BARB 2010 Service

BARB Reference Manual

7. Calculation Methodology

Version 2.5

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CALCULATION METHODOLOGY

1.1. Introduction

This section describes the calculations used to estimate audiences and ratings from the raw data.

Audiences are required for the Network, BBC regions, ITV areas, macro regions and broadcast platform defined universes (e.g. digital satellite). Breakdowns are required by timeshift and platform components. In principle the calculation of audiences is a simple concept but in practice is complicated by ancillary requirements:

- Consistency with universes
- Additivity
- Area reporting requirements
- Variations in content by transmitters and broadcast platforms
- Simulcast viewing on HD channels
- Definitions of audiences to be reported
- Special factoring procedures.

Any solution represents a trade-off between the often conflicting requirements and the need to constrain the complexity of the methodology. An over-complicated methodology will lead to inconsistency in the application of the gold standard calculation procedures and confusion in the application of the data.

It is inevitable that there will be inconsistencies somewhere in the data. The gold standard calculation procedures will address the more important reporting requirements. As the broadcast structure of the television market develops, calculation procedures will continually change to accommodate revised reporting requirements.

BARB's ideal is to maintain as much transparency as possible in the data and associated calculation procedures. However, the demand for disaggregation and consistency means that some procedures (e.g., guest factoring conventions) will have to be "hard-coded" by data processors and will be time dependent (i.e. old data must use old procedures in order to replicate the gold standard).

A key consideration in the construction of audiences is the order in which the various procedures are applied. This affects consistency. Guaranteed consistency would be achieved by fully calculating the audiences to all viewing event fragments and always constructing higher level audiences from these fragments. However, this is a convoluted and inconvenient approach and our preferred solution is to allow some potential for inconsistency and/or some deviation from the perfect audience definition.

Significant changes (simplification) for the BARB 2010 service relate to the introduction of non-overlapping ITV areas and net area reporting.

The BARB reference manual is intended to provide a set of conventions for audience calculations which are relatively time independent. Otherwise the calculation principles conveyed by the reference manual would be lost in continually changing detail as audience definitions change. It does mean that a data processor must keep up to date with specification changes and associated interpretation of the calculation conventions. It is recognised that this interpretation is not always obvious. Appendix E provides some more specific clarifications which relate to the current (February 2010) reporting requirements.

1.1.1 Overview

In outline, the procedure is as follows:

Processing weights are calculated for each individual in the reporting sample.

Audiences are then calculated for single minutes. Audiences are defined in terms of:

- Channel and stations (regional variants)
- Platforms (e.g. digital satellite)
- Activities (e.g. live viewing)
- Categories (demographics)
-

Events on transmission logs contribute to the definitions of audience requirements.

Audience calculation includes the following steps:

- Aggregation of minute counts
- Factoring of guest audiences
- Regional sub-group factoring
- Time-shift consolidation

Audiences can then be combined to derive audiences for further categories, channel combinations or regions.

Audiences for time periods or transmission events are calculated by averaging the audiences of the individual minutes which they span.

1.1.2 Reporting Panels

The BARB panel homes have indicators which allow them to be organised into “reporting panels”, each reporting panel being a sample that has been defined for the purpose of calculating audience estimates. As shown in the BARB 2010 AP01 a reporting panel may represent a region such as an ITV area, or the whole UK, or the universe of receivers via particular groups of broadcast platforms. An individual will be included in a number of reporting panels.

1.1.3 Age Updates

Age must be updated automatically from the panel member's date of birth field. This must happen on a daily basis. A panel member's age will remain constant from 02:00 to 25:59, i.e. consistent with the polling, weighting and processing day. For example:

DOB = 5th June, 1956

Age up to 01:59 on 5th June, 2010 = 53

Age from 02:00 on 5th June, 2010 = 54

From 1st October 2013 for data protection reasons, real date of birth/actual age will no longer be part of the published BARB dataset. Instead, all individuals' age will be set according to their month and year of birth, assuming the 1st of the month as their "birthday". So, actual age changes will only occur on the 1st of the month.

1.2 Calculation of Weights

Prior to the calculation of audiences, processing weights are calculated for all panel individuals aged 4+ that are included in the reporting sample on that day.

For the basic audience estimation requirements, every individual will have two processing weights:

(i) A Network (Panel 50) weight which ensures that the reporting panels correctly represent the Network, each individual BBC region and the combined cable and digital satellite universe. This weight is used for the calculation of Network (Panel 50) and BBC region audiences.

(ii) An ITV weight which ensures that the reporting panels correctly represent each individual ITV area, the Network and the combined cable and digital satellite universe. This weight is used for the calculation of ITV area audiences

Individuals with cable and/or digital satellite reception will have one additional weight to be used for Panel 72 reporting requirements. From 12th July 2010 this weight is numerically equal to their Network weight but is published for transparency.

Members of the ITV Wales panel will have one additional weight to be used for the boosted S4C panel reporting requirements. Members of the S4C boost panel will only have one weight because they do not contribute to the basic audience estimation requirements.

From 1st August 2010 members of panel 941 (Network excluding Wales) will have one additional weight to be used for the boosted S4C Network panel reporting requirements. This weight will be numerically equal to their Network weight but will still be published for transparency.

For the purposes of sub-group factoring, each member of the basic Network panel will have five additional weights, one for each of the areas to be factored – North East, Border, West, West Country and Ulster. These weights ensure that the Network panel is demographically "representative" of the area to be factored.

1.2.1 Pre-Weights

Pre-weighting is used to assign weights to individuals before they go into the main weighting process. This procedure adjusts for the different sampling fraction used in each ITV area.

Pre-weights will be calculated for homes only. Individuals will be assigned the pre-weight that was calculated for the home.

$$\text{Pre-Weight} = \frac{\text{ITV Area Universe}}{\text{ITV Area Target Panel}}$$

Pre-weights are not required for the boosted S4C area audience estimation requirements.

Pre-weights are not required for the network factoring application.

1.2.2 Rim-Weighting

Rim-weighting is a method of weighting whereby a unique weight is calculated for each individual and these weights ensure that the panel is simultaneously representative of a set of independent marginal universe profiles or "rims". These weights are calculated in a series of iterations.

The weight for each cell in a particular rim is computed by dividing the cell universe by the weighted sample count for that cell, and then multiplying this number by the weight obtained for the individual on the previous rim.

The starting weights are the pre-weights described in section 1.2.1. For schemes where pre-weights are not required, starting weights can be set to 1. This pre-weighted sample is then weighted to the universes in the first rim. The weights computed for the first rim are then used to calculate the weights for the second rim. The procedure then cycles through all rims over and over again until the set of weights represents all cell universes in all rims.

The separate rim-weighting schemes are as follows:

Panel 50	Network/BBC Areas/Cable and Digital Satellite

Panel 99	ITV Areas/Network/Cable and Digital Satellite
Panel 39	S4C Boost Panel/Sub-Areas/Welsh Homes/Welsh Speakers
Panel 98012	Network factoring – N. East
Panel 98027	Network factoring – S. West
Panel 98033	Network factoring – Border
Panel 98037	Network factoring – ITV West
Panel 98030	Network factoring – Ulster

Appendix A gives details of the control to Database 2 reporting categories for different reporting panels.

1.2.3 Stopping Rules

Since rim-weighting is an iterative process, it is necessary to specify a set of rules to determine when the iterative process should stop.

1) The weighted sample has converged to within 0.5 of the cell universe in thousands for all cells in all rims. This means that the weighted sample count is within rounding error of the cell universe in thousands.

2) Convergence does not improve with further iterations, for all cells in all rims.

3) The number of iterations reaches a pre-set limit. This limit partly depends upon run time but must reflect the necessary complexity of the various rim-weighting schemes. The unified weighting schemes must allow large numbers of iterations.

If the rim weighting stops due to conditions 2 or 3, then the results must be checked and the specification amended. Automatic amendments (such as a hierarchy of cell collapsing) are not used. Necessary changes to the specification tend to be long-term and rim-weighting failures do not happen often.

1.2.4 Weight Capping

Where possible, a weight capping routine will be applied to constrain the size of the maximum weight relative to an individual's pre-weight (see section 1.2.1).

1.2.5 Assignment of Weights

The home is assigned the weight that has been calculated for the housewife. Guests in the home are also each assigned this weight, as are children under four (for special reporting requirements from analysis of Database 1).

1.3 Calculating Minute Audiences

1.3.1 Aggregate Raw Minute Counts

Raw minute counts are aggregated for each minute by summing the weights of those homes, individuals or guests (when the necessary guest demographic information is available) who are viewing in that minute.

Raw minute counts will be accumulated for a range of channels, platforms, stations, panels, audience categories and viewing activities (notably live viewing, time-shift viewing on same day as live, and time-shift viewing days 2-7).

Audiences are calculated for each reporting panel using the weights pertaining to that particular panel (see section 1.5.4 for rules relating to combined areas).

Minute raw counts are held as thousands viewing to four decimal places.

1.3.1.1 Homes Audiences

Any HOMES audiences required for combinations of channels should be aggregated from the homes viewing at this stage. For other categories it will not normally be appropriate to accumulate audiences for combinations of channels as this should be done at the audience combination stage.

When a home is viewing different stations on more than one set in the same minute, then viewing will count once towards each station being viewed but only once towards the Total TV (or sub-total) viewing.

Homes viewing the same channel on more than one set at the same time will only count once to the viewing for that minute/channel.

Panel member and guest viewing records are held separately in Database 1. It is necessary to accumulate HOMES audiences from both viewing records.

1.3.1.2 Time-Shift Viewing

Audiences are accumulated separately for:

- Live viewing
- Time-shift on same day as live, i.e. where playback occurred up to 25.59 on the day of broadcast.
- Time-shift, i.e. remaining timeshift where playback occurred up to and including 164 hours of recording, all instances of playback being included (i.e. allowing double counting). The samples and weights to be used for accumulating time-shift playback audiences will be those for the day of viewing.

Note that VOSDAL (viewing on same day as live) or consolidated audiences are produced at the audience combination stage by summing the live audience and the

time-shift audience. Guest factoring and sub-group factoring routines are applied after audience accumulation but before consolidation.

For the purpose of calculating the time elapsed between the original broadcast and playback the spring and autumn clock changes should be ignored. Therefore Saturday should be treated as 24 hours long even if it is actually 23 or 25.
See the examples below:

Spring Clock Change

Time	Saturday	Sunday	Monday	....	Friday	Saturday
0200						
...						
0900						A1: Playback starts 0900 A2: Playback starts 0901
1000						A3: Playback starts 1000
...						
1300	Recording Starts 1300					
...						
2300						
2400						
2500	Hour Lost due to Spring Clock Change					

Example A1: Actual elapsed time between Recording and playback is 163 Hours but for the purposes of eligibility (for inclusion in Consolidated Audience Estimates) this is treated as 164 (because the clock Change is ignored).

A2: Any Playback at or after 0901 is not included in Consolidated audience estimates.

A3: Although the actual elapsed time is 164 hours, this playback session is not included in consolidated audience estimates.

Autumn Clock Change

Time	Saturday	Sunday	Monday	....	Friday	Saturday
0200						
...						
0900						B1: Playback starts 0900 B2: Playback starts 0901
1000						
...						
1300	Recording Starts 1300					
...						
2400						
2500						
2600	Extra Hour gained due to Autumn Clock Change					

Example B1: Actual elapsed is 165 Hours but for the purposes of eligibility (to be inclusion in Consolidated Audience Estimates) this is treated as 164 (because the clock Change is ignored).

B2: As before any Playback at or after 0901 is not included in Consolidated Audience Estimates.

