DRAFT
Note for Applicants on Coverage of Local Television

Minimum coverage requirements and transmission arrangements

DRAFT

This is a draft version of the Coverage Note that we intend publishing alongside the Invitation to Apply for the Local TV Multiplex Licence subject to legislation passing through Parliament as currently drafted and feedback received under the Licensing Local Television consultation process.

Certain parameters are also to be finalised through further work and consultation. These are indicated by italicised text contained in square brackets.

Coverage maps are indicative and subject to change.

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Section 1

Transmitter locations

1.1 This Coverage Note provides indicative details of the coverage that might be achieved by local TV transmitters in each of the locations being considered for local TV services.

1.2 Terrestrial television services are broadcast by a network of approximately 50 main transmitters and over 1,000 smaller relay transmitters. The list of local TV locations we are proposing considers 54 of those transmitters serving 44 locations that generally serve the largest number of households with a good spread across the UK. Figure 1 shows the 44 locations.

1.3 We begin with defining local areas by transmitter location because, unlike for radio, most TV reception is through fixed rooftop aerials that only work well when receiving signals from the direction in which they are pointing. As these aerials will be pointing towards the established transitter sites, these provide a sensible basis for identifying where it may be possible to provide services targeting local communities.

1.4 We commissioned an assessment of the available spectrum at each of the larger of the UK's broadcast transmitters. Most of these will broadcast six UK-wide multiplexes (each carrying a number of television services) at the completion of digital switchover. The six multiplexes require six transmission channels at each transmitter site from the 31 channels available to TV broadcasting. Although this leaves 25 channels unused at each transmitter station, many are in use at adjacent stations and cannot therefore be used for broadcasting at sufficiently high powers to achieve useful coverage without unacceptable interference occurring.

1.5 The assessment therefore attempted to identify the best unused frequency that could be sufficiently clear to permit the broadcasting of an additional local multiplex. Notional antenna patterns were then developed that took into account the requirement not to cause undue interference to the other digital television multiplexes.

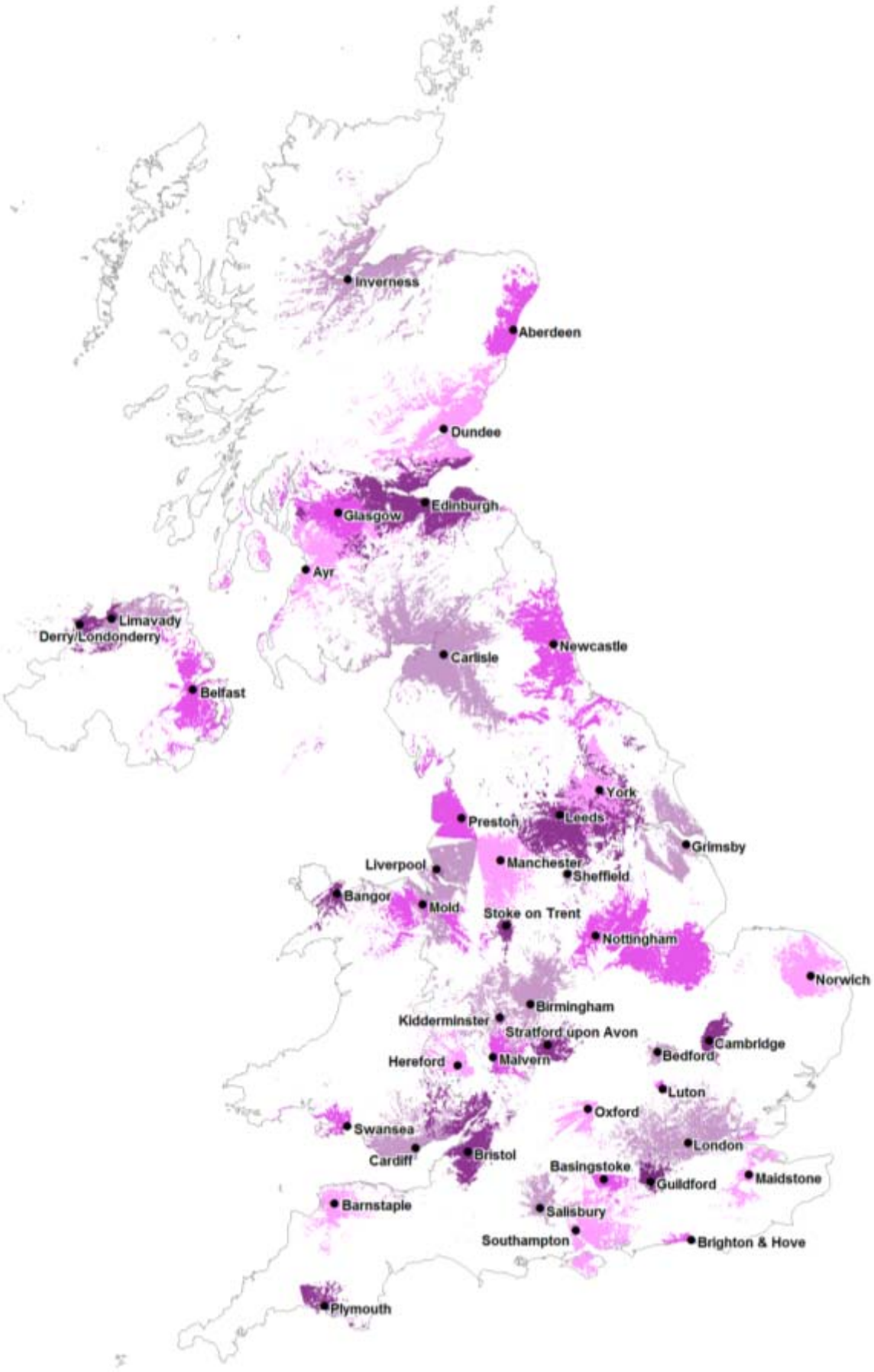


Figure 1. Map of 44 Local TV locations

Section 2

Assumptions and Caveats

2.1 In carrying out the assessment of the feasibility of GI spectrum to accommodate local multiplexes, we have had to make a number of assumptions. The most significant are set out in this section.

Antennas

2.2 We have assumed that separate local multiplex broadcasting antennas would be installed at each transmitter, mounted at around half the height of the transmitter mast.

2.3 We do not at this stage have information about whether the main transmitting antennas used by the six UK-wide multiplexes (and generally situated at the top of masts) could be shared by the local multiplexes. We have therefore adopted a cautious approach to modelling the antenna so as not to overstate the possible coverage that could be achieved.

2.4 The actual coverage achieved in each location will depend on how close the final technical arrangement matches our assumptions.

2.5 Physical space for the new local multiplex antenna will need to be found on the transmitter mast. Should this antenna be higher or lower in practice than the height we have assumed, there may be an increase or decrease in the coverage that could be achieved.

2.6 If the local multiplex can share the main antenna, it would probably achieve more extensive coverage than that shown in the maps in Annex 1. A detailed site-by-site assessment and commercial negotiation would be required to determine the feasibility of the local multiplexes sharing antennas with the UK-wide multiplexes. Sharing the main antenna will definitely not be possible in some cases as they will not meet the necessary antenna pattern restrictions.

Modulation

2.7 A robust signal mode, QPSK 2/3, has been assumed. This enables good coverage to be achieved while offering a capacity of 8 Mbit/s which might be sufficient to carry around three video services. If a different signal mode is ultimately adopted, the coverage achieved by the local multiplexes is likely to be different to that shown. Further information on the applicable transmission standards is provided in the Invitation to Apply document.

Impact on other DTT multiplexes in the UK

2.8 The planning methodology adopted during the assessment and design of notional transmission arrangements for the local multiplexes has been developed to result in minimal impact on the coverage of the UK-wide multiplexes. For example, the power of the local TV transmitters has been kept to modest levels to minimise interference caused to the UK-wide multiplexes. Also, a notional local antenna arrangement has been developed for each site to ensure that the local multiplexes do not cause unacceptable interference to other DTT services.

2.9 Coverage predictions are carried out using a sophisticated computer modelling that breaks the UK into 100m x 100m 'pixels' and calculates the likelihood of reception in each pixel. The model does not have detailed information on the reception conditions in each square and has to make generalised allowances for things like the presence of buildings and trees. We also have to rely upon estimations of the viewing patterns of households in some areas where the coverage of adjacent transmitters overlaps and there is a choice of transmitter from which they can receive their programmes.

2.10 While the planning for introduction of local television services is based on a principle of minimising the impact upon reception of the UK-wide multiplexes, there is a degree of uncertainty inherent in the coverage and impact predictions. It is therefore possible that the number of households that can receive local televion services in some locations may be under or overestimated, as might the number of households whose reception might be affected by the introduction of the local television multiplexes. The method and principles we have adopted are very similar to those used to plan coverage for digital switchover (including the impact of interference from one transmitter to another) which means that we can have confidence that the predictions are correct in the majority of situations.

2.11 In addition, the planning method does not take account of the protection of Re-Broadcast Links (RBLs). RBLs are used by the PSB multiplexes to provide a signal feed from a main station to its relay stations, or from relay station to relay station in a relay chain. Protection could be offered by restricting the local TV station's signals in the direction of the RBL; by improving the RBL (eg. through upgrading the aerials); or a combination of both.

2.12 Further consideration of the obligations to be placed upon the local TV multiplex operator in relation to the impact upon RBLs and upon reception of the UK-wide multiplexes is provided in the Invitation to Apply document.

International considerations

2.13 The UK is obliged through international treaty to limit below a defined level the signals that broadcast services in the UK put into neighbouring countries in Europe. This level is called the coordination trigger threshold[1] and our neighbouring countries are under reciprocal agreements to limit the levels of signals they put into the UK.

2.14 As it is often necessary to exceed the trigger thresholds for transmitters near national boundaries, a process exists to coordinate and agree the use of the frequencies used by the transmitters in each country to manage and minimise the impact of interference from one country into another. For the UK, the transmitters in the south and east of England and in Northern Ireland are those most likely to need coordination.

2.15 The indicative plans for local services presented in this document envisage limiting interference towards the Continent and Ireland to 29dBuV/m. Whilst this level has been used as the basis of coordination of the UK-wide multiplexes, it exceeds the coordination trigger threshold (nominally about 23 dBuV/m). Some local TV multiplexes may therefore be subject to the coordination process and will need to be agreed with the affected administrations. International co-ordination of a high level of exported field strength can take some time (months or even years in exceptional cases). The field strength level we are proposing only exceeds the trigger threshold

[1] The coordination trigger threshold is nominally 23dBuV/m.

by a modest margin and it is expected that a coordination agreement could be reached in a reasonable time frame.

Influence of domestic aerial direction

2.16 The coverage predictions contained in Annex 1 have been derived using the same coverage criteria as are used for planning digital switchover. The maps indicate in purple the maximum coverage from each transmitter where households are predicted to be able to receive the local multiplex, this is called 'gross' coverage.

2.17 It is very unlikely that all households in the gross coverage area have aerials pointing towards the transmitter. Consequently the number of households that could actually receive the local multiplexes and the area covered actually covered in practice would be somewhat smaller. No comprehensive database exists of where aerials are pointing in any particular area and the only way to obtain reliable information is to carry out a rooftop survey. Further information on population coverage is provided in Section 3.

Influence of domestic aerial group

2.18 Traditionally domestic aerials have been designed to work over only a part of the total range of UHF channels; these are called 'grouped aerials'. The grouped aerial approach was sensible as the frequencies used by the historic four analogue television services were usually close together, and the task of designing aerials was made easier by tailoring their response to these relatively narrow channel groups.

2.19 At digital switchover, some of the digital programme services from some transmitters will make use of transmission channels that lie outside the existing analogue aerial group for a particular area. Households in those areas may need to replace their aerials with a wideband design to be able to receive all of the digital programme services reliably. Wideband aerials can receive services on any of the UHF channels and many aerials that have been installed in the last 10 to 15 years are of this type. A considerable number of grouped aerials do however remain in use.

2.20 To maximise the likelihood that households will be able to receive the local multiplexes, we have attempted to find transmission channels that are within, or close to, the existing aerial group. This has not been possible in all cases and the Aerial Compatibility column in Section3, Table 1 provides guidance on the areas where at least some households may have aerials that are not best suited to receiving the local multiplexes. We adopted the following categories:

a) *In group:* The local multiplex channel falls within the analogue aerial group. Households that are predicted to lie within coverage and have an aerial meeting the standard assumptions that points towards the appropriate transmitter should be able to receive the local multiplex.

b) *Just outside:* The local multiplex channel is within a few channels of the analogue aerial group. Although not designed to work on these channels, a grouped aerial can still be expected to perform reasonably well, although some households that are predicted to be in coverage may not be able to receive the local multiplex as a result of their aerial's performance tailing off.

c) *Outside with others:* The local multiplex is outside the aerial group, but so are some of the other digital programme services. Households therefore have a strong motivation to replace their aerials with a wideband type if they would like to

receive all of the programme services. It is unrealistic to expect that all have done so though and some households that are predicted to be in coverage may therefore not be able to receive the local multiplex.

d) *Out of group:* The local multiplex is out of analogue aerial group and some, perhaps many, households may have difficulty receiving the local multiplex unless they have replaced their aerials with a wideband design. In most of these areas, DTT services did operate out of group for many years prior to digital switchover although they have moved back into group at switchover. This would have provided an incentive to households to install wideband aerials, but not all would have done so.

Adjacent Channel Interference

2.21 Local TV multiplexes could be susceptible to adjacent channel interference from the UK-wide multiplexes and hence the coverage they achieve in practice could be less extensive than predicted. Four mechanisms will contribute to the susceptibility of local TV multiplexes.

- Operating at a lower power level relative to the UK-wide multiplexes
- Restricted antenna pattern relative to other multiplexes
- A significant difference in the height of the local multiplex transmitting antennas in relation to other multiplexes at the same transmitting site
- Another multiplex offset towards the local multiplex in particular a UK-wide multiplex using extended carrier DVB-T2.

2.22 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. fewer services can be accommodated within the multiplex. We are proposing that the local multiplexes make use of a robust QPSK modulation scheme.

2.23 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 UK-wide 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 UK-wide multiplex, though this 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 UK-wide multiplex. However, the cost of doing so, or the restrictions required may preclude this.

Offsets

2.24 On occasion the UK-wide 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[2], but also to help with the design of the chain of relay transmitters used by the public service broadcaster

[2]The lower edge of channels 21 and 39 and the upper edge of channels 30 and 60.

multiplexes. Multiplexes whose frequencies are offset towards each other are subject to an increased level of mutual interference[3].

2.25 To mitigate the impact of operating in a channel adjacent to a multiplex incorporating an offset, it has been assumed that the local TV channel will need to employ a similar offset.

2.26 It should be noted that the coverage calculations in this note have not considered offsets. Local TV stations with adjacent channel relationships with the UK-wide multiplexes are noted in Table 1.

[3]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.

Section 3

Indicative Household Coverage

3.1 Coverage maps have been produced based on the type of transmitter arrangement that might be used by local television multiplexes. From these maps, we have picked the largest settlement in each location that is served by the transmitter and taken its name as the principal settlement for that area. These are indicated as the primary location in Table 1. Where a transmitter serves several towns or cities, we have also listed the next larger settlements served in each location, these are detailed as secondary locations.

'Petalling'

3.2 In a few cases, the coverage that could be achieved by a transmitter is very extensive and serves several cities. An example is the Winter Hill transmitter that serves most of the Granada ITV region in the north-west of England. In these cases, we have modelled the potential targeting of coverage using a technique we have named 'petalling'. This enables specific targeting of distinct locations within the transmitter coverage area. The advantage of using petalling is that separate local services can be carried in each petal. In the case of Winter Hill, separate petals could provide different local TV services for Manchester, Liverpool and Preston.

Indicative coverage

3.3 The coverage figures and maps we have produced provide an indication of the kind of coverage that might be achieved by local multiplexes. The assessment we have made of possible locations is, however, based on a purely theoretical analysis of transmitter sites and the available spectrum.

3.4 Population coverage assessments are based on a predicted TV signal strength level in each100m x 100m area of the UK (known as a 'pixel'). All households in pixels within which at least 70% of the locations are predicted to be served are counted. The total number of households in the UK is assumed to be 27.6 million. All coverage figures assume that households have good quality aerials that are correctly aligned and of the appropriate group or are wideband.

3.5 Table 1 includes estimates for each location of the number of households that might be able to receive the local multiplexes, if they were broadcast using the assumed charateristics. It is not possible to provide an exact figure for the number of households that receive their television services from any particular transmitter and it is therefore difficult to be precise about how many households could receive the local multiplexes. As guidance, we have provided two measures:

i) **Gross population** represents the total number of households that could receive the local multiplex if their aerials are pointing towards the appropriate transmitter. In practice, the gross coverage of adjacent transmitters overlaps to some extent which means that households have a choice of which direction to point their aerials. Gross coverage is therefore almost always an overestimate of the number of households using a particular transmitter as some households within the gross coverage area can be expected to be watching a different transmitter. Gross coverage is nevertheless useful as it provides an upper limit on the maximum possible number of households served. Because the gross coverage of adjacent transmitters overlaps, for areas where two transmitters are proposed the

gross population figure represents the gross coverage of the larger transmitter only.

ii) **DPSA (Digital Preferred Service Area)** is an attempt to provide a more realistic estimate of the number of households that might be able to receive the local multiplex than gross population. The DPSA is a prediction of the areas where a particular transmitter is likely to provide better signals than other transmitters. In those areas, it is reasonable to expect that households have aerials pointing at the transmitter in question and could therefore receive the local multiplex broadcast from that transmitter. The DPSA method is a numerical prediction and cannot, however, take account of viewer preferences where households sometimes choose to receive services from a different transmitter. No allowance has been made in the figures for the proportion of households that make use of alternative platforms such as cable or satellite. In locations where two transmitters are proposed, the DPSA coverage figure is the sum of the contribution of both transmitters.

3.6 Our initial assessment shows that the network of transmitters in Table 1 could achieve total coverage (within DPSA) of approximately 12 million homes.

3.7 The predicted coverage is inevitably a theoretical calculation. For example, the use of a transmit antenna at a different height to that assumed will change the predicted coverage. There is also a limit to the accuracy of the computer prediction of the TV signal strength. For example, the method uses statistical clutter models rather than any real data on local buildings, trees or other potential obstacles in a particular area. The method and assumptions are however consistent with those used for digital switchover.

3.8 In the case of a new TV service being introduced into an existing broadcast environment, this method of estimating the predicted coverage for each transmitter does carry with it an implicit assumption that households will be willing to install a new receiving aerial for the new service, if their existing aerial arrangement is not adequate.

3.9 Annex 1 to this Note provides a summary of the planning assignments for each local TV station including an indicative coverage map.

Table 1. List of Proposed Local TV Stations& Indicative Coverage (assuming QPSK 2/3 modulation)

Primary Location	Gross Households	DPSA Households	Transmitter Station	Channel	Aerial Compatibility	Adjacent Channel
Phase 1						
Belfast (incLisburn)	260,000	250,000	Divis	30	In group	Yes
Birmingham (inc. Greater Birmingham, part of Wolverhampton, Walsall, Dudley)	1,200,000	1,200,000	Sutton Coldfield Brierley Hill	51 29	In group Out of group	
Brighton & Hove	150,000	98,000	Whitehawk Hill	54	In group	Yes
Bristol	380,000	330,000	Mendip Bristol Kings Weston Bristol Ilchester Crescent	51 30 30	In group Just outside Just outside	Yes
Cardiff (inc. Newport, Bridgend)	500,000	351,000	Wenvoe	51	In group	
Edinburgh (inc. Edinburgh)	610,000	290,000	Craigkelly	52	In group	
Glasgow (inc. East Kilbride, Motherwell, Paisley)	750,000	660,000	Black Hill	51	In group	
Grimsby (inc. parts of Kingston upon Hull)	270,000	270,000	Belmont	27	In group	Yes
Leeds (inc. Dewsbury, Halifax, Huddersfield, Wakefield)	1,100,000	1,000,000	Emley Moor Beecroft Hill	56 56	Just outside In group	 Yes
Liverpool (inc. St Helens, Widnes, Wigan, Wirral)	880,000	870,000	Winter Hill petal 2 Storeton	56 30	In group In group	Yes Yes
London (inc. Greater London area)	3,200,000	3,100,000	Crystal Palace	29	In group	Yes
Manchester (inc. Bolton, Bury, Oldham, Rochdale, Salford, Stockport)	1,100,000	1,100,000	Winter Hill petal 1	56	In group	Yes
Newcastle	1,000,000	760,000	Pontop Pike	56	In group	Yes

Primary Location	Gross Households	DPSA Households	Transmitter Station	Channel	Aerial Compatibility	Adjacent Channel
(inc Gateshead, South Shields, Sunderland)						
Norwich	155,000	149,000	Tacolneston	57	In group	
Nottingham	310,000	290,000	Waltham Nottingham	26 50	Outside with others	 Yes
Oxford (inc. Abingdon, Didcot)	110,000	110,000	Oxford	51	In group	Yes
Plymouth	94,000	100,000	Caradon Hill Plympton	30 39	In group Outside with others	
Preston (inc. Blackpool)	350,000	340,000	Winter Hill petal 3	56	In group	Yes
Southampton (inc. Eastleigh, Fareham, parts of Isle of Wight, parts of Portsmouth, Winchester)	460,000	250,000	Rowridge VP	29	In group, but different polarisation to analogue	Yes
Swansea (inc. Llanelli)	120,000	73,000	Kilvey Hill	30	In group	Yes
Total Phase 1		**11,591,000**				
Phase 2						
Aberdeen	130,000	130,000	Durris	30	In group	Yes
Ayr (inc. Kilmarnock)	170,000	110,000	Darvel	30	In group	Yes
Bangor	22,000	17,000	Llanddona	51	In group	
Barnstaple	34,000	32,000	Huntshaw Cross Barnstaple	51 49	In group In group	Yes
Basingstoke	88,000	64,000	Hannington	29	In group	
Bedford (inc. Sandy)	64,000	64,000	Sandy Heath	42	Outside with others	
Cambridge	84,000	83,000	Madingley	40	Outside with others	
Carlisle	120,000	91,000	Caldbeck	56	Out of group	
Derry/Londonderry	40,000	36,000	Londonderry	51	In group	

Primary Location	Gross Households	DPSA Households	Transmitter Station	Channel	Aerial Compatibility	Adjacent Channel
Dundee (inc. Arbroath, Perth)	390,000	150,000	Angus Tay Bridge	48 51	In group In group	Yes
Guildford (inc. parts of Woking)	180,000	53,000	Guildford	51	In group	Yes
Hereford	44,000	43,000	Ridge Hill petal 1	51	Out of group	
Inverness	72,000	50,000	Rosemarkie	52	In group	
Kidderminster	35,000	22,000	Kidderminster	56	In group	
Limavady (inc. parts of Ballymoney&Coleraine)	55,000	36,000	Limavady	48	In group	Yes
Luton	81,000	23,000	Luton	45	Just outside	
Maidstone	220,000	140,000	Bluebell Hill	27	Just outside	
Malvern	79,000	50,000	Malvern	51	In group	Yes
Mold (inc. Denbigh, Ruthin)	89,000	25,000	Moel y Parc	56	Just outside	
Salisbury	42,000	31,000	Salisbury	51	In group	Yes
Sheffield (inc. parts of Rotherham)	190,000	120,000	Sheffield	55	Outside with others	
Stoke on Trent (inc. Newcastle under Lyme)	150,000	120,000	Fenton	29	In group	Yes
Stratford upon Avon	68,000	29,000	Lark Stoke	48	Outside with others	
York	150,000	71,000	Bilsdale petal 2	24	In group	Yes
Total Phases 1 and 2		**13,181,000**				

Section 4

The DTT Platform

Description of the DTT platform

4.1 The existing UK-wide DTT services will broadcast from a network of 1,156 transmitter sites when the process of digital switchover completes in October 2012. Each transmitter site will broadcast either three or six UK-wide multiplexes: all sites will carry the three Public Service Broadcaster (PSB) multiplexes (provided by the BBC and Digital 3&4 Ltd), and the UK's 80 primary transmitters will carry a further three 'commercial' multiplexes (provided by Arqiva Ltd and SDN Ltd).

Multiplex	Operator	Notes
PSB1 – BBC A	BBC	
PSB2 - D3&4	Digital 3 & 4	Consortium of Channel 3 licensees and Channel 4
PSB3 - BBC B	BBC Free To View Ltd	DVB-T2 multiplex carrying High Definition channels
COM4 - SDN	SDN	Subsidiary of ITV plc
COM5 - Arqiva A	Arqiva	
COM6 - Arqiva B	Arqiva	

4.2 An estimated 98.5% of the UK population will be served by at least three UK-wide multiplexes by the completion of switchover. Approximately 90% of the population will be served by the network of 80 principal transmitters carrying six UK-wide multiplexes. In areas outside the coverage of the 80principal sites, a much larger number of 3-multiplex sites will provide the three 'public service' UK-wide multiplexes in areas where signals from principal transmitters are poor or unavailable.

Licensing of Existing Multiplex operators

4.3 All UK-wide multiplex operators hold Wireless Telegraphy Act licences from Ofcom which authorise their use of the spectrum. All multiplexes (except BBC A) also hold multiplex service licences awarded under the Broadcasting Act 1996. The BBC A multiplex is 'gifted' directly to the BBC under its Charter and associated Framework Agreement, and therefore does not require a Broadcasting Act licence.

4.4 The multiplex licences place a number of conditions upon the licensees relating to digital switchover, cooperation and interoperability. For the latter category, licensees are required to comply with the *Television Technical Performance Code*[4] and the

[4]Television Technical Performance Code: http://stakeholders.ofcom.org.uk/binaries/broadcast/guidance/tech-guidance/tv_tech_platform_code.pdf

Reference Parameters[5] which describe some minimum conditions for seeking to ensuring interoperability between the licensee's broadcasts and domestic receivers.

Digital Television Group (DTG) and the D-Book

4.5 Although UK DTT services use the internationally standardised DVB-T and DVB-T2 systems, in several areas these standards deliberately include significant scope for flexibility in detailed implementation options. However, the DTT platform in the UK operates on a horizontal model, with several independent multiplex operators (rather than a single platform operator), and with many manufacturers supplying a diverse range of domestic receiver equipment. It is therefore necessary to achieve effective interoperability between both the multiplexes as broadcast, as well as between the signals and receivers, in order to ensure platform stability and to facilitate the technical evolution of the platform.

4.6 Requirements in the licences of the multiplex operators (which the BBC also adheres to in the case of the BBC A multiplex) do reduce the number of options, for example in permissible basic transmission modes. These restrictions were introduced with a view to improving prospects for platform interoperability, and are contained in Ofcom's *Reference Parameters*. Nevertheless many detailed aspects of implementation lie outside the scope of the broadcasters' licences, leaving numerous choices to be made by broadcasters, multiplex operators and receiver manufacturers.

4.7 Since the launch of DTT services, the Digital Television Group[6] (a body whose membership includes both broadcasters and receiver manufacturers) has developed and maintained detailed implementation standards for DTT transmission and reception in the UK, and these are contained in its UK Digital Terrestrial Television: Requirements for Interoperability (known as the 'D-Book'). Manufacturers wishing to use the Freeview or Digital tick logos must ensure their receivers comply with relevant parts of the D-Book.

4.8 Detailed specifications for technical developments on the DTT platform, including Freeview+, Freeview HD, and the forthcoming Connected TV services, are agreed within the DTG and subsequently incorporated into the D-Book.

4.9 Membership of the DTG allows direct participation in the development of technical specifications, for example via the DTG's various working groups specialising in specific aspects of the DTT platform, as well as access to the D-Book.

4.10 DTG Testing is a subsidiary company whose services include providing conformance testing for DTT receiver equipment. DTG testing also manages the 'Engineering Channel', a service which provides a means for manufacturers to deploy over-air receiver software updates.

4.11 The introduction of any new DTT multiplexes, including those carrying local TV services, could raise technical coexistence issues relating to the level of interoperability with existing services. It is therefore important that the Local TV

[5] Reference Parameters for Digital Terrestrial Television Transmissions in the UK: http://stakeholders.ofcom.org.uk/binaries/broadcast/guidance/tech-guidance/dttt_uk.pdf

[6] DTG website: www.dtg.org

multiplex operator and Local content licensees ensure that their technical arrangements are compatible with those described within the D-Book.

4.12 The DTG has produced a paper, *UK DTT features for support of Local TV services*, that describes some of the features offered by the UK DTT platform that may be of use for local TV multiplex operators and local content licensees. The paper is available for download from the DTG's website[7].

DMOL – DTT Multiplex Operators Limited

4.13 To a large extent the existing DTT multiplexes operate as independent entities (each carries unique video, audio and associated data for example). However, a certain amount of ongoing technical coordination takes place between the multiplexes in order to provide some platform-wide services to viewers, and to ensure full interoperability. Two significant areas where ongoing cooperation between multiplexes takes place are in providing programme schedule information (EPG data), and in the assignment of logical channel numbers (LCNs).

4.14 Each multiplex contains programme schedule data which is used by receivers to form and display an EPG, as well as supporting PVR functionality. In order to display an EPG containing schedules for all DTT services (and not just on the multiplex currently tuned to), schedule information is 'cross carried' by all multiplexes: i.e., each multiplex contains information on the programme services and schedules of services carried on all other multiplexes. Ofcom's *Reference Parameters* requires a core amount of schedule data ('now & next') to be cross-carried between multiplexes. In practice the multiplex operators voluntarily cross-carry much more extensive schedule data, which allows receivers to provide a full 7-day EPG.

4.15 To implement cross-carriage, and to incorporate the numerous regional variations carried by the DTT network across the UK, technical infrastructure is in place which provides a central point for the collation and subsequent distribution of 'Central Service Information' (CSI, carrying schedule information amongst other data) to individual groups of transmitter sites. Data is contributed by each multiplex operator to this central point, and it is then collated and made available for distribution to the transmitter transmitters.

4.16 The cross-carriage of Service Information data between multiplexes does impose a data capacity overhead on each multiplex, the size of which is largely dependent on the number of services or multiplexes in the cross-carriage 'pool'.

4.17 Existing DTT programme services are also assigned unique Logical Channel Numbers (LCNs). LCNs allow viewers to select their desired programme services at a consistent location in their EPGs or via their remote control (e.g., ITV2 is allocated LCN 6, or button '6' on the remote control). Centralised allocation of LCNs is required in order to prevent LCN conflicts and possible subsequent errors in receiver behaviour.

4.18 LCN allocation, as well as overall management and ownership of the CSI infrastructure, is carried out by DMOL8 (DTT Multiplex Operators Ltd.). DMOL is a company owned by the operators of the six UK-wide DTT multiplexes (BBC,

[7] DTG documents downloads: http://www.dtg.org.uk/publications/books.html
[8]DMOL website: www.dmol.co.uk

Digital 3&4, SDN &Arqiva), and DMOL membership is open to operators of local multiplexes.

As noted above, the introduction of any new DTT multiplexes, including those carrying local TV services, could raise technical coexistence issues relating to the level of interoperability with existing services: for example, the use and labelling of transport stream components including LCNs and network descriptors, as well as arrangements for the provision / distribution of schedule data to facilitate the integration of new services into the Freeview EPG system. Section 2 in the ITA contains details of our proposals for Technical Standards and Interoperability for Local TV multiplexes.

Section 5

Transmission sites and Reference Offers

Background

5.1 Television broadcasting is largely based upon reception by fixed receivers, the majority of which are connected to rooftop or loft aerials that point at one specific transmitter. The existing DTT multiplexes share transmission sites: the three PSB multiplexes (BBC-A, BBC-B and D3&4) are broadcast from an extensive network of main and smaller relay transmitters. The three commercial multiplexes (SDN, Arqiva A and Arqiva B) are transmitted from only the larger 80 of these sites, yet will still achieve coverage of around 90% of UK households at the completion of switchover.

5.2 Although local multiplex operators could in principle build their transmitters at alternative locations, if these sites are not in the line of sight of existing aerials, their chance of achieving reliable reception are greatly reduced. A further constraint on using alternative sites is that of 'hole punching' where any households near a transmitter broadcasting only a local service might lose reception of the other six multiplexes. This might occur because in that area, the local multiplex signal would be very much stronger than that of the other multiplexes that are broadcast from a more distant transmitter. The houses near the local transmitter might be prevented from receiving signals from the more distant multiplexes in a similar manner to someone trying to listen to a quiet radio programme when someone seated nearby is talking loudly.

