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TECHNICAL SUPPORT FOR WMVS MAXIMIZATION APPLICATION

Introduction

This document is for the purpose of providing a technical basis to the WMVS waiver request for operating outside of the FCC Zone 1 rule for maximum operating power and height, and particularly at the request to maximize to the Effective Radiated Power (ERP) level of 70 kW. The topics to be covered in this document are: (1) reasons for the additional increase in power due to existing reception problems, (2) the fact that no interference is caused by the request for additional power, and (3) how the figure of 70 kW was determined.

Background

My name is Gregory L. Best and I am consulting engineer. I am a registered professional engineer licensed in Missouri, Colorado, Kansas and Kentucky. My education and experience background are a matter of record with the FCC.

At the DTV conversion, WMVS was originally allocated an ERP of 25 kW on channel 8 at its computed HAAT of 354 meters. Once the digital transition occurred, WMVS received a large amount of phone calls and reports from viewers indicating they could no longer receive WMVS. To address the concerns, WMVS did some comprehensive research, executed field tests, and investigated many, many viewer complaints. Indeed, a significant number of viewers within the WMVS protected DTV service area, are not receiving the DTV signal that had previously received the NTSC signal. And in other cases, viewers just outside of the NTSC protected service area but those who had good reception of the analog WMVS signal, also cannot receive the digital WMVS signal.

WMVS is the only full service High Band VHF station serving the community of Milwaukee and its suburban area. As a result of that, nearly all over-the-air viewers have only UHF antennas. Thus, in their market, WMVS suffers a loss of signal right off the bat. Antenna industry experts including Kerry Cozad of Dielectric have indicated there is a significant dB disadvantage of VHF reception using only UHF-only antennas. This applies to both indoor and outdoor reception. In addition, an independent study conducted by a reputable consulting firm found the median of the maximum gain of 4 different passive antennas (one designed for VHF and UHF and the other three designed for UHF) referenced to a VHF dipole to be -18 dB (18 dB loss). The FCC planning factors assume a 6 dB antenna **gain** for VHF so WMVS has an extraordinary challenge to overcome for both outdoor and indoor reception.

As an initial attempt to at least cover the same area as the previous "largest station in the market" (via FCC Rule 73.622 (f) (5)), WMVS applied for and received a construction permit to increase power to 32 kW even though this ERP was above the Zone 1 maximum ERP for the HAAT of 354 meters. The Zone 1 maximum ERP for the HAAT of 354 meters is 18.3 kW based upon the equation given in FCC rule 73.622 (f) (7). Since that time, the previous largest station in the market, operating on UHF, has changed their operating parameters and WMVS became considered the "largest station in the market". The power level of 32 kW is only a small amount (0.28 dB) above the FCC Zone 1 ERP maximum for the HAAT of WMVS. The actual location of the WMVS transmission facility is within 25 miles of the border of Zone 2.

Similar Circumstances

The FCC has granted other requests for significant increases in ERP above the referenced FCC rule for maximum ERP for HAAT's above 305 meters. For example, WVEC (Hampton, VA) is also another station in Zone 1 that was granted a significant power increase that was not related to matching the largest station in the market. WVEC was granted 35 kW of ERP at an HAAT of 363 meters, a 3.2 dB

increase over the ERP limit based upon the HAAT. This was granted on the basis of desiring to extend the coverage of the facility, with the proviso that the coverage contour was not extended 5 miles past the pre-transition facility. In addition, both WAOW & WSAW which are in the Wausau DMA (very near the Milwaukee DMA) are high band VHF stations that were granted significant power increases (WSAW—72 kW ERP, & WAOW—63 kW).

Reception Problems with WMVS

Since the time of the digital transition WMVS has sought to define and quantify its reception problems, to determine whether lack of signal power is the main culprit, and to evaluate how it can improve its reception capability for its viewership.

The areas that report the most incidents of VHF reception problems, whether they are due to lack of signal or due to noise/interference of some type, and that need relief are in the following areas or communities: Downtown and southern Milwaukee, Kenosha, Racine, Fond du Lac, north West Bend, Delavan, Sheboygan, Delafield-Waukesha, and Waukegan/Libertyville, IL. The two most dominant areas are Racine and Waukesha.

