

**ENGINEERING EXHIBIT FOR A SECOND
ADJACENT CHANNEL WAIVER REQUEST FOR
A NEW LPFM BROADCAST STATION
CHANNEL 211 – MILWAUKEE, WI**

1.0 EXECUTIVE SUMMARY

This engineering statement has been prepared as a request for waiver of the spacing requirements of 47 CFR Section 73.807 with respect to short spaced second adjacent channel stations in the vicinity of the proposed LPFM facility. The technical data and narration below will demonstrate that the proposed LPFM facility would not cause prohibited interference using the “ratio” undesired-to-desired (“U/D”) signal method of interference determination as described in 47 CFR Section 73.807(e)(1) and FCC 12-144¹ to any short spaced incumbent second adjacent channel facility.

2.0 ALLOCATION ANALYSIS

Appendix A is channel spacing study which demonstrates the distance separation requirements pursuant to 47 C.F.R. Section 73.807 with respect to surrounding FM stations. As demonstrated, the proposed facility is short spaced with WUWM which is subject to the instant waiver request.

3.0 LPFM HAAT AND EFFECTIVE RADIATED POWER DETERMINATION

The FCC’s LPFM Form 2100 Schedule 318 application does not ask for the antenna Height Above Average Terrain (“HAAT”) or Effective Radiated Power (“ERP”) which

¹ *Creation of a Low Power Radio Service*, Fifth Order on Reconsideration and Sith Report and Order, released December 4, 2012, FCC 12-144, paragraph 78.

are essential figures needed to formulate the U/D study and are hereby derived below.

The proposed LPFM antenna HAAT was determined using the FCC Media Bureau Audio Service's website "[Antenna Height Above Average Terrain \(HAAT\) Calculator](#)"². Appendix B demonstrates the HAAT to be 32 meters based upon Section 73.313(d) methodology using NAD83 coordinates, eight radials, and standard FCC 30 arc second terrain data.

The proposed LPFM ERP was determined using the FCC Media Bureau Audio Services website "[FMpower - Find ERP for an FM Station Class](#)"³. Appendix C demonstrates that based upon the HAAT determined above, the corresponding ERP is 0.087 kW (87 Watts) to achieve a 60 dB μ V/m contour distance of 5.9 km pursuant to Section 73.811(a).

4.0 ANALYSIS AND REQUEST FOR WAIVER

As demonstrated in Appendix A, the proposed LPFM site location meets the Section 73.807 minimum distance separation requirements for all FM full power, LPFM, and FM translator stations except for WUWM. As permitted by Section 73.807(e)(1), the instant applicant seeks a waiver of the second-adjacent minimum separation requirement with respect to the short spaced stations.

As described in Section 73.807(e)(1) the ratio of undesired-to-desired signal method of interference determination may be used by an LPFM applicant to demonstrate that its proposed operations will not result in interference to a station on a second-adjacent channel. WUWM is on a second adjacent channel and is located 14.86 km from the proposed LPFM transmitter facility. The WUWM signal level at the proposed LPFM site is 83.59 dB μ V/m based upon standard FCC F(50,50)

² <https://www.fcc.gov/media/radio/haat-calculator>

³ <https://www.fcc.gov/media/radio/fmpower>

propagation curves as demonstrated in Appendix D. The corresponding undesired interfering signal level is 123.59 dB μ V/m.

Using an isotropic antenna pattern and free space loss calculations, the maximum horizontal distance to the proposed LPFM's 123.59 dB μ V/m interfering contour would be 43.2 meters and is the radius used around the transmitter site for considering structures and roadways potentially impacted by the U/D interference zone. An aerial view of the proposed LPFM site and vicinity is provided in Appendix E along with the 123.59 dB μ V/m free space loss interfering contour. As demonstrated this area contains a single-story church compound. The sanctuary due east of the transmitter site has a very high ceiling; however, it's interior is single story.

