

**§ 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):

The skywave field strength,  $F_c(50)$ , for a characteristic field strength of 100 mV/m at 1 km is given by:

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

The slant distance,  $D$ , is given by:

$$D = \sqrt{40,000 + d^2} \text{ km} \quad (\text{Eq. 2})$$

The geomagnetic latitude of the midpoint of the path,  $\Phi_M$ , is given by:

$$\Phi_M = \arcsin[\sin a_M \sin 78.5^\circ + \cos a_M \cos 78.5^\circ \cos(69 + b_M)] \text{ degrees} \quad (\text{Eq. 3})$$

The short great-circle path distance,  $d$ , is given by:

$$d = 111.18d^\circ \text{ km} \quad (\text{Eq. 4})$$

Where:

$$d^\circ = \arccos[\sin a_T \sin a_R + \cos a_T \cos a_R \cos(b_R - b_T)] \text{ degrees} \quad (\text{Eq. 5})$$

Where:

$a_T$  is the geographic latitude of the transmitting terminal (degrees)

$a_R$  is the geographic latitude of the receiving terminal (degrees)

$b_T$  is the geographic longitude of the transmitting terminal (degrees)

$b_R$  is the geographic longitude of the receiving terminal (degrees)

$a_M$  is the geographic latitude of the midpoint of the great-circle path (degrees) and is given by:

$b_M$  is the geographic longitude of the midpoint of the great-circle path (degrees) and is given by:

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

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

Note (1): If  $|F_M|$  is greater than 60 degrees, equation (1) is evaluated for  $|F_M| = 60$  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:

$$F_c(10) = F_c(50) + \Delta \text{ dB}(\mu\text{V/m})$$

Where:

$\Delta = 6$  when  $|F_M| < 40$

$\Delta = 0.2 |F_M| - 2$  when  $40 \leq |F_M| \leq 60$

$\Delta = 10$  when  $|F_M| > 60$

(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.