5.3 If all multiplexes share transmitter sites, the problem of hole punching does not usually occur as all the multiplexes maintain the same strength in relation to each other: close to the transmitter, they are all strong while further away they all become weaker together. An added advantage is that households only need an aerial pointing at one transmitter.

Site access and price regulation

5.4 As explained above, the existing DTT multiplexes all share common transmitter sites which provides a consistent experience for viewers. In the past, two transmission companies, Crown Castle and ntl:broadcast (ntl) owned approximately half of the sites each.

5.5 Following the coming into force of new EU communications directives in 2003, Ofcom carried out a market review of broadcast transmission services[9]. Ofcom found the two transmission companies did have Significant Market Power in Network Access[10]. In practice, this meant that it would be difficult for alternative suppliers to bid to provide transmission services to customers as they would not have access to cost information for a large portion of the transmission chain. Ofcom therefore imposed several obligations on Crown Castle and ntl:

[9]Broadcast transmission services market review: http://stakeholders.ofcom.org.uk/consultations/bcast_trans_serv/?a=0

[10] Network Access covers part of the transmission chain including broadcast masts, antenna systems, power and buildings.

5.5.1 requirement to provide network access to their respective masts and sites on reasonable request;

5.5.2 requirement not to unduly discriminate in that provision of network access;

5.5.3 requirement to provide network access to their respective masts and sites on cost-orientated terms;

5.5.4 requirement to publish a Reference Offer for that provision of network access.

5.6 In 2008, a round of ownership changes and consolidation occurred that resulted in both transmission companies coming under the ownership of a single company, Macquarie Broadcast Holdings Ltd. The Competition Commission found that this consolidation would lead to a substantial lessening in competition for both network access and also for Managed Transmission Services[11] in the broadcast television market. In order to obtain clearance for the acquisition to take place, Macquarie gave certain Undertakings[12] to the Competition Commission, including producing Reference Offers for Transmission Services as well as for Network Access. Both companies have now been merged into the single transmission company Arqiva which either owns or leases all of the transmission sites used to broadcast television services in the UK.

5.7 Figure 1 sets out a typical transmission chain and how these break down into Network Access and Managed Transmission Service.

5.8 We are confirming with Arqiva details in relation to the publication of Reference Offers for both Network Access and Transmission services for local television multiplexes for the 44 locations set out in Section 3 [*these will be available on Arqiva's website*[13]] The Reference Offers will provide an indication of the likely costs of providing transmission facilities for local multiplexes in those locations.

5.9 Multiplex operators will be able to procure transmission services from alternative transmission companies. Use of alternative sites may be permissible, if the Multiplex Operator can demonstrate that

5.9.1 there will not be a detrimental impact upon reception of other DTT multiplexes through coverage hole punching

5.9.2 the alternative site is in a position where it is in line with the majority of viewers TV aerials in the target area

5.9.3 Coverage achieved from the alternative transmitter site is at least as good as that set out in Annex 1.

5.10 It is likely that the Arqiva sites will need to be used in a large number of cases due to their position and the need to use a sizeable structure to reach the target population. As noted above, alternative transmission companies will be able to provide

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[11] Managed Transmission Services includes the transmitters and monitoring equipment that together with the Network Access elements form the broadcast transmission chain.
[12] Macquarie Undertakings: http://www.adjudicator-bts.org.uk/documents/Undertakings%20-%20Non-confidential%20version.pdf

[13] Arqiva Reference Offers: Insert link when available

transmission services for the multiplex licensee and Arqiva's Network Access Reference Offer will provide a cost basis for access to those sites that other transmission companies can use as the basis of developing proposals for applicants. Arqiva's Transmission Service Reference Offer provide an indication of cost should the licensee wish to use Arqiva to provide transmission services

5.11

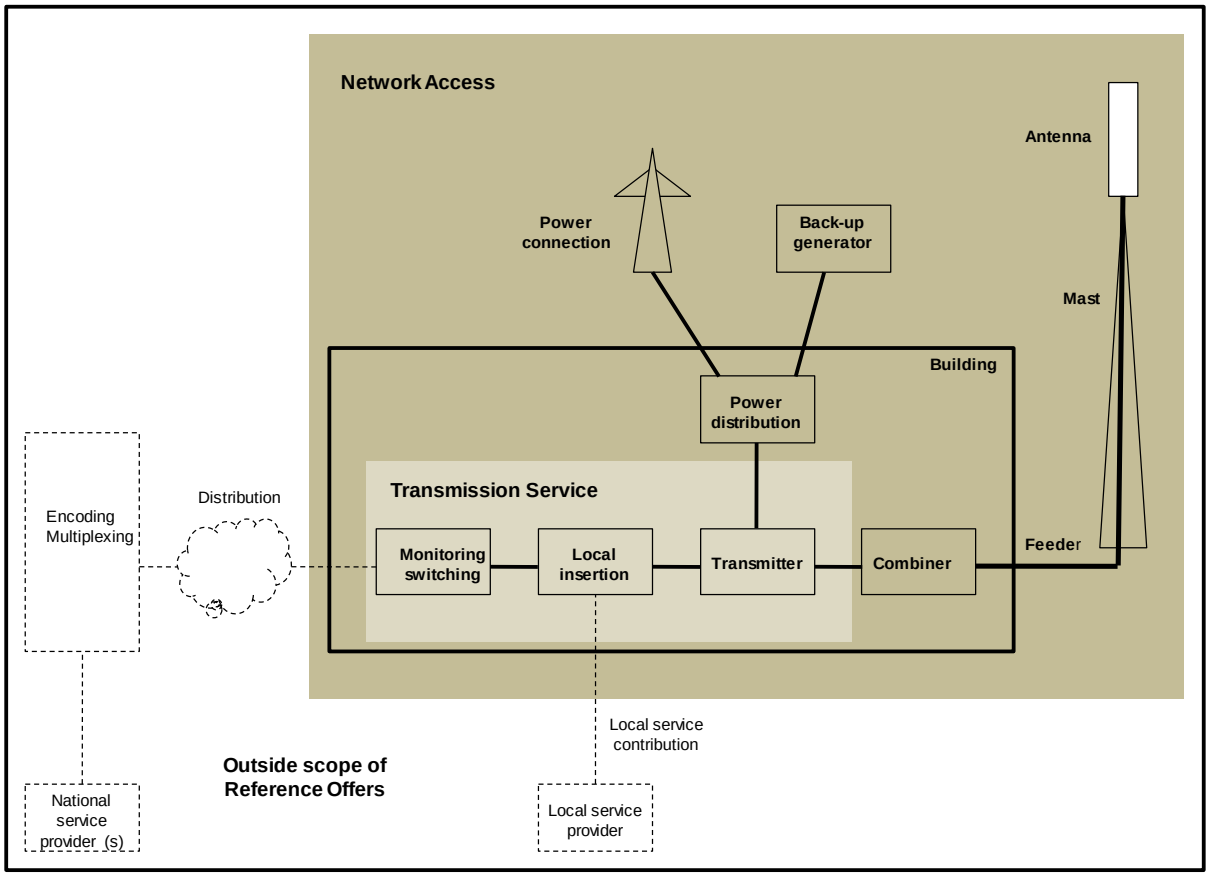
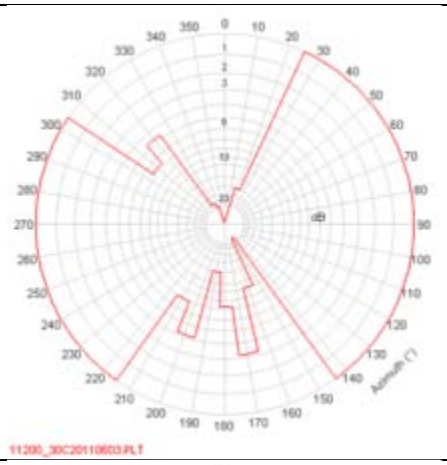
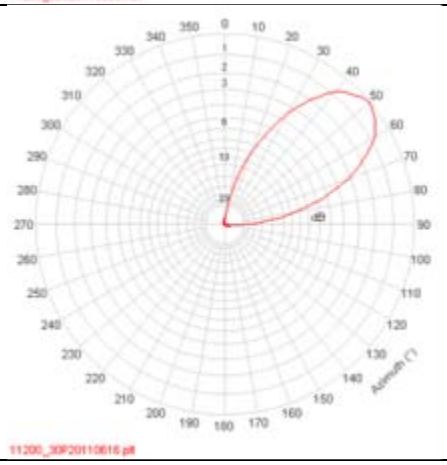


Figure 1: Network Access and Managed Transmission Service

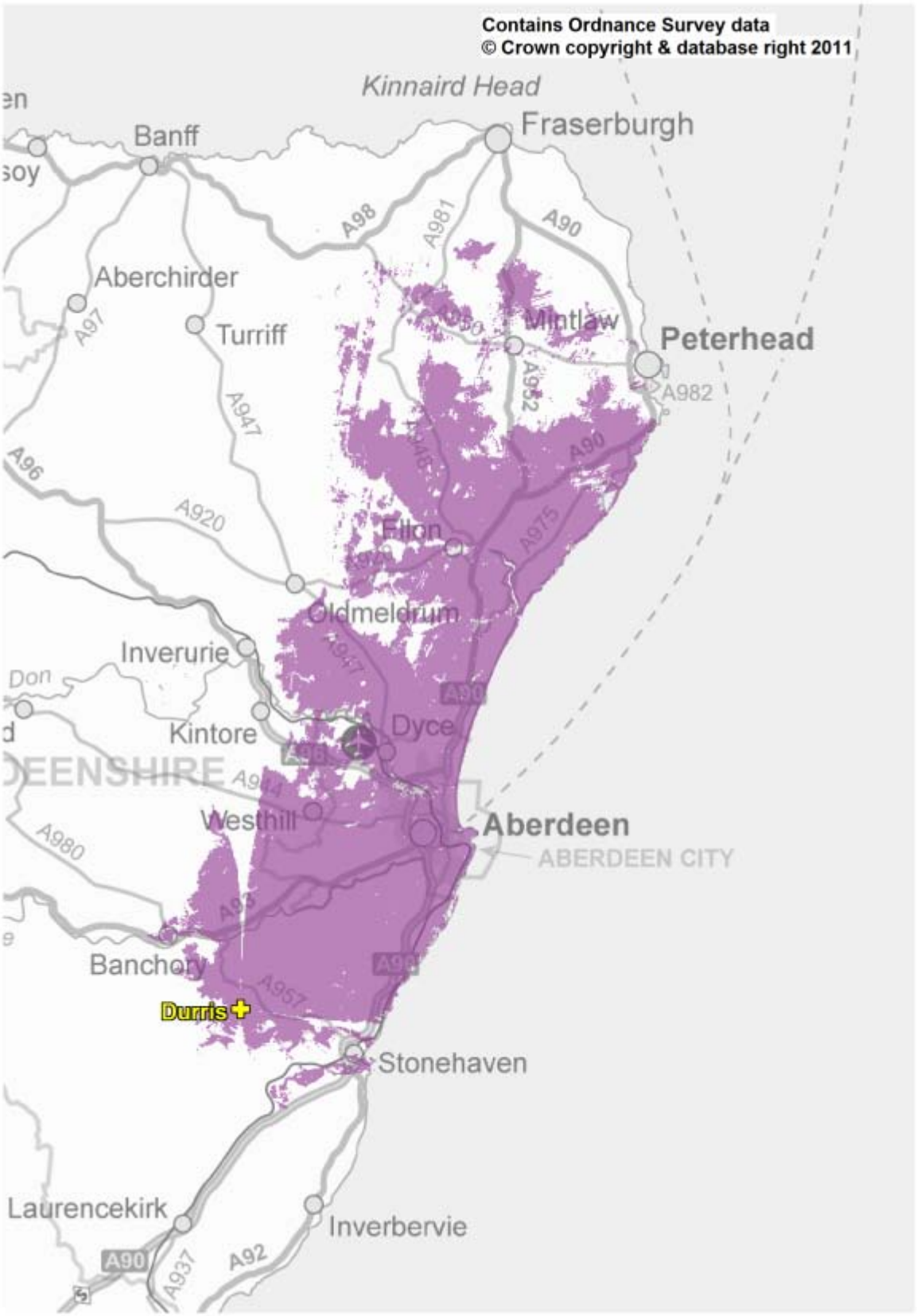
Annex 1

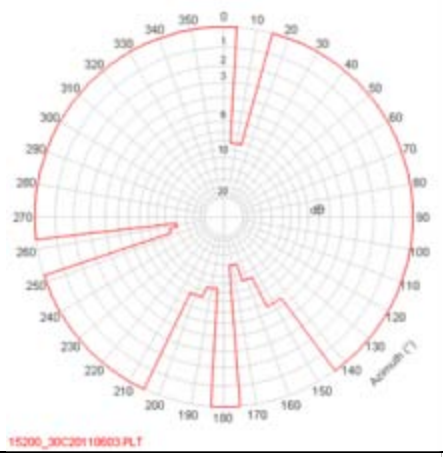
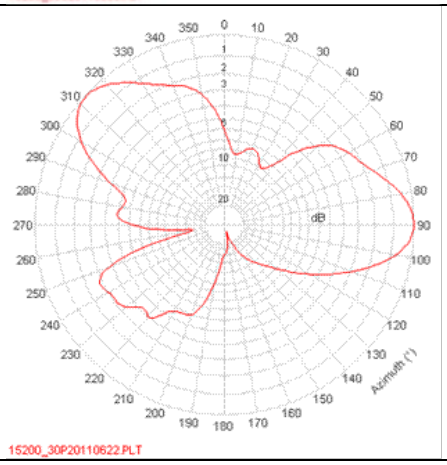
Indicative Coverage Maps

Indicative coverage maps are provided in this Annex, in alphabetical order by location.

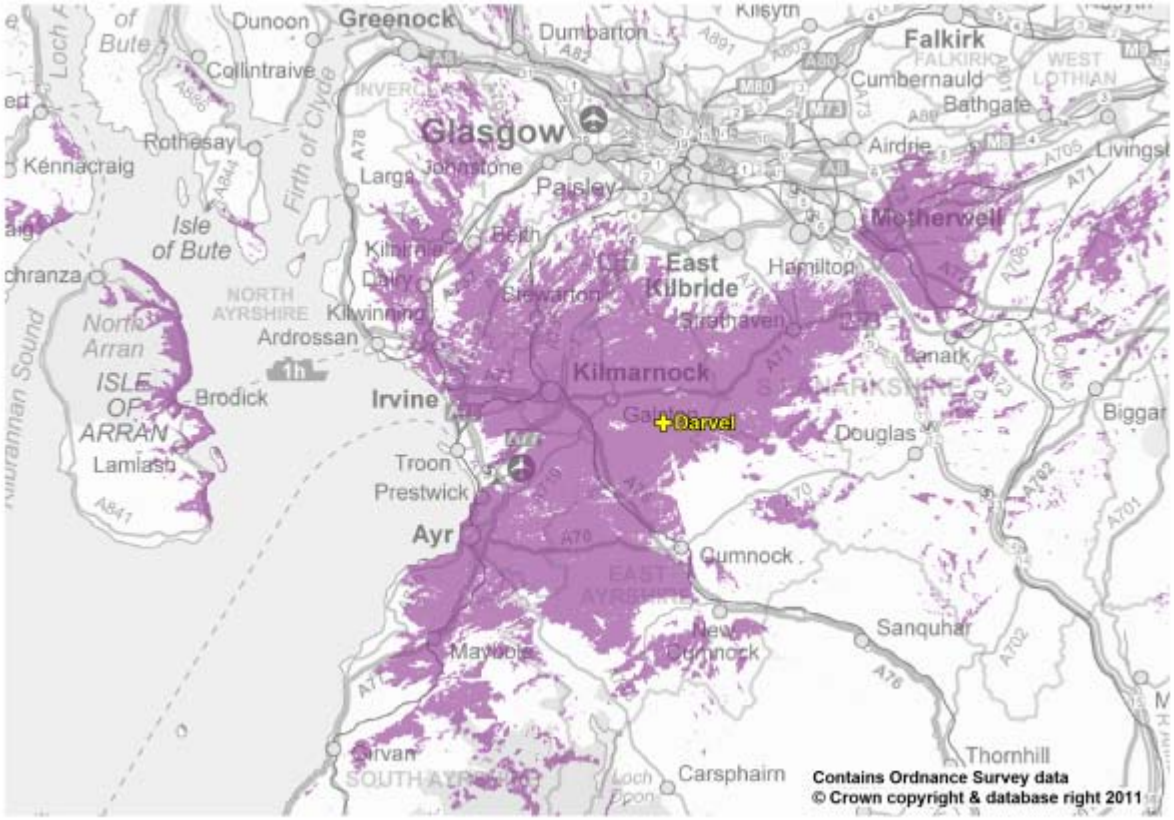
Location	Aberdeen
Station	Durris
Channel	30
Effective Radiated Power	10 kW
Assumed Antenna Height	157m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	130,000 households
Indicative DPSA Coverage (QPSK 2/3)	130,000 households

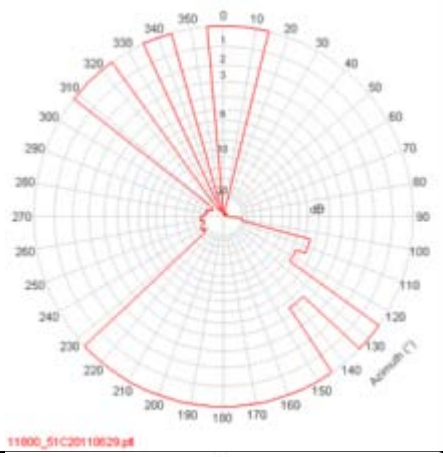
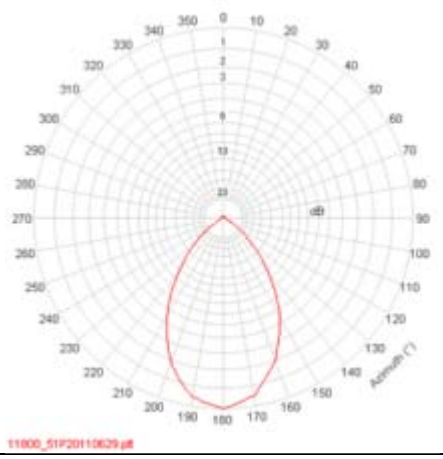
Aberdeen Indicative Coverage Map (assuming QPSK 2/3)



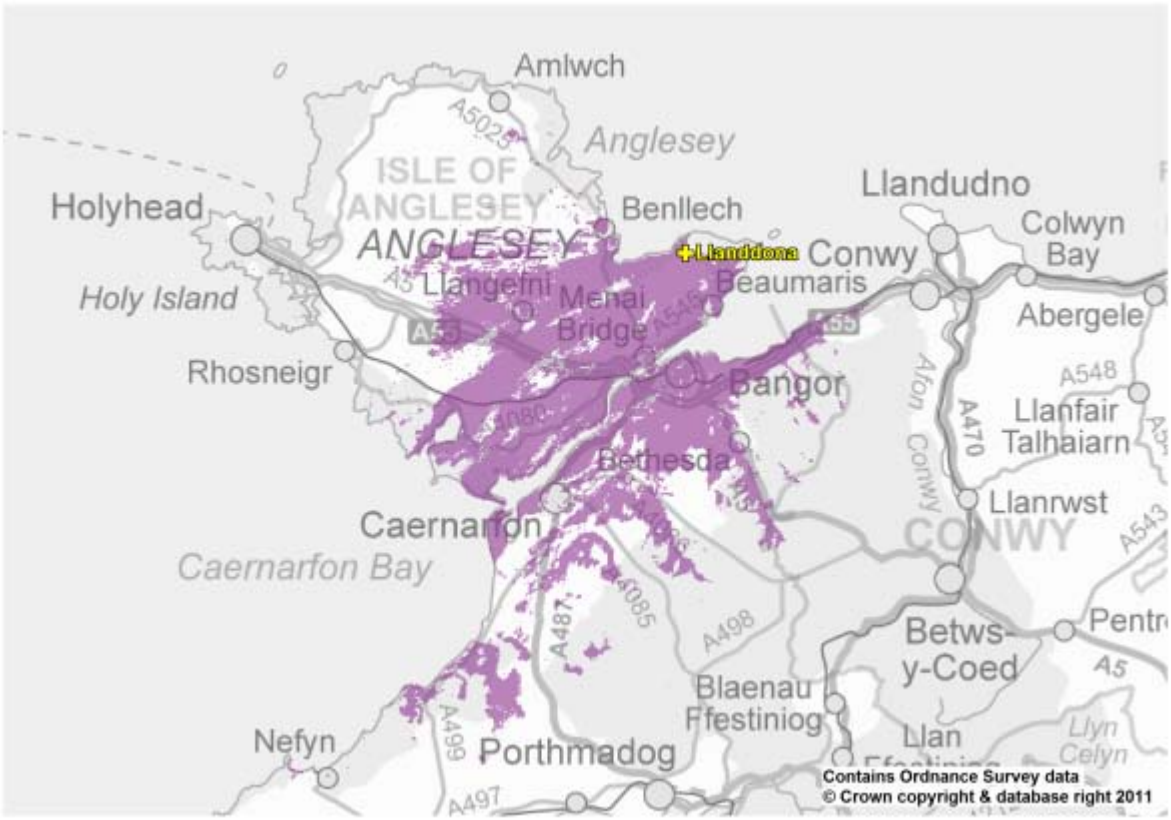
Location	Ayr
Station	Darvel
Channel	30
Effective Radiated Power	1 kW
Assumed Antenna Height	80m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	170,000 households
Indicative DPSA Coverage (QPSK 2/3)	110,000 households

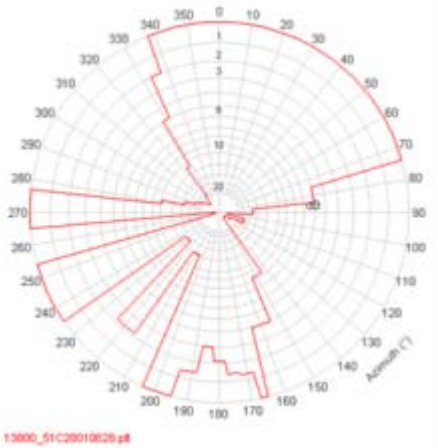
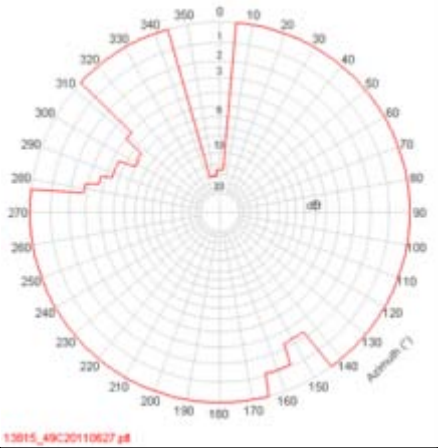
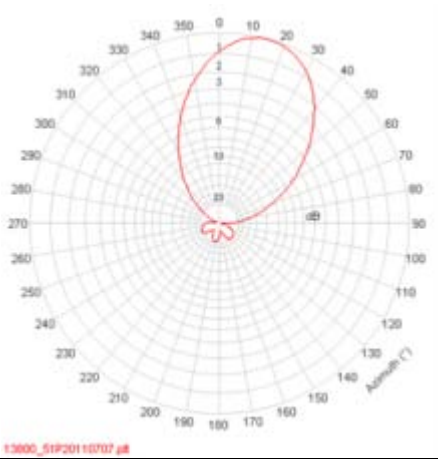
Ayr Indicative Coverage Map (assuming QPSK 2/3)

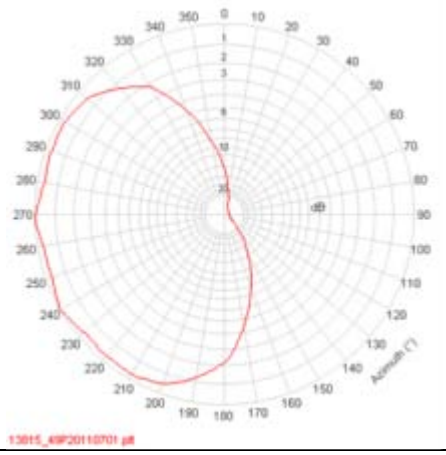


Location	Bangor
Station	Llanddona
Channel	51
Effective Radiated Power	1 kW
Assumed Antenna Height	56m
Indicative Antenna Template	(with respect to 10kW) 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	22,000 households
Indicative DPSA Coverage (QPSK 2/3)	17,000 households

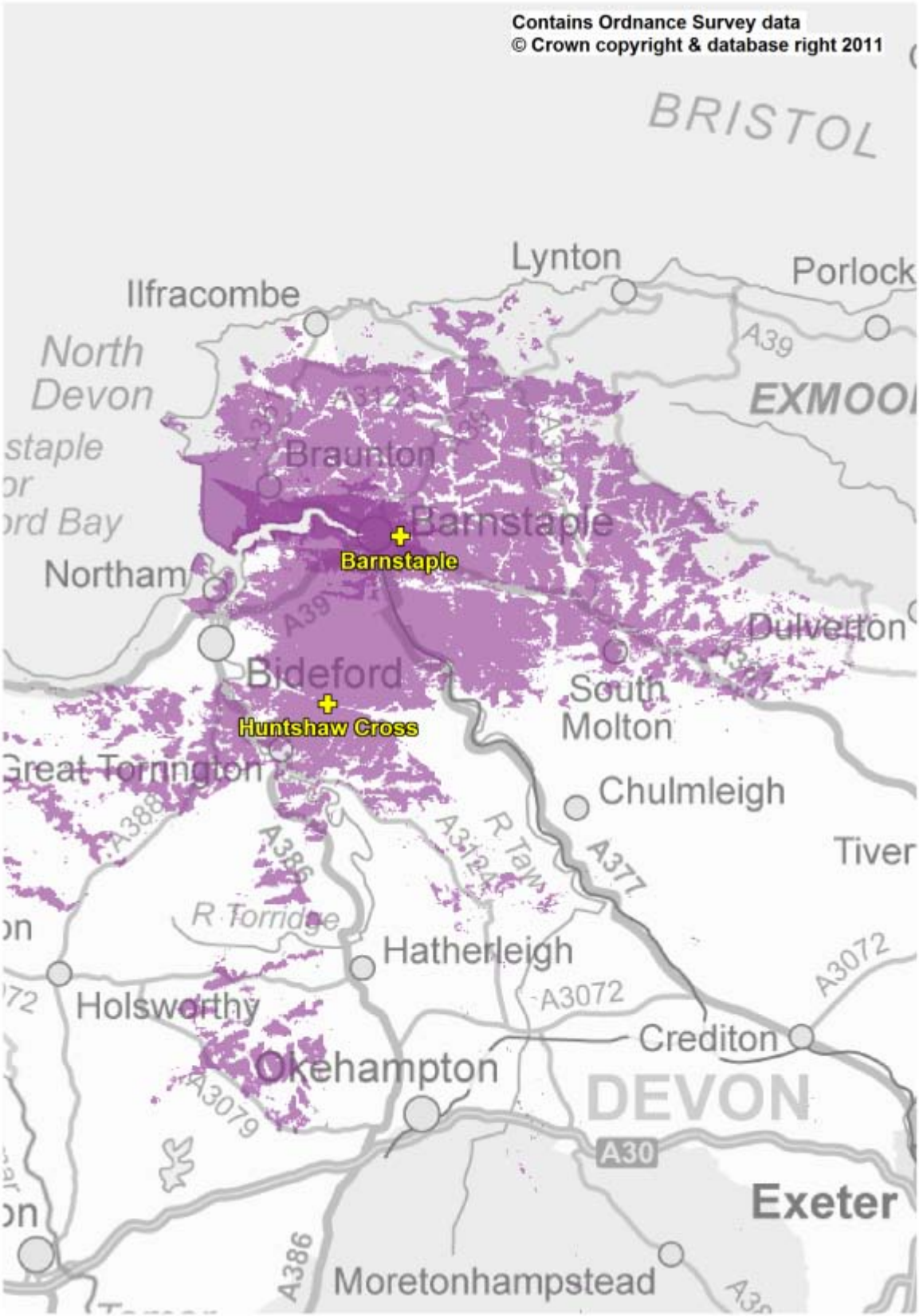
Bangor Indicative Coverage Map (assuming QPSK 2/3)

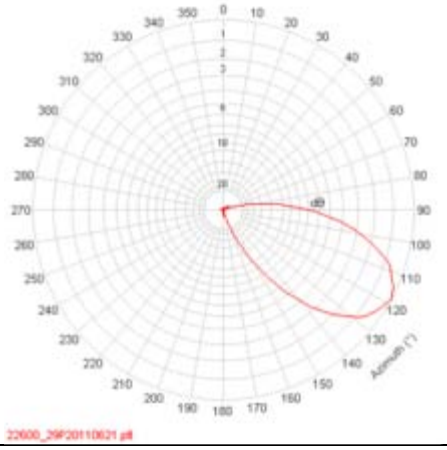


Location	Barnstaple	
Station	Huntshaw Cross	Barnstaple
Channel	51	49
Effective Radiated Power	2 kW	0.001 kW
Assumed Antenna Height	79m	25m
Indicative Antenna Template	Huntshaw Cross (with respect to 10kW)  Barnstaple (with respect to 1kW) 	
Assumed Practical Antenna Pattern	Huntshaw Cross 	

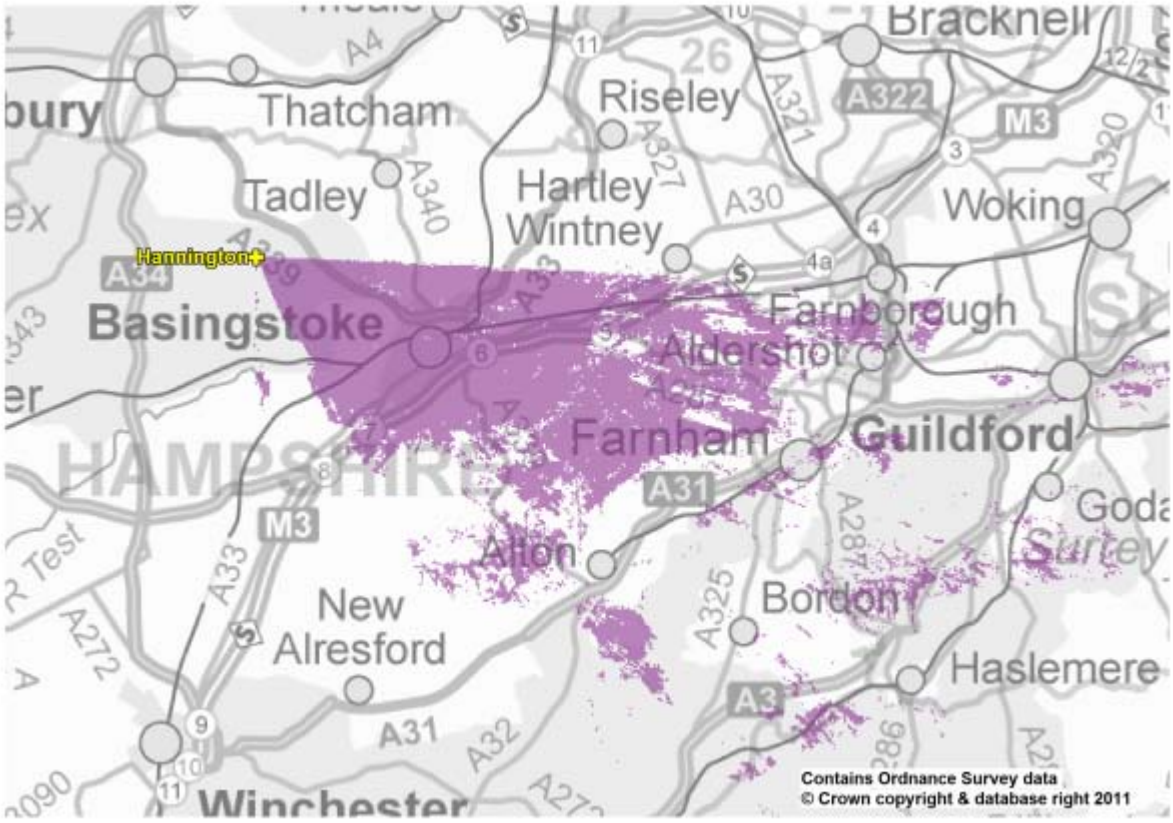
	Barnstaple 
Indicative Gross Coverage (QPSK 2/3)	34,000 households
Indicative DPSA Coverage (QPSK 2/3)	32,000 households

