



# Consumer aerial survey

Implementing Ofcom's UHF Strategy

Research

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## Section 1

# Introduction

## Implementing Ofcom's UHF Strategy

- 1.1 Ofcom's UHF Strategy Statement, published in November 2012, set out two objectives relating to the use of UHF bands IV and V, which cover the frequency range 470-790 MHz, namely:
- enabling the release of additional spectrum for mobile broadband use, to help meet the rapidly increasing demand for mobile data capacity; and
  - securing the ongoing delivery of the benefits provided by Digital Terrestrial Television (DTT).
- 1.2 We published a Call for Inputs<sup>1</sup> (CFI) in April 2013 providing an overview of the work that Ofcom is planning to undertake regarding the future of the 700 MHz band, particularly seeking input from stakeholders on two specific areas:
- the factors that are relevant for us to consider when assessing the costs and benefits associated with a potential future change of use of the 700 MHz band. We are also seeking to explore whether market mechanisms, such as an incentive auction, could have a role to play in determining the timing of a future release of the 700 MHz band.;
  - the measures that we can and should take, ahead of any future change of use of the 700 MHz band, to reduce the disruption and costs which could result from a change of use of the band.
- 1.3 One potential implementation cost that we identified in the CFI is the cost to consumers of equipment replacement – an example being rooftop aerials that might need to be replaced in order to continue to receive DTT services post 700 MHz clearance.
- 1.4 It is therefore important that we have as up-to-date information as possible on the type of aerials that households are using when considering the impact on consumers and the costs that might arise out of a re-organisation of the frequencies used by TV broadcasting.
- 1.5 Information on the type of aerials in use by the UK's households is not however readily available. Firstly, the domestic aerial industry is relatively fragmented with a large number of small companies (often sole traders) offering installation services. Products are available from a variety of manufacturers as well as through retail sales to DIY installers. Industry trade associations such as the Confederation of Aerial Industries and the Registered Digital Institute do not have records of the specific types of aerials that their members install.
- 1.6 Another issue is that the current frequency bands used by TV broadcasting have been in use since the mid-1960s and there is the possibility that some aerials have

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<sup>1</sup> [http://stakeholders.ofcom.org.uk/binaries/consultations/700mhz-cfi/summary/UHF\\_SI\\_call\\_for\\_inputs.pdf](http://stakeholders.ofcom.org.uk/binaries/consultations/700mhz-cfi/summary/UHF_SI_call_for_inputs.pdf)

been in use for a very long time. Studies that have been carried out in the past have been limited in scope and are now some years old.

- 1.7 While there is a small amount of data on the types of aerials in use by households through the above sources, we decided that it was important to carry out a survey of the types of aerials in use by households to more accurately inform our UHF strategy work.
- 1.8 Ofcom therefore carried out an extensive survey of domestic aerials in use at single dwellings across the UK over the summer of 2013. We excluded multiple dwellings due to practical difficulties in carrying out a visual assessment of aerials on large buildings and the low probability that residents would know anything about communal aerials or when they were replaced.
- 1.9 This report sets out the methodology employed and summarises the results of the survey.

### **Structure of this report**

- 1.10 Section 2 summarises the key findings of the survey.
- 1.11 Section 3 provides some background information on aerial types and their significance when considering possible future changes to UHF spectrum use.
- 1.12 Section 4 outlines the methodology used in the survey.
- 1.13 Section 5, 6 and 7 outline the findings of the survey.

## Section 2

# Key findings

## Take-up of wideband aerials

- Our survey found that 55% of single dwelling households are using a wideband aerial to receive DTT. This compares to a figure of 24% from a survey commissioned by BERR (the former Department for Business, Enterprise and Regulatory Reform – now BIS) in 2009.
- 57% of households with wideband aerials had the aerial installed after 2007. Such installations are likely to have been primarily prompted by the UK digital switchover process, which took place between 2007 and 2012.

## Additional information on outdoor aerials in use

- 38% of outdoor aerials are standard ‘contract’ aerials (contract aerials generally have basic standards of design, construction and performance);
- 72% of outdoor aerials are fixed to the chimney stack;
- 79% of outdoor aerials are pointing towards the transmitter predicted to be the ‘most likely’ source of DTT services for the specific location by the DTT coverage prediction model;
- 15% of outdoor aerial systems include a masthead amplifier, and 30% are connected to an internal signal distribution system in single dwelling properties<sup>2</sup>;
- 94% of outdoor aerials are in apparently good mechanical condition (i.e. with no visible physical damage or defects), and have downlead cabling that is secure.

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<sup>2</sup> A previous study commissioned by Ofcom (which is available at <http://stakeholders.ofcom.org.uk/binaries/consultations/dtt/annexes/The-impact-of-LTE.pdf>) makes some estimates on the number of communal aerial systems that are in use in the UK in multiple dwelling units. Our survey concentrated upon single dwellings.

## Section 3

# Background

## Grouped and wideband aerials from 1960s to 1990s

- 3.1 UHF frequency bands IV and V<sup>3</sup> started to be used by TV broadcasting in the mid-1960s. Broadcast TV services on these frequencies were rolled out across the UK over a number of years replacing the older black and white TV services that had been broadcast using VHF spectrum since the 1930s (the VHF TV services were eventually switched off in 1985). As terrestrial TV services still broadcast on the UHF frequencies, there is a possibility that some rooftop aerials have been in use for a considerable period of time.
- 3.2 The vast majority of rooftop aerials in use in the UK are of the ‘Yagi’ type<sup>4</sup>. Yagi aerials have a good performance but typically work well over only a limited range of frequencies. Outside of this range, parameters such as gain (how efficiently the aerial picks up signals) or pattern (how well the aerial rejects signals from unwanted directions) start to degrade. It is possible to extend the range over which a Yagi aerial operates, but this usually involves some degree of compromise, such as accepting a slightly lower overall gain.
- 3.3 Given the above constraints, aerials<sup>5</sup> for TV reception were not originally designed to operate across the whole of Bands IV and V. Instead, the frequency range was divided into three smaller slightly overlapping ranges which permitted performance to be optimised over a narrower bandwidth. This was possible as the analogue TV services being broadcast in each area were broadcast on frequencies that were grouped fairly closely together. The three ranges are known as Group A, Group B and Group C/D.
- 3.4 UHF Bands IV and V are by convention divided into 8 MHz wide channels, each of which originally contained a single analogue TV channel. These channels are designated by the numbers from 21 to 68. The analogue services have now been replaced with digital multiplexes which also each occupy a single 8 MHz channel.
- 3.5 In some areas of the country, the analogue transmitters had to adopt non-standard arrangements and two ‘semi-wideband’ aerial types (Groups E and K) were specified as a compromise between traditional grouped and completely wideband aerials. Few manufacturers made semi-wideband aerials however and installers would often fit fully wideband aerials in those areas. It is therefore believed that the number of households with semi-wideband aerials is low. Table 1 sets out the traditional aerial groups.

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<sup>3</sup> UHF (Ultra High Frequency) bands IV and V cover the frequency range 470 MHz to 854 MHz. The portion from 790 to 854 ceased being used for TV broadcasting following digital switchover and is now in use for mobile broadband services.

<sup>4</sup> Invented by Dr. Shintaro Uda and Dr. Hidetsugu Yagi in Japan in the 1920s.

<sup>5</sup> When we refer to aerials in this report we mean Yagi aerials unless otherwise stated.

**Table 1: Main aerial groups**

Aerial group	Design range	
	UHF channels <sup>6</sup>	UHF frequency range (MHz)
Group A	21 – 37	470 – 606
Group B	35 – 53	582 – 734
Group C/D	48 - 68	694 - 854
Group E	35 – 68	582 – 854
Group K	21 -48	470 – 694
Group W (wideband)	21 – 68	470 - 854
Group T <sup>7</sup> (wideband)	21 – 60	470 - 790

### Digital TV and the need for wideband aerials (1990s to present)

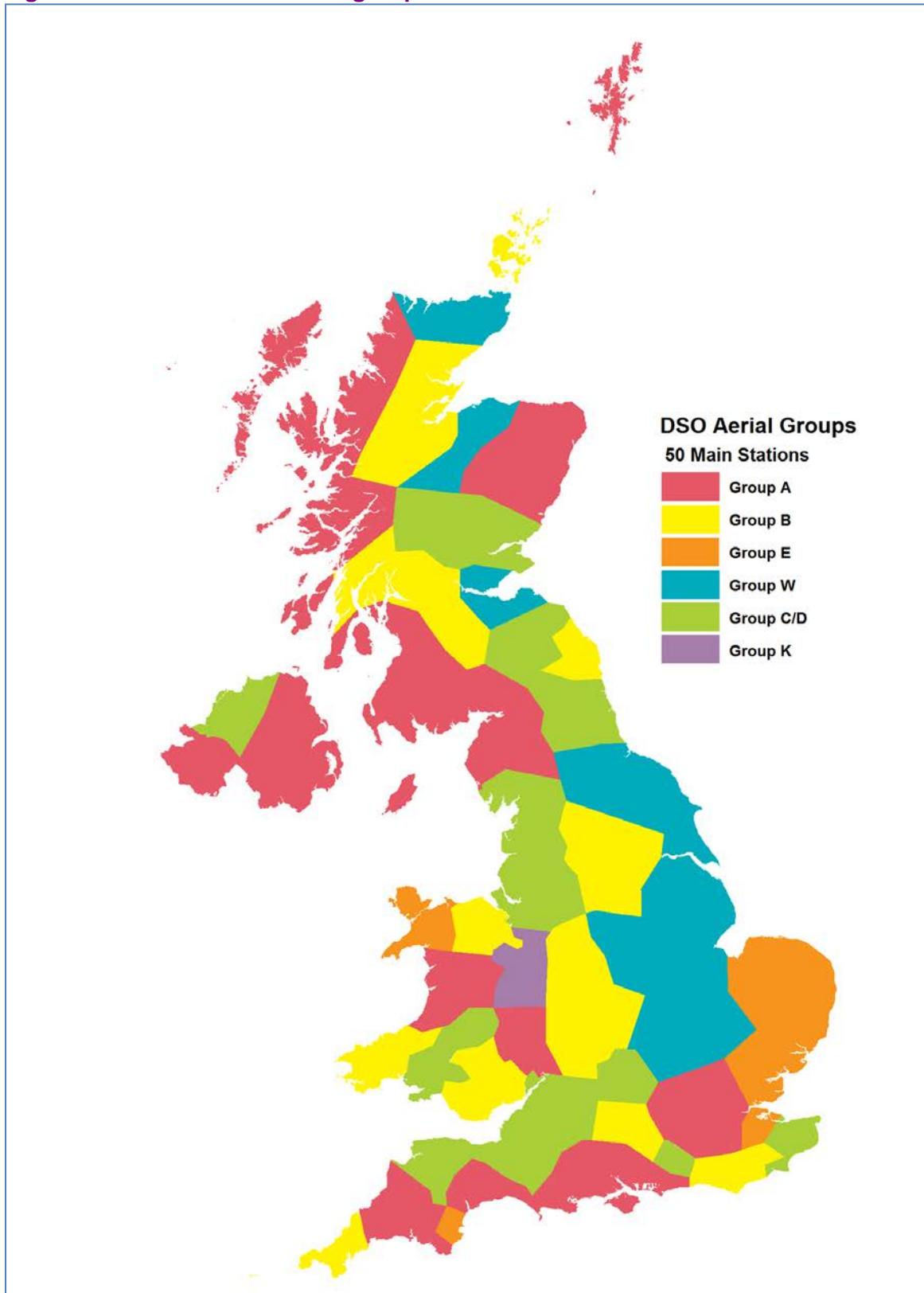
- 3.6 In the late 1990s, DTT services first launched alongside analogue TV services. As the analogue services were still being broadcast, the digital services had to be placed in whatever spectrum was available in Bands IV and V. At many transmitters, it was not possible to identify frequencies within the existing aerial groups. Households in those areas were advised to install wideband aerials (that are designed to operate across the whole of UHF channels 21 to 68) if they experienced difficulty receiving these out of group digital TV services.
- 3.7 In addition, the UK Government initiated a process whereby aerials could be accredited as meeting certain minimum performance standards. These 'benchmarked' aerials were permitted to display the digital 'tick' logo. The overwhelming majority of aerials submitted by manufacturers for testing against the benchmark standard have been wideband aerials.
- 3.8 As the uptake of digital TV increased throughout the early 2000s, an increasing number of households installed wideband aerials, either as a result of difficulties in receiving out of group digital services, or simply as a result of the natural replacement cycle (e.g. as aerials are damaged by weather, corrosion, or mechanical failure).
- 3.9 At digital switchover, DTT services in most areas returned to the frequencies and aerial groups previously occupied by the analogue TV services they replaced. This meant that the motivation for installing wideband aerials was reduced. The advice at switchover to those households that had not yet adopted digital TV was accordingly modified to 'wait and see' if existing aerials were sufficiently good, and not to proactively install a new aerial. Nevertheless, a proportion of households will have had to replace their aerials due to their condition.
- 3.10 In some areas, it was only possible to accommodate the three PSB (public service broadcaster) multiplexes in the previous analogue aerial group. Viewers in those areas that also wish to receive the commercial multiplexes were advised to install a

<sup>6</sup> Channel 61 and above are no longer used for TV broadcasting.