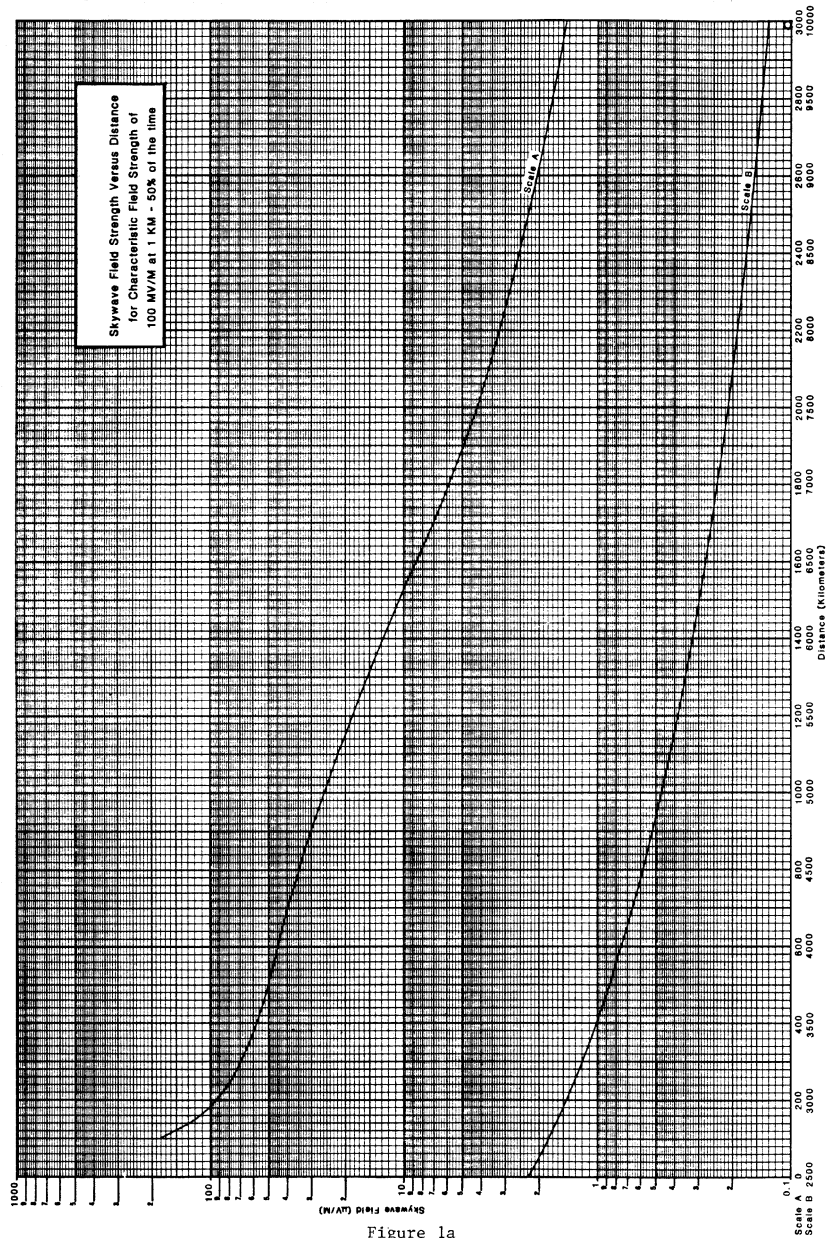
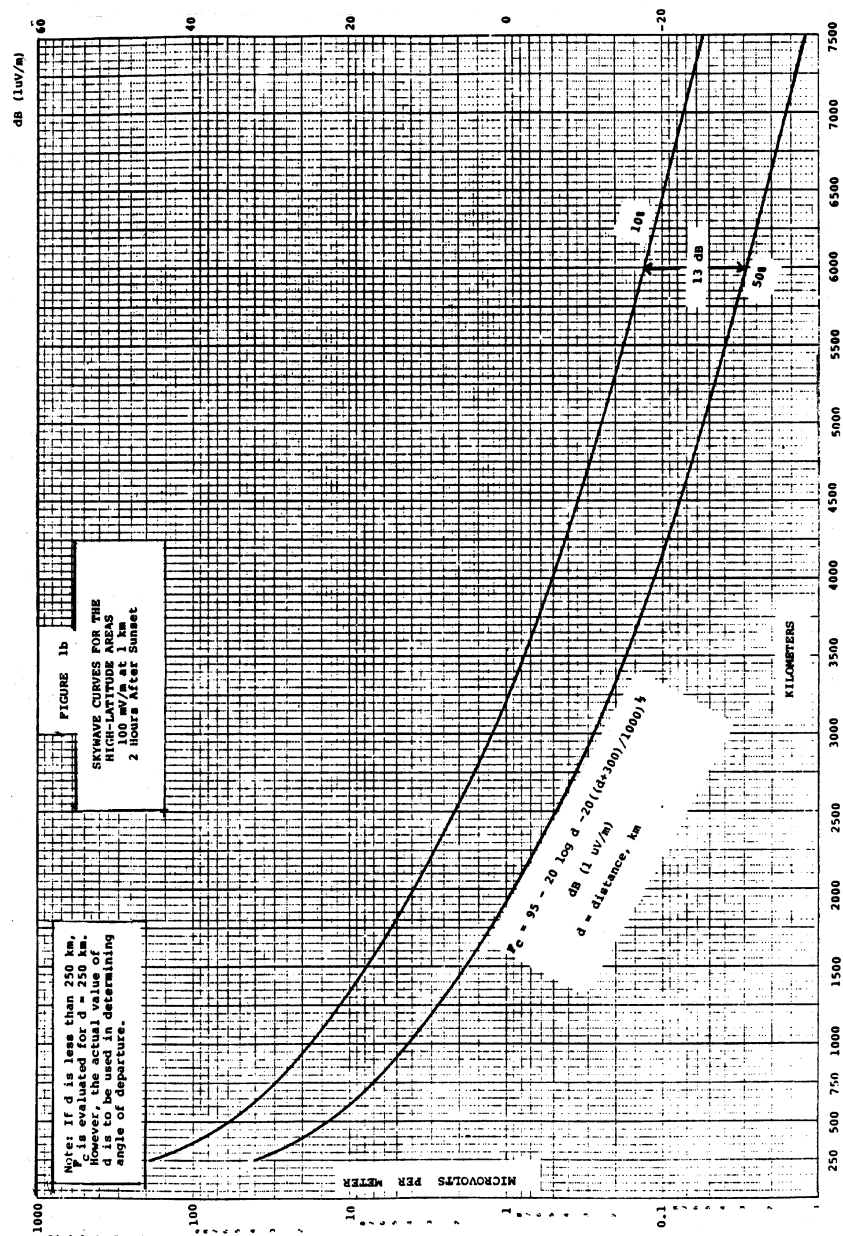
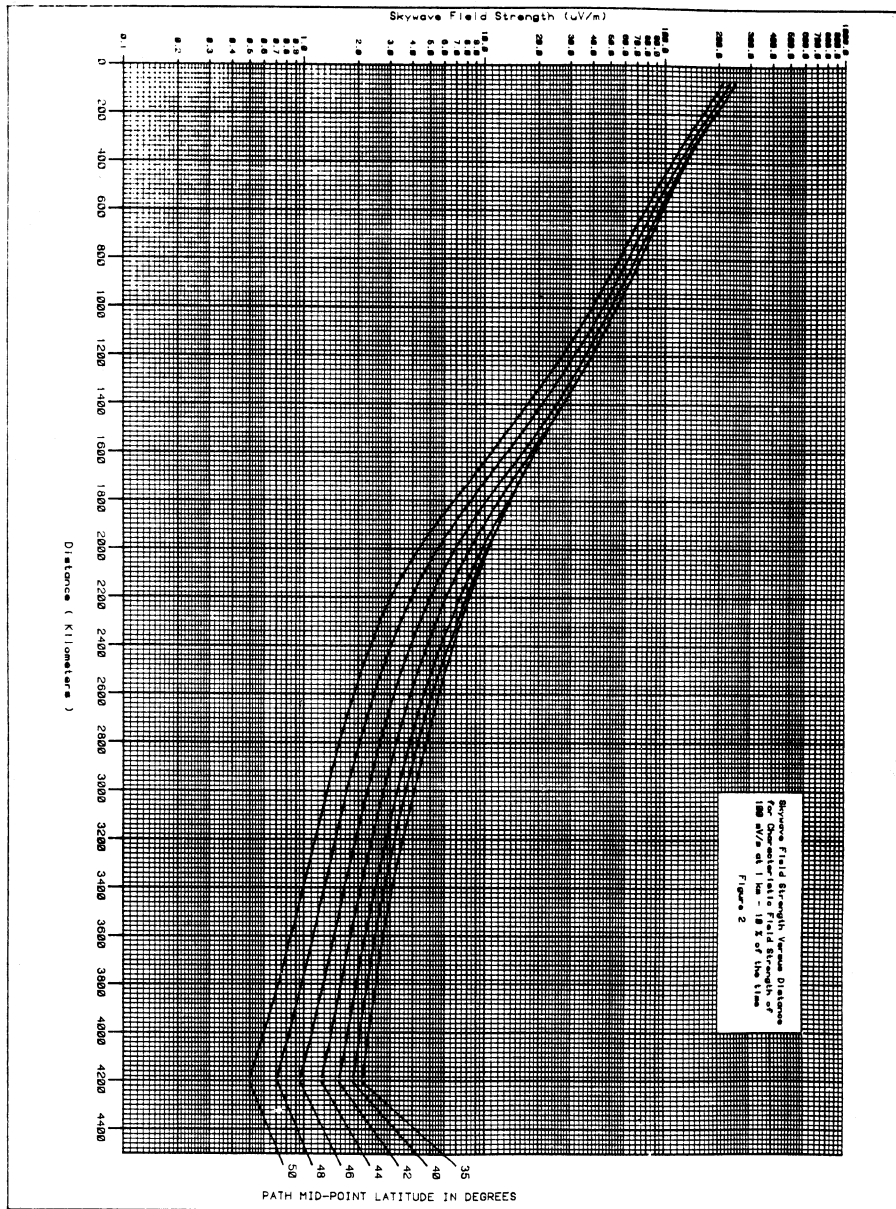