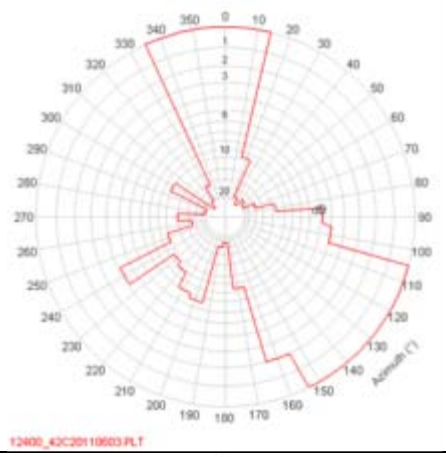
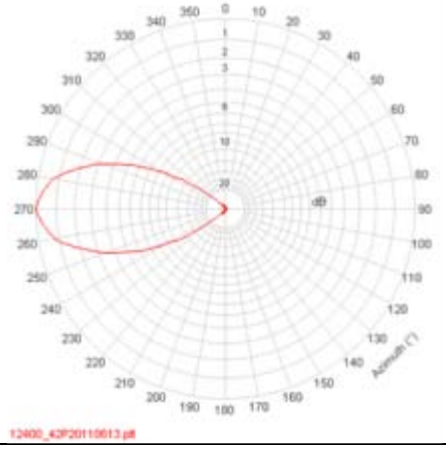
Barnstaple Indicative Coverage Map (assuming QPSK 2/3)



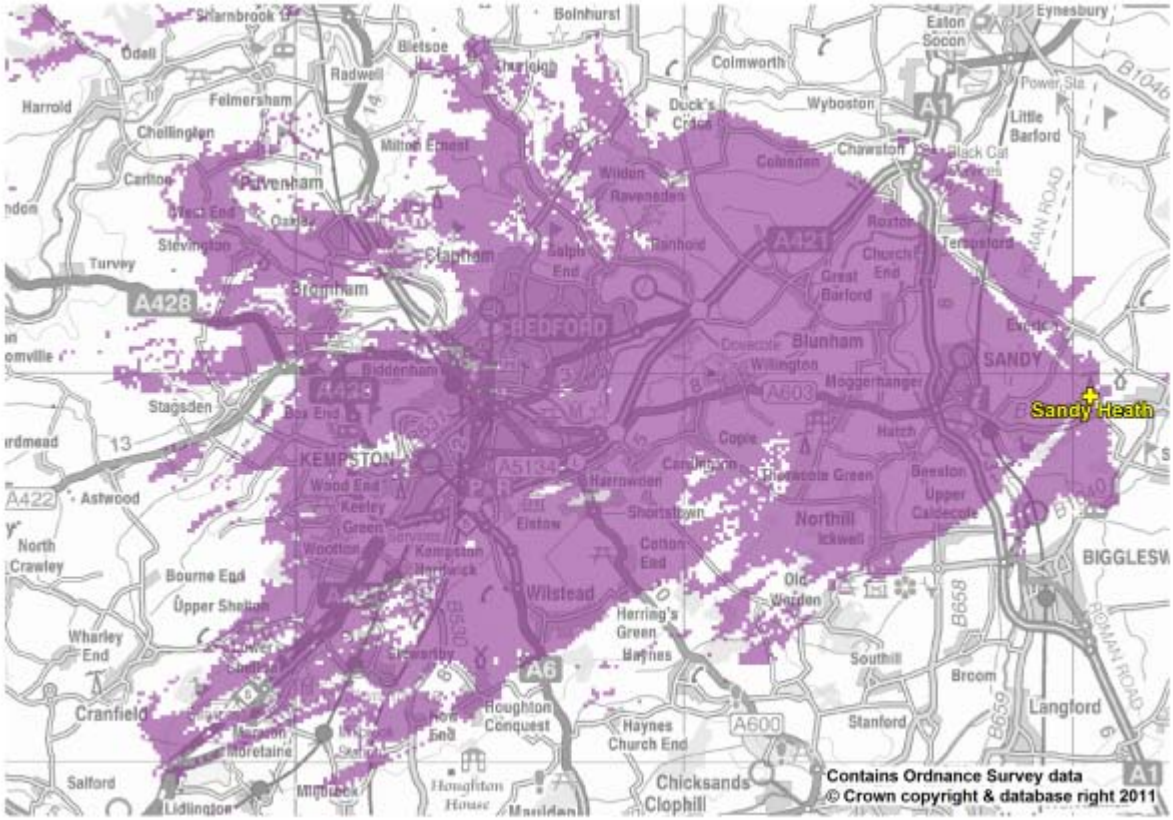
Location	Basingstoke
Station	Hannington
Channel	29
Effective Radiated Power	2 kW
Assumed Antenna Height	71m
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	88,000 households
Indicative DPSA Coverage (QPSK 2/3)	64,000 households

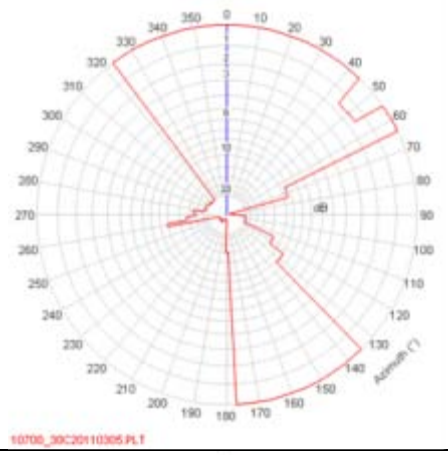
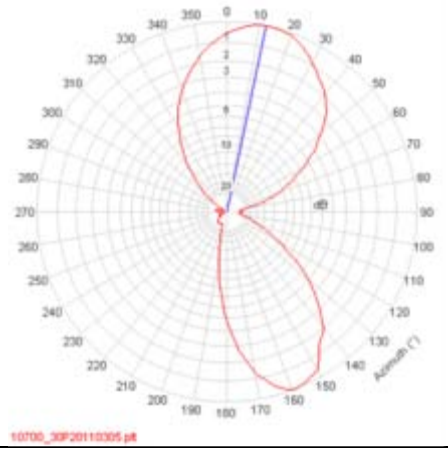
Basingstoke Indicative Coverage Map (assuming QPSK 2/3)



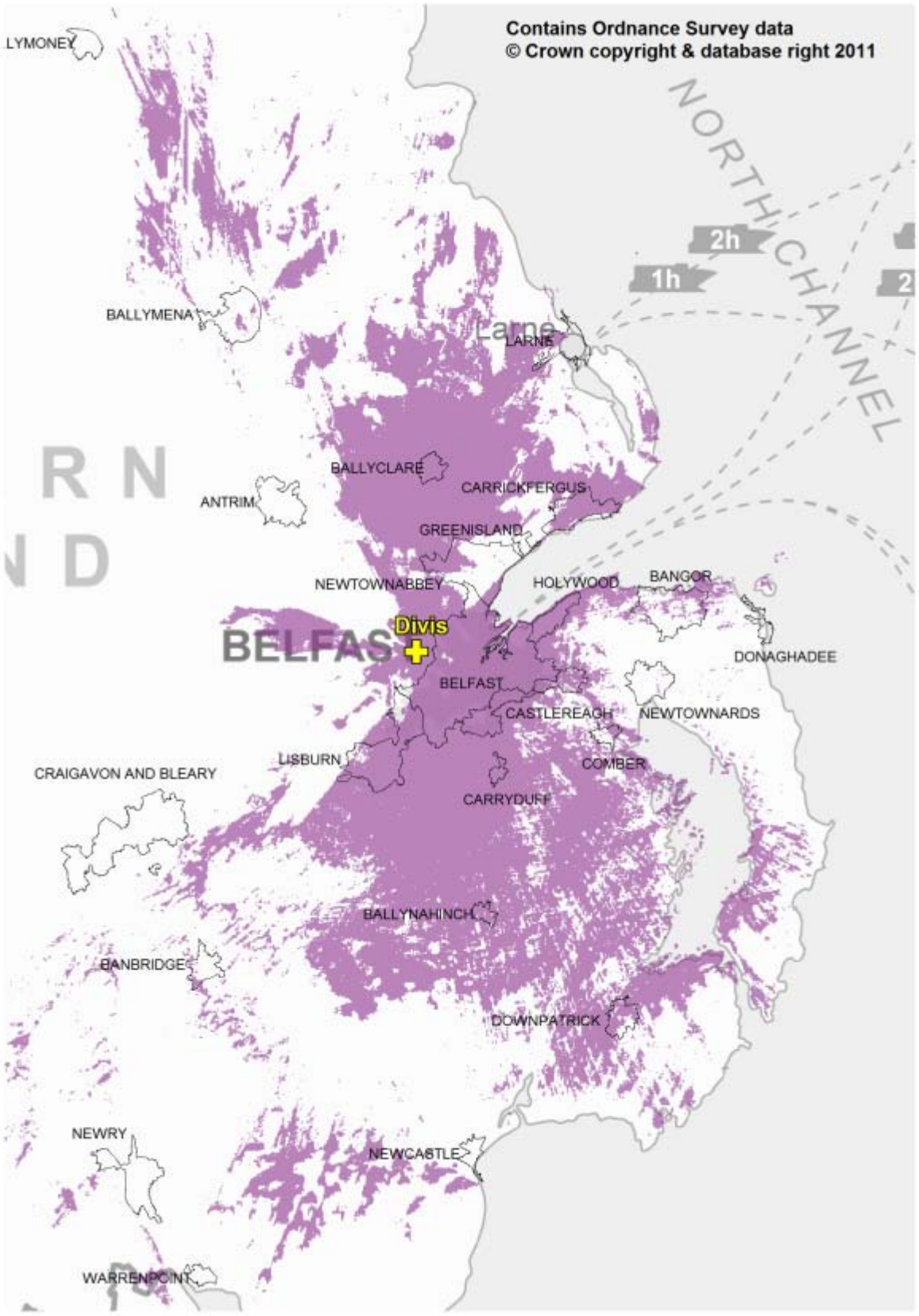
Location	Bedford
Station	Sandy Heath
Channel	42
Effective Radiated Power	2 kW
Assumed Antenna Height	119m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	64,000 households
Indicative DPSA Coverage (QPSK 2/3)	64,000 households

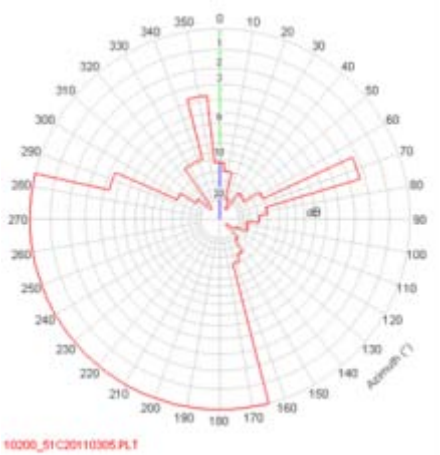
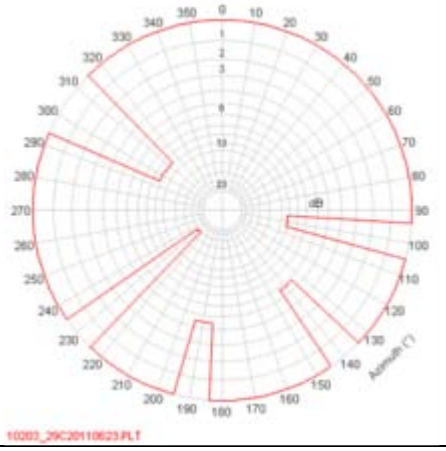
Sandy Heath Indicative Coverage Map (assuming QPSK 2/3)

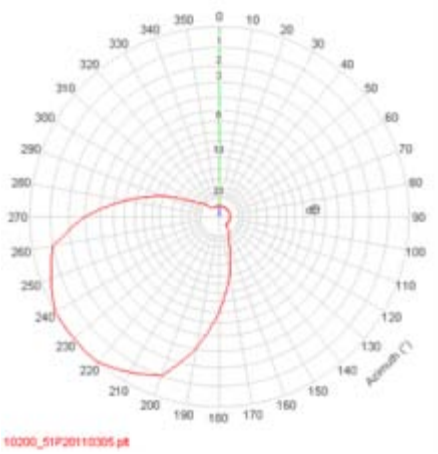
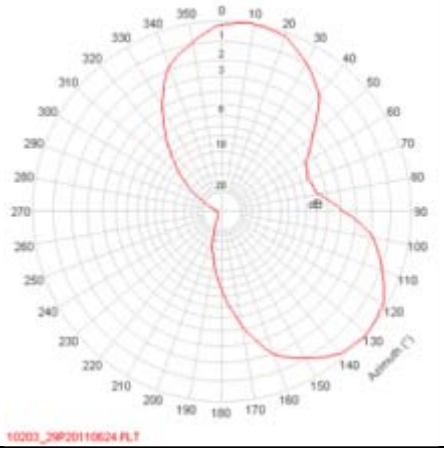


Location	Belfast
Station	Divis
Channel	30
Effective Radiated Power	5 kW
Assumed Antenna Height	93m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	260,000 households
Indicative DPSA Coverage (QPSK 2/3)	250,000 households

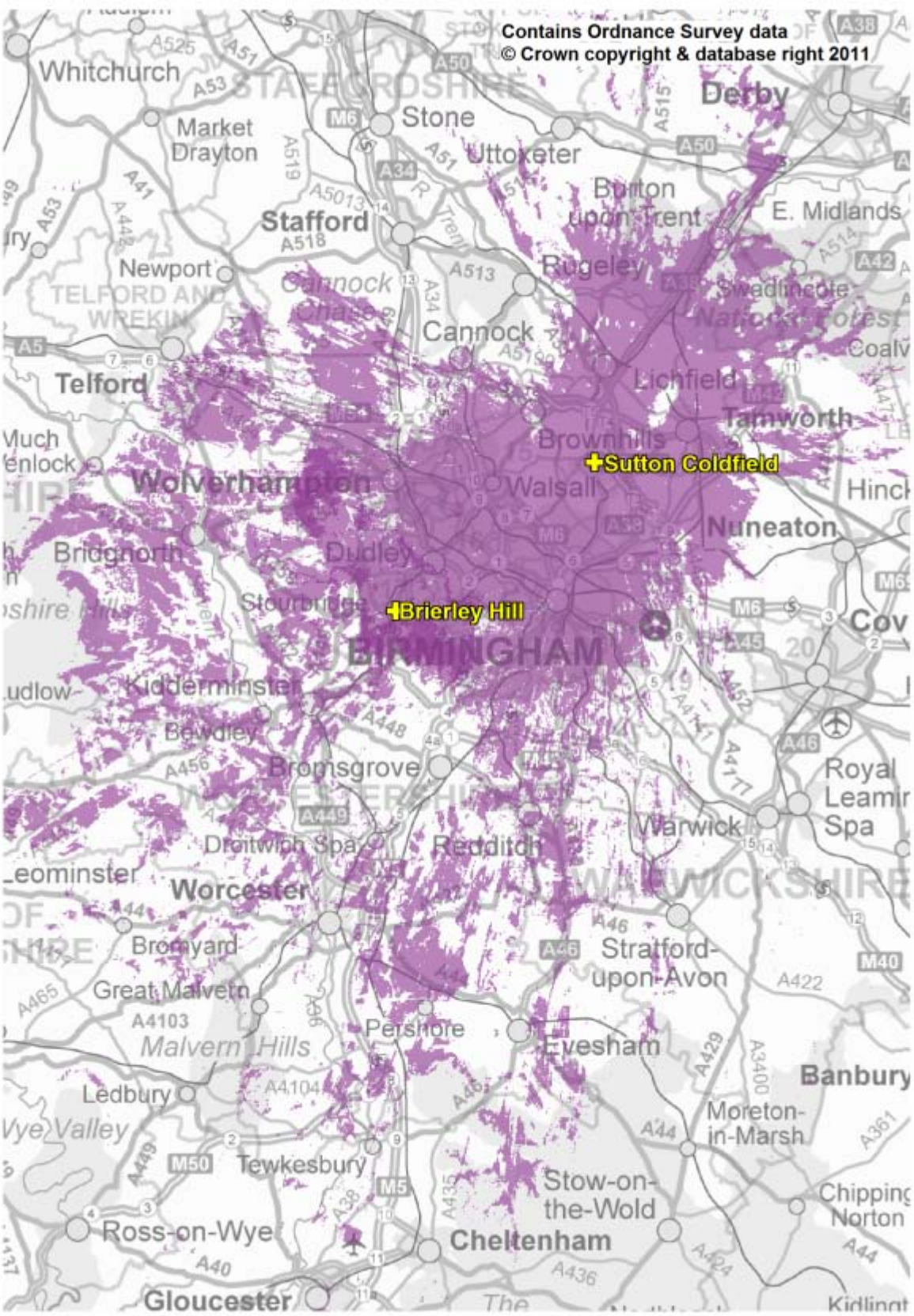
Belfast Indicative Coverage Map (assuming QPSK 2/3)

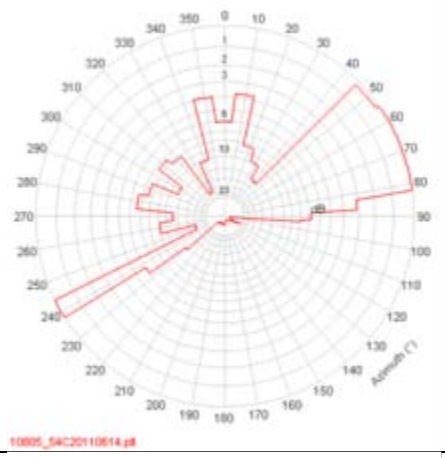
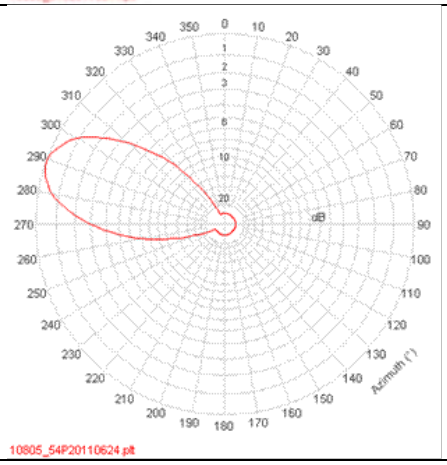


Location	Birmingham	
Station	Sutton Coldfield	Brierley Hill
Channel	51	29
Effective Radiated Power	10 kW	0.2 kW
Assumed Antenna Height	132m	44m
Indicative Antenna Template	Sutton Coldfield  Brierley Hill (with respect to 1kW) 	

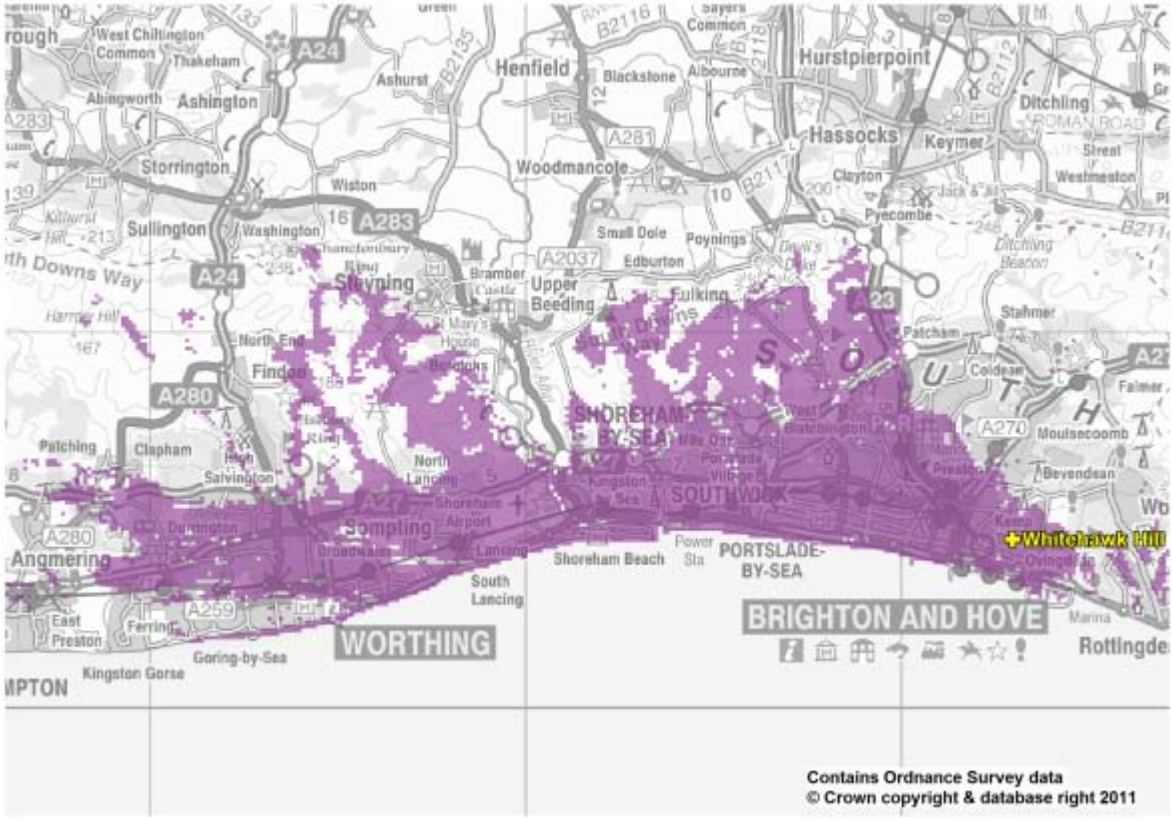
Assumed Practical Antenna Pattern	Sutton Coldfield  Brierley Hill 
Indicative Gross Coverage (QPSK 2/3)	1,200,000 households
Indicative DPSA Coverage (QPSK 2/3)	1,200,000 households

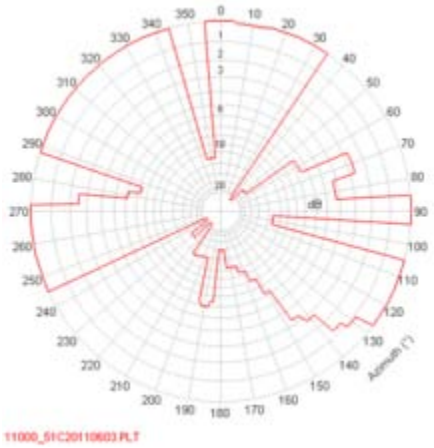
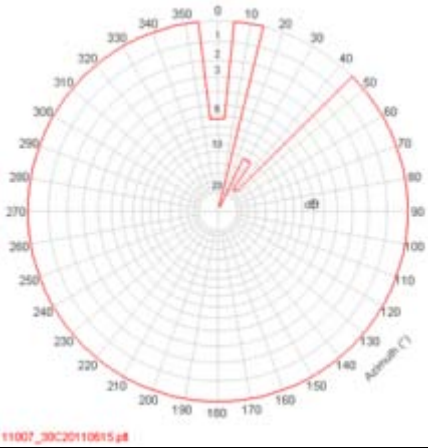
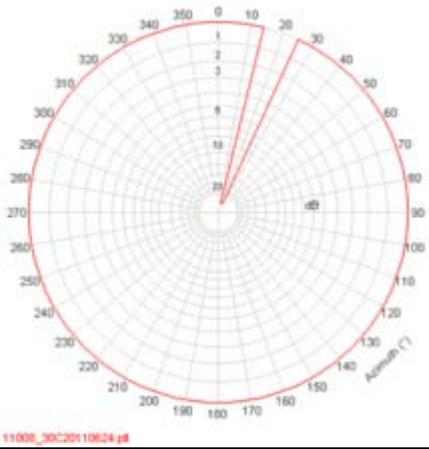
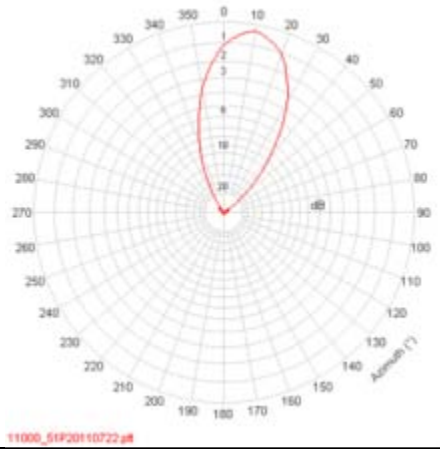
Birmingham Indicative Coverage Map (assuming QPSK 2/3)

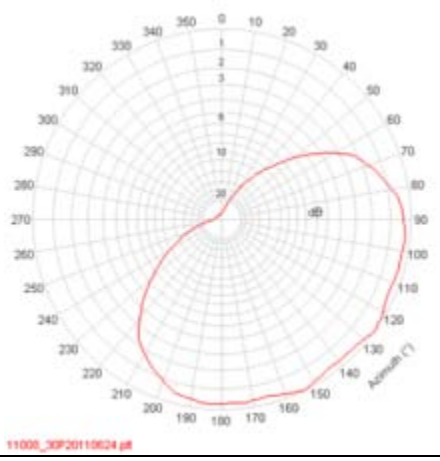
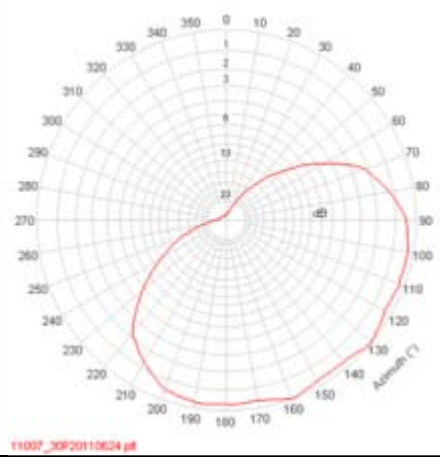


Location	Brighton & Hove
Station	Whitehawk Hill
Channel	54
Effective Radiated Power	0.4 kW
Assumed Antenna Height	39m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	150,000 households
Indicative DPSA Coverage (QPSK 2/3)	98,000 households

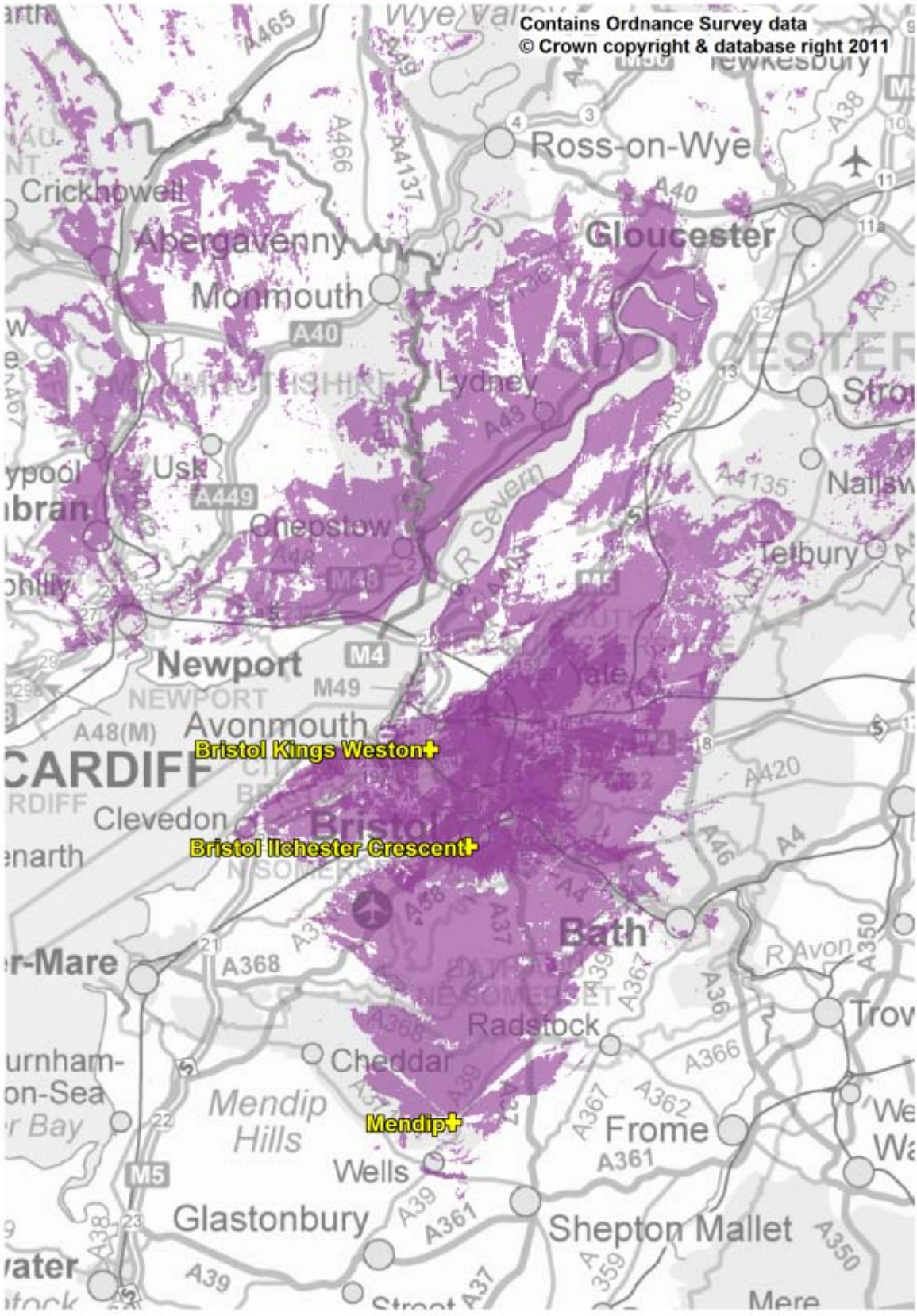
Brighton & Hove Indicative Coverage Map (assuming QPSK 2/3)

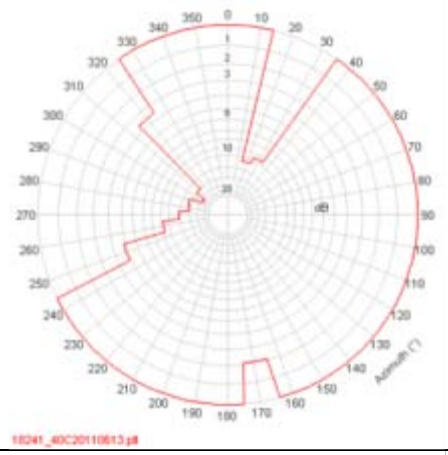
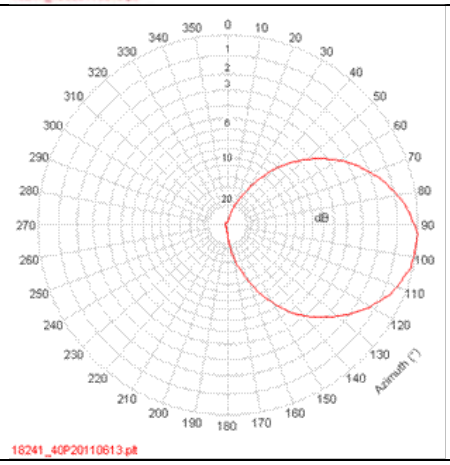


Location	Bristol		
Station	Mendip	Bristol Kings Weston	Bristol Ilchester Crescent
Channel	51	30	30
Effective Radiated Power	10 kW	0.02 kW	0.02 kW
Assumed Antenna Height	144m	43m	42m
Indicative Antenna Template	Mendip  Bristol Kings Weston (with respect to 1kW)  Bristol Ilchester Crescent (with respect to 1kW) 		
Assumed Practical Antenna Pattern	Mendip 		