1.3.1.3 Platform Variants

Some channels have different variants available via digital platforms (e.g. BBC, S4C). In some cases the majority of the schedule will be the same but there will be some inconsistent programming. These variants are identifiable in the system because the broadcaster supplies a different transmission log. In these cases, despite some commonality in the schedule, these variants must be treated as separate channels for audience calculation. Audiences may subsequently be linked together for reporting purposes. However, it is necessary to apply guest factoring and sub-group factoring prior to such audience accumulation.

1.3.2 Guest Factoring

As current monitoring equipment can identify the age group and sex of guests viewing, audiences for these categories do not have to be guest factored as the guest weight will contribute directly to the audience calculated for those categories. In a similar manner the social class of a home will be attributed to guests viewing in that home, and therefore guests will be included within the audience calculated for these categories.

There are however other demographics for which the characteristics of the guest are not known, and in these cases (e.g. non-standard age groups, housewives) guest factoring is necessary.

To ensure these categories are not underestimated the initial minute raw count is multiplied by a guest factor. Different guest factors may be applied to different categories.

Up to 1st July 2011 the following methodology applies:

The definition of a guest factor is as follows:-

$$\text{GUEST FACTOR A} = \frac{\text{CATEGORY A PANEL VIEWERS + CATEGORY A GUEST VIEWERS}}{\text{CATEGORY A PANEL VIEWERS}}$$

Separate guest factors are calculated for every minute, panel, station and activity, truncated to seven decimal places. The aggregated raw count for a category to be guest factored in this way, is then multiplied by the appropriate guest factor.

CATEGORY B RAW COUNT = GUEST FACTOR A * CATEGORY B INITIAL RAW COUNT.

The resulting minute raw counts will be held as thousands viewing to four decimal places, rounded.

In the formulae above, "Category B" is the audience which requires guest factoring and "Category A" is its parent group category. The parent group category chosen should be the smallest group which embraces the category being factored. Social Class takes precedence over Age. All adults is the parent group category for all Housewife based categories.

Guest factoring can mean that some demographic breakdowns will not be additive. However, anything which is defined only in terms of Sex, Standard Age Groups, Social Class will be additive and all Housewives sub-categories will be additive.

Note that guest factoring must take place before sub-group factoring and/or audience combination.

Appendix B defines the parent category for each DB2 category that requires guest factoring.

Guest viewing audiences for Panels 39 (Total S4C), 40 (English speaking only homes), 48 (Welsh speaking homes), 102, 103 and 104 (S4C sub areas) are factored on the basis of each reporting panel treated as a single entity. Factored sub panel guest audiences may not sum to factored Panel 39 guest audiences.

Guest viewing audiences for Panel 41 (Welsh speaking individuals) are derived from the guest viewing audiences for Panel 48 (all individuals in Welsh speaking homes). For each minute, station and activity:

$$\text{PANEL 41 GUEST VIEWERS} = \frac{\text{PANEL 48 GUEST VIEWERS} * \text{PANEL 41 PANEL VIEWERS}}{\text{PANEL 48 PANELVIEWERS}}$$

From July 1st 2011 the following methodology applies:

For each TV set, in each panel home, for each minute of the day, the BARB Panel Viewing File provides a count of the number of guests viewing in each of the following demographic groups:

Male	4 – 9	Female	4 – 9
Male	10 – 15	Female	10 – 15
Male	16 – 19	Female	16 – 19
Male	20 – 24	Female	20 – 24
Male	25 – 34	Female	25 – 34
Male	35 – 44	Female	35 – 44
Male	45 – 64	Female	45 – 64
Male	65 +	Female	65 +

These guest viewer counts will be assigned to the social class (AB, C1, C2, D, E) and the Housewife weight of the home in which they are viewing. This makes it possible to aggregate guest raw minute counts for each of 80 demographic cells (2 sex x 8 age x 5 class) and any reporting category which can be built from these 80 cells.

For other reporting categories, it will be necessary to use guest factoring to estimate the guest raw minute count.

For each reporting category A it is necessary to calculate a guest factor for each of the 80 cells.

The guest factor is calculated as follows:

GUEST FACTOR A FOR CELL i = SUM OF WEIGHTS OF PANEL MEMBERS IN CATEGORY A IN CELL i / SUM OF WEIGHTS OF PANEL MEMBERS IN CELL i

when regional sub-group factoring applies, the sums of weights are taken from the relevant Network factoring panel.

There is only one set of 80 guest factors for each category, for each reporting panel, for each day. Guest factors are truncated to seven decimal places.

Then for each cell, the guest raw minute count for the reporting category is calculated by multiplying the guest raw minute count by the guest factor. These are then summed across the 80 cells:

$$\text{Guest raw minute count category A} = \sum_{i=1}^{80} \left[\text{Guest raw minute count for cell i} \times \text{Guest Factor A for cell i} \right]$$

Finally this factored guest audience is added to the panel audience:

RAW MINUTE COUNT CATEGORY A = PANEL RAW MINUTE COUNT CATEGORY A + GUEST RAW MINUTE COUNT CATEGORY A

The resulting raw minute counts will be held as thousands viewing to four decimal places, rounded.

Note that guest factoring must take place before sub-group factoring and before construction of combined area audiences for macro region reporting.

Guest viewing audiences for Panel 41 (Welsh speaking individuals) are derived from the guest viewing audiences for Panel 48 (all individuals in Welsh speaking homes). The guest factor is calculated as follows:

GUEST FACTOR A FOR CELL i = SUM OF WEIGHTS OF PANEL 41 MEMBERS IN CELL i / SUM OF WEIGHTS OF PANEL MEMBERS 48 IN CELL i

Then:

$$\text{Guest raw minute count category A} = \sum_{i=1}^{80} \left[\text{Panel 48 guest raw minute count for cell i} \times \text{Guest Factor A for cell i} \right]$$

1.3.3 Adult Light Viewers

The Database 2 light viewer categories are:

Light Viewing Adults, Lightest Third
Light Viewing Adults, Lightest Sixth
ABC1 Adults, Lightest Third
16-34 Adults, Lightest Third

By definition, the light viewer universes are exactly one third of All Adults, exactly one sixth of All Adults or exactly one third of ABC1 Adults. However, since there are no adjust to universe procedures on a day to day basis, the effective universe for the calculation of ratings is the sum of weights of light viewers.

Initially each panel member should be classified as "not light" for each light viewer classification. As panel members enter the reporting sample and/or achieve adult status, it will be possible to update the classifications subject to a time lag of one day, as follows:

For each adult panel member (i.e. excluding guests) in the previous day's reporting sample, calculate unweighted average daily hours of live viewing plus time-shift viewing on same day as live (VOSDAL, see 1.3.1.2)to all commercial TV over the 28 days up to but not including the previous processing day. Only valid reporting days are included when calculating the average; a valid reporting day is when a panel member is both an adult and has a processing weight.

For the purposes of this exercise, commercial TV will be Total TV viewing but excluding any viewing to the BBC channels. This is the default definition but BARB may maintain and provide a definitive classification in one of the data files.

Construct a weighted (yesterday's weight) frequency distribution and identify the lightest third or lightest sixth as appropriate. The cut-off point should be the smallest sum of weights which is equal to or exceeds one third (or one sixth) of the total sum of weights. For this reporting day, classify all adults in the lightest third or sixth to be light viewers. This revised classification is then used to update the light viewer classifications to be effective for the current reporting day. Classifications can change on a daily basis.

Live, VOSDAL and consolidated audiences on Database 2 are based upon the same (VOSDAL) light viewing classification.

Guest viewing is factored using an All Adults or an ABC1 Adults guest factor.

Database 1 contains classifications which allow a more comprehensive analysis of viewing by weight of viewing groups:

Adults Commercial TV Viewing Sextile
ABC1 Adults Commercial TV Viewing Sextile
Adults Total Viewing Sextile
ABC1 Adults Total Viewing Sextile
16-34 Adults Commercial TV Viewing Sextile
16-34 Adults Total Viewing Sextile

The determination of the classifications follow the above principles, with panel members defaulting to the heaviest viewing sextile then qualifying or not for the lightest sixth, third, half, two-thirds, five sixths.

Each adult panel member will have a light viewer classification for each of the following reporting panels:

(i) Each of the 13 main ITV panels. This means that:

- The definition of light viewers will vary across the component areas of a macro region.

- The definition of light viewers will be consistent across part-areas (e.g. Central Scotland and North Scotland).

(ii) Each of the 14 main BBC editorial regions. This means that:

- The definition of light viewers will vary across Network panel 50.
- The definition of light viewers will be consistent across sub-regions (e.g. a panel member's BBC South light viewer classification should also be used as their light viewer classification for BBC South Oxford, Hannington or Rowridge).

(iii) Cable and Digital Satellite Panel 72.

(iv) Panel 41, Welsh speaking individuals (for S4C only).

(v) Panel 39, Total S4C.

This means that: - Welsh speaking adults will have a classification for Panel 39 reporting and for Panel 41 reporting.

(vi) Panel 941, Network excluding Wales

- This will be the same as the light viewer classification in each of the 13 main BBC regions.

(vii) Panels 102, 103 and 104, the S4C North, West and South sub-area panels (for S4C only). This means that these sub-areas will have different classifications to main S4C panel (area 39).

(viii) Panels 98012, 98027, 98030, 98033, 98037, the network factoring panels for N. East, S. West, Ulster, Border, West.

Each adult will have a different classification for each of the network factoring panels. Then for the purpose of calculating light viewer factored ratings, the light viewer classification is treated as any other demographic sub-group category.

1.4 Sub-Group Factoring

Sub-Group Factoring is used to calculate audiences for reporting sub-categories for the five smallest ITV area panels:

North East
Border
West
South West
Ulster

In these cases, the All Individuals 4+ audience as calculated above will be accepted.

However, all sub-category audiences must be factored or derived from combinations of smaller factored audiences.

The specially weighted Network panels (described in section 1.2 above) are used to provide the basis for this factoring. For each sub-category which is required to be factored, it is necessary to calculate the "Network" equivalent All Individuals 4+ and sub-category audiences.

The procedures described in section 1.3 should be used in full to estimate "Network" equivalent audiences.

Then if:

Area main = Area actual All Individuals 4+ audience estimate

Network main = Specially weighted Network panel All Individuals 4+ audience estimate.

Network sub = Specially weighted Network panel sub category audience estimate.

Then:

$$\text{Factored audience} = \frac{\text{Network sub}}{\text{Network main}} \times \text{Area main.}$$

The factoring itself is a simple concept. The complexity is absorbed in the "Network" rim-weighting which provides control of the factored area universes.

1.5 Combined Audiences

Audiences may be combined to give further audiences. Combined audiences are calculated by adding other final audiences in order to generate a level of consistency.

Because of rounding issues there is a small chance that a derived audience is calculated as slightly less than zero. In these cases audiences should be set to zero.

The conventions for combining audiences are dependent upon reporting requirements and may vary over time. Examples of combined audiences are as follows:

1.5.1 Consolidated Audiences

Consolidated viewing = Live viewing + Timeshift viewing on same day as Live
+ Timeshift viewing days 2-7

28 day Consolidated viewing = Live viewing + Timeshift viewing on same day as Live
+ Timeshift viewing days 2-7
+ Timeshift viewing days 8-28

1.5.2 Platform Variants

Time segment and simulcast programme and commercial audiences will be summed across platform variants for Database 2 reporting. (See 1.3.1.3 for the definition of a platform variant).

1.5.3 Total TV, Total Commercial TV, Other Commercial TV and Other TV

Different reporting panels have different sets of reporting channels. This also means that "Other Commercial TV" and the catch-all "Other" have different definitions in different reporting panels. "Other Commercial TV" and "other" are treated as single channels at the audience accumulation stage.

Total TV and sub-totals are the summation of the itemised channels' audiences.

If other conventions are adopted in non-standard applications (e.g. itemised satellite channel audiences for home ITV areas) then some inconsistency may arise from sub-group factoring and/or guest factoring.

