Engineering Report

# Moment Method Tower Modeling Results
# For FM antenna installation

W273DZ(FX) – 102.5 MHz
WXTG – AM  1490 kHz
WPMH – AM  1270 kHz

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## Executive Summary

This activity was undertaken in support of Construction Permit (CP) with File Number 0000203788, in reference to the application for the installation of a two-bay FM translator antenna on an existing tower (ASRN 1064793) located in the near vicinity of two AM antenna systems. The first of these, WXTG, is a nondirectional station operating at 1490 kHz on a tower roughly 400' to its northeast, and the second, WPMH, is a three-tower directional (DAN) operating at 1270 kHz, with the array center located 0.9 km to the east. The FM translator system, which will operate on 102.5 MHz, is associated with station WRJR – AM, located in Claremont, VA.

Moment method modeling was undertaken to demonstrate that the tower in question, with the new two-bay antenna installed thereon, is not expected to have any substantial effect on the radiation pattern for either of the two AM stations, within the parameters specified in the "Special Operating Conditions or Restrictions" of the CP, and as codified in the FCC Rules Sections 1.30000 – 1.30004, inclusive.

The results of this study indicate that the tower in question is not expected to cause any disturbance to the radiation patterns for either station, well within the prescribed limits defined in the FCC Rules.

## Tower Modeling Protocol

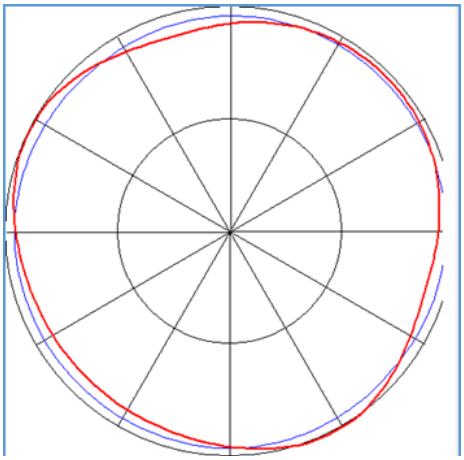
The model produced in this study employed the general methodology specified in the FCC Rules for conducting a Proof of Performance using the Method of Moments, as specified in Section 73.151(c) of the FCC Rules, other than that no actual tower impedance measurements were required to be taken and shown to converge with those obtained by the model results.

The Numerical Electromagnetics Code (NEC) version employed for the modeling study makes use of the NEC-4 core, providing a very high degree of flexibility in the geometrical data for a wide range of antenna systems, including those far more complex than the present study.

A segmentation of .005λ was used in generating the elements, and a perfect ground plane was assumed.

Modeling Results:  Expected Impact on WXTG (NDA)

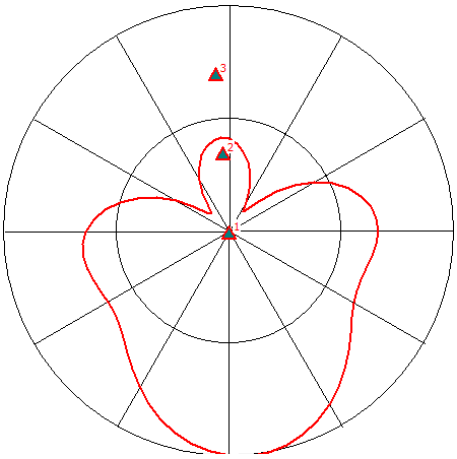
It should be noted that the tower on which the FM antenna is to be installed is detuned for the WXTG frequency (1490 kHz), using a detuning skirt system and detuning network.  The plot shown below indicates the radiation pattern for the 1490 KHz system with the detuning skirt in place (red plot), vs. being series-fed blue plot).  The effectiveness of the detuning skirt to preserve the radiation pattern is clear from this plot, and no impact on the radiation pattern is expected.



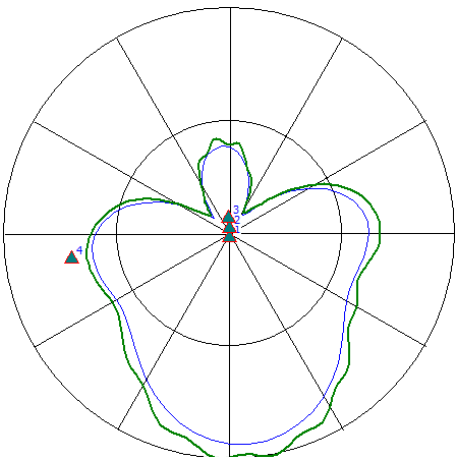
Modeling Results:  Expected Impact on WPMH (DAN)

For the potential impact the FM tower could have on the WPMH directional radiation pattern, two separate modeling cases were considered:  first, a model which looks simply at the three-tower antenna system in the absence of any potential re-radiating structures in the vicinity of the array.  The second case is a model which also includes the potentially offending tower being included as part of the overall antenna array.  For this second modeling case, a "worst-case" situation was modeled in which the "offending structure" is not detuned.

The results of the model for the first case under consideration are presented below.  The plot indicates the standard (theoretical) radiation pattern, as well as the tower configuration for the three towers constituting the array.



The results of the model for the second case, with the inclusion of the new tower, are shown below, along with the tower configuration which now includes that tower as part of the overall tower array.  The theoretical radiation pattern is shown in blue, and the pattern as distorted due to the presence of the other tower is shown in green.



It is clear that, while there is exhibited some degree of distortion in the radiation pattern (with no detuning for this tower included in the model), the distortion is relatively minor. The radiation pattern data used to produce the plot above were analyzed to determine whether the 2 dB limit has been met or not. It was determined through this analysis that the distortion is less than 0.3 dB, averaged over the full range of azimuths (0 to 360 degrees). The worst case distortion observed at any one azimuth was less than 0.9 dB.

This result being from the "worst case" situation of the tower having no detuning, it is clear that, with the detuning that the tower already possesses, the actual distortion can be assumed to be essentially negligible. (Note: the tower being detuned for 1490 kHz, at the lower frequency of 1270 kHz the detuning will not be precise, however, it would clearly be more favorable compared to the situation without any detuning at all.)

## Conclusion

From the above results presented, it has been shown that the special conditions specified in the Construction Permit, regarding possible radiation pattern distortion for either of the two AM stations caused by the proposed FM antenna installation, have been amply met.