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Technical Statement for Minor Modification of a Licensed Facility:

Milwaukee Media LLC
Station WIWN, Facility ID 60571
Channel 5
Fond du Lac, WI

Application for Construction Permit for Modification of Facility Licensed in File No. BLCDT-20120817ABF

Introduction

This Technical Statement provides supplemental technical data and information associated with the FCC application of Milwaukee Media LLC (Milwaukee) for a construction permit (CP) for authority to increase the Effective Radiated Power (ERP) of Station WIWN, operating on Virtual Channel 68 and on Digital Channel 5 and licensed to the community of Fond du Lac, WI. In particular, it addresses the need for additional power and provides interference analyses to supporting the use of the proposed power level increase. This application seeks waivers of the rules on the Zone I power limit and on the power versus height relationship in Zone I.

Grant of the amendment is in the public interest. WIWN provides a multitude of niche programming, such as religious and Spanish-language offerings, as part of its free, over-the-air broadcast stream. The proposed power increase of its facilities will allow WIWN to provide service to a substantial population that, while within the station's predicted service contour, has been unable to view the station due to the combination of spectrum noise unaccounted for in the Commission's rules, a lack of adequate consumer antennas for Low-VHF-channel reception, and other related factors. As discussed below, the Commission has granted power increases for several similarly-situated low VHF stations.

The instant application requests a new construction permit for modification of the facility licensed on September 18, 2012, in File Number BLCDT-20120817ABF. This Technical Statement also addresses the

environmental considerations, notification requirements, and similar factors associated with the proposed operation.

WIWN's license provides for operation using a directional antenna at a site in Milwaukee, WI, with 9 kW ERP at a Radiation Center Height Above Average Terrain (HAAT) of 338 meters. As discussed in detail below, that power level and height combination is insufficient to deliver receivable signals to many consumers within the WIWN predicted noise-limited contour (PNLC), as indicated by numerous contacts with the station from viewers who wish to watch station programming but are unable to do so. The current proposal is to retain the fundamental antenna characteristics while increasing electrical beam tilt and to increase ERP to 48 kW (i.e., by 7.27 dB).

This Technical Statement has sections treating the Rationale for Higher Power, Low-VHF Service Solutions, Facilities Requested and Waiver Justification, Principal Community Coverage, Interference Analyses, Environmental Impact/Radio Frequency Radiation, and Other Changes.

Rationale for Higher Power

The need for higher power is driven by four fundamental factors: (1) The System-Independent Planning Factors and the System-Specific Planning Factors developed by the FCC Advisory Committee on Advanced Television Service (ACATS) were in error by several dB; (2) there has been a significant and ongoing increase in the environmental noise floor since the planning factors were developed roughly a quarter-century ago; (3) the antennas available to consumers generally do not include operation in the Low-VHF spectrum in which Channel 5 is located; and (4) digital television transmission suffers from the "cliff effect" that causes failure of reception when required thresholds for signal delivery are not met. The impact of these factors is evident in the number of complaints that Low-VHF (Channels 2 – 6) television stations receive from viewers. They also are evident in the precedents established by the FCC in authorizing power increases, beyond the levels permitted in the Commission's rules, for several other Low-VHF digital television stations in response to the complaints those stations received from their audience members.

The System-Independent Planning Factors were developed within ACATS to establish the transmission and reception environment in which a selected system would operate. They include such environmental factors as propagation channel losses versus frequency of operation. They include such receiving system parameters as antenna gain, antenna directivity, transmission line loss, transmission channel noise floor, and receiver noise figure. System-Specific Planning Factors also were developed within ACATS to

establish the parameters required to enable reception of the particular system chosen, including such system- and receiver-dependent parameters as the signal-to-noise ratio threshold for reception in an Additive White Gaussian Noise (AWGN) channel, resilience to channel echoes and other impairments, co-channel and adjacent-channel interference effects, and so on. In the case of the ATSC Digital Television System ultimately selected, including 8-VSB transmission in a 6 MHz channel, the several planning factors were applied to arrive at Usable Field Strength values of 28 dBu for Low-VHF channels, 36 dBu for High-VHF channels, and 41 dBu for UHF channels, with a dipole correction factor applied at UHF but not in either of the VHF bands. The Usable Field Strength values then were used to determine the ERP values needed to replicate the service areas of the analog transmission facilities that the digital transmission system was intended to replace.