<sup>7</sup> Group T is a recently introduced aerial type that is wideband across a reduced range of frequencies (channels 21 to 60) that are still in use by DTT broadcasting.

wideband aerial. Figure 1 illustrates the recommended aerial groups for households receiving signals from the UK's 50 main transmitters.

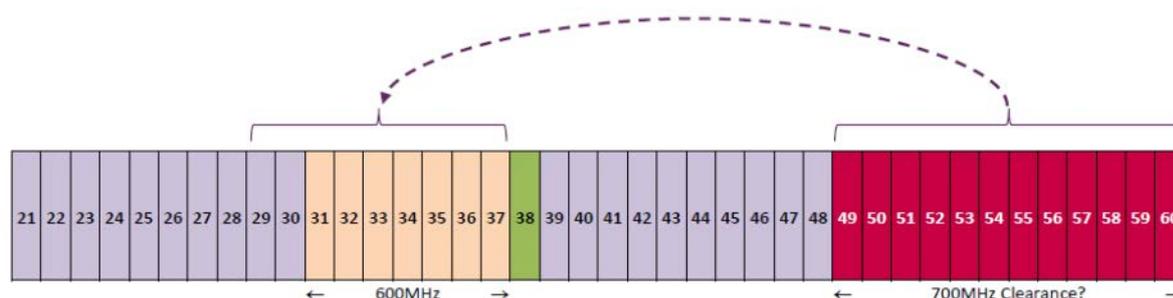
**Figure 1: Recommended aerial groups for the UK's 50 main transmitters**





spectrum in the 600 MHz band (UHF channels 31 to 37) as illustrated in Figure 3. In Annex 8 of our consultation, we consider some options for how the multiplexes might be re-organised.

**Figure 3: DTT multiplex frequency changes arising out of possible 700 MHz clearance**



- 3.17 As explained above, traditional grouped aerials are designed to work over only a limited range of frequencies. Moving the DTT multiplexes currently using channels 49-60 to a lower frequency inevitably moves those services out of Group C/D. Households in those areas may therefore have to replace their aerials to continue to receive TV services, unless they already have wideband aerials.
- 3.18 In developing its cost-benefit analysis, Ofcom needs to take into account the impact that a clearance of the 700 MHz band might have on consumers. Estimating how many consumers might have wideband aerials at the point at which a clearance could take place is an important input to our analysis. The first step is to determine how many households have wideband aerials which are in use today – that is the fundamental question that this study seeks to answer.

## Previous studies

- 3.19 There is little existing data upon which to base a view on what the uptake of wideband aerials is at present. The most recent source of data is an aerial survey carried out by GTech Systems Ltd. under contract to the Government Department for Business, Enterprise and Regulatory Reform or BERR (now Business, Innovation and Skills [BIS]) in 2009.
- 3.20 The BERR survey was principally seeking to carry out measurements on the performance of aerials but did observe that 24% of households in the areas surveyed had wideband aerials<sup>10</sup>. The sample size was however relatively small as fewer than 300 properties were surveyed with locations predominantly in London and the Midlands of England.
- 3.21 A further consideration is that digital switchover had at that time only completed in a few areas of the country (and not in the areas where the survey was carried out). The survey found that in the areas where pre-switchover DTT coverage was available, the proportion of wideband aerials was around 26%, but was only 18% where there was no DTT.

<sup>10</sup> Results are summarised in section 5 of the Aegis report on Domestic TV Aerial performance for Ofcom (14 Dec 2009) available at [http://stakeholders.ofcom.org.uk/binaries/research/tv-research/aerials\\_research.pdf](http://stakeholders.ofcom.org.uk/binaries/research/tv-research/aerials_research.pdf)

## Section 4

# Survey methodology

- 4.1 The number of DTT households affected by any future DTT frequency re-plan would depend on:
- the extent to which the frequencies used by DTT multiplexes change in relation to the current arrangement;
  - the type of aerials used by the households:
    - households with group-specific aerials will potentially need to replace their aerials if DTT multiplexes move outside the frequency range over which the aerials are designed to operate;
    - households with wideband aerials should not need to make changes to their aerials whatever the final frequency plan, as their aerials are designed to operate satisfactorily over entire range of frequencies that could be used by the DTT multiplexes; and
  - the performance of group-specific aerials to receive signals outside their design frequency range.

## Objectives of survey

- 4.2 The scope of this piece of work was to gain an understanding of the types and quantities of aerials currently used by households across the UK. The primary objectives of the aerial audit were to:
- understand what kind of aerial the TV sets in DTT households<sup>11</sup> are using (portable, loft or outdoor aerial); and
  - determine the type of outdoor aerial used by these DTT households.
- 4.3 As part of the audit, we also collected the following data which is likely to be of wider interest to other Ofcom projects that have an interest in domestic television reception:
- proportion of households whose aerials are pointing towards the expected transmitter (based upon our computer model's predictions);
  - location, condition and type of outdoor aerials;
  - information on when aerials were last replaced; and
  - whether households are making use of masthead amplifiers and/or an internal distribution system.

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<sup>11</sup> In order to determine DTT households, we first had to quantify the number of households currently accessing DTT services on primary and on secondary TV sets.

## Survey locations

- 4.4 Television reception conditions are not uniform across the country as signal levels vary depending upon the distance from a transmitter and the local terrain. In order to avoid interference between transmitters, adjacent transmitters generally use different frequencies. Prior to digital switchover, digital TV services were broadcast on frequencies outside the former 'analogue' aerial group (which would provide some motivation to households to install wideband aerials) in some areas, while in other parts of the country, the digital services were broadcast 'in-group'.
- 4.5 We would therefore expect some difference in the installed base of TV aerial systems in different parts of the UK. In order to gain a view of aerial use across the UK, we have collected data from 125 locations where we:
- spoke to 3,140 TV households, of which 2,465 are households that use DTT on either primary or secondary TV sets; and
  - visually surveyed 4,544 dwellings, of which 4,248 had outdoor aerials. We spoke to 2,888 householders in the latter category to determine whether the aerials on their roofs are still in use.
- 4.6 The distribution of the 125 survey locations chosen is shown in Table 2. The number of survey locations for each aerial group was chosen to broadly reflect the percentage of households covered by DTT transmitters which broadcast channels that fall within the reception range of grouped A, B, C/D/E or wideband aerials.

**Table 2: Distribution of survey locations**

Group	% of locations surveyed (no of locations)	Split of locations to be surveyed	
		Good coverage <sup>12</sup>	Marginal coverage <sup>13</sup>
A	30% (38)	27	11
B	25% (31)	23	8
C/D/E	30% (37)	26	11
W	15% (19)	15	4

- 4.7 The number of survey locations within each aerial group was further split according to the standard of DTT coverage to include a range of likely reception conditions. By ensuring that the chosen locations not only included areas where we would expect reception to be good, but also areas where prevailing signal quality was predicted to be more 'marginal' in nature, we can find out whether installations in marginal reception areas were biased towards grouped aerials, as grouped aerials should (in principle) have slightly better performance than wideband aerials..

<sup>12</sup> Good coverage areas are defined where a DTT service is predicted by the planning model to be available for the three public service broadcaster multiplexes at 70% or more of locations within a 100m x 100m area for at least 99% of the time.

<sup>13</sup> Marginal coverage areas are where a DTT service is predicted to be available for the three PSB services at 70% or more locations within a 100m x 100m area for at least 95% of the time but less than 99% of the time.

- 4.8 It should be noted that the split of survey locations between good and marginal coverage areas (73% good vs. 27% marginal) does not however reflect the actual situation with regards to DTT predicted coverage, as 98.5% of the UK population live in 'good' coverage areas, and only 1.1% in areas of 'marginal' coverage. It was however necessary to sample a disproportionately high number of marginal signal areas so that we could obtain statistically significant data for an analysis of the type of aerials in use in marginal coverage areas.
- 4.9 The survey locations within each category above are then chosen randomly and include locations where each of the different aerial groups was formerly used by analogue TV.
- 4.10 Annex 1 lists the postcode sectors of each of the 125 locations surveyed.

## Field survey

- 4.11 Ofcom has field officers based across the UK who carry out interference investigation and enforcement work. Some of these staff were engaged to visit the selected locations and conduct the survey, which consists of two parts:
- 4.11.1 a brief face-to-face interview with the householder to understand whether their household uses DTT services, and if so, the type of aerial(s) used to receive them; and
  - 4.11.2 observation of any external aerial(s) visible on the property to assess their condition and type.
- 4.12 A copy of the questionnaire can be found in Annex 2.
- 4.13 The field survey was conducted at residential properties selected on a random basis within the target postcode area. We excluded flats and communal dwellings in this survey due to difficulty in gaining good visibility of rooftop aerials for observations.
- 4.14 In order to collect statistically representative samples within each postcode area, the survey teams were asked to survey and record data for households selected on a random basis until a target of at least 20 households who use an outdoor aerial for DTT reception were reached in locations with good coverage. For marginal coverage areas, the target was reduced to 10 DTT households in recognition that there are likely to be higher numbers of households making use of satellite or cable services in those areas.
- 4.15 Surveys were all carried out during the day (primarily within normal office hours). This raises the possibility that our results could exhibit a demographic bias towards households where residents were available at home during the day (e.g. retired people, home workers or carers).
- 4.16 As it is not always easy to identify the type of aerial that is in use from street level, the field survey teams took photographs of all aerials where households gave consent, for quality control purposes. As well as the field teams' own assessments, an aerial professional was engaged to carry out an independent check of the observed results.
- 4.17 Full breakdown of the dataset collected can be found in Annex 3.

## Section 5

# Number of DTT households

## Introduction

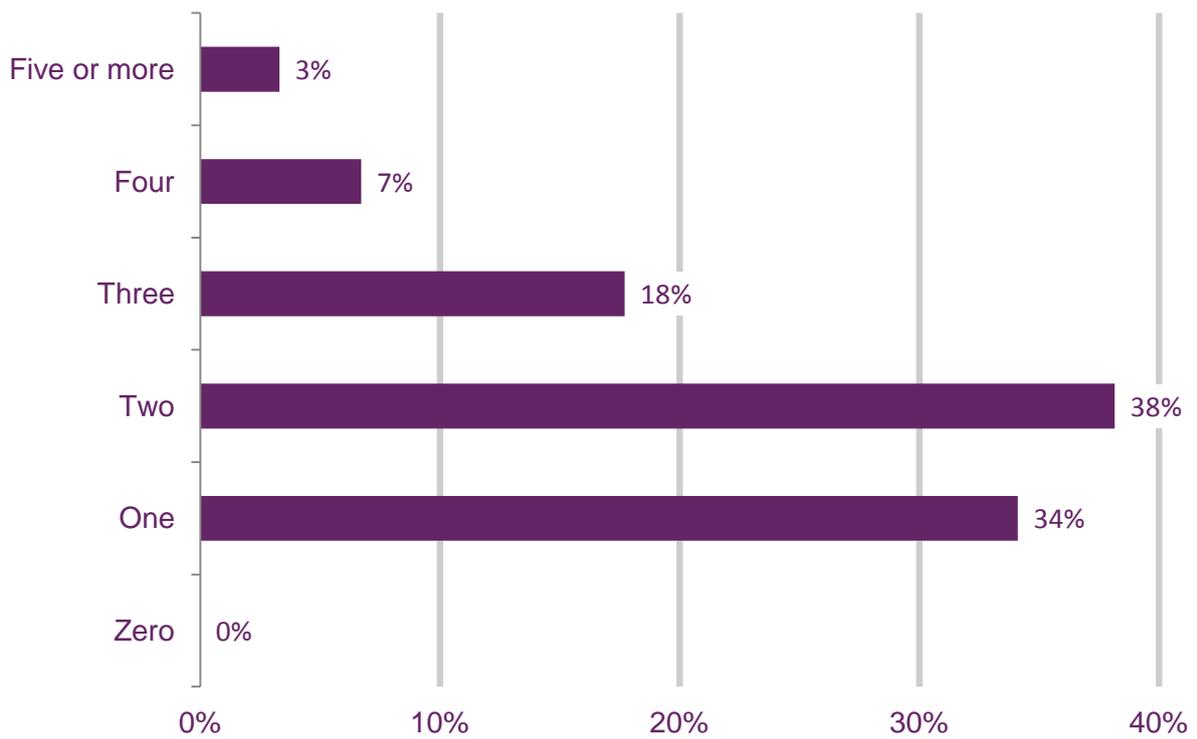
- 5.1 This section outlines our findings to establish the number of households currently accessing DTT services on primary and on secondary TV sets. This then allows us to determine the type of aerials being used by these households and also whether a rooftop aerial is actually in use.
- 5.2 The survey results suggest that 53% of households surveyed relied on DTT on their main set and that take-up of DTT across households is 79%. These figures are higher than other published research such as Ofcom's Digital TV updates and Communications Market reviews<sup>14</sup> that suggest the figure is closer to 40%. The reason why this survey differs from previous figures is almost certainly because our survey sample is not completely representative of the total UK households because of the following constraints:
- 5.2.1 the survey was carried out at day time which may have introduced a demographics bias;
  - 5.2.2 the survey excluded flats and communal dwellings; and
  - 5.2.3 when the survey results were analysed, we discovered a bias by the field officers to survey households where an outdoor aerial was visible (although the brief was to select households on a random basis until a target of number of DTT households were reached).
- 5.3 As the sample is possibly not completely representative of UK households, the results on platform take-up across UK households should be treated with caution. However, as the primary aim of the survey was to determine the types of aerials being used by DTT households, this bias should not affect the conclusions relating to aerials in Section 6 and 7.
- 5.4 When analysing the results for DTT households only, as expected, there is slightly higher DTT uptake in areas of good DTT coverage compared to areas of marginal coverage.

