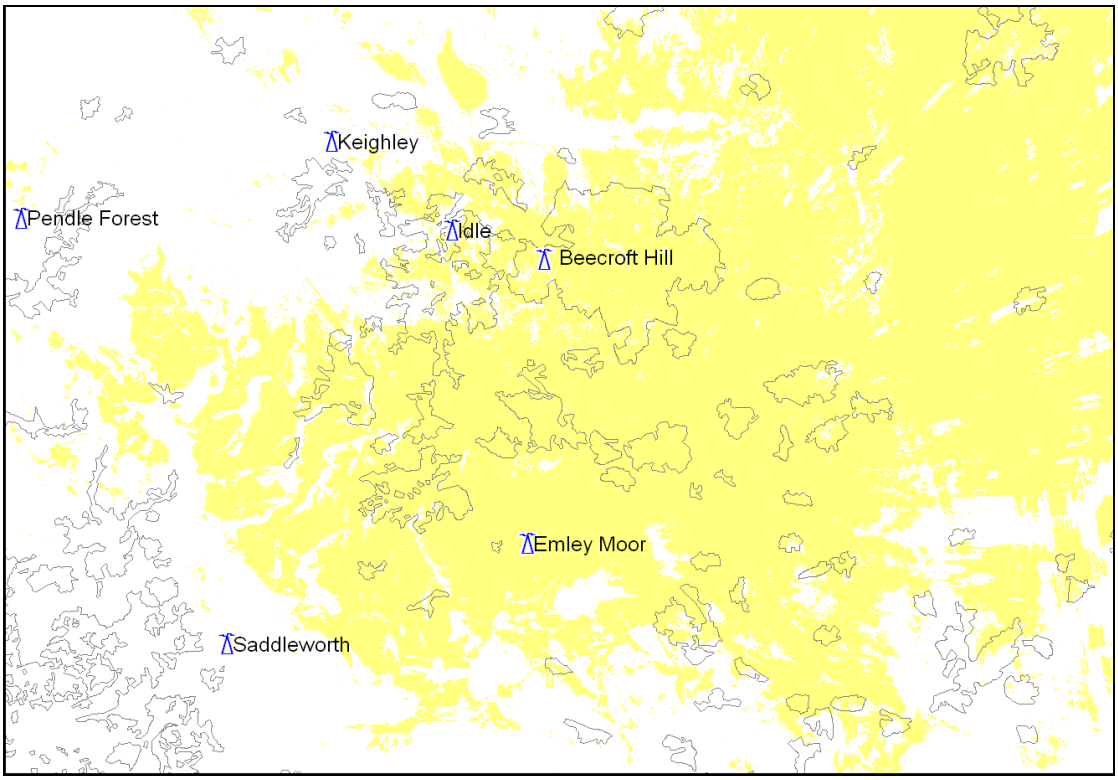

Figure A6-4 : Composite of Emley Moor and Beecroft Hill operating as an MFN

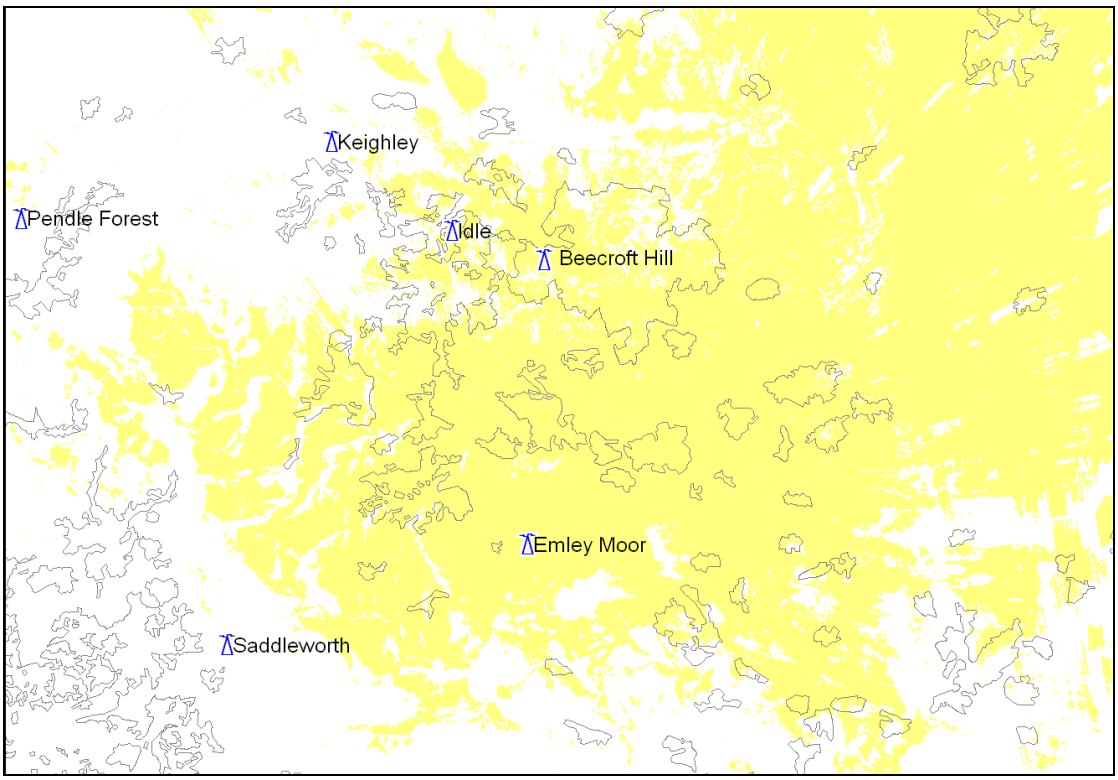

