T55-1-1

T55

DIURNAL FIELD STRENGTH CALCULATIONS

The procedure shown on these two pages has been developed for the FCC for use in calculating interference during sunrise and sunset skip. While it may not represent actual conditions for a given path on a particular day, it hopefully represents average conditions and may even be useful in planning SRS/SSS strategies. At the very least, it should be a fun exercise for the mathematically inclined.

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Appendix—Calculations Using Diurnal Factors

This Appendix exemplifies use of diurnal factors during pre-sunrise and post-sunset periods. Procedures for calculating full nighttime interference on a site-to-site or site-to-contour basis have been established for many years using the propagation conditions occuring two hours after sunset as a standard reference.

To calculate interference during the pre-sunrise or post-sunset periods, the full nighttime interference can be calculated and then modified taking into account the diurnal factor. Diurnal factors are obtained from the diurnal curves in Attachments 1–A and 1–B and are expressed as a ratio of the skywave field strength at any time during the pre-sunrise or post-sunset period to the skywave field strength occurring during the reference hour of two hours past sunset.

The following illustrates application of the diurnal curves when calculating required protection to the 0.5 mV/m 50% contour of a Class I station from a daytime-only station operating during the post-sunset period. A similar procedure may be used for the pre-sunrise period.

1. *Post-Sunset Operations Providing Full Nighttime Protection.* Evaluate the full nighttime interference that would be produced by the daytime operation of the station requesting post-sunset authority to points along the 0.5 mV/m 50% contour of Class I nighttime co-channel stations. The permissible interfering 10% signal from post-sunset operations is less than .025 mV/m at any point along the 0.5 mV/m 50% contour of a Class I station. Identify all points on the 0.5 mV/m 50% contour toward which the permissible interfering signal is exceeded. From these calculations the maximum permissible power for each path that will not cause radiation to exceed that which is permissible can be determined. As a simplification, of course, the lowest permissible power thus obtained could be authorized for post-sunset operation using the daytime or critical hours antenna system. However, in many cases full nighttime protection will be quite restrictive and it may be advantageous to apply the diurnal curves.

2. *Determine the Diurnal Factor.* In order to apply the diurnal curves, it is necessary to determine the time of sunset at the path mid-point. Subtract the sunset time at the path mid-point from 6:00. With this time difference, enter the diurnal factor curves, Attachment 1–B, with the appropriate frequency, interpolate linearly between the diurnal curves and read the diurnal factor. As proposed, this diurnal factor would apply for all months that post-sunset operation occurs.

Example

A hypothetical station is located in Denver, CO, proposing post-sunset operation on 1130 kHz, and a path being analayzed has a mid-point located at N 39°36'36" W 97°02'15". The sunset time at the path mid-point is calculated to be 4:04.1510 PM MST. Assuming that the station in Denver is permitted post sunset operation until 6:00 PM MST, it would be operating 1 hr and 55.8490 minutes (6:00 p.m.–4:04.1510 p.m.) beyond sunset at the path mid-point.

Entering Attachment 1–B with SS + 1:55.8490 on 1130 kHz results in a diurnal factor of approximately 0.94. It should be noted that a diurnal factor greater than 1.0 is never used.

3. *Apply the Diurnal Factor for Modified Power.* Divide the permissible interfering 10% skywave signal toward the Class I station on the path selected by the diurnal factor. This produces the worst case interfering signal adjusted by the diurnal factor along this path from the daytime operation to the protected contour of the Class I station during the post-sunset operating period. With the proposed interfering signal increased by the diurnal factor, the proposed post-sunset power may be increased by direct ratio (using the square root of the power). This increased power would be permitted for this particular path.