In September of 2009, WMVS conducted extensive field tests of reception capability within its protected contour (36 dBu F(50,90)) area. In addition to measurements made of its own signal, WMVS also quantified reception of other stations in the market. All of these other stations of course were UHF so a direct comparison based upon field strength would not be “apples to apples”. So to obtain a basis for comparison, received signal power at the output of the receive antenna and its feedline cable was measured rather than measuring field strength and then trying to compute received signal power. Radials were measured in 5 mile increments up to 30 miles and then in 10 mile increments up to 60 miles in north, northwest, west, southwest, and south azimuths. An antenna height of 30 feet above ground level (AGL) was used for these field tests. The basic test setup consisted of a Sencore SLM-1475 receiver, 50 feet of RG-6 cable and either a DigiTenna VHF antenna with 0 dB gain relative to a VHF dipole at channel 8 or a DigiTenna XF UHF antenna with 12 dB gain over a UHF dipole at channels 33-35. (WMVS can provide the calibration results of the antennas at the channels of interest if desired). The RG-6 cable had an additional 3 dB of loss at channel 35 compared to channel 8. According to the FCC lab report on receiver set-top boxes (STB), the STB receiver sensitivity difference between VHF and UHF was only 1 dB using the 10 percent and 90 percent sensitivity measurement values of the 115 approved STB with the lower value being the VHF reception figure. One of the channels measured by WMVS was channel 35 WMVT. Their signal emanates from the same tower and RCAGL as the WMVS signal so comparison with the WMVT signal is a good place to start. In actuality, all the UHF channels analyzed emanated from a distance within 2 miles (and most were within 0.5 mile) from WMVS and also from a height very similar to the WMVS antenna. For WMVS and WMVT, the antenna pattern field value in each of the directions was within 1 dB except for the south radial which was a 1.8 dB difference. ERP was 500 kW for WMVT and 25 kW for WMVS. The purpose of this information is to provide some background for the comparison of the reception capability and signal power measured at the measurement points. The conclusion of the results of the reception tests was that in all but one radial direction, the median signal power at the output from the 50 feet of RG-6 cable from WMVT was 9-12 dB higher than from WMVS. Three other stations, (WISN, WITI, and WPXE) also had median received signal powers 7-12 dB higher than from WMVS. Thus in order to bring reception back to the viewers on par with the UHF WMVT signal who would be using an STB, WMVS would have to increase power by 9-12 dB minus the 1 dB difference in the STB sensitivity or, 8-11 dB in the case of the same antennas and height used as the field test antennas. As indicated in the previous background section of this document, the situation is much more often than not that the viewer will be using a UHF-only antenna than a VHF antenna and that situation will reduce the signal power even further. Thus, since the field strength of the signal has not changed from the transmitter, the situation of most viewers who use an outdoor UHF-only antenna for both UHF and VHF reception, and also for the viewer who uses an indoor UHF-only antenna for both UHF and VHF reception, such as the ones indicated in the referenced independent antenna study, the situation is exacerbated even more. In the case of these field measurements made at the measurement height of 30 feet and using the median loss of the antenna performance at VHF, all other factors being the same, the resultant

signal level power difference between channel 35 (WMVT) and channel 8 (WMVS) would be 26-29 dB with the WMVS signal power being pushed further towards the noise floor.

Thus, the efforts undertaken in the field study do confirm the lack of sufficient signal is probably the most likely source of the reception problems and hence the reason for the request for a significant power increase. In 2010, WMVS requested an STA to operate at 69 kW ERP but due to an abundance of concern to interference with both WMKE (in Milwaukee) and WLS (in Chicago), the request was not granted. Neither of those interference situations are now possible.

The other factor that needs to be taken into account is the decrease in the signal-to-noise for VHF stations due to the presence of significant man-made noise. This factor was discussed at the recent FCC Broadcast Engineering Forum section on VHF reception. The simplified conclusion from noted experts in the broadcast industry regarding VHF power levels, is that high band VHF ERP values need to be upgraded roughly 10 dB to overcome the man-made noise that has increased since the inception of NTSC and has continued through the transition to ATSC reception.

As much as WMVS would like to increase its ERP by 10 dB, it is not feasible to implement such a change for two reasons. An increase in transmitter power of 10X would be an operational and capital cost that would be very, very difficult to obtain. Thus, WMVS seeks to mitigate as much as practical the signal power discrepancy as well as not causing interference to other services.

Interference Concerns

A significant portion of the interference received in the WMVS viewing area comes from WWMT in Grand Rapids which is across the lake from Milwaukee. There is no terrain between the locations as there might be in other continental locations and the lake can create multiple reflections. The only way that WMVS can protect from this is to increase its signal. WMVS employs 100 % power in both the Hpol and Vpol components of its signal to take advantage of the vpol power.

Since WLS moved to channel 44 (and will be moving to channel 22 post-repack), interference caused to channel 7 in Chicago should no longer be an issue. The output from TV Study has indicated that an ERP level of 70 kW at the same HAAT can be sustained without causing objectionable interference to any other authorized facility. This ERP level, which is 3.4 dB above the already granted CP value of 32 kW ERP, was chosen because it was achievable by a "reasonable" increment in transmitter size.

Another measure employed by WMVS was to apply for and secure a construction permit for a channel 36 "replacement" translator to focus its energy on the downtown and southern Milwaukee area. This had a significant effect on the downtown area and allowed previous channel 8 viewers to receive the programming on physical channel 36 free of interference. However, the FCC Incentive auction and repack has displaced this channel 36 facility so it will no longer be an asset to WMVS.

SUMMARY

When comparing the WMVS situation to the WSAW & WAOW situations we find similar circumstances. Wausau is a less metropolitan market than Milwaukee but it is believed the comparison is still valid. Evaluating the WMVS proposed facility with the current facility, the proposed 70 kW ERP produces a F(50,90) contour that is 5 miles greater in the direction of maximum radiation and less in other directions. On that basis, and because no objectionable interference would be created, it would seem appropriate to allow WMVS the ERP increase to the proposed ERP. Please see the attached contour map showing the WMVS current facility with 32 kW and the proposed 70 kW facility.

For the reasons listed above, WMVS requests a waiver to the Zone 1 maximum power and height limits to the ERP requested in this construction permit application. This request still goes to the heart of WMVS's mission to serve its viewership by providing a viewable signal. As a NCE station, this request is made in light of the significant cost and effort this will require on the station and its personnel. WMVS is committed to its viewership and is willing to expend the effort and cost for this ERP increase and to make good use of the VHF spectrum with which it has been entrusted. This waiver request and

amendment to the construction permit can be viewed as a furtherance to that goal and one that causes no interference.

Sincerely,

A handwritten signature in black ink that reads "Gregory L. Best, PE". The signature is written in a cursive style with a large initial 'G' and a distinct 'PE' at the end.

President

Attachment