BARB 2010 AP04 shows the channel itemisation for each reporting panel. The BARB Master File (BARB 2010 DSP14) flags channels which are excluded from Commercial TV.

Note that "Other Commercial TV" is not itemised in Database 2 but has to be calculated as a building block for construction of "Total Commercial TV".
At present (from January 2010), in all reporting panels apart from Panels 50 and 72, "Total Commercial TV" is treated as a single channel at the audience accumulation stage, i.e. the above convention is not followed.

1.5.4 Total Screen Time

Total Screen Time will be reported separately in the IBT file and is based on all television set activity at the time of viewing. There will be breakdowns for each activity (e.g. Live, viewing broadcast within the week). For each activity reported, the standard guest factoring and sub-group factoring calculation conventions will be applied. Sub-group factoring will applied within each activity and platform.

1.5.5 Combined Area Audiences (Macro Regions)

Macro regions are combinations of individual ITV areas and are used by ITV, Channel 4, Channel 5 and ITV Breakfast.

The macro region audience is the summation of the audiences calculated for each component ITV area mixing factored and unfactored audiences as appropriate.

If programme start times are different across the component ITV areas, then the Network linking rules apply (see section 1.8.2).

The Channel 4 Network is defined as a macro region for commercial audience reporting.

Appendix C and AP01 gives the definition of all macro regions in terms of their component ITV areas. Note that Panel 39 (Total S4C) is NOT treated as a macro region (for audience calculation Panel 39 is a single panel whose weights are taken from Panels 40 and 48.)

From 1st August 2010, there is a requirement to calculate a version of the Network audiences including the S4C panel boost. These audiences are reported in Panel 49 in Database 2 and are calculated as a macro region of Panels 39 (Total S4C) and 941 (Network excluding Wales).

Network Panel 50 calculation conventions (see section 1.8) apply to Panel 941, in particular treating the panel as a single entity for audience accumulation and factoring. Panel 941 weights and light viewer classifications will be published in Database 1. Panel 941 audiences will not be published in Database 2.

1.6 Universes for Non-Standard Audiences

In cases where a universe is not available or the rim-weighting does not control the reporting panel to the known universe, then a universe may be derived by summing the weights of the category sample. If the category concerned has been factored, then the weights to be summed are those from the specially weighted Network panel.

Macro region universes are the sum of the component ITV area universes.

For component areas where the category universe is unavailable or uncontrolled, then use the sum of weights as above.

All panel members aged 16+ are asked to complete a questionnaire which asks, for example, about their leisure activities, holidays, spending habits and also includes some attitudinal statements.

The Lifestyle Insights universes are approximated by summing the weights of the category sample and calculation conventions for audiences are to guest factor and sub-group factor where applicable.

It should be noted that sums of weights will vary from day to day and that audiences in thousands will tend to be under-estimated because a small percentage of the panel are unclassified. In order to avoid underestimating indexes on other standard categories it is best to work in ratings (see 1.10.6) rather than audiences.

1.7 Channels and Stations

Currently the following channels have regional variants:

BBC1
BBC2
ITV1
ITV1+1
ITV1 HD
Channel 4
Channel 4+1
Channel 5

These variants are identified by station codes and are listed in APO4. A complication is that the level of regional variants is different for different platforms.

For BARB 2010, a different approach has been agreed for ITV area reporting:

ITV areas no longer overlap geographically
All TV homes in an ITV area count to the universe
All regional variants will count as home station viewing for the published databases

In order to provide the necessary functionality for both BBC and ITV area reporting requirements, the construction and interpretation of the station codes held on the panel viewing file are different for BBC1/2 compared to the regional commercial channels.

For BBC1/2, the original station codes are used in the viewing session's records. This allows a full breakdown (when required) of viewing by station within each BBC region.

For the regional commercial channels, the original station codes are held in an unpublished quality control version of the panel viewing file. An alternative version of the station codes are constructed for the published panel viewing file. In the 2010 BARB system, ITV areas are non-overlapping and defined in terms of regional digital satellite delivery. If a home/individual is within a station's net area, then all viewing to the relevant channel is assigned to that station. This provides a straight forward mechanism for reporting total commercial channel audiences by ITV area and allows "net area station" breakdowns by BBC region.

In the case of digital macro station feeds (Channel 4, Channel 4+1 and Channel 5), if a home/individual is within the macro region (i.e. any of the component net ITV areas) then all viewing to the relevant channel is assigned to that macro station.

Channel 5 has four station feeds whose regional delivery currently varies by platform:

STATION DELIVERY	**Channel 5 Macro Regions**			
	London	**North**	**Scotland**	**Other**
Platform				
Analogue Terrestrial	London	North	Scotland	Part-N/W
Digital Terrestrial				
Up to 25/05/2011	Part-N/W	Part-N/W	Part-N/W	Part-N/W
From 26/05/2011	London	North	Scotland	Part-N/W
Analogue Satellite	London	North	Scotland	Part-N/W
Digital Satellite	London	North	Scotland	Part-N/W
Analogue Cable				
Up to 21/07/2010	London	Part-N/W	Part-N/W	Part-N/W
From 22/07/2010	London	North	Scotland	Part-N/W
Digital Cable				
Up to 21/07/2010	London	Part-N/W	Part-N/W	Part-N/W
From 22/07/2010	London	North	Scotland	Part-N/W

Viewing is re-badged to the intended station by platform and region.

Reporting requirements will determine how/when this viewing is used and when it is necessary to treat the separate stations as separate channels in the calculation procedures (i.e. whether to aggregate at the audience accumulation stage or at the audience combination stage).

For ITV1 HD (As of August 2016), the following ITV1 stations are delivered to each ITV1 macro region. (Refer to BARB AP04 document for up to date station delivery)

Macro Region	**ITV1 Feed (HD Station Code)**
London	London (1407)
South East	Meridian Sussex (1408), Anglia East (1413)
Mid-West	Central West (1409), Wales (1412)
North	Granada (1410), Emily Moor (1414), Tyne Tees (1415)
Scotland	Granada (1410), Glasgow (1411)

Stations delivered vary by platform and region. ITV1 HD viewing is rebadged to the intended station by platform and region. Note from October 2012 Ulster will begin delivering ITV1 HD on the DTT platform only.

In Database 2, ITV1 HD and ITV Breakfast HD are reported as channels in their own right and separate to ITV1 and ITV Breakfast. In all individual ITV areas, only the home station audience is reported (i.e. excluding London 1407 except in the London area).

For macro regions which exclude London, the audiences are straight forward summations of the reported component ITV area home station audiences.

For macro regions which include London, the London 1407 only audience in each component ITV area also qualifies. These out of area London audiences are not reported in Database 2 but are identified in the viewing records in Database 1. They must be calculated completely (including factoring routines) as additional, separate audiences in the individual component ITV areas, prior to macro region summation.

Channel 4 SD/HD is reported as a single channel in Database 2. Channel 4 HD carries the Channel 4 London station feed everywhere. Channel 4 HD is not rebadged.

Channel 4 HD must be excluded from home station commercial audiences outside London. Therefore Channel 4 HD has its own station code in Database 1 and is always treated as a separate channel (building block) for audience calculation purposes, aggregation takes place at the audience combination stage.

Channel 5 HD is reported as a single channel in Database 1. Channel 5 HD caries the Channel 5 Part-Network station feed everywhere. Channel 5 HD is not rebadged. Channel 5 HD is always treated as a separate channel (building blocks) for audience calculation purposes.

BBC1 HD carries the London feed in all BBC regions. It is not reported as a separate channel on Database 2, instead it is combined with BBC1 London SD at the audience accumulation stage. BBC1 HD is not rebadged.

When reporting BBC1 London in BBC regions then HD and SD will be combined before factoring and when reporting BBC1 in ITV regions, all BBC1 stations and BBC1 HD will be combined before factoring.

For ITV1+1 (from January 2011), the stations delivered vary by platform and region. ITV1+1 viewing is rebadged to the intended station by platform and region.

In Database 2, ITV1+1 and ITV Breakfast +1 are reported as channels in their own right and separate to ITV1 and ITV Breakfast. In all individual ITV areas, only the home station audience is reported (similar to ITV1 HD).

For macro regions there will be fragments of viewing which do not qualify for individual ITV area reporting but do qualify for macro regions. These out of area audiences are not reported in Database 2 but are identified in the viewing records in Database 1. They must be calculated completely (including factoring routines) as additional, separate audiences in the individual component ITV areas, prior to macro region summation.

For ITV area reporting of BBC programme audiences, the programme log of the largest available BBC station will be used. The programme audiences will include viewing to all BBC stations even if carrying a different programme. The current allocation of BBC stations to ITV areas is:

ITV Area	**Largest BBC Station**
London	London
Midlands	Midlands West
North West	North West
Yorkshire	Yorks. and Lincs.
North East	NE and Cumbria
Scotland	Scotland
South East and SE	South
East	East
South West	South West
Ulster	Ulster
Border	NE and Cumbria
West	West
Wales	Wales

1.7.1 Reporting of HD Channels

The default methodology is to treat SD/HD as a single channel for all aspects of audience calculation i.e. factoring. This will apply irrespective of whether or not they are reported as separate channels on DB1 e.g. ITV2 HD. (see BARB 2010 AP19)

BBC1 HD is reporting in Northern Ireland, Wales and Scotland, which will mean all viewing, will be combined with their regional SD station at the audience accumulation stage before factoring. The remaining HD viewing will carry the London feed and will be assigned to the BBC1 SD London station at the audience accumulation stage before factoring.

BBC has launched BBC2 HD, which will carry the London feed in all BBC regions. It will not be reported as a separate channel on Database 2, instead it is combined with BBC2 London SD at the audience accumulation stage. BBC2 HD is not rebadged.

There are however special cases where Database 2 reporting, requires HD to be reported separately or left out of some audiences. Such cases are Channel 4 and ITV1 which treats their SD and HD elements as separate channels for all aspects of calculation methodology.

Currently Channel 5 HD is not reported separately but is treated as a separate channel for all aspects of calculation methodology.

1.8 Network Panel 50 Reporting

Impacts by Time (IBTs) and programme audiences are reported on the basis of the Network Panel 50 for all itemised BARB channels. Reporting requirements determine which commercial audiences are reported against Panel 50.

This is straight forward for channels without regional variants – all viewing by all reporting panel members in Panel 50 is pooled at the audience accumulation stage, prior to guest factoring.

For channels with regional variants, the building blocks for Network audience estimates are audiences to the individual regional stations (even for networked programmes). The reporting panel for every station is Panel 50, accumulating viewing to the station by all panel members irrespective of their geographical location (note that geographical edits have already been applied in the construction of regional commercial station codes, see section 1.7). Platform variants (see section 1.3.1.3) are treated as separate stations at this stage. Station by station audiences are then summed to generate Network audiences. Guest factoring is applied before the station by station audiences are combined.

For BBC1, all BBC1 HD viewing is combined with the BBC1 London station at the audience accumulation stage, i.e. before guest factoring, which will also be before the station by station audiences are combined.

Note that regional audience estimates do not exactly sum to Network audience estimates.

1.8.1 Partially Networked Programmes

For programmes which are partially Networked, only audiences for the qualifying stations are accumulated. For ITV and BBC, in these cases there is a need to calculate Total TV for the same time slot so that programme share can be calculated.

Based upon Total TV (Total Commercial TV) across the Network, audience share figures will be low. In order to produce a second, more meaningful share figure, the

components of the Total TV audience must be forced to represent the same set of stations. This is achieved by following the Network calculation methodology for every channel but only accumulating the viewing of panel members in the ITV or BBC areas in which the programme was broadcast. Note that ITV area geography and panel membership are consistent in the 2010 net area scenario. Panel members who are not in the ITV or BBC areas in which the programme was shown are still in the analysis base, with their Panel 50 weights, but are counted as nil viewers. For ITV this exclusion rule is exact because all ITV viewing in an ITV area has been rebadged to the home station. For BBC the exclusion rule is an approximation because there is out of area viewing.