Substituting the isotropic antenna discussed above with a real antenna having vertical plane suppression further reduces the interference towards occupied structures and roads within the 43.2-meter interference zone. The applicant is proposing to use an Nicom model BKG77 having one element. Appendix F provides a plot of the antenna elevation pattern. Appendix G provides a plot and tabulation of the 123.59 dB μ V/m interfering contour with respect to ground level from the base of the tower out to 43.2 meters from the base of the tower with the antenna elevation pattern applied. Appendix G demonstrates that the 123.59 dB μ V/m contour never falls below an elevation of 11.8 meters above ground level and is thus well clear of the any single story occupancy within the church compound. These exhibits demonstrate higher signal levels that would exceed the 40 dB μ V/m undesired-to-desired ratio with respect to WUWM are at locations which are well elevated, inaccessible, and unpopulated. As demonstrated, the proposal complies with Section 73.807(e)(1) with respect to WUWM. It is herein demonstrated that zero population will be impacted by the proposed LPFM facility and thus a waiver of Section 73.807 of the Commission's Rules is respectfully requested.

5.0 CERTIFICATION

The foregoing statement and the report regarding the aforementioned engineering work are true and correct to the best of my knowledge. Executed on December 8, 2023

Ryan Wilhour



Consulting Engineer

Second Adjacent Channel Waiver Request

APPENDIX A – ALLOCATION ANALYSIS

REFERENCE
42 59 03.80 N. CLASS = L1
88 00 30.20 W. Current Spacings to 2nd Adj.
----- Channel 211 - 90.1 MHz -----

DISPLAY DATES
DATA 12-07-23
SEARCH 12-08-23

Call	Channel	Location	Azi	Dist	FCC	Margin		
WUWM	LIC	209B	Milwaukee	WI	37.4	14.86	66.5	-51.6
WMBI-FM	LIC	211B	Chicago	IL	179.9	117.31	111.5	5.8
WJWD	CP -D	212B1	Marshall	WI	294.7	97.55	73.5	24.1
WJWD	LIC-D	212B1	Marshall	WI	294.6	97.56	73.5	24.1
WRME-LD	LI -D	06---	Chicago	IL	165.2	124.75	91.0	33.8
WRME-LD	LI -D	06 --	Chicago	IL	165.2	124.75	91.0	33.8
WVFL	LIC-D	210A	Fond Du Lac	WI	343.8	94.72	55.5	39.2
WBCR-FM	LIC-D	212A	Beloit	WI	237.7	99.36	55.5	43.9
WORT	LIC	210B1	Madison	WI	274.0	120.74	73.5	47.2

All separation margins include rounding

APPENDIX B – HEIGHT ABOVE AVERAGE TERRAIN CALCULATION

The Height above Average Terrain (HAAT) was calculated from the FCC's HAAT Calculator tool:

<https://www.fcc.gov/media/radio/haat-calculator>

Results are as follows:

Antenna Height Above Average Terrain Calculations -- Results

Input Data

Latitude **42° 59' 3.8" North**

Longitude **88° 0' 30.2" West (NAD 83)**

These coordinates convert to NAD 27 coordinates of
42° 59' 03.75", North, 88° 00' 29.89" West (NAD 27).

Height of antenna radiation center above mean sea level: **258.7 meters AMSL**

Number of Evenly Spaced Radials = **8** 0° is referenced to True North

Results

Calculated HAAT = **32 meters**

Antenna Height Above Average Terrain calculated
using FCC 30 second terrain database (continental USA only)

Individual "Radial HAAT" Values, in meters

0°	35.8 m
45°	61.3 m
90°	63.8 m
135°	39.8 m
180°	35.4 m
225°	14.6 m
270°	-6.1 m
315°	12.9 m

APPENDIX C – ERP CALCULATION

The operating ERP was calculated from the FCC's FM power calculation tool:

<https://www.fcc.gov/media/radio/fmpower>

Results are as follows:

Choose a U.S. State or Possession:

Station Class:

meters Antenna Height Above Average Terrain (HAAT)

Results:

