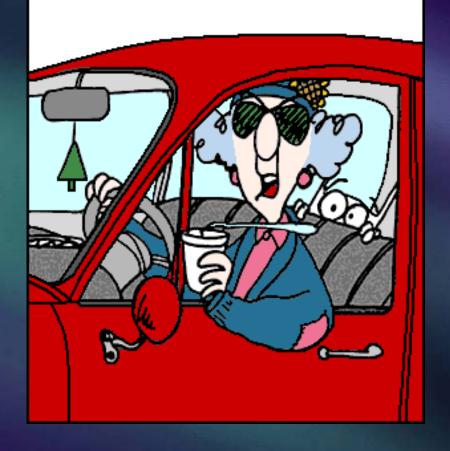
# Translators and LPFM

Jeremy D. Ruck, PE Canton, Illinois jeremy@jeremyruck.com





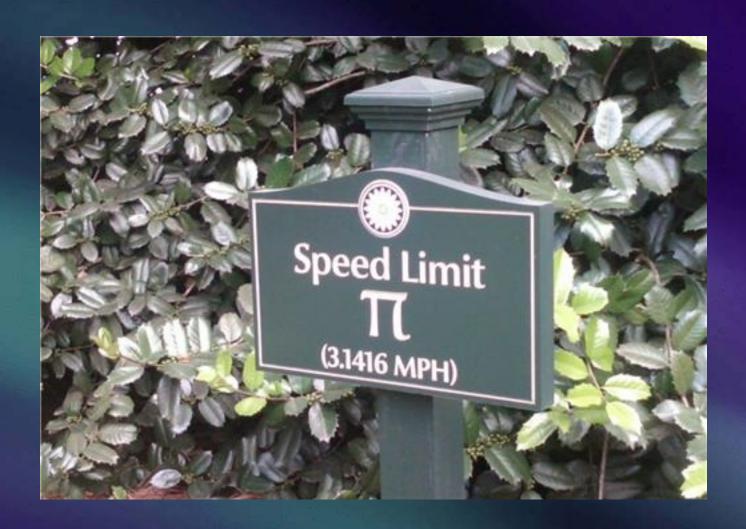
Personally I think conservatives and liberals should move towards the middle of the road. Makes it easier to run 'em over.







DAFUQ - this is FAILKING.COM



# Translators and LPFM

Jeremy D. Ruck, PE Canton, Illinois jeremy@jeremyruck.com

#### Translators and LPFM

- Definition of Services.
- History of Services.
- Technical Stuff.
- Pitfalls.
- Jeremy's Crystal Ball.
- Conclusion, Questions, and Discussion.

#### Service Definitions

An FM translator is a station in the broadcasting service operated for the purpose of retransmitting the signals of an AM or FM radio broadcast station or another FM broadcast translator station without significantly altering any characteristics of the incoming signal other than its frequency and amplitude, in order to provide radio broadcast service to the general public. (47 CFR 74.1201)

#### Service Definitions

- FM translators come in several flavors:
- Non-Commercial FM translator.
- Commercial FM translator.
- Fill-in translator.
- A translator cannot be non-commercial and commercial simultaneously.
- A commercial translator is not necessarily a fillin translator.
- ALL AM translators are fill-in translators.

#### Service Definitions

- An LPFM station is quite simply a low power non-commercial FM broadcast station.
- Many of the rules applicable to full-power FM stations apply to LPFM facilities.
- Conceptually, they are somewhat similar to the old Class D NCE FM stations.
- LPFM facilities can originate material, while in general translators cannot.

# History of FM Translators

- 1970 Translator service first created.
- 1990 Major revision to translator rules.
- 1997 Changes to US/Canada agreement.
- 2003 ~13,000 translator applications filed.
- 2009 AM translators authorized.
- 2013 3,000+ apps from 2003 dismissed.
- 2013 Final cleanup of 2003 window.

# History of LPFM Facilities

- 1948 Class D stations first authorized.
- 1978 Class D phase out begins.
- 1987 LPFM movement "starts" in Illinois.
- 1993 Radio Free Berkeley.
- 1998 LPFM movement gathers steam.
- 1999 FCC proposes new LPFM service.
- 2000 FCC creates LPFM service.
- 2001 First LPFM filing window.
- 2010 Local Community Radio Act.
- 2013 Second LPFM filing window.