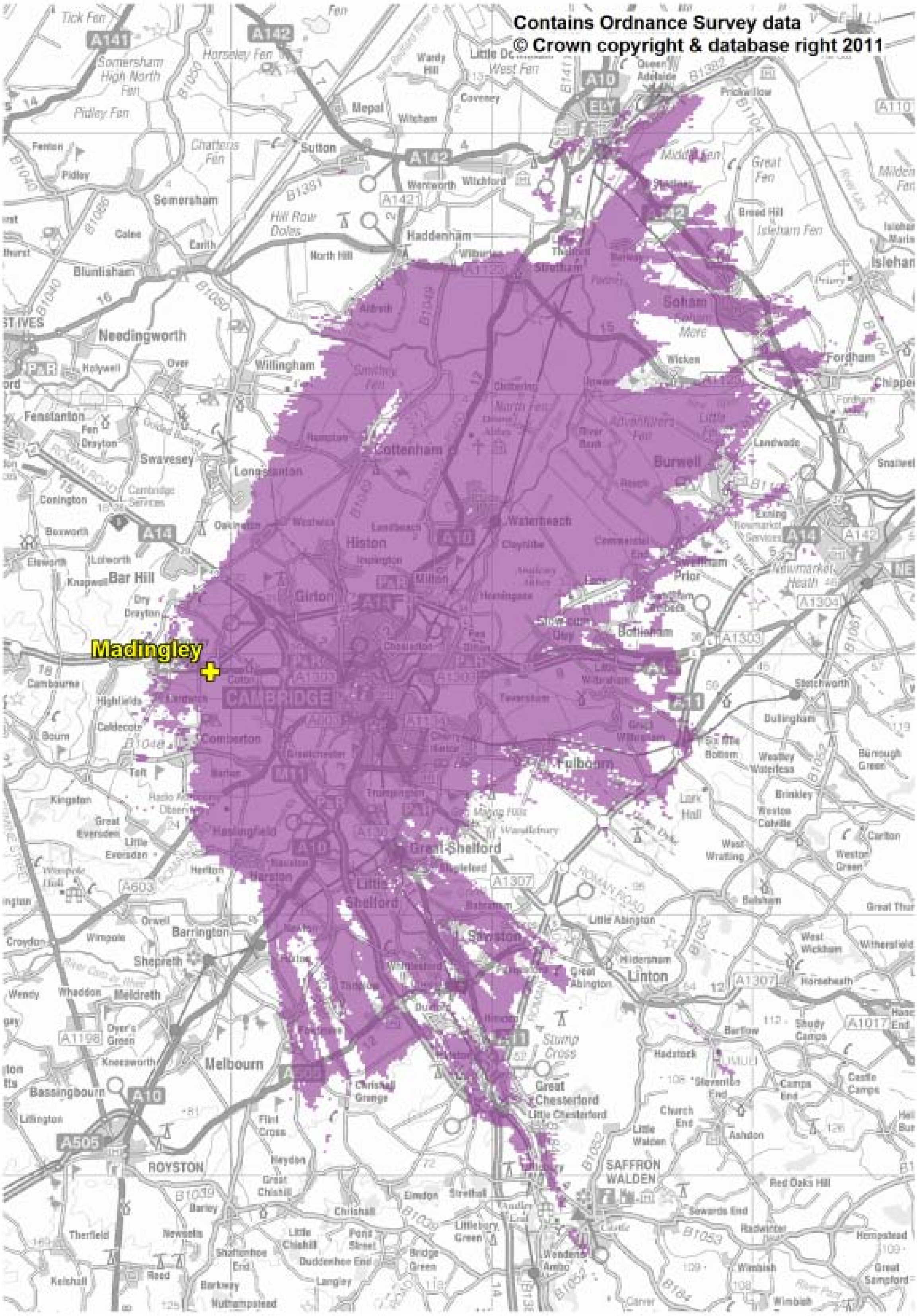
	Bristol Kings Weston	Bristol Ilchester Crescent
		
Indicative Gross Coverage (QPSK 2/3)	380,000 households	
Indicative DPSA Coverage (QPSK 2/3)	330,000 households	

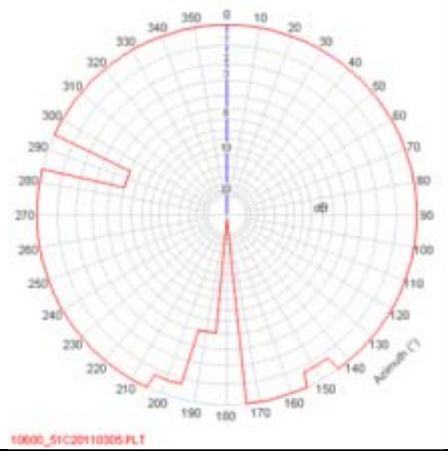
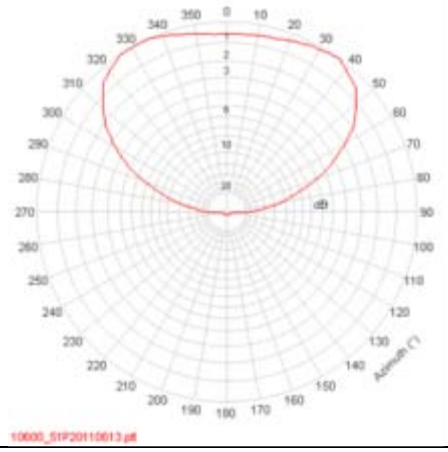
Bristol Indicative Coverage Map (assuming QPSK 2/3)



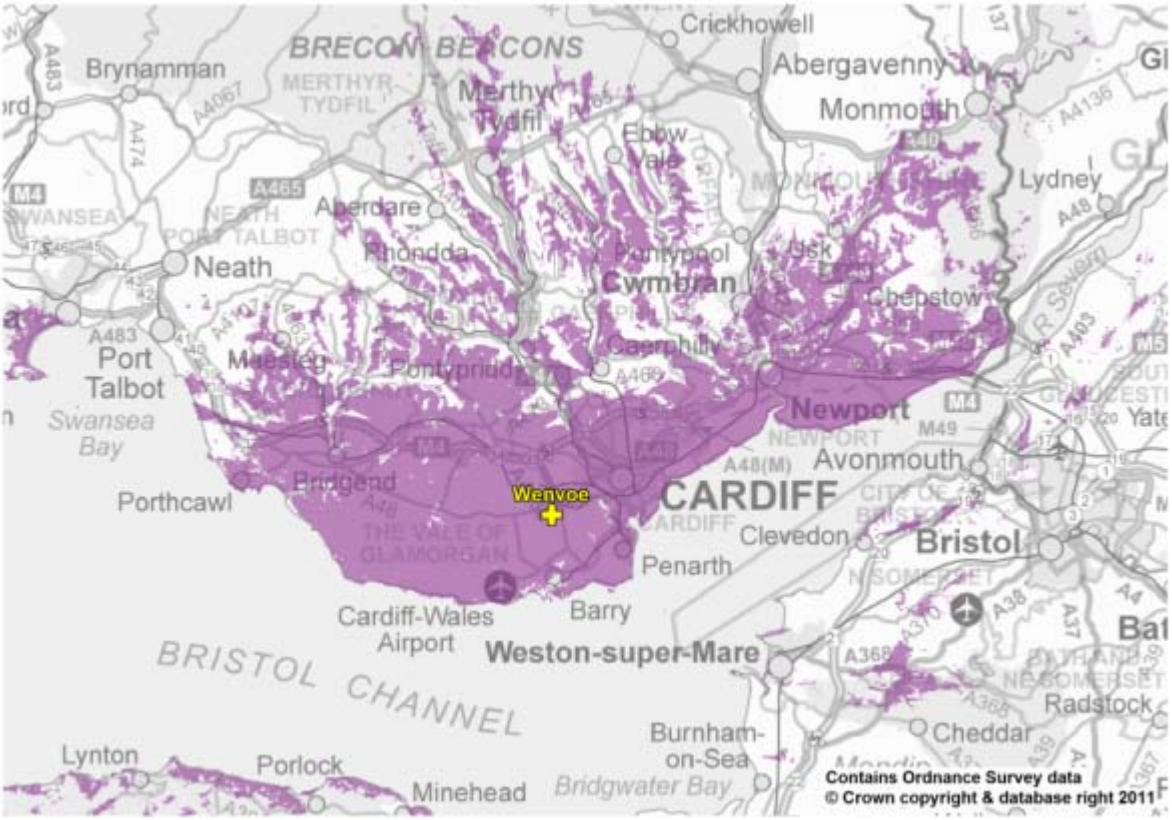
Location	Cambridge
Station	Madingley
Channel	40
Effective Radiated Power	1 kW
Assumed Antenna Height	45m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	84,000 households
Indicative DPSA Coverage (QPSK 2/3)	83,000 households

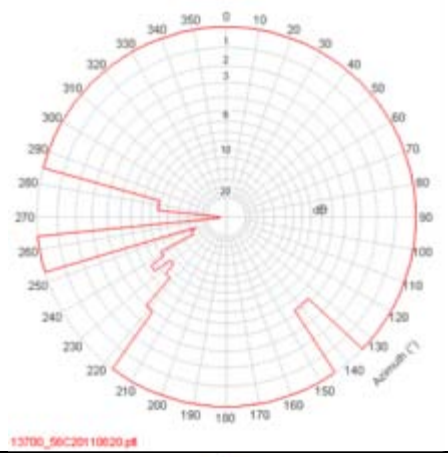
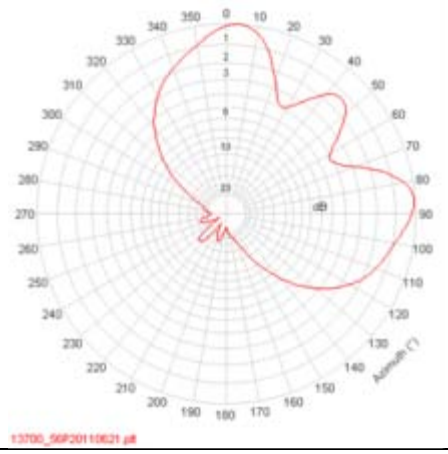
Cambridge Indicative Coverage Map (assuming QPSK 2/3)



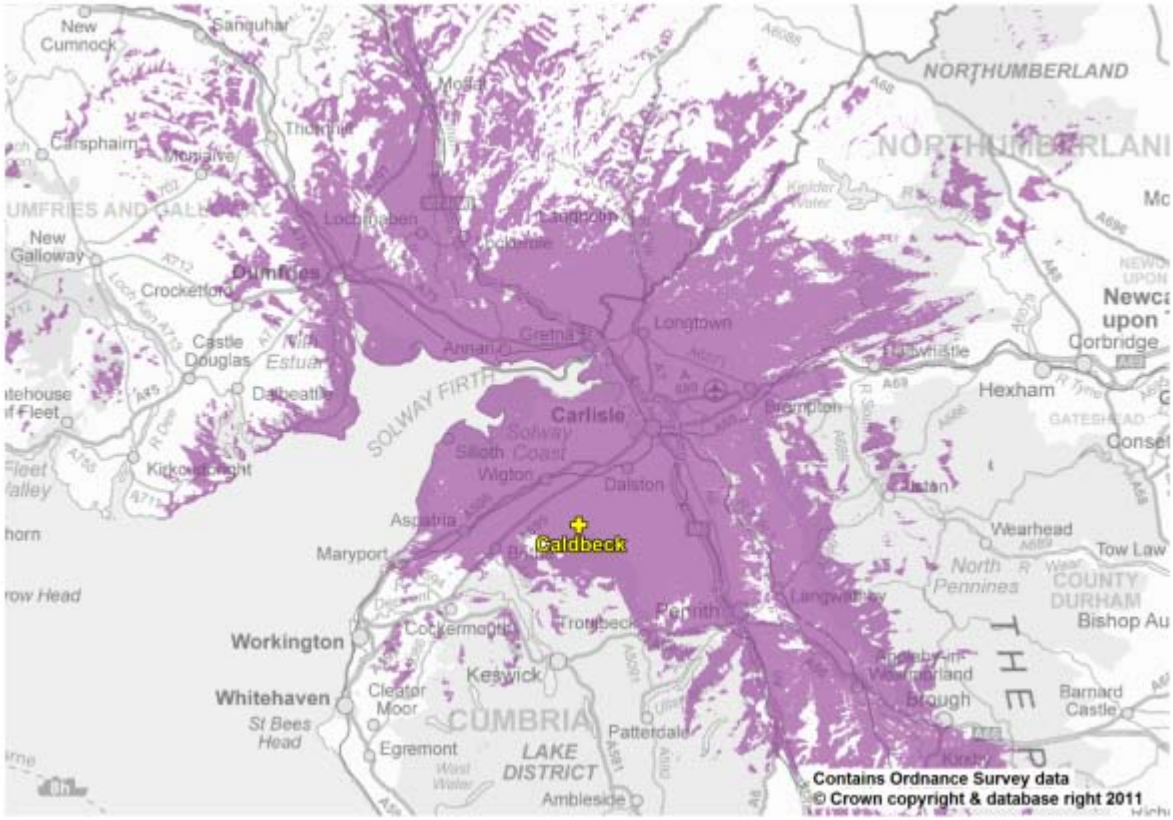
Location	Cardiff
Station	Wenvoe
Channel	51
Effective Radiated Power	10 kW
Assumed Antenna Height	71m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	500,000 households
Indicative DPSA Coverage (QPSK 2/3)	351,000 households

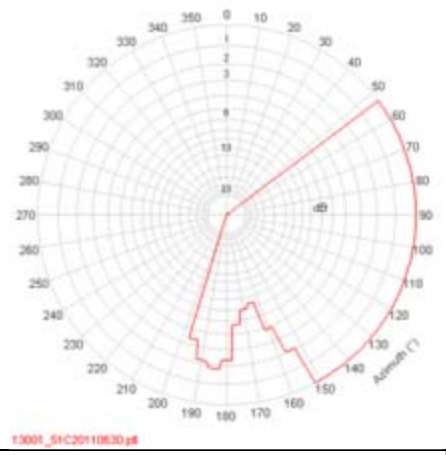
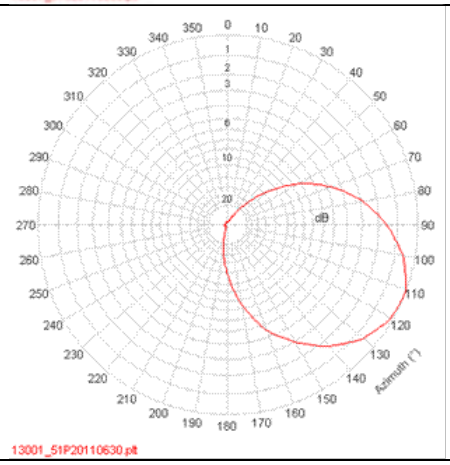
Cardiff Indicative Coverage Map (assuming QPSK 2/3)



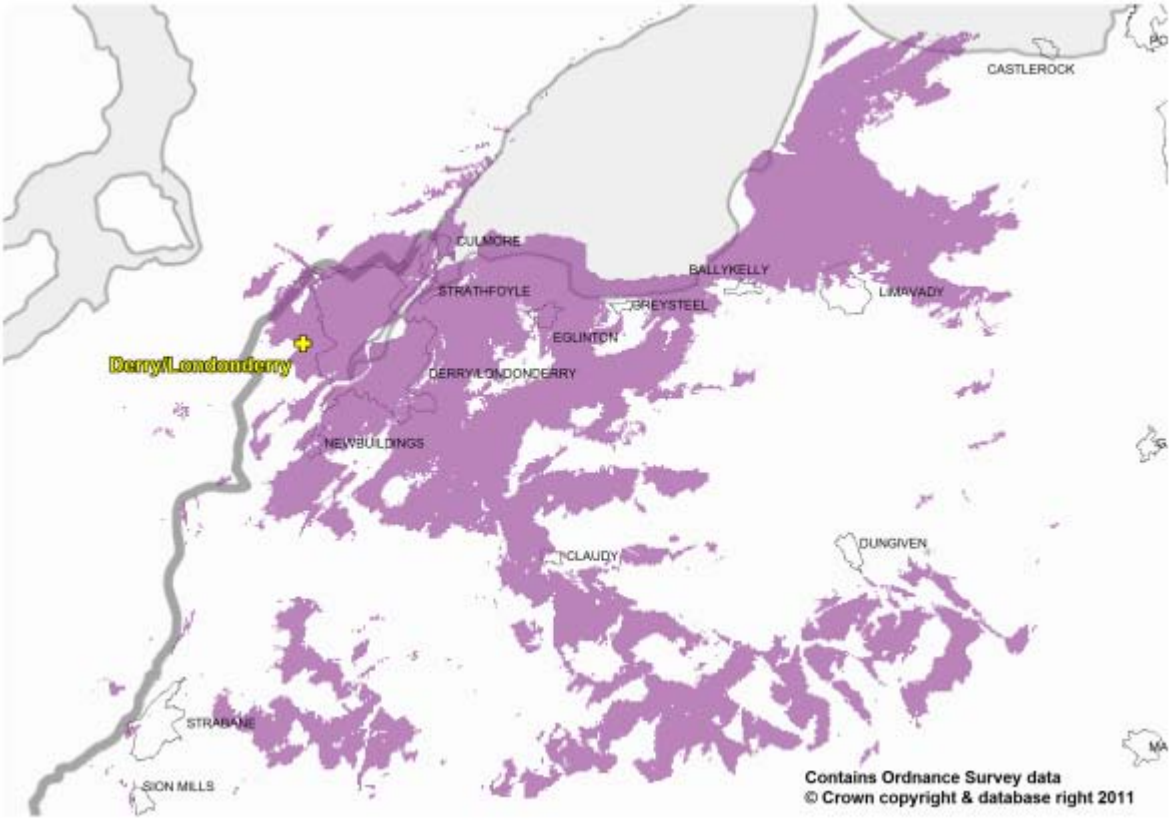
Location	Carlisle
Station	Caldbeck
Channel	56
Effective Radiated Power	5 kW
Assumed Antenna Height	165m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	120,000 households
Indicative DPSA Coverage (QPSK 2/3)	91,000 households

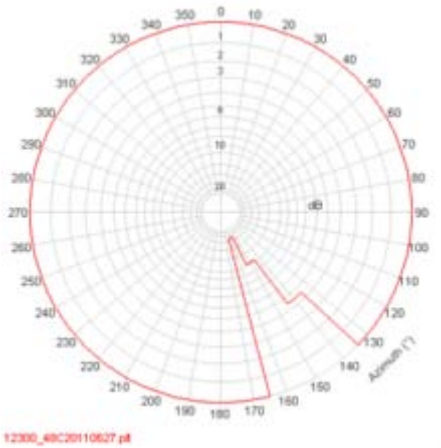
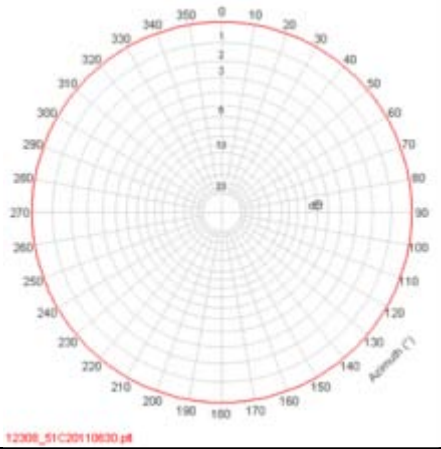
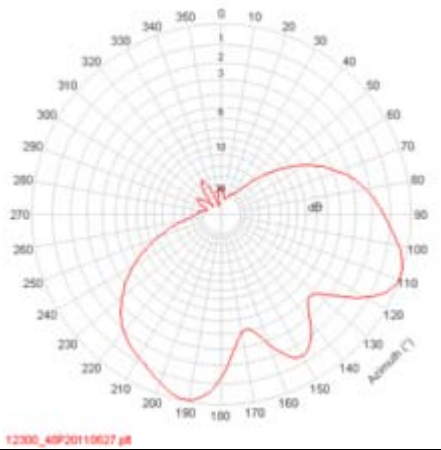
Carlisle Indicative Coverage Map (assuming QPSK 2/3)

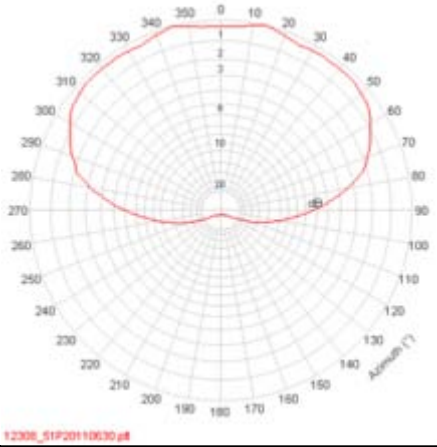


Location	Derry/Londonderry
Station	Londonderry
Channel	51
Effective Radiated Power	1 kW
Assumed Antenna Height	59m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	40,000 households
Indicative DPSA Coverage (QPSK 2/3)	36,000 households

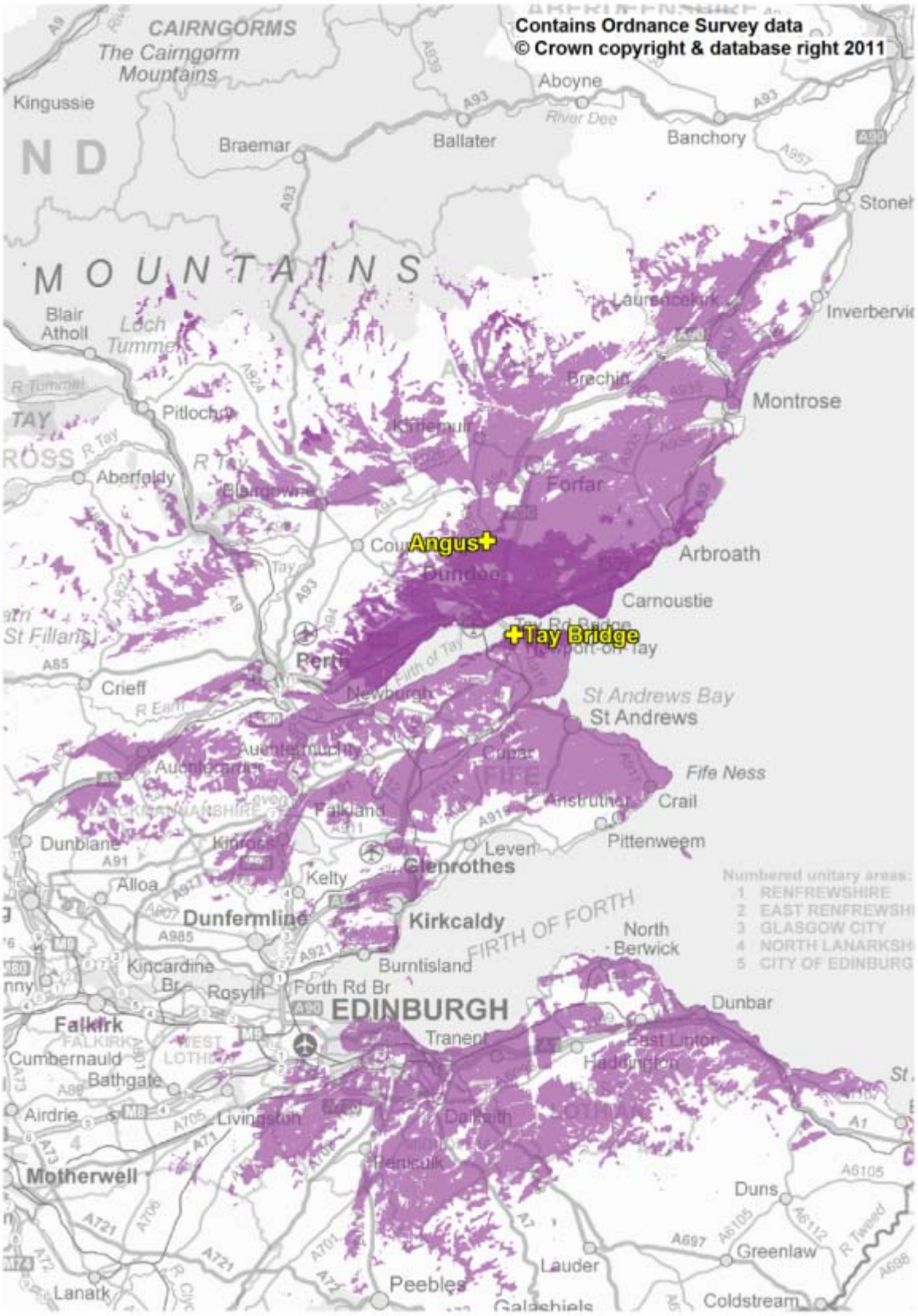
Derry/Londonderry Indicative Coverage Map (assuming QPSK 2/3)

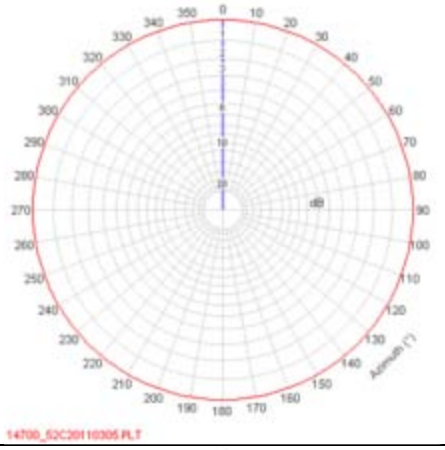
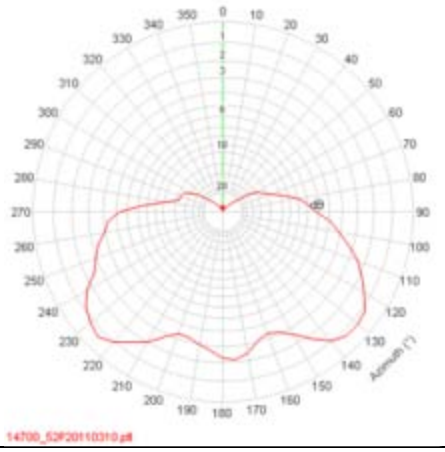


Location	Dundee	
Station	Angus	Tay Bridge
Channel	48	51
Effective Radiated Power	1 kW	0.01 kW
Assumed Antenna Height	117m	43m
Indicative Antenna Template	Angus (with respect to 10kW)  Tay Bridge (with respect to 1kW) 	
Assumed Practical Antenna Pattern	Angus 	

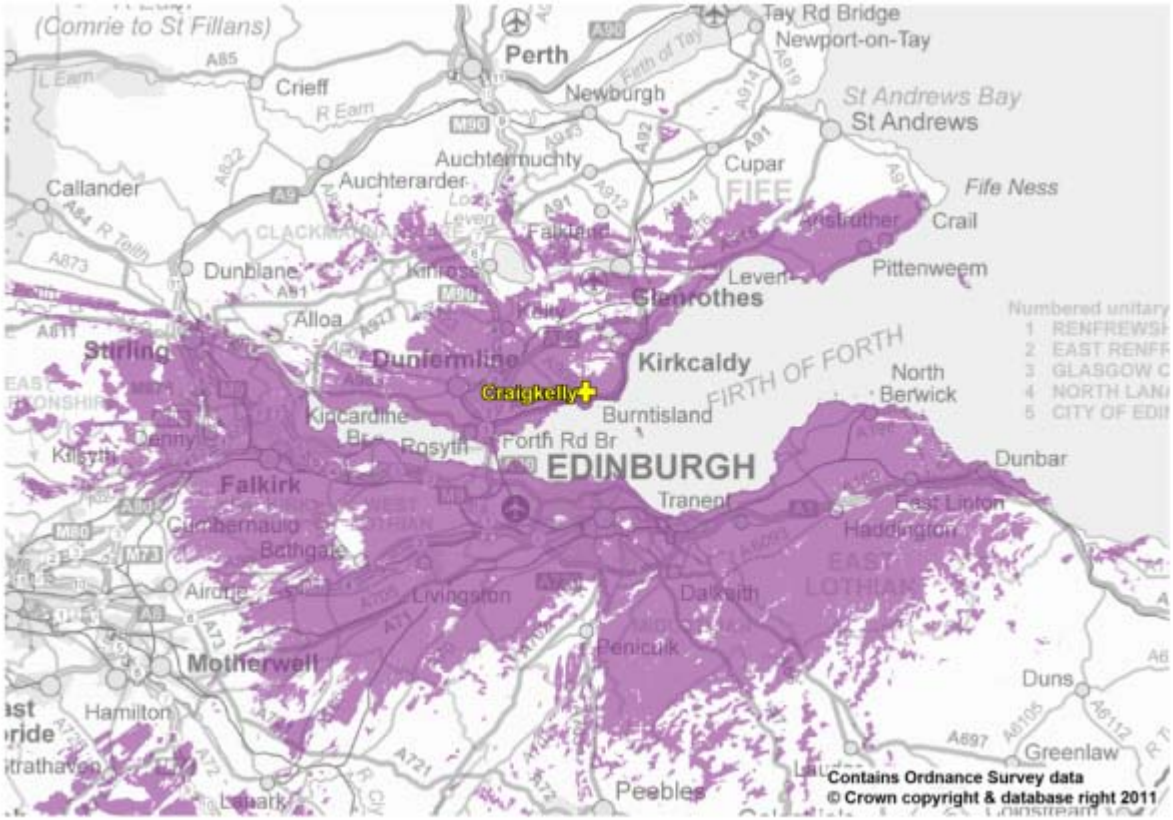
	Tay Bridge 
Indicative Gross Coverage (QPSK 2/3)	390,000 households
Indicative DPSA Coverage (QPSK 2/3)	150,000 households

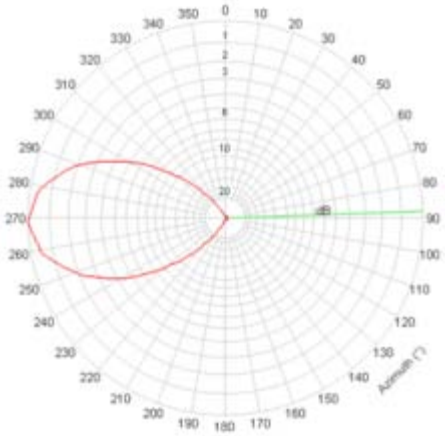
Dundee Indicative Coverage Map (assuming QPSK 2/3)



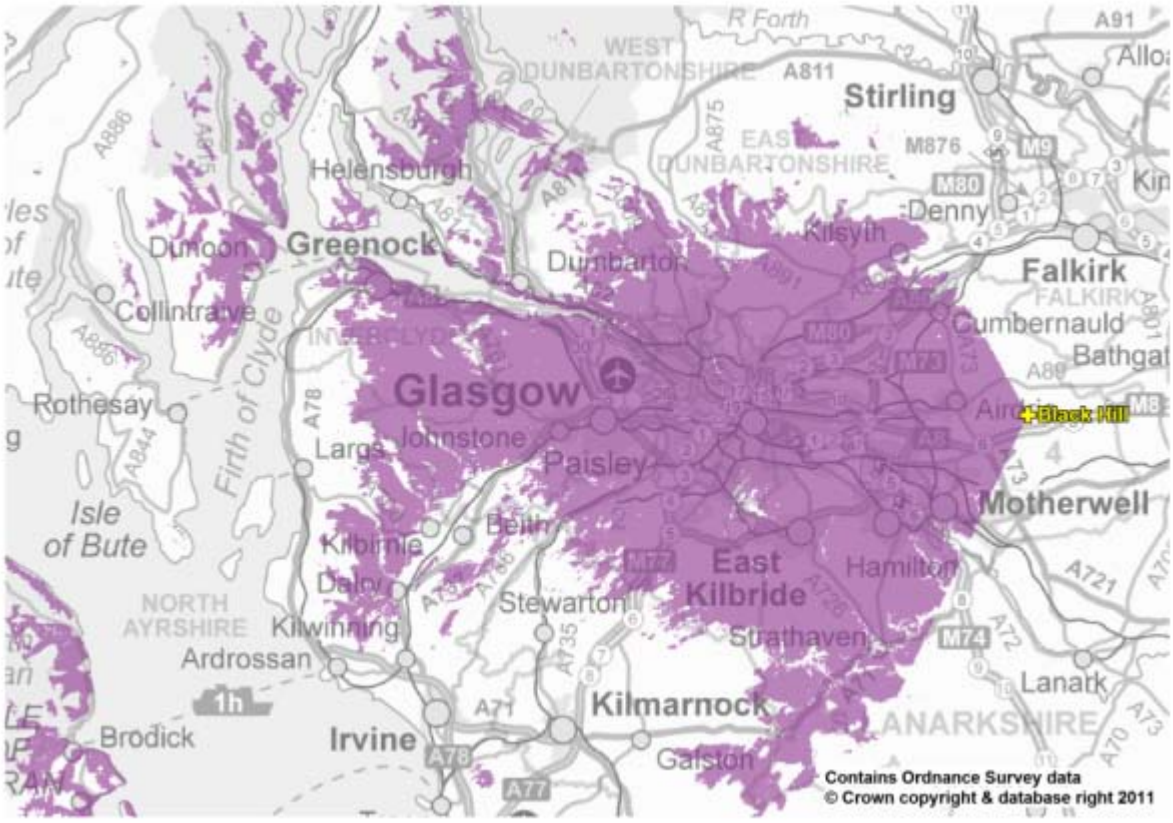
Location	Edinburgh
Station	Craigkelly
Channel	52
Effective Radiated Power	5 kW
Assumed Antenna Height	65m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	610,000 households
Indicative DPSA Coverage (QPSK 2/3)	290,000 households

