§ 73.190 Engineering charts and related formulas.

(a) This section consists of the following Figures: 2, 3, 5, 6a, 7, 8, 9, 10, 11, 12, and 13. Additionally, formulas that are directly related to graphs are included.

(b) Formula 1 is used for calculation of 50% skywave field strength values.

\[ F_s(50) = (97.5 - 20 \log D) - \left(2\pi + 4.95 \tan^2 \phi M \right) \left(\frac{D}{1000}\right) \text{ dB} \text{ (μV/m)} \]  

(Eq. 1)

The slant distance, \( D \), is given by:

\[ D = \sqrt{40,000 + d^2} \text{ km} \]  

(Eq. 2)

The geomagnetic latitude of the midpoint of the path, \( \Phi M \), is given by:

\[ \Phi M = \arccos(\sin a_T \sin \theta T + \cos a_T \cos \theta T \cos(\theta R - \theta T)) \text{ degrees} \]  

(Eq. 3)

The short great-circle path distance, \( d \), is given by:

\[ d = 111.18 d^\circ \text{ km} \]  

(Eq. 4)

Where:

\[ a_T = \arccos(\sin \theta T \sin a_R + \cos \theta T \cos a_R \cos(b_R - b_T)) \text{ degrees} \]  

(Eq. 5)

\[ a_M = 90 - \arccos(\frac{\sin a_R \cos d^\circ + \cos a_R \sin d^\circ}{2}) \]  

(Eq. 6)

\[ b_M = b_R + k \left[ \arccos\left(\frac{\cos\frac{d^\circ}{2} - \sin a_R \sin a_M}{\cos a_R \cos a_M}\right) \right] \]  

(Eq. 7)

Note (1): If \( |F_{ad}| \) is greater than 60 degrees, equation (1) is evaluated for \( |F_{ad}| = 60 \) degrees.

Note (2): North and east are considered positive; south and west negative.

Note (3): In equation (7), \( k = -1 \) for west to east paths (i.e., \( b_R > b_T \)), otherwise \( k = 1 \).

(c) Formula 2 is used to calculate 10% skywave field strength values.

FORMULA 2. Skywave field strength, 10% of the time (at SS+6):

\[ F_s(10) = F_s(50) + \Delta \text{ dB} \text{ (μV/m)} \]  

Where:

\[ \Delta = 6 \text{ when } |F_{ad}| < 40 \]
\[ \Delta = 0.2 |F_{ad}| - 2 \text{ when } 40 \leq |F_{ad}| \leq 60 \]
\[ \Delta = 10 \text{ when } |F_{ad}| > 60 \]

(d) Figure 6a depicts angles of departure versus transmission range. These angles may also be computed using the following formulas:
\[ \theta^\circ = \tan^{-1}\left( k_n \cot \frac{d}{444.54} \right) - \frac{d}{444.54} \]

Where:
- \( d \) = distance in kilometers
- \( n \) = 1 for 50% field strength values
- \( n \) = 2 or 3 for 10% field strength values

and where
- \( K_1 = 0.00752 \)
- \( K_2 = 0.00938 \)
- \( K_3 = 0.00565 \)

**NOTE:** Computations using these formulas should not be carried beyond 0.1 degree.

(e) In the event of disagreement between computed values using the formulas shown above and values obtained directly from the figures, the computed values will control.
ANGLES OF DEPARTURE
VERSUS
TRANSMISSION RANGE

1 for use in computing 50% signals
2 and 3 for use in computing 10% signals

\[ e^n = \tan^{-1} \left( k_n \cot \frac{d}{444.54} \right) - \frac{d}{444.54} \]

where:
- \( k_1 = 0.00752 \) (\( h_a = 96.56 \text{ km} \))
- \( k_2 = 0.00938 \) (\( h_a = 120.70 \text{ km} \))
- \( k_3 = 0.00963 \) (\( h_a = 72.42 \text{ km} \))
§ 73.190

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ANTENNAS FOR AM BROADCAST STATIONS

MINIMUM VERTICAL HEIGHT OF ANTENNAS PERMITTED TO BE INSTALLED (A, B, C)

A. CLASS A STATIONS (EXCEPT ALASKAN A) OR
   A MINIMUM EFFECTIVE FIELD INTENSITY
   OF 362 mw/M FOR 1 kW @ 1 KM
   WHERE IT IS SHOWN THAT AN ANTENNA OF MORE
   THAN 152 METERS CANNOT BE APPROVED AT
   ANY LOCATION WITHIN A METROPOLITAN AREA
   BECAUSE OF AIR TRAFFIC CONSIDERATION,
   A HEIGHT OF 152 METERS WILL BE ACCEPTED.

B. CLASS A (ALASKAN A), B, & D STATIONS, OR
   A MINIMUM EFFECTIVE FIELD INTENSITY
   OF 202 mw/M FOR 1 kW @ 1 KM

C. CLASS C STATIONS, OR A MINIMUM EFFECTIVE
   FIELD INTENSITY OF 241 mw/M FOR 1 kW @ 1 KM
   (750 WATTS, 75 kW @ 250 WATTS, 125 kW @ 1 KM)

D. 825 WAVELENGTH

E. 8500 WAVELENGTH

F. 9825 WAVELENGTH

Figure 7
Figure 8
PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

Figure 9
PERMISSIBLE DAYTIME RADIATION
FOR CLASS II STATIONS

1000 KC

Figure 10
PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

1600 KC

Figure 11
SUNWAVE DIURNAL FACTORS FOR SUNRISE

Note: Factors given in terms of hour with respect to sunrise at mid-point of path.
Subpart B—FM Broadcast Stations

§ 73.201 Numerical designation of FM broadcast channels.

The FM broadcast band consists of that portion of the radio frequency spectrum between 88 MHz and 108 MHz. It is divided into 100 channels of 200 kHz each. For convenience, the frequencies available for FM broadcasting (including those assigned to non-commercial educational broadcasting) are given numerical designations which are shown in the table below:

<table>
<thead>
<tr>
<th>Frequency (Mc/s)</th>
<th>Channel No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.1</td>
<td>201</td>
</tr>
<tr>
<td>88.3</td>
<td>202</td>
</tr>
</tbody>
</table>