#### **Translator Technical Parameters**

- Absolute maximum ERP of 250 Watts.
- No specified height limit for fill-in translators.
- 47 CFR 74.1235(b) for non fill-in translators.
- East of MS River 4.5 mile 60 dBu radius.
- Zone I-A 4.5 mile 60 dBu radius.
- All other areas ~8.3 mile 60 dBu radius.
- Convoluted HAAT determination.
- Other limits by treaty or interference apply.

#### **Translator Technical Parameters**

- Translator service contour function of primary.
- 60 dBu (1 mV/m) for non fill-in translators.
- 60 dBu for fill-in of class A, C3, C2, C1, C0, and C.
- 57 dBu (0.7 mV/m) for fill-in of class B1.
- 54 dBu (0.5 mV/m) for fill-in of class B.
- 60 dBu for AM translators.
- 60 dBu of AM translator must be contained within both the 2 mV/m daytime contour and 25 mile radius centered on AM site.

#### **LPFM Technical Parameters**

- LP10 maximum ERP 10 Watts at 30 m HAAT.
- Maximum HAAT of 100 meters (1 W ERP).
- Minimum ERP of 1 Watt at any height.
- No minimum contour distance.
- LP100 maximum ERP of 100 W at 30 m HAAT.
- Maximum HAAT of 450 meters (1 W ERP).
- Minimum contour distance 4.7 km (2.9 mi).
- Maximum contour distance 5.6 km (3.5 mi).
- No LP10 stations exist.

#### LPFM Technical Parameters

- LP250 facilities proposed for rural areas.
- LP250 facilities not implemented at this time.
- FCC appears open to further consideration.
- LP10 class deleted.
- Only LP100 stations are authorized.
- Only LP100 stations will be authorized.

# Signal Delivery

- LPFM facilities generally originate programming.
- Translators generally do not originate.
- Off-air feed of translators.
- Terrestrial feed of translators.
- Satellite feed of translators.
- LPFM feed of translator.
- Prohibitions on translator feed methods.

#### Protections

- First come first served.
- Translators secondary authorization.
- LPFM protect 3<sup>rd</sup> adjacent translator input.
- Essentially no outgoing interference permitted.
- Limited LPFM interference permitted.
- Complaints are driving force for interference.

# Facility Allocation – Part I

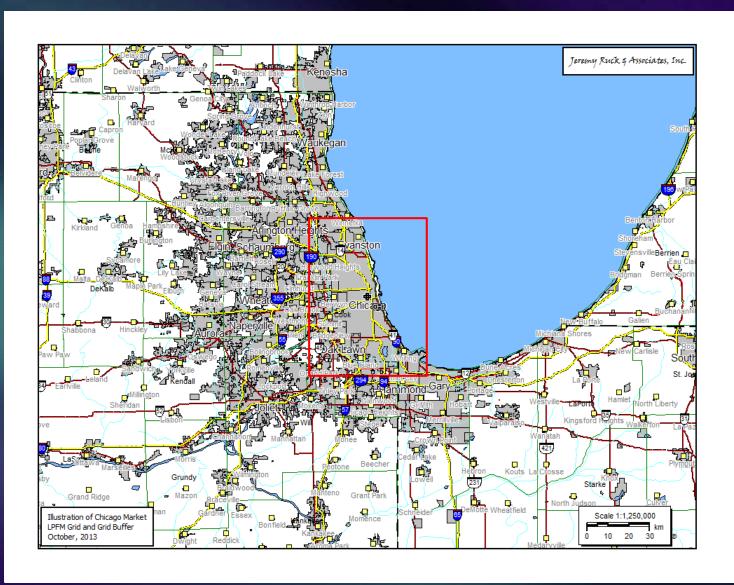
- LPFM facilities generally follow spacing table.
- No spacing requirements for translators.
- IF spacing debatable at last word from Staff.
- Translators generally follow contour protection.
- 2<sup>nd</sup> adjacent waiver possible for LPFM.
- Section 74.1204(d) usable for translators.
- 3<sup>rd</sup> adjacent applies to translators.
- 3<sup>rd</sup> adjacent applies in limited cases to LPFM.

