MMS Golden Rules

Video in home

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Contents

0. Updates

Paragraph	Title	Date
	Document created	2025-04-02

1 Components

1.1 Introduction

Video in home is a data source which can be used to analyze total in home audiences for specific time slots. The data includes the combined consumption of broadcasted TV channels and streaming services per media company. It covers streaming on all type of screens (TV, smartphone, PC and tablet) but only in home consumption via the home internet network.

The data is currently only available through MMS reporting tool "Video in home". The purpose of this document is to describe the detailed calculations behind the metrics reported in the tool.

1.2 Data source

The source for Video in home is MMS Video panel and their total video consumption in home. It's a single source panel measurement where the viewing is measured through People meters (as in the TV currency) together with Streaming meters which identifies what streaming service has been watched.

1.3 Objects of measurement

Video in home is reported on media company level. The metrics can be calculated per timeslots like for example a minute, hour, or complete day. It is also possible to calculate cumulative reach across a schedule of timeslots over a period of multiple days.

It is not possible to analyze specific programmes or spots. It is also not possible to break down the result on specific types of screens.

1.4 Target groups

The reporting tool contains the same available target groups (Age and Gender) as in the Broadcast tool for the TV currency. MMS are aiming to include more sociodemographic information going forward.

2 Calculation of metrics

2.1 Time shifted viewing

The main difference between MMS TV currency and Video in home is how time shifted viewing is handled.

The TV currency covers viewing up to 7 days after live broadcast day, and the time shifted viewing is always allocated and reported to the *live broadcast day* and the original broadcast slot.

In Video in home there is no such allocation being made. Instead, all type of viewing will be reported to the *viewing day* and to the time slot where the actual consumption took place.

All viewing, regardless of whether it's live, time shift or non-broadcast, will be treated in the same way. This means that time shifted viewing will be reported to different days and time slots in Video in home compared to the TV currency definition.

The time shift definition used for Video in home is equivalent to how TV data is calculated in MMS Cross-platform measurement.

2.2 Weights and demographics

All calculations are using the weights and demographic information from the *viewing day.* This is a difference compared to the TV currency where there are special rules regarding which weights and demographics are used for time shifted viewing.

2.2 Rating

Rating is defined as the average number of viewers per minute across a specific time slot. Rating is non-unique measure of the program's average audience size, where the intensity of viewing time has been considered.

Rating is calculated by dividing the accumulator *A* of weighted viewing minutes in panel, with the length of the measured slot in minutes.

The calculation is being done at target-module level (*m)* before being summarized into the complete target group (*M*):

Accumulator (A)	$\sum_{v=1}^{V}(t_v * w_p)$
Absolute rating (target module)	$round\left(\frac{A_m * \frac{U_m}{W_m}}{L}\right)$
Absolute rating (target group)	$\sum_{m=1}^{M} Absolute\ rating_m$
Relative rating (target group)	$\frac{Absolute\ rating_M}{U_M}$

Where:

V= Total number of viewing statements *v.*
t= Number of minutes for viewing statement *v* that matches the slot being measured.
w= Daily weight for panelist *p.*
U= The universe size of target-module or -group*.*
W= The sum of weights of possible panel-viewers in target-module *m*
L= Length of the measured slot in minutes.

2.3 Average viewing time

Average viewing time is the number of minutes viewed in average per individual in the target population.

As for rating, the base is accumulator of weighted viewing minutes (*A).* It is calculated (universe-adjusted and rounded) per each target-module (*m)* before being summarized and divided with the universe size of the complete target group (*M):*

Accumulator (A)	$\sum_{v=1}^{V}(t_v * w_p)$
Average viewing time (target group)	$\frac{\sum_{m=1}^{M} round\left(A_m * \frac{U_m}{W_m}\right)}{U_M}$

Where:

V= Total number of viewing statements *v*.
t= Number of minutes for viewing statement *v* that matches the slot being measured.
w= Daily weight for panelist *p*.
U= The universe size of target-module or target-group.
W= The sum of weights of possible panel-viewers in target-module *m*.

