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WFXT Antenna-Type Change Comparisons

In the Construction Permit Certifications section of the construction permit application to which this document is attached, it has been indicated that the proposed WFXT DTV facility does not comply with the condition that it will "not expand the noise-limited service contour in any direction beyond that established by the post-incentive auction channel reassignment public notice." This document explains the cause for that outcome and also demonstrates that the application does comply with the condition that it does not expand the noise-limited service contour by more than one percent in any direction, as permitted by FCC rules §73.3700(b)(1)(ii)(B).

To enable its change from Channel 31 to Channel 34, WFXT will be using a different antenna technology than it has in the past. It will be shifting from its existing slotted coaxial antenna to a broadband panel antenna shared with other stations. This change has been determined by the owner of the facility at which WFXT's transmitter is located to be necessary in order to meet the structural requirements that must be followed when major changes are made. Specifically, the change must be made to enable following the mandates of ANSI/TIA-222-G, adopted in 2005 and updated in 2008 – the so-called Code G. With its stricter requirements for structural safety margins, many towers have to shed loads if they cannot be upgraded significantly. Moving to shared antennas is one way to reduce loads. Shared antennas typically use broadband panel arrays because they can operate over wider frequency ranges and can carry more power than slotted coaxial antennas, both of which characteristics are needed if an antenna is to be shared between high power television broadcast stations.

It is the nature of broadband panel array antennas that their radiation patterns undulate with signal transmission bearings in a manner often described as "scalloping." Their radiation patterns also vary in shape by a moderate amount across the frequency spectrum for which they are designed. Consequently, it can be expected that the radiation patterns of such antennas will not only differ from one channel to another but also will be significantly different from the patterns of antennas designed using other technologies – such as slotted coaxial designs. When a station has been using one technology and must move to the other technology, it can become a very complex and difficult matter to do so without the loss of

service area and population reached. That is because the process is like the proverbial "fitting a square peg into a round hole." The issues are exacerbated when limits are placed on power levels at various headings, when interference constraints limit accommodation of the different pattern shapes, and when such changes must be made in an environment in which much else is changing – leading to instability of the environment making the design process that much harder and more involved.

That is the case with the antenna that will be used by WFXT and shared with other stations. To support designing a new antenna pattern for WFXT using broadband panel array technology that matches its existing pattern as closely as possible, a spreadsheet method was employed that measures contour extensions along 360 radials and flags those that exceed the 1 percent limit set in the Commission's rules. The method also permits identifying the largest extension in any particular pattern and aids keeping track of the population covered by iterations of the design process. At the current state of antenna pattern development for WFXT, a reasonably good correspondence has been achieved with the parameters and pattern specified for the station by the FCC in the post-incentive auction channel reassignment public notice. The pattern results in increases in the contour distances in some directions but never by more than the one-percent expansion in any direction permitted by §73,3700(b)(1)(ii)(B). This document and the accompanying Excel spreadsheet workbook file demonstrate that result.

Before turning to the spreadsheet workbook, two related changes in parameters from those specified by the FCC must be acknowledged. The tower owner has determined that, in order to accommodate all the stations it is working to fit onto the same tower, it will be necessary for the center of radiation of the antenna to be used by WFXT to be approximately 10 meters lower than that of the current WFXT antenna. Consequently, in compensation for the reduction in elevation, the effective radiated power proposed for WFXT has been increased from the 829 kW value included in the Commission's parameters for the station to 910 kW, the value of which was determined by adjusting its level until the best fit was found between the existing and new patterns through comparisons of the contours that resulted using the contour extension measurement mechanism. The remaining discussion herein refers to the spreadsheet workbook to discuss the results of the design effort.

In the spreadsheet workbook, the first tab contains two charts that compare the radiation patterns of the current WFXT antenna on Channel 31 (currently licensed and specified in the FCC channel reassignment parameters) and of the proposed antenna on Channel 34 (the channel to which WFTV actually was reassigned). To reiterate, WFXT operates on Channel 31 with a slotted coaxial antenna and will use a broadband panel array on Channel 34. The lower chart compares the relative field values of the two antennas on their respective channels. The upper chart shows the contours produced by the two antennas

when operated with the related sets of parameters, as previously described. In both charts, the plot in blue represents the current WFTV radiation pattern on Channel 31. The plot in dark purple represents the radiation pattern on Channel 34 at the reduced elevation and higher power.

The next tab provides comparisons of the contour distances from the transmitter. On the sheet, there are three sets of data showing, each grouped into four columns. Each column has 360 rows, representing compass bearings every one degree in azimuth. The first group of columns shows the contour distance results from the current Channel 31 operation using the radiation pattern shown in blue on the chart on the first tab. The second group of columns shows the contour distance results predicted from the Channel 34 operation using the radiation pattern shown in purple on the chart on the first tab in combination with the adjusted parameters previously described.

The third group of columns provides comparisons of the distances to the contour created by the blue pattern and its associated parameters with the distances to the contour created by the purple pattern and its associated parameters at the same azimuthal bearings. The value above the right-hand end of the group is the maximum extension value in percent at any bearing in the comparison. As can be seen, its value is less than one percent at every bearing, meaning that the requirement of the rule limiting contour extensions to one percent in all directions is met by the set of parameters chosen for operation using the new pattern on the replacement antenna. It also can be noted from the population counts provided with the first two groups of data that the population included within the contour of the replacement antenna on Channel 34 is approximately 99.1 percent of the population within the contour of the currently licensed antenna on Channel 31.

Given the results just described, it has been shown that the changes in pattern and contour resulting from the use of a different technology for the WFXT replacement antenna have been minimized to the extent possible but that the pattern of the broadband panel array to be used by WFXT will result in some small extensions of the station's contour using the set of parameters selected to most closely match the characteristics given by the FCC for WFXT in the post-incentive auction channel reassignment public notice. It also has been shown, however, that the ensuing shape change of the contour and the corresponding contour extensions meet the requirements of the relevant rules. The construction permit requested based on these considerations therefore should be approved.

(Please note that, for reference, the raw data used in preparation of the charts and the comparisons on the first two tabs are provided on the remaining tabs of the workbook. The antenna pattern relative field data given on the last several tabs and plotted on the first tab was provided by the antennas' manufacturers – Dielectric and Radio Frequency Systems. All contour data was obtained using EDX SignalPro software to generate the contour distances based on the charts in §73.699 and the Commission's TVFMFS routine.)