Figure A6-5 : Composite of Emley Moor and Beecroft Hill operating as an SFN

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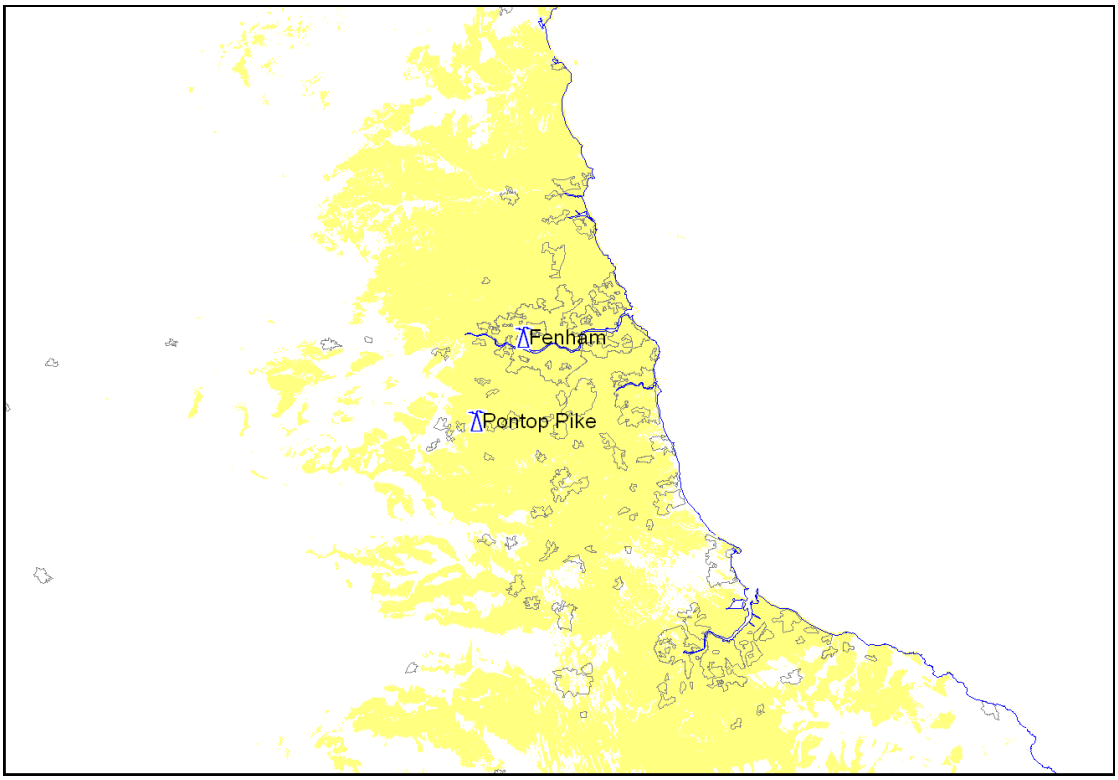

