



## ***Engineering Statement***

### ***WSUM(FM), Channel 219A Madison, Wisconsin University of Wisconsin System***

This statement and attached figures have been prepared by B. Benjamin Evans, P.E. of Evans Associates, Consulting Communications Engineers, on behalf of the University of Wisconsin System, licensee of WSUM(FM), Channel 219A, Madison, Wisconsin. This is in regard to an application for construction permit being filed for changes to the directional antenna pattern envelope and to increase power.

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On August 23, 2002, WSUM filed an application for construction permit (BPED-20020823AAJ) to change its directional antenna pattern to increase coverage in the Madison area. This application was dismissed on October 24, 2002 because the proposal was determined by Audio Division staff to cause *de minimus* overlap between WSUM's proposed 60 dBu contour and the 40 dBu interference contour of WSUW, Channel 219A, Whitewater, Wisconsin.

Since the dismissal of its application, WSUM has obtained a license for a new directional antenna but at a lower power of 4.9 KW ERP (BMLED-20021028ABS). WSUM had previously operated at 5.6 KW ERP. WSUM is hereby re-submitting its application for increased coverage.

In the application that was dismissed, this engineer stated and demonstrated that the use of the 3-second terrain database clearly establishes that no overlap would occur between WSUM and WSUW. However, in their dismissal letter, the Audio Division staff said that in order to request consideration of contour calculations based on the 3-second database, tabular HAAT and contour distance data must be submitted. Pursuant to this requirement, attached as Figures 1 and 2 are HAAT and contour distance calculations in tabular form for WSUM, as proposed herein, and WSUW. HAAT and contour distances are shown using both 30-second and 3-second terrain databases. These calculations were performed using the V-Soft Probe II software, which uses the same contour distance algorithm and digitized FM field strength curve data as the FCC's FMOVER program.

Attached as Figure 3 for reference is the printout of the FMOVER analysis conducted by the Audio Division staff when the original application was being studied for compliance. The most



overlap, up to 0.77 kilometer or 0.24 dB<sup>1</sup>, according to the FCC's study, occurred between 66 and 68 degrees azimuth from WSUM, or between 286 and 287 degrees azimuth from WSUW. Referring to Figures 1 and 2, it can be seen that at these azimuths, the difference in the HAAT's, using the 3-second database instead of the 30-second database, is enough to pull the respective contours away from each other by between 0.8 and 1.0 kilometer. If there were a 0.77-kilometer contour overlap as the FMOVER study contends, the use of the 3-second database should eliminate it.

The attached Figures 1 and 2 were prepared using 5.6 KW as the maximum ERP for WSUM. In an abundance of caution, however, WSUM is proposing 5.5 KW as the authorized ERP.

Respectfully submitted,

B. Benjamin Evans, P.E.  
Consulting Engineer for WSUM

November 15, 2002

#### **ATTACHED FIGURES**

- Figure 1 - - - Protected Contour Calculations – WSUM(FM), Madison, WI
- Figure 2 - - - Interference Contour Calculations – WSUW(FM), Whitewater, WI
- Figure 3 - - - FMOVER Printout for WSUM and WSUW

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<sup>1</sup> In the recent past, the Audio Services staff had the authority to waive up to 0.25 dB of interfering signal in excess of the prescribed U/D ratio. This is because the digitized form of the FCC FM field strength curves has a margin of error up to 0.25 dB. Refer to FCC staff decision re: KXLC(FM), La Crescent, MN, (BMPED-19901010IG), and its de minimus overlap with WHHI, Highland, WI.

**Protected Contour Calculations**  
**Proposed WSUM (FM), Madison, WI**  
**Channel 219A**  
**N Lat 42-54-16, W Long 89-33-20**  
**5.6 KW ERP (Dir), 103 m HAAT, 403.5 m AMSL**