Figure 1a





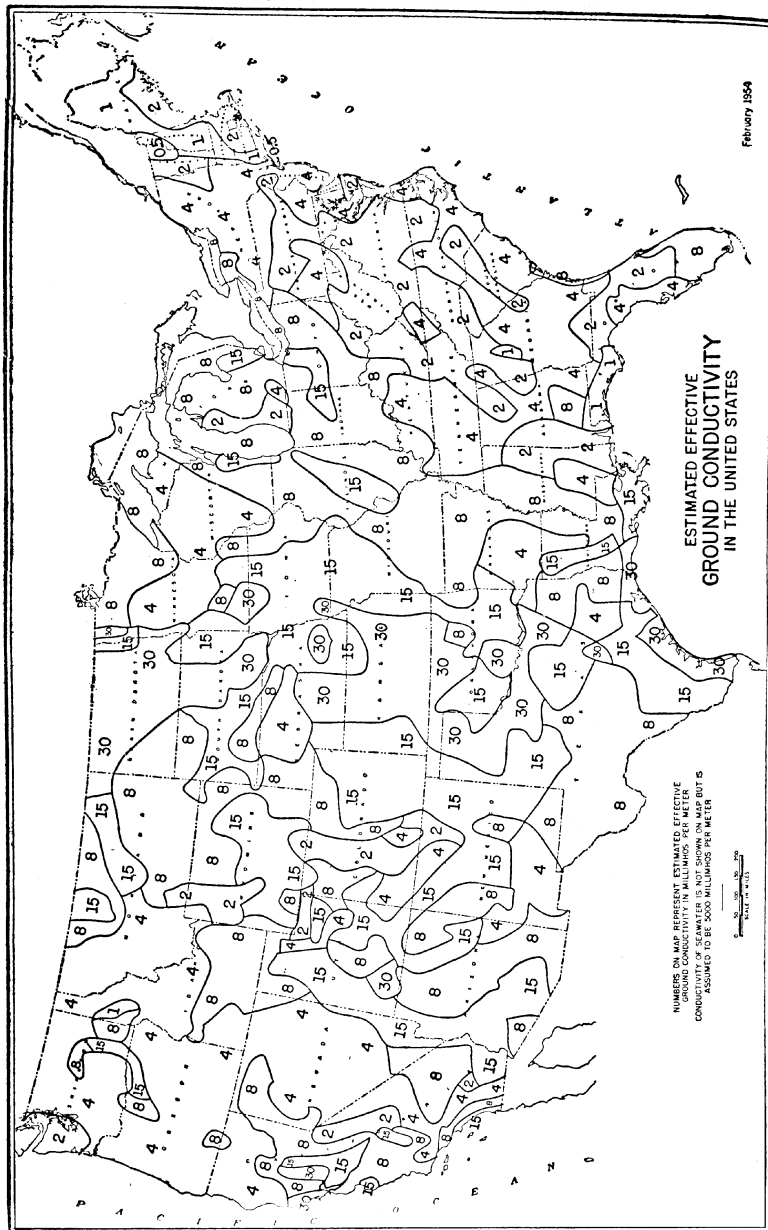


FIGURE E3.

