

**MEASUREMENT OF FIELD STRENGTH FOR VHF (METRIC) AND UHF
(DECIMETRIC) BROADCAST SERVICES, INCLUDING TELEVISION**

(Question 7/5)

(1959-1963-1966-1978-1986)

1. Description of coverage

For the purpose of frequency assignment, the description of coverage for VHF (metric) and UHF (decimetric) broadcast services (television broadcasting, frequency-modulation broadcasting, etc.), should be in terms of the extent to which service is provided to potential viewers or listeners. The service may be classified in accordance with the quality of the signal at an individual location. For the purpose of assigning stations, it is probably necessary to consider only one quality of service; however, it may be useful for other purposes to define more than one quality.

Several methods have been proposed for describing the service coverage of broadcast stations in the VHF (metric) and UHF (decimetric) bands.

* This Report is brought to the attention of Study Groups 10 and 11.

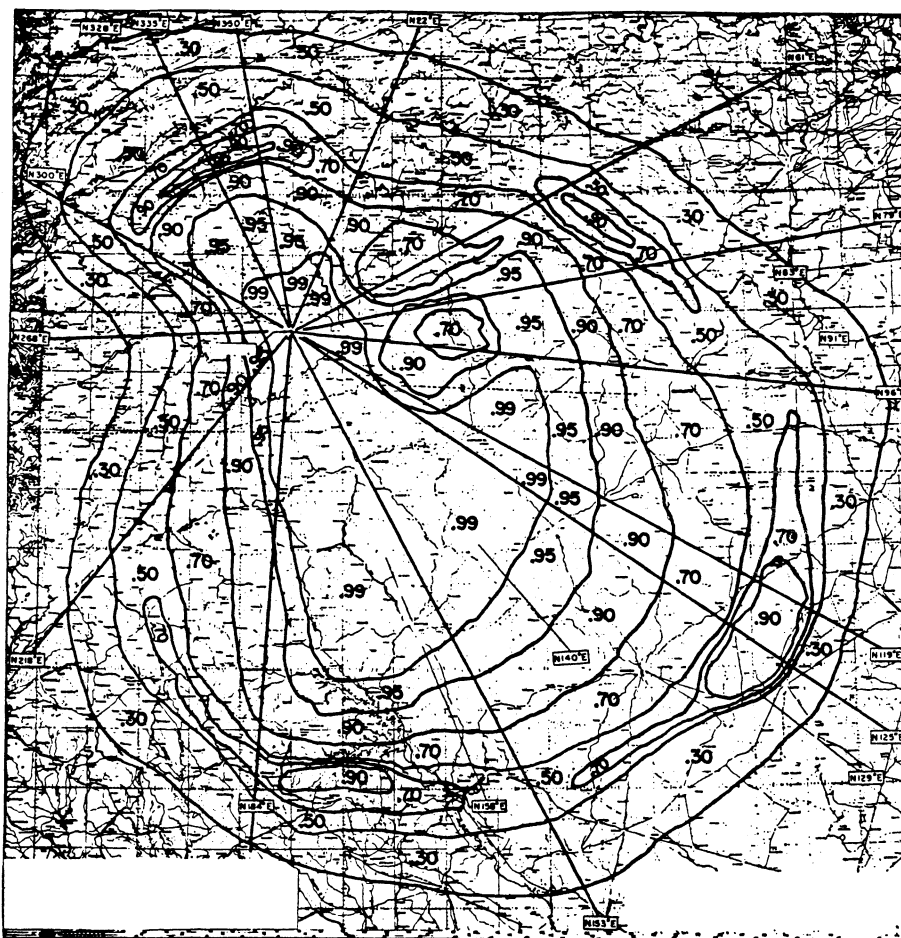
An acceptable method for describing broadcast service should meet the following criteria [TASO, 1959]:

- 1.1 it should show the location and extent of all areas provided with a given quality of service;
- 1.2 it should take into account significant variations with time;
- 1.3 the method of specifying service should be sufficiently fine-grained to be capable of showing the amount (area or population) and location of service in distinct areas and directions from the transmitter;
- 1.4 it should be capable of showing the effect of interference from one or more stations in terms of the amount and location of service lost;
- 1.5 it should be capable of showing two or more qualities of service;
- 1.6 it should be possible to predict the service area by means of a reasonable number of measurements and/or calculations of field strength;
- 1.7 it should lend itself to simple two-dimensional presentation.