## TV ownership

- 5.5 To establish the percentage of households that watch television, each household surveyed was first asked how many TV sets it owned. Figure 4 sets out the results.

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<sup>14</sup> For example, <http://stakeholders.ofcom.org.uk/binaries/research/tv-research/tv-data/dig-tv-updates/2012Q4.pdf>

**Figure 4: Number of TVs owned**

*Base: All households talked to (3,140)*

5.6 From the 3,140 households spoken to,

- 34% households have only one TV (main set only); and
- 66% households have more than one TVs (main and secondary sets).

## Platform take-up

5.7 Next, we asked what TV platforms the household makes use of, and on which sets.

**Figure 5: Platform take-up by households**

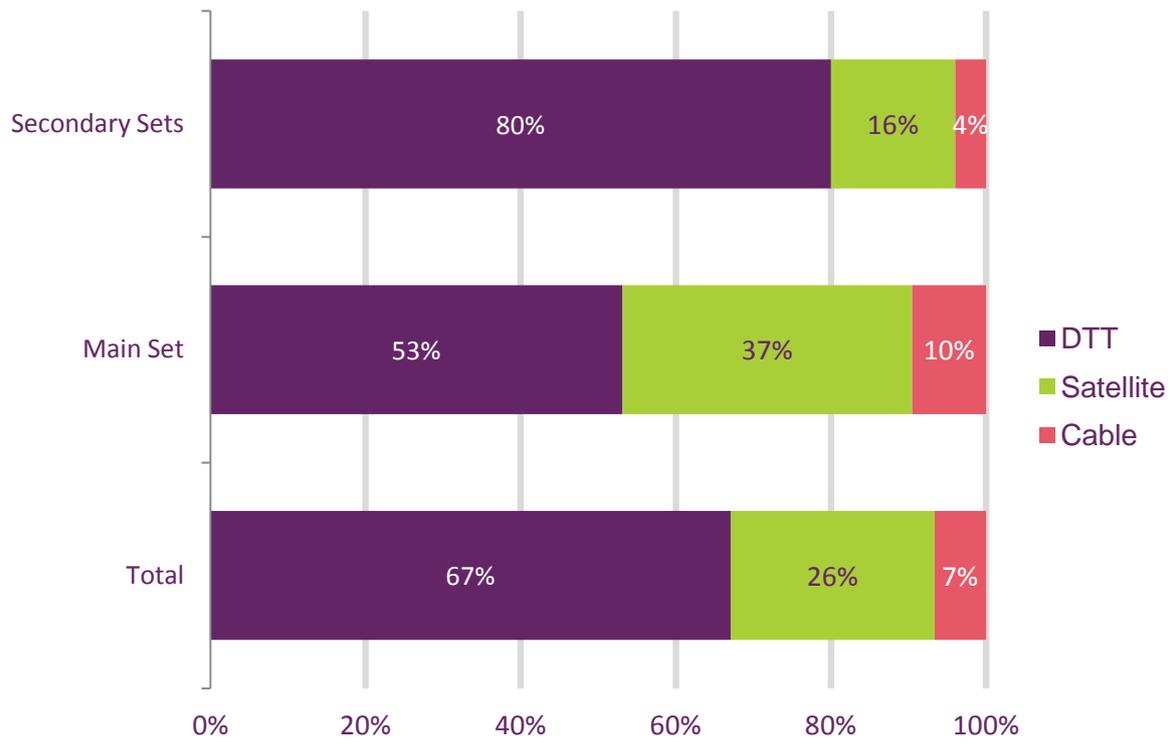


*Base: Total = All households talked to (3,140). Main Set = All households talked to with a main set (3,140). Secondary Sets = All households talked to with one or more secondary sets (2,069)*

5.8 As explained above, the numbers presented in Figure 5 and 6 should be treated with caution as the sample for this question is possibly not completely representative of UK households.

5.9 It should be noted that in the case of total households and households with secondary sets, the results sum to more than 100% because households with secondary sets may have different TV providers for the different sets (e.g. cable on the main set, DTT on secondary sets). Therefore, these households would have been counted more than once.

**Figure 6: Platform take-up by total TV sets**



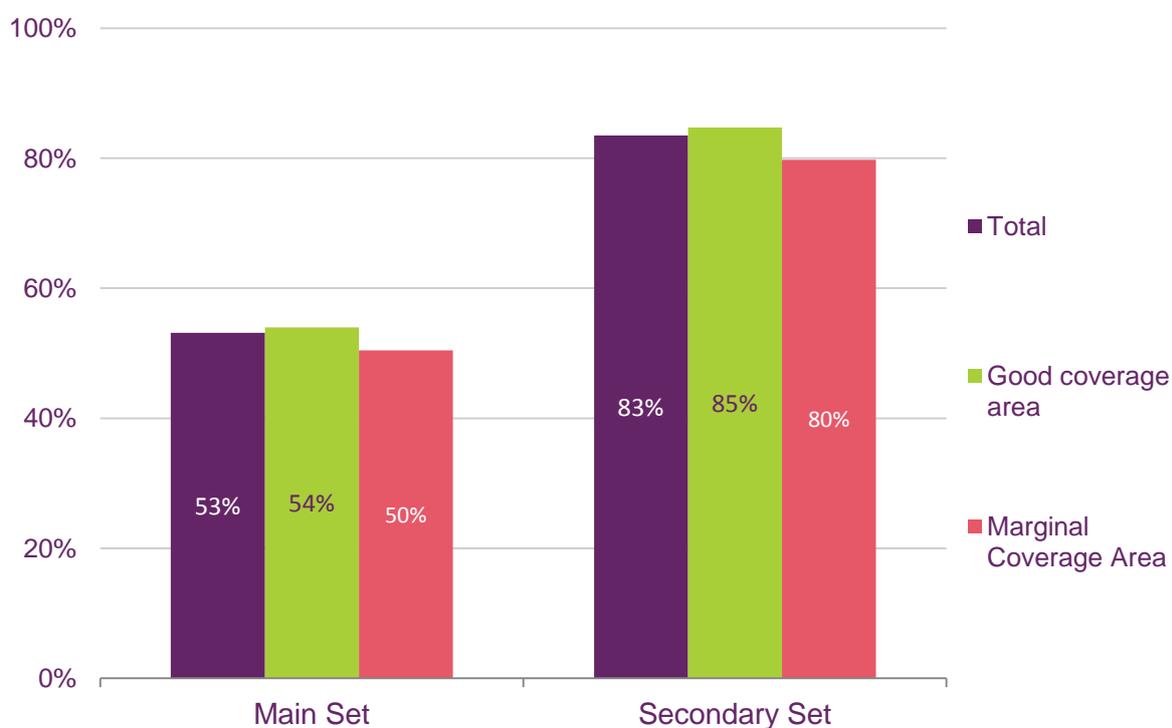
*Base: Total = All TV sets (6,535). Main Set = All main TV sets (3,140). Secondary Sets = All secondary TV sets (3,395)*

## DTT take-up

5.10 We further analysed DTT take-up in greater detail. This analysis includes:

- a breakdown of DTT take-up across households in good and marginal coverage areas;
- a breakdown of DTT households by those using DTT on their main, those using DTT on their secondary set, and those using DTT on both main and secondary sets; and
- understanding the proportion of households using satellite or cable on their main set, but where the main set is also connected to a UHF aerial and hence capable of receiving DTT.

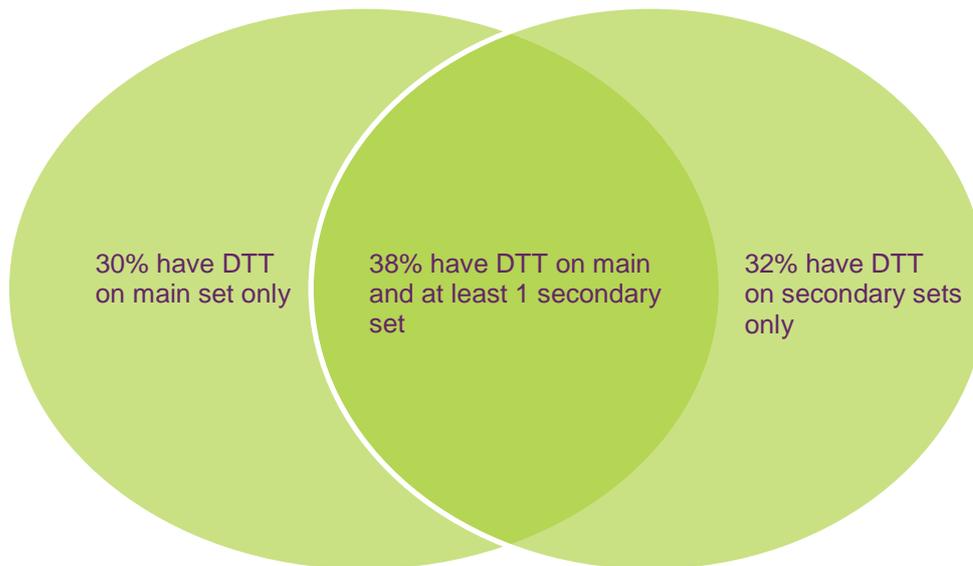
**Figure 7: DTT take-up by coverage area**



*Base: Main Set = All households talked to with a main set (3,140), in good coverage areas (2,367) and marginal coverage areas (773). Secondary set = All households talked to with a secondary set (2,069), in good coverage areas (1,545) and marginal coverage areas (524)*

5.11 Noting the caveat in 5.8, the results of DTT take-up by coverage area indicate that there is a higher take-up of DTT in households having good DTT coverage compared to areas with marginal DTT coverage for both main sets (significant at the 5% confidence level) and secondary sets (significant at the 1% confidence level).

**Figure 8: DTT take-up by main and secondary sets**



*Base: Total = All DTT households (2,465)*

- 5.12 Figure 8 shows that from all the DTT households sampled (i.e. households with DTT on any TV set), the highest proportion of households have DTT on the main TV and at least one secondary set.
- 5.13 In the survey, we assume that any households connected to cable/satellite are using these as the primary means of reception (on the set which is connected to a non-DTT source). However, we also asked the respondents if these TV sets are also connected to aerials to receive DTT.

**Figure 9: DTT also used as secondary feed to cable/satellite**

All main sets	70.7%
All secondary sets	57.3%

*Base: All main sets = All TV households with satellite/cable on main sets (1,472). All secondary set = All TV households with satellite/cable on any secondary sets (475)*

- 5.14 Figure 9 suggests that over half of TV sets being fed by satellite and cable are also connected to DTT as secondary feed. This is quite significant, although we didn't establish in the survey how reliant a household is on having DTT as a secondary feed, or indeed whether DTT is actually used on that set.

## Section 6

# Aerial type and replacement cycle

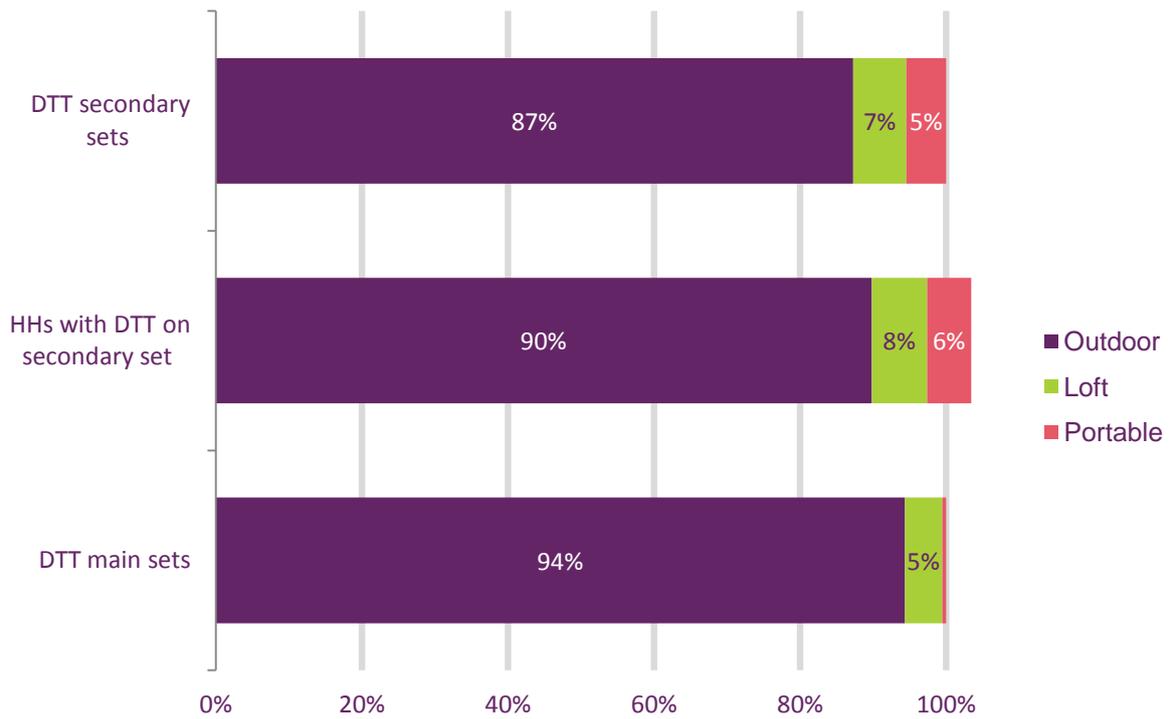
## Introduction

- 6.1 The main objective of the aerial survey was to determine the proportion of DTT households using wideband aerials compared to those using grouped aerials.
- 6.2 Having identified a household as making use of DTT (on either their primary or secondary sets), we then asked what type of aerial each TV set is connected to. As noted in the previous section, the bias introduced in sampling UK households does not affect the results in this section as the sample used for the data analysis here (i.e. DTT households) is a subset of the sample on UK households.
- 6.3 We also visually assessed all outdoor aerials that were observed at the properties where we spoke to householders. Our survey questions were designed to ascertain the take-up of wideband aerials versus grouped aerials for all outdoor aerials and also to determine which outdoor aerials are actually in use.
- 6.4 When determining whether an aerial is in use, we discounted aerials connected to TV sets fed by cable or satellite services, as we considered these to have DTT as a secondary feed.
- 6.5 The key findings are that in DTT households, outdoor aerials are the predominant type of aerial used, with 94% of main sets connected to an outdoor aerial for DTT reception. The percentage of households using a wideband aerial for DTT reception has increased significantly compared to previous studies, with 55% using a wideband aerial (compared to 24% from the 2009 BERR survey as described in section 3). 57% of DTT households with wideband aerials report that these were replaced after 2007.