Calculated ERP (rounded per Section 73.212) = 0.087 kW

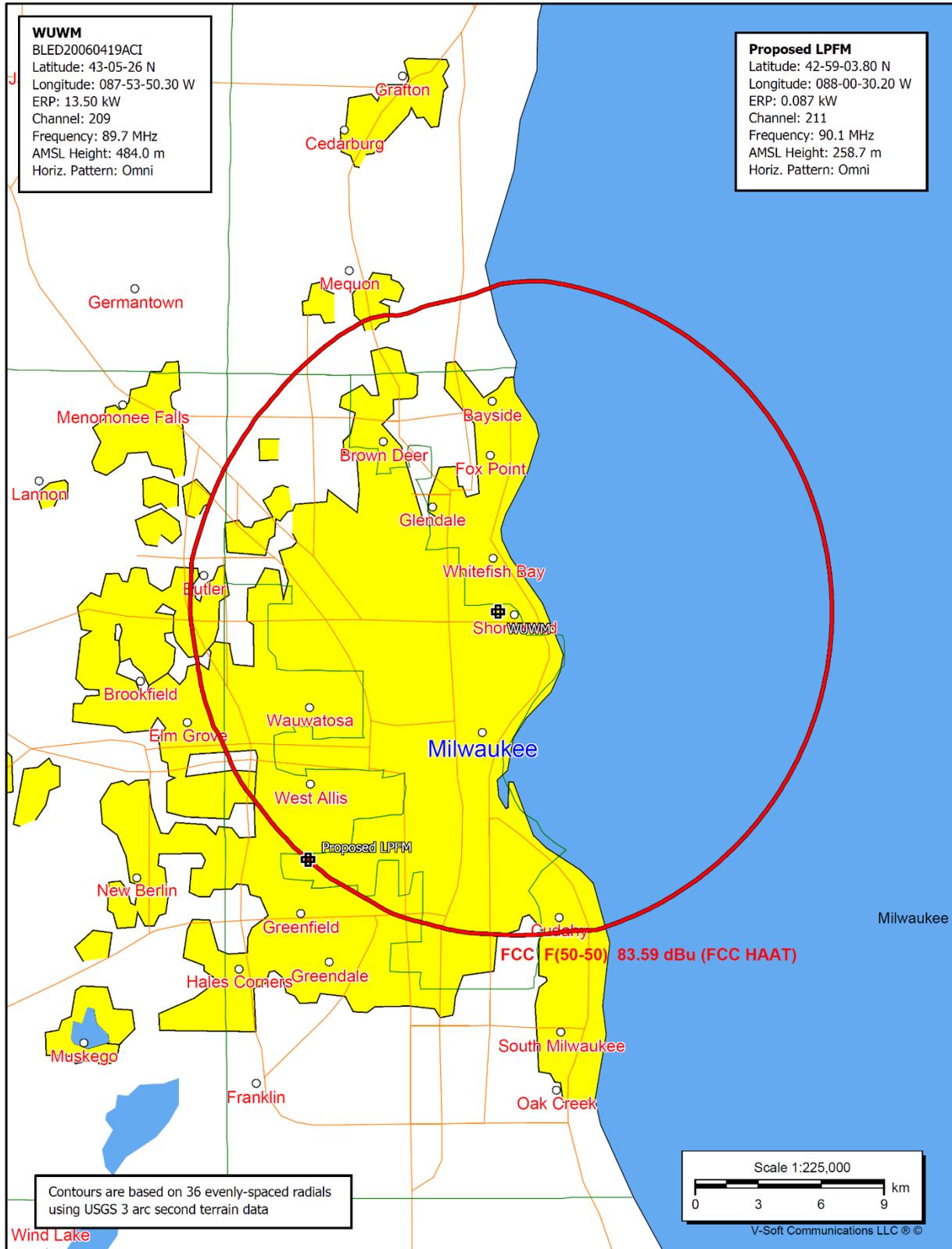
Unrounded ERP = 0.086988 kW

Comments:

