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§ 73.160 Vertical plane radiation characteristics, f(θ).

(a) The vertical plane radiation characteristics show the relative field being radiated at a given vertical angle, with respect to the horizontal plane. The vertical angle, represented as θ, is 0 degrees in the horizontal plane, and 90 degrees when perpendicular to the horizontal plane. The vertical plane radiation characteristic is referred to as f(θ). The generic formula for f(θ) is:

\[ f(\theta) = \frac{E(\theta)}{E(0)} \]

where:
- \( E(\theta) \) is the radiation from the tower at angle \( \theta \).
- \( E(0) \) is the radiation from the tower in the horizontal plane.

(b) Listed below are formulas for f(θ) for several common towers.

1. For a typical tower, which is not top-loaded or sectionalized, the following formula shall be used:

\[ f(\theta) = \frac{\cos G \sin \theta - \cos G}{1 - \cos G \cos \theta} \]

where:
- \( G \) is the apparent electrical height: the sum of \( A \) and \( B \).
- \( A \) is the physical height of the tower, in electrical degrees, and
- \( B \) is the difference, in electrical degrees, between the apparent electrical height (G, based on current distribution) and the actual physical height.

See Figure 1 of this section.
(3) For a sectionalized tower, the following formula shall be used:

\[ G = A + B \]
\begin{equation}
\begin{align*}
f(\theta) &= \frac{\sin \Delta \left[ \cos B \cos (A \sin \theta) - \cos G \right] + \\
&\quad \sin B \left[ \cos D \cos (C \sin \theta) - \sin \theta \sin D \sin (C \sin \theta) - \cos \Delta \cos (A \sin \theta) \right]}{
\cos \theta \left[ \sin \Delta (\cos B - \cos G) + \sin B (\cos D - \cos \Delta) \right]} 
\end{align*}
\end{equation}

where:

A is the physical height, in electrical degrees, of the lower section of the tower.

B is the difference between the apparent electrical height (based on current distribution) of the lower section of the tower and the physical height of the lower section of the tower.

C is the physical height of the entire tower, in electrical degrees.

D is the difference between the apparent electrical height of the tower (based on current distribution of the upper section) and the physical height of the entire tower. D will be zero if the sectionalized tower is not top-loaded.

G is the sum of A and B; A+B.

H is the sum of C and D; C+D.

\( \Delta \) is the difference between H and A; H−A.

See Figure 2 of this section.
(c) One of the above \( f(\theta) \) formulas must be used in computing radiation in the vertical plane, unless the applicant submits a special formula for a particular type of antenna. If a special formula is submitted, it must be accompanied by a complete derivation and
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§ 73.182

Engineering standards of allocation.

(a) Sections 73.21 to 73.37, inclusive, govern allocation of facilities in the AM broadcast band 535–1705 kHz. §73.21 establishes three classes of channels in this band, namely, clear, regional and local. The classes and power of AM broadcast stations which will be assigned to the various channels are set forth in §73.21. The classifications of the AM broadcast stations are as follows:

(1) Class A stations operate on clear channels with powers no less than 10kW nor greater than 50 kW. These stations are designed to render primary and secondary service over an extended area, with their primary services areas protected from objectionable interference from other stations on the same and adjacent channels. Their secondary service areas are protected from objectionable interference from co-channel stations. For purposes of protection, Class A stations may be divided into two groups, those located in any of the contiguous 48 States and those located in Alaska in accordance with §73.25.

(i) The mainland U.S. Class A stations are those assigned to the channels allocated by §73.25. The power of these stations shall be 50 kW. The Class A stations in this group are afforded protection as follows:

(A) Daytime. To the 0.1 mV/m groundwave contour from stations on the same channel, and to the 0.5 mV/m groundwave contour from stations on adjacent channels.

(B) Nighttime. To the 0.5 mV/m-50% skywave contour from stations on the same channel.

(ii) Class A stations in Alaska operate on the channels allocated by §73.25 with a minimum power of 10 kW, a maximum power of 50 kW, and an antenna efficiency of 282 mV/m/kW at 1 kilometer. Stations operating on these channels in Alaska which have not been designated as Class A stations in response to licensee request will continue to be considered as Class B stations. During daytime hours a Class A station in Alaska is protected to the 100 μV/m groundwave contour from co-channel stations. During nighttime hours, a Class A station in Alaska is protected to the 100 μV/m-50 percent skywave contour from co-channel stations. The 0.5 mV/m groundwave contour is protected both daytime and nighttime from stations on adjacent channels.

[46 FR 11993, Feb. 12, 1981]