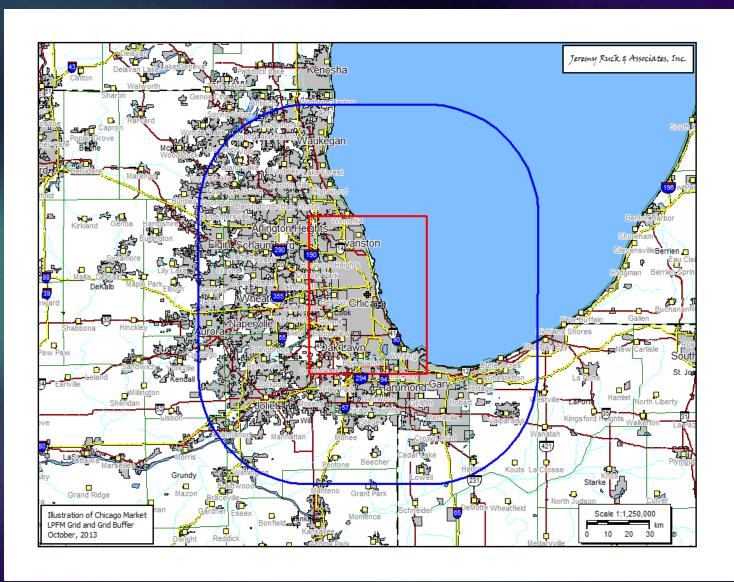
# **Spectrum Competition**

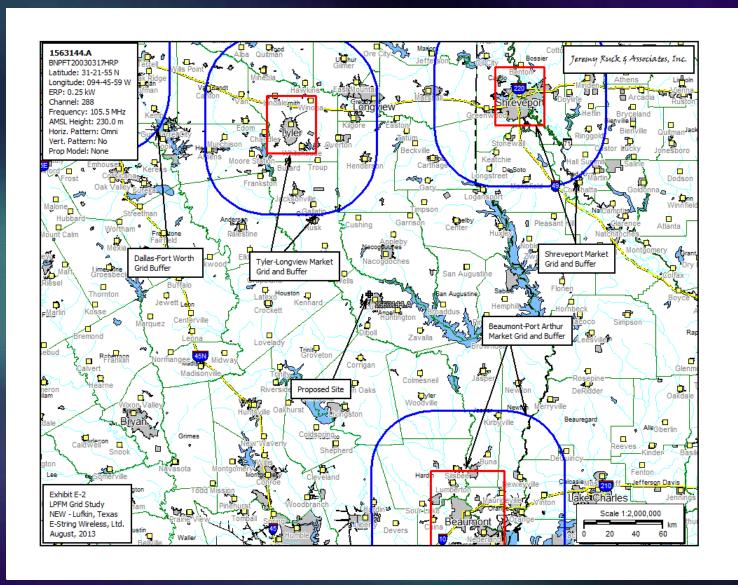
- Filing windows are similar to a dam bursting.
- FCC underestimated translator demand in 2003.
- FCC did not expect spectrum warehousing.
- Auction 83 produced a conundrum.
- Thousands of applications frozen for a decade.
- Applications were short-form in 2003 so no mechanism for clean up.
- Congress mandated spectrum availability for broadcast, translator, and LPFM.