All programmes will be reported in the Network Panel 50 part of Database 2, even if they are only broadcast on one station. For certain publication purposes (e.g. top programmes), there is a requirement that a programme must be broadcast on at least 9 of the main stations.

1.8.2 Linked Network Programmes

BBC regional programmes will be linked to create network programme records where the transmissions on the same channel have the same programme description, start within rounded 10 minutes of the key start time and end within the rounded 10 minutes of the key end time. The key start time, end time and programme duration is that which occurred in the majority of the 14 main BBC regions. If no majority of regions apply then the key start time and duration is that of the largest region within the tied groupings. The hierarchy of BBC regions is:

London
North West
Midlands West
Yorkshire and Lincolnshire
South
East
North East and Cumbria
West
Midlands East
South East
South West
Scotland
Wales
Northern Ireland

Audiences to linked network programmes will be the sum of the station audiences to that programme in the regions where it has been linked.

Total TV audiences must be calculated for the staggered time slots appropriate for each station and then summed.

Linked regional ITV programmes are flagged in the programme logs and all have exactly the same start time and duration.

1.8.3 Platform Variants

Programme Audiences will be summed across platform variants (see section 1.3.1.3) as long as they satisfy the network linking rules. Remaining fragments may be linked with each other or reported separately.

Time segment audiences (IBTs) will always be summed across platform variants for Database 2 reporting.

1.8.4 Regional Reporting of Network Audiences

For Network programmes, ITV regional audiences can be calculated by using BBC (Panel 50) weights within the ITV geographical regions. This would ensure consistency throughout (e.g. programme share within a common BBC/ITV region like Wales, regional programming audiences accumulating to Network).

These ITV area audience estimates can only be calculated using Database 1 as Database 2 would require additional components that would unnecessarily increase the file size disproportionate to the use.

1.9 BBC Area Reporting

The Database 2 files report the viewing of individuals living within a BBC region's geographical boundary.

The building blocks for audience calculation are minute results for each combination of:

BBC area * station * platform variant

for all channels. When guest factoring applies, BBC area audiences will not sum exactly to Network audiences.

1.9.1 Programme Audiences

Within BBC areas, for BBC1, BBC2 and ITV, Database 2 reports home station and out of area programme audiences separately. Within this, simulcast programmes are consolidated across platform variants (see section 1.3.1.3). Otherwise the separate platform fragments are reported as separate programme audiences.

For other channels, Database 2 reports programme audiences consolidated across platforms and stations on which programmes are simulcast.

For the calculation of programme share, Total TV will include the viewing to all home and out of area stations and all platform variants.

1.9.2 Time Segments (IBTs)

Within BBC areas Database 2 reports:

Home station audiences to BBC1 and BBC2.
Total audiences to BBC1 (except Ulster), BBC2 (except Ulster), ITV, Channel 4, Channel 4+1, Channel 5, S4C (Wales only) and "Other", all across all variants and platforms. The summation, Total TV, provides the basis for the calculation of share for both home station and total audiences.

1.9.3 BBC Sub-Regions

BBC sub-region audiences are calculated from Database 1 as a demographic breakdown.

1.10 Time Period and Transmission Audiences

Time-period and transmission audiences will be calculated for a range of categories and viewing activities (live viewing, consolidated viewing etc.) Audiences will be reported as hundreds viewing, rounded.

1.10.1 Time Segment Audiences (IBTs)

Audiences for time segments (e.g. clock quarter hours, 5 minutes) are the average of the one-minute audiences in that time segment.

1.10.2 Programme Audiences

Programme audiences are calculated by averaging the audiences of all minutes covered by the programme transmission, from the start-time of the programme until the end time of the programme, but excluding any commercial breaks or promotions (interval events) which are partially or wholly transmitted between the programme start and end time. The transmission logs will identify these intervals. To determine whether the minutes at the start and end of the programme segments are included in the programme audience, the times are rounded to the nearest whole minute. Seconds 0-29 are rounded down, and seconds 30-59 are rounded up to the next minute.

For programmes with a duration of 60 seconds or less, in some cases the rounding procedure leads to no minutes being allocated to the programme. In such cases, the start minute, before rounding, is allocated to the programme.

Some additional clarifications are as follows:

- Contiguous intervals (ending then starting in consecutive seconds) must be merged into a single interval for the purpose of identifying programme segments.

- A BARB audience minute runs from 0 to 59 seconds. For example:

  10:25 means 10:25:00 to 10:25:59

- Because an end time of 10:25 implies 10:25:59 rather than 10:25:00 it is necessary to subtract one minute when calculating rounded end times.

- There can be minutes which are allocated to neither programmes nor intervals.

- The programme minutes field in the Daily Programmes Data file is the number of BARB minutes allocated to the programme for calculation of the average audience.

- The Daily Programme and Interval Events Transmission Data gives the programme start and end times and embedded interval start and end times in hours:minutes:seconds.

Programme segments are calculated by determining which minutes are excluded from the Programme.

Any interval events occurring partially or wholly between the programme start and end times will be grouped together (the contiguous interval rule) as long as there are no gaps longer than 5 seconds between them. The start time of the first event and the end time of the last event from this block of contiguous events will be used to define which minutes are excluded from the programme. A minute is to be excluded if an interval event (or the block of contiguous intervals) crosses the 30th second, so any minute including an interval event (or the block of contiguous intervals) which starts before and including the 30th second and ends after and including the 30th second will be excluded from the programme.

The following example illustrates the programme minute allocation rules for a programme with two segments:

	Transmission Data		**Rounded Minutes**	
	Start	End	Programme Minutes	Excluded from Programme Minutes
Programme	10:25:29	10:40:30	10:25-10:40	
Break Event 1	10:30:30	10:30:59		10:30
Break Event 2	10:31:00	10:32:50		10:31-10:32
Break Event 3	10:32:51	10:35:31		10:33-10:35
Interval Duration				**6**
Programme Minutes			**10**	

A “contiguous intervals” rule (May 2011) exists to remove the possibility of gaps between event log files causing phantom minutes to be included as programme minutes.

Events will be grouped together as long as no gaps are longer than 5 seconds. The start time of the first event and the end time of the last event from this block of contiguous events will be used to define which minutes are excluded from the programme.

The following examples illustrate the allocation of BARB minutes for very short programmes:

	Transmission Data	Rounded Minutes	Final Attribution
Programme Start	10:25:29	10:25	10:25
Programme End	10:25:29	10:24	10:25
Duration	0:01	0	1
Programme Start	10:25:29	10:25	10:25
Programme End	10:25:30	10:25	10:25
Duration	0:02	1	1
Programme Start	10:25:29	10:25	10:25
Programme End	10:26:29	10:25	10:25
Duration	1:01	1	1
Programme Start	10:25:29	10:25	10:25
Programme End	10:26:30	10:26	10:26
Duration	1:02	2	2
Programme Start	10:25:30	10:26	10:25
Programme End	10:25:30	10:25	10:25
Duration	0:01	0	1
Programme Start	10:25:30	10:26	10:25
Programme End	10:26:29	10:25	10:25
Duration	1:00	0	1
Programme Start	10:25:30	10:26	10:26
Programme End	10:26:30	10:26	10:26
Duration	1:01	1	1

1.10.3 Commercial Spot Audiences

The audience for a commercial transmission is the audience for the minute in which the commercial starts.

1.10.4 Commercial Break Audiences

Commercial break audiences are calculated as the average audience of the minutes covered by the break, weighted according to the proportion of each minute included in the break. The break start time and duration used is that derived from the commercial spot log (provided by the broadcaster).

1.10.5 Commercial Sponsorship Audiences

Calculation of commercial sponsorship/promotion audiences should be treated the same as programmes, given that these sponsorship spots are attached to programmes. Standard factoring conventions are applied.

1.10.6 Commercial Audience Factoring (Part Areas)

There are special cases where TV Companies transmit on a split-area basis for a limited number of commercials, for example on the Grampian or Central Scotland transmitters in Scotland. In these cases commercial audiences will be calculated by applying a factor to the total area commercial audiences. There will be only one factor per sub-area, based upon the relative homes universe.

1.10.7 TVR Calculation

TV Ratings may be calculated for minute results, time period, programme or commercial audiences. TVR's are calculated by applying the following formula:

$$\text{CATEGORY TVR} = \frac{\text{CATEGORY AUDIENCE} * 100}{\text{CATEGORY UNIVERSE}}$$

See section 1.6 for categories where a universe is not available or the rim-weighting does not control the reporting panel to the known universe. In these cases a warning should be added to the effect that "Universes are not controlled to the Establishment Survey Estimates".

1.10.8 Staggercast Channel Share

In the staggercast scenario a minute of content is broadcast as follows:

Minute m on the parent channel
Minute m + x on the parent + x channel
Minute m + y on the parent + y channel

Typically x is 60 minutes (1 hour) and there is only one staggercast channel.

For BARB reporting, these channels are all treated as separate entities reported chronologically. In this respect they have Live, VOSDAL and Consolidated audiences in Database 2.

From time to time, users require an aggregated staggercast audience and this is straightforward from Database1 or Database 2. There may also be a requirement to assess this aggregated staggercast audience against all other channels viewing, whether standard or aggregated staggercast, e.g. channel share. This requires the calculation of a meaningful "Total TV" figure for each parent channel broadcast minute m.

One approach is to substitute the minute m audience, for staggercast channels, with the minute m + x or m + y audiences. Since the minute m + x or m + y audiences are only different at a second order level in the context of Total TV, BARB's agreed methodology is to use the existing, published Channel 90 Total TV audiences.

1.10.9 Targeted Advertisements

Target Advertisements (e.g. Adsmart) are specific commercials that are delivered to households based on their known geodemographic characteristics and stored within the STB. On participating channels these commercials will replace standard linear commercials when prompted by the STB and any minutes where a targeted advert has been broadcast will be flagged in the panel viewing file.

These Target Advertisements spot audiences are reported separately in the 1 minute IBT files from the linear spot audiences.

The following table illustrates how a spot/minute will be measured and reported:

	Minute 1		
Spot	**Spot 1**	**Spot 2**	**Spot 3**
Total Audience	**100**	**100**	**100**
Linear Audience	80	80	80
Targeted Ad Audience	20	20	20
Targeted Ad Flag	**Y**	**N**	**N**
Linear Impacts Reported	80	100	100
Targeted Ad Impacts	20	-	-

In minute 1 linear broadcast spot 1 is substituted with the target advert in some homes, but the linear broadcast spots 2 and 3 are shown in all homes and are reported with the full channel audience.

Calculation conventions will be to guest factor and subgroup factor each targeted advertisement and linear spot viewing separately before accumulating to get a total spot audience. The guest factoring will retain consistency, as the factors are calculated using the same fixed proportions from the reporting sums of weights. In

order to maintain consistency the minute sub-group factor for the combined audience is applied to both the linear and Target Advertisement elements.

1.11 Non Linear Programme Audience

As is the case with linear programme audience, the non-linear programme audiences are calculated by averaging the audiences of all minutes covered by the programme transmission. Standard guest factoring and sub-group factoring calculation conventions should be applied with this content being treated as a separate activity type. The non-linear programme durations used to calculate average programme audiences are provided by broadcasters via the content ID masterfile.

Audiences can be accumulated across any reporting period in which the content is made available and all daily programme audiences should be calculated independently before accumulation.