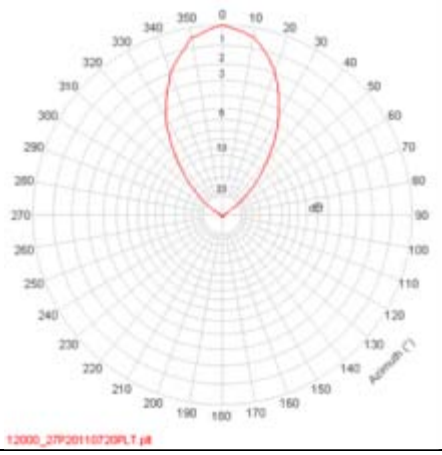
Edinburgh Indicative Coverage Map (assuming QPSK 2/3)



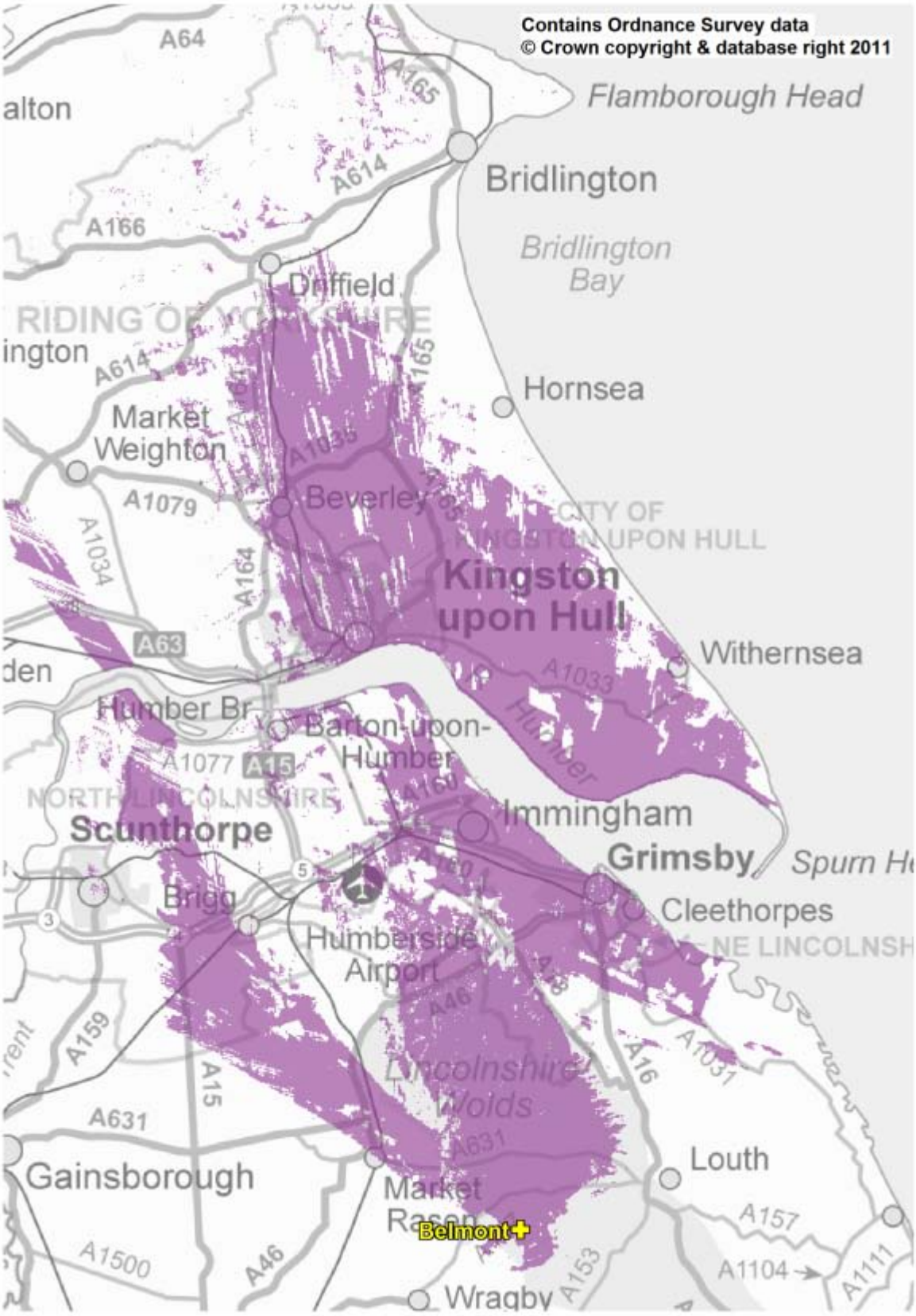
Location	Glasgow
Station	Black Hill
Channel	51
Effective Radiated Power	5 kW
Assumed Antenna Height	154m
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	750,000 households
Indicative DPSA Coverage (QPSK 2/3)	660,000 households

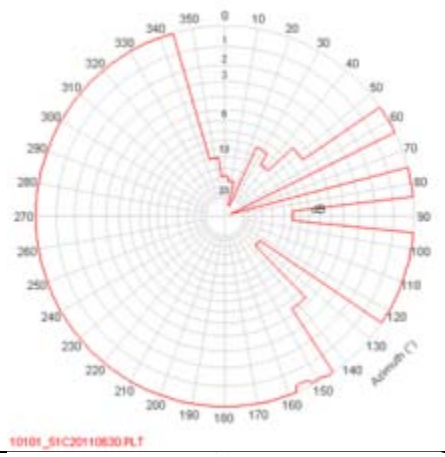
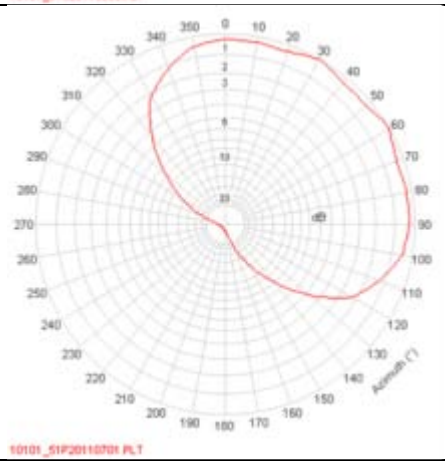
Glasgow Indicative Coverage Map (assuming QPSK 2/3)



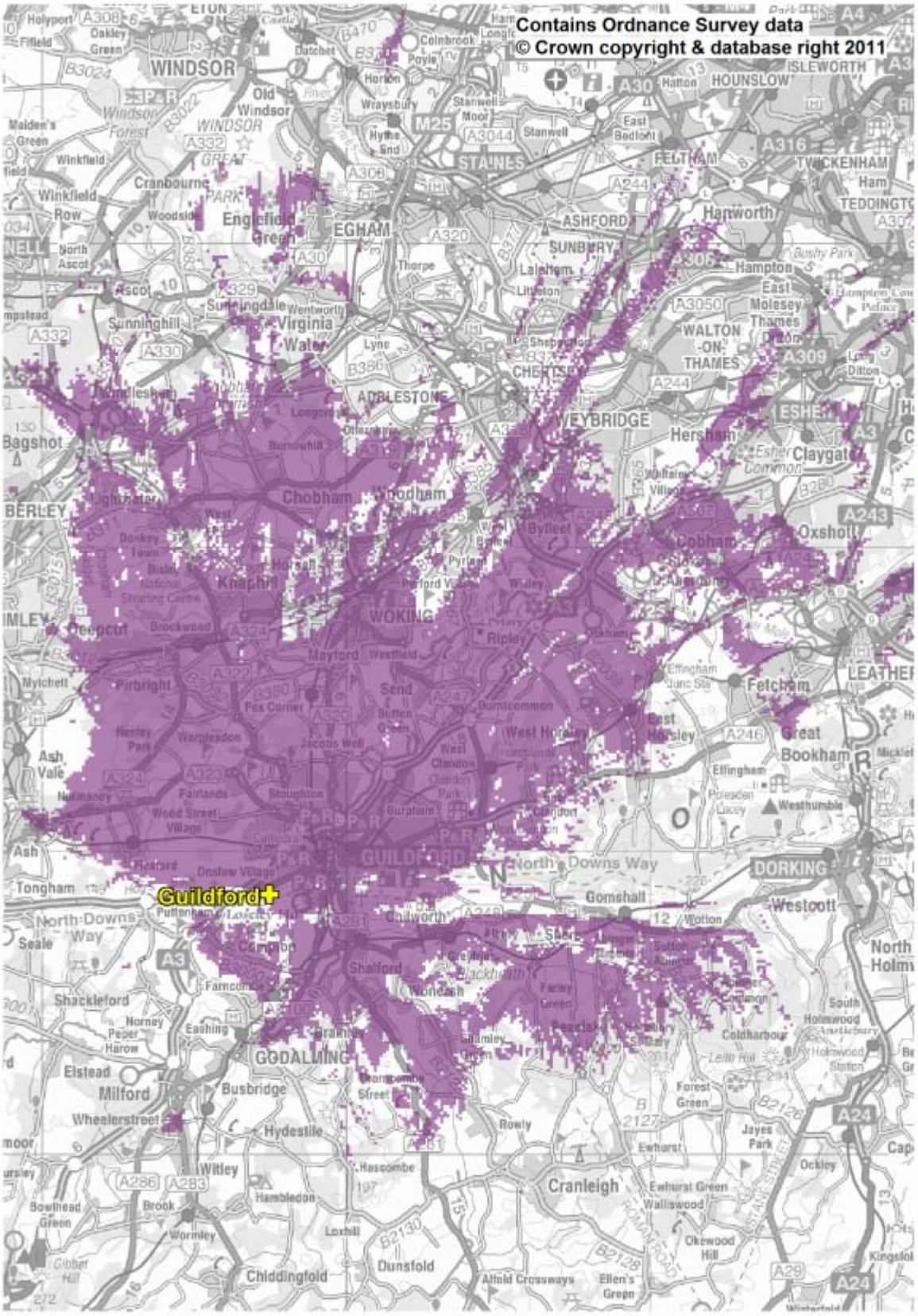
Location	Grimsby
Station	Belmont
Channel	27
Effective Radiated Power	10 kW
Assumed Antenna Height	222m
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	270,000 households
Indicative DPSA Coverage (QPSK 2/3)	270,000 households

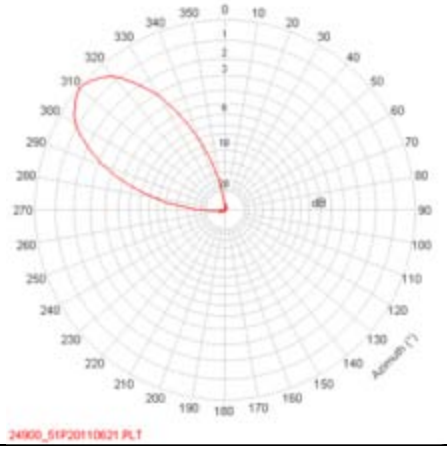
Grimsby Indicative Coverage Map (assuming QPSK 2/3)



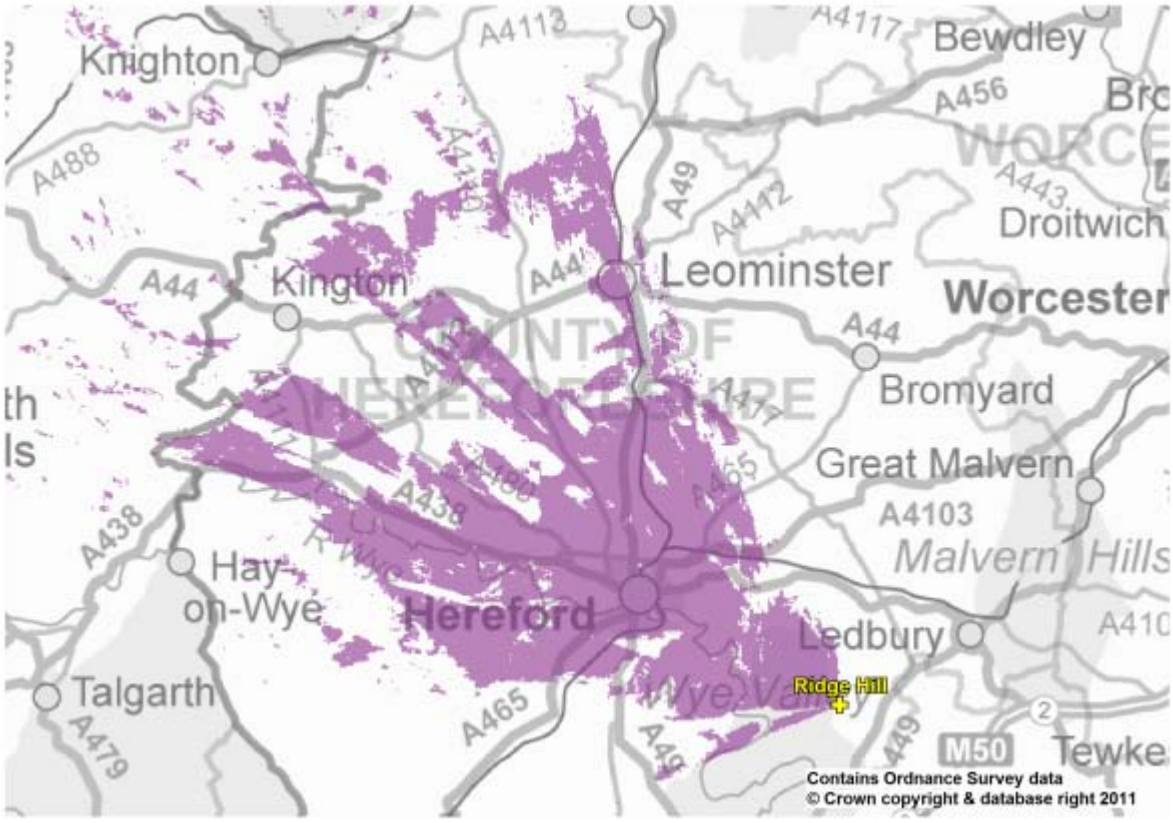
Location	Guildford
Station	Guildford
Channel	51
Effective Radiated Power	0.1 kW
Assumed Antenna Height	45m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	180,000 households
Indicative DPSA Coverage (QPSK 2/3)	53,000 households

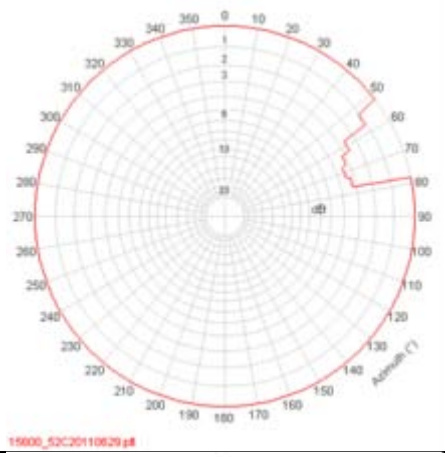
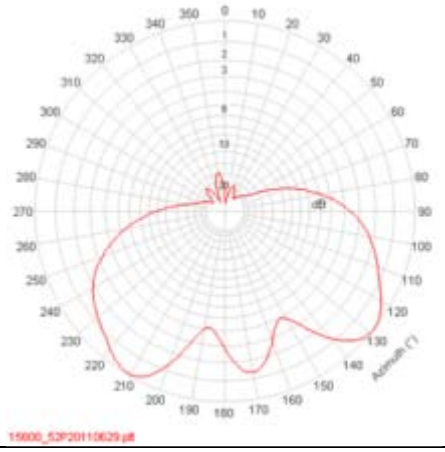
Guildford Indicative Coverage Map (assuming QPSK 2/3)



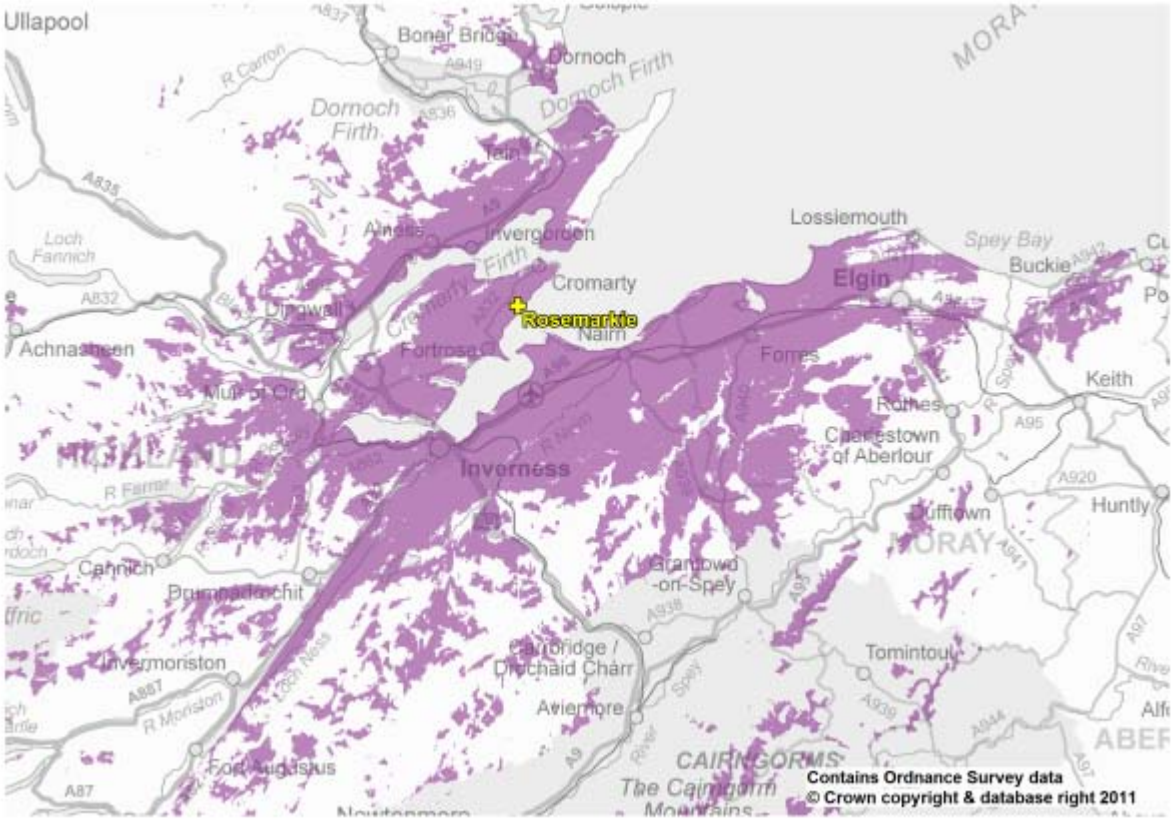
Location	Hereford
Station	Ridge Hill
Channel	51
Effective Radiated Power	1 kW
Assumed Antenna Height	79m
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	44,000 households
Indicative DPSA Coverage (QPSK 2/3)	43,000 households

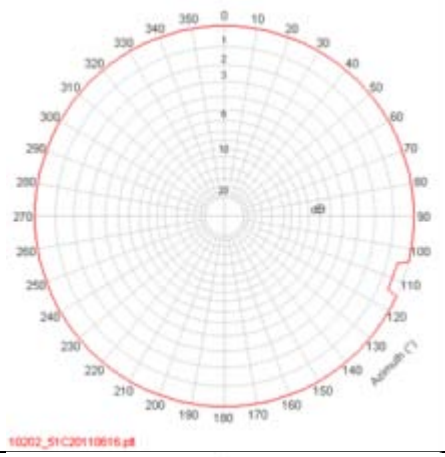
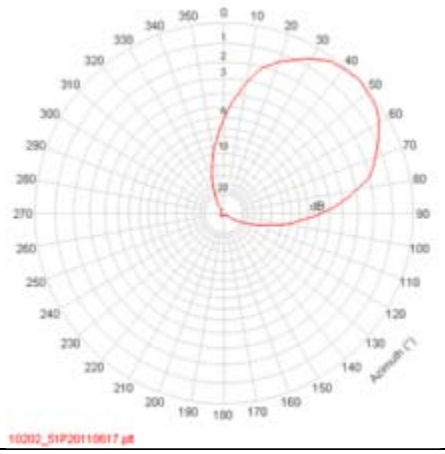
Hereford Indicative Coverage Map (assuming QPSK 2/3)



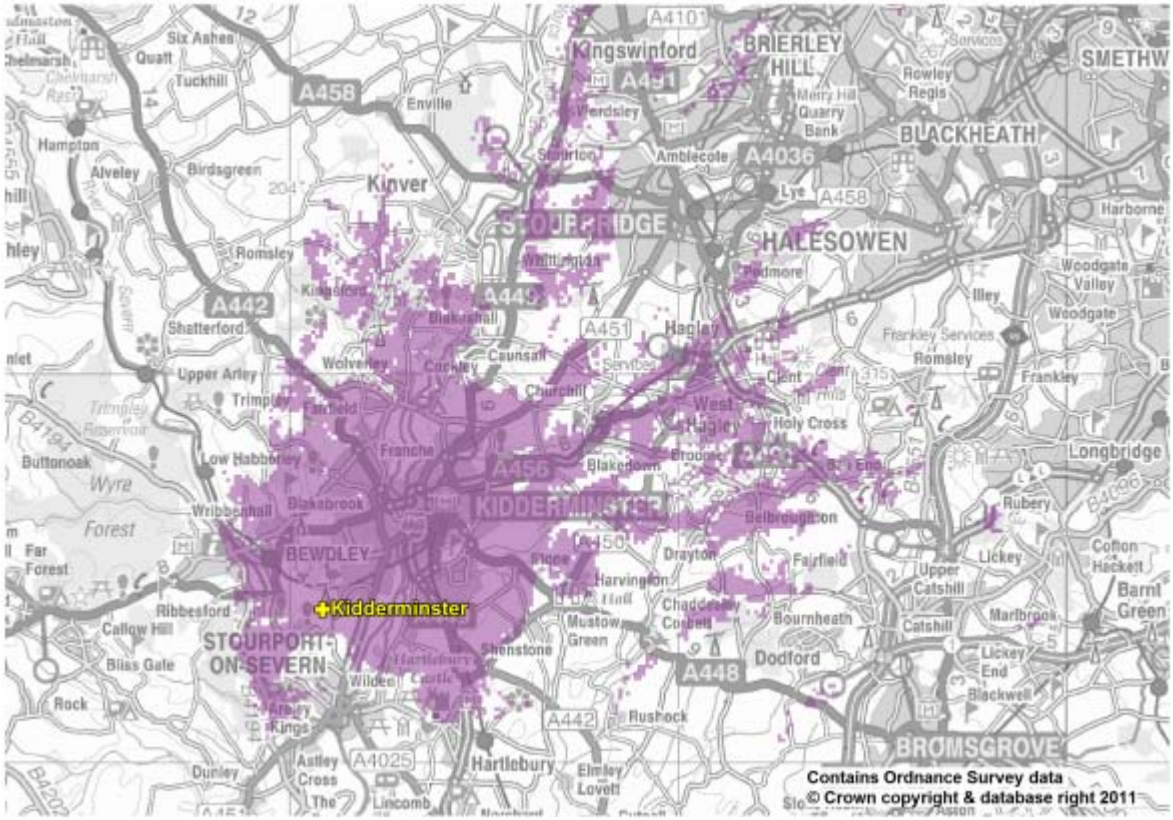
Location	Inverness
Station	Rosemarkie
Channel	52
Effective Radiated Power	1 kW
Assumed Antenna Height	60m
Indicative Antenna Template	With respect to 10kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	72,000 households
Indicative DPSA Coverage (QPSK 2/3)	50,000 households

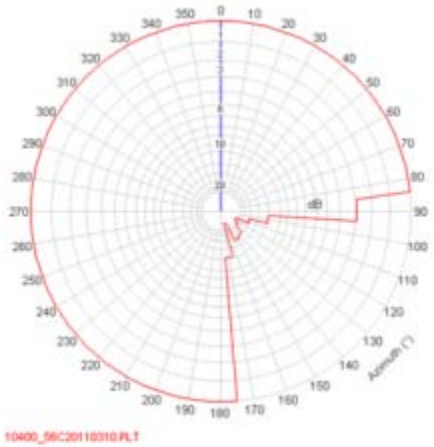
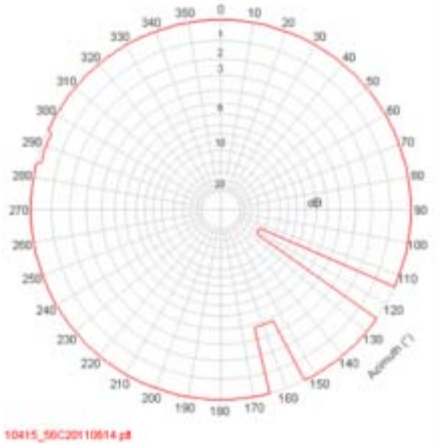
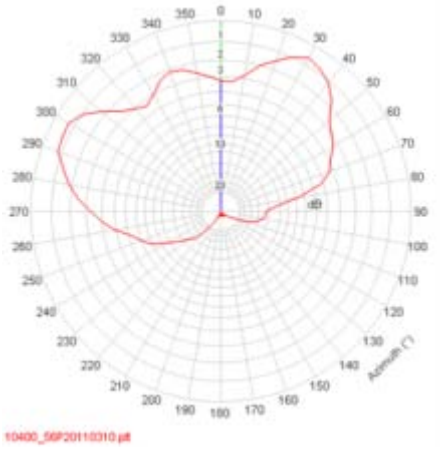
Inverness Indicative Coverage Map (assuming QPSK 2/3)

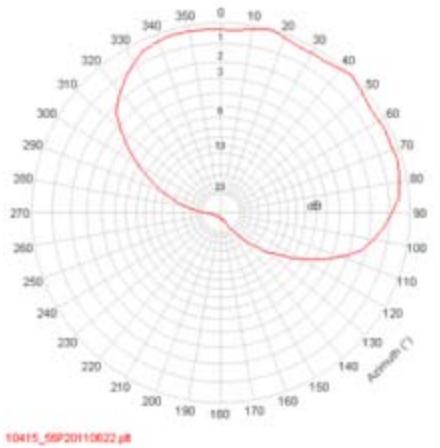


Location	Kidderminster
Station	Kidderminster
Channel	56
Effective Radiated Power	0.04 kW
Assumed Antenna Height	45m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	35,000 households
Indicative DPSA Coverage (QPSK 2/3)	22,000 households

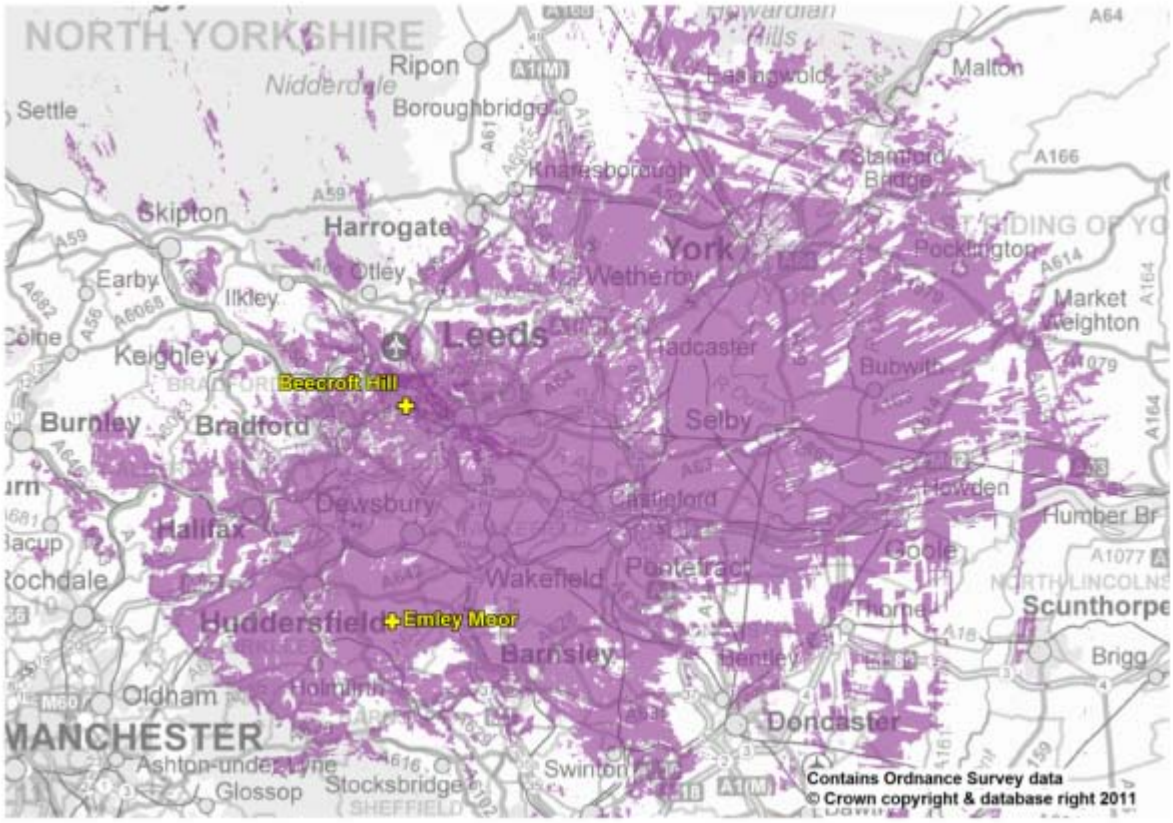
Kidderminster Indicative Coverage Map (assuming QPSK 2/3)

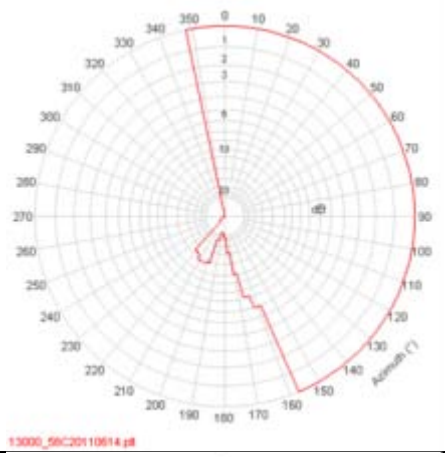
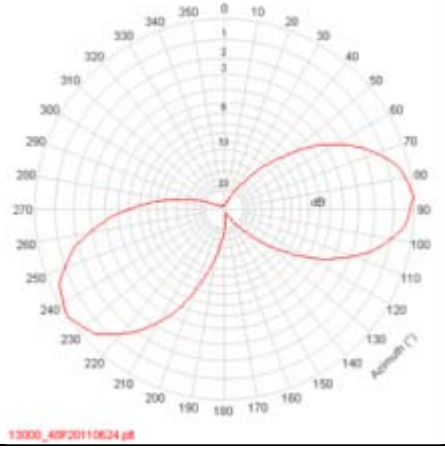


Location	Leeds	
Station	Emley Moor	Beecroft Hill
Channel	56	56
Effective Radiated Power	5 kW	0.02 kW
Assumed Antenna Height	161m	43m
Indicative Antenna Template	Emley Moor  Beecroft Hill 	
Assumed Practical Antenna Pattern	Emley Moor 	