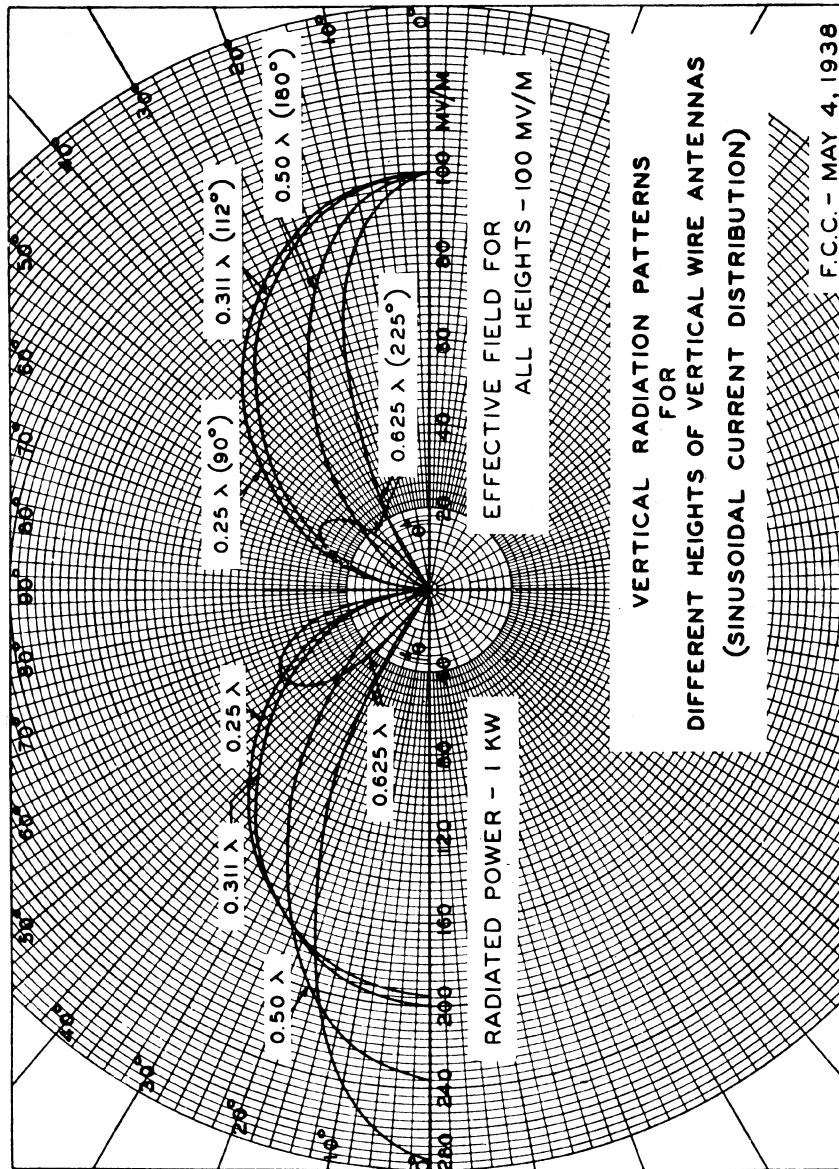
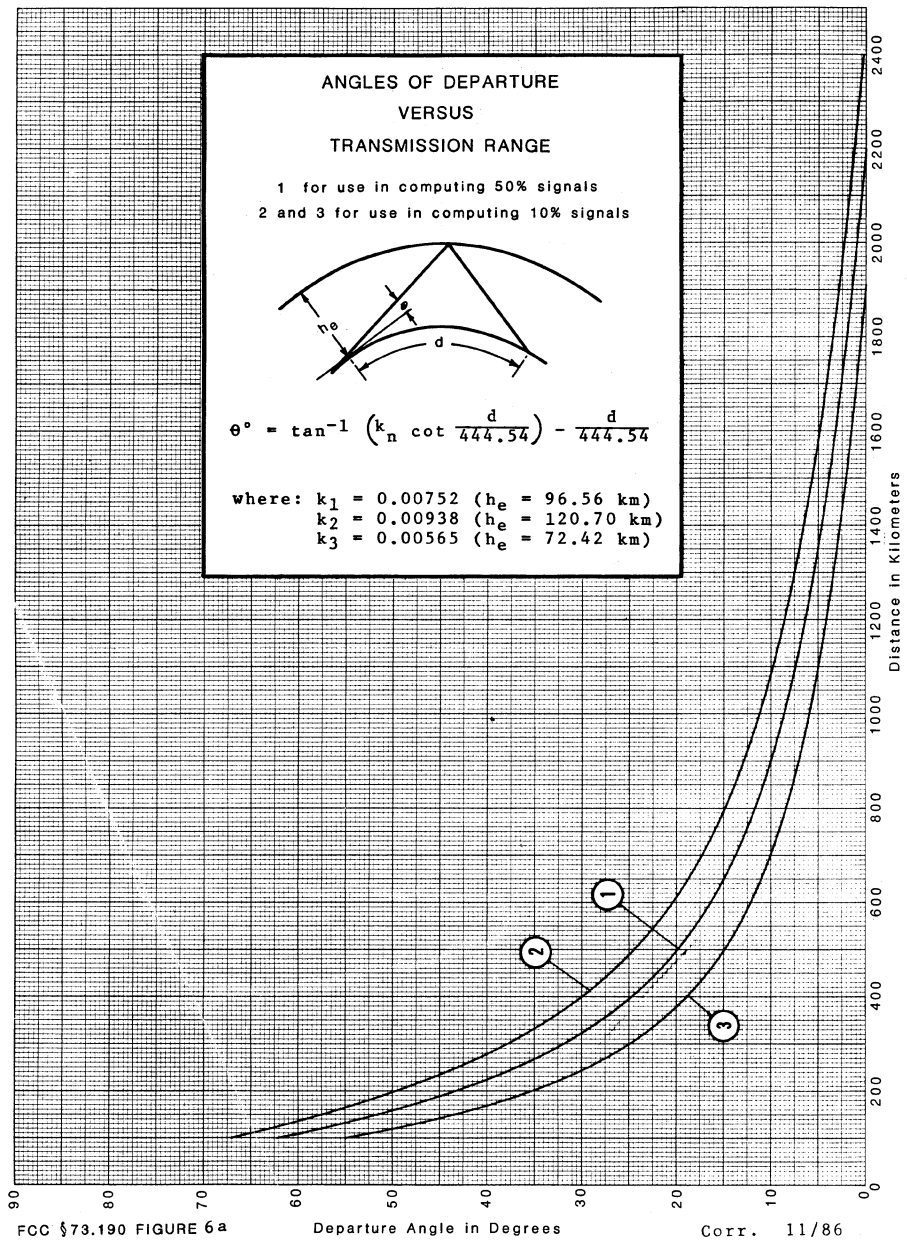


