§73.1125(b)(2)
Main Studio Showing

Longley/Rice Alternate Propagation
Main Studio Showing for

KKEQ(FM) – Fosston, MN
BMPH-20140324AEQ
(Facility ID: 52634)
Channel 296C1 – 107.1 MHz

September, 2014

CERTIFICATION OF ENGINEERS

The firm of Munn-Reese, Inc., Broadcast Engineering Consultants, with offices at 385 Airport Drive, Coldwater, Michigan, has been retained for the purpose of preparing the technical data forming this report.

The data utilized in this report was taken from the FCC Secondary Database and data on file. While this information is believed accurate, errors or omissions in the database and file data are possible. This firm may not be held liable for damages as a result of such data errors or omissions.

The report has been prepared by properly trained electronics specialists under the direction of the undersigned whose qualifications are a matter of record before the Federal Communications Commission.

I declare under penalty of the laws of perjury that the contents of this report are true and accurate to the best of my knowledge and belief.

September 3, 2014

By _____
Wayne S. Reese, President

By _____
Justin W. Asher, Project Engineer

MUNN-REESE, INC.
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Discussion of Main Studio Coverage Showing

This firm has been retained to prepare an engineering report demonstrating compliance with §73.1125(b)(2) regarding the main studio location for KKEQ(FM) – Fosston, MN (Facility ID: 52634), associated with the pending construction and licensing of authorized Construction Permit BMPH-20140324AEQ. KKEQ(FM).CP will operate on Channel 296C1, 107.1 MHz with 100.0 kW ERP at 630 meters AMSL. Alternate propagation methodology (Longley/Rice) has been employed pursuant to §73.1125(b)(2) regarding the main studio location.

The transmitter site for the KKEQ(FM).CP facility is identified by NAD 27 coordinates of 47° 36' 22" NL; 95° 25' 31" WL. The main studio for KKEQ(FM).CP will now be identified by the NAD 27 coordinates of 47° 27' 21.2" NL; 94° 52' 53.5" WL. These coordinates and the KKEQ(FM).CP authorized parameters results in no coverage of the new KKEQ(FM) main studio using the standard 70 dBµ f(50:50) FCC propagation contour. However, pursuant to §73.1125(b)(2), the main studio lies within the 70 dBµ city grade contour of the KKEQ(FM)CP facility when analyzed under the Longley/Rice Propagation methodology.

FCC Rules require several specific stipulations prior to accepting Longley-Rice as an alternate propagation method for coverage issues. Each stipulation will be discussed in detail. Also attached as ***Exhibit 1.0*** is a V-Soft®, Probe IV™ map demonstrating compliance with the below mentioned criteria. All relevant distances and contours as well as operating parameters employed have been noted.

> ***1.) A showing of why a supplemental showing (Longley-Rice) was warranted. (e,g., very flat, very rough or anomalous terrain.) In cases where Delta h*** (Δ) ***is to be the sole determinant a showing must be provided that terrain "departs widely" from the average Delta h*** (Δ) ***of 50 meters. The applicant must provide evidence that the Delta h*** (Δ) ***of the path from the transmitter to the principal city is less than 20 (or more than 100.) Also, the applicant can show that the antenna HAAT along the radials toward the community of license (using an extended radial) varies by more than 30% from the HAAT obtained by using the standard method. For purposes of determining Delta h*** (Δ), ***the commission has established a profile length of between the transmitter and community, not to exceed 50 km. See Section 73.313. Alternately, pursuant to DA 10-1760,*** **Skytower Communications – 94.3, LLC; Licensee of Station WULF(FM), Hardinsburg, Kentucky Request for Determination of Compliance with the Main Studio Location Rule, 47 C.F.R. § 73.1125*; (MO&O and Notice of Apparent Liability for Forfeiture); adopted September 16, 2010 and released September 17, 2010, the sole qualification for determining if terrain departs widely from the norm was further relaxed to include instances where the Alternate Propagation Method results in a 30% or greater difference in the distance to the 70 dBµ contour compared to the distance provided by the standard prediction method.***

In this case, use of the supplemental Longley-Rice methodology is warranted based on the *Skytower Communications* decision. The distance to the 70 dBµ contour as predicted by the supplemental method has been calculated to be 31.5% to 36.4% larger than the distance to the standard contour prediction method over the arc of radials toward the proposed main studio. 70 dBµ contours have been supplied both in map and tabulation form as noted on ***Exhibit 1.0***. The applicant would like to note that consistent with FCC policy, in instances where the Longley-Rice 70 dBµ service contour exceeds the FCC 60 dBµ F(50:50) contour (protected service contour for Class C1 operation), the Longley-Rice contour is to be truncated to no longer than the FCC 60 dBµ f(50:50) contour (protected service contour for Class C1 operation). However in this instance, truncation is not required for any main studio radial arc.

