Description of Methodology

BARC India

March 2023

Version 2.1

TABLE OF UPDATES

Version	Date	Summary of Updates
1	July 2020	Base document
1.1	July 2020	Corrections for formatting and typos
1.2	September 2020	Section 4.2. addition of LPA
1.3	July 2021	TV Universe Estimate (UE) 2021 Added and Removed details w.r.t. OOH
1.4	March 2022	Sections 4.3 and 4.4 were added to include information on Estimation and the Augmented Data Reporting Standards for News and Special Interest genre channels
2.0	February 2023	Sections 2.1 to 2.2 updated to reflect the new Weighting Model. Section 3.1.1 updated to reflect new MIB guidelines
2.1	March 2023	Methodology for OOH added and Panel size updated

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1. SAMPLING AND RECRUITMENT

1.1. SAMPLE UNIVERSE

BARC India's (BARC's) television audience measurement covered two distinct sample universes. A sample universe is the target population in which the various audience estimates are projected to, and hence, represent.

1.1.1. TV PANEL SAMPLE UNIVERSE

BARC India's (BARC's) various measurement products cover distinct sample universes. A sample universe is the target population that various audience estimates are projected to, and hence, represent.

The sample universe for BARC's currency electronic measurement panel consists of individuals two years of age and older, residing in television households in all parts of India except certain geographies that are unreachable due to the harsh terrain, distance, or political unrest and safety concerns. These uncovered areas include Andaman & Nicobar Islands, Lakshadweep, Kashmir Valley, Ladakh UT and Arunachal Pradesh (except Itanagar).

1.1.2. OUT-OF-HOME PANEL SAMPLE UNIVERSE

BARC's sample universe for BARC's out-of-home (OOH) panel consists of all types of eateries in Urban India except for those in malls, clubs, shops, or canteens. The eatery must have at least one working TV set connected to a linear MOSR in an area accessible by the patrons and an independent seating space for at least 24 patrons.

1.2. SAMPLE FRAME

BARC currently employs two sample frames to support its panels. The first sample frame is a frame of households supporting the TV Panel and the second sample frame is a frame of eateries supporting the OOH panel.

1.2.1. HOUSEHOLD SAMPLE FRAME

The sample frame for BARC's TV panel is designed to include private households in all parts of India except those within the uncovered areas of the Sample Universe (see section 1.1.1.). Electoral rolls form the basis of BARC's sample frame.

1.2.2. OOH PANEL SAMPLE FRAME

The sample frame for eateries is based upon a pre-existing sample frame. This sample frame is a comprehensive listing of all eateries within Urban India. This sample frame was built by combining databases and publicly available information.

1.3. SAMPLING PROCESS

BARC employs different sampling processes for its various panels. The sampling processes are described in the following sections.

1.3.1. TV PANEL SAMPLING PROCESS

The BARC India panel is recruited in a two-stage process. The first stage consists of the Broadcast India (BI) Establishment Survey (ES). This is a large-scale face-to-face survey of a sample of approximately 3 lakh households from the target population. The ES furnishes a list of households (i.e., sampling frame) from which the panel itself is drawn. In the case where there are not sufficient ES records to meet panel recruitment needs, additional households are added to the sampling frame through the process of a listing study (LS).

The second stage of the process is Recruitment. It is in the recruitment stage that the appropriate candidate households are approached to join the panel.

1.3.1.1. STAGE ONE: ESTABLISHMENT SURVEY AND LISTING STUDY

The first step in the sampling process is to *establish* each household in the sample. Each household is asked to complete an in-person survey that collects basic household demographics needed to control the panel such as television ownership, age and sex of household members, languages spoken in the household, mode of signal reception, and other variables. All households that complete the establishment process, except those who are excluded for occupational reasons (see section 1.5), are available for recruitment, provided the household has at least one working television set.

The ES is conducted annually with fieldwork occurring over several months. However, ES was suspended for the past 2 years because of the potential impact on Universe Estimates (UEs) by NTO in 2019 followed by a nationwide lockdown due to COVID-19 in 2020 wherein it was not possible to conduct fieldwork.

Between BI surveys, if the current ES does not furnish enough sample to meet panel recruitment needs, the additional sample will be generated through a Listing Study. The Listing Study functions similarly to the ES but is targeted only at regions where the additional sample is needed.

1.3.1.1.1. SAMPLE SELECTION

The cluster head for ES sample clusters is randomly selected using a systematic random sampling approach from electoral rolls. Using this cluster head, households are selected to form sample clusters of a fixed size (c) for every sampling stratum.

1.3.1.1.1.1. CLUSTER HEAD SELECTION

A *1-in-k* systematic sampling selection procedure is used then to choose cluster heads. The household selected by the sampling procedure is thereby the basic household. Should the basic household not be found, or refuses to participate, an alternate household is selected. The first two alternate households are the immediately prior and latter households (i.e., k_{-1}, k_{+1}) from the electoral role. The third alternate household is the household immediately on the right from the closest intersection to households k_{-1}, k,

and k_{+1}. Subsequent alternate households are obtained using the next household on the right until a successful complete is obtained – forming the cluster head.

1.3.1.1.1.2. SUBSEQUENT CLUSTER HOME SELECTION
Subsequent cluster homes are selected based on the initially completed cluster head, be it a basic or alternate cluster head. From this initial household, subsequent households are selected using a right-hand rule with a pre-determined skipping pattern.

1.3.1.1.2. SAMPLE TARGET
The total sample target for BI 2021 is set at 3,00,000 households and is set for two dimensions: Urban/Rural and Hindi Speaking Markets (HSM)/South (Table 1). The Urban/Rural split is based on market needs and determined by BARC's Technical Committee (TechComm). The HSM/South split is based on the current Universe Estimates (UEs).

Table 1
BI target sample splits

		Region		
		HSM	**South**	**Total**
Region Type	**Urban**	1,06,110	48,438	1,54,548
	Rural	1,15,710	29,742	1,45,452
Total		2,21,820	78,180	3,00,000

ES targets are re-assessed before every survey and are adjusted accordingly.

Listing Studies have sample targets based on the shortfalls in the available sample for recruitment and panel recruitment needs.

1.3.1.2. STAGE TWO: RECRUITMENT SAMPLE
The recruitment sample is randomly selected from homes that completed the ES or listing study. The sample can be selected from the most recent ES or listing study. Only in exceptional cases will the sample be selected from older studies. This is to ensure that the information regarding the household, furnished by the ES or listing study, is as up-to-date as possible.

To ensure against any convenience sampling on the field, 'clusters' (or groups) of eligible HHs are created by BARC India based on panel control variables. All households in a single cluster are equally eligible to be recruited, and any single household is representative of the relevant cell that the cluster aims to fill. IDs of these HHs are fed into a central ID Master, which uploads the address and other relevant details of the household, along with a priority, to the mobile tablets used by assigned field executives. The field executives are expected to approach only the HHs which are in the cluster and request them to join the panel. Once one household in a cluster agrees to be a panellist, the remaining un-attempted households move back into the main pool for future use, and households that are rejected/refused to be a panellist are churned out of the database.

1.3.1.2.1. PANEL TARGET

The current panel target is 55,000 households. The panel target is set for three dimensions: megacities/ Rest of Urban/Rural and HSM/South (Table 2). The megacities/rest of Urban/Rural split is based on market needs and is determined by BARC's TechComm. The HSM/South split is based on the current UEs.

Table 2
Panel splits

| | | Region | | |
		HSM	South	Total
	Megacities	15%	18%	16%
Region Type	**Rest of Urban**	47%	38%	44%
	Rural	38%	44%	40%
Total		66%	34%	100%

1.3.1.3. RECRUITMENT PROCESS

The field recruiter goes to the household sample location assigned by BARC India Measurement Science, explains the purpose of the BARC India TV Measurement Service and then seeks consent from the chief wage earner and householder for registering with BARC India. If the household is eligible (i.e. no disqualifications basis media/research affiliations of household members, adequate GSM wireless signal strength, agreement to incentives provided by BARC India, confirmation of compliance) the field recruiter asks the householder to provide specific household and household member information via a standardized panel recruiting questionnaire administered by the recruiter using a computer tablet app. Presently, fieldwork for panel recruitment and ongoing maintenance is handled by Meterology Data Pvt. Ltd. (MDPL) as well as three independent agencies, hereinafter called the Panel Management Agency recruited by MDPL.

An integrated "Panel Management Software (PMS)" links the mobile tablet that the field executives carry to the server, thereby enabling the capture and transfer of panel household details via the wireless cellular network directly to BARC's central office server. Automated validation checks in-built into the PMS enable many quality control checks to ensure panel health. This provides BARC India with a fully automated data collection process for use at all stages of the panel household relationship.