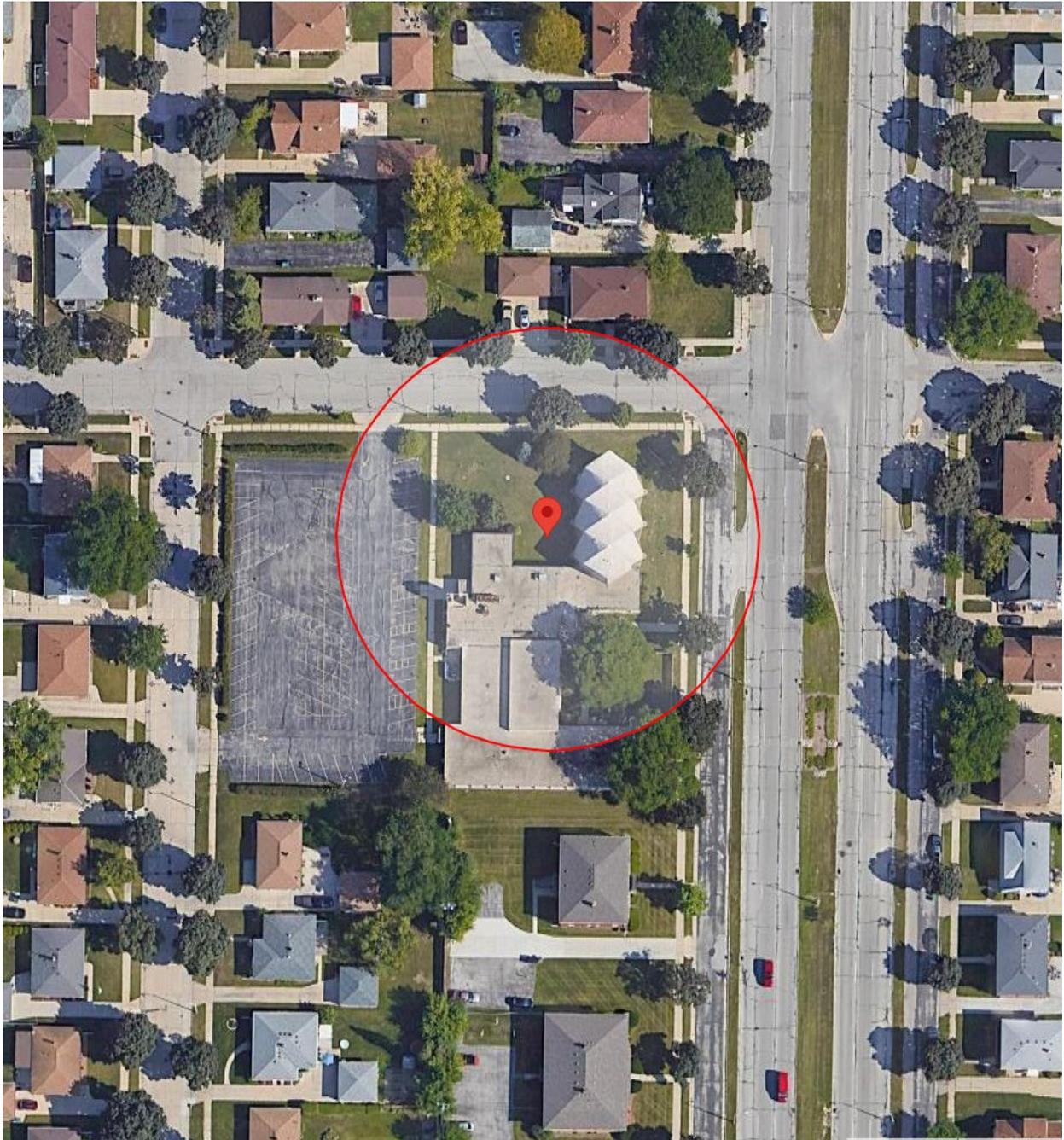
Low Power FM (LPFM) stations are authorized throughout the United States.