Figure A6-6 : Composite of Pontop Pike and Fenham operating as an MFN

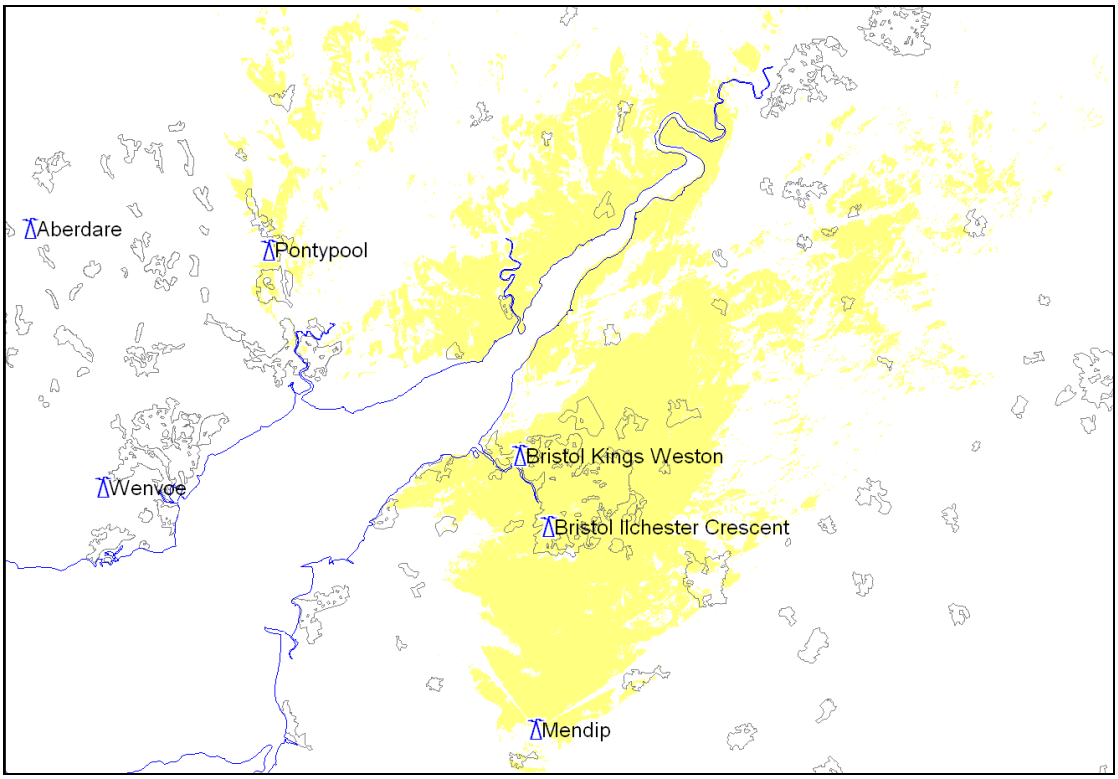

Figure A6-7 : Composite of Mendip, Bristol Ilchester Crescent and Bristol Kings Weston (MFN)

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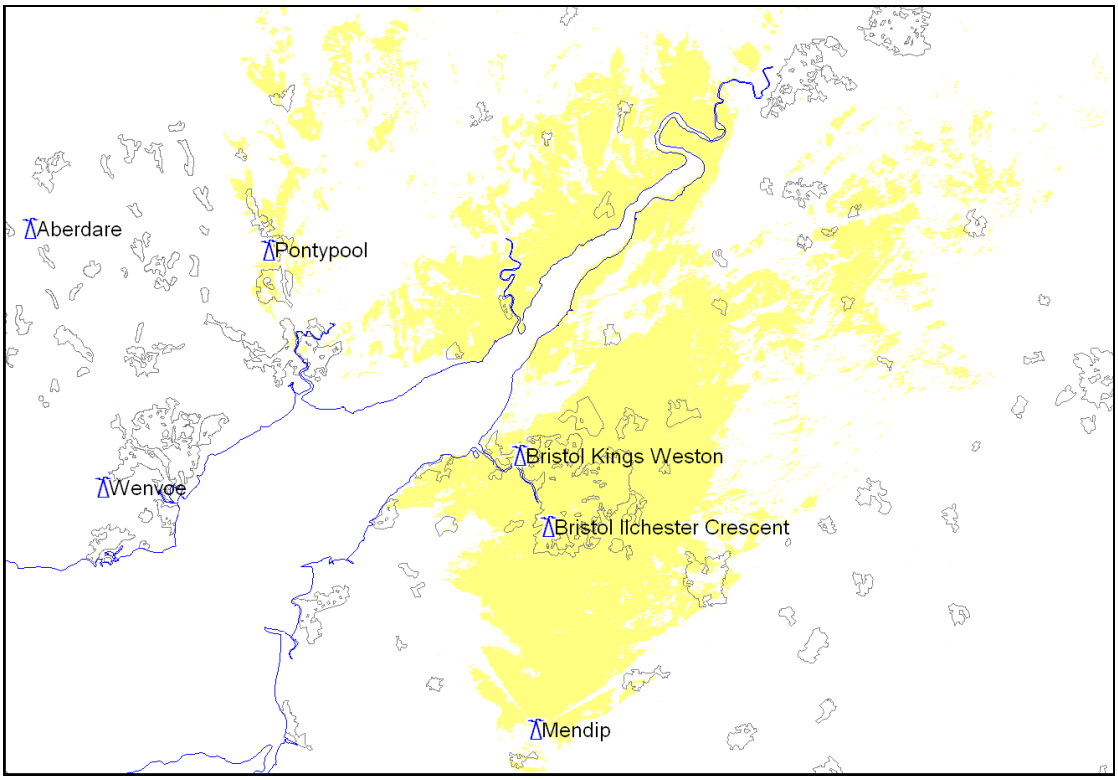

Figure A6-8 : Composite of Mendip with Bristol Ilchester Crescent and Bristol Kings Weston operating as an SFN