Strict confidentiality is maintained at all steps of the panel recruitment, training and maintenance process. Ongoing hygiene checks are performed on Panel Management Application (PMA) fieldwork by BARC India and its Design and Quality Control partners.

1.3.1.4. PANEL MAINTENANCE

The viewing behaviour of panel homes is reported to BARC India daily. The BARC India validation process analyzes household and individual viewership behaviours, highlighting behaviours considered to be outliers (at the individual/household level). Based upon validation results, Measurement Science asks the PMA to perform coincidental checks on these homes either telephonically or physically. Certain suspicious outliers are also checked directly by BARC India – bypassing the Panel Management Application (PMA). BARC India also involves a separate vigilance agency to check on outliers that it considers highly suspicious. Non-compliance is categorised as a behavioural issue of the household or a technical issue with the meter. Any discrepancy in information is noted at this stage. If it is a behavioural issue, the household is then re-

trained. If non-compliance continues, then the panel home is dropped. If there is a technical issue with the meter, then the issue is resolved by the BARC India field and technical teams. Where needed, technical issues are raised with meter technology providers.

Panellist training and compliance maintenance are priority issues for the PMA. Under BARC India policy, those households that exhibit substandard compliance, when compared to BARC India standards, are retrained. However, if after retraining, a household continues to underperform, it will be churned out of the panel.

The training protocol specifies two post-installation training visits. The first visit is generally made 3-5 days post-installation and includes training household members in button pressing, observing the working condition of equipment, verifying that the user manual is provided and available for use, etc. The second visit, generally made 10-12 days post installation, includes coincidental checks – whether the TV is ON or OFF, channel viewed and persons viewing with retraining as needed, in button pressing and confirming that the family member button assignments are correct. The PMS application also has a pre-loaded training module for this purpose.

To ensure up-to-date and correct household data as well as for periodic re-training, the Field SOP mandates a complete demographic check every six months of each panel household of all key variables.

1.3.1.5. REPLACEMENT SAMPLE

Recruitment of homes to the panel is done regularly. Recruitment is required to replace homes that have been removed from the panel. Homes are removed for a variety of reasons, from household members' non-compliance to the household's request. To maintain panel balance, homes selected for replacement sample are matched as closely to the current needs of the panel (see section 2.5 for control strata). Depending on the needs of the panel at the time of recruitment, homes selected for recruitment may not match the homes which were dropped from the panel.

1.3.2. OOH PANEL SAMPLING PROCESS

1.3.2.1. Out-of-Home Universe Estimate Study Sampling Process

1.3.2.1.1. Sample Selection

Based on UEs a sample requirement grid is prepared at the State Group X Town Class X NCCS X Age X Sex level monthly. Within each Towns Class, all towns with a population of 10 lakh or more are covered and a sample of the remaining smaller towns is selected using systematic random sampling. The sample target is then distributed amongst all the identified pin-codes within the selected towns.

A starting point is identified for each pin-code. Starting points can be one of many recognizable landmarks such as, but not limited to, schools, places of worship, or police stations. Households immediately on the right of the starting point are approached for an interview. Following a successful interval, a skip pattern of every sixth household is used.

1.3.2.1.2. Sample Target

There is a monthly sample target of 6,000 individuals.

1.3.2.2. Establishment Sampling Process

The BARC Establishment panel is recruited in a single-stage process.

1.3.2.2.1. Sample Selection

To draw a probability sample a sampling frame – which is a complete list of statistical units covering the target population – is required. BARC India used a pre-existing sampling frame for drawing the sample. This sampling frame was a comprehensive list of all eateries along multiple variables such as state, Town Class, Restaurant type, Town Name, and Pin-code. The frame was built by combining multiple databases of eateries. In a few locations, the right-hand rule using a skip pattern was used from the last eatery of a cluster that was unsuccessful due to the limitation of the fame.

Statistical stratification was conducted in the allocation of the sample, ensuring proper representation. Stratification was across the following variables:

- State Group;
- Town Class;
- Restaurant type; and
- Pin-code.

To prevent convenience sampling from occurring on the field, 'clusters' (or groups) of eligible eateries were created based on panel control variables such as the type of eatery and pin code. All eateries in a single cluster are equally eligible to be recruited, and any single eatery is representative of the relevant cell that the cluster aims to fill.

1.3.2.2.2. Sample Target

The OOH panel comprises of 1,600 TV sets at 1,150 eateries. All towns with a population greater than 20 Lakhs were included in the OOH Panel. The remaining medium and small size towns were selected using systematic random sampling. Population Proportionate Sampling (PPS) was then used for sample allocation amongst the remaining towns.

1.3.2.2.3. Recruitment Process

Using the location assigned by BARC India, a field recruiter visits the eatery and explains the purpose of the BARC India OOH TV Measurement Service and seeks consent from the Manager / Owner of the eatery for participation. If the eatery is eligible (i.e., the name of the eatery is correct, the type of eatery is matching and the owned TV sets are in working condition), the field recruiter collects specific information for the eatery such as operating hours, seating capacity followed by other recruitment information. The recruitment questionnaire is administered via a mobile phone or tablet. All fieldwork for the OOH panel is managed by Meterology Data Ltd. (MDL) and their sub-contracted panel management agencies (PMA).

An integrated "Panel Management Software" (PMS) links the mobile tablet that the field executives carry to the server, thereby enabling the capture and transfer of OOH panel details via the wireless

cellular network directly to BARC India's central office server. Automated validation checks in-built into the PMS enable many quality control checks to ensure OOH panel health. This provides BARC India with a fully automated data collection process for use at all stages of the OOH panel relationship.

1.3.2.2.4. Footfall Measurement

Footfall measurement is necessary to report daily reach and impressions. Footfall is measured in almost 100+ eateries across multiple cities and mapped to the viewership of 1,150 eateries.

Eatery footfall is measured manually using a first-in/first-out (FIFO) technique. Footfall is measured in-person using a device on which the ticker APP is installed. This process then captures individuals going in or out of the unit. This manual approach is the most common and reliable type of footfall measurement allowing for accurate footfall analytics. Footfall measured and analyzed in this way is very rich in terms of the data provided (people counts, dwell times, movement, heat maps, the time between visits and more).

Footfall was captured throughout the operating hours of the eateries across the week within each State group X Town Class. Details captured were as follows

- Count of patrons entering and exiting;
- Sex of each patron; and
- In-time and out-time of patrons.

A schedule of eateries is prepared for every day of the quarter thereby allowing for the rotation of measured eateries – ensuring the adequate spread of the eateries throughout the year.

Unbiased Validation rules and Quality checks were set up to ensure adequate footfalls are being captured from data.

1.3.2.2.5. Replacement Sample

Recruitment of establishments to the panel is done regularly. Recruitment is required to replace establishments that have been removed from the panel. Establishments are typically removed due to a request from the establishment. To maintain panel balance, establishments selected for replacement sample are matched as closely to the current needs of the panel (see section 2.5 for control strata). Depending on the needs of the panel at the time of recruitment, establishments selected for recruitment may not match the establishment which was dropped from the panel.

1.4. PANEL TURNOVER AND DE-INSTALLATION

In line with the Ministry of Information and Broadcasting's (MIB's) Policy Guidelines for Television Rating Agencies in India, BARC India employs a panel rotation policy keeping the total annual rotation rate at 25% and a maximum in-time sample of 7 years in the panel.

The panel rotation process includes natural attrition and forced churn. Panel replacement is thus the total of natural attrition and forced churn.

Panel rotation is typically achieved through a rotation policy. In the case of the TV panel, households on the panel have a maximum time-in-sample in which they can remain in the panel. Despite forced turnover incurring high costs and overall churn rates, forced churn is a simple and commonly used method in many global television audience measurement panels.

The forced churn at BARC India is planned in such a manner that older panel homes are removed first while maintaining the representativeness of the panel. The rotation is conducted in a staggered manner by rotating panel homes every month.

1.5. HOUSEHOLD MEMBERS INELIGIBLE TO PARTICIPATE

All household members, 2 years of age or older, are recruited to participate in the panel. This method maximizes the use of sample and reduces the possible bias that may arise from using age/sex quotas. Additionally, participation in the panel is facilitated when all household members are involved.

Households with members employed by broadcasters, advertisers, broadcast distributors, media affiliates or market research, are ineligible to participate.