Figure 1

<u>Azimuth</u> <u>(Degrees)</u>	<u>ERP</u> <u>(KW)</u>	<u>30 Second Database</u>		<u>3 Second Database</u>		<u>Difference 03-30</u>	
		<u>HAAT</u> <u>(m)</u>	<u>Dist to</u> <u>60.0 dBu</u> <u>(Km)</u>	<u>HAAT</u> <u>(m)</u>	<u>Dist to</u> <u>60.0 dBu</u> <u>(Km)</u>	<u>HAAT</u> <u>(m)</u>	<u>Dist to</u> <u>60.0 dBu</u> <u>(Km)</u>
55.0	1.445	99.2	20.4	96.8	20.0	-2.4	-0.4
56.0	1.380	100.2	20.2	98.5	20.0	-1.7	-0.2
57.0	1.316	100.5	20.0	100.6	20.0	0.1	0.0
58.0	1.254	99.9	19.7	100.3	19.7	0.4	0.0
59.0	1.193	98.6	19.3	96.8	19.1	-1.8	-0.2
60.0	1.134	96.9	18.9	94.0	18.6	-2.9	-0.3
61.0	1.088	95.9	18.6	92.8	18.3	-3.1	-0.3
62.0	1.042	96.0	18.4	92.7	18.0	-3.3	-0.4
63.0	0.998	97.3	18.3	93.2	17.9	-4.1	-0.4
64.0	0.954	98.8	18.3	94.3	17.8	-4.5	-0.5
65.0	0.912	99.8	18.1	96.5	17.8	-3.3	-0.3
66.0	0.870	100.6	18.0	98.1	17.7	-2.5	-0.3
67.0	0.830	101.0	17.8	98.0	17.5	-3.0	-0.3
68.0	0.790	101.5	17.6	97.7	17.2	-3.8	-0.4
69.0	0.751	102.0	17.4	98.1	17.0	-3.9	-0.4
70.0	0.714	102.3	17.2	99.1	16.8	-3.2	-0.4
71.0	0.686	102.3	17.0	99.9	16.8	-2.4	-0.2
72.0	0.660	101.9	16.8	100.0	16.6	-1.9	-0.2
73.0	0.633	101.7	16.6	100.0	16.4	-1.7	-0.2
74.0	0.608	101.8	16.4	100.2	16.2	-1.6	-0.2
75.0	0.582	102.4	16.2	100.4	16.1	-2.0	-0.1
76.0	0.558	103.5	16.1	100.9	15.9	-2.6	-0.2
77.0	0.534	104.5	16.1	101.9	15.8	-2.6	-0.3
78.0	0.510	105.4	15.9	103.1	15.7	-2.3	-0.2
79.0	0.487	106.0	15.8	103.7	15.5	-2.3	-0.3
80.0	0.464	106.0	15.5	103.4	15.3	-2.6	-0.2
81.0	0.448	105.3	15.3	102.7	15.1	-2.6	-0.2
82.0	0.431	104.2	15.1	102.1	14.9	-2.1	-0.2
83.0	0.415	102.9	14.8	100.9	14.7	-2.0	-0.1
84.0	0.399	101.6	14.6	99.5	14.4	-2.1	-0.2
85.0	0.383	101.0	14.4	98.8	14.2	-2.2	-0.2



**Interference Contour  
Calculations  
WSUW (FM), Whitewater, WI  
Channel 219A  
N Lat 42-50-10, W Long 88-44-36  
1.30 KW ERP, 55 m HAAT, 317 m AMSL**

Figure 2

<u>30 Second Database</u>			<u>3 Second Database</u>		<u>Difference 03-30</u>	
<u>Azimuth</u> <u>(Degrees)</u>	<u>HAAT</u> <u>(m)</u>	<u>Dist to</u> <u>40.0 dBu</u> <u>(Km)</u>	<u>HAAT</u> <u>(m)</u>	<u>Dist to</u> <u>40.0 dBu</u> <u>(Km)</u>	<u>HAAT</u> <u>(m)</u>	<u>Dist to</u> <u>40.0 dBu</u> <u>(Km)</u>
280	52.4	51.7	50.7	51.0	-1.7	-0.7
281	52.6	51.8	51.2	51.2	-1.4	-0.6
282	52.7	51.8	51.6	51.4	-1.1	-0.4
283	52.9	51.9	51.7	51.5	-1.2	-0.4
284	52.9	52.0	51.9	51.5	-1.0	-0.5
285	53.0	52.0	52.1	51.6	-0.9	-0.4
286	53.4	52.1	52.2	51.6	-1.2	-0.5
287	53.8	52.3	52.4	51.7	-1.4	-0.6
288	54.1	52.4	52.4	51.7	-1.7	-0.7
289	54.4	52.5	52.4	51.8	-2.0	-0.7
290	54.9	52.7	52.5	51.8	-2.4	-0.9
291	55.6	52.9	53.1	52.0	-2.5	-0.9