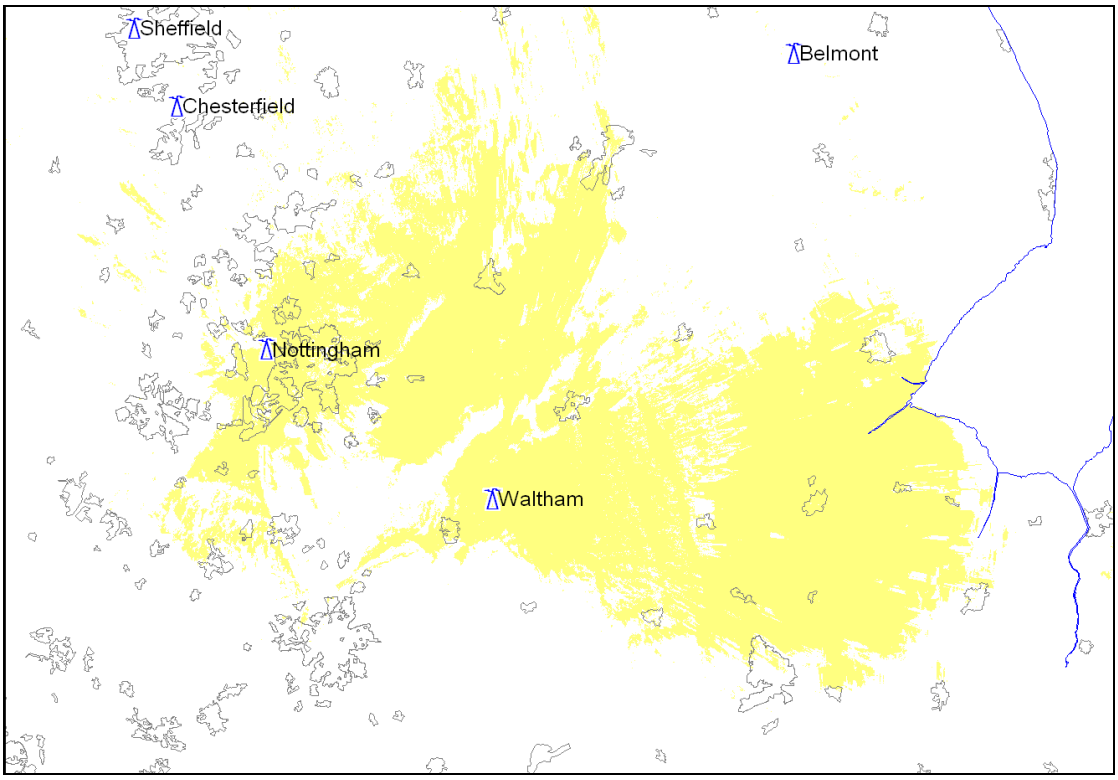

Figure A6-9 : Composite of Waltham and Nottingham

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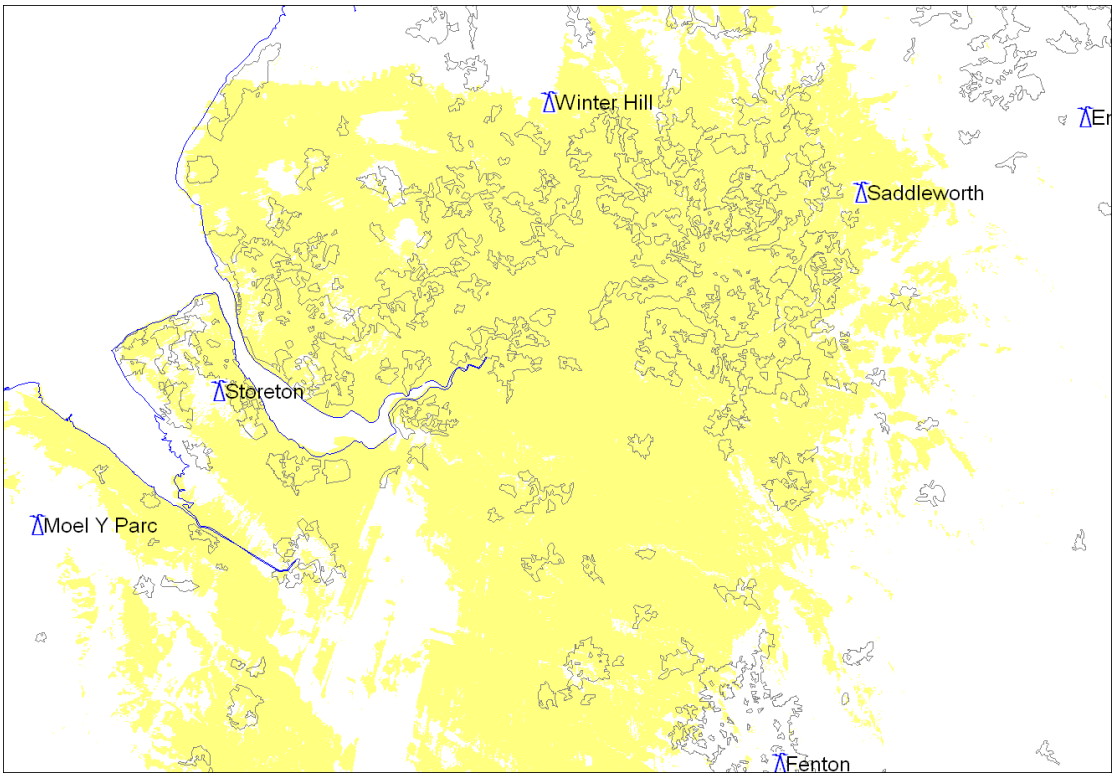

