Note for Applicants on Coverage of Forth Valley Local Television

Publication date: May 2014
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Section 1

Transmitter location

1.1 This Coverage Note provides details of the indicative coverage that might be achieved by a potential Forth Valley local TV service. This Note is being published as Ofcom considers that potential applicants for the local TV licence may find this information useful when commencing their own technical analysis. The Note reflects Ofcom’s estimate of the coverage that might be achieved, but applicants will need to inform themselves in order to develop their own view of the coverage which might be possible.

1.2 We commissioned an assessment of the available spectrum at the Black Hill transmitter, which broadcasts six UK-wide multiplexes (each carrying a number of television services). The six multiplexes require six transmission frequencies from the spectrum available to TV broadcasting. Black Hill also broadcasts a seventh multiplex that carries principally high definition TV services as well as a local TV multiplex targeted at Glasgow. Although this leaves some spectrum unused, many are in use at adjacent transmitters and cannot therefore be used for broadcasting at sufficiently high powers to achieve useful coverage without interference occurring.

1.3 The assessment therefore attempted to identify the best unused frequency that could be sufficiently clear to permit the broadcasting of a local multiplex to serve the Forth Valley area. A notional antenna pattern was then developed that took into account the requirement not to cause undue interference to the other digital television multiplexes.
Section 2

Assumptions and Caveats

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

Antenna

2.2 We have assumed that a separate local multiplex broadcasting antenna would be installed at Black Hill. We have further assumed that this antenna would be mounted at around halfway up the transmitter mast.

2.3 We do not have detailed information about whether the main transmitting antenna used by the six UK-wide multiplexes (situated at the top of the mast) could be shared by the local multiplex. 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 will depend on how closely 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 map in Annex 1. A detailed site assessment and commercial negotiation would be required to determine the feasibility of the local multiplex sharing an antenna with the UK-wide multiplexes. Sharing the main antenna will definitely not be possible in some cases as it will not meet the necessary antenna pattern restrictions.

Modulation

2.7 Indicative population coverage figures based on QPSK rate 3/4 are provided in Annex 1 of this document to reflect the currently assumed transmission mode.

2.8 If a different signal mode is ultimately adopted, further variations to the indicative coverage of the local multiplex are likely to occur. Further information on the applicable transmission standards is provided in the Invitation to Apply for the Local Multiplex Licence.¹

Impact on other DTT multiplexes in the UK

2.9 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

¹ http://licensing.ofcom.org.uk/tv-broadcast-licences/local/
been developed for each site to ensure that the local multiplexes do not cause unacceptable interference to other DTT services.

2.10 Coverage predictions are carried out using a sophisticated computer modelling system 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.

2.11 While the planning for the 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 television 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.

2.12 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 (for example, through upgrading the aerials); or a combination of both.

2.13 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 for the Local Multiplex Licence.

International considerations

2.14 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\(^2\) and our neighbouring countries are under reciprocal agreements to limit the levels of signals they put into the UK.

2.15 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 most likely to need coordination.

2.16 The indicative plan for Forth Valley local TV presented in this document envisages limiting interference towards the Continent and Ireland to the coordination trigger threshold of 23dBuV/m. Forth Valley is therefore not subject to the coordination process and should not need to be agreed with other administrations.

\(^2\) The coordination trigger threshold is nominally 23dBuV/m.
Influence of domestic aerial direction

2.17 The coverage prediction contained in Annex 1 has been derived using the same coverage criteria as are used for planning digital switchover. The map indicates in purple the maximum coverage (assuming QPSK rate 3/4 modulation) from Black Hill where households are predicted to be able to receive the Forth Valley local multiplex. This is called ‘gross’ coverage.

2.18 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 Forth Valley local multiplex and the area 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

2.19 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.

2.20 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.

2.21 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. The Forth Valley local multiplex channel falls a little outside the analogue aerial group. Households that are predicted to lie within coverage and have an aerial meeting the standard assumptions that points towards Black Hill should be able to receive the local multiplex.

Adjacent channel interference

2.22 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:

2.22.1 Operating at a lower power level relative to the UK-wide multiplexes;

2.22.2 Restricted antenna pattern relative to other multiplexes;

2.22.3 A significant difference in the height of the local multiplex transmitting antennas in relation to other multiplexes at the same transmitting site; and

2.22.4 Another multiplex offset towards the local multiplex in particular a UK-wide multiplex using extended carrier DVB-T2.
2.23 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.

2.24 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.
Indicative Household Coverage

3.1 The coverage figures and map we have produced provide an indication of the kind of coverage that might be achieved by a Forth Valley local multiplex. The assessment we have made, however, is based on a purely theoretical analysis of transmitter sites and the available spectrum.

3.2 Population coverage assessments are based on a predicted TV signal strength level in each 100m 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. No adjustment has been made for the number of households that may be receiving their TV services from other platforms such as satellite or cable. The latest figures published by Ofcom for the first quarter of 2011 show that approximately 44% of primary TV sets are used to receive terrestrial television, 42% from satellite and 11% connected to cable, the remaining 3% are used for broadband TV and video on demand services. For secondary sets, the proportion making use of satellite and cable is much lower and around 75% of all homes make some use of terrestrial television on at least one set.

3.3 The total number of households in the UK is assumed to be 28.3 million: this figure is derived from the Royal Mail Postcode Address File (PAF), which includes business as well as residential addresses. All coverage figures assume that households have good quality aerials that are correctly aligned and of the appropriate group or are wideband.

3.4 Annex 1 includes estimates for the number of households that might be able to receive the Forth Valley local multiplex, if it was broadcast using the assumed characteristics. 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 Forth Valley local multiplex. As guidance, we have provided two measures:

3.4.1 **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 for 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.

3.4.2 **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

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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.

3.5 The technical characteristics for the Forth Valley transmitter have been agreed by the other multiplex operators. International frequency coordination should not be required.

3.6 The predicted coverage is inevitably a theoretical calculation and the actual coverage that could be achieved in practice might vary from the predicted figures. For example, the use of a transmit antenna at a different height to that assumed will change the 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 data on the actual buildings, trees or other potential obstacles in a particular area. The method and assumptions are however consistent with those used for digital switchover.

3.7 Applicants should note that no coverage is predicted for Falkirk town centre for a Forth Valley service from Black Hill. In addition, it is believed that many DTT households in Falkirk town centre probably have aerials pointing at the Craigkelly transmitter rather than Black Hill.

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 the Forth Valley local TV service including an indicative coverage map. Note that the indicative household coverage figures and map assume that QPSK rate 3/4 modulation is used.
### Annex 1 – Technical parameters and indicative coverage map

<table>
<thead>
<tr>
<th>Location</th>
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<tbody>
<tr>
<td>Station</td>
<td>Black Hill</td>
</tr>
<tr>
<td>Channel</td>
<td>56</td>
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<tr>
<td>Effective Radiated Power</td>
<td>5 kW</td>
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<tr>
<td>Assumed Antenna Height</td>
<td>154m</td>
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**Indicative Antenna Template (Green) & Assumed Practical Antenna Pattern (Red)**

**Indicative Coverage (QPSK 3/4)**
- DPSA: 380,000 households
- Gross: 460,000 households
Forth Valley Indicative Coverage Map (assuming QPSK 3/4)