Figure 3-A

# *FMOVER Printout for Proposed WSUM and WSUW*

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 \* 14:19:00 FM Overlap Study 15-OCT-02 \*  
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BPED20020823AAJ APP WSUM  
 MADISON WI US  
 219A 91.7 MHz Updated 20020826  
 BOARD OF REGENTS OF UNIVERSITY O  
 N Lat 42-54-16 W Lon 089-33-20

BLED1792 LIC WSUW  
 WHITEWATER WI US  
 219A 91.7 MHz Updated 19970903  
 BD. OF REGENTS, UNIV. OF WIS.  
 N Lat 42-50-10 W Lon 088-44-36

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 ERP HAAT RCAMSL  
 H 5.600 kw 103 m 404 m  
 V 5.600 kw 103 m 404 m  
 DAY Make:ODD Mod:ODD990429IB  
 Rotation: degrees  
 Is it 73.215: N

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 ERP HAAT RCAMSL  
 H 1.300 kw 55 m 317 m  
 V 1.300 kw 55 m 317 m  
 DAY Make: Mod:  
 Rotation: degrees  
 Is it 73.215: N

20020823AAJ  
 PROTECTED  
 60.00 dBu

1792  
 INTERFERING  
 40.00 dBu

AZIMUTH (degrees)	ERP (kw)	HAAT (m)	DIST (km)	AZIMUTH (degrees)	ERP (kw)	HAAT (m)	DIST (km)	ACTUAL (dBu)	IX (km)
0.0	5.600	99.5	27.8	298.46	1.300	61.4	74.9	34.45	
10.0	5.600	101.9	28.1	300.23	1.300	62.3	70.6	35.61	
20.0	5.600	103.6	28.3	301.50	1.300	62.7	65.9	36.86	
30.0	4.506	101.9	26.8	300.52	1.300	62.4	61.0	38.19	
40.0	2.847	95.5	23.4	296.78	1.300	60.5	57.0	39.22	
50.0	1.794	94.7	20.9	292.99	1.300	57.2	54.3	39.76	
60.0	1.134	96.0	18.8	289.01	1.300	54.9	52.7	40.02	**
70.0	0.714	103.5	17.3	285.36	1.300	53.7	51.7	40.18	**
80.0	0.464	106.0	15.3	281.64	1.300	53.0	51.9	40.03	**
90.0	0.309	99.7	13.3	278.42	1.300	53.1	53.2	39.64	
100.0	0.238	105.6	13.0	275.92	1.300	52.4	53.6	39.45	
110.0	0.224	107.2	13.0	273.57	1.300	50.1	54.1	39.02	
120.0	0.224	109.9	13.1	271.31	1.300	48.6	54.9	38.62	
130.0	0.224	120.9	13.7	268.96	1.300	47.2	55.7	38.21	
140.0	0.224	131.1	14.3	266.87	1.300	45.5	57.1	37.61	
150.0	0.240	142.3	15.2	264.79	1.300	44.3	58.9	37.00	
160.0	0.281	140.9	15.8	263.44	1.300	44.0	61.3	36.37	
170.0	0.331	124.0	15.4	263.47	1.300	44.0	64.0	35.71	
180.0	0.361	117.3	15.3	263.61	1.300	44.0	66.7	35.10	
190.0	0.384	121.4	15.9	263.63	1.300	44.0	69.5	34.48	
200.0	0.384	109.0	15.0	265.10	1.300	44.5	71.7	34.02	
210.0	0.384	107.6	14.9	266.19	1.300	45.0	73.9	33.58	
220.0	0.384	103.3	14.6	267.61	1.300	46.0	75.7	33.25	
230.0	0.384	94.4	13.9	269.32	1.300	47.5	76.9	33.07	
240.0	0.384	92.3	13.7	270.85	1.300	48.3	78.1	32.84	
250.0	0.384	91.9	13.7	272.43	1.300	49.2	79.1	32.66	
260.0	0.384	90.7	13.6	274.08	1.300	50.7	79.8	32.61	
270.0	0.471	98.0	14.9	275.68	1.300	52.2	81.5	32.30	
280.0	0.610	106.4	16.8	277.58	1.300	53.2	83.4	31.88	
290.0	0.878	109.4	18.9	279.84	1.300	52.8	85.1	31.46	
300.0	1.389	101.3	20.3	282.31	1.300	53.1	85.6	31.34	
310.0	2.209	84.1	20.7	284.63	1.300	53.4	84.6	31.61	
320.0	3.495	79.7	22.5	287.45	1.300	54.7	84.3	32.75	
330.0	5.544	87.9	26.2	291.23	1.300	55.6	84.8	31.69	
340.0	5.600	97.7	27.6	294.24	1.300	58.5	82.6	32.38	
350.0	5.600	104.1	28.4	296.90	1.300	60.5	79.4	33.28	