2.4 Reach single slot

This metric calculates the number of unique individuals that has been reached during a specific slot. Each viewer is only counted once, regardless the number of times the panelist has watched during the slot being measured.

The reach calculation can be combined with a reach criterion stating that the panelist needs to have been viewing for at least X continuous minutes to be included.

The weights of all unique panelist viewers are summarized, and within each target module (*m)* this sum is multiplied with the ratio between universe size and sum of panel weights. The absolute reach for each target module (*m)* can then be summarized into the complete reach of target group (*M*)

The relative reach is calculated by dividing the absolute reach with the universe size.

Absolute reach (target module)	$round\left(\left(\sum_{p=1}^{P} w_p * D_{p,v}\right) * \frac{U_m}{W_m}\right)$ $D_{p,v} = \begin{cases} 1, & if\ v_i = v_1\ and\ t > c \\ 0, & else \end{cases}$
Absolute reach (target group)	$\sum_{m=1}^{M} Absolute\ reach_m$
Relative reach (target group)	$\frac{Absolute\ reach_M}{U_M}$

Where:
P= Total number of panel-members in selected target-module *m* or target-group *M.*
w= Daily for panelist *p.*
v= Viewing statement for panelist *p* that matches the selection criteria.
t= Length in minutes for viewing statement *v.*
c= Reach criterion in minutes
U= The universe size of target-module or target-group.
W= The sum of weights of possible panel-viewers in target-module *m*.
D= A 'dummy'-variable that indicates if the panel-members viewing statement ***v*** should be considered in the reach calculation or not. Each individual panelist should only be counted once.

2.5 Reach and frequency across multiple slots

This section refers to calculation of unique viewers and frequency distribution over a schedule of multiple slots over time.

Panel-day

In this kind of calculation, a certain *panel-day* should be used. For reporting of Video in home, the ***first*** day of the period is used as panel-day.

This is a difference compared to the TV currency where the middle day of the period is being used. The Video in home definition is in line with the Online currency and the Total video measurement which also uses the first day as panel-day.

Example: The selected period for the analysis is 20250101-20250107. In this case 20250101 will be used as the panel-day.

The base for the calculation is the set of all possible panelists, guests to be excluded, and their weights, belonging to the panel-day. Only this set of panelists and their viewing during the selected period are to be considered in the reach calculation. Any viewing made by a panelist not belonging to the panel-day should not be part of the calculation.

To correct for differences between the reporting samples for each specific day and the used sample belonging to the panel-day, MMS will use the negative binomial distribution (NBD) to model the final frequency distribution. This is the same procedure as used in both the TV and Online currencies.

Reach criterion

The calculation of reach across multiple days can be combined with a reach criterion in a similar way as for reach single slot (2.4).
The calculation of the frequency distribution F_i should then be limited to the set of viewing statements where the viewing length is equal to or longer than the specified reach criterion.

Calculation of input parameters

The first step is to calculate the input parameters needed for the NBD modelling:

- "True" rating
- "Raw" rating
- "Raw" frequency vector of the number of individuals who have viewed exactly 1 slot, exactly 2 slots…exactly n slots during the selected period.

1. The true rating is basically the total sum of absolute rating for the selection of S slots. The rating for each specific slot s should be calculated according to section 2.1:

$$True_S = \sum_{s=1}^{S} Absolute\ rating_s$$

2. The *raw* number of contacts are calculated in a similar way, but with one important difference. Only the viewing statements belonging to panelists included in the reporting sample of the chosen panel-day are to be considered, and guest viewers are excluded. This means that the panelists weights from the panel-day should be used when calculating the viewing time accumulator A.

$$Raw = \sum_{s=1}^{S} Absolute\ raw\ rating_s$$

3. For each panelist belonging to the panel-day, all viewing statements (fulfilling the reach criterion) for all viewing-days in the selected period should be used to count the number of viewed slots within the period.