Figure 5





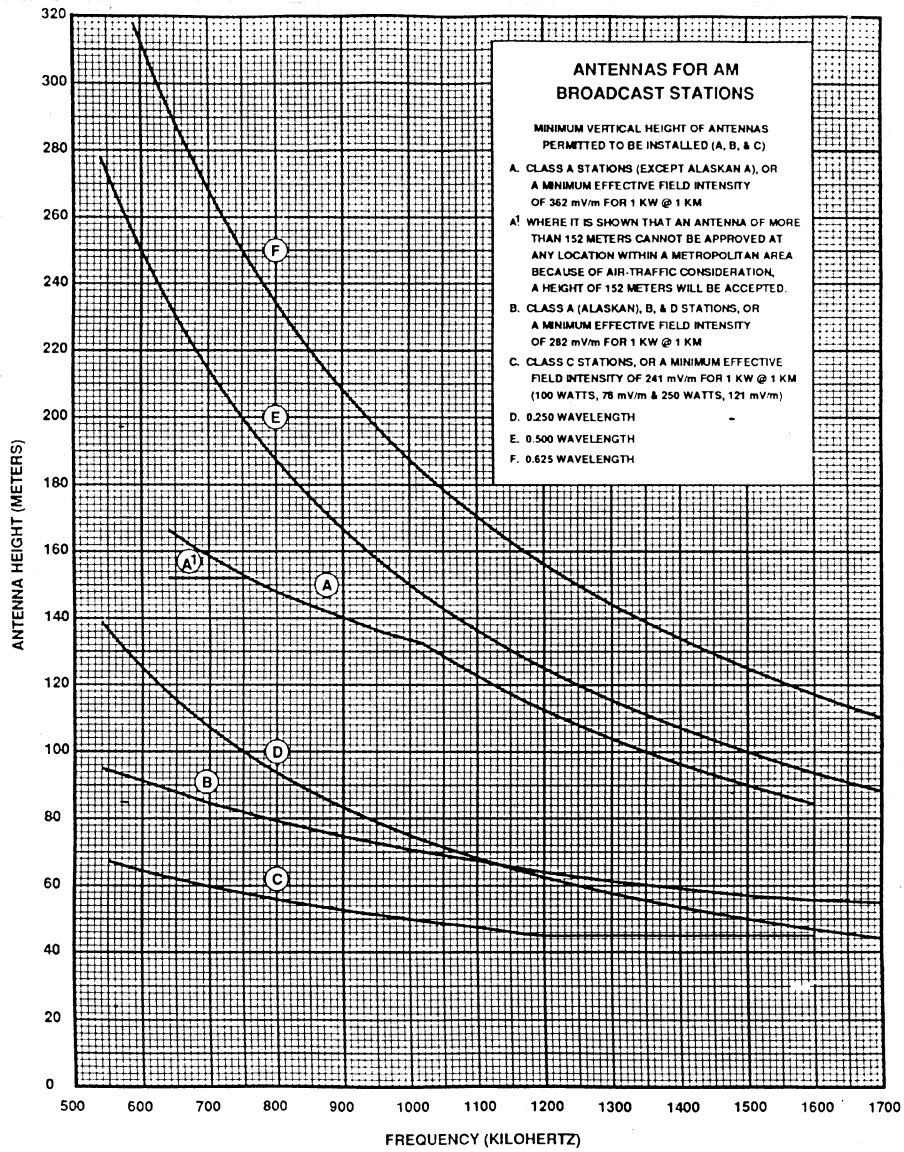


Figure 7

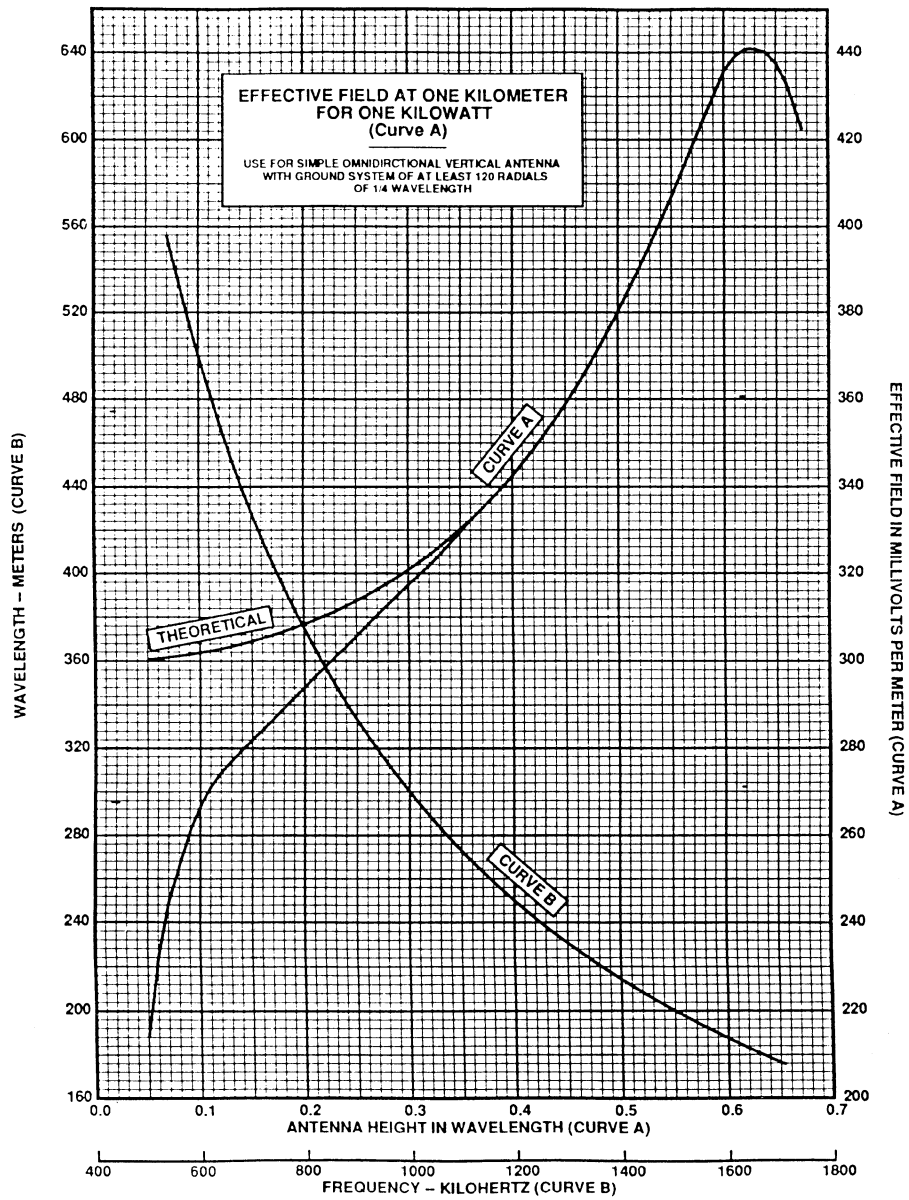


Figure 8

## PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

500 KC

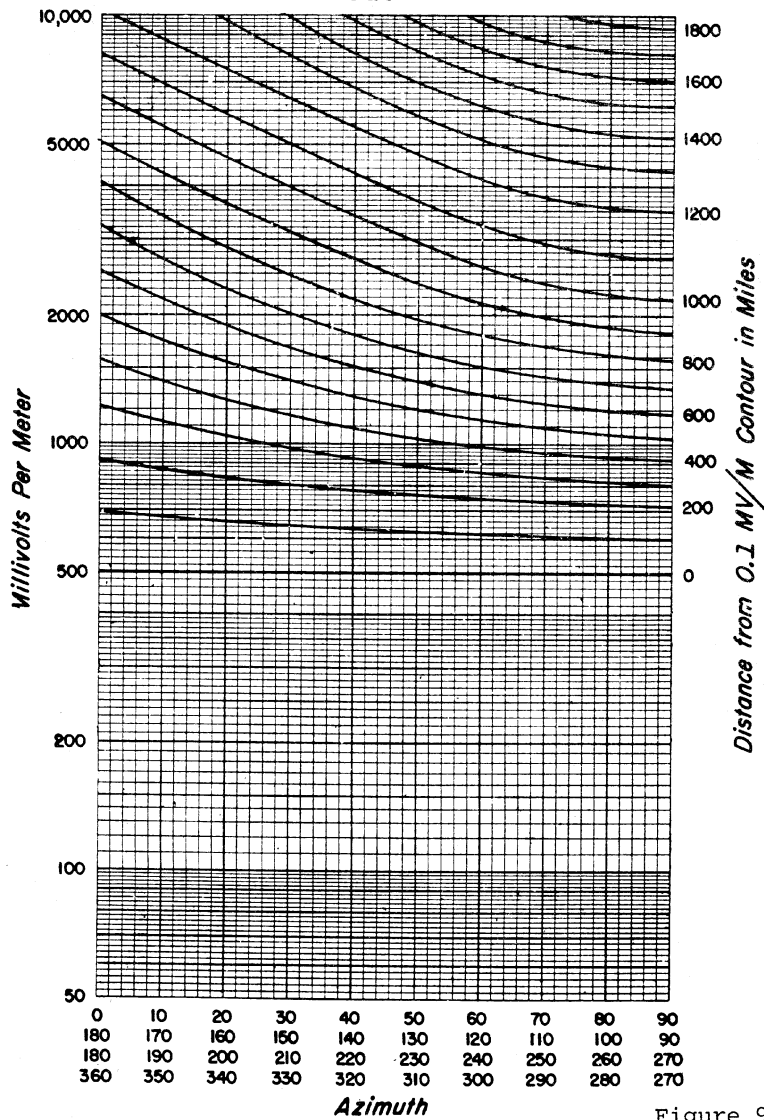


Figure 9

## PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

1000 KC