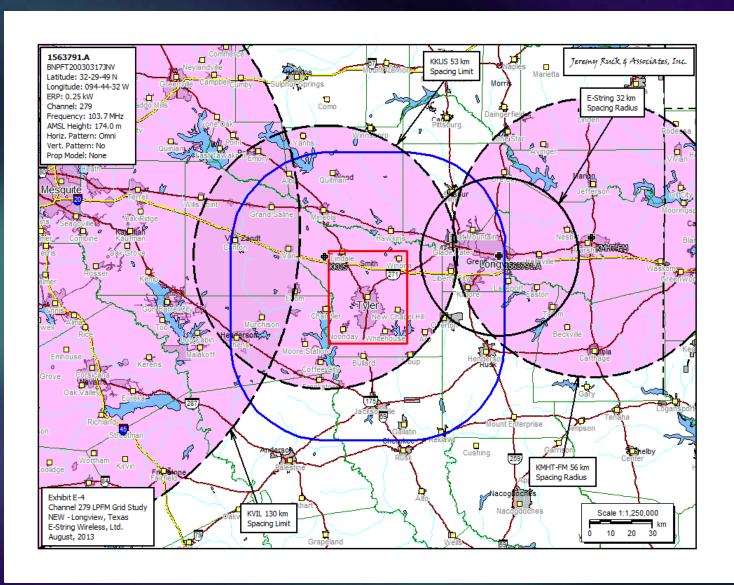
## **Spectrum Competition**

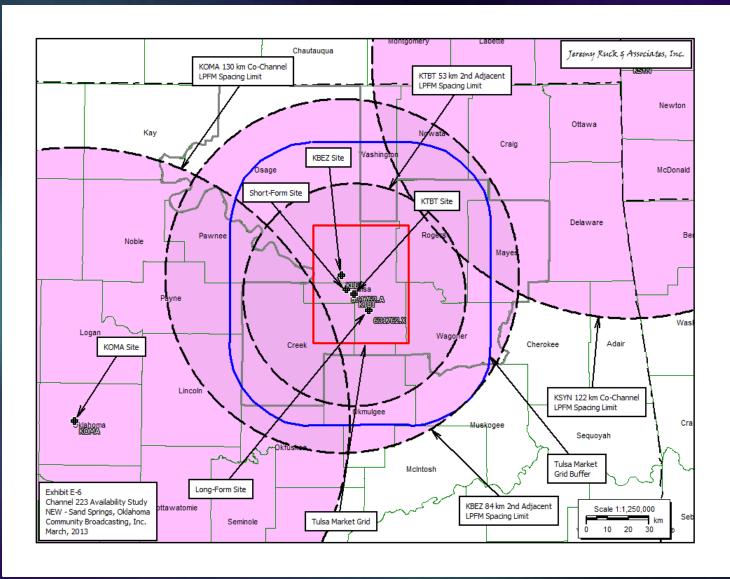
- Many translator applications required dismissal.
- Established market and national caps.
- FCC established LPFM market grid concept.
- Replaced process/dismiss all concepts.
- Top 150 radio markets studied.
- 30x30 or 20x20 minute grid established.
- Classified as spectrum available or limited.
- Translator apps could not impact grid.
- Impact based on spacings.