2. SAMPLE WEIGHTING

Sample weighting is a technique used to compensate for the disproportionate representation of specific population groups in the in-tab sample. This approach guarantees the data will properly replicate the behaviour of the population they represent.

Two conditions must be present for sample weighting to be used:

- a. Specific population groups are disproportionately represented in the sample; and
- b. The behaviour that is measured is likely to be different for those specific population groups.

2.1. WEIGHTING MODEL

BARC India uses a two-step hybrid weighting approach leveraging Cell and Random Iterative Method (RIM) weighting techniques designed to maximize the reliability of the sample data and minimize any statistical bias. This is achieved by performing the least amount of weighting required to correct for sample disproportionalities that may distort the estimates of the audience.

In the first stage, BARC breaks the total television panel into 72 sub-panels, or cells, a process akin to cell weighting. In the second stage, RIM weighting is applied on each of the 72 sub-panels.

The panel is weighted separately for household and individual level ratings with each level carrying its own set of weighting variables.

2.1.1. WEIGHTING STEP 1

In the first step of weighting, the BARC total television panel is broken into 72 sub-panels, or cells. These sub-panels are non-overlapping panels which are the basis of three household characteristics. This is applied to both individuals and households.

The sub-panels are defined against three variables:

1. State Group (Table 3);
2. Town Class (Table 4); and
3. NCCS (Table 5).

Table 3
State Groups for allocation to sub-panels

• Bihar – Jharkhand	• Kerala	• West Bengal
• Andhra Pradesh – Telangana	• Madhya Pradesh – Chhattisgarh	• Uttar Pradesh – Uttarakhand
• Delhi Sales region	• Maharashtra – Goa	• North East-Sikkim[2]
• Gujarat - DNH[1]	• Odisha	• Rajasthan
• Karnataka	• Tamil Nadu - Puducherry	• Punjab – Chandigarh
		• Haryana – Himachal Pradesh – Jammu & Kashmir[3]

Table 4
Town Classes for allocation to sub-panels

- Urban 75 lakh and above (i.e., Megacity)
- Urban below 75 lakh
- Rural

Table 5
NCCS values for allocation to sub-panels

- NCCS A or B
- NCCS C or D/E

Basis the above variables, the following are examples of sub-panels:

- Bihar-Jharkhand/Urban below 75 lakh/NCCS CDE
- Odisha/Rural/NCCS AB
- West Bengal/Urban 75 lakh and above/NCCS AB

2.1.2. WEIGHTING STEP 2

RIM Weighting is then applied against each of the 72 sub-panels. It is done once against the households in the sub-panel to obtain household-level weights, and once against the individuals in the sub-panel to obtain individual-level weights.

2.1.2.1. RIM WEIGHTING

RIM Weighting is a process where weights are assigned against the various weighting variable totals. It is conducted using a mathematical algorithm known as Iterative Proportionate Fit in which all weighting variables are adjusted so that after a maximum number of loops (iterations), the target values match the population for all of the selected variables.

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[1] Includes the Union Territories of Daman and Diu, and Dadra and Nagar Haveli.
[2] Includes the States of Sikkim, Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur, Tripura and Mizoram.
[3] Includes Jammu region from UT Jammu & Kashmir.

In the first stage, all households or individuals in the sample sub-panel are assigned the same weight using a cell weighting approach as follows:

$$Expected\ Average\ Weight_i = \frac{N_i}{n_i}$$

Where, N_i is the total population of the ith sub-panel, and n_i is the total sample count of the ith sub-panel.

Then, the Sum of Weights (SOW) of the individuals or households in the jth level of the kth weighting variable is calculated and then compared to the respective population, N_{jk}, to obtain an adjustment factor as follows:

$$Adjustment\ Factor_{jk} = \frac{N_{jk}}{SOW_{jk}}$$

The adjustment factor for the jth level of the kth weighting variable is applied against the weights of the individuals or households in the jth level of the kth weighting variable.

This process then continues for weighting variables k = 2, …, n. This then represents the first iteration.

Iterations continue until either the kth adjustment factors are close enough to 1.000 in the iteration.

2.1.2.2. HOUSEHOLD LEVEL WEIGHTING VARIABLES

The household sample in each of the 72 sub-panels is weighted on up to three variables at the household level, each with two or more weighting classes:

1. Town Class (Table 6) [only applicable for Urban below 75 lakh sub-panels];
2. NCCS (Table 7); and
3. Household Size (Table 8).

Table 6
Household level town class weighting classes [only applicable for Urban below 75 lakh sub-panels]

- Urban 10 to 75 lakh
- Urban 1 to 10 lakh
- Urban below 1 lakh

Table 7
Household-level NCCS weighting classes

NCCS AB sub-panels	NCCS CDE sub-panels
• NCCS A	• NCCS C
• NCCS B	• NCCS D/E

Table 8
Household level household size weighting classes

- Small (1 to 2 person)
- Medium (3 to 4 persons)
- Large (5 or more persons)

2.1.2.3. INDIVIDUAL-LEVEL WEIGHTING VARIABLES

The individual sample in each of the 72 sub-panels is weighted on up to four variables at the individual level, each with two or more weighting classes:

1. Town Class (Table 9) [only applicable for Urban below 75 lakh sub-panels];
2. NCCS (Table 10);
3. Household Size (Table 11); and
4. Age-Sex (Table 12).

Table 9
Individual level town class weighting classes [only applicable for Urban below 75 lakh sub-panels]

- Urban 10 to 75 lakh
- Urban 1 to 10 lakh
- Urban below 1 lakh

Table 10
Individual-level NCCS weighting classes

NCCS AB sub-panels	NCCS CDE sub-panels
• NCCS A	• NCCS C
• NCCS B	• NCCS D/E

Table 11
Individual-level household size weighting classes

- Small (1 to 2 person)
- Medium (3 to 4 persons)
- Large (5 or more persons)

Table 12
Individual-level age-sex weighting classes

• Male 2-14	• Female 2-14
• Male 15-21	• Female 15-21
• Male 22-30	• Female 22-30
• Male 31-40	• Female 31-40
• Male 41-50	• Female 41-50
• Male 51-60	• Female 51-60
• Male 61 years or older	• Female 61 years or older

2.2. MINIMUM AND MAXIMUM WEIGHTS

To avoid the possibility of extreme weights, household and individual level weights within each sub-panel are capped at 5 times the expected average weight of the sub-panel. The expected average weight is defined as follows:

$$Expected\ Average\ Weight_i = \frac{N_i}{n_i}$$

Where, N_i is the total population of the ith sub-panel, and n_i is the total sample count of the ith sub-panel.

Due to weight capping, there is a possibility of lost population in some sub-panels. Lost population is when the total Sum of Weights is less than the actual total Population of the sub-panel. Initial simulations show that the possibility of lost population is low, and when it occurs, its impact is minimal. Deviations ranged from 0.00 to 0.4%.

2.3. COLLAPSING

If the sample size in a particular weighting cell is too small, erratic results can occur during cell weighting. Therefore, before the weighting algorithm starts, BARC India passes the sample counts through a 'cell collapse' check. If a weighting does not pass the check, it will be joined with another weighting cell to ensure an adequate sample size. The 'cell collapse' check is based upon a pre-determined minimum sample count.

2.4. TYPES OF WEIGHTS

In BARC's panel, there is only one basic weight type: Daily. The data for each day is weighted separately and then combined at the individual level.

2.5. SAMPLE CONTROL CONFIGURATIONS

For the panel, BARC India balances the recruited sample to one set of independent population estimates. Since entire households are recruited, balancing occurs at the household level. The panel is balanced against a set of Primary and Secondary Control variables. Maintaining the balance of Primary variables takes precedence over Secondary variables. These variables have been selected as they have been shown to have the most impact on the variability of television audience estimates.

The primary control variables (strata) for the panel are state group, town class, and NCCS. The secondary control variables for the panel are household size, languages spoken at home + language most often spoken at home, education of the highest educated individuals in the household and mode of signal reception (MOSR).

2.5.1. PRIMARY CONTROL VARIABLES

2.5.1.1. STATE GROUP
The state group demos in which BARC India balances the TV panel are as follows (Table 13).

Table 13
State group control strata

• Bihar – Jharkhand	• Kerala	• West Bengal
• Andhra Pradesh – Telangana	• Madhya Pradesh – Chhattisgarh	• Uttar Pradesh – Uttarakhand
• Delhi NCR	• Maharashtra – Goa	• North East[3]
• Gujarat – DNH[2]	• Odisha	• Rajasthan
• Karnataka	• Tamil Nadu – Puducherry	• North[4]

2.5.1.2. POP STATA

The town class demos in which BARC India balances the TV panel are as follows (Table 14).