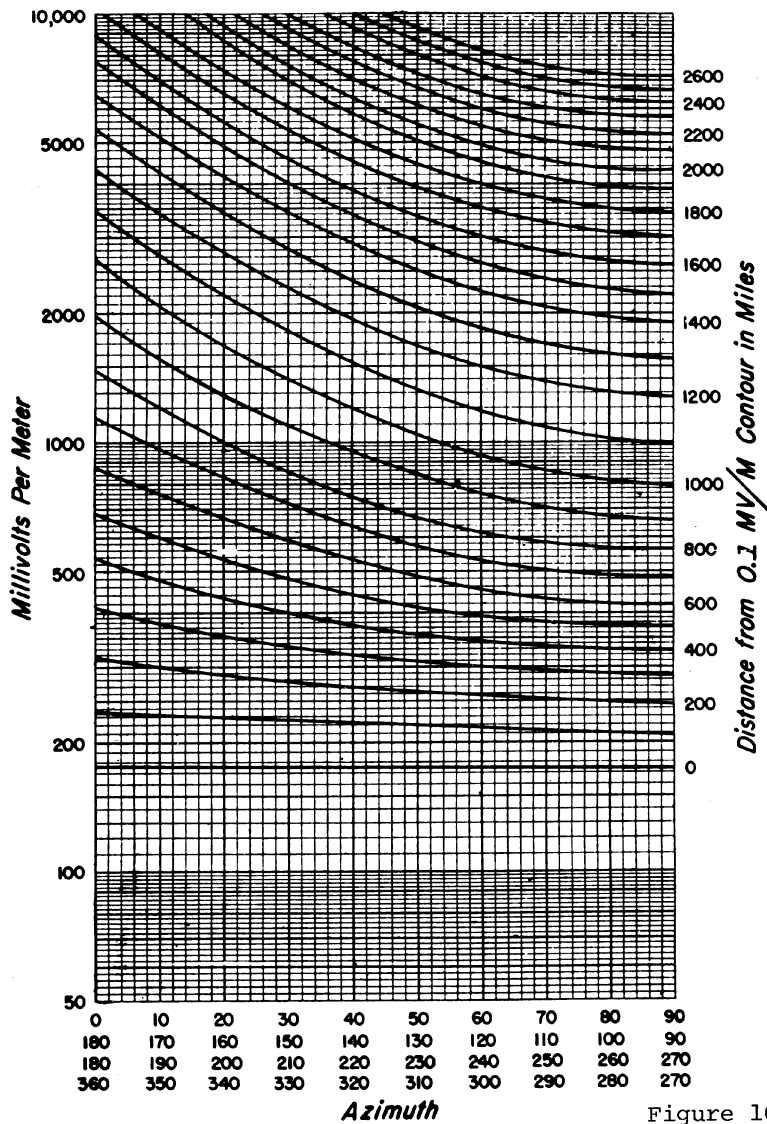


Figure 10

## PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

1600 KC

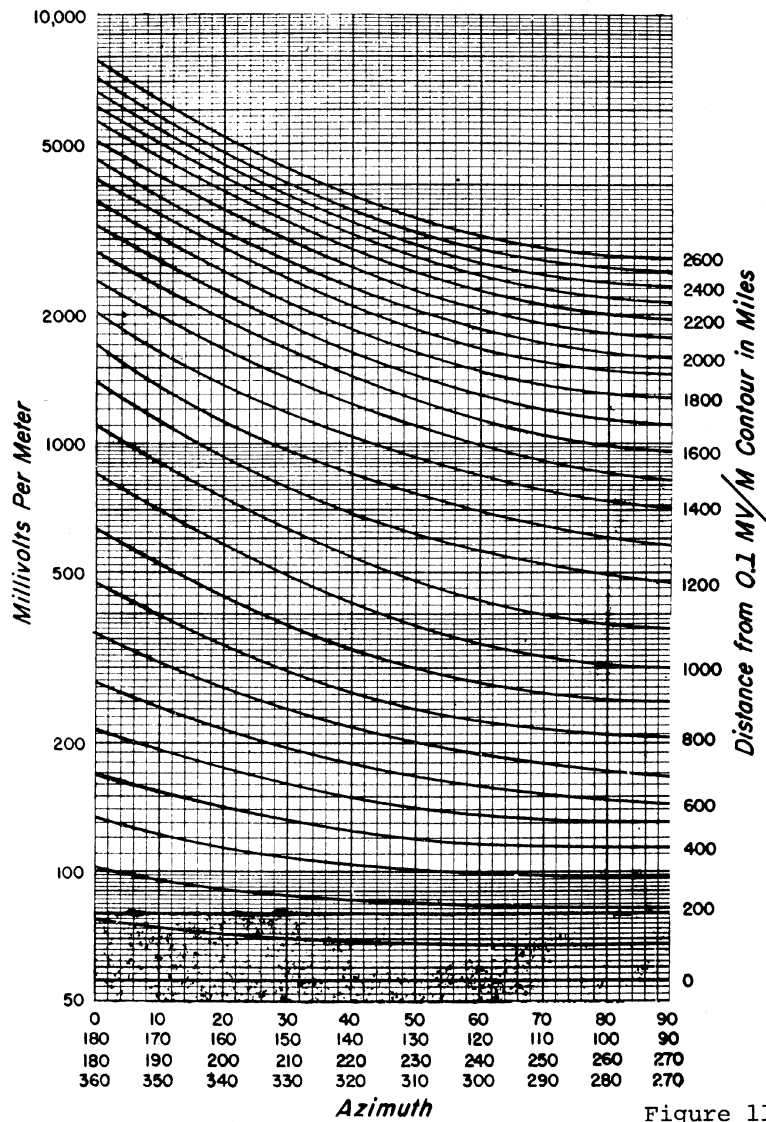
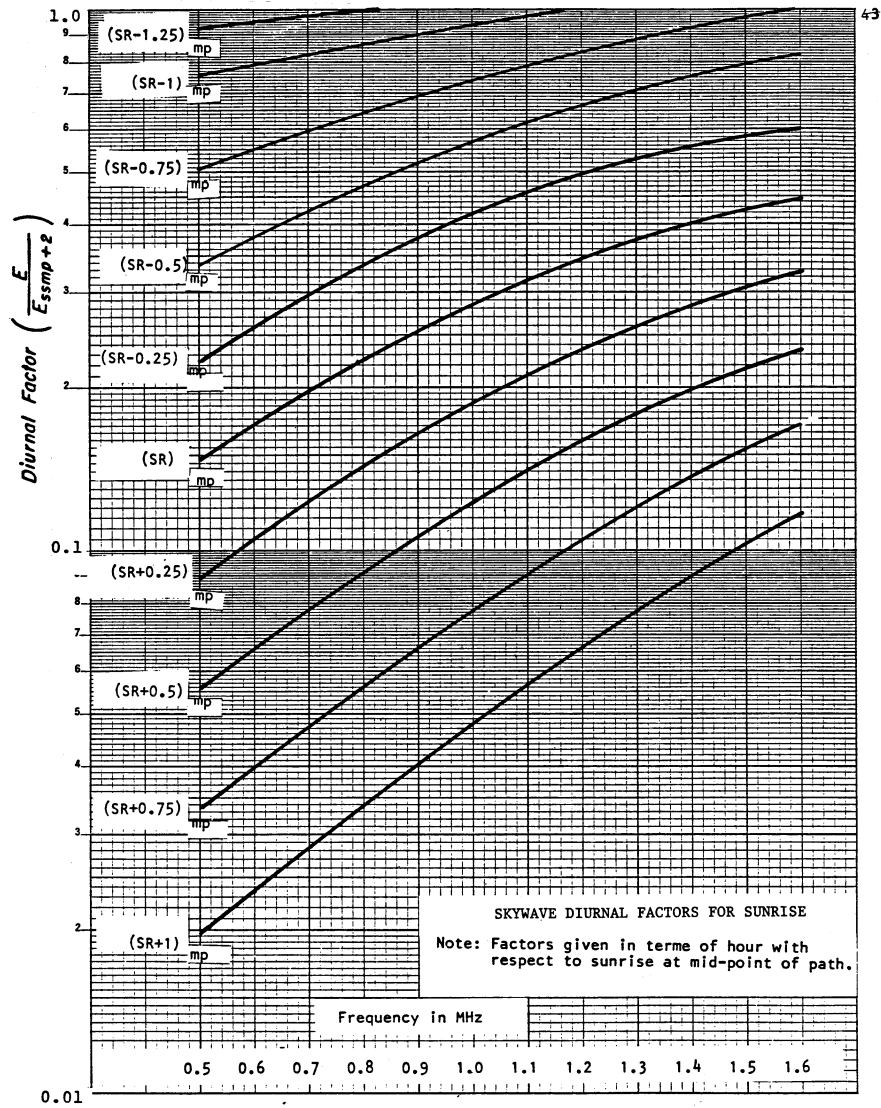
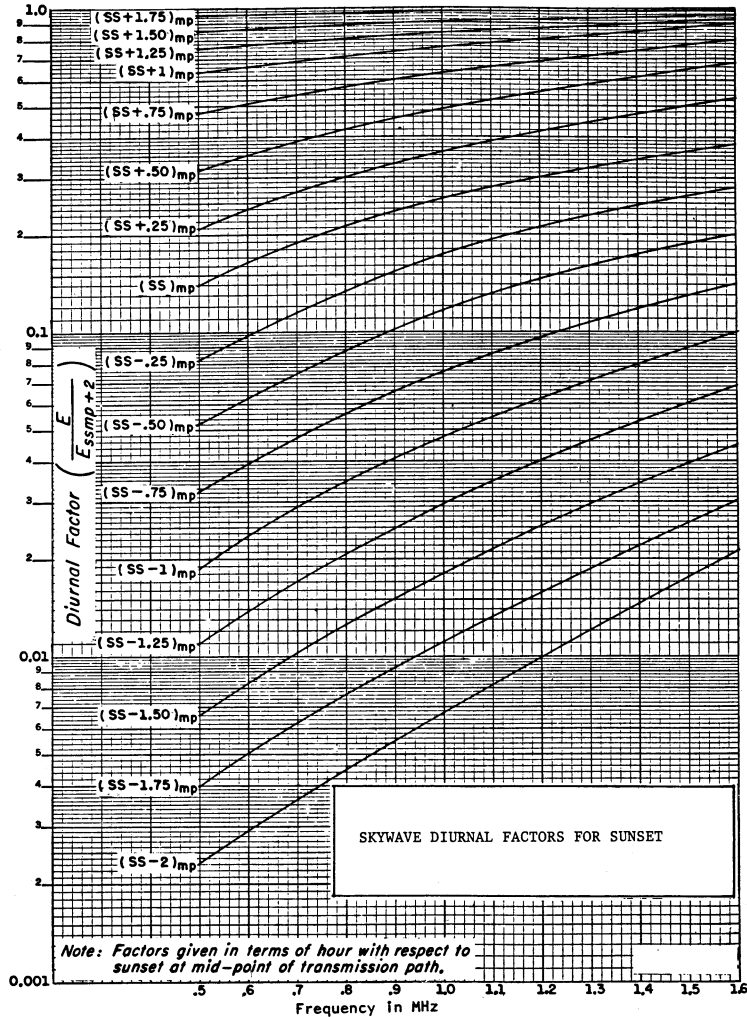


Figure 11





FCC §73.190 Figure 13

[28 FR 13574, Dec. 14, 1963, as amended at 30 FR 12720, Oct. 6, 1965; 33 FR 15420, Oct 17, 1968; 48 FR 42959, Sept. 20, 1983; 49 FR 43963, Nov. 1, 1984; 50 FR 18844, May 2, 1985; 51 FR 4753, Feb. 7, 1986; 52 FR 36879, Oct. 1, 1987; 56 FR 64869, Dec. 12, 1991]

**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 fre-

quencies available for FM broadcasting (including those assigned to non-commercial educational broadcasting) are given numerical designations which are shown in the table below:

Frequency (Mc/s)	Channel No.
88.1	201
88.3	202