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WILLIAM F. HAMMETT, P.E.  
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MARK D. NEUMANN, P.E.  
ROBERT P. SMITH, JR.  
RAJAT MATHUR  

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ROBERT L. HAMMETT, P.E.  
1920-2002  
EDWARD EDISON, P.E.

**BY E-MAIL MSTARLING@NPR.ORG**

November 11, 2004

Michael I. Starling, Esq.  
Vice President  
National Public Radio  
635 Massachusetts Avenue, N.W.  
Washington, D.C. 20001-3753

Dear Mike:

As requested, we have completed study work regarding noncommercial FM (NCE-FM) stations and TV Channel 6 ("TV6") protection as we move into the digital television (DTV) transition. This project work is based on our e-mail quotation of January 28.

## **Background**

Compliance with FCC Rules Section 74.525, "TV Channel 6 Protection," has always been challenging for NCE-FM stations located in the vicinity of NTSC TV6 broadcast stations. This rules section, added in the mid-1980s, is intended to curb the likelihood of, and to address specific remedies for, destructive interference being received by over-the-air TV6 (82-88 MHz) viewers from NCE-FM stations operating in the 88.1-91.9 MHz reserved band. Lacking a blanket waiver by the potentially affected TV6 station (a power that the rule clearly delegates), NCE-FM stations located within or near the Grade B contour of the TV6 station have had to reduce power, operate with vertical-only or elliptical polarization instead of circular polarization, employ directional transmitting antennas, collocate with the TV6 station, coordinate distribution and installation of interference filters, or employ combinations of these requirements in order to meet the requirements of the rule.

Your supposition was that the FCC might just delete the Rules Section 73.525 TV6 protection requirements, entirely, at the conclusion of the DTV transition period.\* In that case, a significant number of NCE-FM stations might be able to improve their technical facilities, and

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\* In fact, the FCC's recent Report and Order to MB Docket 03-15 regarding DTV transition issues and procedures gives special consideration to accommodate low-band VHF NTSC stations (operating on Channels 2 through 6) that do not wish to return to their low-band VHF channel for post-transition DTV operation. Technical concerns include undesirable noise sources and propagation effects prevalent within that frequency range.

hence overall facility coverage, by eliminating existing TV6 protections. Thus, we concluded that a useful study would be to determine how many stations would be affected, and what degree the expected improvement might be for the “average” affected station.

## **Study Overview**

There are 58 licensed, domestic, full-service NTSC TV6 stations, so all affected NCE-FM stations would be near those facilities. Section 73.525(a)(1) specifies distances to TV6 stations, ranging from 154 to 265 kilometers, depending on NCE-FM channel, for which protection studies are required. Using the median distance of 196 kilometers, we determined a universe of 1,759 licensed, domestic, full-service NCE-FM stations that could be actively protecting a TV6 facility.

To narrow the field of station study candidates, we identified NCE-FM stations employing vertical-only polarization, those employing both antenna polarizations but with greater vertical polarization power (*i.e.*, elliptical polarization), NCE-FM stations that are collocated with TV6 stations, and NCE-FM stations having directional antenna patterns that appear to limit radiation toward a TV6 facility. The use of such a multi-part culling method reduced, to 407, the universe of affected NCE-FM stations to be considered. Of these, allocation studies were conducted on 25 of these facilities (8.1%), with the intention of determining weighted “improvement factors,” related to return of circular polarization, overall power increase possibility, and/or relaxation or elimination of directional antenna patterns.<sup>†</sup> 2000 U.S. Census data was used to determine a nominal population percentage improvement to the present 60 dBu coverage area for each NCE-FM station identified as having upgrade potential.

## **Station Selection and Study Procedure**

Studied NCE-FM facilities were selected in a pseudo-random fashion, weighted in accordance with the universe of stations found in each subcategory during database culling. As shown in the table of accompanying Figure 1, 13 stations employing vertical-only polarization, six stations using elliptical polarization, four stations collocated with NTSC TV6 stations, and two stations having directional transmitting antennas apparently protecting TV6 reception areas were selected for study. Specific stations selected for study were determined by dividing each subcategory, which listed stations alphabetically by community of license (without regard to state or geographic area), into equal parts proportional to the number of stations to be selected for study. For example, the universe of 212 vertical-only polarization stations was cut into 13 approximately equal parts, using a randomly-selected starting point within the list, and the first 13 stations found in each part were selected for study.