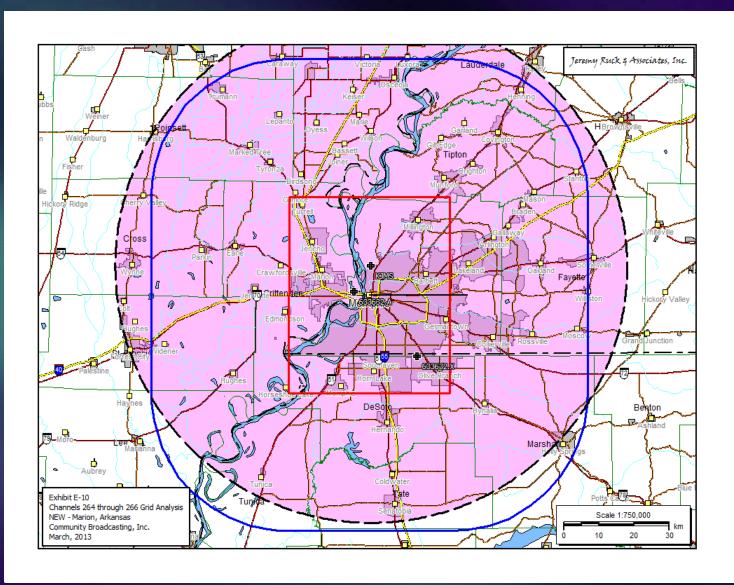


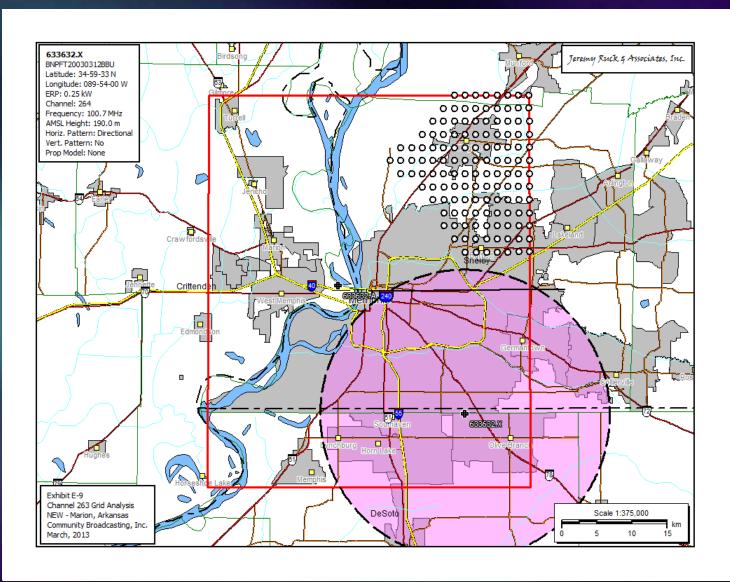


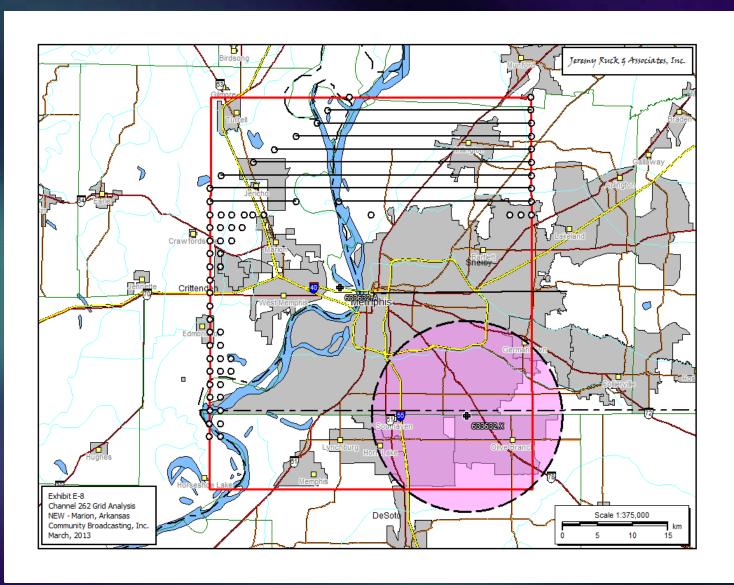








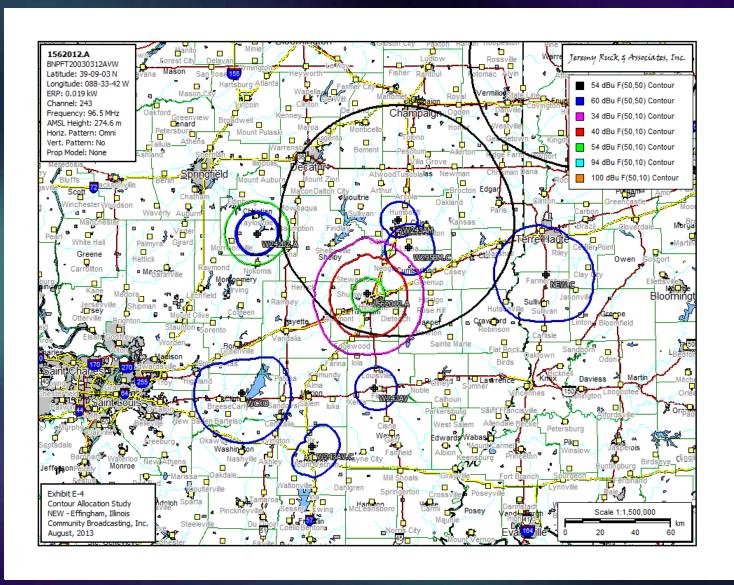




# Facility Allocation – Part II

- Initial basis for translator allocation is contours.
- Contour protection follows the usual ratios.
- Protected contour based on class.
- Co-channel is -20 dB U/D ratio.
- 1st adjacent is -6 dB U/D ratio.
- 2<sup>nd</sup> and 3<sup>rd</sup> adjacent is +40 dB ratio.
- Alternate methods permissible.
- Alternate method usable only on 2<sup>nd</sup> adjacent for LPFM