1.11.1 Combining Linear and Non-Linear Programme Audiences

Linking Non-linear viewing content to linear broadcasts of the programme is possible via the broadcast content ID (BCID). This allows content that is shown via an on-demand player to be matched with any linear broadcasts of the content. Content that is solely shown via on-demand (i.e. non-broadcast) can be grouped together in the same way using the BCID.

Multiple versions of the same non-linear programme content (e.g. sign language version) shown by broadcasters, which have differing BCID can be linked together using the 'Parent BCID'.

Total average programme audiences are calculated by combining total audiences for each repeated Linear and non-linear programme content and dividing by the average programme duration. Each of the programme durations are derived separately and can differ from other linear programmes showing the same content. The programme duration non-linear programme content is published in the content ID masterfile.

1.12 Calculation of a Rating Over Time

An audience to a number of events (programme, quarter hour or time segment) may be expressed as:

- The average of the event audiences in thousands
  or
- The average of the event TVRs

In either case the calculation procedure should be duration-weighted in the same manner as that used to calculate, for example, the audience to a programme i.e. the

sum of audiences to all minutes in the programme, divided by the number of minutes in the programme.

Example:	Audience (000's)	Duration (mins)
Programme 1.	27,865	29
Programme 2.	13,428	31
Programme 3.	17,249	33
Programme 4.	10,145	28

Average audience is:

(27,865*29)+(13,428*31)+(17,249*33)+(10,145*28) = 2,007,630/121
= 17,170 thousands

In order to convert this audience to a duration-weighted TVR, then a similar procedure should be followed in weighting the universe component in order to reflect any changes in universe over time.

	Universe (000's)	Duration (mins)
Universe applicable to Programme 1.	53,204	29
Universe applicable to Programme 2.	53,204	31
Universe applicable to Programme 3.	53,598	33
Universe applicable to Programme 4.	53,598	28

Average universe is:

(53,204*29)+(53,204*31)+(53,598*33)+(53,598*28) = 6,461,718/121
= 53,403 thousands

Therefore the duration-weighted TVR is 17,170/53,403 = 32.2.

Note: In the case of common-length events, such as quarter hours, then no duration-weighting is necessary.

1.13 Reach

1.13.1 Reach Viewing Qualification

An individual is a Reach viewer if they are viewing the same channel/station/platform for at least 3 consecutive minutes, which can be across days and activity type within a defined time period. With respect to activity this will mean Live and Timeshifted sessions will have to be amalgamated as reach may be split across activity (e.g. 2 minutes live, pause for 10 minutes, then 1 minute VOSDAL). Depending upon the reporting requirement, it may be necessary to recognise that 3 consecutive minutes can be achieved even if they span two stations

or platforms. Late reporters (i.e. those homes who weren't included in the viewing sample but where viewing records exist) should always be included in reach analysis, especially for reach greater than 1 day. Daily reach will be affected only to the extent that any late timeshift data should be included.

1.13.2 Calculating reach Audiences

The Reach audience is calculated by summing the weights of the Reach viewers (not including guest viewers).

1.13.3 Reach Over More than One Reporting Day

Reach may be calculated for a period of more than 1 day (e.g. average weekly reach). In this case the sample definition, demographics, weights and universes to be used are those for the middle day of the periods involved. Reach is accepted when viewing for 3 continuous minutes crosses the day boundary.

Individuals in homes not in the sample on the middle day are excluded from the analysis. However, viewing is taken for late reporters up to seven days after. The weight to be used when accumulating the Reach audience is always that of the middle day, irrespective of the day on which the viewing took place.

The middle day is defined as:-

$$\frac{\text{NUMBER OF DAYS}}{2}$$

rounded up.

BARB days are defined to run from 06:00 to 29:59. Count all days which contribute to the whole or part of the reach period. In this respect, time-shift viewing is allocated to the original broadcast day for consolidation.

1.13.4 NBD Adjustment for Weekly Reach/Extended Reach

An adjustment (NBD) factor is applied in order to account for potential non-response for reach greater than 1 day and also to enable reach for an extended long term period over 1 week to be calculated. (Full details of this procedure is available in Appendix D)

1.13.5 Reach Percentage

Where Reach Percentage is required this should be calculated as in 1.10.6 above.

Reach over long periods of time is estimated by a protocol which can be made available.

1.14 Reach and Frequency Calculations

1.14.1 Introduction

The recommended methodology for calculation of cover and frequency analysis has the following objectives:

- To incorporate the requirement for demographic weighting of the sample base.
- To incorporate guest viewing into cover and frequency analysis and to generate consistency with published ratings.
- To use a more representative sample base which does not suffer from any detrimental effects of panel turnover.
- To incorporate the sub-group factoring principle for small sample panels.

To summarise the methodology:-

- A cover and frequency analysis is run with a sample base equal to those panel members reporting on either the first or middle calendar day of the schedule. The middle day is defined in Section 1.12.3. Non-response on other days is ignored - if a first (or middle) day reporter does not report on another day, then they are assumed to be a nil viewer on that other day.
- This analysis will underestimate TVRs and reach, particularly TVRs for those spots towards the end (tails) of the schedule. A probability model is used to scale up the results to the levels of the "published" TVRs, or to TVRs calculated to a similar standard to the "published" TVRs.
- In addition to correcting deficiencies in the "raw" cover and frequency analysis, the probability model will also incorporate guest viewing into the cover and frequency analysis. The basic assumption is that guest viewing is a surrogate measurement of panel members' out-of-home viewing. A probability model is required to maintain the correct cover-frequency relationship whilst scaling-up.
- For single area analyses where sub-group factoring applies, the specially weighted Network panel is used to construct the raw reach and frequency analysis (see Section 1.13.7).
- It is recommended that single-precision floating point arithmetic is used throughout. (Note: the examples in Appendix E do not reflect this level of accuracy). If fixed point calculation is used, then at least 5 decimal places should be retained.

1.14.2 The "First (or Middle) Day" Cover and Frequency Analysis

The sample base for this analysis is all those individuals reporting on the first (or middle) day of the schedule. (If the schedule spans an even number of days, then the convention is to use the latter of the two middle days). The base day chosen for the analysis should be shown on all cover and frequency output. The reporting sample on the first (or middle) day is all those individuals with a processing weight for that day but excluding guests.

For most applications, the recommendation is to use the middle day sample. However, it is recognised that some users will want to use a consistent sample base when they are re-analysing a schedule as it builds over time.

If a first (or middle) day reporter does not report on another day in the schedule, then they are assumed to be a nil viewer for that day. Note that for all other days in the schedule apart from the first (or middle) day, the viewing of late reporters should be included. Late reporters are in those homes from which data is not collected in time for their inclusion in basic reports or Database 2. (These individuals will not have processing weights for the days on which they were late reporters).

For each individual in the sample base, the number of spots viewed in the schedule (or pre-defined segment of the schedule) is counted. By applying the processing weights for the first (or middle) day, these counts are used to generate the "raw" weighted frequency distribution, i.e. the weighted numbers of individuals viewing 0, 1, 2, 3, 4, etc. spots in the schedule:-

Thousands viewing 0 spots	=	Sum of first (or middle) day weights of panel members viewing 0 spots.
Thousands viewing 1 spot	=	Sum of first (middle) day weights of panel members viewing 1 spot.

etc.

$$\text{"Raw" Total TVRs} = \frac{\text{Thousands viewing 1 spot} + 2 * \text{Thousands viewing 2 spots} + ...}{\text{Sum of weights of first (middle) day reporters}}$$

1.14.3 Fitting the Probability Model

The Negative Binomial Distribution (NBD) is fitted to the "raw" weighted frequency distribution. The NBD is a two parameter mathematical function which accurately models the complete frequency distribution of the schedule:-

$$\text{Proportion viewing i spots} = \frac{\Gamma(k+i)}{\Gamma(k)\Gamma(i+1)} \times \left(\frac{1}{1+a}\right)^{k} \times \left(\frac{a}{1+a}\right)^{i}$$

This can be expressed more simply for computational purposes:-

(1) $$\text{Proportion viewing 0 spots} = \left(\frac{1}{1+a}\right)^{k}$$

(2) $$\text{Proportion viewing i spots} = \left(\frac{k+i-1}{i}\right) \times \left(\frac{a}{1+a}\right) \times \text{Proportion viewing i-1 spots}$$

"k" and "a" are the two parameters which are estimated from the "raw cover and frequency analysis as follows:-

P_0 = Proportion viewing 0 spots

T = Total TVR's for schedule (or defined segment)

C = $$\frac{T}{100 \times \ell n(P_0)}$$

Note:- "ℓn" denotes the natural logarithm.

(3) a = $-c \times \ell n\,(1 + a)$

(4) k = T/a

There are a variety of iterative techniques which can be used to solve equation (3). One particular technique is incorporated into the algorithm in Appendix C.

Having calculated "a" and "k", the modelled frequency distribution is calculated using equations (1) and (2) and compared with the actual frequency and distribution:-

Difference Proportion Viewing *i* Spots	in =	Actual Proportion Viewing *i* Spots	–	Modelled Proportion Viewing *i* Spots

These differences are retained for final adjustment of the "scaled-up" frequency distribution (see 1.13.5).

The algorithm in Appendix E also caters for those special cases which cause the basic model to fail mathematically.

(i) P_0 = 0 (i.e. 1+cover = 100%)

(ii) P_0 = 1 (i.e. 1+cover = 0%)

(iii) Any frequency = 1 (i.e. everybody views *i* spots)

(iv) Single spot schedule

(v) "c" $\geq$ -1

(i) is dealt with by fitting the NBD to the remainder of the distribution, i.e. as if the proportion viewing *i* spots was actually the proportion viewing *i*-1 spots.

(Note: T = Total TVRs – 100.)

(ii) and (iii) are dealt with by not fitting the model but as a special case in the "scaling-up" (1.10.5).

(iv) and (v) are dealt with by using the Poisson distribution rather than the NBD:-

Proportion viewing *i* spots = $\frac{\lambda^i e^{-\lambda}}{i!}$

This also can be expressed more simply for computational purposes:-

Proportion viewing 0 Spots = $e^{-\lambda}$

Proportion viewing i Spots = $\frac{\lambda}{i} \times \text{Proportion viewing i-1 spots}$

The single parameter "λ" is estimated from the "raw" cover and frequency analysis as follows:-

$\lambda = \frac{\text{Total TVRs for schedule (or defined segment).}}{100}$

1.14.4 Calculation of "Published" TVRs

Having calculated and modelled the "raw" cover and frequency analysis, the next step is to generate the best estimate of the TVR for each spot.

For evaluation of schedules where the spots are in Database II and the demographic group is in – or is derivable from – Database II, then the best audience estimates are those from Database II. Otherwise the audience estimate must be calculated from Database I.

Unlike the "raw" cover and frequency analysis (1.13.3), the sample base for the calculation of "published" TVRs is the complete reporting sample for the day on which the spot was transmitted (i.e. all individuals with a processing weight for the day of transmission).

1.14.5 Scaling-up to "Published" TVRs

Having established the best estimates of the spot TVRs for the schedule and calculated the parameters of the model for the "raw" cover and frequency analysis, the latter must be scaled-up. Note that because the published TVRs include guest viewing, the scaling-up is incorporating guests into the cover and frequency analysis as well as compensating for the deficiencies in the "raw" cover and frequency analysis.