Maximum class limit determined from:
Class: L1 Reference ERP: 0.1 kW Reference HAAT: 30 meters Distance to 60 dBu F(50,50) contour: 5.6 km

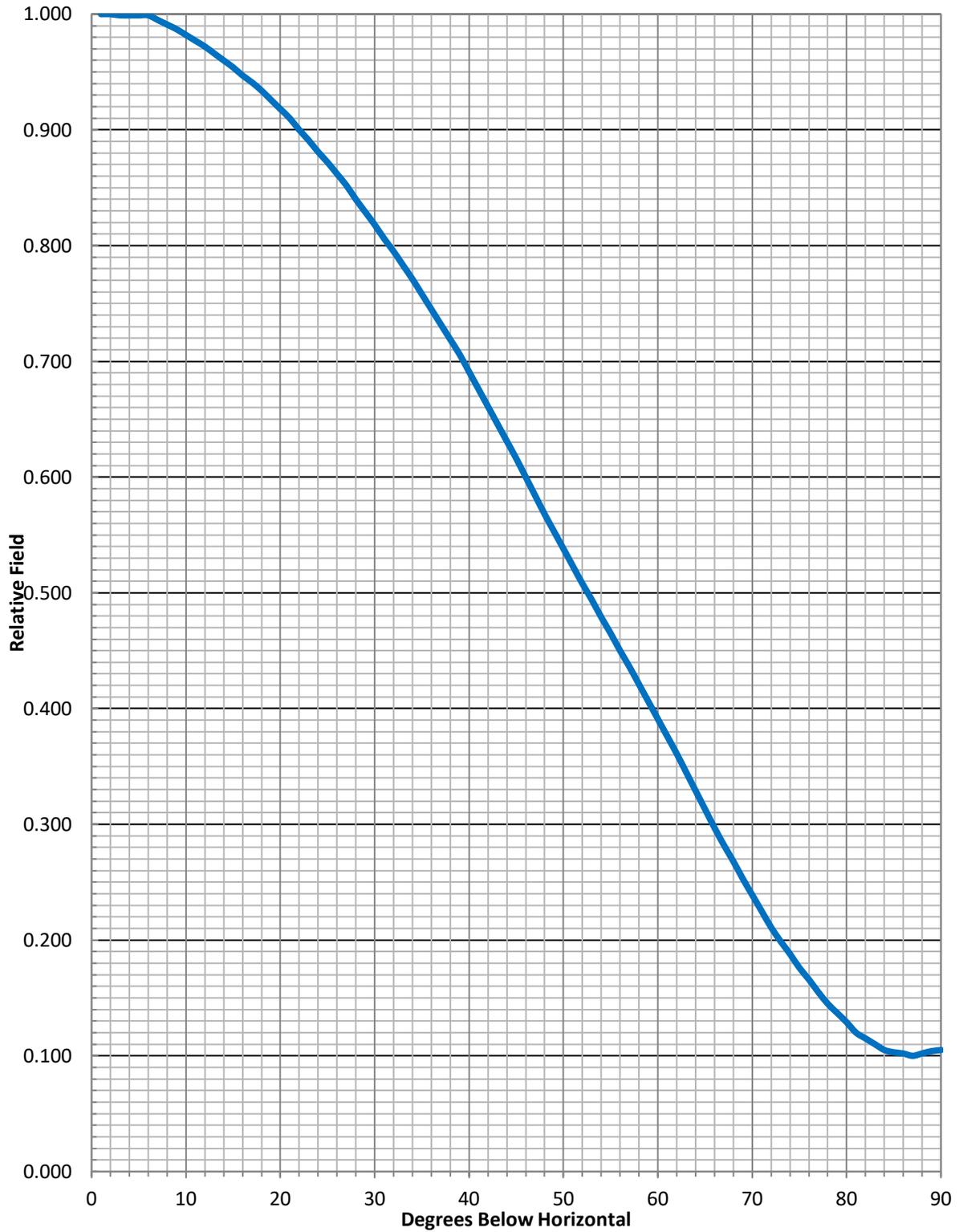
APPENDIX D – PROTECTED FIELD STRENGTH AT LPFM TRANSMITTER SITE



APPENDIX E – ARIAL VIEW OF INTERFERENCE CONTOUR



APPENDIX F – Antenna Relative Field Elevation Pattern



APPENDIX G – U/D Interference Calculation

Antenna: Nicom BKG77 1 bay
 C/R Elevation: 31 m AGL
 Vertical Clearance: 4.5 m AGL - Occupied Elevation for a 2 Story Building
 ERP: 0.087 kW
 IX Signal Level: 123.59 dBμV/m