   By then summarizing the weights for the panelists who have viewed exactly 1 slot, exactly 2 slots…exactly n slots:

   $$F_i = \sum_{p=1}^{P} pw_p$$

   for $i = 1,2,3,\ldots,n$

   Where:
   P= Total number of possible panelists (guests excluded) belonging to the panel-day.
   pw= Weight for panelist ***p*** at the panel-day
   i= Number of viewed slots within the period

   The "raw" frequency distribution will be adjusted by fitting the negative binomial distribution to it as described in the following section.

Fitting the probability model

1. Calculate the relative frequency distribution by dividing each element of the input frequency vector with the universe size of the selected target-group:

$$Fr_i = \frac{F_i}{U_M}$$

$$for\ i = 1,2,3, \dots, n$$

Note: For class2 variables this refers to the base target derived from RB3-file. For class 3 variables the sum of weights of panelists in target group should be used. This applies for all cases where the universe size parameter is mentioned in this section.

2. Calculate the share of individuals watching exactly 0 days of the period by summarizing all elements of the frequency vector calculated in the previous step, and subtract this from 1:

$$Fr_0 = 1 - \sum_{i=1}^{n} Fr_i$$

Special case: In case $\sum_{i=1}^{n} Fr_i > 1$, let element $Fr_0 = 0$.

3. Add element Fr_0 to the frequency vector Fr to make it cover $i = 0,1,2, \dots, n$ number of active viewing days.

Special case: In case Fr begins with one or more elements where $Fr_i = 0$, these elements should be removed from the frequency vector before applying the probability model in the following steps.

Example: Assume the following relative frequency distribution:
Exactly 0 slots: 0
Exactly 1 slot: 0
Exactly 2 slots: 0.5
Exactly 3 slots: 0.4
Exactly 4 slots: 0
Exactly 5 slots: 0.1

Since the distribution begins with two elements with value 0, these two elements should be removed from the frequency vector. The remaining Fr_i will then cover the counts $i = 2,3,4,5$.

4. Before being able to apply the model, it is necessary to estimate the needed NBD parameters. The first step is to estimate the parameter *k:*

$$k = abs\left[-\frac{RawR * ln(Fr_0)}{ln(Fr_0) - RawR * W_{-1}\left[\frac{Fr_0^{\left(\frac{1}{RawR}\right)} * ln(Fr_0)}{RawR}\right]}\right]$$

Where:

RawR= The relative version of the input parameter *Raw*, where it is divided by the universe size of the relevant target-group:

$$RawR = \frac{Raw}{U_M}$$

Fr_0 = The value of the 0-element in the frequency vector, as calculated in step 2.
W_{-1}[ ]= The Lambert W function (using the secondary branch).

Special case: In case $k > 120$, let $k = 120$.

5. After estimating the value of *k,* the parameters *a* and *b* can be calculated as:

$$a = \frac{\frac{Raw}{k}}{U_M}$$

Where:

Raw: The input parameter of raw number of contacts
U: The universe size of target-group *M*.

$$b = a * \frac{True}{Raw}$$

Where:

True: The input parameter of "true" number of contacts.
Raw: The input parameter of "raw" number of contacts.

6. With the values of *a* and *b,* the NBD probabilities of *p_raw* and *p_true* can be calculated as:

$$p\_raw = \frac{a}{(a+1)}$$

$$p\_true = \frac{b}{(b+1)}$$

7. With all needed parameters, each element of the frequency distribution Fr will be adjusted by using the function of the negative binomial distribution:

$$\widehat{Fr}_i = \frac{\Gamma(k+i)}{\text{i! }\Gamma(\text{k})}[(p\_true)^i(1-p\_true)^k - (p\_raw)^i(1-p\_raw)^k] + Fr_i$$

Where:

Γ( )= Gamma function.
i= The number of $i = 0,1,2,\dots,n$ active slots as remaining after step (3.).