The principle is that the scaled-up frequency distribution also follows a Negative Binomial Distribution, but with a scaled-up value for the parameter "a" = A.

$$A = \text{a} \times \frac{\text{Total TVRs (best estimates)}}{\text{Total TVRs (raw cover and frequency)}}$$

Then the scaled-up frequency distribution is calculated as follows:-

$$\textit{Proportion viewing 0 Spots} = \left(\frac{1}{1+A}\right)^{k}$$

$$\textit{Proportion viewing } i \textit{ spots} = \left(\frac{k+i-1}{i}\right) \times \left(\frac{A}{1+A}\right) \times \text{Proportion viewing i - 1 spots}$$

Then, using the differences calculated in 1.13.3:-

Adjusted Proportion Viewing *i* Spots	=	Proportion Viewing *i* Spots	+	Difference in Proportion Viewing *i* Spots

The procedures for the special cases identified in 1.13.3 are as follows:-

(i) P_0 = 0 (i.e. 1+cover = 100%)

The model is scaled-up to the best estimates of the TVRs as follows:-

$$A = a \times \frac{\text{Total TVRs (best estimates)} - 100}{\text{Total TVRs (raw cover and frequency)} - 100}$$

Then the scaled-up frequency distribution is calculated as follows:-

Proportion viewing 0 Spots = 0

Proportion viewing 1 Spot = $\left(\frac{1}{1+A}\right)^k$

Proportion viewing i spots = $\left(\frac{k+i-2}{i-1}\right) \times \left(\frac{A}{1+A}\right) \times \text{Proportion viewing i - 1 spots}$

Adjusted Proportion Viewing *i* Spots = Proportion Viewing *i* Spots + Difference in Proportion Viewing *i* Spots

(ii) P_0 = 1 or (iii) Any frequency = 1

If the proportion viewing *i* spots = 1

Calculate:-

$$x = \frac{\text{Total TVRs (best estimate)} - \text{Total TVRs (raw coverage and frequency)}}{100}$$

The scaled-up frequency distribution is:-

Proportion Viewing *i* Spots = 1 - abs (*x*)

If *x*< 0, then proportion viewing i – 1 spots = abs (*x*)

If *x* >0, then proportion viewing i + 1 spots = *x*

All other frequencies are zero.

No further adjustment is required.

(Note: abs (*x*) denotes the absolute value of x)

(iv) Single spot schedule or (v) "c" ≥ -1

$$\wedge = \lambda \times \frac{Total\ \text{TVRs (best estimate)}}{\text{Total TVRs (raw cover and frequency)}}$$

Then the scaled frequency distribution is calculated as follows:-

Proportion viewing 0 spots = $e^{-\wedge}$

Proportion viewing i spots = $\left(\frac{\wedge}{i}\right)$ Proportion viewing i-1 spots

Adjusted Proportion Viewing *i* Spots	=	Proportion Viewing *i* Spots	+	Difference in Proportion Viewing *i* Spots

1.14.6 Unique Spot Cover and Frequency Build

Unique spot cover is defined to be the decrease in 1+ cover when a single spot is removed from a schedule. This is normally calculated for every spot in a schedule.

Frequency build analysis is the frequency distribution after 1, 2, 3, 4 etc. spots in a schedule. In particular, the frequency build is used to calculate the incremental coverage from sequentially adding spots to the schedule.

In each case, the requirement is to identify a subset of the schedule.

At this level of detail, scaling up the "raw" cover and frequency distribution to published TVRs may generate the following inconsistencies:-

- Negative unique spot cover
- Negative increment in cover build
- Unique spot cover greater than increment in build

Whilst procedures can be applied to force consistency, this degree of sophistication is considered unnecessary for such statistics.

Therefore it is recommended that these statistics are always based upon the "raw" cover and frequency analysis - i.e. without scaling-up. The result is that both will tend to be over-estimated and more so at the beginning (or middle) of the schedule, but that this is an acceptable compromise for these ancillary statistics. A sample pro-forma for the output is:-

----------NBD----------				----------Panellists Only----------				
TVR Frequency Distribution				Unique TVR	Cum Contr.	Frequency Build	Distribution	
Spot 1:	12.1	1+	82.3	12.0	0.0	12.0	1+	80.5
Spot 2:	5.0*	2+	79.1	5.0	0.1	16.3	2+	78.2
Spot 3:	11.4	3+	72.0	11.5	1.2	20.7	3+	70.4
etc.								

Base day for analysis: 5th June 2010
Consolidated spot TVRs
Time-shift viewing included in Reach
* = Non-Gold Standard TVRs

1.14.7 Sub-Group Factoring

For ITV area analyses where sub-group factoring applies (see section 1.4) the specially weighted Network sample (see section 1.2) must be used to construct the raw reach and frequency analysis for all sub-groups. The area sample issued for All Individuals only. Application of the large Network sample provides a robust analysis of the detail of the schedule frequency distribution. The NBD probability model is then applied in the usual way to scale the analysis to the published gold standard single area ratings.

In constructing the raw reach and frequency analysis, it must be assumed that the single area spots are broadcast simultaneously across the whole Network. The fact that these particular minutes will fall within programmes in some parts of the Network is ignored.

1.14.8 Part Areas

If the objective is to calculate a reach and frequency analysis for, say, a Grampian only schedule, the methodology is straightforward. The whole Scotland panel is used, assuming that everyone who views the minute also sees the commercial. This gives a whole Scotland reach and frequency analysis in terms of percentages. These percentages then hold for the Grampian part area population. (Remember that for part areas, it is assumed that the minute ratings are the same in each area as the whole area.)

The more important application is a reach and frequency analysis of a whole area schedule which includes part area spots. It is necessary to consider the following two schedules separately:

(i) The spots shown across the whole of Scotland plus those shown in Grampian only.

(ii) The spots shown across the whole of Scotland plus those shown in Central Scotland only.

The full reach and frequency methodology is applied separately to each schedule. The first gives an analysis in percentages which applies to the Grampian part area population. The second gives an analysis in percentages which applies to the Central Scotland population. All the results in thousands can then be added to create a whole area analysis, which can of course be converted to percentages.

Part area spots that are included in Network campaigns are treated as full area spots when calculating the raw reach and frequency using Network weights throughout. This reach and frequency is then adjusted as usual using the methods detailed in 1.13.3 to 1.13.6. This will then naturally adjust the distribution to account for part area delivery.

1.14.9 Macro Regions

Macro regions are defined in terms of combinations of whole ITV areas. In order to construct a macro region reach and frequency analysis, it is first necessary to construct a separate reach and frequency analysis for each component ITV area. The ITV area results, in thousands, are simply summed to generate the macro region results.

However, care must be taken in constructing the output; the total number of spots is the summation of the number of spots “networked” across the macro region and the numbers of spots shown only in subsets of the macro region.

For example, the ITV North macro region combines North West, Yorkshire, North East and Border. If there were:

10 spots “networked” across the macro
10 spots shown simultaneously in North West and Border
10 spots shown in Yorkshire only
10 spots shown in North East only

then the number of spots in the macro region would be 40.

1.14.10 Mixed Network/ITV Area/S4C Schedules

For the 2010 BARB contract, satellite channel commercial spot audiences are reported against the Network Panel 50. Therefore pre 2010 calculation procedures relating to the multi-channel sub-universe are no longer necessary. However, there is still a need to create consistent reach and frequency analysis across spots reported against Panel 50 (e.g. satellite channels, Channel 5 network, Channel 5 part-network) and those reported against ITV areas (e.g. ITV, Channel 4, Channel 5 regional, Channel 4+1, ITV Breakfast and S4C).

(Note: although S4C geography is now identical to ITV Wales geography, S4C spot audiences are based upon the boosted and separately weighted S4C panel).

In all cases the BARB gold standard methodology is used to calculate "published" audiences. For the calculation of reach and frequency the following conventions also apply:

(i) Wales; S4C spots only:

Use S4C Panel 39 and S4C weights for the "raw" reach and frequency analysis.

(ii) Wales; S4C and other channels:

Use ITV Wales Panel 37 and ITV weights for the "raw" reach and frequency analysis.

(iii) Network; regional spots only:

Use macro region methodology (Section 1.13.9).

(iv) Network; network and/or Channel 5 part-network spots only:

Use network Panel 50 and network weights for the "raw" reach and frequency analysis.

(v) Network; network and regional spots:

Use network Panel 50 and network weights for the "raw" reach and frequency analysis.

(vi) Network; network and Part Area regional spots:

Use network Panel 50 and network weights for the "raw" reach and frequency analysis. Adjust the reach and frequency to published TVRS for the schedule, where the TVRs for the part area spots are adjusted by STI factors.

1.14.11 Regional Reporting of Commercial Impacts

In terms of regional commercial audiences the methodology is based on calculating the "real" regional audiences. Campaigns that are regional (e.g. ITV), use the ITV weights and the protocols for reach and frequency calculations (e.g. NBD adjustment). For network campaigns the methodology for calculating the regional breakdowns should also use the ITV weights.

The benefits of using ITV weights directly to calculate the ITV area audience estimates mean that these audiences will be controlled to the monthly universes for the following:

- ITV area Universe
- Key demographic control by ITV area
- P72 (Cable/Satellite) control by ITV area

Within each ITV area the current reach and frequency protocols would be applied; for a campaign this would entail calculating overall audiences for the demographic target audience for each ITV area to be used to adjust the raw reach and frequency.

Using ITV weights will bring levels of inconsistency with results at the Network level but this will be minimal.

APPENDIX A - RIM-WEIGHTING CONFIGURATIONS AND REPORTING CATEGORY CONTROL

This section gives details of the control of reporting categories within the Network and BBC Regions rim weighting schemes. The rim-weighting scheme is constantly evolving and controls for both categories and other behavioural controls. As an illustration to see the level of control the following table details the status of Reporting Categories controlled in Network and BBC Regions as of May 2016:

	Network	Digital Satellite and Cable Homes	East of England	West	South West	South	Yorkshire and Lincolnshire	North East and Cumbria	North West	Scotland	Ulster	Wales	Midlands West	Midlands East	London	South East
Category Name	50	72	503	504	505	506	507	508	509	510	511	512	513	514	515	516
All Homes	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
All Adults 16+	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Total Men	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Total Housewives	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Total Children aged 4-15	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 16-24	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 16-34	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 35-44	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 45-54	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 55-64	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 18-20	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 21-24	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 45-49	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men 16-24	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men 16-34	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men 35-44	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men 45-54	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men 55-64	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men 18-20																
Men 21-24																
Men 45-49																
H/W 16-34	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
H/W 16-44	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
H/W 35-54	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Individuals AB	•	•	•			•	•		•	•	•	•	•		•	
Individuals C1	•	•	•			•	•		•	•	•	•	•		•	
Individuals C2	•	•	•			•	•		•	•	•	•	•		•	
Adults ABC1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults AB	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults C2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men ABC1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men AB	•	•	•			•	•		•	•	•	•	•		•	
Men C2	•	•	•			•	•		•	•	•	•	•		•	
Adults ABC1 16-24	•	•	•			•	•		•	•	•	•	•		•	
Adults ABC1 16-34	•	•	•			•	•		•	•	•	•	•		•	
Adults ABC1 16-44	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults ABC1 35-54	•	•	•			•	•		•	•	•	•	•		•	
Men ABC1 16-24	•	•														
Men ABC1 16-34	•	•	•			•	•		•	•	•	•	•		•	
Men ABC1 16-44	•	•														
Men ABC1 35 -54	•	•	•			•	•		•	•	•	•	•		•	
H/W ABC1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
H/W ABC1 16-34	•	•	•			•	•		•	•	•	•	•		•	
Adults working full-time	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men working full-time	•	•	•			•	•		•	•	•	•	•		•	
H/W working full-time	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Men ABC1 working full-time	•	•	•			•	•		•	•	•	•	•		•	
Men AB working full-time	•	•														
Housewives with children 0-15	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
H/W with children 0-3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Children 4-9	•	•	•			•	•		•	•	•	•	•		•	
Children 4-6	•	•	•			•	•		•	•	•	•	•		•	
Children 10-12	•	•	•			•	•		•	•	•	•	•		•	
Boys 4-15	•	•	•			•	•		•	•	•	•	•		•	
Boys 4-9	•	•	•			•	•		•	•	•	•	•		•	
Boys 10-12																
Light Viewing Adults, Lightest Third	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Light Viewing Adults, Lightest Sixth	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults ABC1, Lightest Third	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Adults 16-34, Lightest Third	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Bold underlined denotes reporting category control in the Network and Panel 72 overlays as well as in every BBC area.