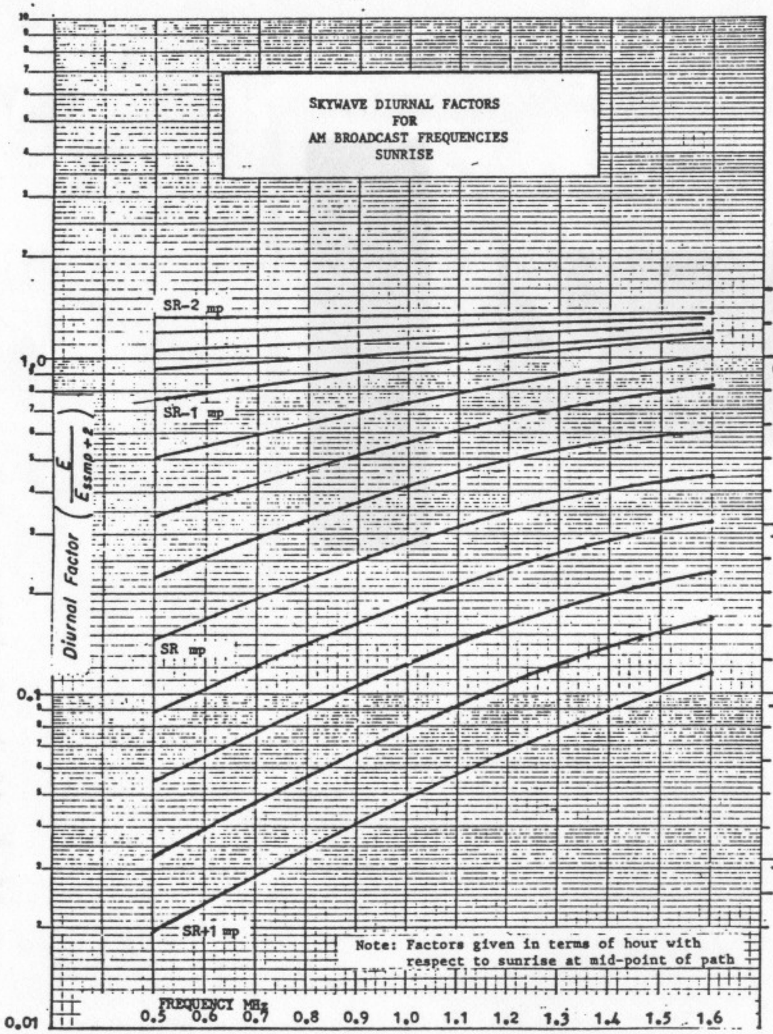
Example

From the previous example, the diurnal factor was determined to be 0.94. For the hypothetical case of the station in Denver, suppose that the permissible antenna radiation for the selected path that provides full nighttime protection is 75 mV/m.

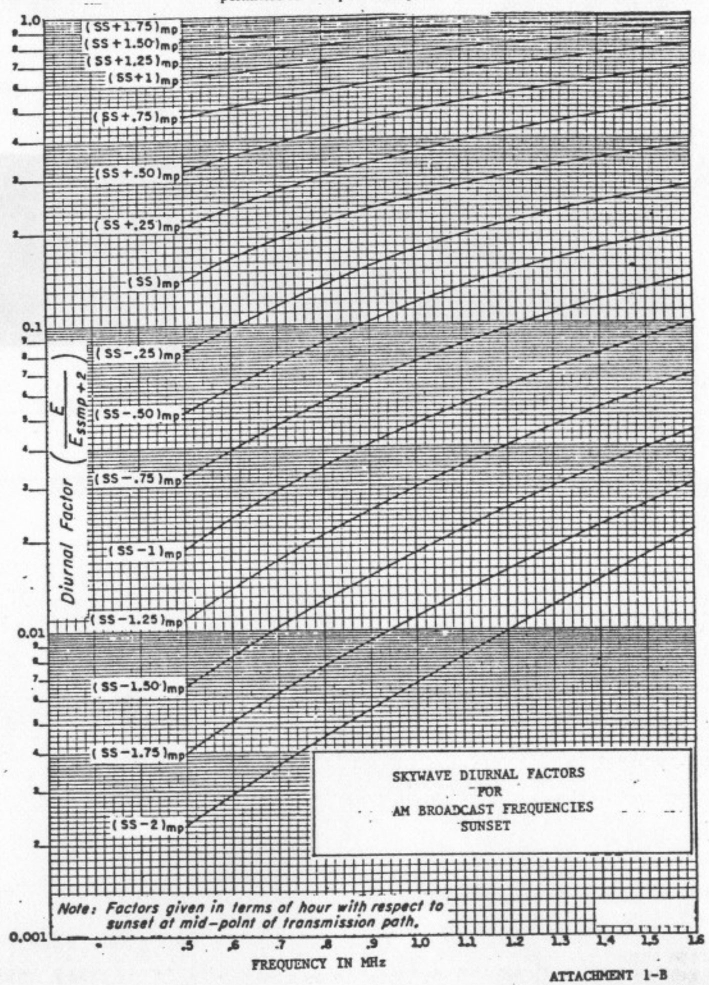
Applying the diurnal factor for this path, the permissible radiation becomes $75 \div 0.94 = 79.79$ mV/m. If it is necessary to reduce the daytime power to 260 watts to provide full nighttime protection, application of the diurnal factor would permit a modified power of 294.27 watts ($260 \times 79.79^2 \div 75^2$ or 260 watts $\div .94^2$).

4. *Determine the Post-Sunset Operating Power.* After analyzing the pertinent paths, the operating power that would be permitted for post-sunset operation is that which is determined for the most restrictive path.

5. *Foreign Consideration.* Although the example that has been used herein describes use of the diurnal curves for protection to the 0.5 mV/m 50% contours of domestic Class I stations, they are also being considered for use in calculating interference toward foreign Class A, Class B, and Class C stations and may be recommended for inclusion in any future agreement considering pre-sunrise and post-sunset operations.



ATTACHMENT 1-A



ATTACHMENT 1-B