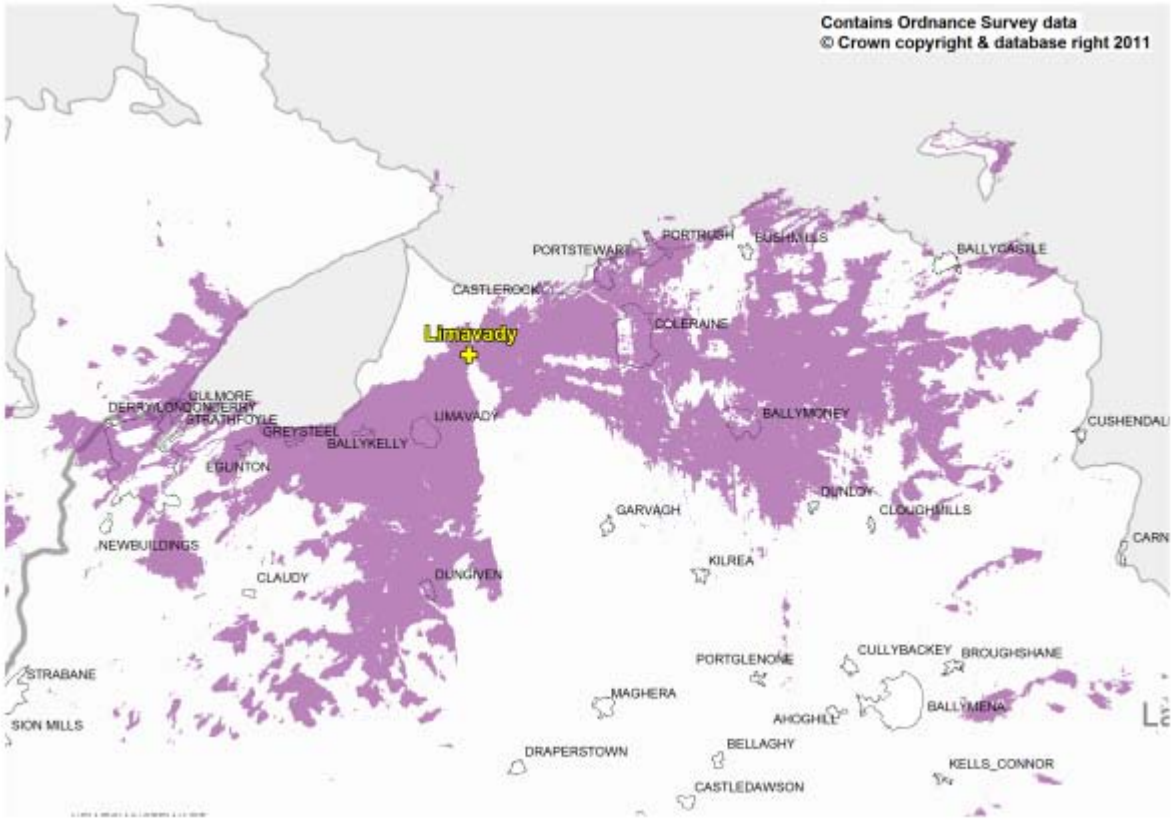
	Beecroft Hill 
Indicative Gross Coverage (QPSK 2/3)	1,100,000 households
Indicative DPSA Coverage (QPSK 2/3)	1,000,000 households

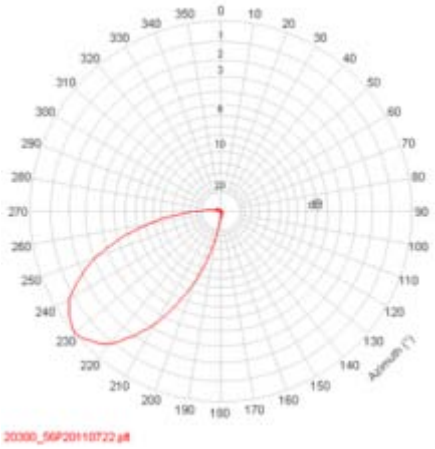
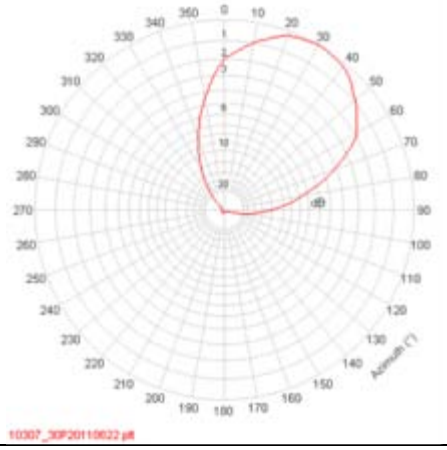
Leeds Indicative Coverage Map (assuming QPSK 2/3)



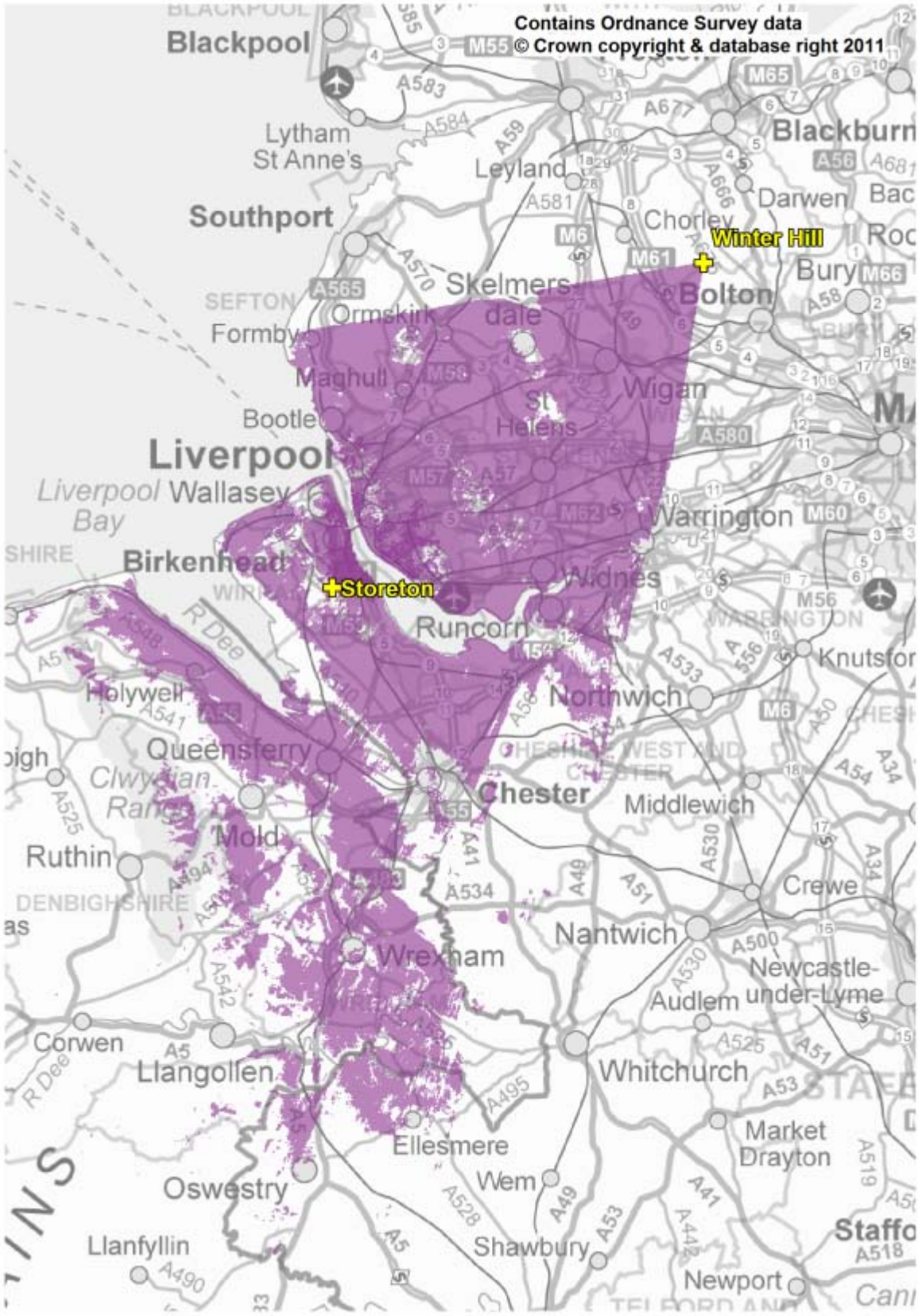
Location	Limavady
Station	Limavady
Channel	48
Effective Radiated Power	2 kW
Assumed Antenna Height	35m
Indicative Antenna Template	With respect to 10kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	55,000 households
Indicative DPSA Coverage (QPSK 2/3)	36,000 households

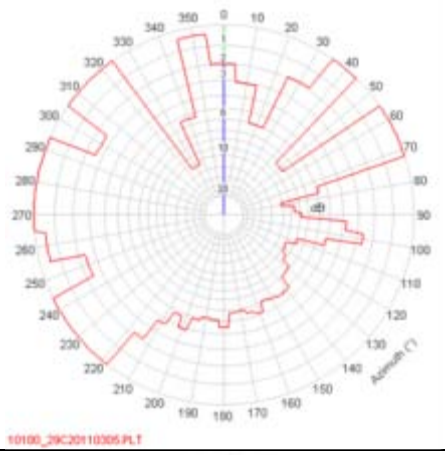
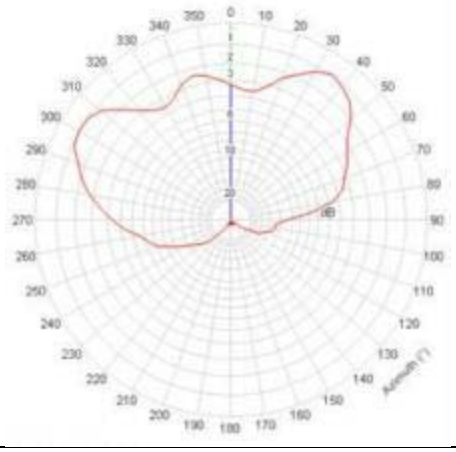
Limavady Indicative Coverage Map (assuming QPSK 2/3)



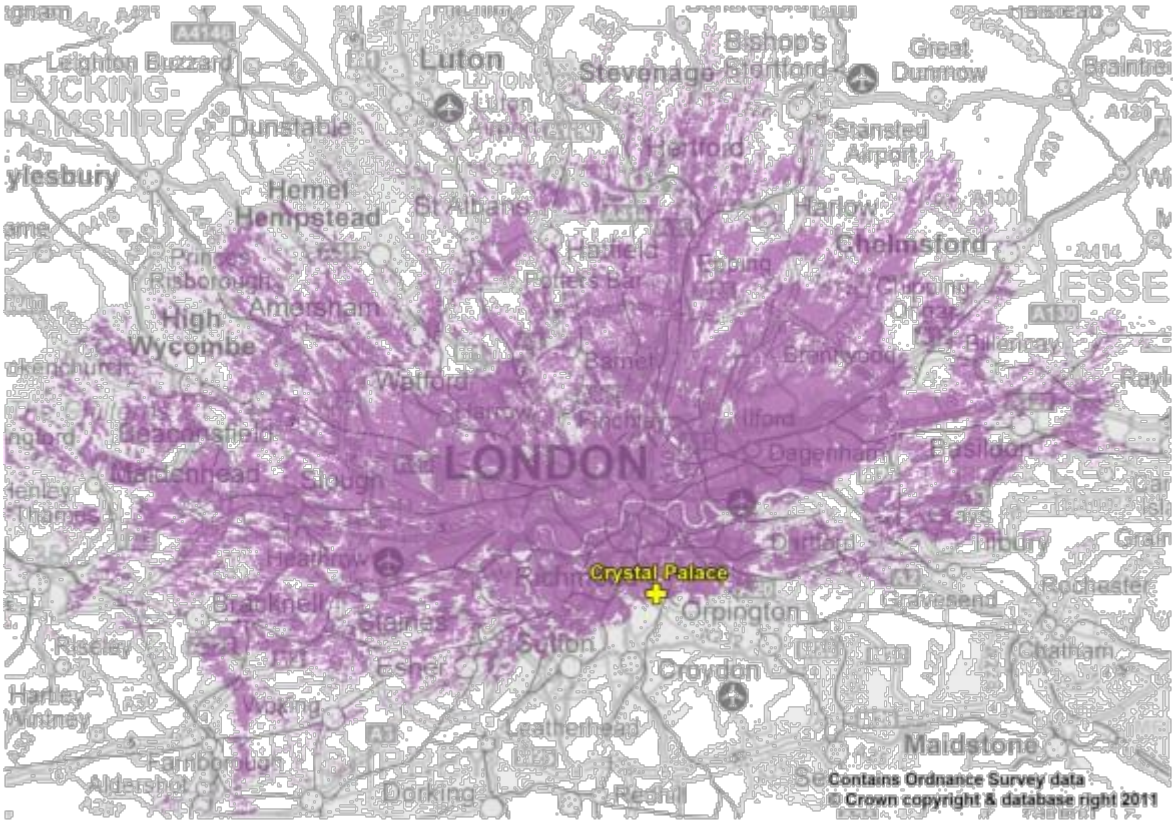
Location	Liverpool	
Station	Winter Hill	Storeton
Channel	56	30
Effective Radiated Power	2 kW	0.06 kW
Assumed Antenna Height	144m	43m
Assumed Practical Antenna Pattern	Winter Hill  Storeton 	
Indicative Gross Coverage (QPSK 2/3)	880,000 households	
Indicative DPSA Coverage (QPSK 2/3)	870,000 households	

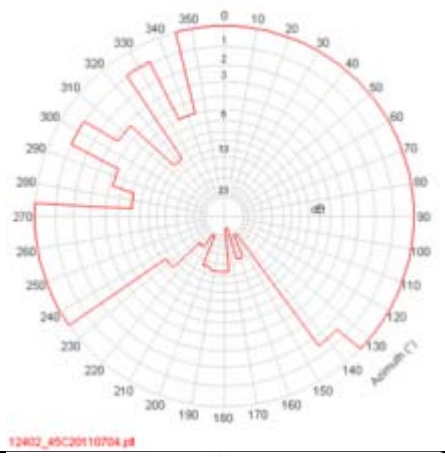
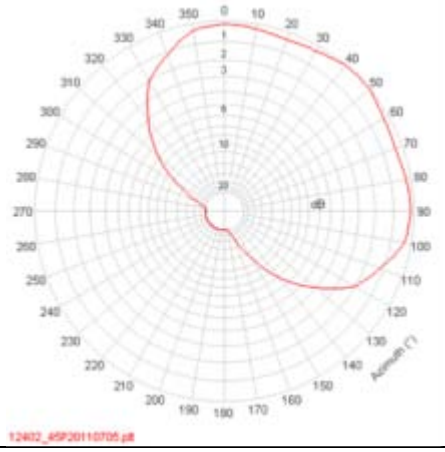
Liverpool Indicative Coverage Map (assuming QPSK 2/3)



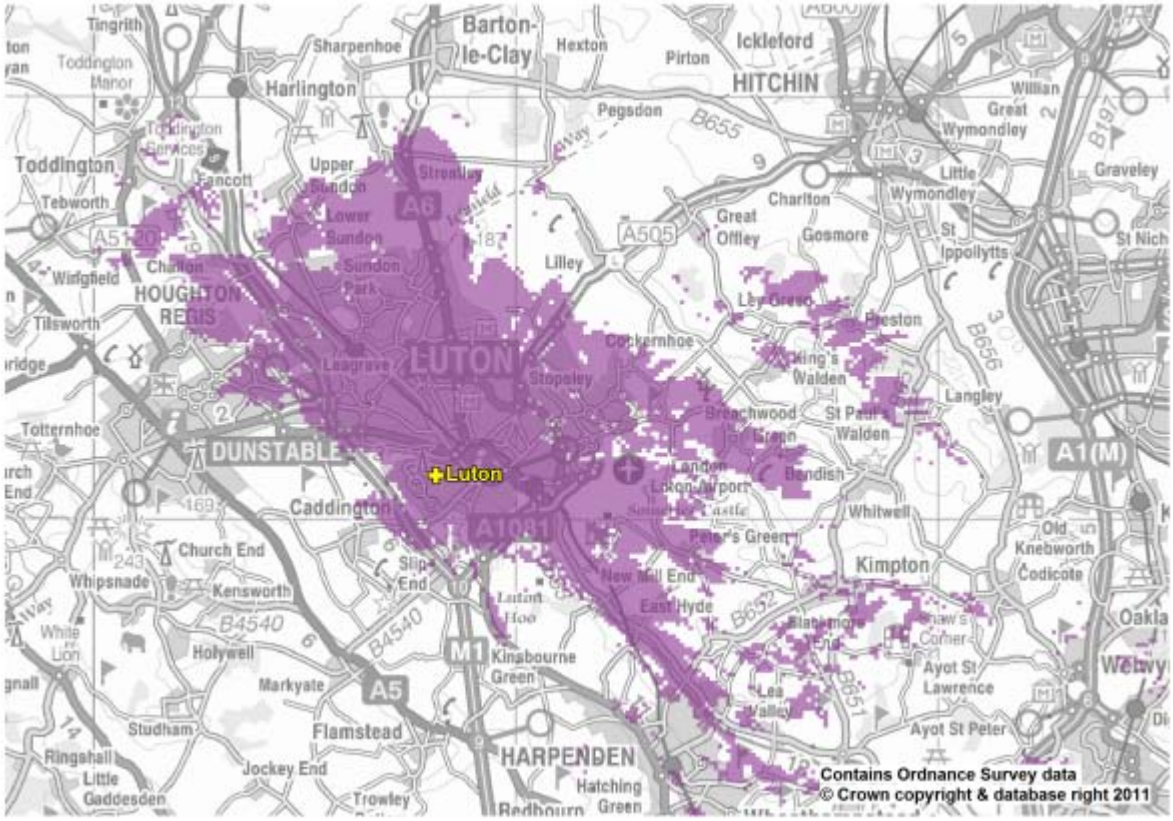
Location	London
Station	Crystal Palace
Channel	29
Effective Radiated Power	2 kW
Assumed Antenna Height	106m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	3,200,000 households
Indicative DPSA Coverage (QPSK 2/3)	3,100,000 households

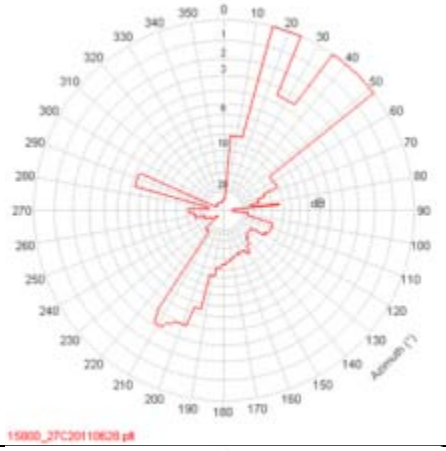
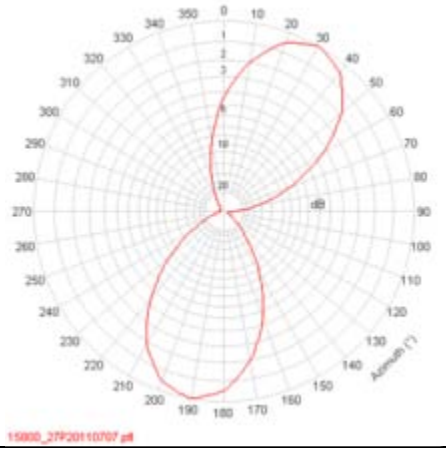
London Indicative Coverage Map (assuming QPSK 2/3)



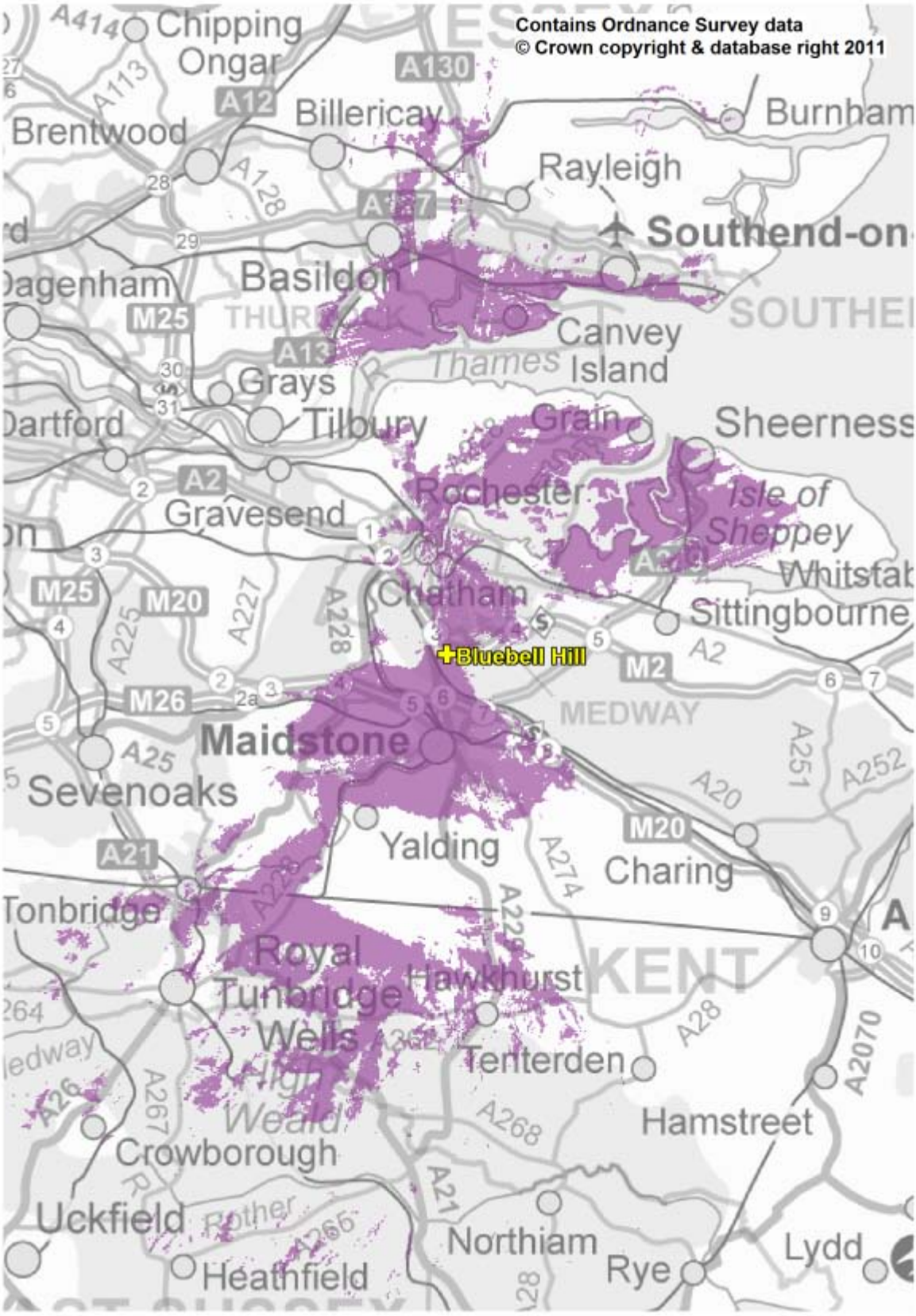
Location	Luton
Station	Luton
Channel	45
Effective Radiated Power	0.05 kW
Assumed Antenna Height	42m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	81,000 households
Indicative DPSA Coverage (QPSK 2/3)	23,000 households

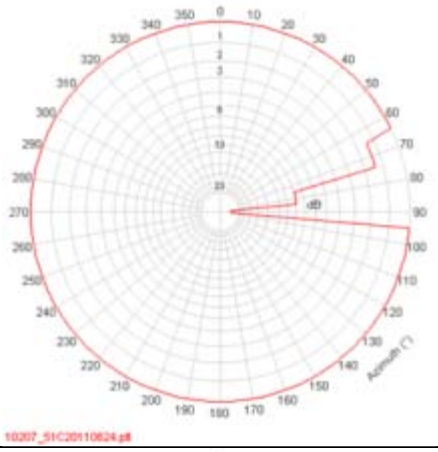
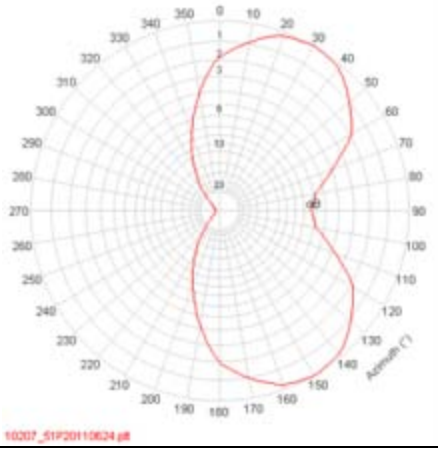
Luton Indicative Coverage Map (assuming QPSK 2/3)



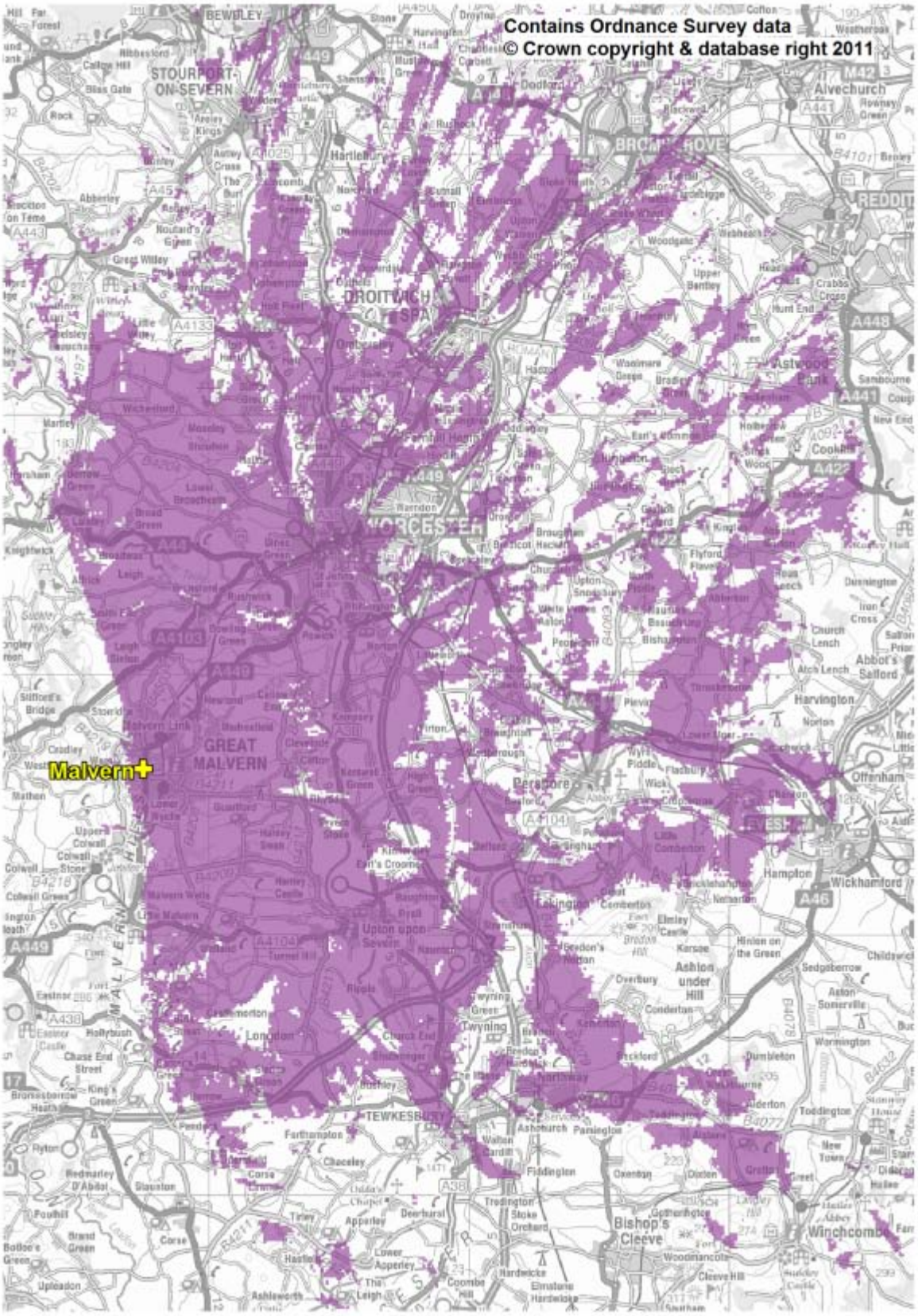
Location	Maidstone
Station	Bluebell Hill
Channel	27
Effective Radiated Power	1 kW
Assumed Antenna Height	44m
Indicative Antenna Template	With respect to 10kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	220,000 households
Indicative DPSA Coverage (QPSK 2/3)	140,000 households

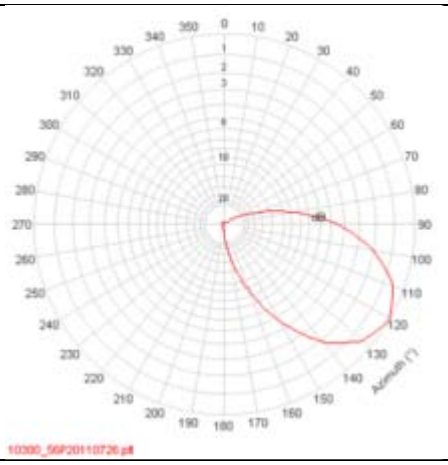
Maidstone Indicative Coverage Map (assuming QPSK 2/3)



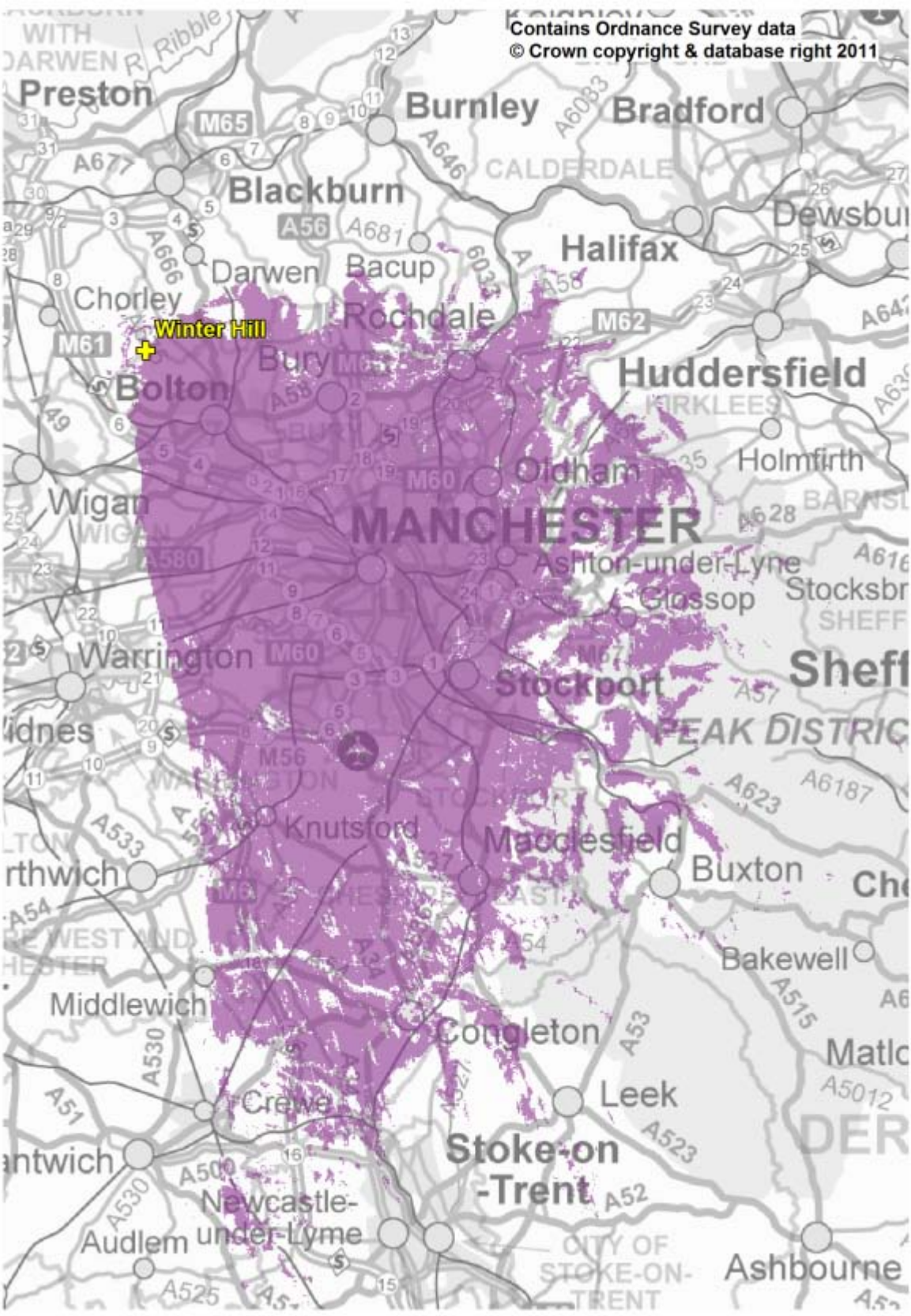
Location	Malvern
Station	Malvern
Channel	51
Effective Radiated Power	0.04 kW
Assumed Antenna Height	38m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	79,000 households
Indicative DPSA Coverage (QPSK 2/3)	50,000 households