Bold denotes control in the Network and Panel 72 overlays as well as in the larger BBC areas; 503 East, 506 South, 507 Yorkshire and Lincolnshire, 509 North West, 510 Scotland, 511 Ulster, 512 Wales, 513 Midlands West and 515 London. These categories are not controlled in the remaining areas: 504 West, 505 South West, 508 North East and Cumbria, 514 Midlands East and 516 South East.

Bold italics denote control in the Network and Panel 72 overlay only.

APPENDIX B - GUEST FACTORING – DB2 PARENT CATEGORIES

The principles for defining parent categories for guest factoring are described in section 1.3.2. The following table defines the parent category for each DB2 category that requires guest factoring Up to 1st July 2011:

Category No	Description	Parent Category
1	All Homes	
2	All Adults 16+	
3	Total Men	
4	Total Housewives	All Adults 16+
5	Total Children aged 4-15	
6	Adults 16-24	
7	Adults 16-34	
8	Adults 35-44	
9	Adults 45-54	Adults 45-64
10	Adults 55-64	Adults 45-64
11	Adults 18-20	Adults 16-24
12	Adults 21-24	Adults 20-24
13	Adults 45-49	Adults 45-64
14	Men 16-24	
15	Men 16-34	
16	Men 35-44	
17	Men 45-54	Men 45-64
18	Men 55-64	Men 45-64
19	Men 18-20	Men 16-24
20	Men 21-24	Men 20-24
21	Men 45-49	Men 45-64
22	H/W 16-34	All Adults 16+
23	H/W 16-44	All Adults 16+
24	H/W 35-54	All Adults 16+
25	Individuals AB	
26	Individuals C1	
27	Individuals C2	
28	Adults ABC1	
29	Adults AB	
30	Adults C2	
31	Men ABC1	
32	Men AB	
33	Men C2	
34	Adults ABC1 16-24	
35	Adults ABC1 16-34	
36	Adults ABC1 16-44	
37	Adults ABC1 35-54	Adults ABC1 35-64
38	Men ABC1 16-24	

39	Men ABC1 16-34	
40	Men ABC1 16-44	
41	Men ABC1 35-54	Men ABC1 35-64
42	H/W ABC1	All Adults 16+
43	H/W ABC1 16-34	All Adults 16+
44	Adults working full-time	All Adults 16+
45	Men working full-time	Total Men
46	H/W working full-time	All Adults 16+
47	Men ABC1 working full-time	Men ABC1
48	Men AB working full-time	Men AB
49	Housewives with children 0-15	All Adults 16+
50	H/W with children 0-3	All Adults 16+
51	Children 4-9	
52	Children 4-6	Children 4-9
53	Children 10-12	Children 10-15
54	Boys 4-15	
55	Boys 4-9	
56	Boys 10-12	Boys 10-15
57	Light viewing adults, Lightest Third	All Adults 16+
58	Light viewing adults, Lightest Sixth	All Adults 16+
59	ABC1 Adults, Lightest Third	Adults ABC1
60	Adults 16-34, Lightest Third	Adults 16-34

APPENDIX C – MACRO REGION DEFINITIONS

		London	Midlands	North West	Yorkshire	North East	Scotland	South & South East	East of England	South West	Ulster	Border	ITV West	ITV Wales
Area	Description	1	4	7	11	12	17	21	24	27	30	33	37	38
18	Wales and West												●	●
61	**MidWest Macro**		●							●			●	●
62	West Macro									●			●	●
63	Yorkshire / North East Macro Region				●	●								
67	North West / Border Macro Region			●								●		
68	Granada North Macro Region			●	●	●						●		
69	South East Macro Region							●	●					
75	Channel 5 London													
76	Channel 5 North			●	●	●								
77	Channel 5 Scotland						●					●		
79	Channel 5 Part Network	●	●	●	●	●	●	●	●	●	●	●	●	●
80	CH4 Network	●	●	●	●	●	●	●	●	●	●	●	●	●
82	CH4 South							●	●	●			●	●
84	CH4 North			●	●	●								
85	CH4 Scotland						●					●		
87	CH4 Network (Ex.Ulster)	●	●	●	●	●	●	●	●	●		●	●	●
88	CH4 England	●	●	●	●	●		●	●	●			●	●
89	CH4 London / South / Midlands	●	●					●	●	●			●	●
90	CH4 London / South	●						●	●	●			●	●
58	ITV Breakfast: North, South, Midlands		●	●	●	●		●	●	●		●	●	●
59	ITV Breakfast: England & Wales	●	●	●	●	●		●	●	●		●	●	●

Notes:
Panel 50 (Network) is a single panel whose weights are the same as the BBC regional panels.
Panel 39 (Total S4C) is a single panel whose weights are the same as those for Panels 40/48.
Macro regions which incorporate London must include ITV1 HD out of area audiences.

APPENDIX D – WEEKLY REACH ADJUSTMENT (NBD)

This algorithm covers the procedures to adjust the weekly reach to account for non-response and to calculate reach over an extended period.

Inputs

(All Inputs are weighted)

p = Average daily reach

d = Average daily reach for middle day cohort (using middle day weight)

w = n – weekly reach for middle day cohort (using middle day weight)

m = d*n*7

	Algorithm	Comment
	if w = 0 then go to 50	
	c = m/$\log_e$(1-w)	
	if c $\geq$ -1 then go to 60	Special case: NBD fails so use Poisson
	a = -2*(1+c)	Estimate NBD parameter ‘a’ and ‘k’.
30	b = a	Iterate until valid ‘a’ parameter found
	a = c*(a-(1+a)* $\log_e$ (1+a))/(1+a+c)	
	if abs (b-a)<0.0001 then go to 40	
	go to 30	
40	k = -m/a	NBD parameter ‘k’.
	A = 0	‘A’ = scaled-up parameter ‘a’.
	A = a*p/d	
	Scaled reach = 100*(1-(1+A)**k)	Extended schedule reach
	END	Reach from NBD fit.
50	Scaled reach = 0	
	END	
60	A = 0	Reach = 0
	Scaled reach = 100*(1-exp(Log(1-w)*p/d))	Reach from Poisson fit
	END	

APPENDIX E - REACH AND FREQUENCY ALGORITHM AND EXAMPLES

D.1 Reach and Frequency Algorithm

This algorithm covers the procedures for fitting a probability model to the weighted frequency distribution from the "raw" cover and frequency analysis of a schedule or defined segment of a schedule, and then scaling this up to "published" TVRs.

Inputs

n = Number of spots in the schedule.

fc(i) = Proportion of (weighted) individuals viewing i spots in the schedule (i=0,1,2,……,n) as calculated in the "raw" cover and frequency analysis.

tc = Total TVRs as calculated in the "raw" cover and frequency analysis.

tp = Total TVRs for schedule, either as published in Database 2 or calculated using the BARB approved methodology.

Note: The input values fc and tc should be the internal calculated values i.e. not rounded or truncated.

Output

fp(i) = Proportion of individuals viewing i spots in the schedule (i=0,1,2,……,n) but consistent with published or BARB approved ratings.

Other Notation

c = A constant used in the estimation of NBD parameters.

ln(x) = The natural logarithm of x.

a,k = NBD parameters.

abs(x) = The absolute value of x.

ap = Scaled-up NBD parameter.

pc(j) = NBD estimate of "raw" frequency distribution.

pp(j) = NBD estimate of preliminary scaled-up frequency distribution.

λ = Poisson parameter.

Λ = Scaled-up Poisson parameter.

	Algorithm	Comment
	j = 0	
	if n = 1 then go to 50	Single spot schedule.
10	if fc(j) > 0 then go to 20	Check for initial zero
	fp(j) = 0	frequencies (e.g. 1+ cover = 100)
	j = j+1	and set up input data for model
	tc = tc-100	fitting to the remainder of the
	tp = tp-100	distribution if this happens.
	go to 10	
20	if fc(j) = 1 then go to 70	Check for frequency = 100%.
	c = tc/(100*ln (fc(j))	Calculate 'c'.
	if c ≥ -1 then go to 50	Check for Poisson condition.
	a = -2*(1+c)	
30	b = a	Estimate NBD parameter 'a' iteratively.
	a = c*(a-(1+a)* ln (1+a))/(1+a+c)	
	if abs (b-a)<0.0001 then go to 40	
	go to 30	
40	k = tc/(100*a)	NBD parameter 'k'.
	ap = a*tp/tc	'ap' = scaled-up parameter 'a'.
	pc(j) = fc(j)	NBD estimates of first non-zero
	pp(j) = (1/(1+ap))**k	frequency for "raw" and scaled-up
	fp(j) = pp(j)	distributions.
	sum = fp(j)	Cumulative scaled-up frequency.
	a = a/(1+a)	Pre-calculation for following
	ap = ap/(1+ap)	generation of all other frequencies.
	if n = j+1 then go to 60	Check next frequency = last.
	for i = j+1 to n-1	Sequential calculation of NBD
	x = (k+i – j-1)/(i-j)	estimates of "raw", scaled-up and
	pc(i) = x*a*pc (i-1)	adjusted frequency distributions,
	pp(i) = x*ap*pp(i-1)	and cumulative scaled-up and
	fp(i) = pp(i) + fc(i) – pc(i)	adjusted frequency.
	sum = sum + fp(i)	
	next i	
	go to 60	Go to last frequency calculation.

```
50      λ = tc/100                      Poisson parameter λ.
        Λ = tp/100                      Λ = scaled-up parameter λ.
        pc(j) = exp (-λ)                Poisson estimates of first
        pp(j) = exp (-Λ)                non-zero frequency for "raw",
        fp(j) = pp(j)+fc(j)-pc(j)       scaled-up and adjusted distributions.
        sum = fp(j)

        if n = j+1 then go to 60        Check next frequency = last.

        for i = j+1 to n-1          Sequential calculation of Poisson
          pc(i) = λ*pc (i-1)/(i-j)        estimates of "raw", scaled-up and
          pp(i) = Λ*pp(i-1)/(i-j)         adjusted frequency distributions, and
          fp(i) = pp(i)+fc(i)-pc(i)       cumulative scaled-up and adjusted
          sum = sum + fp(i)               frequency.
        next i

60      fp(n) = 1 – sum                 Last frequency calculation.

        end

70      if j = n and tp > 0 then tp = 0
        fp(j) = 1 - abs (tp)/100        Procedure when one of the "raw"
        if tp < 0 then go to 80         frequencies is 100%.  The frequency
        if j < n then fp(j+1) = tp/100  in question is decreased and a
        go to 90                        value given to either the next
                                        frequency up or the next frequency
                                        down to generate the total
                                        'published' TVRs.  All other
                                        frequencies are set to zero.
80      fp(j-1) = -tp/100
        if j < n then fp(j+1) = 0

90      for i = j+2 to n
          fp(i) = 0
        next i

        end
```

D.2 Example 1

All Adults in Granada home ITV households
51 ITV/CH4 spots

Inputs

tp = 280 = Total TVRs from Database 2
tc = 244 = Total TVRs from cover and frequency analysis

fc(0) = 0.27

fc(1) = 0.21
fc(2) = 0.16
fc(3) = 0.13
fc(4) = 0.06
fc(5) = 0.05
fc(6+) = 0.12

fc(i) = proportion viewing i spots, as calculated in the cover and frequency analysis

n = 51

Algorithm

c = 244/(100*ln(0.27)) = -1.864

a = -2*(1-1.864) = 1.728

b = 1.728

a = -1.864*(1.728 – 2.728*ln(2.728))/(2.728 – 1.864)