## Type of aerial use

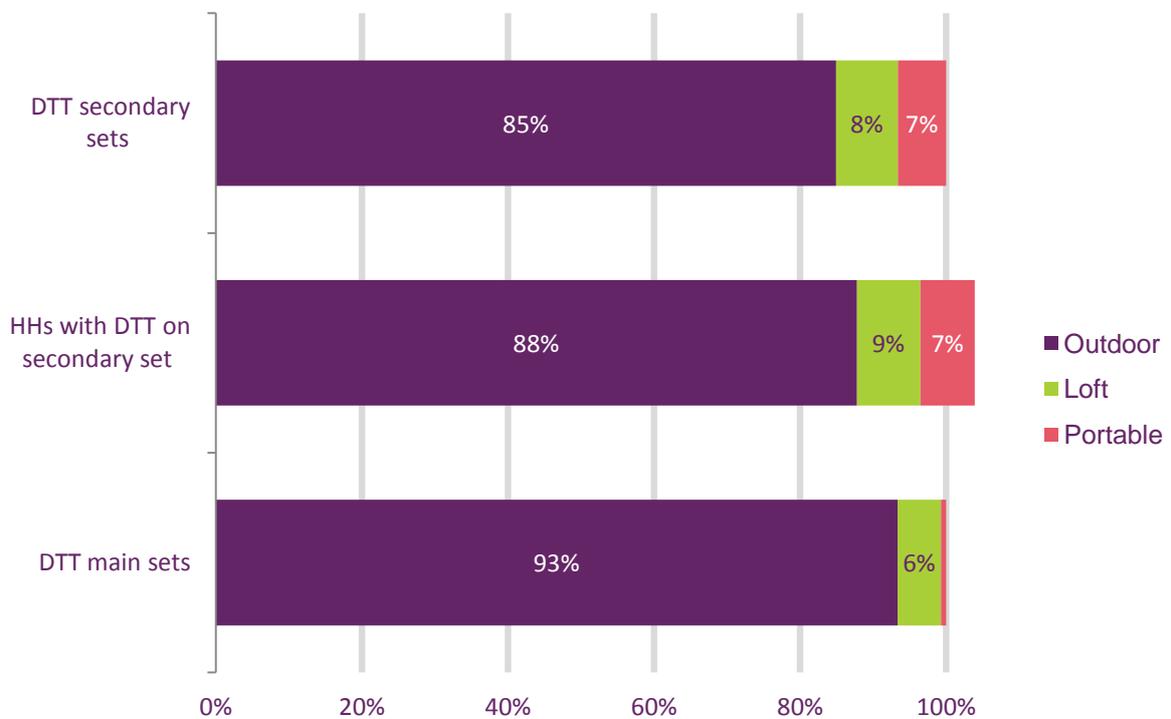
- 6.6 To establish what type of aerial is being used by DTT households, all DTT households surveyed were first asked what type of aerial each of their TV sets are connected to.
- 6.7 We have presented the results on a per-set basis (i.e. main TV set is DTT and secondary TV set is DTT) as well as by households (households with DTT on their primary set and households with DTT on secondary sets). 'Households with DTT on their primary set' and 'all main TV sets with DTT' is effectively the same condition.
- 6.8 We have also broken down the results by location of the households (i.e. those located in good or marginal coverage area).

**Figure 10: Type of aerial used in DTT households**



Base: DTT main sets = All households with DTT on main set (1,668). HHs with DTT on secondary set = All households with DTT on secondary set (1,727). DTT secondary sets = All secondary sets with DTT (2,716)

**Figure 11: Type of aerial use in DTT households in good coverage areas**



Base: DTT primary sets = All households with DTT on main set (1,278). HHs with DTT on secondary set = All households with DTT on secondary set (1,309). DTT secondary sets = All secondary sets with DTT (2,038)

**Figure 12: Type of aerial use in DTT households in marginal coverage areas**



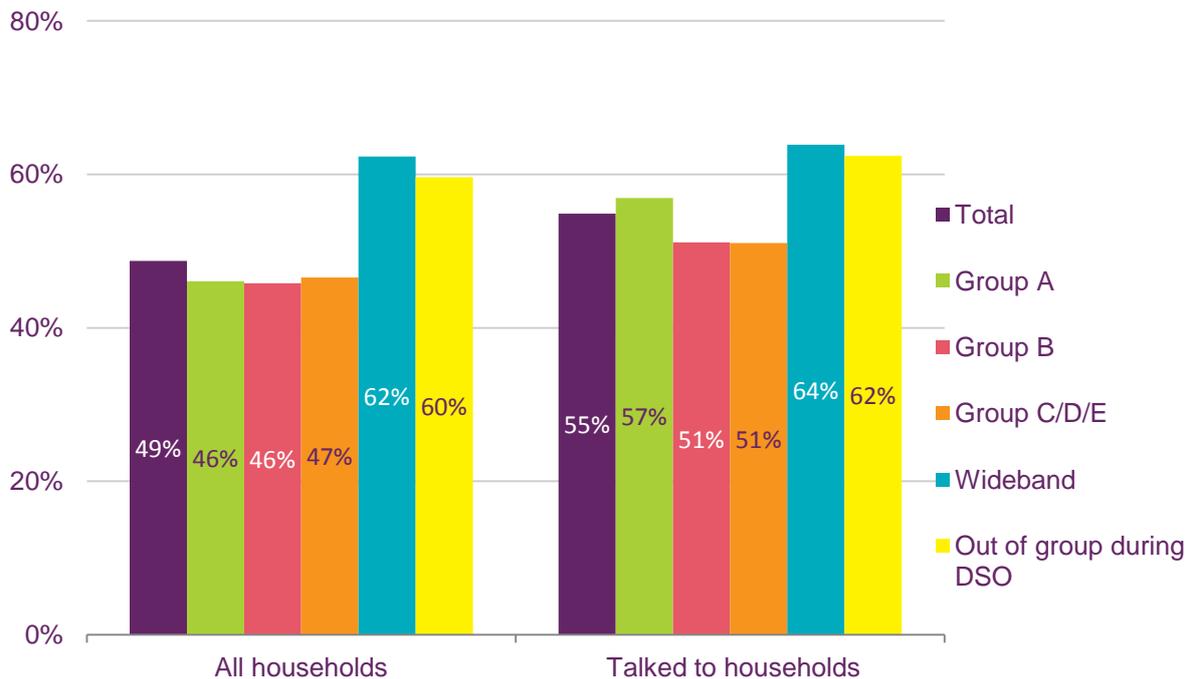
*Base: DTT primary sets = All households with DTT on main set (390). HHs with DTT on secondary set = All households with DTT on secondary set (418). DTT secondary sets = All secondary sets with DTT (678)*

- 6.9 We can conclude that outdoor aerials are the predominant type of aerial used by households to receive DTT. The use of outdoor aerials is slightly higher on main sets than on secondary sets (significant at the 99% confidence level). Perhaps unsurprisingly, the use of outdoor aerials is higher in areas with marginal DTT coverage compared to areas in good DTT coverage (significant at the 99% confidence level).
- 6.10 Loft and portable aerials are mainly used to feed secondary sets and their use is more common in areas of good predicted coverage.

## Outdoor aerials type and usage

- 6.11 Where households had an outdoor aerial, the aerial was observed from street level (using binoculars if necessary) and an assessment of whether the aerial was wideband or grouped was recorded. Where households gave consent, a photograph of the aerial was also taken so that third-party validation of the observed aerial type could subsequently be carried out.
- 6.12 Where households had more than one rooftop aerial, we only considered one aerial as the main aerial for the purposes of this survey. Where the households have multiple aerials of different types, we classified the wideband aerial as the main aerial as the wideband aerial is likely to have been installed most recently.

**Figure 13: Take-up of wideband aerials by traditional analogue aerial group area**



*Base: All households = All households with an outdoor aerial, excluding those households where we are unsure about the aerial type (4,219), in group A locations (1,196), group B locations (1,037), group C/D/E locations (1,325), group W locations (661) and out of group during DSO locations (706). Talked to households = All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,284), in group A locations (650), group B locations (530), group C/D/E locations (725), group W locations (379) and out of group during DSO locations (412)*

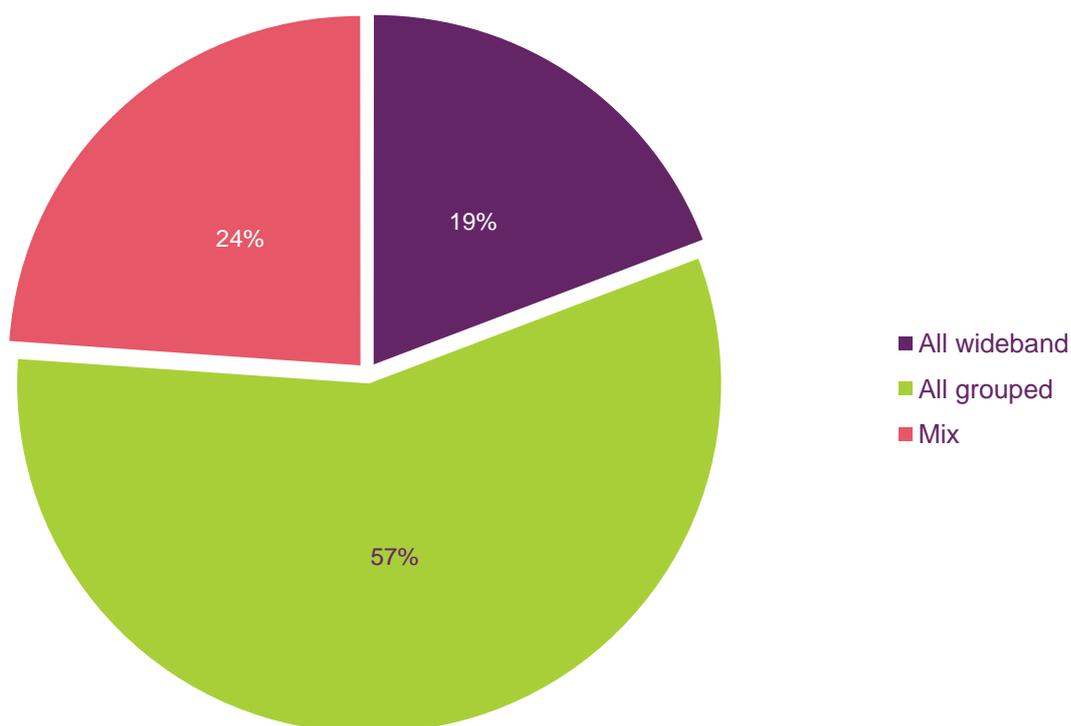
- 6.13 The results show that, overall, 49% of households with outdoor aerials have aerials that are wideband. If we exclude aerials that are no longer in use, the take-up of wideband aerials increases to 55%. Conversely, in households where the outdoor aerial is not in use, the proportion of wideband aerials is much lower at 33% as the unused aerial is more likely to be an older grouped aerial. This is also reflected in the later section on aerial replacement trends, where we conclude that the most recent aerial replacements are wideband.
- 6.14 There is relatively little difference in the take-up of wideband aerials in areas where the historic aerial group is A, B or C/D. Where at least some of the DTT multiplexes are broadcast on frequencies requiring a wideband aerial, the take-up of wideband

aerials is higher at 62-64%. A similar situation applies to those areas where the DTT multiplexes were out of group prior to digital switchover, as might be expected.