Table 14: Pop strata

- Urban 75 lakh and above
- Urban 10 to 75 lakh
- Urban 1 to 10 lakh
- Urban below 1 lakh
- Rural

2.5.1.3. NCCS

The NCCS demos in which BARC India balances the TV panel are as follows (Table 15).

Table 15
NCCS control strata

- NCCS A
- NCCS B
- NCCS C
- NCCS D/E

2.5.1.4. PIN-CODE

Sample targets in all sampled towns are stratified proportionately across all known pin codes to avoid cluttering of panel homes.

2.5.2. SECONDARY CONTROL VARIABLES

2.5.2.1. HOUSEHOLD SIZE

The household size demos in which BARC India balances the panel are as follows (Table 16).

Table 16
Household size control strata

Household size	Number of members
Small	1 to 2 members
Medium	3 to 4 members
Large	5 or more members

2.5.2.2. LANGUAGES SPOKEN AT HOME + LANGUAGE MOST OFTEN SPOKEN AT HOME

This control variable is an interlace between the languages spoken at home (LSOH) and the language most often spoken at home (LMOS). The specific levels vary for each state group by town class and are based on the local languages and propensity for other languages. For example, the levels can be as simple as three languages as in the case of rural towns with a population of 2 to 5 lakhs in Kerala (Table 17) or can be as complicated as seven in the case of the Mumbai Sales Region (Table 18).

Table 17

LMOS + LMOS control strata for rural towns with a population of 2 to 5 lakh in Kerala

- Languages spoken at home do not include English and the language most often spoken is Malayalam
- Languages spoken at home do not include English and the language most often spoken is not Malayalam
- Languages spoken at home include English

Table 18

LMOS + LMOS control strata for rural towns with a population of 2 to 5 lakh in the Mumbai Sales Region

- Languages spoken at home do not include English and the language most often spoken is either Hindi or Bhojpuri
- Languages spoken at home do not include English and the language most often spoken is Marathi
- Languages spoken at home do not include English and the language most often spoken is Gujarati
- Languages spoken at home do not include English and the language most often spoken is not Hindi, Bhojpuri, Marathi, or Gujarati
- Languages spoken at home include English and the language most often spoken is Marathi or Hindi
- Languages spoken at home include English and the language most often spoken is Gujarati or English
- Languages spoken at home include English and the language most often spoken is not Marathi, Hindi, Gujarati, or English

2.5.2.3. EDUCATION OF THE HIGHEST EDUCATED INDIVIDUAL IN THE HOUSEHOLD

The education of the highest educated individual in the household demos in which BARC India balances the TV panel are as follows (Table 19).

Table 19

Education of the highest educated individual in the household control strata

- Up to 9th standard
- SSC/HSC, some college but not graduate
- Graduate+

2.5.2.4. MODE OF SIGNAL RECEPTION

The mode of signal reception (MOSR) demos in which BARC India balances the TV panel are as follows (Table 20).

Table 20

Mode of signal reception control strata

- Cable
- Direct to Home (DTH)[4] – Free
- Direct to Home (DTH) – Pay

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[4] This includes Freedish Connection and analogue antenna

2.6. TV UNIVERSE ESTIMATES (WEIGHTING AND CONTROL)

Post launch of the TV panel in 2015, BARC India has completed two BIs – one in the year 2016 followed by BI in 2018. Details for both the BIs along with implementation dates for the UE update in the panel are in table no. 19.

2.6.1 TV UEs 2020 – IMPLEMENTED IN 2021
An alternate approach for estimating TV UEs was used for the development of TV UEs and subsequently got implemented in the first half of 2021. The projection and execution dates of the alternate methodology are mentioned in table 21.

Table 21
Details of TV UEs implemented

Study name	Fieldwork period	TV UE Projection date	UE update into the panel
BI 2016	October 2015 to January 2016	1st March 2016	18th February 2017 (i.e. Week 8)
BI 2018	November 2016 to March 2017	1st January 2018	14th July 2018 (i.e. Week 29)
TV UE 2020	NA	1st March 2020	3rd April 2021 (i.e. Week 13)

2.6.1.1 METHODOLOGY FOR TV UEs 2020

TV UEs have been developed by computing the linear growth of TV Households and TV Individuals from the past two Broadcast India studies (i.e., BI 2016, BI 2018) at geographic and demographic levels (i.e. State group, Population strata, Age group and Sex). The distribution of the TV population by NCCS was then taken from the latest Indian Readership Survey.

Linear growth is computed using the following formula

$$Y = b_0 + b_1 x$$

Y = 2020 estimate
b_0 = BI 2018 estimate
b_1 = monthly growth rate between BI 2016 and 2018: (BI 2018 estimate – BI 2016 estimate) / number of months between projection points
x = number of months between 2020 and BI 2018 projection points

BARC India has updated the universe for weighting and panel control from Week 14 of 2021.

3. PANEL SIZE AND DESIGN

3.1. TV PANEL SIZE AND DESIGN

3.1.1. TV PANEL SIZE
BARC's TV panel size is mandated by the Ministry of Information and Broadcasting's (MIBs) Policy Guidelines for Television Rating Agencies in India. The panel size is currently 55,000 households.

3.1.2. TV PANEL DESIGN
The initial panel of 22,000 HHs was allocated per state group/metro based on Relative Errors (REs). RE is a type of statistical sampling error described as the potential deviation expressed as a percentage of the observed value from the actual/expected value due to using a sample. As the sample size is increasing (currently at 55,000 HHs), REs are naturally reducing. For the increased sample, BARC India has also considered improved weighting efficiencies for designing the panel (i.e., decreasing the variance in assigned individual weights).

All cities with a population above 5 lakhs as per Census 2011 are selected individually (except for Srinagar). Sample allocations for all other town classes within a State are based on the town-class group which is further Selection of actual Towns/Villages was performed using systematic random amongst Towns and Villages with TV-owning household populations.

The panel is statistically representative of the entire country.

3.1.2.1. OVERSAMPLING IN THE PANEL DESIGN
To ensure the usability of the BARC TV panel data, a minimum sample target of 180 households is maintained for each geographic weighting stratum. Additionally, due to the heterogeneity of viewing and other market dynamics, BARC India oversamples megacities and urban India (Table 22).

Table 22
TV Universe and sample proportions by regions

Region	TV Universe 2020	Sample Design
Megacities	11%	16%
Urban India less megacities	32%	44%
Rural India	57%	40%

3.2. OOH PANEL SIZE AND DESIGN

3.2.1. OOH PANEL SIZE
BARC's OOH Panel has a total sample size of 1,150 eateries.

3.1.2. OOH PANEL DESIGN
All towns with a population greater than 20 Lakhs were included in the PPH Panel. The remaining medium and small size towns were selected using systematic random sampling. Population Proportionate Sampling (PPS) was then used for sample allocation amongst the remaining towns.

4. DATA PROCESSING

BARC India employs four primary data processing steps: pre-processing, data validation, estimation, and the application of the Augmented Data Reporting Standards.

4.1. PRE-PROCESSING

The data from the collection server is first pre-processed, where errors and inconsistencies that may creep in due to technical issues are cleaned up. In this state, attribution rules are applied.

Data collected from the meters is in seconds. However, in keeping with international standards, all validation rules are on viewing sessions (blocks of time of TV Set on in the HH – Tuning; and of each individual viewing TV - Viewing) and reported data is in clock minutes. Hence, all data needs to be converted to clock minutes (i.e. HH:MM format, e.g. 12:00:00 to 12:01:00, 12:01:00 to 12:02:00 and so on).

Attribution rules are applied on the statement file at the pre-validation stage, i.e. after the data is received from collection servers for production processing and validation.

There are five conditions under which viewing behaviour is to be attributed:

1. TV set session;
2. Magnetisation;
3. Bridging;
4. Individual viewing sessions within a clock minute; and
5. Channel viewing sessions within a clock minute.

4.1.1. TV SET SESSION

BARC India attributes viewing to the minute. If a TV set is on for 30 seconds or more in a clock minute, it is attributed as being on for the entire clock minute. In the BAR-O-Meter measurement system, TV On and Off status is determined by the presence or absence of a watermarked channel. Since viewership of non-watermarked channels is not captured by the BAR-O-Meter, any viewing of non-watermarked channels is considered as TV Off.

4.1.2. MAGNETISATION

There is generally a gap between the time viewers switch on the TV set, move to the channel intended to be viewed, and press their viewing buttons on the BARC India remote. Unless removed, this gap would depress viewing by the duration from the time the TV is switched on and the individual button is pressed. A Magnetisation algorithm is applied in such cases and the viewership of these individuals is 'magnetised' or linked back to the time when the first watermarked channel was started to be viewed.