Figure A6-10 : Composite of Winter Hill, Storeton and Saddleworth co-channel sites operating as an SFN

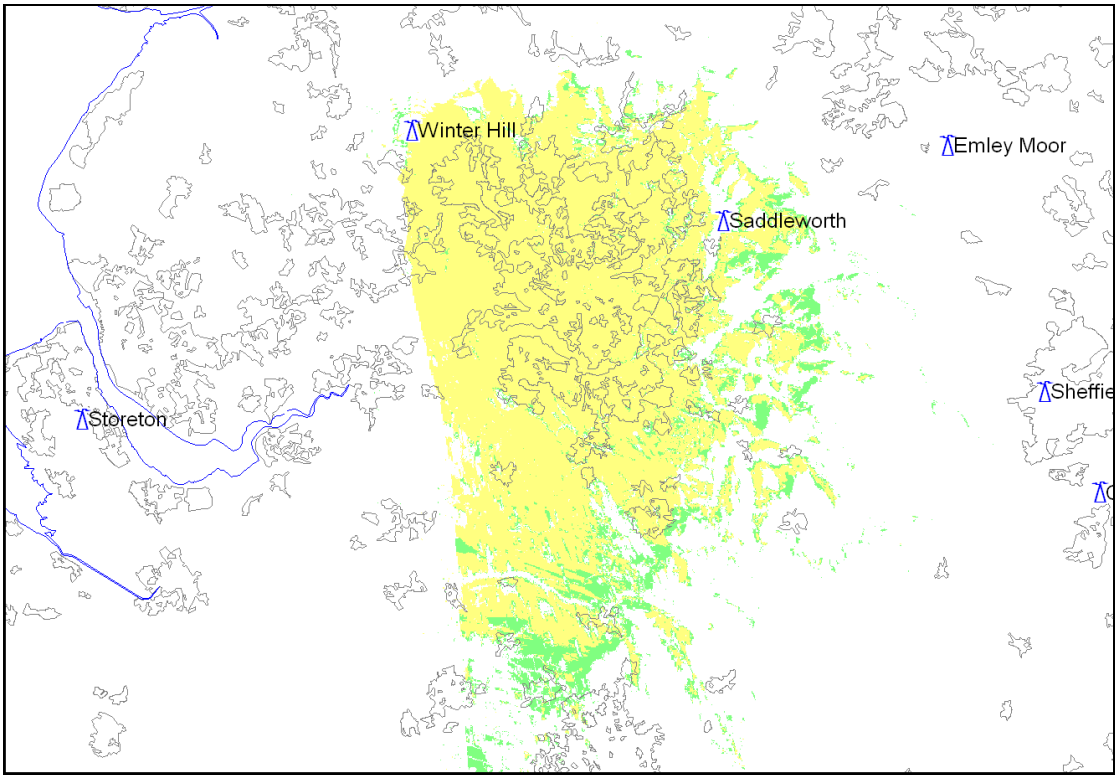

Figure A6-11 : Composite of Winter Hill (Manchester beam) and Saddleworth

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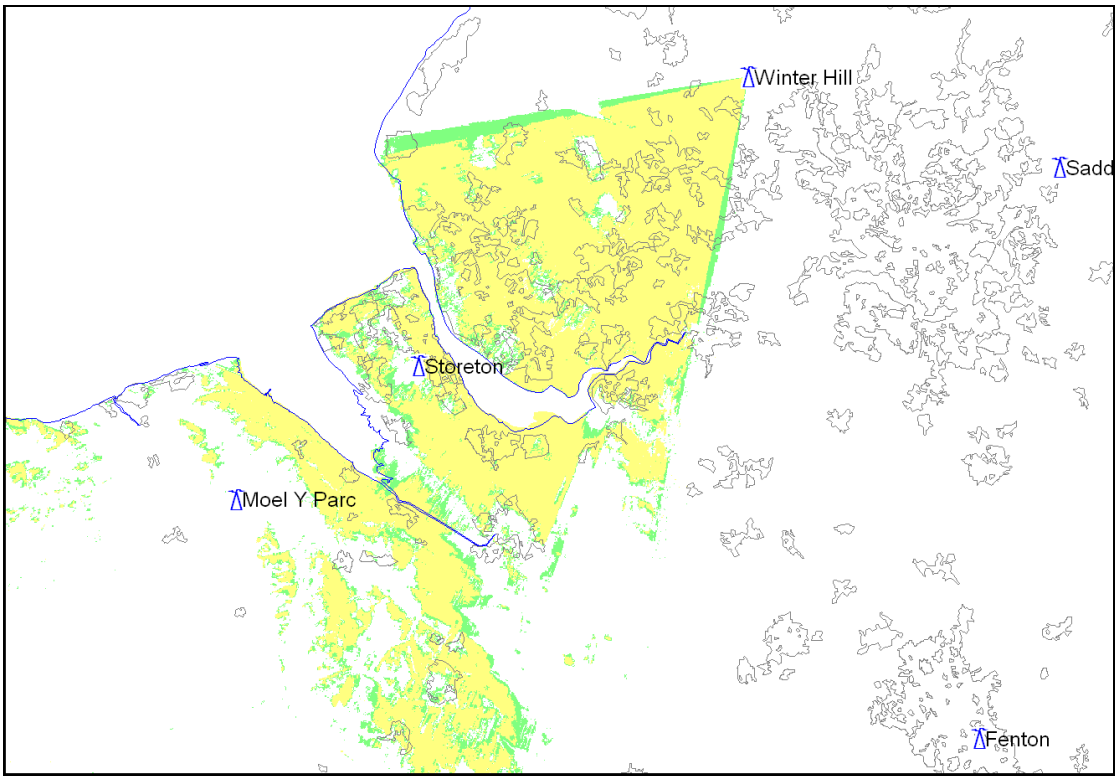