As it turned out, the Usable Field Strength values determined by the ACATS process were in error by several dB. This outcome was determined in 2002 by the ATSC through an activity of its Implementation Subcommittee Radio Frequency Working Group (IS-RFWG). The IS-RFWG evaluated numerous receiving configurations typically found in consumer settings and derived new Usable Field Strength values necessary for operation under the conditions previously defined within the ACATS effort. The values for Low-VHF operations ranged between 33.3 dBu and 43.3 dBu. Relative to the 28 dBu value included in the ACATS output and adopted in the FCC rules, the ATSC IS-RFWG work showed that transmitter power at Low-VHF for a given service distance is low by 5.3 – 15.3 dB (3.4 – 33.9 times). Thus, starting from a practical analysis of the planning factors, to achieve reception in the locations intended by the rules, several-fold more power is needed.

It is well known that noise across the radio frequency spectrum is increasing with time. Sources of the continuing increase in noise are largely man-made. They include both intentional and unintentional emitters. Unintentional emitters appear to be the larger source, but they can be divided into purposeful and accidental generators of RF energy. Examples of purposeful generators are switching power supplies, which are sold in the billions annually for powering or recharging batteries on myriad consumer products such as smartphones, electric shavers, and tablet computers. Examples of accidental generators are power line insulator breakdown, automobile and home heating system ignition systems, and passive intermodulation (PIM) sources (e.g., “rusty bolts”) within or nearby to transmission systems – especially digital transmission systems. As the sources of such noise in the RF spectrum proliferate, it is to be expected that the spectrum entropy will continually increase. While it is

very difficult to predict just how much noise increase will occur in any given location over any given time period, it is clear that the trend leads ever higher.

Low-VHF television suffers from the fact that the noise described above tends to be stronger at lower frequencies. Also, most efficient antennas must be resonant at the frequencies at which they work, and lower frequencies require larger antennas to achieve resonance. At the same time, consumers have become accustomed to satellite receiving antennas being relatively small and to consumer electronics becoming ever smaller and simultaneously more functional. Because consumers tend to prefer smaller broadcast television receiving antennas, there has been a proliferation of small panel antennas in the market. Such small antennas inherently cannot be resonant at Low-VHF frequencies due to their sizes and therefore cannot be very efficient. As a result, the consumer antennas will not have the gain values used by both the ACATS and ATSC committees that determined the appropriate values for the planning factors.

To make matters worse, there are antennas in the marketplace that are identified as suitable for VHF reception in a way that can be misleading to consumers. A recent examination of the web sites of a major manufacturer of consumer television receiving antennas and of a major distributor of such antennas showed that each included listings of antennas claimed to operate at "VHF" without differentiating between High-VHF and Low-VHF. Examining the specifications, when available, and/or the structures of the various antennas indicated that only a very small percentage of antennas sold to consumers actually were designed to operate efficiently at VHF, and only a very small percentage of those designed for operation at VHF were designed to operate efficiently at Low-VHF. Therefore, consumers are likely to be purchasing antennas that they erroneously believe are suitable for "VHF" reception, including all VHF Channels between 2 and 13, not realizing that there is a difference between the antennas equipped to receive Channels 2 – 6 and those equipped to receive Channels 7 – 13. Consequently, consumers buy antennas with an expectation that they can receive all of the signals in their markets, but the antennas they purchase do not behave as expected; in fact, they discriminate against VHF, and especially Low-VHF, to the extent that they distort severely the planning factors developed by ACATS and ATSC because they violate certain assumptions underlying those parameter sets. With the attendant reduction in gain at the receiving end from what was built into the planning factors, the only way the connection from the broadcaster to the consumer through the transmission channel can be restored is through an increase in power at the transmitter. This effect is in addition to the shortfall from the errors in the original planning factors.

The last of the four fundamental factors impacting reception of Low-VHF stations by consumers is the fact that digital transmission suffers from the "cliff effect." In other words, when signal levels drop, instead of slowly deteriorating (e.g., becoming noisy) as happens with analog signals, they suddenly disappear, as if falling over a cliff. The cliff effect magnifies the impact of the low signal levels that are prevalent on Low-VHF channels due to the combination of incorrect planning factors, increasing noise floor, and poor antennas. When already weak signals vary in received level with propagation changes, the programs that viewers are watching and to which they are listening abruptly will disappear and reappear. These interruptions call immediate attention to the fact that the signal levels are varying. The disturbance is far more pronounced and obvious than was the case with analog signals, which would get more or less noisy with signal fading. With digital signals, the viewer does not have the choice of continuing to watch despite the fades because there is no content to watch or hear after the signal goes over the cliff. Consequently, viewers become much more sensitive to the variations in signals, especially in the much larger areas with signal levels much lower than they were supposed to be, and are more irritated with the program service than they would be otherwise.