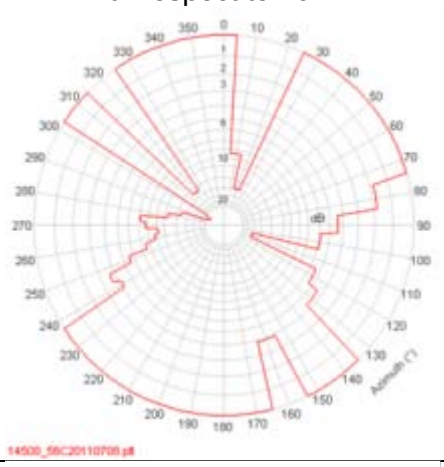
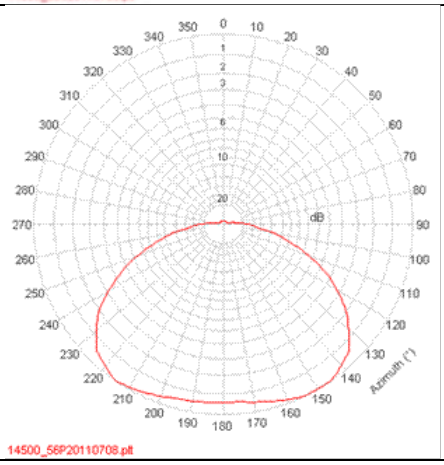
Malvern Indicative Coverage Map (assuming QPSK 2/3)



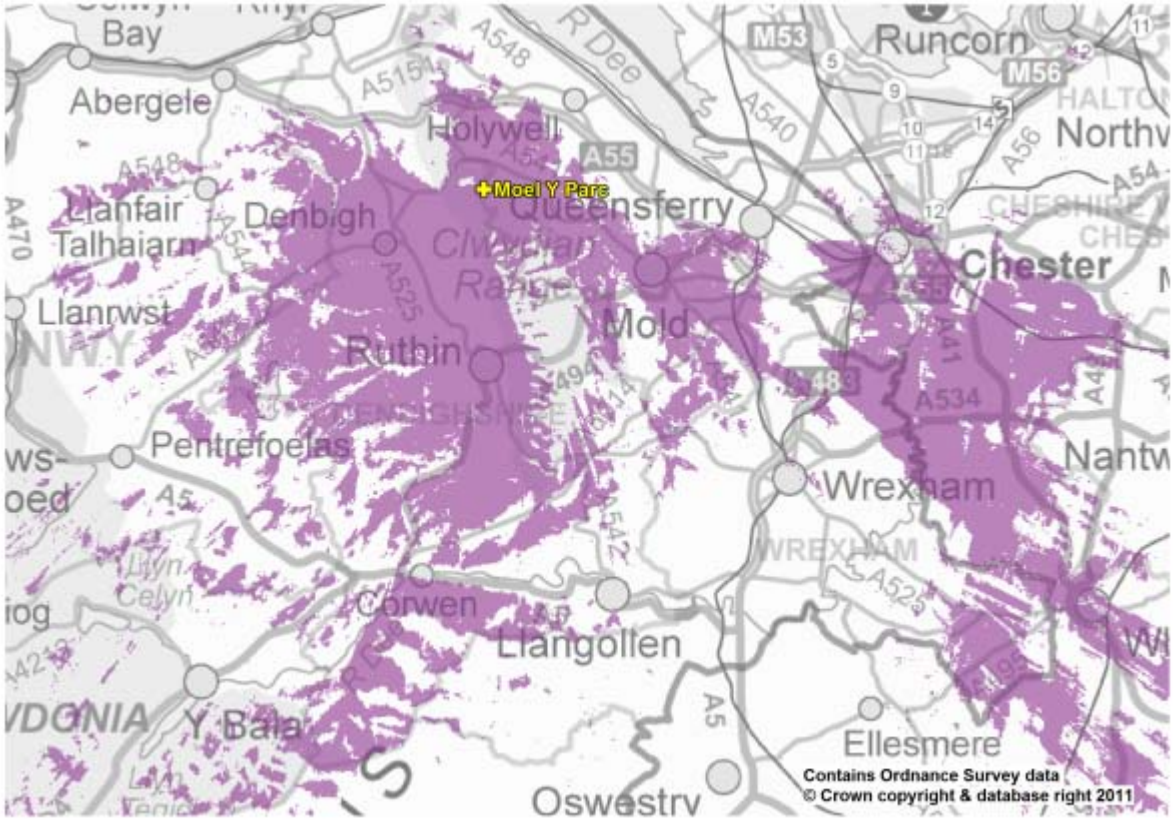
Location	Manchester
Station	Winter Hill
Channel	56
Effective Radiated Power	2 kW
Assumed Antenna Height	144m
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	1,100,000 households
Indicative DPSA Coverage (QPSK 2/3)	1,100,000 households

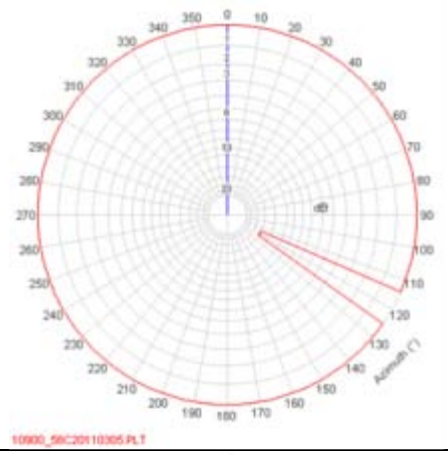
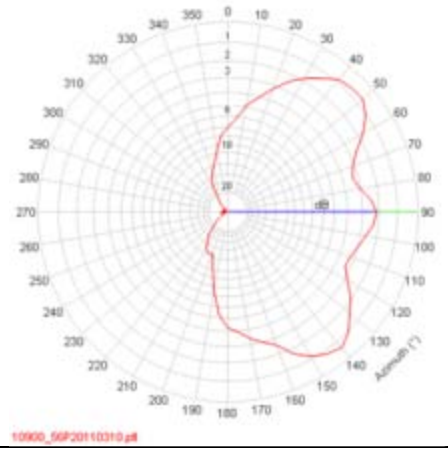
Manchester Indicative Coverage Map (assuming QPSK 2/3)



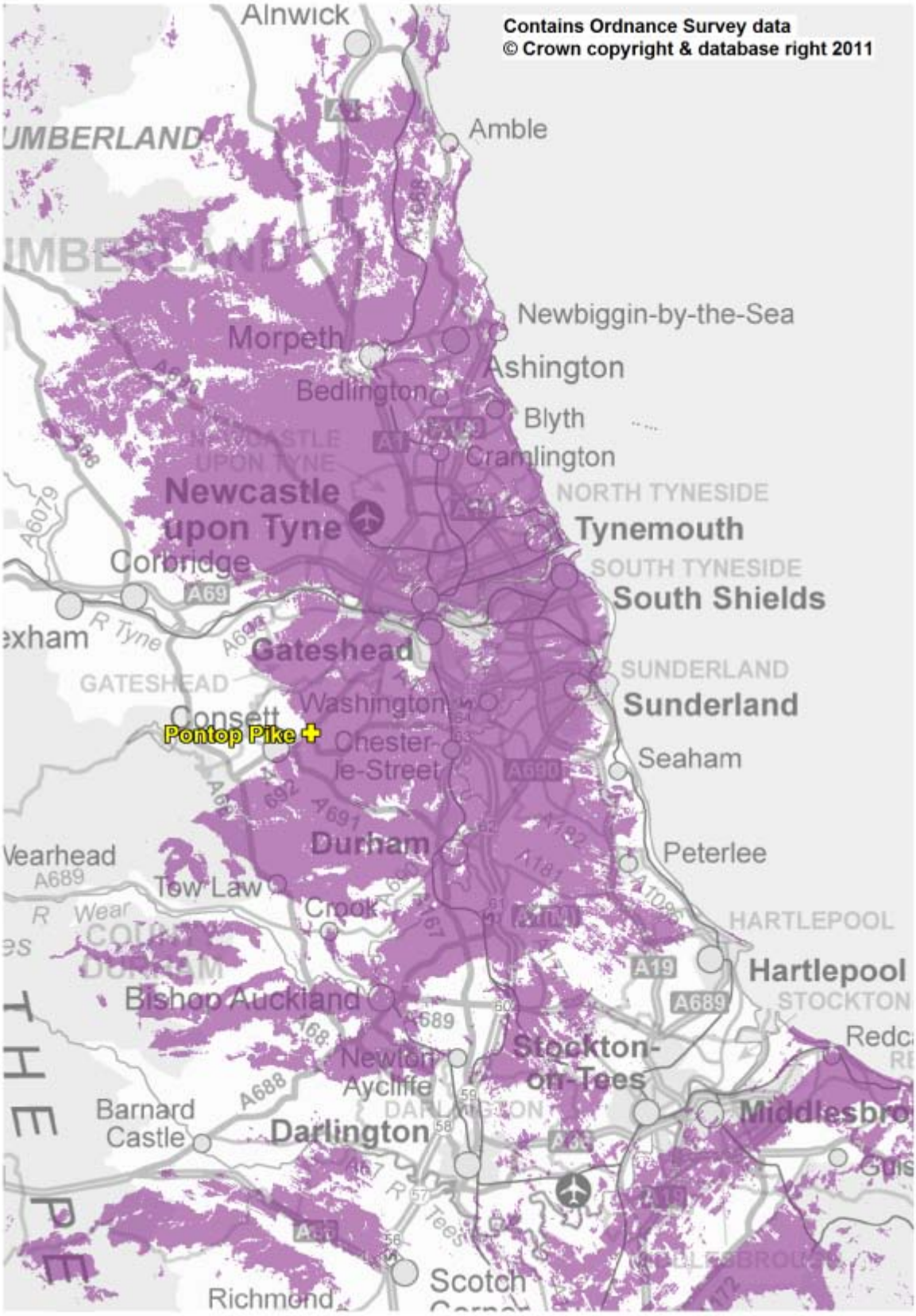
Location	Mold
Station	Moel y Parc
Channel	56
Effective Radiated Power	2 kW
Assumed Antenna Height	118m
Indicative Antenna Template	With respect to 10kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	89,000 households
Indicative DPSA Coverage (QPSK 2/3)	25,000 households

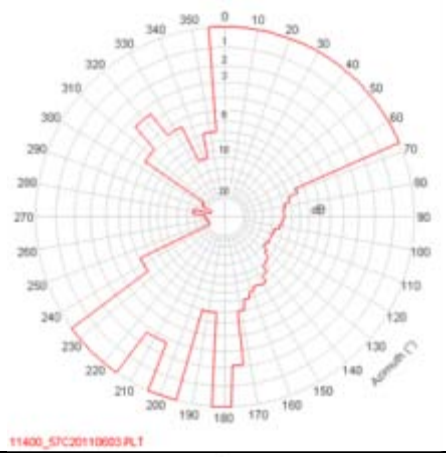
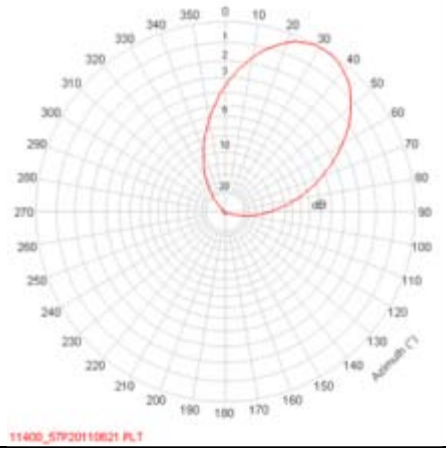
Mold Indicative Coverage Map (assuming QPSK 2/3)



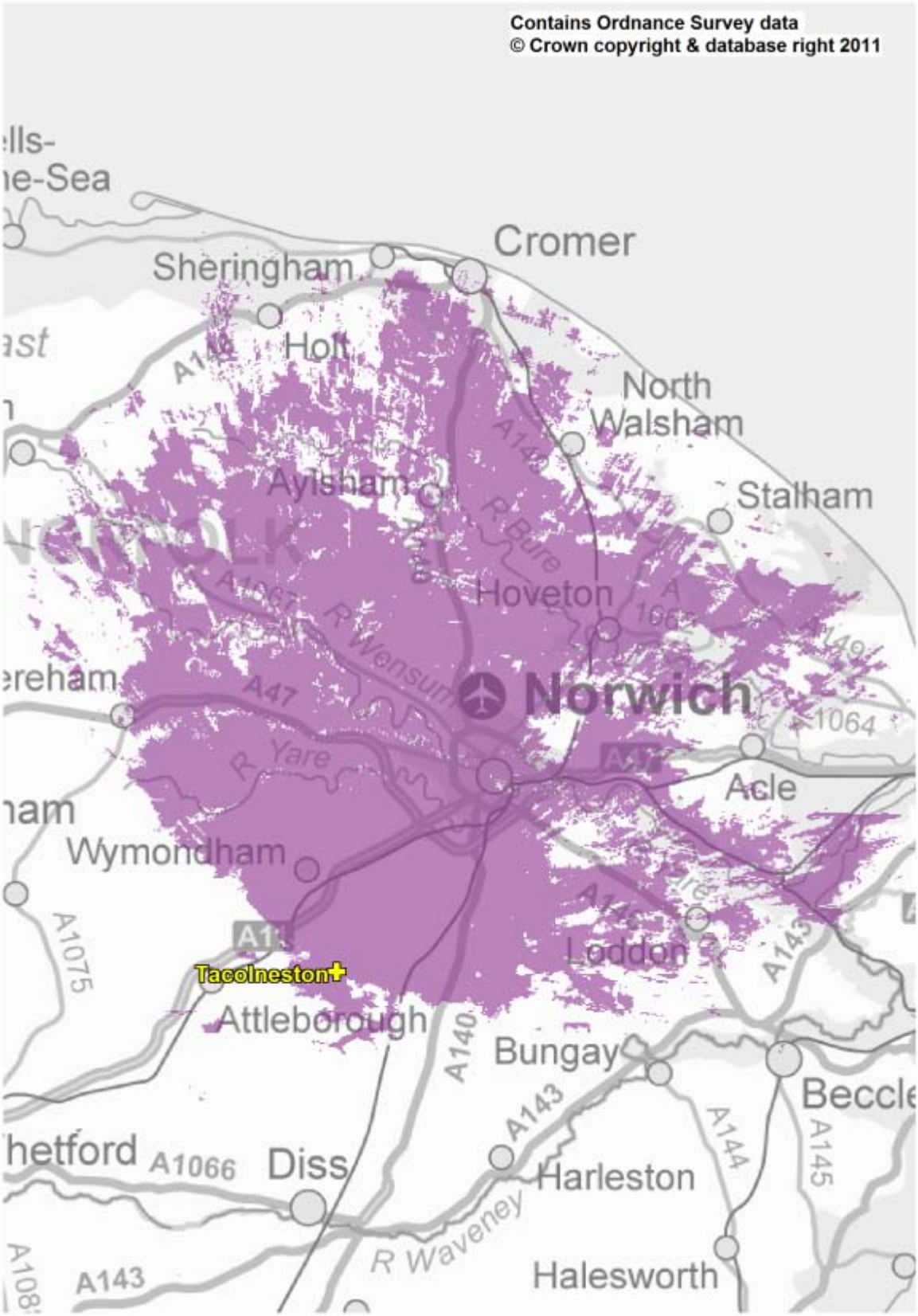
Location	Newcastle
Station	Pontop Pike
Channel	56
Effective Radiated Power	5 kW
Assumed Antenna Height	73m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	1,000,000 households
Indicative DPSA Coverage (QPSK 2/3)	760,000 households

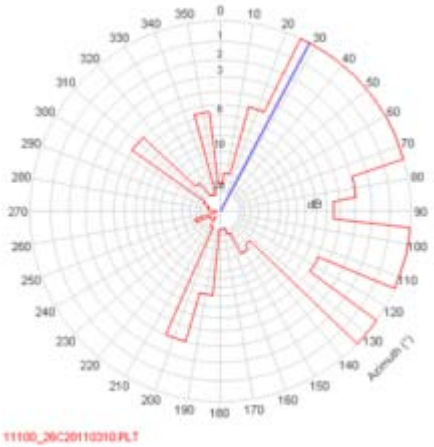
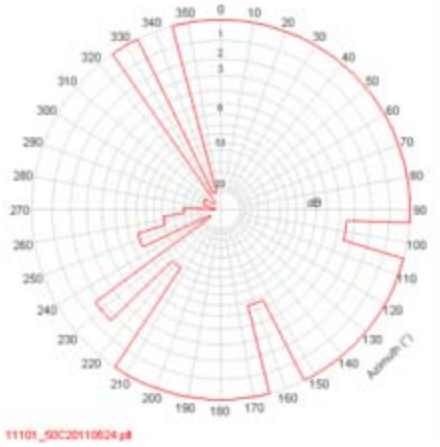
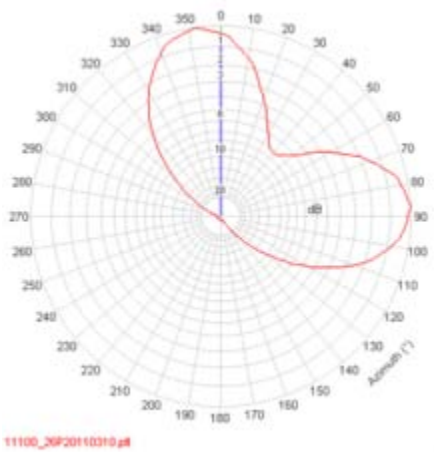
Newcastle Indicative Coverage Map (assuming QPSK 2/3)

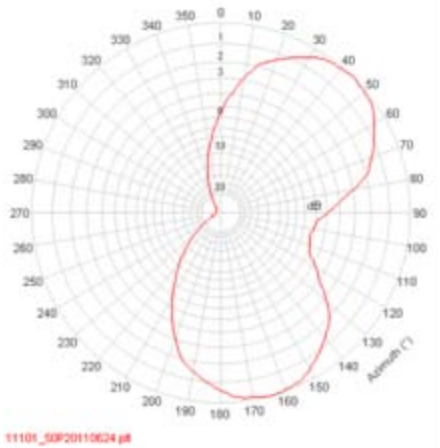


Location	Norwich
Station	Tacolneston
Channel	57
Effective Radiated Power	10 kW
Assumed Antenna Height	100m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	155,000 households
Indicative DPSA Coverage (QPSK 2/3)	149,000 households

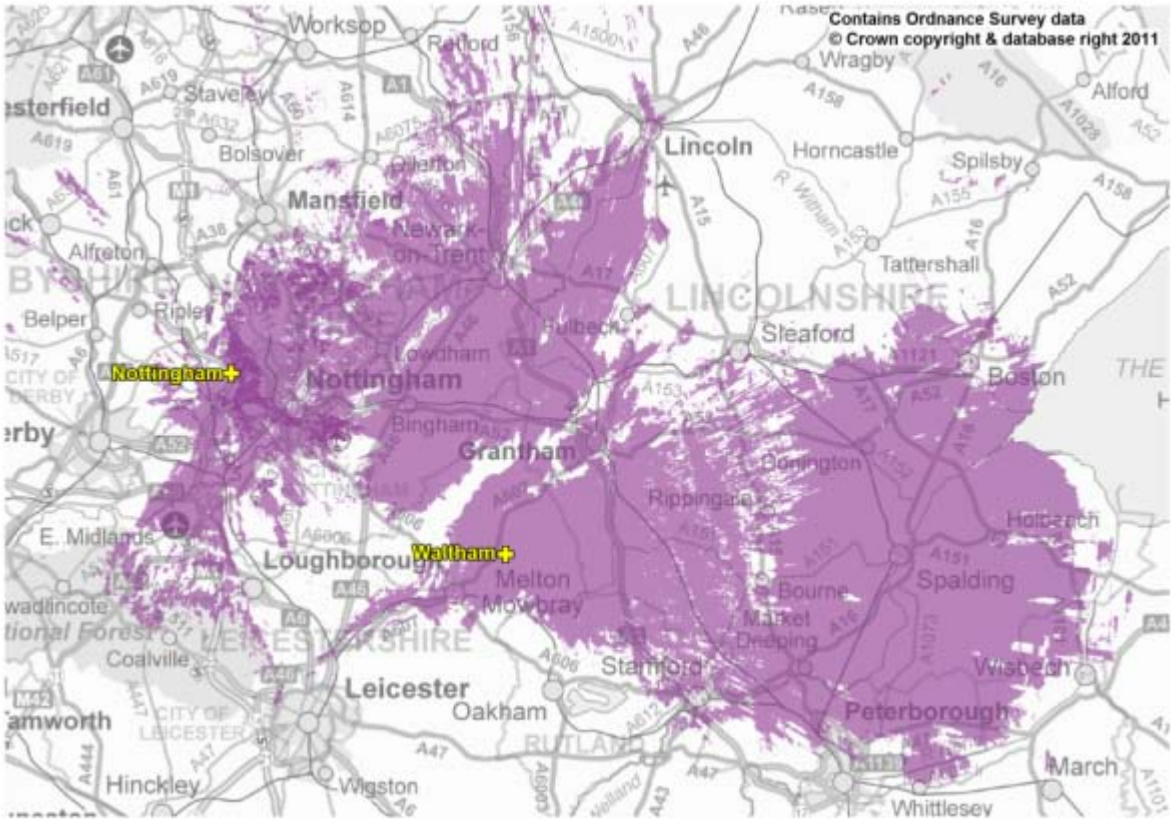
Norwich Indicative Coverage Map (assuming QPSK 2/3)

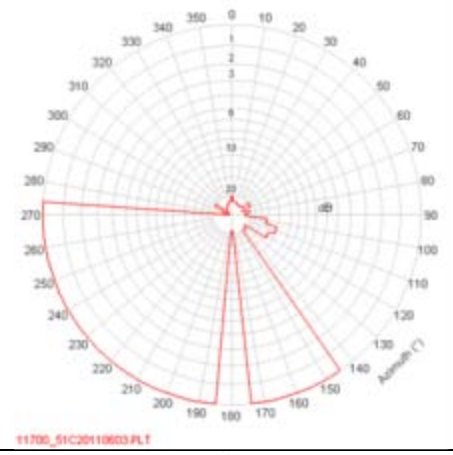
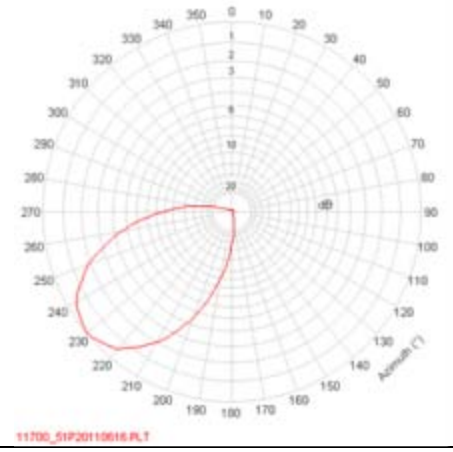


Location	Nottingham	
Station	Waltham	Nottingham
Channel	26	50
Effective Radiated Power	5 kW	0.1 kW
Assumed Antenna Height	151m	41m
Indicative Antenna Template	Waltham  Nottingham 	
Assumed Practical Antenna Pattern	Waltham 	

	Nottingham 
Indicative Gross Coverage (QPSK 2/3)	310,000 households
Indicative DPSA Coverage (QPSK 2/3)	290,000 households

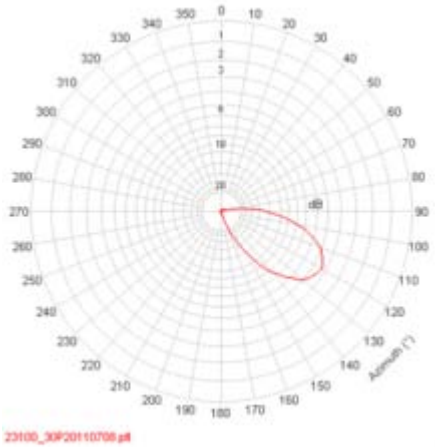
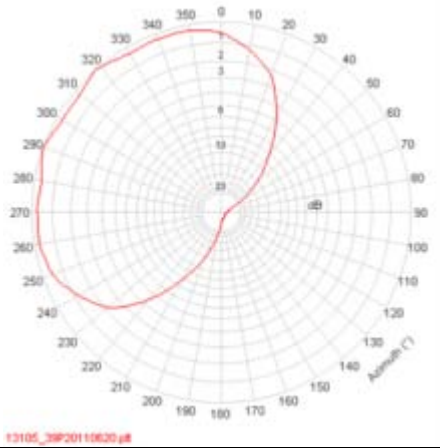
Nottingham Indicative Coverage Map (assuming QPSK 2/3)



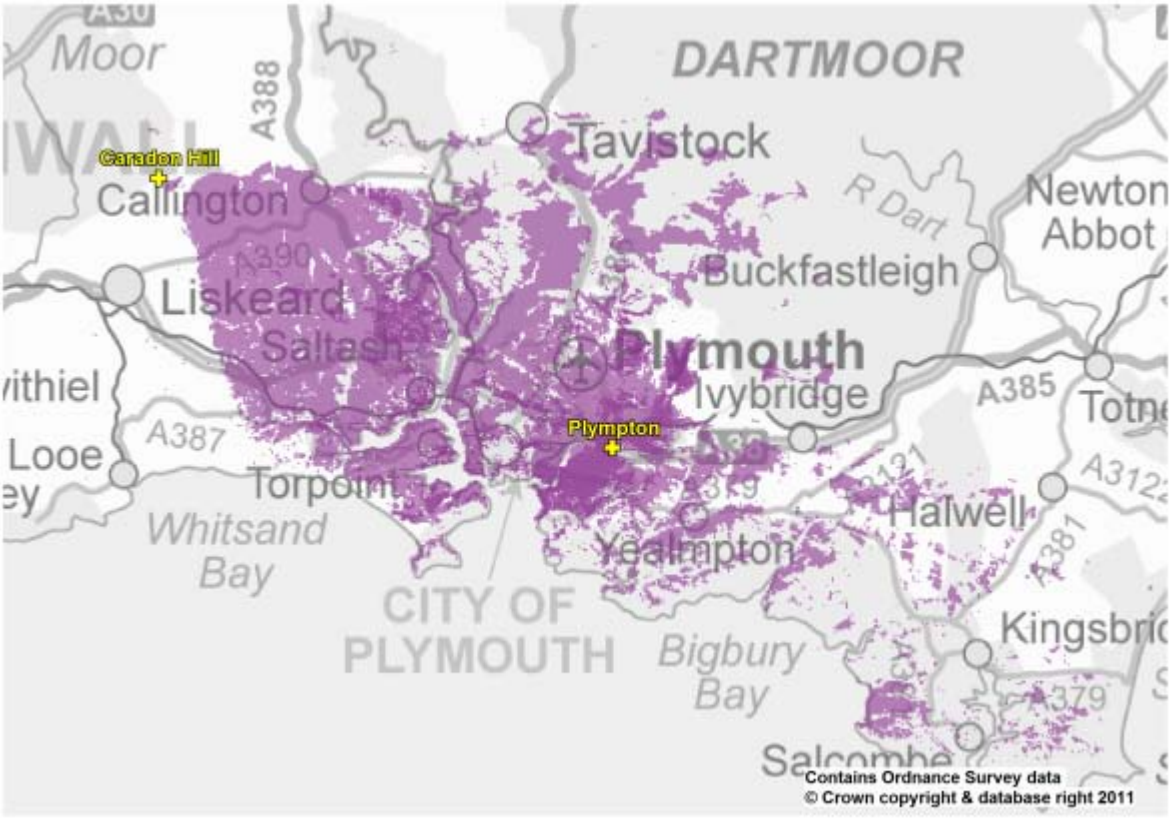
Location	Oxford
Station	Oxford
Channel	51
Effective Radiated Power	10 kW
Assumed Antenna Height	80m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	110,000 households
Indicative DPSA Coverage (QPSK 2/3)	110,000 households

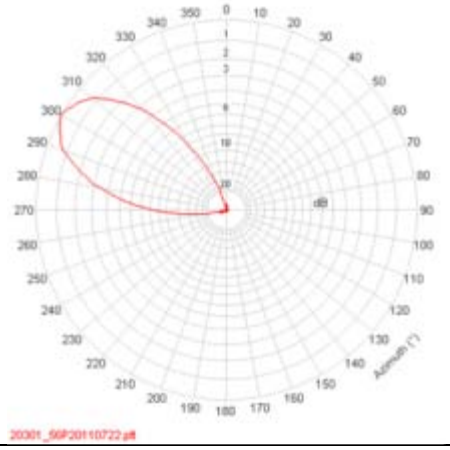
Oxford Indicative Coverage Map (assuming QPSK 2/3)



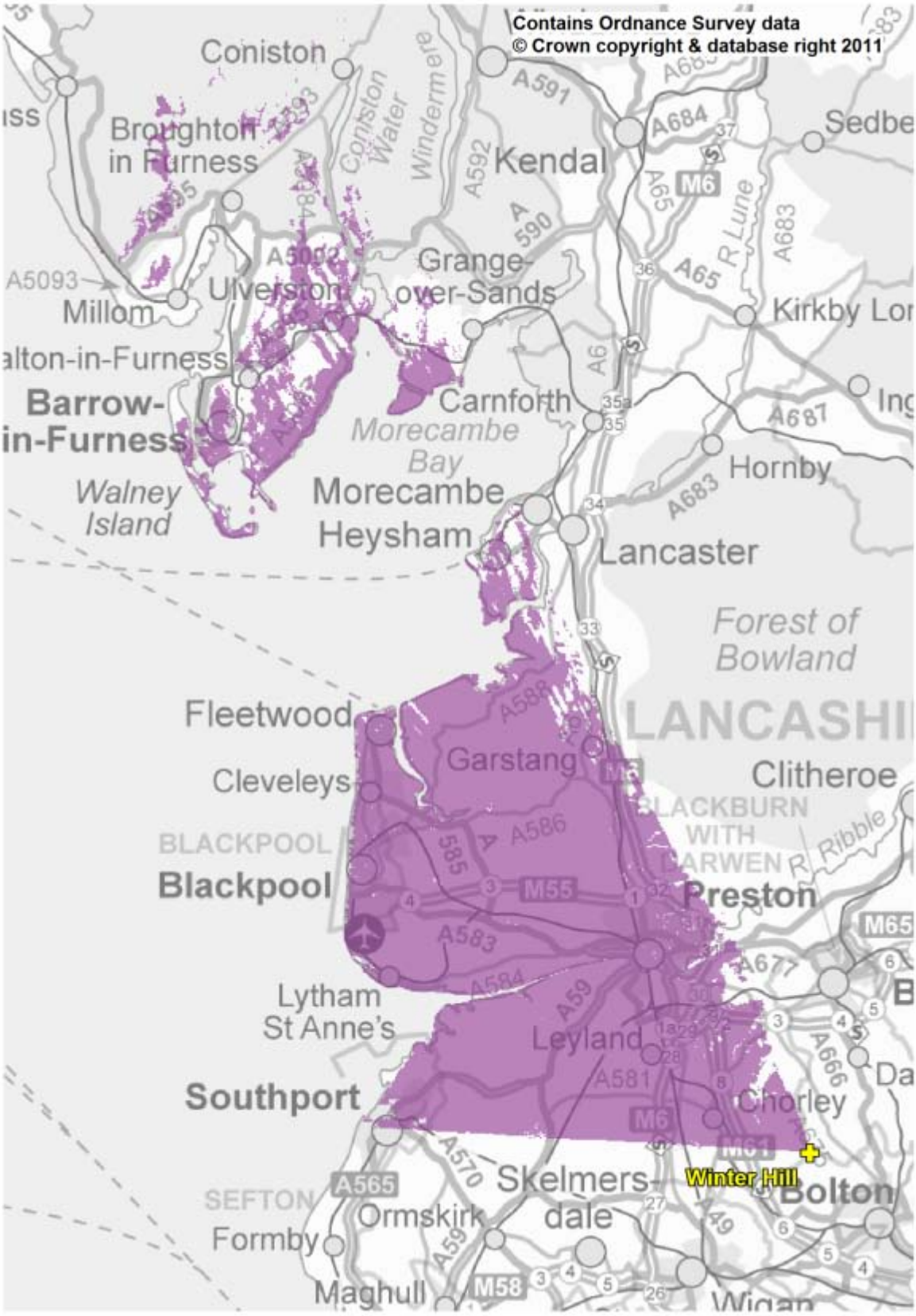
Location	Plymouth	
Station	Caradon Hill	Plympton
Channel	30	39
Effective Radiated Power	2 kW	0.1 kW
Assumed Antenna Height	182m	45m
Assumed Practical Antenna Pattern	Caradon Hill  Plympton 	
Indicative Gross Coverage (QPSK 2/3)	94,000 households	
Indicative DPSA Coverage (QPSK 2/3)	100,000 households	