# Facility Allocation – Part II



# Section 74.1204(d)

The provisions of this section concerning prohibited overlap will not apply where the area of such overlap lies entirely over water. In addition, an application otherwise precluded by this section will be accepted if it can be demonstrated that no actual interference will occur due to intervening terrain, lack of population, or such other factors as may be applicable.

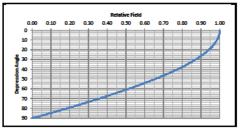
# Section 74.1204(d)

- Allows for alternate methods to be used.
- Intervening terrain clause generally will not apply in the Midwest.
- Although accurate, Longley-Rice generally must be augmented with another study.
- A "simple" ratio study works very well for 2<sup>nd</sup> and 3<sup>rd</sup> adjacent situations.
- Such study can be used to show zero population is affected by translator (or LPFM).

- Antenna radiation varies in vertical plane.
- Study works better when translator or LPFM is closer to the facility under consideration.
- Ideal situation is co-location.
- Method generally does not work when translator or LPFM is at, or close to, protected contour.
- Basis of study is free-space calculations.
- Power density is related to field strength through free space impedance.

Exhibit E-6 Translator Proximity Interference Analysis NEW - Effingham, Illinois

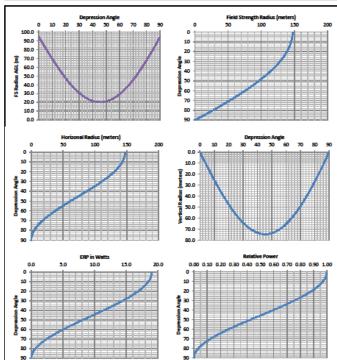
Antenna No:	1	; - ; -	Center of Radiation:	95 m AGL
Manufacturer:	Shively	: ::	Effective Radiated Power:	19 Watts
Model:	68128-1		FS Contour:	104.2 dBu
Number of Bays:	1		E Field Strength:	0.16218 V/m
Bay Spacing:	Lembde		20 (Ohms):	377 Ohms
			Power Density:	6.97684E-05 W/m^2



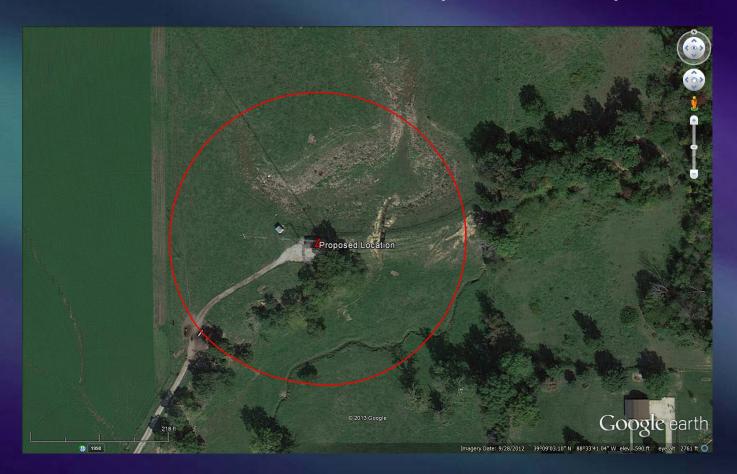
Depression Angle										
0	10	20	30	40	50	60	70	80	90	
30										
25									H	
20					-11				H	
15										
10										
5										
									=	