### Households with more than one outdoor aerial

6.15 As mentioned above, only one aerial was considered as the main aerial when determining the take-up of wideband aerials in households with more than one aerial. However, we also noted the types of aerials in use at these households, and from these observations we found that 12% of households with outdoor aerials have multiple aerials.

Figure 14: Type of aerial in households with more than one outdoor aerial



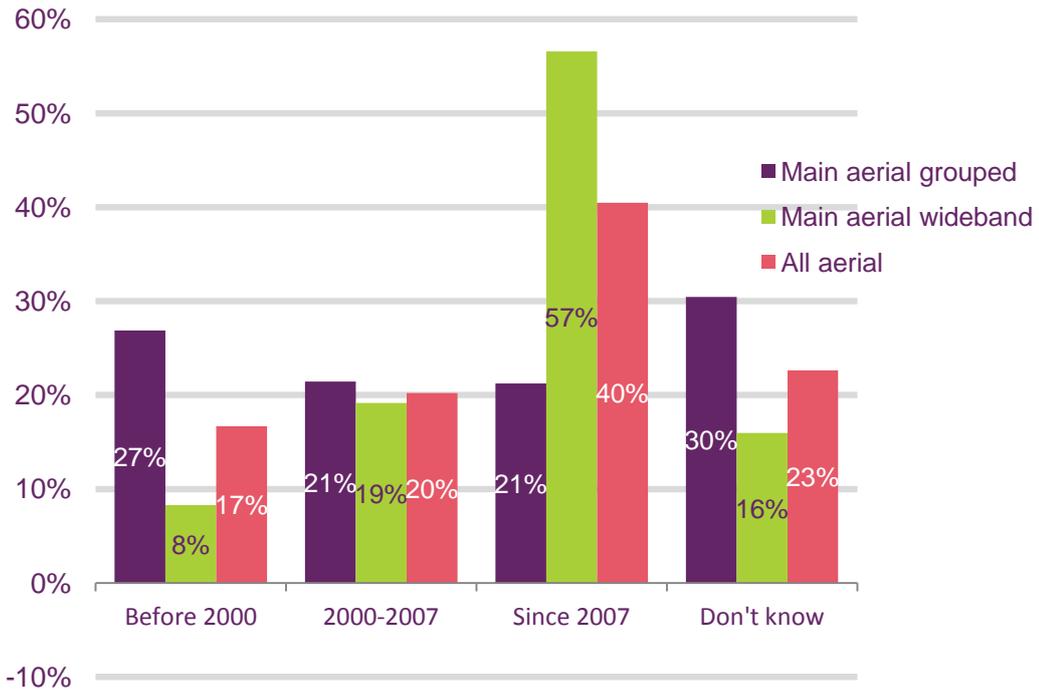
*Base: All households with more than one aerial, excluding those households where we are unsure about the aerial type (490)*

6.16 From the 12% of households with more than one outdoor aerial, approximately a quarter have both grouped and wideband aerials.

## Aerial replacement trends

6.17 All households using aerials were asked when their aerial was last replaced. The results in Figure 15 indicate that there has been an increase in the take-up of wideband aerials since 2007, with 57% of households currently using a wideband aerial reporting that their aerial was replaced after 2007. This is likely to have been influenced by advice to consumers during the digital switchover process that wideband aerials should be installed where possible if the household required a new aerial.

**Figure 15 Grouped and wideband aerial replacement trend**



*Base: All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292), with grouped main aerial (1,031) and wideband main aerial (1,253)*

## Section 7

# Additional outdoor aerial information

## Introduction

7.1 In addition to assessing whether aerials are wideband or grouped, we also collected other information on those aerials that may be of use to associated projects:

- the standard of aerial installed;
- whether the aerial is pointing towards the transmitter predicted by the DTT coverage prediction model to provide the best service to that location;
- whether the aerial is connected to an internal or external amplifier;
- where the aerial is installed; and
- the general condition of the aerial.

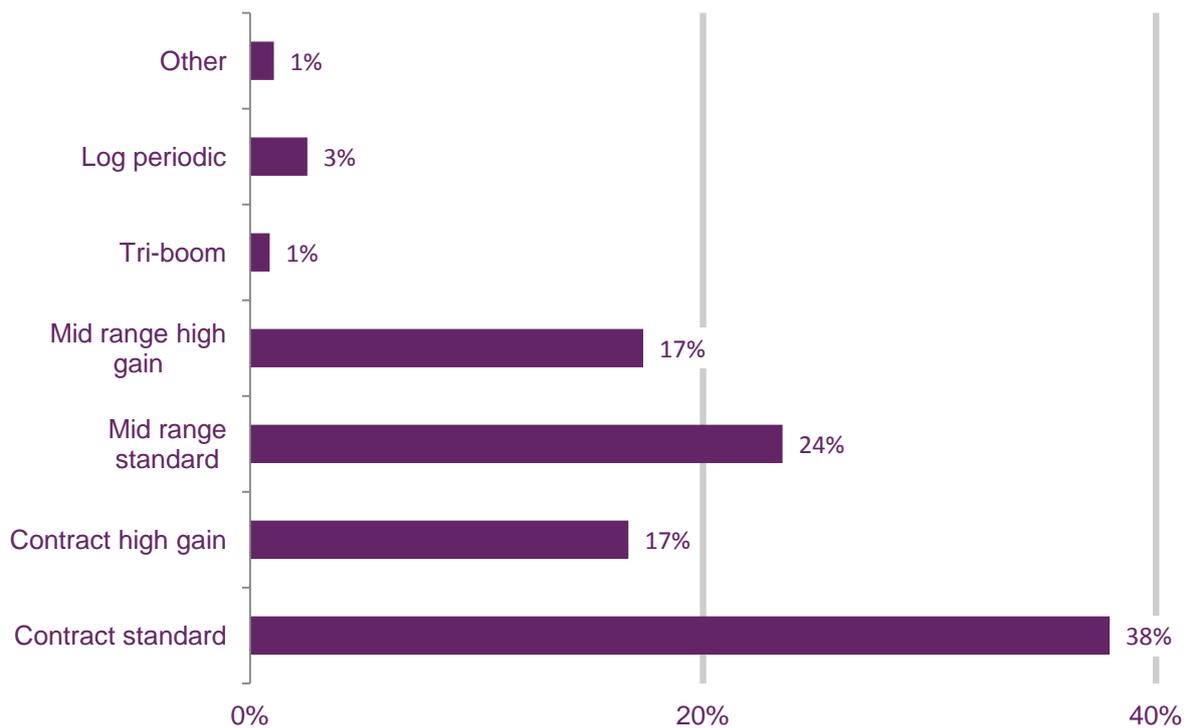
7.2 The key findings are, for those outdoor aerials currently in-use:

- 38% are standard 'contract' aerials;
- 72% are fixed to the chimney stack;
- 79% are pointing towards the transmitter predicted to be the 'most likely' source of DTT services for the specific location by the DTT coverage prediction model;
- 15% have masthead amplifier and 30% are connected to an internal distribution system; and
- 94% are in apparently good mechanical condition (i.e. with no visible physical damage or defects), and have downlead cabling that is secure.

## Standard of aerials

7.3 Domestic aerials are available in a range of quality and price levels. The least expensive models produced by manufacturers are termed 'contract' aerials – these usually have relatively few elements and a small reflector and correspondingly modest performance which are generally adequate in many situations. Mid range aerials are designed to a higher standard with larger reflectors and other features to improve performance.

7.4 The assessment teams were asked to classify the rooftop aerials they observed into one of several broad categories. Figure 16 sets out the results.

**Figure 16 Aerials categories**

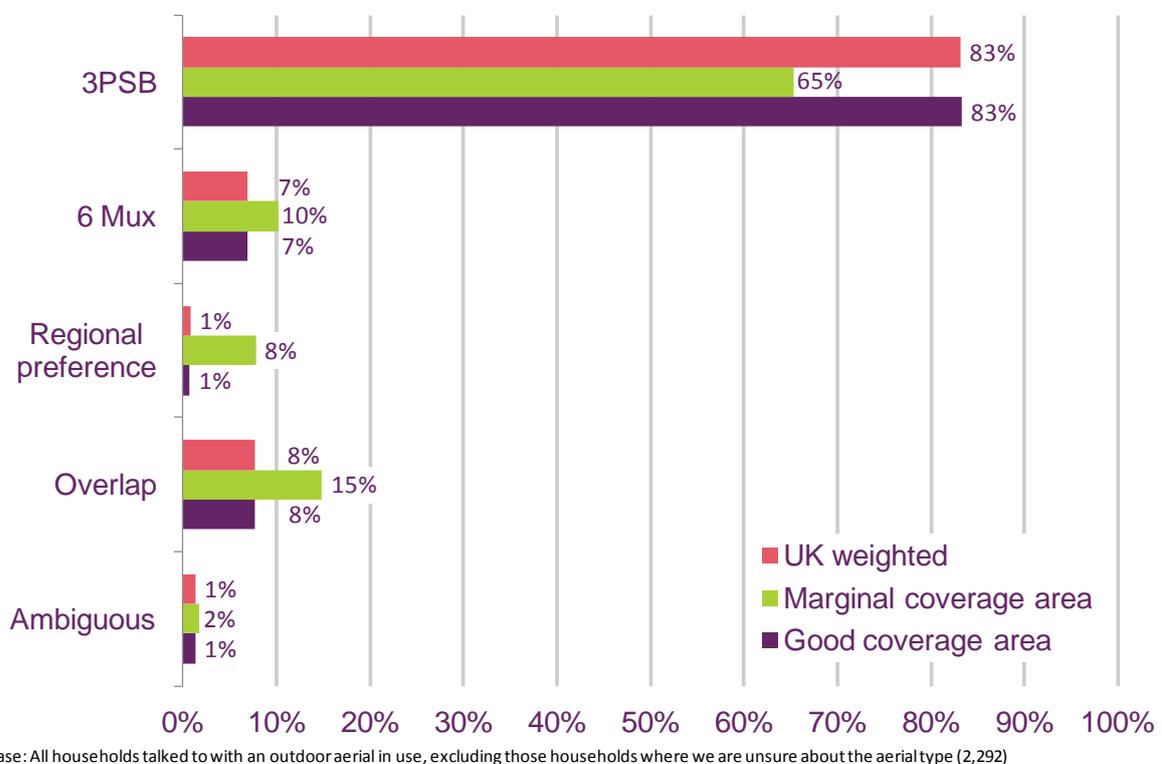
*Base: All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292)*

- 7.5 The survey suggests that the largest proportion of households (38%) is using standard contract aerials.
- 7.6 High gain aerials make up 34% of installations, compared with 62% standard gain aerials.
- 7.7 Uptake of newer wideband aerial types such as tri-boom and log-periodic aerials is still relatively low at 1% and 3% respectively.

## Aerial direction

- 7.9 In some parts of the UK, signals from more than one TV transmitter are available. In these signal overlap areas, households have a choice over which transmitter their aerial points towards. There is no definitive database of where aerials are directed – most often the decision is based upon considering which transmitter provides the most reliable signal or the widest range of programme services. In some cases, the decision is driven by preference for a particular regional or national news service. In others, it may be made by, or as a result of, local effects such as trees or tall buildings blocking signals from one direction.
- 7.10 The spectrum planning model used to plan DTT coverage contains a number of algorithms which aim to predict which transmitter a particular household is most likely to be receiving their programme services from. For each survey location, the planning model’s prediction of the transmitter most likely to provide the best signal to the location for the three PSB multiplexes was used as the basis for observations. The assessment teams took compass bearings of the direction that rooftop aerials were pointing towards in the areas visited, and compared these measurements with the direction of the expected ‘3PSB’ transmitter. For locations where the recorded aerial direction differed from what was expected, the bearings were analysed against other transmitters that potentially served the area and a judgement made for the reason for the difference.
- 7.11 The results are presented in Figure 17 below.

**Figure 17: Proportion of aerials pointing at expected 3PSB transmitter and alternative sources of signals**



- 7.12 The results show that 83% of household aerials located in good DTT reception areas are pointing towards the expected transmitter predicted to provide the best signals for the three PSB multiplexes. In marginal DTT reception areas, the proportion falls to

65%. However, households in marginal signal areas account for only 1.1% of the UK population so when the overall results are weighted by population, the UK-wide picture closely follows the patterns observed in good signal areas.

- 7.13 There are three main reasons<sup>15</sup> why the observed aerial direction differs from what is predicted and these apply in both good and marginal coverage areas:
- *Viewers seeking a greater number of programme services.* The transmitters predicted to offer the best signals in some of the marginal areas surveyed in this report are provided by smaller ‘relay’ transmitters and some households would rather receive signals from a weaker transmitter carrying a greater number of programme services. (**6Mux** in Figure 1);
  - *Viewers seeking a regionally appropriate news service.* In some areas, the best signals are predicted to be provided by a transmitter in an adjacent region that does not carry the most appropriate news service. Households point their aerials towards a transmitter providing their preferred services. (**Regional preference** in Figure 1); and
  - *There is a choice of transmitters providing an adequate signal level.* Coverage of transmitters does overlap to some extent and in some areas, there is little difference in the signal levels provided by any transmitter and if they both carry news from the same regions, the choice of aerial direction is down to installer preference or very localised effects. (**Overlap** in Figure 1).
- 7.14 The effects are particularly noticeable in areas of marginal coverage, perhaps due to their situation at the edge of programme regions, the distance from main transmitters and a greater reliance upon relay transmitters.