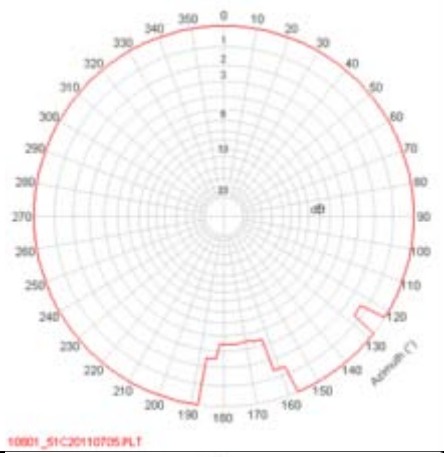
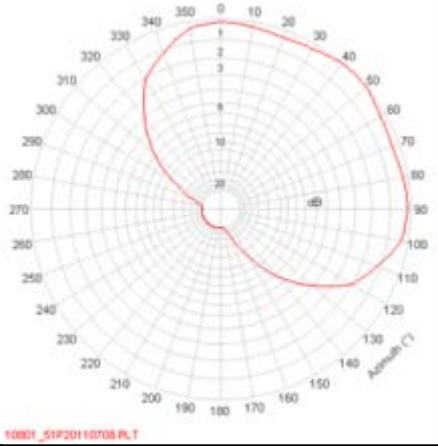
Plymouth Indicative Coverage Map (assuming QPSK 2/3)



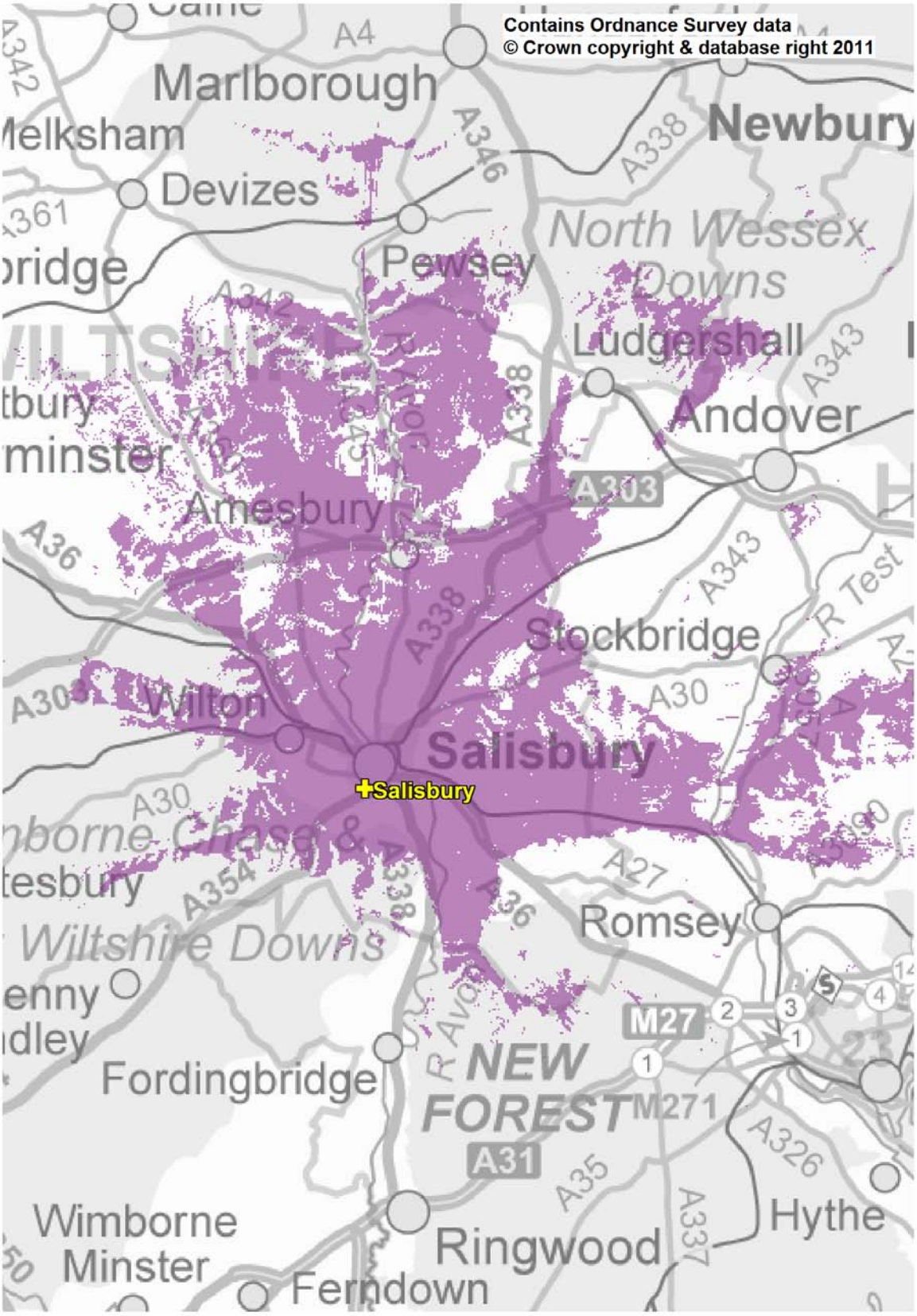
Location	Preston
Station	Winter Hill
Channel	56
Effective Radiated Power	1 kW
Assumed Antenna Height	144m
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	350,000 households
Indicative DPSA Coverage (QPSK 2/3)	340,000 households

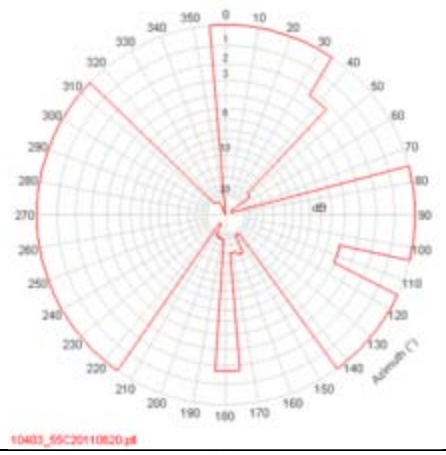
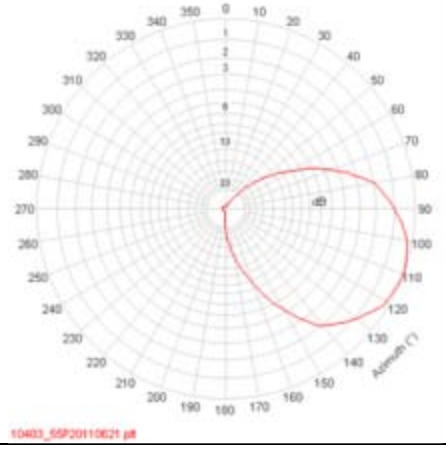
Preston Indicative Coverage Map (assuming QPSK 2/3)



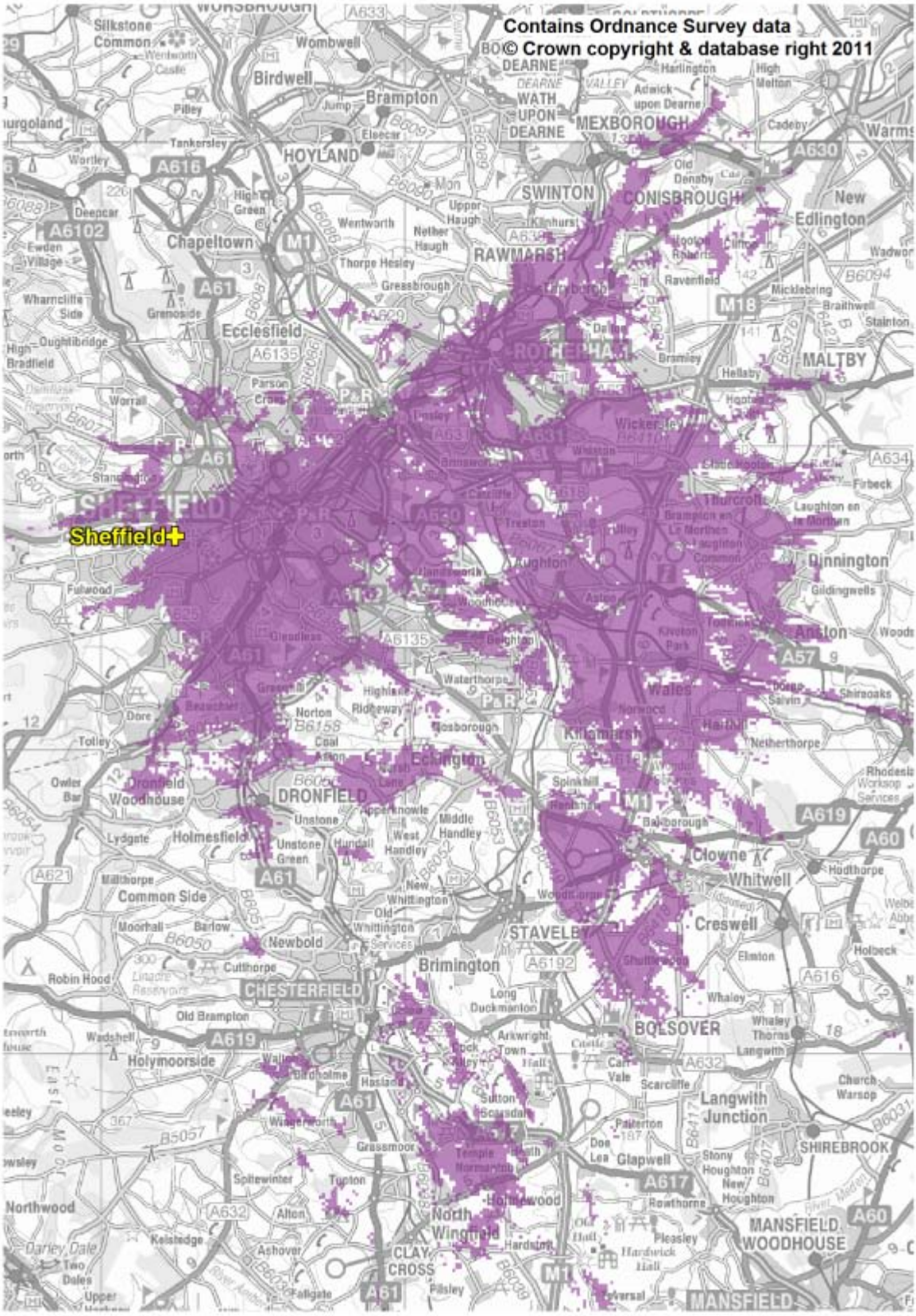
Location	Salisbury
Station	Salisbury
Channel	51
Effective Radiated Power	0.2 kW
Assumed Antenna Height	45m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	42,000 households
Indicative DPSA Coverage (QPSK 2/3)	31,000 households

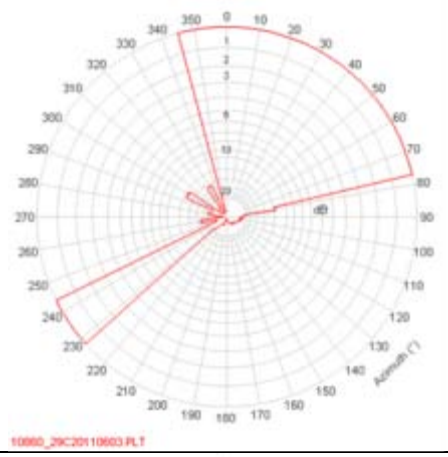
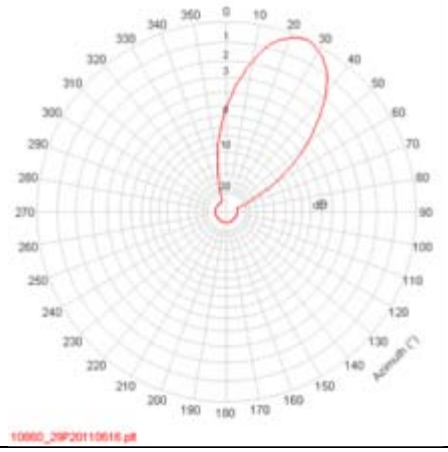
Salisbury Indicative Coverage Map (assuming QPSK 2/3)



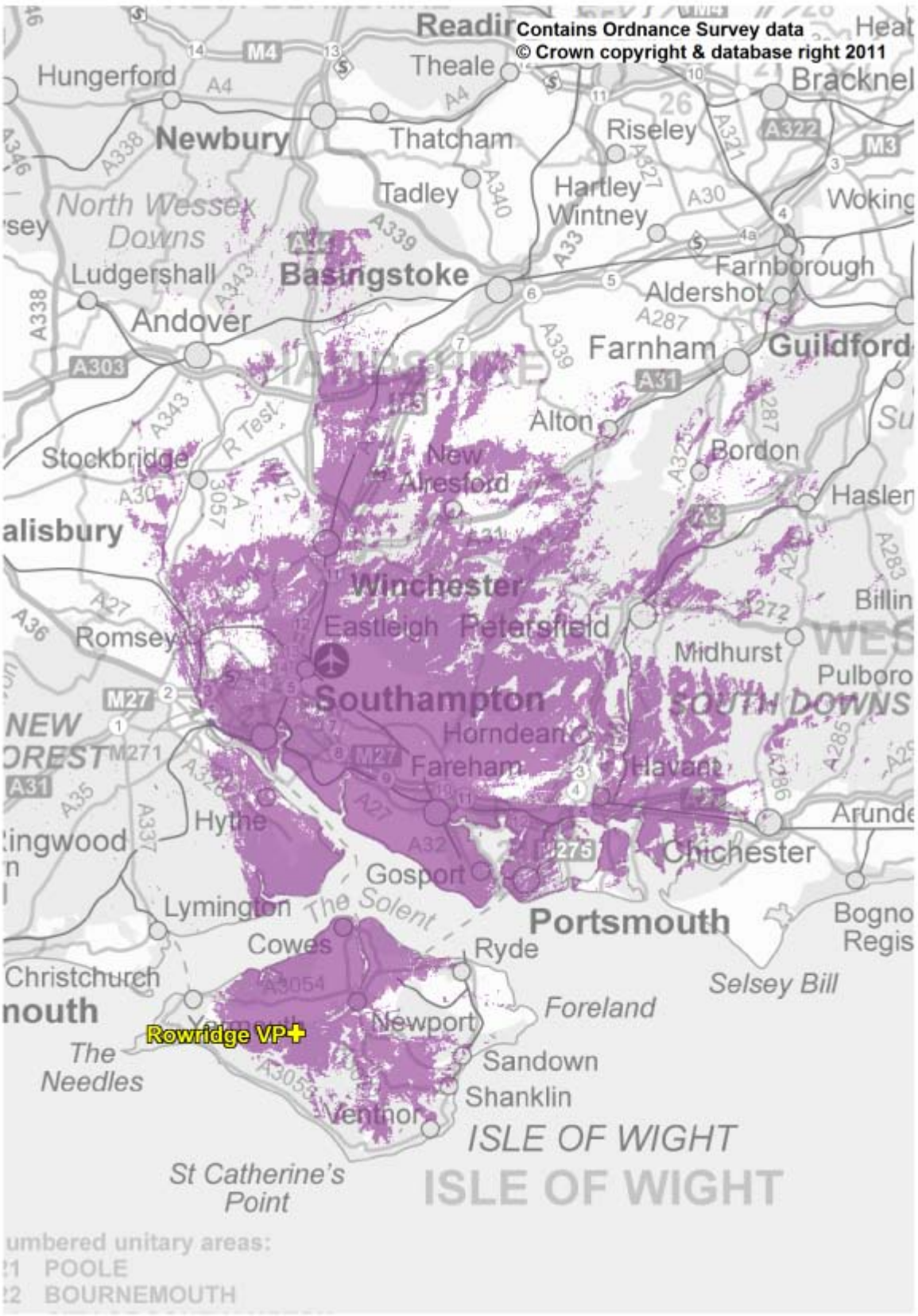
Location	Sheffield
Station	Sheffield
Channel	55
Effective Radiated Power	0.1 kW
Assumed Antenna Height	43m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	190,000 households
Indicative DPSA Coverage (QPSK 2/3)	120,000 households

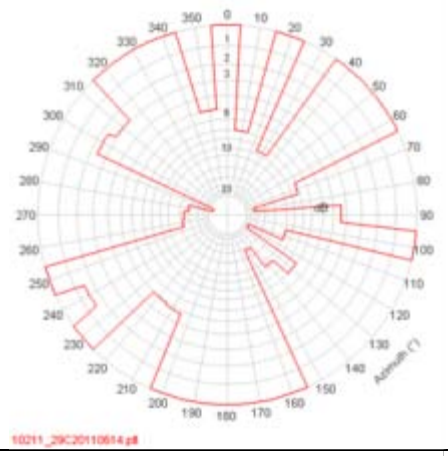
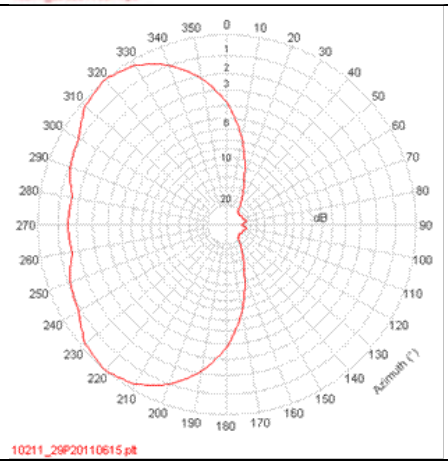
Sheffield Indicative Coverage Map (assuming QPSK 2/3)



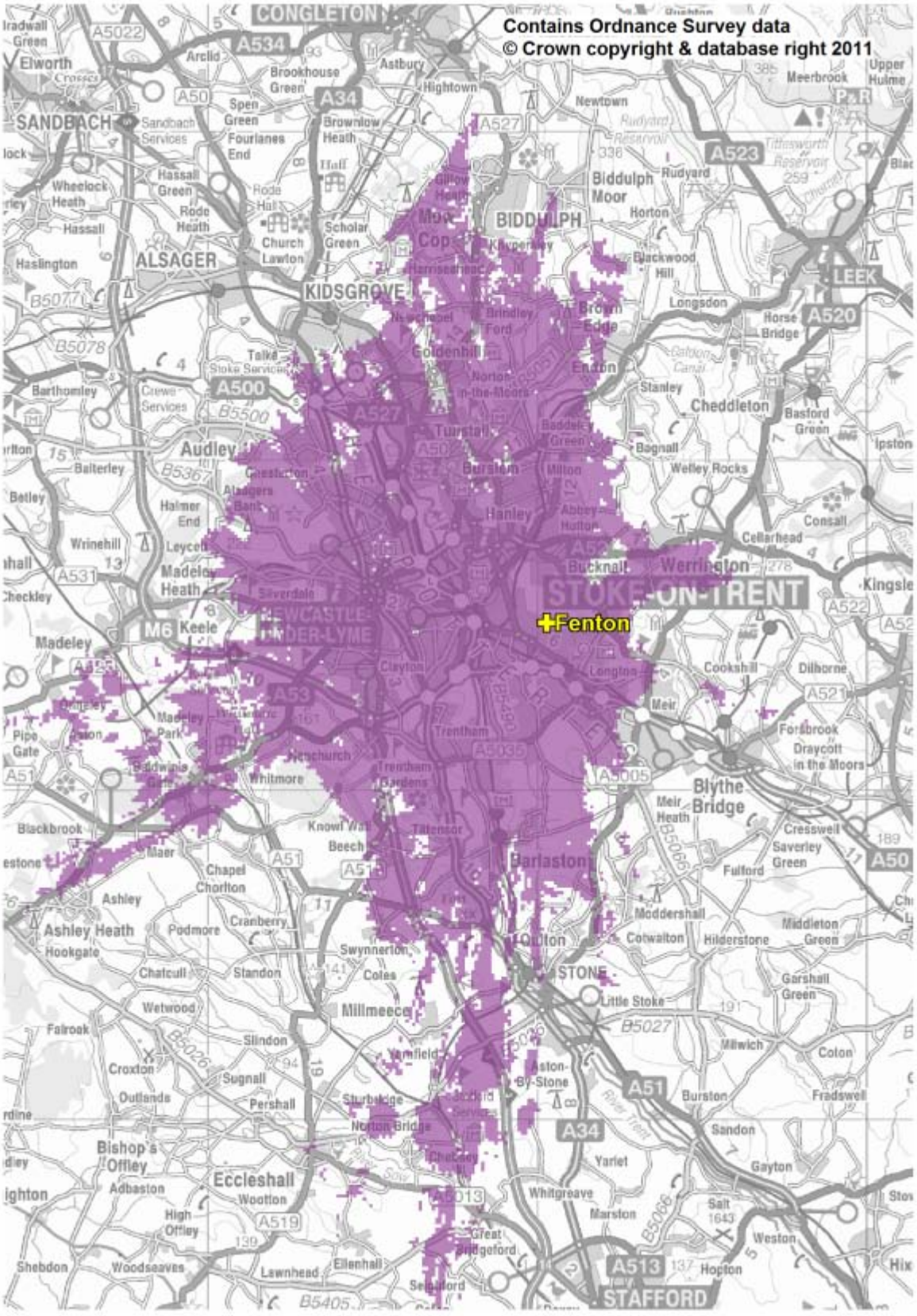
Location	Southampton
Station	Rowridge VP
Channel	29
Effective Radiated Power	10 kW
Assumed Antenna Height	89m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	460,000 households
Indicative DPSA Coverage (QPSK 2/3)	250,000 households

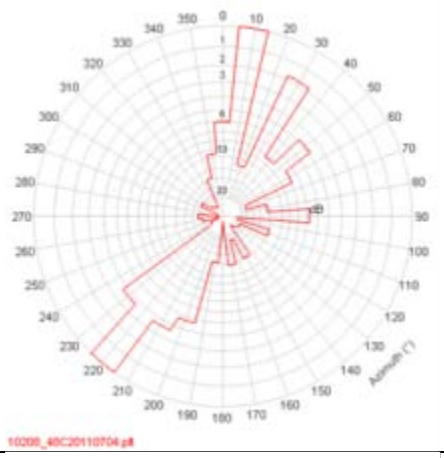
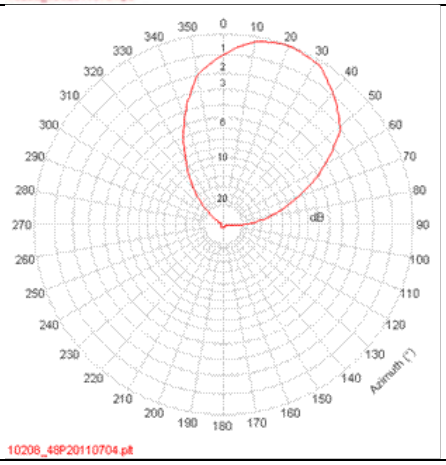
Southampton Indicative Coverage Map (assuming QPSK 2/3)



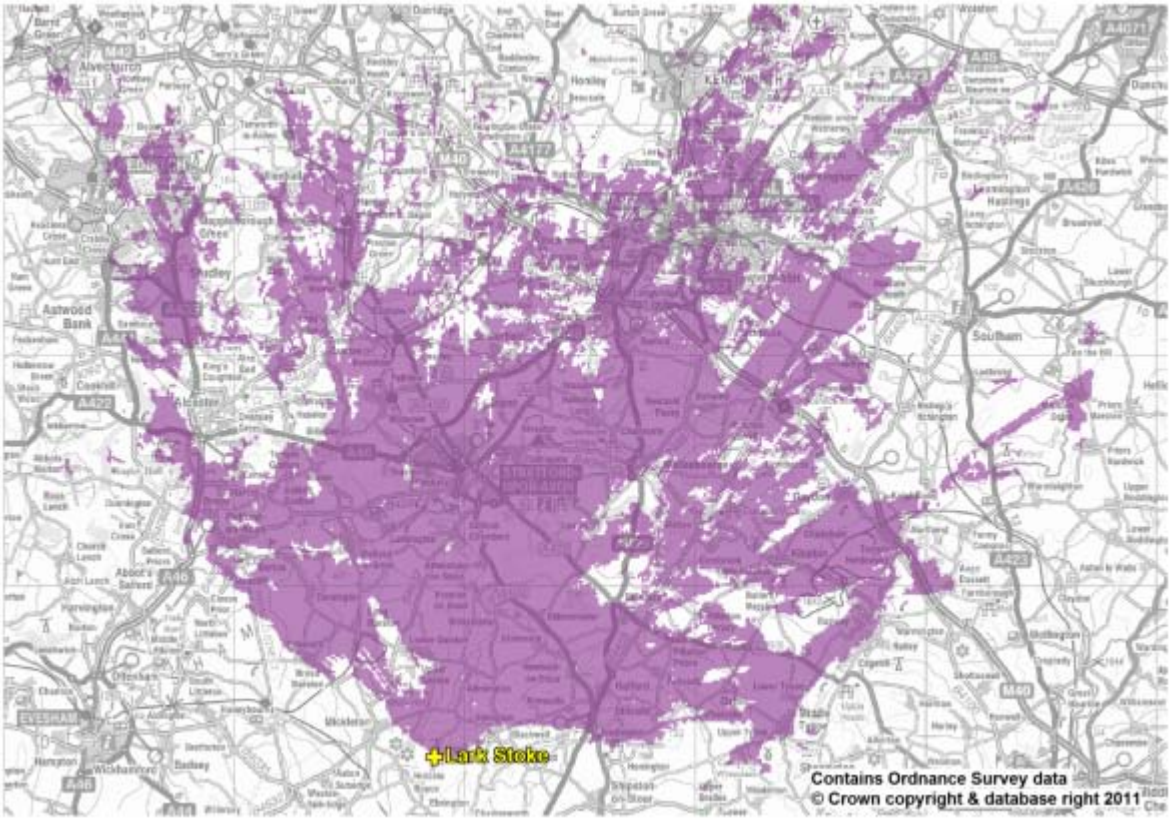
Location	Stoke On Trent
Station	Fenton
Channel	29
Effective Radiated Power	0.05 kW
Assumed Antenna Height	45m
Indicative Antenna Template	
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	150,000 households
Indicative DPSA Coverage (QPSK 2/3)	120,000 households

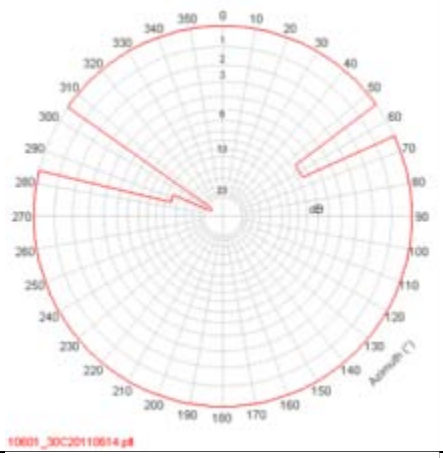
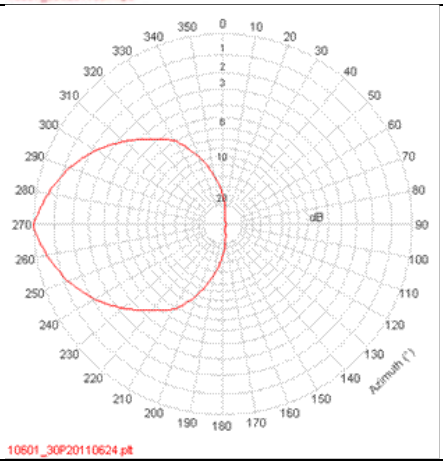
Stoke On Trent Indicative Coverage Map (assuming QPSK 2/3)



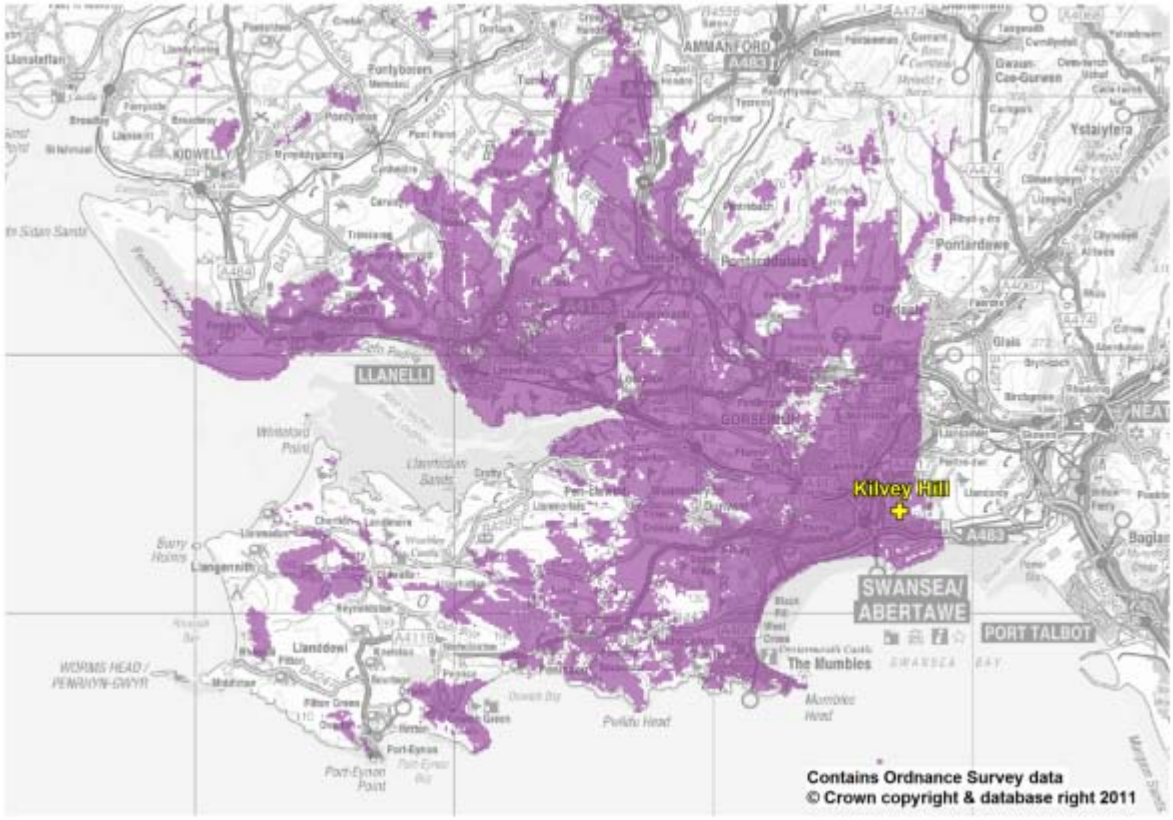
Location	Stratford Upon Avon
Station	Lark Stoke
Channel	48
Effective Radiated Power	0.1 kW
Assumed Antenna Height	10m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	68,000 households
Indicative DPSA Coverage (QPSK 2/3)	29,000 households

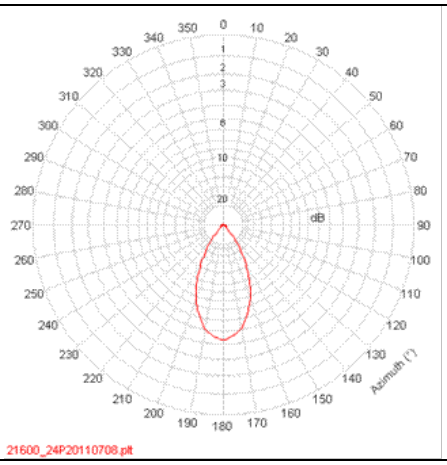
Stratford Upon Avon Indicative Coverage Map (assuming QPSK 2/3)



Location	Swansea
Station	Kilvey Hill
Channel	30
Effective Radiated Power	0.1 kW
Assumed Antenna Height	45m
Indicative Antenna Template	With respect to 1kW 
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	120,000 households
Indicative DPSA Coverage (QPSK 2/3)	73,000 households

Swansea Indicative Coverage Map (assuming QPSK 2/3)



Location	York
Station	Bilsdale
Channel	24
Effective Radiated Power	2 kW
Assumed Antenna Height	148m
Assumed Practical Antenna Pattern	
Indicative Gross Coverage (QPSK 2/3)	150,000 households
Indicative DPSA Coverage (QPSK 2/3)	71,000 households

York Indicative Coverage Map (assuming QPSK 2/3)