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<sup>†</sup> Some factors, such as the ability to relocate a NCE-FM facility to a more desirable site, are probably real but were considered too subjective for a study that is meant to provide a general indication of potential improvement.

In addition to the study type category, the table of Figure 1 includes specific studied station callsign, channel/class, location, transmitting antenna type (directional or nondirectional), effective radiated power (ERP), and FCC Facility ID number. The associated affected NTSC TV6 stations are included, by callsign and location, along with distance and bearing information between the NCE-FM and TV6 stations. Note that three studied NCE-FM stations (Seq. Nos. 5, 9, and 19) had two TV6 stations each within the 196-kilometer search area.

Without regard to the TV6 station presence, FCC allocation contour studies were conducted for each of the 25 studied NCE-FM stations to determine the potential for improved coverage areas. The table of accompanying Figure 2 provides a summary of the study results, based on co-channel and first-, second-, and third-adjacent channel contour relationships to other stations. An entry of "OK" indicates no particular limitation for a given channel relationship, where a callsign and direction entry indicate a limiting station. In cases where more than one station is involved in a limitation for a given channel relationship, the total number of stations are specified.

An additional column, added for informational purposes, lists whether the studied NCE-FM station 60 dBu contour enters the 47 dBu (Grade B) contour area of the TV6 station, and if so, the approximate percentage of FM contour contained within the TV6 contour. A "Y" with no percentage shown indicates that 100% of the FM contour is contained within the TV6 contour. By definition, the contour of a collocated NCE-FM station is entirely contained within the TV6 contour.

Finally, the right-most column of the table of Figure 2 specifies the determination of whether the studied NCE-FM station may likely increase its service area. The determination "No Increase" means that the close proximity of other station contours or existing contour overlap effectively prohibits any service area increase for that station. The entry "No Practical Increase" means that while some opportunity may exist in given direction(s) to increase service area, the need for a complex directional transmitting antenna pattern likely leads, in our opinion, to a diminishing returns condition, so no practical increase opportunity would be present. One NCE-FM station, WTLI (Seq. No. 1) is limited by a pending application, while another, WMFL (Seq. No. 4), would be maximized if its existing FCC construction permit were implemented. Neither of these stations was studied further. However, four stations were identified as likely power increase candidates, while a fifth station was identified as a candidate to significantly relax present restrictions toward its associated TV6 station.

## **Study Findings**

For the five NCE-FM stations identified as being able to increase service area, improved transmitting facilities were designed and 2000 U.S. Census population increases were determined. Maps depicting existing and increased service areas are provided in accompanying Figures 3A-3E. A brief discussion of each studied facility is provided below:

1. FM Station KDRH, 91.3 MHz, Channel 217A, King City, California - This station utilizes a nondirectional transmitting antenna (vertical polarization only) operating at 300 watts ERP. TV6 Station KSBY is located 108.4 kilometers to the southeast. Our allocation study findings show that lacking the FCC Rules Section 73.525 restriction, KDRH could increase power to the 6 kW ERP Class A maximum using a circularly-polarized transmitting antenna. The increased 60 dBu contour would add Soledad to the coverage area, for a 56% population increase.
2. FM Station WVLS, 89.7 MHz, Channel 209B1, Monterey, Virginia - WVLS employs a directional transmitting antenna (vertical polarization only) operating at 360 watts ERP. TV6 Station WVVA is located 184.6 kilometers to the southwest. Our allocation study findings show that WVLS can increase power to 450 watts ERP and employ a nondirectional circularly-polarized transmitting antenna, yielding an 82% gain in population served. However, it is likely that WVLS could accomplish at least most of this increase under the current FCC Rules, since the Rules Section 73.525 impact appears minimal.
3. FM Station WMLU, 91.3 MHz, Channel 217A, Farmville, Virginia - WMLU, licensed to Longwood University, operates with a nondirectional transmitting antenna using elliptical polarization operating at 150 watts ERP vertical, 1 watt horizontal. Our allocation study findings show that lacking the FCC Rules Section 73.525 restriction, WMLU could increase power to the 6 kW ERP Class A maximum using a circularly-polarized transmitting antenna. The increased 60 dBu contour would add several small communities to the coverage area, for a 203% population increase.
4. FM Station WMEA, 90.1 MHz, Channel 211C, Portland, Maine - This station is licensed to Maine Public Broadcasting Corporation. It is collocated with TV6 Station WCSH, and operates with a nondirectional transmitting antenna operating at 24.5 kW ERP (circular polarization), close to the maximum afforded by FCC Rules Section 73.525(d)(1). Our allocation study findings show that lacking the FCC Rules Section 73.525 power restriction, WMEA could increase power to the 55 kW ERP, nondirectional. In that case, population within the 60 dBu contour is projected to increase by 18.2%.
5. FM Station WYFS, 89.5 MHz, Channel 208C, Savannah, Georgia - WYFS is licensed at Class C maximum 100 kW ERP using a directional transmitting antenna, but only at 183 meters HAAT, so technically the station would be considered Class C1. The elliptical polarization (but nearly circular at 100 kW ERP horizontal/91 kW ERP vertical) directional transmitting antenna pattern was specifically identified as most likely being used to protect the TV6 Station WJBF viewing area, to the north-northwest. Our allocation study findings show that lacking the FCC Rules Section 73.525 restrictions, a nearly circular azimuth pattern directional antenna could be substituted, operating with 100 kW ERP circular polarization. Population within the 60 dBu contour is projected to increase by 17.2%.