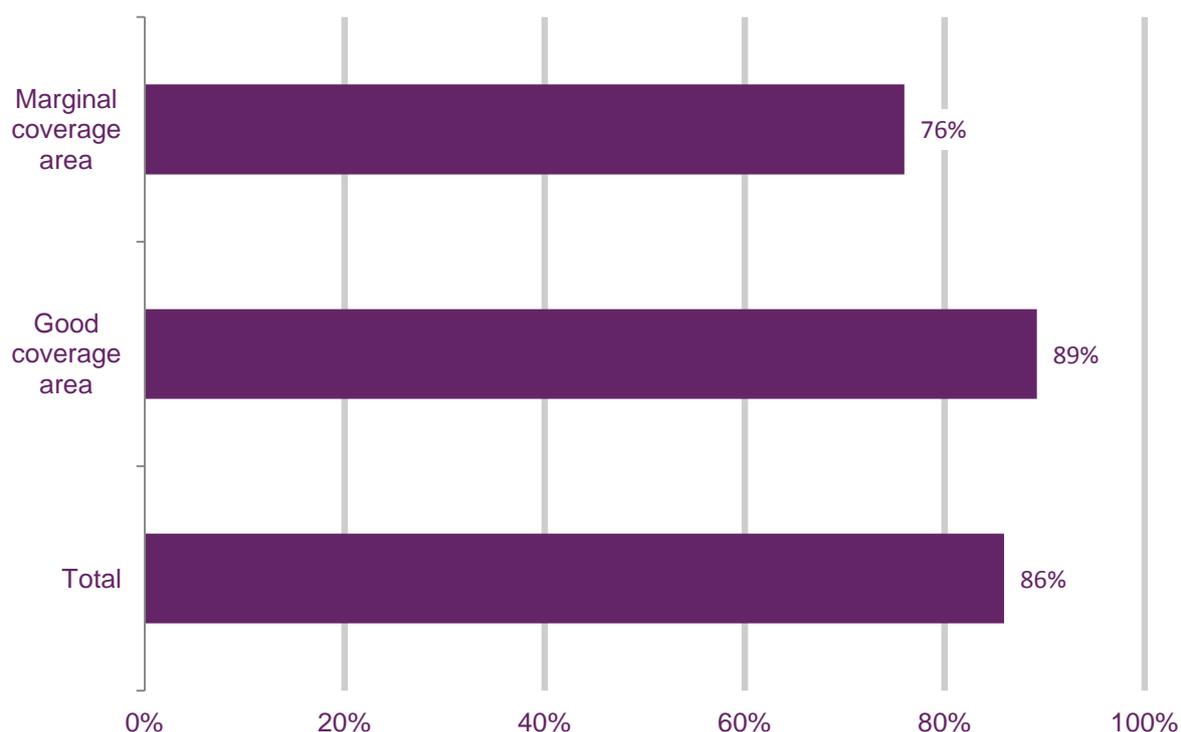
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<sup>15</sup> In some locations, we could not identify which transmitters aerials were pointing at. These locations have been classified as ‘ambiguous’ in Figure 1.

## Aerial polarisation

7.15 The assessment teams were also asked to note the polarisation<sup>16</sup> of individual rooftop aerials, which was then compared with the polarisation of the transmitter expected to be used in each location. In the previous section, we explained that a proportion of households are receiving signals from a transmitter other than the one predicted by the coverage planning model. It is therefore unsurprising that the polarisation of rooftop aerials follows a similar trend to the result for aerial pointing above as alternative transmitters to the predicted best 3PSB transmitter may be using a different polarisation.

**Figure 18: % of aerial with correct polarisation**



*Base: Total = All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292), in good coverage areas (1,726), and marginal coverage areas (566)*

<sup>16</sup> Whether the aerial is mounted with its elements pointing horizontally or vertically. This will match the polarisation of the transmitted signal.

## Amplifiers – masthead and indoor distribution

7.16 While the survey teams were visiting the household locations, they were asked to gather data on whether a DTT household using an outdoor aerial is also making use of a masthead amplifier. It is important to note that we excluded flats and communal dwellings, which usually have signal distribution systems installed, due to the anticipated difficulty in gaining good visibility of rooftop aerials for recording observations, and the low probability that flat occupants have knowledge of the aerials of when they were replaced.

7.17 The results are shown in Figure 19, which confirm that aerial systems located in areas with marginal DTT reception are twice as likely to incorporate a masthead amplifier as aerial systems located in good DTT coverage areas.

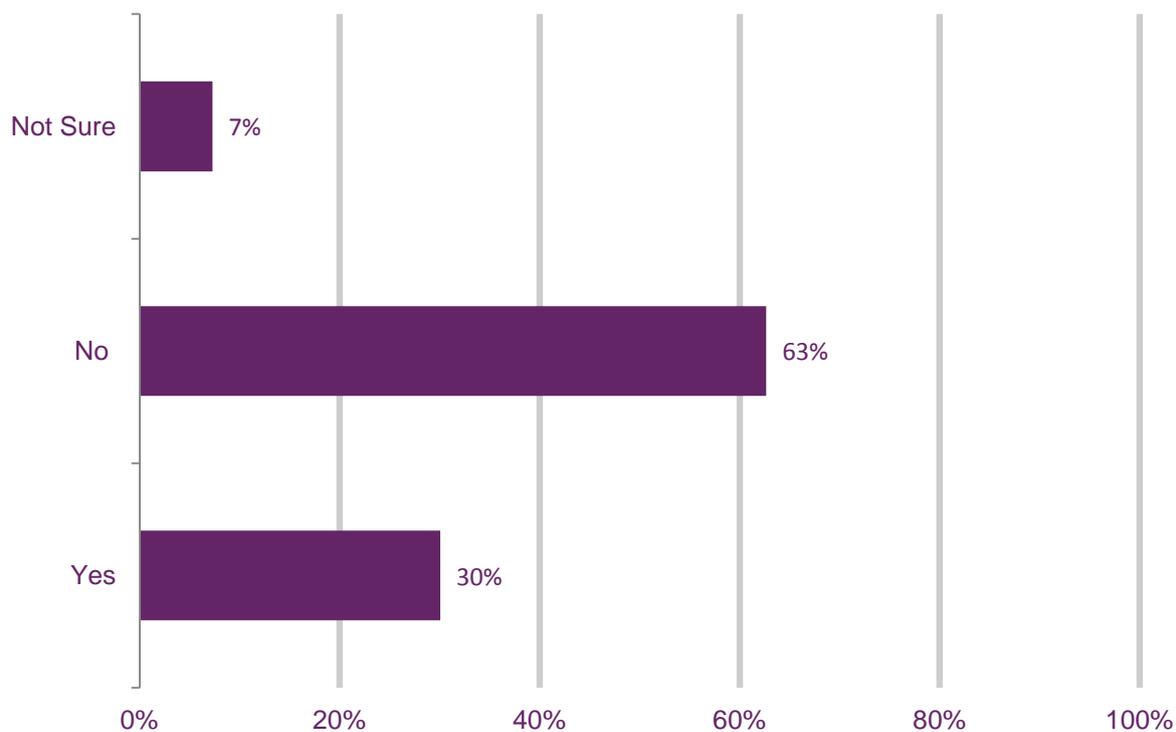
**Figure 19: Proportion of aerials connected to masthead amplifiers**



*Base: Total = All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292), in good coverage areas (1,726), and marginal coverage areas (566)*

7.18 DTT households were also asked whether their outdoor aerials are connected to any internal distribution system. The results are shown below and indicate that while the majority of households do not have an internal distribution system, around a third of households with outdoor aerials in use do.

**Figure 20: % of DTT households with internal distribution system**

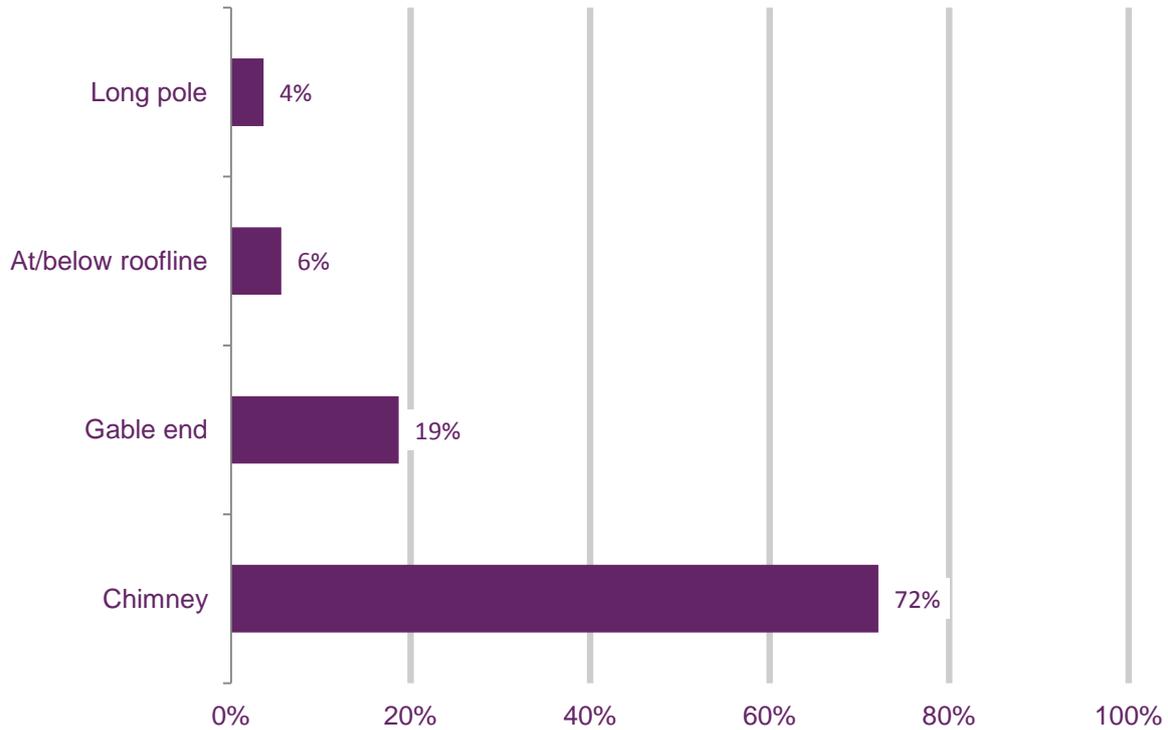


*Base: All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292)*

## Aerial location

7.19 The survey teams were asked to note where on a property the rooftop aerial is mounted. The standard assumption made by the planning model software is that an aerial is mounted at roof height, approximately 10m above the ground. If aerials are mounted on long poles, this often indicates that signal levels are somewhat low – usually due either to the household being a long way from a transmitter, or as a result of terrain or other localised physical obstructions.

**Figure 21: Aerials location**



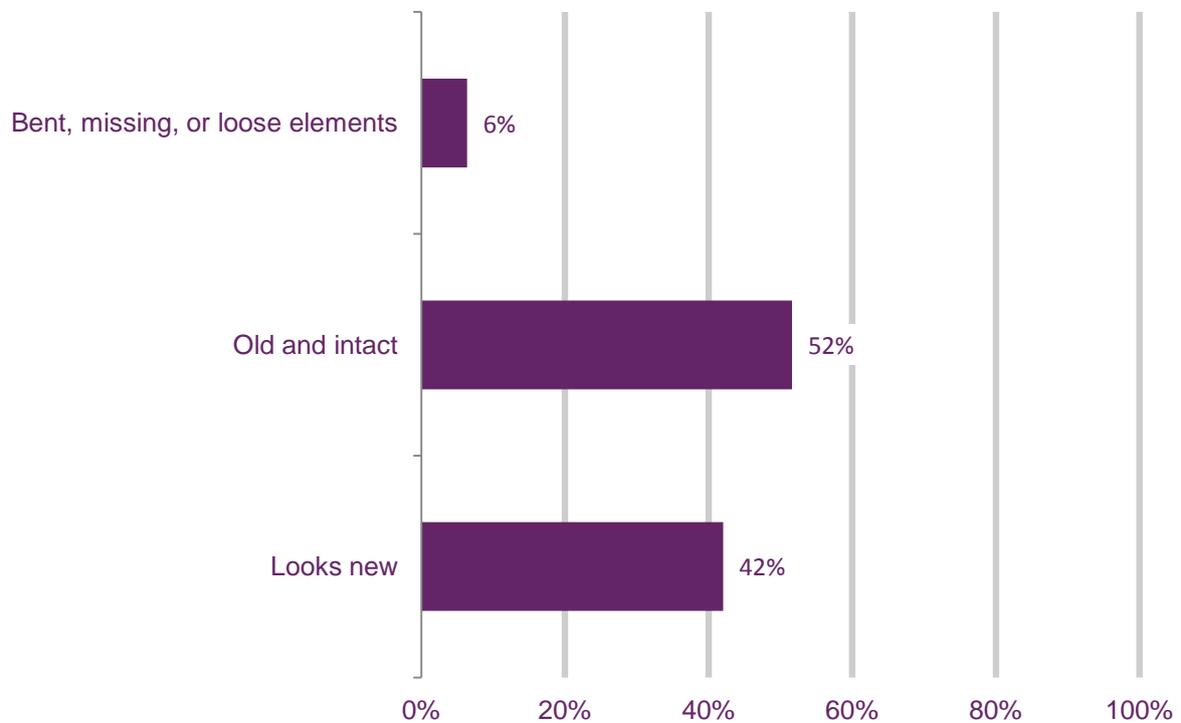
*Base: All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292)*

7.20 The results in Figure 21 shows that almost three quarters of outdoor aerials are mounted on the chimney stack, with over 90% at or around the height assumed by the planning model.