Figure A6:12 : Composite of Winter Hill (Liverpool beam) and Storeton

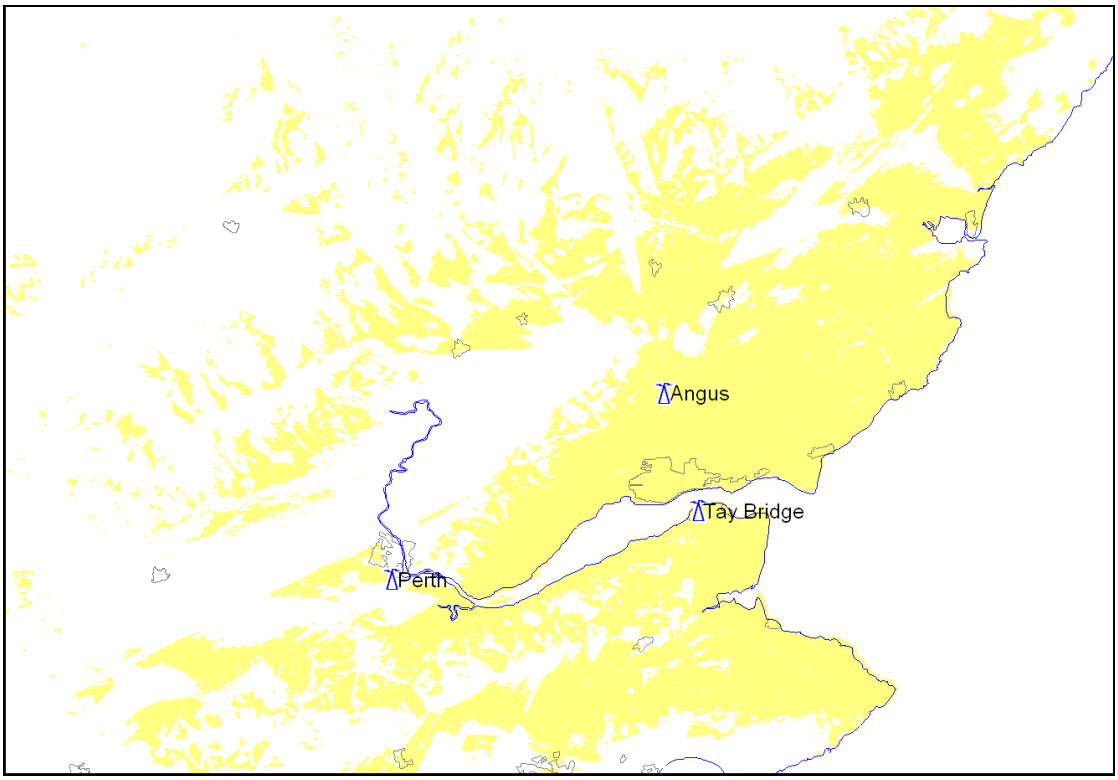

Figure A6-13 : Composite of Angus and Tay Bridge

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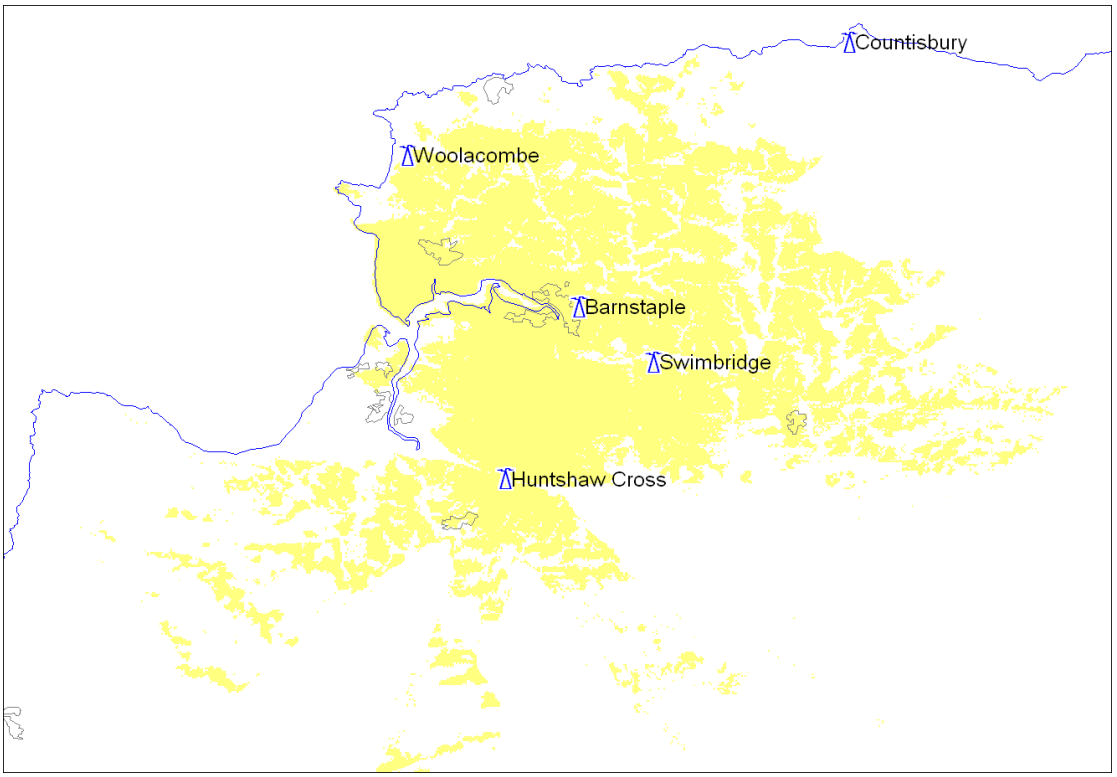

Figure A6-14 : Composite Huntshaw Cross and Barnstaple

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Annex 7 : UHF Channel Groups

UK DTT planning is based on the use of standard groups of channels. Each group consists of three channels. Use of standard groups ensures that interference between stations using the same group is the same on all channels and hence coverage of those channels is equal. In some areas of the country, particularly along the south and east coast, non standard channel grouping has had to be used to avoid interference from the Continent.

21	24	27	
22	25	28	
23	26	29	
23	26	30	Group used in the South East and Central England
39	42	45	
40	43	46	
41	44	47	
48	52	51	Group used in northern half of England
48	52	56	Group used in the southern half of England
53	57	60	
54	58	49	
55	59	50	

Figure A7 – 1 : UK channel groups

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Annex 8 : Adjacent Channel Information