Deg Below Hor	Relative Field	ERP (kW)	Distance to IX Contour From Antenna (m)	Horizontal Distance of IX Contour From Tower (m)	Vertical Clearance of IX Contour AGL (m)	Occupied Elevation (m)	Margin (m)
1	1	0.087	43.2	43.2	30.2	4.5	25.7
2	1	0.087	43.2	43.2	29.5	4.5	25.0
3	0.999	0.087	43.2	43.1	28.7	4.5	24.2
4	0.999	0.087	43.2	43.1	28.0	4.5	23.5
5	0.999	0.087	43.2	43.0	27.2	4.5	22.7
6	0.999	0.087	43.2	42.9	26.5	4.5	22.0
7	0.995	0.086	43.0	42.7	25.8	4.5	21.3
8	0.991	0.085	42.8	42.4	25.0	4.5	20.5
9	0.987	0.085	42.6	42.1	24.3	4.5	19.8
10	0.982	0.084	42.4	41.8	23.6	4.5	19.1
11	0.977	0.083	42.2	41.4	22.9	4.5	18.4
12	0.972	0.082	42.0	41.1	22.3	4.5	17.8
13	0.966	0.081	41.7	40.7	21.6	4.5	17.1
14	0.96	0.080	41.5	40.2	21.0	4.5	16.5
15	0.954	0.079	41.2	39.8	20.3	4.5	15.8
16	0.947	0.078	40.9	39.3	19.7	4.5	15.2
17	0.941	0.077	40.7	38.9	19.1	4.5	14.6
18	0.934	0.076	40.4	38.4	18.5	4.5	14.0
19	0.926	0.075	40.0	37.8	18.0	4.5	13.5
20	0.918	0.073	39.7	37.3	17.4	4.5	12.9
21	0.91	0.072	39.3	36.7	16.9	4.5	12.4
22	0.9	0.070	38.9	36.1	16.4	4.5	11.9
23	0.891	0.069	38.5	35.4	16.0	4.5	11.5
24	0.881	0.068	38.1	34.8	15.5	4.5	11.0
25	0.872	0.066	37.7	34.1	15.1	4.5	10.6