4.1.3. BRIDGING

Bridging applies only to TV sets measured with BAR-O-Meters for use when people put the TV set on mute for short durations (i.e., 3 minutes). Unless this gap is 'bridged', it would be considered as TV off and the time spent viewing during the gap would not be captured. To include the gap as viewing time, a bridging

algorithm is applied when no watermark is present between two watermarked channels for a certain maximum duration. For bridging, the following rules are applied on the TV set:

- In case the channel before and after the non-watermarked duration is the same, the viewing duration of the non-watermarked period is attributed entirely to this channel.

- In case the channels before and after the non-watermarked duration are different, the viewing duration of the non-watermarked period is attributed alternately to the earlier and later channel, i.e. the viewing is attributed to the channel being viewed before the non-watermarked duration in the first, third, fifth (and so on) instances observed in the system; and the viewing is attributed to the channel being viewed after the non-watermarked duration in the second, fourth, sixth (and so on) instances observed in the system.

4.1.4. INDIVIDUAL VIEWING SESSIONS WITHIN A CLOCK MINUTE

There are rules applied to the second-by-second events that attribute viewing to one and only one TV channel for an entire clock minute. In each system, only one channel is eligible to receive viewing credit for each clock minute throughout the viewing day. if an individual is viewing a TV channel for 30 seconds or more in a clock minute, the rules are straightforward and viewing is attributed to that channel for the entire clock minute.

The rules become more complex when viewing during a clock minute involves multiple channels for a total of 30 seconds or more. Additional rules are required as described below for processing BAR-O-Meter event data.

4.1.5. CHANNEL VIEWING SESSIONS WITHIN A CLOCK MINUTE

Individuals can view multiple channels within a single clock minute. However, only one channel will be assigned the viewing in each clock minute. To assign this viewing, the following rules are applied:

4.1.5.1. ONLY ONE CHANNEL WATCHED

The viewing for the entire clock minute gets attributed to that channel.

4.1.5.2. MULTIPLE CHANNELS WATCHED WITH DIFFERENT VIEWING DURATIONS

Viewing is attributed to the channel with the maximum viewing duration.

4.1.5.3. MULTIPLE CHANNELS WATCHED WITH TWO OR MORE CHANNELS HAVING THE SAME MAXIMUM VIEWING DURATION

There are two scenarios for this rule:

- Scenario A – one of the channels with the maximum viewing duration moves into the next clock minute. In this case, viewing is attributed to the channel moving into the next clock minute; and
- Scenario B – none of the channels with the maximum viewing duration moves into the next clock minute. In this case, viewing is attributed to a random channel from among those channels having the maximum viewing duration, using a random allotment algorithm.

It is pertinent to note that the 30 seconds or more rule, wherever applied, refers to a total of 30 seconds in a clock minute – whether consecutive or not.

4.2. DATA VALIDATION

Validation of viewership data is a daily process performed at three levels. The first is the identification and treatment of landing page activities, the second is the identification of statistical outliers, and the third is against channels that have been confirmed as having attempted tampering of panel households following a rigorous process of Vigilance investigations and raw data analyses by Data Scientists. These data validation procedures consist of documented and strictly controlled rules applied transparently and systematically during daily production processing.

Validation rules and their application are subjected to external audit and ongoing review by the BARC Oversight Committee but are not otherwise disclosed to prevent individuals who might attempt to tamper with panel HHs to gain valuable insights.

Further details on BARC's data validation processes can be found here:
https://barcindia.co.in/whitepaper/data-processing-and-validation-processes.pdf

4.3. ESTIMATION

Reach and Viewing minutes are the base audience estimates from which all of the other audience estimates (e.g., AMA, Rating, GRP, Reach%) are derived. Therefore, BARC's estimation process first produces an estimator of the population's total viewing minutes (τ) and an estimator of the population's Reach (Rch).

Under a simple random sample (SRS), the estimator for a population total is as follows:

$$\hat{\tau} = \frac{N \sum_{i=1}^{n} y_i}{n}$$

Where N is the total Universe of television individuals, n is the total number of intab panellists on that day and y_i is the total unweighted viewing minutes captured for the ith panellist.

Likewise, under SRS, the estimator for the population's Reach is as follows:

$$\widehat{Rch} = \frac{N \sum_{i=1}^{n} I_i}{n}$$

Where N is the total Universe of television individuals, n is the total number of intab panellists on that day and I_i is an indicator variable for the ith panellist where $I_i = 1$ if the ith panellist watched for at least one minute, and $I_i = 0$ otherwise.

In SRS, all respondents represent an equal number of individuals in the population. BARC applies a weighting and calibration approach (see section 2) whereby respondents in the sample State Group x Town Class x NCCS x Age Group x Sex (i.e., cell) are weighted together. Therefore weights are the same within a cell but can differ across cells. The above two equations can therefore be re-written as follows:

$$\hat{\tau} = \sum_{j=1}^{L} \frac{N_j \sum_{i=1}^{n_j} y_{ij}}{n_j}$$

Where j is the jth cell of the L State Group x Town Class x NCCS x Age Group x Sex combinations, N_j and n_j are the Universe of television individuals and intab panellists respectively of the jth cell and y_{ij} is the unweighted viewing minutes captured of the ith panellist in the jth cell.

$$\widehat{Rch} = \sum_{j=1}^{L} \frac{N_j \sum_{i=1}^{n_j} I_{ij}}{n_j}$$

Where j is the jth cell of the L State Group x Town Class x NCCS x Age Group x Sex combinations, N_j and n_j are the Universe of television individuals and intab panellists respectively of the jth cell and I_{ij} is an indicator variable for the ith panellist in the jth cell where I_i = 1 if the ith panellistt watched for at least one minute, and I_i = 0 otherwise.

When multiple days are considered in a period of analysis, the total viewing minutes is simply the sum of each of the daily viewing minutes and the average daily reach is simply the mean of the reach estimates.

4.3.1. CONVERSION OF VIEWING MINUTES TO OTHER AUDIENCE ESTIMATES
As previously mentioned, viewing minutes is the base audience estimate in which several other audience estimates can be calculated, such as Average Minute Audience, and its relative equivalent Rating%, as well as Average Time Spent per Viewer.

4.3.1.1. AVERAGE MINUTE AUDIENCE AND RATING%
Average Minute Audience (AMA) is simply the total viewing minutes (τ) for the target group averaged over the total number of minutes for the event or daypart of interest.

$$\widehat{AMA} = \frac{\hat{\tau}}{d}$$

Rating% is, therefore, the relative equivalent of AMA where the AMA is expressed as a ratio against the Sum of Weights of the target group of interest.

4.3.5.2. AVERAGE TIME SPENT PER VIEWER
Average Time Spent per Viewer {ATS(viewer)} is the average of total viewing minutes (τ) for the target group averaged over the Reach of the target group.

$$ATS(\widehat{viewer}) = \frac{\hat{\tau}}{\widehat{Rch}}$$

4.3.2. CONVERSION OF REACH TO OTHER AUDIENCE ESTIMATES
Reach is the base audience estimate in which its relative equivalent, Reach% (Rch%) can be calculated. The Rch% of a target group is simply the Reach divided by the Sum of Weights of the target group.

4.3.3. ESTIMATION OF WEEKLY CUME REACH

Since intab panellists change daily due to phenomena like churn, connectivity, or recruitment, an intab panellist may not be intab for all days through the week. Estimation of Cume Reach, therefore, needs to be modelled to address this phenomenon. The estimation process for Cume Reach, therefore, takes into consideration all distinct panellists who were intab for one or more days in the reporting week.

A panellist who has viewed the event for 1 minute or more in the reporting week, is considered for the estimation of Cume Reach. The projected weight of the subset of panellists with viewing for Cume Reach is then calculated by averaging their assigned weights over the week. For days that the panellist was not intab, a weight of zero is applied. This is done to maintain a constant universe size. The Cume Reach is then the aggregated average weight for each of the intab panellists who have viewed the event for one minute or more in the week.

4.4. APPLICATION OF THE AUGMENTED REPORTING STANDARDS

Effective March 17th, 2022 (i.e., Week 10/2022), BARC began reporting audience estimates under the Augmented Data Reporting Standards. These reporting standards only apply to channels falling into a News or Special Interest genre. All channels falling under these standards/genres are reported as a 4-week rolling average in BARC's YUMI software.