Discussion of Community Coverage Showing

Pursuant to DA 10-1760, *Skytower Communications – 94.3, LLC; Licensee of Station WULF(FM), Hardinsburg, Kentucky Request for Determination of Compliance with the Main Studio Location Rule, 47 C.F.R. § 73.1125*; (MO&O and Notice of Apparent Liability for Forfeiture); adopted September 16, 2010 and released September 17, 2010, the sole qualification for determining if terrain departs widely from the norm was further relaxed to include instances where the Alternate Propagation Method results in a 30% or greater difference in the distance to the 70 dBμ contour compared to the distance provided by the standard prediction method. As stated before, distance to the 70 dBμ contour as predicted by the supplemental method has been calculated to be 31.5% to 36.4% larger than the distance to the standard contour prediction method over the arc of radials toward the proposed main studio. Therefore, pursuant to the *Skytower Communications* decision, use of a supplemental alternate propagation §73.1125(b)(2) showing is warranted.

2.) Showing that the distance to the 70 dBμ contour as predicted by the supplemental method is at least 10% larger than the distance predicted by the standard contour prediction method.

Distance to the 70 dBμ contour as predicted by the supplemental method has been calculated to be 31.5% to 36.4% larger than the distance to the standard contour prediction method along the radials spanning the main studio location. The 70 dBμ contours have been supplied both in map and tabulation form as noted in ***Exhibit 1.0***. The applicant would like to note that consistent with FCC policy, in instances where the Longley-Rice 70 dBμ service contour exceeds the FCC 60 dBμ F(50:50) contour (protected service contour for Class C1 operation), the Longley-Rice contour is to be truncated to no longer than the FCC 60 dBμ f(50:50) contour (protected service contour for Class C1 operation). However in this instance, truncation is not required for any main studio radial arc

3.) A showing of the coordinates for the proposed main studio locations in compliance with Sec 73.1125.

The coordinates for the main studio location have been properly noted and plotted on the ***Exhibit 1.0*** coverage map. This Longley-Rice Alternate Propagation Main Studio Showing demonstrates main studio compliance under §73.1125(b)(2).

4.) A map showing the relative locations of the main studio location or legal boundaries of the community of license and the principal city community contours as predicted by the standard and supplemental method.

The location and corresponding coordinates of the main studio location have been properly noted and plotted on the ***Exhibit 1.0*** coverage map.

5.) A list of assumptions and an explanation of the method used in generating the supplemental analysis.

Longley/Rice and standard predicted methodology as described by the computer software manufacturer has been included in ***Exhibit 1.1***. It is believed sufficient showing has been presented meriting a grant of the proposed KKEQ(FM).CP Alternate Propagation Main Studio Showing with regard to §73.1125(b)(2), however additional showings will be provided upon FCC request.

6.) Sample calculations using the supplemental procedure.

Documentation of the supplemental main studio coverage contour and FCC contour distances have been supplied in ***Exhibit 1.0***. Tabulations of each relevant arc and contour distances have been supplied in the exhibit as well. Additional showings will be supplied upon request.

KKEQ.C
Fosston, MN
BMPH20140324AEQ
Facility ID: 52634
Latitude: 47-36-22 N
Longitude: 095-25-31 W
ERP: 100.00 kW
Channel: 296C1
Frequency: 107.1 MHz
AMSL Height: 630.0 m
Horiz. Pattern: Omni

Prop Model: Longley-Rice
Climate: Cont temperate
Conductivity: 0.0050
Dielec Const: 15.0
Refractivity: 311.0
Receiver Ht AG: 9.1 m
Receiver Gain: 0 dB
Time Variability: 50.0%
Sit. Variability: 50.0%
ITM Mode: Broadcast
Method: Last Occurence

Exhibit 1.0
Alternate Propagation Community Coverage Showing (Longley-Rice)

Azimuth (degrees)	Distance to Main Studio (km)	Distance to 70 dBµ FCC Contour (km)	Distance to 60 dBµ FCC Contour (km)	Distance to 70 dBµ Longly-Rice (km)	Percent Difference 70 dBµ
111.0°T	42.22	41.42	61.86	56.50	36.4%
112.0°T	42.22	41.41	61.86	55.20	33.3%
113.0°T	42.22	41.38	61.82	54.40	31.5%

KKEQ.C

KKEQ(FM) Main Studio
206 5th St NW
Bemidji, MN 56601
Latitude: 47-27-21.20 N
Longitude: 094-52-53.50 W
NAD 1927

Bemidji

KKEQ(FM) Main Studio

Longley-Rice 70 dBµ F(50:50)

FCC 70.0 dBµ F(50:50)

111.0°
112.0°
113.0°

50 km Radius from KKEQ(FM) Site

FCC 60.0 dBµ F(50:50)

Terrain
360 610 m

USGS 03 SEC Terrain Database
U.S. Census 2010 PL Database
NAD 1927 Coordinate Datum

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Scale 1:275,000
0 3 6 9 km

Exhibit 1.1 - Explanation of Propagation Methodology

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V-Soft COMMUNICATIONS®
R.F. Communications Software and Engineering Consulting

