§ 73.190 Engineering charts and related formulas.

(a) This section consists of the following Figures: 2, r3, 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.

**FORMULA 1.** Skywave field strength, 50% of the time (at SS+6):

\[
F_c(50) = (97.5 - 20\log D - \left(2\pi + 4.95\tan^2 \phi_u\right) \left(\frac{D}{1000}\right) dB(\mu V/m) \quad (Eq. 1)
\]

Where:
- \(F_c\) is the characteristic field strength of 100 mV/m at 1 km
- \(\phi_u\) is the geomagnetic latitude of the transmitting terminal
- \(D\) is the slant distance
- \(a_t\) is the geographic latitude of the transmitting terminal
- \(b_T\) is the geographic longitude of the transmitting terminal
- \(a_r\) is the geographic latitude of the receiving terminal
- \(b_R\) is the geographic longitude of the receiving terminal
- \(\phi_M\) is the geographic latitude of the midpoint of the great-circle path
- \(a_M\) is the geographic latitude of the midpoint of the great-circle path
- \(b_M\) is the geographic longitude of the midpoint of the great-circle path

\(a_M = 90 - \arccos \left[ \sin a_R \cos \left(\frac{d^o}{2}\right) + \cos a_R \sin \left(\frac{d^o}{2}\right) \left(\frac{\sin a_T - \sin a_R \cos d^o}{\cos a_R \sin d^o}\right) \right] \quad (Eq. 6)\)

\(b_M = b_R + k \arccos \left[ \frac{\cos \left(\frac{d^o}{2}\right) - \sin a_R \sin a_M}{\cos a_R \cos a_M} \right] \quad (Eq. 7)\)

Note (1): If \(|F_{ad}| > 60\) 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 for calculation of 10% skywave field strength values.

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

The skywave field strength, \(F_c(10)\), is given by:

\[
F_c(10) = F_c(50) + \Delta dB(\mu V/m)
\]

Where:
- \(\Delta = 6\) when \(|F_{ad}| < 40\)
- \(\Delta = 0.2\) when \(40 \leq |F_{ad}| \leq 60\)
- \(\Delta = 10\) when \(|F_{ad}| > 60\)

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

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

\[ \theta = \tan^{-1} \left( k \cot \left( \frac{d}{444.54} \right) - \frac{d}{444.54} \right) \]

where:
- \( k_1 = 0.00752 \) \( (h_0 = 96.56 \text{ km}) \)
- \( k_2 = 0.00938 \) \( (h_0 = 120.70 \text{ km}) \)
- \( k_3 = 0.00965 \) \( (h_0 = 72.42 \text{ km}) \)
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ANTENNAS FOR AM BROADCAST STATIONS

A. Class A stations (except Alaskan A1 or A2), or a minimum effective field intensity of 382 mw/m² for 1 kW @ 1 km

B. 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 considerations, a height of 152 meters will be accepted.

C. Class C stations, or a minimum effective field intensity of 250 mw/m² for 1 kW @ 1 km

D. 0.250 wavelength

E. 0.500 wavelength

F. 0.825 wavelength

Figure 7
EFFECTIVE FIELD AT ONE KILOMETER FOR ONE KILOWATT (Curve A)

USE FOR SIMPLE OMNIDIRECTIONAL VERTICAL ANTENNA WITH GROUND SYSTEM OF AT LEAST 120 RADIALS OF 1/4 WAVELENGTH

EFFECTIVE FIELD IN MILLIVOLTS PER METER (CURVE A)

WAVELENGTH - METERS (CURVE B)

ANTENNA HEIGHT IN WAVELENGTH (CURVE A)

FREQUENCY - KILOHERTZ (CURVE B)

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
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>