For example, the data released for Monday of Week 10/2022 for these channels would be an average of the audiences for the Monday of Week 10/2022, Week 9/2022, Week 8/2022, and Week 7/2022. Subsequently, the data released for Monday of Week 11/2022 for these channels would be an average of the audiences for the Monday of Week 11/2022, Week 10/2022, Week 9/2022, and Week 8/2022.

Further information can be found in the BARC's Policy for Augmented Data Reporting Standards for News and Special Interest Genres found on BARC's website. (Policy Link)

4.4.1. DEFINITION OF NEWS AND SPECIAL INTEREST GENRES

Channels are assigned a genre as per BARC's Genre Language Classification Policy found on BARC's website (https://barcindia.co.in/policy-updates/genre-and-language-policy.pdf). Classification occurs quarterly based on the playout data of the previous 13-week period.

4.4.1.1. DEFINITION OF NEWS GENRES

A channel will be classified under the News genre if it is licensed by the Ministry of Information and Broadcasting (MIB) as a News channel, and if it airs News Content for more than 50% of its airtime.

4.4.1.2. DEFINITION OF SPECIAL INTEREST GENRES

Special Interest genres are those where the tuned sample and/or the Average Time Spent of the genre is less than 1 normalized standard deviation (1SD) below the normalized mean of the tuned sample and Average Time Spent of all genres excluding News.

4.4.2. ROLLING AVERAGE METHODOLOGY

To preserve data security and integrity and keep the cadence of advertisement planning consistent for all channels, the underlying DSM files downloaded to the YUMI software and any internal RLD files, are presented at a 4-week rolling average for News and Special Interest genre channels. This is ensured

through a statistical model which averages both the weighted Reach and ATS of a channel at a 30-minute block over the most recent 4-weeks.

The model has been built to address the following challenges:

- Due to several factors (e.g., connectivity of meters, churn, recruitment, households taking vacations), the intab sample changes daily. This is to say that the intab sample for the four days being averaged is not the same;
- Individual weights are assigned daily and can, therefore, change from one day of the week to another. That is to say that even if the respondent is being averaged on all four days, their assigned weight may differ on each day; and
- Viewership is captured and estimated at the minute level; thus, the same individual may have viewed different channels at the same minute on the four days being averaged.

The statistical model follows five principal steps as follows:

1. The weighted viewership data (i.e., Reach and ATS) of News and Special Interest genre channels of the past 4-weeks of the same day is divided into 30-minute blocks;
2. The average of the 4-week data is calculated for each block;
3. A probabilistic mathematical optimization model is run to assign the minute-level viewing of panellists in the prior three weeks to the panellists in the current week ensuring alignment with the computed averages in step 2;
4. Quality control checks are run on the data; and
5. The viewership data for News and Special Interest genres channels is then joined with the viewership of the rest of the channels.

It should be noted that since the above statistical model has been adopted, the resultant 'averaged' data may vary slightly from a manually calculated average using unrolled weighted estimates.

4.5. MODELLING AND FUSION (OOH ESTIMATES ONLY)

BARC measures in-home (IH) and OOH television viewing of individuals who reside in a household with at least one working TV. Therefore, to correctly attribute OOH viewing to the BARC TV panel, the proportion of OOH viewing coming from individuals residing in TV households needs to be estimated. This step is done through a multi-stage modelling system. This system not only allowed for an understanding of the proportion of OOH viewing which should be attributed to the panel but also, the correct individuals in the panel who could be eligible to receive OOH viewing.

To identify eligible panel individuals for OOH viewing a survey was conducted amongst members of the TV panel from Urban India. The goal of the survey was to gauge the incidence and behaviour of these individuals for:

a) Likelihood of visiting eateries on daily basis;
b) Preferred days of visiting eateries;

c) Frequency of visiting eateries;

d) Last visit to an eatery; and

e) Type of eateries visited.

Using the data collected from the survey a likelihood (i.e., probability score) was computed for each individual visiting eateries from the TV panel. The higher the score for the day, the higher the opportunity for the individual to be the most probable individual to receive OOH viewership.

4.5.1. ALGORITHM

Multi-stage data modelling techniques were adopted to produce TV+OOH Viewership results in BMW. There were 5 different models used.

4.5.1.1. FOOTFALL EXTRAPOLATION

Despite OOH viewership being measured in 1,150 eateries with roughly 1,600 meters, on any given day, the maximum number of eateries in which footfall gets measured was measured is 100. Hence, a 5-tier hierarchy approach for attributing footfall from eateries to eateries without footfall was required. This was done to find out the best-fit eatery to map the footfall and viewership. The hierarchy of the approach is as follows:

1. Eatery type;
2. City/town;
3. Town class;
4. Seating capacity; and
5. State group.

When the number of TV sets in an establishment was more than one, the footfall was divided between TV sets using Bayesian probability. This ensures that all TV sets in the eatery are directly mapped to specific viewership and footfall data.

4.5.1.2. CREATING CLUSTERS

Clusters were created using a hierarchical clustering technique for clubbing the viewing sessions at the channel level. The hierarchy was based on the following variables:

1. In-time for patrons;
2. State group;
3. Town class;
4. Sex; and
5. Channel.

Post-creating clusters, in-time and out-time were averaged using the start- and end-time and the number of all individuals appearing in that clusters. A new Cluster was created every 30 minutes ensuring zero duplication of channels within the same cluster.

Usable clusters were identified basis the top channels by duration in each cluster and the count of individuals from the HH TV panel to which OOH Clusters needed to be allocated in the TV panel. Details of the computing count are covered in the last section of the Algorithm

4.5.1.3. ATTRIBUTION OF DEMOGRAPHIC VARIABLES

The variables captured in the OOH individual UE survey data provided distribution patterns of Age group X NCCS for each genre watched within eateries. This distribution proportion of Age X NCCS for each genre from the study was attributed to OOH clusters at the lowest possible level. This allowed for a channel mapping with Age X Sex X NCCS for each usable cluster in each State X Town Class.

4.5.1.4. OOH WEIGHTING

The weighting process assigns a weight or factor to each Cell that reflects their proportionate representation of the universe. Sample weighting is a statistical process used to correct for imbalances that may exist within the realized sample. Weighting occurs daily and assigns OOH individual weights which are then applied to OOH clusters.

Data output from the OOH Monthly rolling UE is used for OOH estimation and weighting purposes. Weighting was done using a cell weighting technique. The variables used for weighting were as follows:

1. Reported state group (16 levels);
2. Reported town class within each state group (up to 3 levels);
3. Reported NCCS (3 levels);
4. Sex (2 levels); and
5. Reported age group (7 levels).

4.5.1.5. APPLYING OOH VIEWERSHIP TO TV PANELLISTS

The count of the individuals from the TV Panel to which OOH clusters have to be applied was computed by dividing the "OOH UE weight" by the "weighting factor of TV Individual" at the lowest common weighting levels.

Using the probability Scoring system (explained above), the individuals of the TV panel were sorted in descending order of Score and the best-fit procedure was used to ensure OOH clusters were properly allocated. This allocation was accomplished at the State group X Town Class X NCC X Sex X Age group level. This means that only a subset of individuals from the TV panel carry the TV and OOH viewership data for reporting TV+ OOH Viewership

5. TECHNICAL DETAILS

For capturing TV viewing, BARC India uses a TV set metering technology that captures watermarks embedded in the audio transmission of TV channel transmissions to identify the channel being watched.

The BARC BAR-O-Meter captures TV usage, TV station identification, and individual viewing through the use of two digital devices: one installed by the broadcaster (embedder) at the station head end/transmission site(s) and the other – referred to as the BAR-O-Meter – that is installed on each TV set in the panel households.

5.1. METERING WATERMARK EMBEDDER

Embedder equipment is placed at the Broadcaster's headend where the Channel signal transmission begins. The device embeds a unique watermarked code in the audio component of the program content workflow. This code consists of the Channel ID & the time stamp. Each channel has its own unique code (or codes, in case the channel has taken a backup). Once the unique watermark IDs are generated and assigned to each broadcast station cooperating with BARC India, the embedder is installed at the broadcaster's headend transmission site and a special channel-specific electronic card is inserted. This results in the embedder continuously placing a time-stamped channel name and watermark ID in the channel's content workflow. The watermark is an inaudible audio code made available to TV broadcasters that subscribe to and support the BARC India measurement of TV audiences. A master list of TV Channel Watermarked IDs is stored on the BARC India server and downloaded to BAR-O-Meters for the identification and measurement of TV Channel viewing.

5.2. METERING UNIT

Each meter system consists of a main unit, a display unit and probes that capture the audio output of the TV set for BAR-O-Meters.