Depression	Relative	Relative	ERP	Radii in meters				
Angle	Field	Power	Watts	Field Strength	Horizontal	Vertical	AGL	
0	1.0000	1.0000	19.00	147.21	147.21	0.00	95.00	
1	1.0000	1.0000	19.00	147.21	147.19	2.57	92.43	
2	0.9990	0.9980	18.96	147.06	146.97	5.13	89.87	
3	0.9990	0.9980	18.96	147.06	146.86	7.70	87.30	
4	0.9980	0.9960	18.92	146.92	146.56	10.25	84.75	
5	0.9960	0.9920	18.85	146.62	146.06	12.78	82.22	
6	0.9950	0.9900	18.81	146.48	145.67	15.31	79.69	
7	0.9930	0.9860	18.73	146.18	145.09	17.82	77.18	
8	0.9910	0.9821	18.66	145.89	144.47	20.30	74.70	
9	0.9880	0.9761	18.55	145.45	143.65	22.75	72.25	
10	0.9850	0.9702	18.43	145.00	142.80	25.18	69.82	
11	0.9820	0.9643	18.32	144.56	141.91	27.58	67.42	
12	0.9790	0.9584	18.21	144.12	140.97	29.96	65.04	
13	0.9750	0.9506	18.06	143.53	139.85	32.29	62.71	
14	0.9710	0.9428	17.91	142.94	138.70	34.58	60.42	
15	0.9670	0.9351	17.77	142.35	137.50	36.84	58.16	
16	0.9630	0.9274	17.62	141.76	136.27	39.08	55.92	
17	0.9580	0.9178	17.44	141.03	134.87	41.23	53.77	
18	0.9530	0.9082	17.26	140.29	133.43	43.35	51.65	
19	0.9480	0.8987	17.08	139.56	131.95	45.44	49.56	
20	0.9420	0.8874	16.86	138.67	130.31	47.43	47.57	
21	0.9360	0.8761	16.65	137.79	128.64	49.38	45.62	
22	0.9300	0.8649	16.43	136.91	126.94	51.29	43.71	
23	0.9240	0.8538	16.22	136.02	125.21	53.15	41.85	
24	0.9170	0.8409	15.98	134.99	123.32	54.91	40.09	
25	0.9100	0.8281	15.73	133.96	121.41	56.62	38.38	
26	0.9030	0.8154	15.49	132.93	119.48	58.27	36.73	
27	0.8950	0.8010	15.22	131.75	117.39	59.82	35.18	
28	0.8870	0.7868	14.95	130.58	115.29	61.30	33.70	
29	0.8790	0.7726	14.68	129.40	113.18	62.73	32.27	
30	0.8710	0.7586	14.41	128.22	111.04	64.11	30.89	
31	0.8620	0.7430	14.12	126.90	108.77	65.36	29.64	
32	0.8540	0.7293	13.86	125.72	106.62	66.62	28.38	
33	0.8450	0.7140	13.57	124.39	104.33	67.75	27.25	
34	0.8350	0.6972	13.25	122.92	101.91	68.74	26.26	
35	0.8260	0.6823	12.96	121.60	99.61	69.75	25.25	
36	0.8160	0.6659	12.65	120.12	97.18	70.61	24.39	
37	0.8060	0.6496	12.34	118.65	94.76	71.41	23.59	
38	0.7960	0.6336	12.04	117.18	92.34	72.14	22.86	
39	0.7850	0.6162	11.71	115.56	89.81	72.73	22.27	
40	0.7740	0.5991	11.38	113.94	87.28	73.24	21.76	
41	0.7630	0.5822	11.06	112.32	84.77	73.69	21.31	
42	0.7520	0.5655	10.74	110.70	82.27	74.07	20.93	
43	0.7410	0.5491	10.43	109.08	79.78	74.40	20.60	
44	0.7290	0.5314	10.10	107.32	77.20	74.55	20.45	
45	0.7170	0.5141	9.77	105.55	74.64	74.64	20.36	
70	W/1/U	U.3141	2.77	au3.35	74.04	74,04	20.36	