## Aerial condition

7.21 The survey teams made a subjective visual assessment of the condition of the aerals under observation.

**Figure 22: Aerial condition**

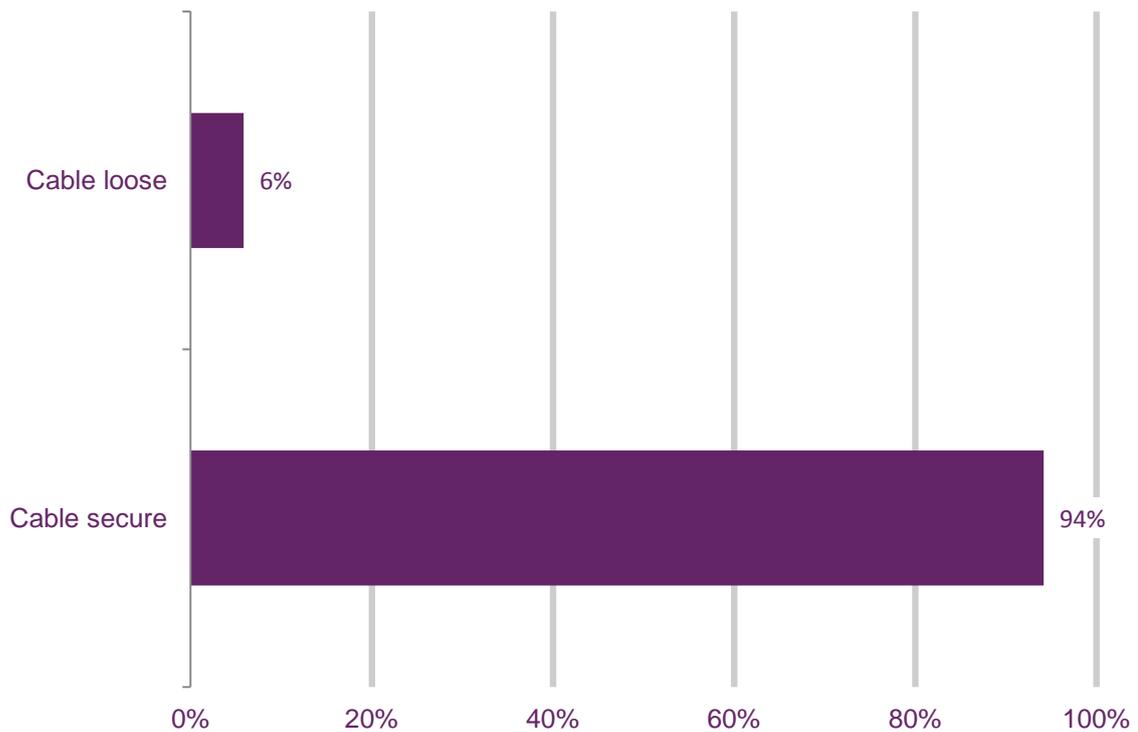


*Base: All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292)*

7.22 Only 6% of aerals show signs of physical damage, with the majority of aerals observed appearing physically intact. Of these, 42% of aerals which are in use look new (e.g. still appearing relatively bright and uncorroded).

- 7.23 Another factor that can lead to degraded aerial system performance is if the aerial cable is not securely attached to the mounting pole. Over time, a loose cable will suffer stress fractures or chafing (leading to water ingress) due to being blown about by the wind. Reassuringly, most of the aerals in use appear to have secured cabling. Note that the presence of a secured cable does not guarantee that the cable will be performing adequately, as other factors (e.g. water ingress at the point where the aerial is connected to the cable) can also affect its performance.

**Figure 23: Aerial cabling condition**



*Base: All households talked to with an outdoor aerial in use, excluding those households where we are unsure about the aerial type (2,292)*

## Annex 1

## Survey locations

Table A1: Survey locations split by aerial group and coverage

Aerial Group	No	Preferred transmitter <sup>17</sup>	Postcode Sector	Location	Coverage
A	1	Crystal Palace	SE22 0	London (Dulwich)	Good
A	2	Crystal Palace	TW2 6	London (Twickenham)	Good
A	3	Crystal Palace	SS8 9	Canvey Island	Good
A	4	Durriss	AB15 7	Aberdeen	Good
A	5	Caradon Hill	EX23 8	Bude	Good
A	6	Rowridge	PO30 1	Newport	Good
A	7	Divis	BT20 5	Bangor (NI)	Good
A	8	Divis	BT30 6	Downpatrick	Good
A	9	Caldbeck	CA3 9	Carlisle	Good
A	10	Caldbeck	DG12 5	Annan	Good
A	11	Ridge Hill	HR1 1	Hereford	Good
A	12	Ridge Hill	GL51 3	Cheltenham	Good
A	13	Stockland Hill	EX12 2	Seaton	Good
A	14	Stockland Hill	EX2 7	Exeter	Good
A	15	Darvel	KA3 7	Kilmarnock	Good
A	16	Darvel	KA8 9	Ayr	Good
A	17	Storeton	CH63 7	Bebington	Good
A	18	Pendle Forest	BB9 8	Nelson	Good
A	19	Bath	BA1 6	Bath	Good
A	20	Fenham	NE15 7	Newcastle upon Tyne	Good
A	21	Kilvey Hill	SA12 6	Port Talbot	Good
A	22	North Oldham	OL1 3	Oldham	Good
A	23	Merthyr Tydfil	CF47 0	Merthyr Tydfil	Good
A	24	Aldeburgh	IP15 5	Aldeburgh	Good
A	25	Lancaster	LA1 2	Lancaster	Good
A	26	Blaenplwyf	SA46 0	Aberaeron	Good
A	27	Fenton	ST3 1	Stoke on Trent	Good
B	1	Black Hill	EH47 0	Whitburn	Good
B	2	Black Hill	PA11 3	Bridge of Weir	Good
B	3	Heathfield	TN22 1	Uckfield	Good
B	4	Heathfield	BN22 0	Eastbourne	Good
B	5	Wenvoe	CF64 3	Penarth	Good
B	6	Wenvoe	NP20 3	Newport (Wales)	Good

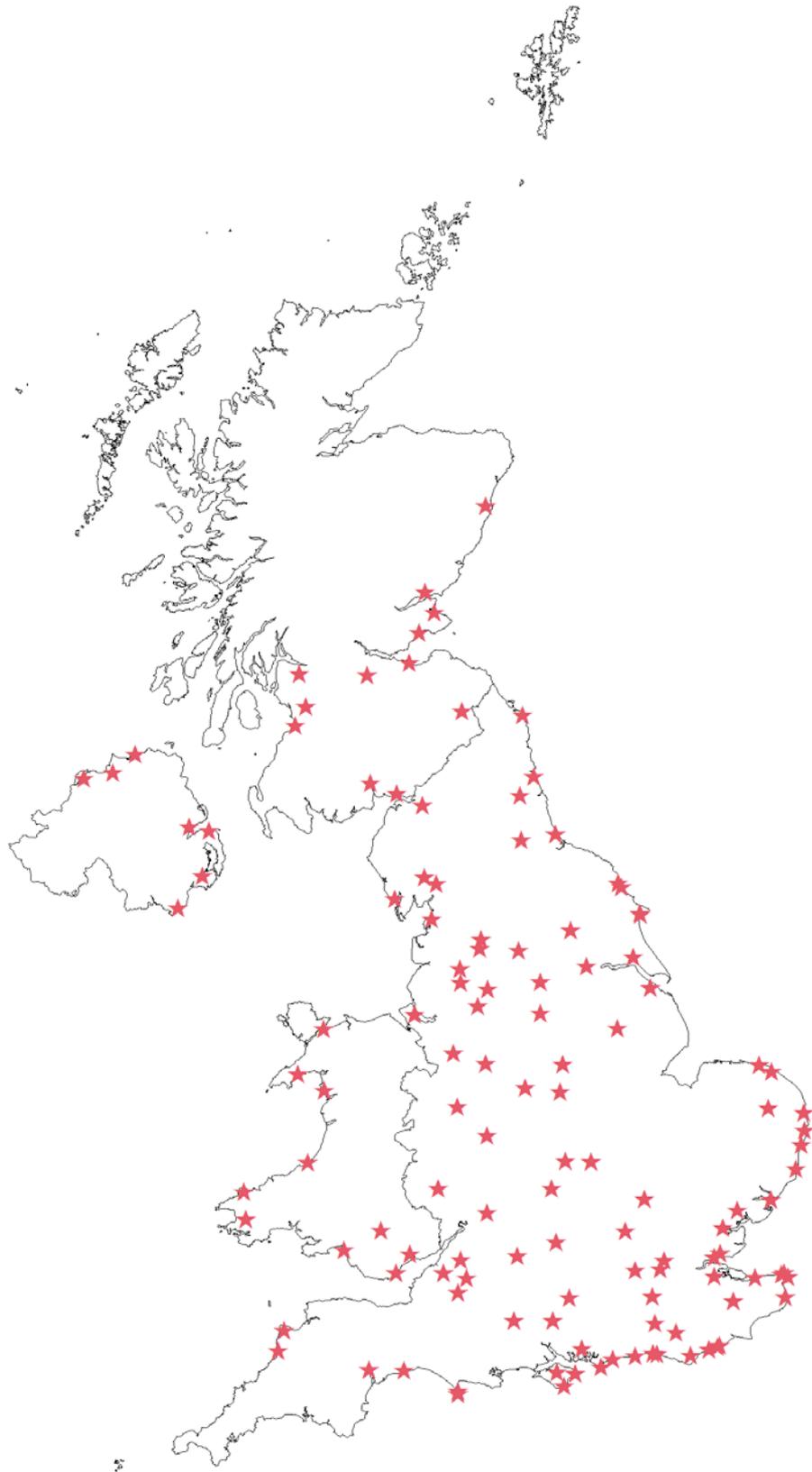
<sup>17</sup> Transmitter predicted to be the 'most likely' source of DTT services for the specific location by the DTT coverage prediction model;

<b>Aerial Group</b>	<b>No</b>	<b>Preferred transmitter<sup>17</sup></b>	<b>Postcode Sector</b>	<b>Location</b>	<b>Coverage</b>
B	7	Sutton Coldfield	DE14 2	Burton Upon Trent	Good
B	8	Sutton Coldfield	NN11 9	Daventry	Good
B	9	Emley Moor	S71 4	Royston (Barnsley)	Good
B	10	Emley Moor	DN14 6	Goole	Good
B	11	Bristol Ilchester Crescent	BS3 2	Bristol	Good
B	12	Carnmoney Hill	BT37 0	Newtownabbey	Good
B	13	Derry/Londonderry	BT47 5	Derry/Londonderry	Good
B	14	Darwen	BB3 3	Darwen	Good
B	15	Skipton	BB18 5	Barnoldswick	Good
B	16	Margate	CT9 2	Margate	Good
B	17	Hannington	RG22 5	Basingstoke	Good
B	18	Hannington	SO22 6	Winchester	Good
B	19	Chatton	NE68 7	Seahouses	Good
B	20	Dumfries South	DG2 7	Dumfries	Good
B	21	Arfon	LL53 5	Pwllheli	Good
B	22	Preseli	SA61 1	Haverfordwest	Good
B	23	Windermere	LA23 2	Windermere	Good
C/D/E	1	Angus	DD4 9	Dundee	Good
C/D/E	2	Angus	KY16 9	St Andrews	Good
C/D/E	3	Pontop Pike	NE24 2	Blyth	Good
C/D/E	4	Pontop Pike	DL14 6	Bishop Auckland	Good
C/D/E	5	Winter Hill	BL1 3	Bolton	Good
C/D/E	6	Winter Hill	M20 6	Manchester	Good
C/D/E	7	Winter Hill	CW5 5	Nantwich	Good
C/D/E	8	Sudbury	CO2 9	Colchester	Good
C/D/E	9	Sudbury	CM9 4	Maldon	Good
C/D/E	10	Limavady	BT49 0	Limavady	Good
C/D/E	11	Limavady	BT56 8	Portrush	Good
C/D/E	12	Mendip	BA3 3	Radstock	Good
C/D/E	13	Mendip	BS37 4	Yate	Good
C/D/E	14	Brierley Hill	DY9 8	Dudley	Good
C/D/E	15	Kendal	LA9 5	Kendal	Good
C/D/E	16	Salisbury	SP1 3	Salisbury	Good
C/D/E	17	Llanddona	LL57 1	Bangor (Wales)	Good
C/D/E	18	Hemel Hempstead	HP3 9	Hemel Hempstead	Good
C/D/E	19	Bretch Hill	OX16 5	Banbury	Good
C/D/E	20	Ventnor	PO38 1	Ventnor	Good
C/D/E	21	Oxford	OX14 5	Abingdon	Good
C/D/E	22	Oxford	SN3 3	Swindon	Good
C/D/E	23	Selkirk	TD5 7	Kelso	Good
C/D/E	24	Tacolneston	NR1 2	Norwich	Good
C/D/E	25	Olivers Mount	YO12 6	Scarborough	Good