Figure 3-B

***FMOVER Printout for  
Proposed WSUM and WSUW***

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 \* 14:19:00 FM Overlap Study 15-OCT-02 \*  
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20020823AAJ  
 PROTECTED  
 60.00 dBu

1792  
 INTERFERING  
 40.00 dBu

AZIMUTH (degrees)	ERP (kw)	HAAT (m)	DIST (km)	AZIMUTH (degrees)	ERP (kw)	HAAT (m)	DIST (km)	ACTUAL (dBu)	IX (km)
55.0	1.445	98.4	20.2	291.38	1.300	55.7	33.1	39.97	0.00
56.0	1.383	99.3	20.1	291.06	1.300	55.5	32.9	40.02	0.03
57.0	1.321	99.5	19.9	290.66	1.300	55.3	32.7	40.04	0.15
58.0	1.258	98.9	19.6	290.16	1.300	55.2	32.6	40.05	0.17
59.0	1.196	97.5	19.2	289.60	1.300	55.0	32.6	40.04	0.13
60.0	1.134	96.0	18.8	289.01	1.300	54.9	32.7	40.02	0.07
61.0	1.090	95.4	18.5	288.56	1.300	54.9	32.6	40.04	0.12
62.0	1.045	95.9	18.4	288.21	1.300	54.9	32.5	40.08	0.25
63.0	1.001	97.4	18.3	287.92	1.300	54.8	32.3	40.13	0.43
64.0	0.956	99.2	18.3	287.64	1.300	54.8	32.1	40.18	0.59
65.0	0.912	100.5	18.2	287.31	1.300	54.6	31.9	40.21	0.69
66.0	0.872	101.6	18.1	286.97	1.300	54.5	31.8	40.23	0.76
67.0	0.833	102.4	18.0	286.60	1.300	54.3	31.7	40.24	0.77
68.0	0.793	103.1	17.8	286.22	1.300	54.1	31.6	40.23	0.77
69.0	0.753	103.6	17.6	285.81	1.300	53.9	31.6	40.22	0.72
70.0	0.714	103.5	17.3	285.36	1.300	53.7	31.7	40.18	0.60
71.0	0.687	102.9	17.1	284.94	1.300	53.5	31.7	40.16	0.51
72.0	0.661	102.1	16.8	284.50	1.300	53.4	31.7	40.12	0.40
73.0	0.635	101.5	16.6	284.08	1.300	53.4	31.8	40.09	0.31
74.0	0.609	101.3	16.4	283.69	1.300	53.3	31.9	40.08	0.25
75.0	0.582	101.9	16.2	283.34	1.300	53.3	31.8	40.07	0.24
76.0	0.559	103.2	16.1	283.02	1.300	53.2	31.8	40.08	0.27
77.0	0.535	104.5	16.1	282.70	1.300	53.1	31.7	40.09	0.29
78.0	0.512	105.6	15.9	282.37	1.300	53.1	31.7	40.09	0.29
79.0	0.488	106.2	15.8	282.02	1.300	53.0	31.8	40.07	0.24
80.0	0.464	106.0	15.5	281.64	1.300	53.0	31.9	40.03	0.09
81.0	0.448	105.0	15.3	281.27	1.300	52.9	32.0	39.98	0.00
82.0	0.432	103.7	15.1	280.91	1.300	52.9	32.2	39.93	0.00
83.0	0.416	102.3	14.8	280.55	1.300	52.8	32.3	39.87	0.00
84.0	0.399	101.2	14.5	280.20	1.300	52.8	32.5	39.82	0.00
85.0	0.383	100.7	14.4	279.88	1.300	52.8	32.6	39.78	0.00