After extensive studies of the various methods for describing VHF (metric) and UHF (decimetric) broadcast services, the location probability has been recommended [TASO, 1959; FCC, 1949 and 1950] as the best statistic for describing services. A brief description of the meaning of this statistic is given for the benefit of those not familiar with the term. Under steady-state laboratory conditions, it has been possible to evaluate statistically the useful signal-to-interfering signal ratios which are required to produce pictures or sound of a quality acceptable to different observers in the presence of various types of interference. The ratio accepted by some percentage of the observers, say 50%, is chosen as the acceptance ratio for each type of interference. At any specific location, the useful signal and/or the interference may vary with time, so that the term "time-availability" is used to indicate the percentage of time for which the acceptance ratio is exceeded. A particular quality of service corresponds to a specified acceptance ratio exceeded for a given percentage of time at an agreed standard receiving installation. The location probability is then defined as the probability of receiving this quality of service, or better. Alternatively, the location probability may be defined as the percentage of locations in a small area, for which this quality of service, or better, is expected. To minimize computations, a single value of 90%, 95% or 99% time availability may be adopted as the satisfactory level. This figure might be changed as found desirable, or several levels and standard receiving installations might be adopted to show different qualities of service.

Location probability describes, in a satisfactory manner, the location and amount of the service available from the point of view of the station assignment and allocation planner, the operating authority, and the viewer or listener. It is believed that this statistic is the most meaningful and practical for the description of television and frequency-modulation broadcast service and easily meets all the above criteria. Location probability is preferable to the signal-to-interference ratio of the useful signal level as a service index, because it provides a comparable measure of the quality of service which is independent of frequency, distance, etc. Although the signal-to-interference ratio might be easier to comprehend, it has the disadvantage of requiring different numbers at different frequencies and distances to describe the same quality of service. The useful signal level is an unsatisfactory index, in that it varies with frequency and cannot take into account interference other than receiver noise. However, when the interference is receiver noise, then contours of constant location probability will also be contours of constant field strength. Procedures for the computation of location probability are relatively simple and rapid [FCC, 1949 and 1950; Kirby, 1957].

Two illustrations of the presentation of service by the use of location probability are given in Figs. 1 and 2. The solid curves represent contours of constant service along which the location probability of a given quality of service is constant for a standard installation. Where service is limited by noise, rather than co-channel interference, the location probability, found at a given distance along any radial in Fig. 1, corresponds to some fixed median-time, median-location value of field strength. For example, a location probability of 0.5 in Fig. 1 corresponds to a median field strength of 57 dB relative to 1 $\mu\text{V/m}$. Fig. 1 shows a great amount of detail, possibly more than could be shown normally with a practical amount of data. However, such detail might be desired for specific sections of a station service area, depending upon the particular problem at hand. Fig. 2 shows what a service map might look like in a more typical case, where the great amount of data for a more detailed map like Fig. 1 is not available.



The numbers indicate the probability of locations receiving an acceptable service for at least 90 % of the time

This method of portrayal is also convenient for estimating the interference effects of existing, new, or proposed stations in neighbouring areas. Thus, the overall location probability for service in the presence of a number of interfering services, is approximately the product of the individual location probabilities for service of the useful station in the presence of each source of interference acting alone [FCC, 1949 and 1950]. This approximation is fairly good when the resultant overall location probability is 50% or better and improves as the resultant service increases. More accurate methods for computing the effects of multiple interference are also available [FCC, 1949 and 1950; Norton *et al.*, 1952].