Final adjustments and reach calculation

1. The next step is to adjust the sum of the frequency shares to make it equal to 1 (=100% of the population).

   In case the sum of $\widehat{Fr} \neq 1$, the difference should be added by adjusting the last, n^{th}, element of the frequency distribution as:

$$\widehat{Fr}_n = \widehat{Fr}_n + \left(1 - \sum_{i=0}^{n} \widehat{Fr}_i\right)$$

   Special case: In case any elements of the frequency distribution were removed due to the special case rule in step (3.), these should now be included again (with their values of 0) to make the full adjusted frequency distribution $\widehat{Fr}_i$ cover the complete number of $i = 0,1,2,\dots,n$ number of slots.

2. The relative reach across the selected period can now be calculated as the sum of elements $i = 1,2,\dots,n$, i.e the share of individuals who have watched during at least one of the slots within the period:

$$Relative\ reach\ (across\ multiple\ slots) = \sum_{i=1}^{n} \widehat{Fr}_i$$

Calculate the absolute frequency counts by factor all elements of the relative frequency distribution $\widehat{Fr}$ with the universe size of the relevant target groups:

$$\hat{F}_i = \widehat{Fr}_i * U_M$$

The sum of the absolute frequency distribution $\hat{F}$ gives the absolute number of reached individuals during the selected period:

$$Absolute\ reach\ (multiple\ slots) = \sum_{i=1}^{n} \hat{F}_i$$

Cumulative reach over time

The reach calculation can be used to display the growth of additional reached viewers day by day for the selection of slots.

All above steps including calculation of input parameters, fitting the probability model and final reach calculation needs to be done in an iterative way adding each slot within the period one at a time for s1, s1+s2, s1+s2+s3 etc. up until the complete S slots of the selection.

The panel-day is chosen based on the complete selected period and should be used for each specific iteration within the period.

To avoid the risk of decreasing reach levels within a period of analysis, MMS applies and additional correction step upon the results. This will be described by the following example:

Example: Assume a reach and frequency-analysis for the period 20250101-20250105 (slot: full day) with the below results for the frequency distribution $\hat{F}_i$ after performing the negative binomial modelling as described in previous steps.

The absolute reach after 20250103 is lower, 107 000, compared to the results after the previous day 20250102.

	$\hat{F}_1$	$\hat{F}_2$	$\hat{F}_3$	$\hat{F}_4$	$\hat{F}_5$	***Absolute Reach+1***
d1=20250101	100 000					**100 000**
d2=20250102	80 000	30 000				**110 000**
d3=20250103	75 000	27 000	5 000			**107 000**
d4=20250104	70 000	32 000	4 000	2 000		**108 000**
d5=20250105	65 000	35 000	10 000	2 000	1 000	**113 000**

The absolute reach level after each day in the period needs to be compared with the previous one:

$$difference_d = Absolute\ reach_d - Absolute\ reach_{d-1}$$

In case $difference_d < 0$, the absolute value of the difference should be added to the last, n^{th} , element of the frequency distribution $\hat{F}_i$ as:

$$\hat{F}_n = \hat{F}_n + abs(difference_d)$$

In the example we can see that the difference between d3 and d2 is 107 000-110 000= -3000 which means that that:

$$\hat{F}_{3,d3} = 5000 + abs(-3000) = 8000$$

And the absolute reach after d3 now equals to 110 000.

Continuing with the procedure we can see that also the reach level after 20250104 needs to be adjusted since it now will be lower compared to the corrected reach level of 20250103.

The final frequency distribution and reach+1 levels of the example are seen in the table below:

	$\hat{F}_1$	$\hat{F}_2$	$\hat{F}_3$	$\hat{F}_4$	$\hat{F}_5$	***Absolute Reach+1***
d1=20250101	100 000					**100 000**
d2=20250102	80 000	30 000				**110 000**
d3=20250103	75 000	27 000	*8 000*			***110 000***
d4=20250104	70 000	32 000	4 000	*4 000*		***110 000***
d5=20250105	65 000	35 000	10 000	2 000	1 000	**113 000**