WIWN has experienced many of the impacts described in the preceding paragraphs. It has received complaints from numerous viewers who are unable to watch the station's programming but are able to watch the other stations in the market without difficulty. Often, the viewers describe antennas that clearly are not designed to work at Low-VHF. In many cases, they are not designed for VHF reception at all. This means that those antennas are operating at very low gain compared to the gain levels assumed in the designs of the planning factors. The planning factors expected outdoor antennas, 30 feet in the air, with a gain of 4 dB at Low-VHF. Very often, the viewers contacting WIWN are using indoor antennas that may be 6 feet above ground. This combination can result in a total gain that is 20 - 30 dB below the value included in the planning factors, i.e., an antenna with a loss of 10 dB instead of a gain of 4 dB (for a total difference of 14 dB), a loss due to the lower height of another 6 dB, and a loss due to the signals having to penetrate the building of perhaps 10 dB – possibly more. Building penetration will be lower at Low-VHF than on the higher frequency bands, putting Low-VHF at a further disadvantage.

Low VHF Service Solutions

There are three potential ways in which the problems described above could be mitigated: (1) Reduce the man-made noise in the environment; (2) increase the gains of the receiving antennas of each of the consumers having reception difficulties; or (3) increase ERP of the television broadcast station. For a number of reasons, possibilities 1 and 2 are not practical. Reducing the man-made noise would take a

change in the FCC rules to eliminate all of the sources of such noise and would take a very long time to achieve, since all of the noise sources would have taken out of service and presumably replaced with an equivalent device or system that would create no or very little noise. Increasing the gains of the receiving antennas would require different products being brought to market and the public being educated on the need to purchase and install replacement antennas so that they can view the few Low-VHF television stations that they cannot receive reliably – none of which could be mandated, as a practical matter. Both options would require changes in policies and rules and take a very long time, plus the cooperation of multiple industry segments and the public. All of those factors coming together in a timely way is highly unlikely.

That leaves increasing the ERP of the broadcast television station as the only practical solution. In fact, that approach has been taken by other Zone I Low-VHF stations and the FCC. In the first two instances, the Commission granted permission for operation on Channel 6 at 30+ kW to WRGB in Schenectady, NY, and WPVI in Philadelphia.[1] Recently, WPVI has requested permission for experimental operation at 62.9 kW. Recently, a group of four stations on Channels 2, 3, and 4 in the Delaware, New Jersey, and Virginia[2] region jointly requested authorization for operation above the 10 kW power limit applied by the rules to Low-VHF stations in Zone I.

Besides permitting stations in the Low-VHF TV band to operate at power levels above those provided in the rules, the FCC has recognized the difficulties of operation on Channels 2 – 6 in other ways. For instance, in the recent incentive spectrum auction, the Commission valued the Low-VHF channels lowest of those in the three TV bands and compensated stations willing to move to Low-VHF from UHF or from High-VHF more than for any other alternative except giving up their spectrum completely. This relationship demonstrated that the Low-VHF channels were the least desirable and required the greatest incentive to persuade stations to move there. The reasons for the lack of desirability of Low-VHF channels are exactly those problems described herein with respect to delivering service reliably on those channels to viewers.

[1] *See*, *e.g.* Application of WPVI, File No. BPCDT-20090617ADQ; Application of WRGB, BPCDT-20090622AB; and subsequent minor modification applications filed by the stations.
[2] *See* LMS File No. 0000035792 describing minor modification sought by KJWP, Channel 2, Wilmington, DE; WJLP, Channel 3, Middletown Township, NJ; WACP, Channel 4, Atlantic City, NJ; and WVIR-TV, Channel 2, Charlottesville, VA.

Facilities Requested and Waiver Justification

In the instant case, the request is for an ERP increase using the pattern of the existing antenna at the Milwaukee site. An adjustment in the antenna elevation pattern is planned to increase electrical beam tilt to use the available RF power more effectively to deliver signals to consumers. The ERP value was determined to be the highest value possible without causing impermissible interference to any other stations. The success of this approach is described below in the section on Interference Analyses.

The specific facilities requested in this application include power increased to 48.0 kW ERP at a height above average terrain of 339 meters at the Milwaukee site, with the electrical beam tilt of the antenna increased to 4.0 degrees. Therefore, this applications requests waiver of FCC rules §73.622(f)(5) and §73.622(f)(6). Waiver of §73.622(f)(5) is necessary because the requested facilities would exceed those of the largest station in the market when only the contour is used to determine size of a station's coverage without consideration of the factors discussed above. Waiver of §73.622(f)(6) is necessary because the requested facilities would exceed the limitation of 10 kW ERP for Low-VHF stations in Zone I and would exceed the height versus power limitations for stations in Zones II and III.