		GI Mux			Main Mux		
Station Id	Station Name	channel	Offset		channel	Offset	T2
10100	Crystal Palace	29	-	Adjacent to ch30 & ch28	30 & 28	- & -	yes/no
10200	Sutton Coldfield	51			clear		
10300	Winter Hill	56		Adjacent to ch55 & ch57	55 & 57	0 & 0	no
10400	Emley Moor	56			clear		
10500	Black Hill	51			clear		
10600	Wenvoe	51			clear		
10700	Divis	30	Crit Mask	Band Edge Adjacent to ch29	29		
10900	Pontop Pike	56		Adjacent to ch55	55	0	no
11100	Waltham	26			clear		
14700	Craigkelly	52			clear		
12400	Sandy Heath	42			clear		
11000	Mendip	51		Adjacent to ch52	52	0	no
12000	Belmont	27		Adjacent to ch28	28	0	no
10800	Rowridge	29		Adjacent to ch28	28	0	no
11600	Bilsdale	24		Adjacent to ch23	23	0	yes
12600	Hannington	51			clear		
11500	Sudbury	0			n/a		
11700	Oxford	51		Adjacent ch50	50	0	no
11400	Tacolneston	57			clear		
14900	Ridge Hill	51			clear		
12100	The Wrekin	51			clear		
11200	Durris	30	Crit Mask	Band Edge Adjacent to ch29	29	0	no
15200	Darvel	30	Crit Mask	Band Edge Adjacent to ch29	29	0	no
14100	Redruth	39	+	Band Edge	clear		
13600	Beacon Hill	39	+	Band Edge	clear		
	Madingley	40			clear		
10415	Beecroft Hill	56		Adjacent to ch55 & ch57	55 & 57	0	no
10206	Bromsgrove	29	-	Adjacent to ch30	30	-	yes
10203	Brierley Hill	29			clear		
11007	Bristol KW	30	-	Band Edge	clear		
11008	Bristol Ilch Cres	30	-	Band Edge	clear		
13700	Caldbeck	56			clear		
13100	Caradon Hill	30	-	Band Edge	clear		
10903	Fenham	30	-	Band Edge	clear		
10211	Fenton	29		Adjacent to ch28	28	0	no
10202	Kidderminster	51			clear		
10601	Kilvey Hill	30	Crit Mask	Band Edge Adjacent to ch29	29	0	yes
13000	Limavady	48		Adjacent to ch49	49	0	no
10207	Malvern	51		Adjacent to ch50	50	0	no
11101	Nottingham UHF	50		Adjacent to ch51	51	0	no
13105	Plympton	39	+	Band Edge	clear		
10103	Reigate	51			clear		
10307	Storeton	30	Crit Mask	Band Edge Adjacent to ch29	29	0	no
10403	Sheffield	55			clear		
10306	Saddleworth	41			clear		
10805	Whitehawk Hill	54		Adjacent to ch53	53	0	no
11300	Dover	57			clear		
13900	Heathfield	29			clear		
15800	Bluebell Hill	27			clear		
12300	Angus	48		Adjacent to ch49	49	0	no
10105	Hemel Hempstead	42		Adjacent to ch41	41	0	no
11900	Carmel	52		Adjacent to ch53	53	0	no
15600	Rosemarkie	50			clear		
12900	Presely	30	-	Band Edge	clear		
11800	Llanddona	51			clear		
10335	Lancaster	30	-	Band Edge	clear		
10101	Guildford	51		Adjacent to ch52	52	0	no
13001	Londonderry	51			clear		
13800	Huntshaw Cross	51		Adjacent to ch50 & 52	50 & 52	0 & 0	no
12308	Tay Bridge relay	51			clear		
13815	Barnstaple relay	49			clear		
13200	Stockland Hill	39	+	Band Edge	clear	0	no
14500	Moel-y-Parc	56			clear		
12500	Midhurst	51		Adjacent to ch50	50	0	no
10104	Tunbridge Wells	48		Adjacent to ch52	52	0	no
15100	Brougher Mountain	26		Adjacent to ch25 & 27	25 & 27	0 & 0	yes
10302	Pendle Forest	30	-	Band Edge	clear		
15211	Rosneath VP	48		Adjacent to ch49	49	0	no
10208	Lark Stoke	48		Adjacent to ch47	47	0	no
10407	Keighley	56		Adjacent to ch57	57	0	no
10804	Poole	50			clear		
15300	Knockmore	56		Adjacent to ch57	57	0	no
12002	Olivers Mount	56		Adjacent to ch57	57	0	no
10801	Salisbury	51		Adjacent to ch51	50	0	no
12402	Luton	45			clear		

Table A8 – 1 : GI Adjacent Channel Relationship with Main Multiplexes

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Annex 9 : Glossary of Abbreviations

3COM	Coverage of the area where all three commercial multiplexes are available
3PSB	Coverage of the area where all three PSB multiplexes are available
6Core	Coverage of the area where all six main multiplexes are available
600 MHz Band	UK released spectrum consisting of channels 31, 32, 33, 34, 35, 36 and 37
800 MHz Band	Released spectrum consisting of channels 61, 62, 63, 64, 65, 66, 67, 68 and 69
C/N	Carrier to Noise ratio
CEPT	European Conference of Postal and Telecommunication Administrations
COM	Commercial multiplex
DMOL	Digital television Multiplex Operators Limited
DSO	Digital switchover
DTT	Digital Terrestrial Television
DVB-T	Digital Video Broadcasting – Terrestrial; the original system standard
DVB-T2	Digital Video Broadcasting – Terrestrial; the new version of DVB-T
ERP	Effective Radiated Power
EPG	Electronic Programme Guide
FEC	Forward Error Correction
GE06	GE06 agreement, Geneva 2006
GI	Geographically Interleaved
ITC	Independent Television Commission (now part of Ofcom)
ITU	International Telecommunication Union
JPP	Joint Planning Project
Mbit/s	Megabits per second
MFN	Multi-frequency Network
MHz	Megahertz
PMSE	Programme Making and Special Events
PSB	Public-service broadcasting
QAM	Quadrature Amplitude Modulation

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RPC1	Fixed roof level reception
RRC-06	Radio Regional Conference 2006
SFN	Single-frequency Network
SI	Service Insertion
SIP	Service Insertion Point
UHF	Ultra High Frequency
WRC	World Radio Conference

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