

# Multiweek Cume Formula

For many years, the RADAR® service has used a multiweek cumulative audience projection model. This document briefly describes, in nonmathematical terms, the logic of the model and the way it works.

The model has been incorporated into the RADAR computer systems, including the RADAR Software Suite software packages, as an adjunct to:

- specific schedule audience tabulations, which provide reach and frequency estimates, overall and by demographics, for a designated set of network broadcasts; and
- rotation plan audience tabulations, which provide average reach and frequency estimates, overall and by demographics, for a number of units rotated with designated dayparts.

Reach and frequency estimates are available for 126 sex/age categories and for all socio-economic groups.

## Individual Week Reach

The RADAR database reflects radio usage over one week. Hence, the reach of a network radio spot schedule is calculated in the RADAR Software Suite by passing the respondent database and ascertaining which respondents are in the audience of at least one spot in the schedule. Reach is simply the sum of the weights assigned to those respondents.

Calculation of the reach of a network radio rotation plan is somewhat more complicated because reach is actually an average of all possible results of the rotations specified by the plan. The reach is determined by passing the respondent database and calculating, for each respondent, the probability that they would be

in the audience of the plan. Reach is simply the sum, over all respondents, of the probability of inclusion times the weight assigned to a respondent.

While reach over one week is based on "actual" calculations, projections of reach to two or more weeks are based on a mathematical formula, namely the beta function.

## Multiweek Reach

The beta function is a two-parameter mathematical formula. Like any two-parameter formula, two points on the curve are required to fit it. The two points used for RADAR multiweek projections are the average individual broadcast audience of a schedule (or plan) and the reach of the schedule (or plan) over one week.

For a given schedule (or plan) the function is fitted to each of the up to 18 discrete sex/age groups that may be included in an audience target. Projections to two or more weeks are done separately for each sex/age group and accumulated to arrive at an overall number for an audience target. Separate calculations are performed for each audience target.

## Methodological Basis

The RADAR service has conducted extensive research on this multiweek projection model, and has concluded that it yields logical results and is theoretically sound. For example, schedules and plans with relatively low one-week frequency accumulate reach faster than those with higher one-week frequency. In all cases, reach tends to increase at a diminishing rate.

The hypothesis underlying the use of the beta formula is simply that this particular mathematical equation describes, with reasonable

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accuracy, the way in which radio audiences accumulate. We have put this assumption to a series of rather stringent tests for schedules and plans over a one-week period—the period for which the RADAR service has complete survey data. The formula has performed well in these tests, even when it was used to project reach involving up to 240 broadcasts given only the average audience and the pairwise duplication rates among those broadcasts.

In using the beta formula to project reach over two or more weeks from RADAR data over one week, a tacit assumption is that duplication rates between broadcasts in different weeks are about the same as duplication rates between broadcasts in the same week. Trial calculations completed, with different assumptions, led to the conclusion that the assumptions about duplication rates implicit in the beta formula are very rational for network radio. The natural decrease in audience duplication for different programs across weeks is for the most part canceled by higher duplication rates for the same programs across weeks. If the model errs, it probably errs in being conservative; i.e., assuming more pairwise duplication than is actually the case with a consequent estimate of reach that is conservative (on the low side) and a consequent estimate of frequency that is somewhat on the high side.

This model, based upon actual turnover rates from specific plans, is superior to “standard” reach and frequency estimation procedures that are based upon only the average audience together with the number of units and/or networks or the average audience and general daypart cumulative audiences.

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