WIWN is located in the very northwest corner of Zone I, with its azimuth pattern pointing to the edge of Zone I and into Zone II. The facts that only one other full-service station was found by TVStudy to be close enough to require evaluation, as discussed below in the section on Interference Analyses, and that no Class A stations were found in proximity to WIWN indicate that it is well isolated from other spectrum users on Channels 4, 5, and 6. Further, it is not located in a portion of the country having dense use of that portion of the Low-VHF band. Consequently, permitting WIWN to operate at higher power will not preclude use of the spectrum by others and, at the same, will meet FCC objectives for the fullest and most efficient use of the spectrum by enabling its use for reliable delivery of television service in a part of the country that currently is not making extensive use of those channels.

A plot of the proposed predicted noise-limited contour (PNLC) of the transmitter is provided in Figure 1, where the proposed contour is in orange. Also shown in Figure 1, in blue, is the 35-dBu Principal Community contour of the proposed facility, which can be seen to encompass the entire community of Fond du Lac, WI (outlined in black), as required by §73.625(a). (The map of Figure 1 and the antenna pattern plots of Figures 2 – 5 all are contained in the file named <WIWN Contour Map & Antenna Pattern Plots.pdf>.)

As required by §73.625(c), a plot of the azimuthal radiation pattern of the antenna in relative field values is included as Figure 2. The azimuthal power pattern expressed in decibels relative to 1 kW (dBk), at the depression angle having maximum power (4.0 degrees depression), is plotted in Figure 3. The elevation radiation pattern in relative field values is included as Figure 4. The elevation power pattern expressed in decibels relative to 1 kW (dBk) is plotted in Figure 5. The azimuth pattern data for the antenna has been included in the online application form in the LMS ingest system.

The transmitter to be used in the WIWN facility will be Type Verified as per Section 73.1660 of the Commission's Rules. The transmitters will be of solid state design.

Principal Community Coverage

As required by §73.625(a)(1) of the FCC rules, the transmitter location must be chosen so as to put a minimum F(50,90) field strength of 35 dBu over the entire community to be served. §73.625(a)(2) further requires that "[t]he location of the antenna must be so chosen that there is not a major obstruction in the path over the principal community to be served." As demonstrated by the 35-dBu contour of the transmitter, shown in blue on the coverage map of Figure 1, the transmitter location chosen, combined with the other characteristics of the transmission system, does deliver at least the minimum required field strength over the entire principal community to be served – Fond du Lac, WI. There is no major obstruction in the path over the principal community to be served.

Interference Analyses

As a result of the proposed antenna pattern modification and power increase, interference studies were conducted to confirm that interference protection to neighboring stations would be maintained after the proposed changes. The studies were conducted using the Commission's TVStudy software, version 2.2.3. The Licensing and Management System (LMS) database dated December 4, 2017 was applied.

TVStudy found only one record requiring analysis, representing the licensed facilities of one full-service television station. The station, record number, and results are included in the following table. The percentage of interference increase due to the WIWN application shown in the last column is that of the worst case scenario reported by TVStudy.

Call	Chan	Svc	Status	City, State	File Number	Dist. km	IX % Incr.
WGVK	D5	DT	LIC	KALAMAZOO, MI	BLEDT20060703ABQ	203.5	0.38

As can be seen in the table, the single record shows an increase in predicted interference from the proposed WIWN power increase of 0.38 percent. With a permissible increase in the level of predicted interference of 0.5 percent, there is no impermissible new interference predicted to be caused to the station. Complete data from the interference study described are provided in a file uploaded to the LMS record named <WIWN Ch5 48kW tvixstudy.pdf>. As will be noted in the attachment, the studies were conducted with a default Study Cell Size of 2.0 km and a Terrain Profile Point Spacing of 1.0 km.

Environmental Impact/Radio Frequency Radiation

The proposed antenna pattern change and power increase impact the determination of predicted Radio Frequency Radiation (RFR) previously on file with the Commission. Consequently, the RFR percentage of the Maximum Permissible Exposure (MPE) has been recalculated using the proposed pattern and power level, and the results are reported in the file <Environmental Impact - Radio Frequency Radiation - WIWN Fond du Lac Power Increase.pdf>, which has been uploaded to the LMS record for this application.

Other Changes

The recent run of TVStudy regarding the KVMD DTS produced a slightly different value for HAAT for the Center of Radiation of the antennas than was in the LMS database previously. Consequently, the value in the LMS record has been updated to the value computed by TVStudy.