<b>Aerial Group</b>	<b>No</b>	<b>Preferred transmitter<sup>17</sup></b>	<b>Postcode Sector</b>	<b>Location</b>	<b>Coverage</b>
C/D/E	26	Chingford	E4 7	Chingford	Good
W	1	Sandy Heath	NN3 2	Northampton	Good
W	2	Sandy Heath	SG6 3	Letchworth	Good
W	3	Belmont	DN33 2	Grimsby	Good
W	4	Belmont	HU8 0	Kingston Upon Hull	Good
W	5	Craigkelly	EH7 6	Edinburgh	Good
W	6	Craigkelly	KY8 3	Methil	Good
W	7	The Wrekin	TF4 2	Telford	Good
W	8	Idle	BD10 9	Shingley	Good
W	9	Reigate	RH1 2	Redhill	Good
W	10	Sheffield	S2 3	Sheffield	Good
W	11	Bilsdale	YO31 9	York	Good
W	12	Bilsdale	TS26 0	Hartlepool	Good
W	13	Nottingham	NG6 0	Nottingham	Good
W	14	Belmont	LN2 4	Lincoln	Good
W	15	Waltham	LE11 5	Loughborough	Good
A	1	Hastings	TN34 1	Hastings	Marginal
A	2	Rowridge	DT5 2	Portland	Marginal
A	3	Stockland Hill	DT5 1	Portland	Marginal
A	4	Aldeburgh	IP18 6	Southwold	Marginal
A	5	Blaenplwyf	SA64 0	Fishguard	Marginal
A	6	Rowridge	PO20 0	Selsey Bill	Marginal
A	7	Rowridge	PO22 7	Bognor Regis	Marginal
A	8	Rowridge	BN11 3	Worthing	Marginal
A	9	Crystal Palace	SS9 3	Southend	Marginal
A	10	Rowridge	PO35 5	Bembridge	Marginal
A	11	Rowridge	PO9 4	Havant	Marginal
B	1	Heathfield	TN35 5	Hastings	Marginal
B	2	Heathfield	RH17 6	Balcombe, Ardingley	Marginal
B	3	Bexhill	TN40 1	Bexhill	Marginal
B	4	Margate	CT9 5	Margate	Marginal
B	5	Great Yarmouth	NR31 6	Gorleston on Sea	Marginal
B	6	Preseli	LL43 2	Tal Y Bont	Marginal
B	7	Heathfield	TN27 0	Charing, Pluckley	Marginal
B	8	Kilkeel	BT34 4	Kilkeel	Marginal
C/D/E	1	Dover	CT10 1	Broadstairs	Marginal
C/D/E	2	Dover	CT14 7	Deal	Marginal
C/D/E	3	Whitehawk Hill	BN2 1	Brighton	Marginal
C/D/E	4	Whitehawk Hill	BN3 2	Brighton	Marginal
C/D/E	5	Sudbury	CT5 2	Whitstable	Marginal
C/D/E	6	Bluebell Hill	ME7 2	Gillingham	Marginal
C/D/E	7	Sudbury	CO12 3	Harwich	Marginal

<b>Aerial Group</b>	<b>No</b>	<b>Preferred transmitter<sup>17</sup></b>	<b>Postcode Sector</b>	<b>Location</b>	<b>Coverage</b>
C/D/E	8	Tacolneston/Lowestoft	NR33 7	Lowestoft	Marginal
C/D/E	9	Hartland/Huntshaw Cross	EX39 6	Hartland	Marginal
C/D/E	10	Winter Hill	LA18 4	Millom	Marginal
C/D/E	11	Tacolneston	NR11 8	Mundesley	Marginal
W	1	Belmont	YO15 2	Bridlington	Marginal
W	2	Belmont	YO16 7	Bridlington	Marginal
W	3	Bilsdale	YO13 0	Ravenscar	Marginal
W	4	Belmont	NR26 8	Sheringham	Marginal

**Figure A2: Map of survey locations**



**Annex 2**

# Survey questionnaire

Post Code  House Number

1. How many TV sets do you have?

If none go to Q7

2. So for your **<main, second etc>** TV set, how do you receive your TV services?

Repeat for each set

TV set	Via a terrestrial TV aerial <sup>18</sup>	Satellite (Sky or Freesat)	Cable (Virgin media)	Satellite or cable sets still connected to an aerial
Main				
2				
3				
4				
5				
6				

If all sets are **terrestrial** go to **Q4**.  
If **satellite/cable**, go to **Q3**

3. Are the sets receiving cable or satellite still connected to an aerial?

If no for **ALL sets**, go to **Q7**

[Note answer in the table above]

4. To what type of aerial is your **<main, second etc>** TV set connected?

Repeat for each set

TV set	Outdoor	Aerial that has been placed in the loft	Portable indoor aerial	Don't know
Main				
2				
3				
4				
5				
6				

If no loft or rooftop aerials, go to **Q6**

5. Do you know when the aerial was last replaced?

	Prior to 2000	2000 – 2007	Since 2007	Don't know
Main aerial				

6. Do you have a distribution system (an amplifier feeding several sets) or booster amplifiers?

Yes  No

Comments:

7. Observe whether rooftop aerial is present

Yes  No

<sup>18</sup> (Using a Freeview TV or set top box – via Freeview, YouView, BT Vision, Talk Talk TV, Top up TV)

**8. Where is aerial mounted?**

	Chimney	Gable end	At/below roofline e.g. fascia board	Long pole
Main aerial				

**9. Aerial condition**

	Condition			Cable	
	Looks new	Old and intact	Bent, missing or loose elements	Cable secure	Cable loose
Main aerial					

**10. Aerial type**

	Contract standard	Contract high gain	Mid range standard	Mid range high gain	Tri-boom	Log periodic	Other (specify)
Main aerial							
Comments:							

**11. Grouped or wideband?**

	Grouped	Wideband	Not sure
Main aerial			
Aerial 2			
Aerial 3			

**12. Is a masthead amplifier present?**

Yes		No	
-----	--	----	--

**13. Is the antenna the correct polarisation for the area?**

Yes		No	
-----	--	----	--

**14. Is the aerial pointing towards expected transmitter?**

Yes		No	
-----	--	----	--

**15. Note bearing where aerial is pointing** [Number from 0 to 360 where 0 = North and 90 = East]

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**16. Picture of aerials**

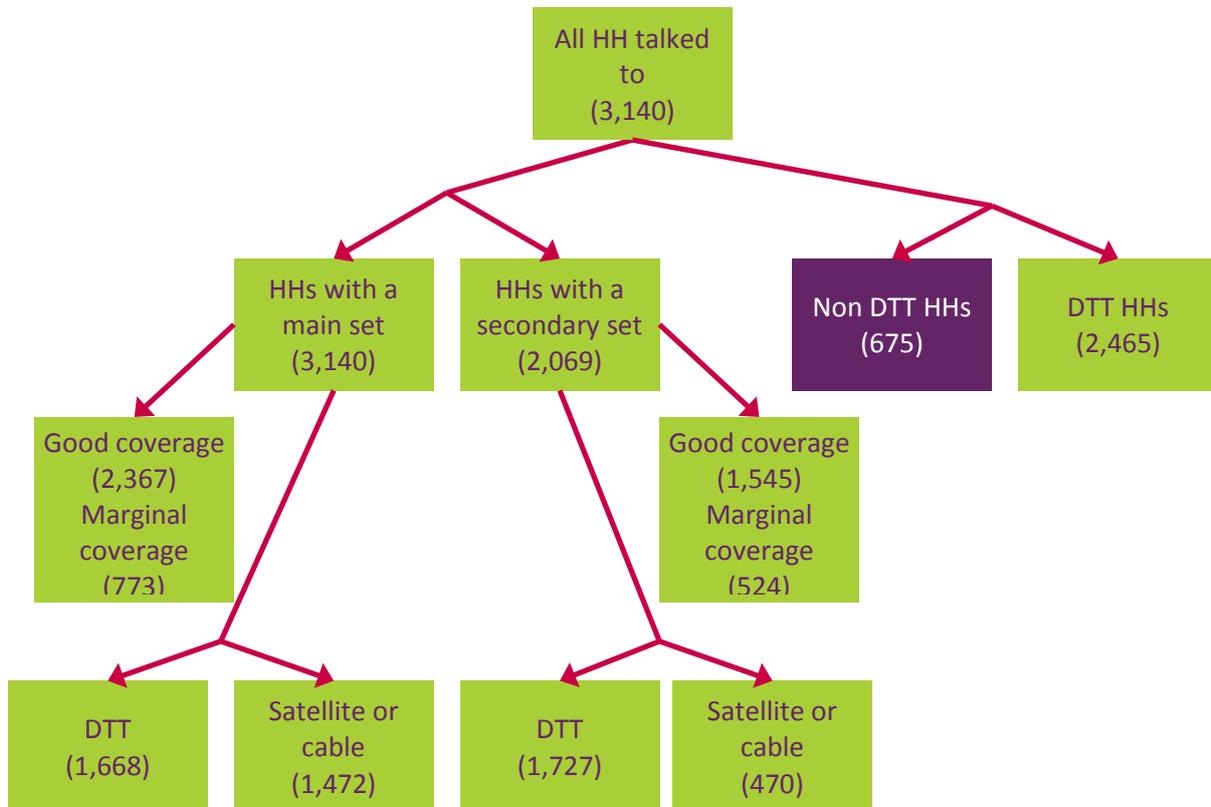
Yes		No	
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**Annex 3**

# Breakdown of base data

- A3.1 The findings in Section 5 to 7 shows the different bases which were used for analysing the results. This Annex provides a detailed breakdown of the base data.
- A3.2 It should be noted that due to the constraints when conducting the survey, the base data shown in Figure A3 and A4 is possibly not representative of the UK households.

**Figure A3: Breakdown of base by households**



**Figure A4: Breakdown of base by TV sets**

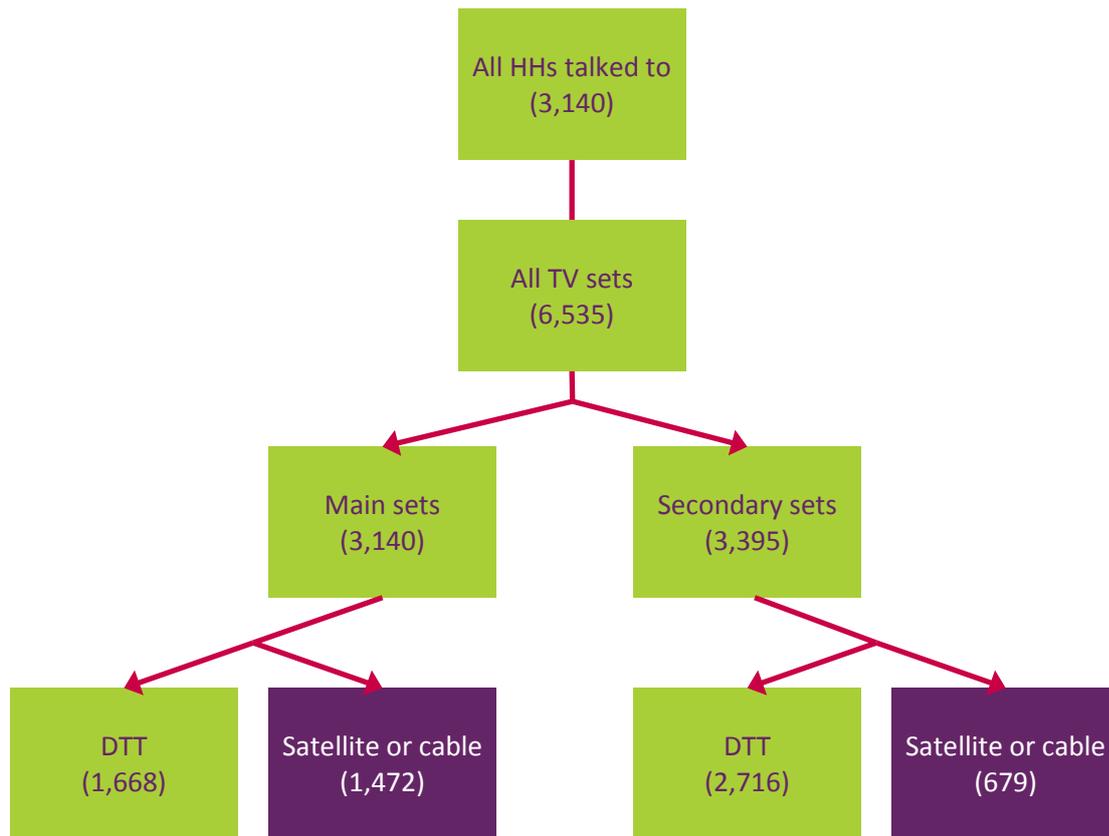


Figure A5: Breakdown of base for outdoor aerial