Propagation Methodology

FCC Propagation Curves

The FCC curves were created through a combination of the free-space equations and actual measurements, which augmented the equations with real world experience. Initially, the curves were available only as a set of graphs. However, with the advent of computers, the U.S. Federal Communications Commission employed its staff to translate the curves to a set of digitally stored tables, which could be interpolated by machine. With the input of desired signal level, radiated power, and effective antenna height the curves will give the user an accurate estimate of the distance from the antenna where the signal will exist. The curves can also be used to determine signal level at a distance with the input of power, antenna height and distance from the antenna. Proper use of the curves requires that the input variable "antenna height" be calculated to represent the antenna's height above "average terrain". The FCC specifies certain methods for determining this value. When topographic maps are employed, the Commission requires that at least 50 points be taken from 3.16 to 16 kilometers (FM) and then averaged to produce the height above average terrain. The computer implementation of the curves will generally take terrain samples at one/tenth kilometer intervals. The FCC's method is excellent at representing coverage over somewhat smooth or rolling terrain, however the methods tend to break down in places where the terrain is rugged. Since the method simply averages the terrain elevations, inaccuracies are introduced when the terrain varies widely or when it varies significantly at points beyond the method's 16-kilometer cutoff.

Longley-Rice Model

In the mid-sixties, the National Bureau of Standards published Technical Note 101. P. L. Rice, A. G. Longley, A. Norton and A. P. Barsis authored this two-volume propagation treatise in the course of their work at the Institute for telecommunications Sciences and Aeronomy at Boulder, Colorado. The concepts expressed in these documents were incorporated into a series of computer routines that came to be known as the "Longley-Rice Model". This model has recently been employed by the Commission to determine the new DTV allocation scheme. It has now become the standard alternative prediction method. Going well beyond the FCC curves, the Longley-Rice method considers atmospheric absorption including absorption by water vapor and Oxygen, loss due to sky-noise temperature and attenuation caused by rain and clouds. It considers terrain roughness, knife-edge, (with and without ground-reflections), loss due to isolated obstacles, diffraction, forward scatter and long-term power fading. The model and our V-Soft Communications implementation require the following inputs for analysis based on multiple point-to-point paths:

Frequency (20 - 20,000 MHz)

Transmitter antenna parameters:

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Transmitter antenna height (above mean sea level - meters.) Transmitter antenna height (above ground - meters.) Transmitter power. Transmitter antenna pattern.

Receiver antenna height (above ground - meters)

System antenna polarization (vertical or horizontal)

System Ground Conductivity (mhoS/m)

- .001 = Poor Ground
- .005 = Average ground
- .020 = Good ground
- 5.000 = Sea water
- .010 = Fresh Water

System dielectric constant (Permitivity)

- 4.0 = Poor ground
- 15.0 = Average ground
- 25.0 = Good ground
- 81.0 = Sea and fresh water

System minimum monthly mean surface refractivity (Adjusted to sea level.)

- 200 to 450 (available from map, 301 N-units is default.)

Climate Code:

- 1 = Equatorial
- 2 = Continental sub-tropical
- 3 = Maritime Subtropical
- 4 = Desert
- 5 = Continental temperate (default for U.S. continent)
- 6 = Maritime temperate
- 7 = Maritime temperate overseas

Probability Factors:

- Qt = (Time variability) The percentage of time the actual path loss is equal or less than the predicted path loss (Standard broadcast coverage = 50%)

Exhibit 1.1 - Explanation of Propagation Methodology

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- Ql = (Location Variability) The percentage of paths (all with similar characteristics) whose actual path loss is less than or equal to the predicted path loss. (Used with area mode only.)

- Qc = (Prediction Confidence or "Quality") The percentage of the measured data values the model is based on that are within the predicted path loss. (Standard broadcast = 50%, DTV = 90%.)

V-Soft Communication's implementation of Longley-Rice predicts received signal strength level at some 264,000 points. Our programs Probe and Terrain-3D allow instantaneous manipulation of these points to produce numerous graphic representations of the coverage pattern. The user can choose any of the pre-defined signal level representations or input a user-defined signal level. Costal features, cities, political boundaries and streets to the individual road level are available for plotting.

Okumura Propagation Model

The basic Okumura propagation model uses the height above average terrain to calculate path loss and does not consider specific terrain obstacles. The Okumura propagation model that Probe uses is the Okumura/Hata/Davidson implementation. Hata developed a set of equations that provide Okumura model predictions for computer use. The Davidson correction factors extend the frequency and base antenna height range.

COST-231 Propagation Model

Probe implements the COST-231/Hata version of the COST-231 propagation model. This model uses the HAAT along each radial to determine the attenuation based the following equation:

Path Loss (dB) = 46.3 + 33.9*log(F) - 13.82*log(H) + [44.9 - 6.55*log(H)]*log(D) + C

where

F = Frequency (MHz)
D = Distance between base station and receiver (km)
H = HAAT in the direction of the receiver (m)
C = Environmental-correction factor (dB)

The Hata correction for receiver height and frequency is then applied to calculate the final attenuation.

Probe - Terrain 3-D