= 2.178

a = -1.864*(2.178 – 3.178*ln(3.178))/(3.178 – 1.864)

= 2.123

abs (b-a) = 0.055

b = 2.123

Continue Iterating

a = 2.1222

k = 244/(100*2.1222) = 1.1498

ap = 2.1222*280/244 = 2.4353

pc(0) = 0.2700

pp(0) = (1/(1+2.4353))**1.1498 = 0.2420

fp(0) = 0.2420

sum = 0.2420

a = 2.1222/(1+2.1222) = 0.6797

ap = 2.4353/(1+2.4353) = 0.7089

i = 1

x = (1.1498+1-1)/1 = 1.1498

pc(1) = 1.1498*0.6797*0.2700 = 0.2110

pp(1) = 1.1498*0.7089*0.2420 = 0.1973

fp(1) = 0.1973 + 0.2100 – 0.2110 = 0.1963

sum = 0.2420 + 0.1963 = 0.4383

i = 2

x = (1.1498+2-1)/2 = 1.0749

pc(2) = 1. 0749*0.6797*0.2110 = 0.1542

pp(2) = 1. 0749*0.7089*0.1973 = 0.1496

fp(2) = 0.1496 + 0.1600 – 0.1542 = 0.1554

sum = 0.4383 + 0.1554 = 0.5937

i = 3

x = (1.1498+3-1)/3 = 1.0499

pc(3) = 1. 0499*0.6797*0.1542 = 0.1100

pp(3) = 1. 0499*0.7089*0.1496 = 0.1113

fp(3) = 0.1113 + 0.1300 – 0.1100 = 0.1313

sum = 0.5937 + 0.1313 = 0.7250

i = 4

x = (1.1498+4-1)/4 = 1.0375

pc(4) = 1. 0375*0.6797*0.1100 = 0.0776

pp(4) = 1. 0375*0.7089*0.1113 = 0.0819

fp(4) = 0.0819 + 0.0600 – 0.0776 = 0.0643

sum = 0.7250 + 0.0643 = 0.7893

i = 5

x = (1.1498+5-1)/5 = 1.0300

pc(5) = 1. 0300*0.6797*0.0776 = 0.0543

pp(5) = 1. 0300*0.7089*0.0819 = 0.0598

fp(5) = 0.0598 + 0.0500 – 0.0543 = 0.0555

sum = 0.7893 + 0.0555 = 0.8448

Output

i Number of Spots Viewed	fc(i) Proportion Viewing (Cover & Frequency)	fp(i) Proportion Viewing (Consistent Database 2)
0	0.270	0.242
1	0.210	0.196
2	0.160	0.155
3	0.130	0.131
4	0.060	0.064
5	0.050	0.056
6+	0.120	0.156
Total TVRs	244	280
1+ Cover	73.0%	75.8%
4+ Cover	23.0%	27.6%

D.3 Example 2

(1+Cover = 100%, 2+Cover = 100%)

Inputs

tp = 480
tc = 444

fc(0) = 0.00
fc(1) = 0.00
fc(2) = 0.27
fc(3) = 0.21
fc(4) = 0.16
fc(5) = 0.13
fc(6+) = 0.23

n = 51

Algorithm

j = 0
fp(0) = 0

j = 1

tc = 444 – 100 = 344

tp = 480 – 100 = 380

fp(1) = 0

j = 2

tc = 344 – 100 = 244

tp = 380 – 100 = 280

c = 244/(100*ln(0.27)) = -1.864

a = -2*(1-1.864) = 1.728

b = 1.728

a = -1.864*(1.728 – 2.728*ln (2.728))/(2.728 – 1.864) = 2.178

abs (b-a) = 0.450

b = 2.178

a = -1.864*(2.178 – 3.178*ln (3.178))/(3.178 – 1.864) = 2.123

abs (b-a) = 0.055

b = 2.123

Continue Iterating

a = 2.1222

k = 244/(100*2.1222) = 1.1498

ap = 2.1222*280/244 = 2.4353

pc(2) = 0.2700

pp(2) = (1/(1 + 2.4353))**1.1498 = 0.2420

fp(2) = 0.2420

sum = 0.2420

a = 2.1222/(1 + 2.1222) = 0.6797

ap = 2.4353/(1 + 2.4353) = 0.7089

i = 2+1 = 3

x = (1.1498 + 3 - 2 - 1)/(3-2) = 1.1498

pc(3) = 1.1498*0.6797*0.2700 = 0.2110

pp(3) = 1.1498*0.7089*0.2420 = 0.1973

fp(3) = 0.1973 + 0.2100 – 0.2110 = 0.1963

sum = 0.2420 + 0.1963 = 0.4383

i = 4

etc.

Output

i Number of Spots Viewed	fc(i) Proportion Viewing (Cover & Frequency)	fp(i) Proportion Viewing (Consistent Database 2)
0	0.000	0.000
1	0.000	0.000
2	0.270	0.242
3	0.210	0.196
4	0.160	0.155
5	0.130	0.131
6+	0.230	0.276
Total TVRs	444	480
1+ Cover	100.0%	100.0%
4+ Cover	52.0%	56.2%

D.4 Example 3

(Everyone views exactly 2 spots)

Inputs

n = 51

fc(0) = 0.00
fc(1) = 0.00
fc(2) = 1.00
fc(3+) = 0.00

tc = 200
tp = 220

Algorithm

j = 0
fp(0) = 0
j = 1
tc = 200 – 100 = 100
tp = 220 – 100 = 120
fp(1) = 0
j = 2
tc = 100 – 100 = 0
tp = 120 – 100 = 20
fc(2) = 1 so go to line 70
fp(2) = 1 – abs (20)/100 = 0.80
fp(3) = 20/100 = 0.20
fp(i) = 0 for i>3

Output

i Number of Spots Viewed	fc(i) Proportion Viewing (Cover & Frequency)	fp(i) Proportion Viewing (Consistent Database 2)
0	0.000	0.000
1	0.000	0.000
2	1.000	0.800
3	0.000	0.200
4+	0.000	0.000
Total TVRs	200	220
1+ Cover	100%	100%
4+ Cover	0.0%	0.0%

D.5 Example 4

($c \geq -1$, i.e. Poisson approximation)

Inputs

n = 51

fc(0) = 0.07
fc(1) = 0.22
fc(2) = 0.27
fc(3) = 0.21
fc(4) = 0.13
fc(5) = 0.06
fc(6+) = 0.04

tc = 244

tp = 280

Algorithm

j = 0

c = 244/(100*ln(0.07)) = -0.918

c = $\geq$ -1 so go to 50

λ = 244/100 = 2.44

Λ = 280/100 = 2.80

pc(0) = exp (-2.44) = 0.087

pp(0) = exp (-2.80) = 0.061

fp(0) = 0.061 + 0.070 – 0.087 = 0.044

sum = 0.044

i = 1

pc(1) = 2.44*0.087/1 = 0.213

pp(1) = 2.80*0.061/1 = 0.170

fp(1) = 0.170 + 0.220 - 0.213 = 0.177

sum = 0.044 + 0.177 = 0.221

i = 2

pc(2) = 2.44*0.213/2 = 0.259

pp(2) = 2.80*0.170/2 = 0.238

fp(2) = 0.238 + 0.270 - 0.259 = 0.249

sum = 0.221 + 0.249 = 0.470

i = 3

pc(3) = 2.44*0.259/3 = 0.211

pp(3) = 2.80*0.238/3 = 0.222

fp(3) = 0.222 + 0.210 - 0.213 = 0.221

sum = 0.470 + 0.221 = 0.691

i = 4

pc(4) = 2.44*0.211/4 = 0.129

pp(4) = 2.80*0.222/4 = 0.156

fp(4) = 0.156 + 0.130 - 0.129 = 0.157

sum = 0.691 + 0.157 = 0.848

i = 5

pc(5) = 2.44*0.129/5 = 0.063

pp(5) = 2.80*0.156/5 = 0.087

fp(5) = 0.087 + 0.060 - 0.063 = 0.084

sum = 0.848 + 0.084 = 0.932

etc.

Output

i Number of Spots Viewed	fc(i) Proportion Viewing (Cover & Frequency)	fp(i) Proportion Viewing (Consistent Database 2)
0	0.070	0.044
1	0.220	0.177
2	0.270	0.249
3	0.210	0.221
4	0.130	0.157
5	0.060	0.084
6+	0.040	0.068
Total TVRs	244	280
1+ Cover	93.0%	95.6%
4+ Cover	23.0%	30.9%

APPENDIX F - INTERPRETATION OF CALCULATION CONVENTIONS

Broadcasting delivery by region/platform and audience reporting requirements are continually subject to change. For example, within each ITV area different platforms carry different (Channel) Channel 5 stations; however it is expected that at some point, within each ITV area all platforms will carry the same Channel 5 station. This change will affect the building block conventions for audience calculation.

The BARB reference manual is intended to provide a set of conventions for audience calculations which are relatively time independent. Otherwise the calculation principles conveyed by the reference manual would be lost in continually changing details as audience definitions change. It does mean that a data processor must keep up to date with specification changes and associated interpretation of the calculation conventions. It is recognised that this interpretation is not always obvious. Therefore this appendix provides some more specific clarifications which relate to the current (February 2011) reporting requirements.

(i) Network Panel 50/72 Building Blocks

For Panel 50/72 reporting, audiences for individual stations must be calculated completely and then summed to generate Network audiences. This applies to:

BBC1
BBC2
ITV
ITV1 HD
ITV1 +1
Channel 4 & Channel 4 HD
Channel 4+1
Channel 5 & Channel 5 HD

(ii) Five Audience Building Blocks

For Panel 50/72 and all ITV area reporting of Channel 5 (IBTs, Programmes, Commercials) audiences for individual stations must be calculated completely and then summed to generate total Channel 5 audiences. This is necessary because different stations carry different commercials.

(iii) Channel 4 HD

For all Channel 4 reporting, separate audiences must be calculated completely for Channel 4 and Channel 4 HD and then summed to generate total Channel 4 audiences and the same applies to Channel 4+1. This is necessary because Channel 4 HD carries the London feed (with London commercials) everywhere.

(iv) Other HD Channels

The AP19 identifies which HD channels are reported separately (usually different content) and which are combined with a parent channel before audience accumulation.

(v) S4C Building Blocks

For all S4C reporting, separate analogue and digital audiences must be calculated completely and then summed to generate total S4C audiences.

For panels in which S4C is not itemised as a reporting channel, i.e. is part of "Other" which itself is treated as a single channel, this split is obviously not relevant.

(vi) BBC Regional IBTs (see Section 1.9.2)

Within each BBC region, total audiences to BBC1, BBC2, ITV1 & ITV1 Breakfast, ITV1 +1 and Channel 4+1 are each accumulated as a single channel, rather than the summation of the component station audiences.

As in all panels where Channel 5, Channel 4 and/or S4C are reported/itemised, the audience building blocks are:

Channel 5 vs. Channel 5 HD
Channel 4 vs. Channel 4 HD
S4C Analogue vs. S4C Digital

(vii) Channel 5 Sub-Group Factoring

For the calculation of Ulster, North East, Border, West and South West Network Factoring Panel audiences, Channel 5 and Channel 5 HD are treated as separate channels. Therefore different Network Factoring Panel audiences (factors) will be used to calculate the Channel 5 and Channel 5 HD sub-group factored audiences.

(viii) Channel 4 Sub-Group Factoring

For the calculation of Ulster, North East, Border, West and South West Network Factoring Panel audiences, Channel 4 and Channel 4 HD are treated as separate channels. Therefore different Network Factoring Panel audiences (factors) will be used to calculate the Channel 4 and Channel 4 HD sub-group factored audiences.