Each main unit is equipped with a microprocessor and a modem. The main unit is placed near the TV set being measured in the panel household. Each main unit has a probe attached to it that is either placed near the TV set or connected to the line or audio out of the TV. The probe captures the identity of each tuned TV signal and feeds this information to the main unit where it is time-stamped and stored for transmission as viewing events to BARC's central site collection servers assigned to BAR-O-Meter measurement systems.

5.2.1. INDIVIDUAL VIEWER IDENTIFICATION

The method of a person's viewer identification for the BAR-O-Meter is a button-pushing remote, a handheld device. The measurement system provides one handheld remote control unit for each metered TV set. The handheld device has buttons made available for assignment to household members who are asked as part of their panel participation to press their assigned button when they are viewing TV. Each panel household member aged 2 years and older is assigned a button on the remote control handheld unit. Separate buttons on the remote handheld device are reserved for use by guests, entering their gender and age bracket when viewing TV.

Note. While it is captured, guest viewing is not considered in the BARC audience estimates.

5.3. DATA CAPTURE, STORAGE, TRANSMISSION, AND COLLECTION

The TV set metering systems continuously and passively capture TV viewing events in real-time, recording the time and duration of channel tuning events and capturing the viewership events of individual members aged 2 years or older that have pressed their viewer ID button to confirm their presence in the audience.

The main unit stores the individual time-stamped events in memory for transmission to the BARC India server at predetermined intervals throughout the viewing day. The BAR-O-Meter TV viewing event data is then received by the BARC India collection server where collected TV event data is simultaneously backed up and made available to pre-processing software.

6. METHODOLOGICAL FLOW

The following section outlines the methodological flow for the BARC TV and OOH audience estimates.

6.1. METHODOLOGICAL FLOW FOR THE TV PANEL

BARC India follows a methodological flow consisting of twelve distinct steps (Figure 1).
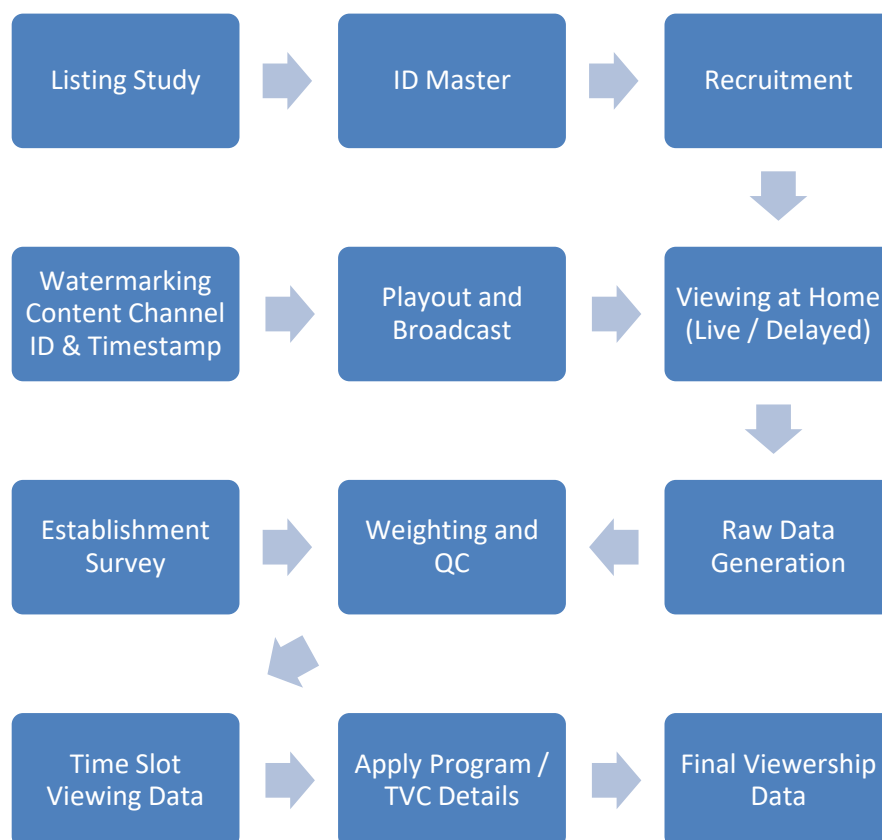
Figure 1. TV Panel Process Flow

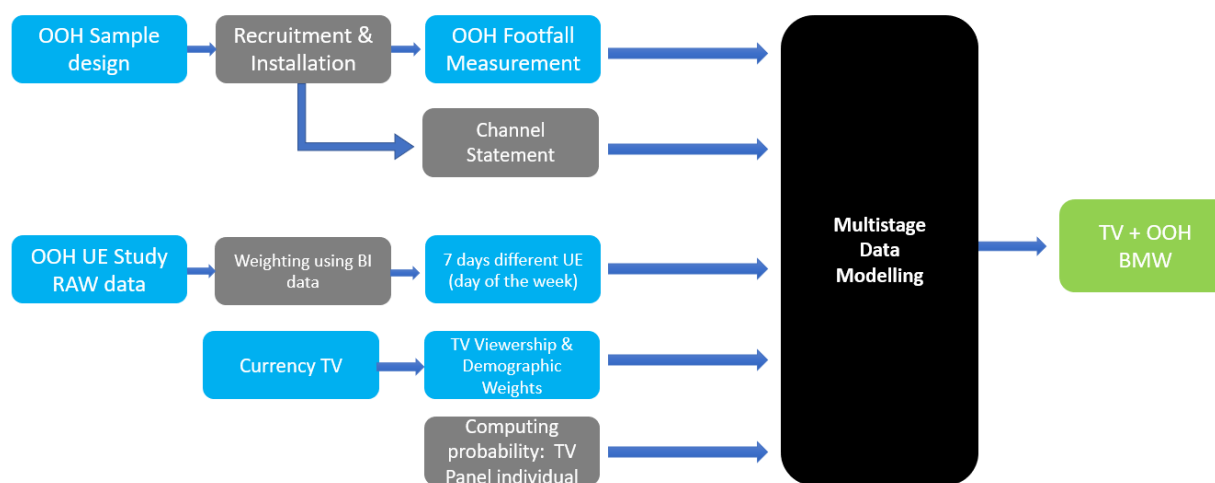## 6.2. METHODOLOGICAL FLOW FOR THE OOH PANEL

Figure 2. Out-of-Home Process Flow

7. SOURCES OF ERROR IN BARC TELEVISION AUDIENCE ESTIMATES

BARC's television rating services produce data which is used to produce rating estimates. Since these estimates are based on samples, there are several sources of error to which they may be subject. There are many ways to classify survey error, but in the scheme presented by Groves (1989)[5] we can classify the potential errors associated with BARC's audience estimates as follows:

7.1. ERROR OF NON-OBSERVATION

There are three main areas where the error of non-observation can be attributed, namely: Sampling Error, Coverage Error and Nonresponse Error.

7.1.1. SAMPLING ERROR

Sampling Error (SE) can be defined as the error associated with observing a sample rather than a population. This type of error is the main cause of variation in estimates from sample to sample, or, in the case of BARC India, over time. Since BARC India employs probability samples, theoretically, the amount of possible sampling error in an estimate can be quantified through the Standard Error (SE), Confidence Interval (CI), or Relative Error (RE) of the estimate. BARC India encourages users to take the associated SE, CI, or RE into consideration for all estimates.

Information on BARC's REs can be found here:
https://barcindia.co.in/whitepaper/barc-india-relative-error-whitepaper.pdf

YUMI provides the option for SEs for the following audience estimates Rat% and Rch%.

7.1.2. COVERAGE ERROR

Coverage Error specifically refers to the absence of certain populations in the sampling frame. In the case of BARC's television measurement service, the sampling process ensures that coverage error is minimized. Any non-sampled regions are excluded from the population UEs, thereby ensuring that the audience estimates are correctly projected.

7.1.3. NONRESPONSE ERROR

Nonresponse Error can be defined as any error which can be attributed to the inability to collect data from certain individuals. This error can include individuals who refuse to participate or individuals who are unable to be contacted (i.e., unit nonresponse) or missing data related to a sample element (i.e., item nonresponse). We can break both unit and item nonresponse into two main components: nonresponse Missing at Random (MAR) and nonresponse Not Missing at Random (NMAR).

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[5] Groves, R. M. (1989). *Survey Error and Survey Costs*. New York, NY: Wiley.

In the case of MAR, the nonresponse is non-systematic and therefore, not a problem. It can be accounted for through post-stratification, or weighting, techniques but will increase variance in responses. The case of NMAR is more serious since the non-response is systematic and could result in biased estimates.