### **Specific Issues Affecting Study Findings**

As discussed above, many noncommercial FM stations that have been limited since the early 1980s to protect NTSC TV6 stations may still not be allowed to increase power or coverage area due to existing allocation conditions with other FM stations. However, our study showed that 4 (16%) and perhaps 5 (20%) of the 25 sampled study stations could increase power and coverage if the TV6 restrictions of FCC Rules Section 73.525 were deleted. Because of the nature of the FCC's rules, though, it is believed that at least some of these upgrades could be accomplished under the present regulatory climate, particularly the provisions that allow virtually unrestricted interference agreements with NTSC TV6 stations. The deletion of Section 73.525 would streamline the ability of NCE-FM stations to improve facilities if they wish, but such an action would not likely present the *only* option for presently affected stations.

Another issue that we have researched as a part of this project has been how to quantify the improvement gained by changing transmitting facilities from vertically-polarization only or elliptical polarization to circular polarization. Contour projections, either by FCC or terrain-sensitive methods, yield essentially the same population for any polarization scenario. Theoretically, circular polarization does add 3 dB of radiated power over vertical polarization, but no receiving antennas are in general use that can make simultaneous use of all energy from both horizontal and vertical polarizations. Anecdotally, we know that circular polarization is better for FM broadcasting because it provides added field strength to receiving antennas of any random polarization, but numerically quantifying the number of persons in a given coverage area receiving the signal under use of a circularly-polarized transmitting antenna, versus use of a vertical polarization-only or elliptical polarization antenna, is quite difficult.

Some field study work was conducted in the 1960s that led the FCC toward authorization of dual and circular polarization FM transmitting antennas. However, the initial polarization used for FM broadcasting was horizontal, and stations later converted to H/V or circular polarization. In the case of present day NCE-FM stations within or near TV6 coverage areas, primarily vertical polarization is employed, and elimination of FCC Rules Section 73.525 would allow addition of the horizontal component. Mobile reception of FM broadcasts, by virtue of present and past automotive designs, is best suited for vertical polarization, so no dramatic improvement would be expected from a vertical-to-circular polarization conversion, as was most certainly the case in the 1960s and 1970s during conversion from horizontal-only to circular polarization.

### **Conclusion**

Based on the existing variable regulatory climate with respect to NCE-FM/TV6 protection, as well as present uncertainties regarding determination of perceived differences between vertical-only and circular polarization, the creation of "improvement factors" was deemed too unreliable for practical application. However, the study did yield the result that approximately 20% of the 407 NCE-FM stations presently required to protect NTSC Channel 6 reception areas in some fashion could, in the event that FCC Rules Section 73.525 were deleted, improve technical

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facilities and associated coverage areas. In such a case, the average 60 dBu contour population increase was found to be 75%.

As always, we appreciate the opportunity to be of service. Please let us know if you have questions or additional needs.

Sincerely



Stanley Salek

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Enclosures