Second Adjacent Channel Waiver Request

Deg Below Hor	Relative Field	ERP (kW)	Distance to IX Contour From Antenna (m)	Horizontal Distance of IX Contour From Tower (m)	Vertical Clearance of IX Contour AGL (m)	Occupied Elevation (m)	Margin (m)
26	0.862	0.065	37.2	33.5	14.7	4.5	10.2
27	0.852	0.063	36.8	32.8	14.3	4.5	9.8
28	0.84	0.061	36.3	32.0	14.0	4.5	9.5
29	0.829	0.060	35.8	31.3	13.6	4.5	9.1
30	0.818	0.058	35.3	30.6	13.3	4.5	8.8
31	0.806	0.057	34.8	29.8	13.1	4.5	8.6
32	0.795	0.055	34.3	29.1	12.8	4.5	8.3
33	0.783	0.053	33.8	28.4	12.6	4.5	8.1
34	0.771	0.052	33.3	27.6	12.4	4.5	7.9
35	0.758	0.050	32.7	26.8	12.2	4.5	7.7
36	0.745	0.048	32.2	26.0	12.1	4.5	7.6
37	0.732	0.047	31.6	25.3	12.0	4.5	7.5
38	0.719	0.045	31.1	24.5	11.9	4.5	7.4
39	0.706	0.043	30.5	23.7	11.8	4.5	7.3
40	0.691	0.042	29.9	22.9	11.8	4.5	7.3
41	0.676	0.040	29.2	22.0	11.8	4.5	7.3
42	0.661	0.038	28.6	21.2	11.9	4.5	7.4
43	0.646	0.036	27.9	20.4	12.0	4.5	7.5
44	0.631	0.035	27.3	19.6	12.1	4.5	7.6
45	0.616	0.033	26.6	18.8	12.2	4.5	7.7
46	0.6	0.031	25.9	18.0	12.4	4.5	7.9
47	0.584	0.030	25.2	17.2	12.5	4.5	8.0
48	0.568	0.028	24.5	16.4	12.8	4.5	8.3
49	0.553	0.027	23.9	15.7	13.0	4.5	8.5
50	0.538	0.025	23.2	14.9	13.2	4.5	8.7
51	0.523	0.024	22.6	14.2	13.4	4.5	8.9
52	0.508	0.022	21.9	13.5	13.7	4.5	9.2
53	0.494	0.021	21.3	12.8	14.0	4.5	9.5
54	0.479	0.020	20.7	12.2	14.3	4.5	9.8
55	0.465	0.019	20.1	11.5	14.5	4.5	10.0
56	0.45	0.018	19.4	10.9	14.9	4.5	10.4
57	0.436	0.017	18.8	10.3	15.2	4.5	10.7
58	0.421	0.015	18.2	9.6	15.6	4.5	11.1
59	0.406	0.014	17.5	9.0	16.0	4.5	11.5
60	0.391	0.013	16.9	8.4	16.4	4.5	11.9

Second Adjacent Channel Waiver Request

Deg Below Hor	Relative Field	ERP (kW)	Distance to IX Contour From Antenna (m)	Horizontal Distance of IX Contour From Tower (m)	Vertical Clearance of IX Contour AGL (m)	Occupied Elevation (m)	Margin (m)
61	0.376	0.012	16.2	7.9	16.8	4.5	12.3
62	0.361	0.011	15.6	7.3	17.2	4.5	12.7
63	0.345	0.010	14.9	6.8	17.7	4.5	13.2
64	0.329	0.009	14.2	6.2	18.2	4.5	13.7
65	0.313	0.009	13.5	5.7	18.7	4.5	14.2
66	0.297	0.008	12.8	5.2	19.3	4.5	14.8
67	0.282	0.007	12.2	4.8	19.8	4.5	15.3
68	0.268	0.006	11.6	4.3	20.3	4.5	15.8
69	0.253	0.006	10.9	3.9	20.8	4.5	16.3
70	0.239	0.005	10.3	3.5	21.3	4.5	16.8
71	0.225	0.004	9.7	3.2	21.8	4.5	17.3
72	0.211	0.004	9.1	2.8	22.3	4.5	17.8
73	0.199	0.003	8.6	2.5	22.8	4.5	18.3
74	0.188	0.003	8.1	2.2	23.2	4.5	18.7
75	0.176	0.003	7.6	2.0	23.7	4.5	19.2
76	0.166	0.002	7.2	1.7	24.0	4.5	19.5
77	0.155	0.002	6.7	1.5	24.5	4.5	20.0
78	0.145	0.002	6.3	1.3	24.9	4.5	20.4
79	0.137	0.002	5.9	1.1	25.2	4.5	20.7
80	0.129	0.001	5.6	1.0	25.5	4.5	21.0
81	0.12	0.001	5.2	0.8	25.9	4.5	21.4
82	0.115	0.001	5.0	0.7	26.1	4.5	21.6
83	0.11	0.001	4.8	0.6	26.3	4.5	21.8
84	0.105	0.001	4.5	0.5	26.5	4.5	22.0
85	0.103	0.001	4.4	0.4	26.6	4.5	22.1
86	0.102	0.001	4.4	0.3	26.6	4.5	22.1
87	0.1	0.001	4.3	0.2	26.7	4.5	22.2
88	0.102	0.001	4.4	0.2	26.6	4.5	22.1
89	0.104	0.001	4.5	0.1	26.5	4.5	22.0
90	0.105	0.001	4.5	0.0	26.5	4.5	22.0