It is very difficult to measure nonresponse errors. Typically, this error is measured through the Response Rate (RR) which is an indication of the success of a survey at representing the population of interest. However, the RR does not differentiate between MAR and NMAR nonresponse, or more specifically, quantify the amount of bias which may be present in the sample.

7.2. ERROR OF OBSERVATION

Errors of Observation are errors which can be attributed to the respondent, instrument or method of data collection. This includes but is not limited to, panellist compliance, fraudulent behaviour or technical measurement issues.

BARC India monitors the panel for extreme tuning, viewing or behaviour and will remove panellists who are not complying properly. In extreme cases, data will be re-issued with the panellist removed.

8. FRAME EXCLUSIONS AND INELIGIBLES IN BARC'S TELEVISION PANEL

The television panel sampling frame excludes all Individuals below two years of age, Individuals residing in Non-TV owning homes and in uncovered areas[1], or geographies that are unreachable due to harsh terrain, distance, or areas with political unrest and safety concerns to the field workers.

BARC India uses a sampling process to establish and recruit households and therefore has a limitation where the sampling frame is smaller than the Universe. This shortage, or gap, is referred to as frame exclusion. There are also cases where a household is ineligible or unable to be established or recruited. This is referred to as Ineligibility.

This section outlines the frame exclusions and ineligibilities in the BARC panel.

8.1. PANEL EXCLUSIONS

There are two primary exclusions in the panel, those related to uncovered areas and those related to other issues.

8.1.1 EXCLUSIONS DUE TO UNCOVERED AREAS

Certain areas of India are excluded from the sampling frame of the Panel. These uncovered geographies represent 0.6% of Indian households and 0.7% of Indian individuals. Since these areas are not covered in the study, BARC India also excludes their estimated population from the BARC India TV Universe Estimates. Therefore, this exclusion will have no impact on the accuracy of BARC's television audience estimates.

8.1.2. OTHER EXCLUSIONS

Due to technical reasons, households with either five or more television sets or more than 13 members are not included on the panel. This represents an immaterial portion of the population, estimated to be 0.5%.

8.1.3. ESTABLISHMENT EXCLUSIONS

Establishments with working televisions, in which out-of-home viewing can occur, can have either a linear MOSR which has watermarked viewing or a non-linear MOSR which will contain limited watermarked viewing. In the absence of a Universe Estimate, BARC excludes the viewership from the non-linear MOSR Establishments with a TV as it is assumed to be very small. This frame exclusion is estimated at 1.6%[6] and thereby will have little impact on the accuracy of BARC's out-of-home television audience estimates.

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[1] Uncovered areas include Andaman & Nicobar Islands, Lakshadweep, Kashmir Valley, Ladakh UT and Arunachal Pradesh (except Itanagar).

[6] Basis a random sample of n=1600 establishments, thereby carrying a standard error of 0.31 [95% confidence interval of 1.0% to 2.2%]

8.2. INELIGIBILITY

There are certain cases which result in Ineligibility to be established or recruited, specifically Media Ineligibility, Households without a Kitchen, Institutional and Houseless Households, and Other Ineligibility.

8.2.1. MEDIA INELIGIBILITY

The following households are ineligible to participate for the reason of media affiliation:

1. Households with members employed by Television Broadcasters, or Advertising Agencies (including repeat houses) are ineligible to participate; and
2. Households with members who are current or former employees of TAM Ltd. or BARC India.

8.2.2. HOUSEHOLDS WITHOUT A KITCHEN

As per the Census of India, a household is defined as a group of persons who normally live together and take their meals from a common kitchen. In the Census, a kitchen can take four forms depending on where meals are cooked:

1. Within a separate room within the house (i.e., Cooking inside the house: Has a kitchen)
2. Within the house in an unenclosed space, when a separate room is not available (i.e., Cooking inside the house: Does not have a kitchen)
3. Outside the house in a kitchen, being a separate room available for cooking (i.e., Outside the house: Has a kitchen)
4. Outside the house in the open (i.e., Outside of the house: Does not have a kitchen)

Households that do not have a kitchen (i.e., not included in one of the above four categories) are classified as No Cooking households and are ineligible to be established or recruited. According to the 2011 Census, about 0.3% of Indian households do not have a kitchen. This exclusion is 0.2% and 0.5% in Rural and Urban India respectively. Television households are more likely to be of greater economic means and, therefore, the percentage without a kitchen is expected to be significantly lower.

8.2.3. INSTITUTIONAL HOUSEHOLDS AND HOUSELESS HOUSEHOLDS

As per the Census of India, a group of unrelated persons who live in an institution and take their meals from a common kitchen is called an 'Institutional Household'. Examples include boarding houses, messes, hostels, rescue homes, observation homes, beggars' homes, jails, ashrams, old age homes, children's homes, orphanages, etc. Individuals living in these households typically do not have input into the purchasing or economic activity of the households, as well as have limited input into its media consumption and are hence ineligible to be established or recruited. According to the 2011 Census, about 0.3% of Indian households are institutional households. This exclusion is 0.2% and 0.4% in Rural and Urban India respectively.

Houseless Households are households which do not live in buildings or Census homes but live in the open or roadside, on pavements, in hume pipes, under fly-overs and staircases, or in the open in places of worship, mandaps, railway platforms etc. These households are not covered in the Census Houselisting phase and are hence ineligible to be established or recruited. According to the 2011 Census, about 0.3% of Indian households are Houseless. This exclusion is 0.2% and 0.4% in Rural and Urban India respectively. These households likely do not have electricity and hence do not own a

working television; therefore, the percentage of television households which are Houseless is expected to be near zero.

8.2.4. OTHER INELIGIBILITY

Occasionally households are unable to be established or recruited due to language barriers or sickness/health issues. These households are treated as In-scope non-responding units for Response Rate calculations.

APPENDIX 1. LIVE TESTING PROCEDURES

BARC India rarely conducts "live" tests in the panel. If a "live" test is requested either internally by staff or externally by members, the potential impact of the test is assessed by BARC's Measurement Science Department, Management Assurance Department and the field team (i.e., MDPL) before proceeding with the plan. Within BARC India, the authority to run any Research or Operational test live, or to change current Standard Operating Procedures on the live panel lies with the Chief Executive Officer and the Chief of Measurement Science & Business Analytics, of BARC India.

IMMATERIAL IMPACT TEST

Objectives and procedures are reviewed and findings are reported to BARC's Technical Committee.

MINOR IMPACT TEST

Objectives and procedures are discussed and **approved by BARC's Technical Committee.** Findings are subsequently reported to BARC's Technical Committee.

BARC India will communicate to all members that a test is to be conducted and will include the test in the Journal of Changes.

APPENDIX 2. NEW CONSUMER CLASSIFICATION SYSTEM (NCCS) ASSIGNMENT PROCESS

The New Consumer Classification System (NCCS) is a means of socio-economically classifying consumers in India. The NCCS classification of a household is based on two main variables:

1. Education of the household's Chief Wage Earner (CWE), defined as the person who contributes the most to the payment of household expenses; and
2. The ownership within the household of 11 specific durable goods. These durable goods are as follows:
   a. Electricity connection;
   b. Ceiling fan;
   c. LPG stove;
   d. Two-wheeler;
   e. Colour TV;
   f. Refrigerator;
   g. Washing machine;
   h. Personal computer / Laptop;
   i. Car, Jeep, or Van;
   j. Air conditioner; and
   k. Agricultural land.

Based upon the above two variables, households are assigned an NCCS grade ranging from A1, being the highest, to E3, being the lowest. The assignment is based on the grid in the Table .

Table 21
NCCS assignment grid

Education of the CWE		Illiterate	Illiterate but no formal schooling /up to 4th standard	Schooling between 5th and 9th standard	SSC / HSC	Some college but not graduated	Graduate /Post-graduate General	Graduate/ Post-graduate Professional
	None	E3	E2	E2	E2	E2	E1	D2
	1	E2	E1	E1	E1	D2	D2	D2
	2	E1	E1	D2	D2	D1	D1	D1
Number	3	D2	D2	D1	D1	C2	C2	C2
of	4	D1	C2	C2	C1	C1	B2	B2
Durables	5	C2	C1	C1	B2	B1	B1	B1
Owned	6	C1	B2	B2	B1	A3	A3	A3
	7	C1	B1	B1	A3	A3	A2	A2
	8	B1	A3	A3	A3	A2	A2	A2
	9+	B1	A3	A3	A2	A2	A1	A1