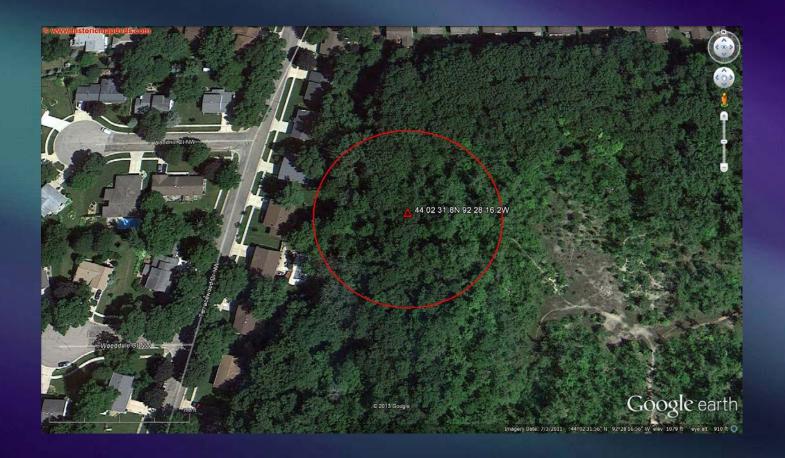
Argin         Field         Power         Watts         Field Strength         Horizontal         Vertical         ACX           45         0.170         0.5341         3.77         0.5541         3.78         3.668.9         3.78.46         3.484         20.36           46         0.0200         0.4870         9.44         1.02.72         0.92.8         74.61         20.39           48         0.6000         0.4649         8.45         98.13         66.58         74.29         20.61           49         0.6000         0.4469         8.45         98.13         66.42         74.11         20.29           50         0.6500         0.4469         8.45         98.13         66.42         74.11         20.29           51         0.6410         0.4409         7.49         92.45         55.22         77.23         72.13           52         0.6210         0.3404         7.49         92.45         55.22         77.23         72.13           53         0.640         0.3790         7.16         90.39         54.40         77.19         22.81           54         0.0000         0.3600         6.44         7.09         86.23         81.52	Depression	Relative	Relative	ERP	Radii in meters				
146	Angle	Field	Power	Watts	Fleid Strength Horizontal Vertical			AGL	
47 0.6990 0.4862 9.12 102.02 69.58 74.61 20.39 48 0.6800 0.4649 8.45 96.19 100.10 66.58 74.59 20.39 48 0.6800 0.4649 8.45 96.19 100.10 66.58 74.59 20.39 50 0.6840 0.427 1.11 20.89 51 0.4610 0.4009 7.41 94.36 61.89 73.73 12.57 52 0.6200 0.3944 7.49 92.45 59.36 73.31 21.67 53 0.4640 0.3707 7.16 90.39 44.07 74.9 12.45 59.36 73.31 21.67 54 0.6000 0.3960 6.44 88.33 51.52 77.85 22.15 55 0.5500 0.3564 6.47 88.33 51.52 77.46 23.54 55 0.5500 0.3564 6.42 88.33 51.52 77.46 23.54 55 0.5500 0.3564 6.32 88.627 49.48 70.67 24.33 56 0.5700 0.3872 6.22 84.21 47.09 66.81 23.19 57 0.5500 0.3272 6.22 84.21 47.09 66.81 23.19 58 0.5460 0.2798 5.32 76.88 40.01 66.75 74.46 25.54 60 0.5340 0.3620 3.77 8.8 3.21 77.88 40.11 66.75 28.25 59 0.5200 0.2798 5.32 77.88 40.11 66.75 28.25 61 0.4900 0.3600 4.45 9.02 77.57 73.31 65.3 72.47 61 0.4900 0.3600 4.45 9.02 77.57 73.31 65.3 72.47 62 0.4860 0.2304 4.45 71.25 23.45 64.25 20.75 63 0.4800 0.2300 4.45 9.02 77.25 23.35 55.00 82.27 82.65 64 0.4300 0.2300 4.45 9.02 73.27 93.35 55.00 82.27 8	45	0.7170	0.5141	9.77	105.55	74.64	74.64	20.36	
148	46	0.7050	0.4970	2,44	103.78	72.09	74.66	20.34	
148	47	0.6930	0,4802	9.12	102.02	69.58	74.61	20.39	
Section   Sect	48	0.6800	0.4624	8.79	100.10	66.98	74.39	20.61	
\$\begin{array}{cccccccccccccccccccccccccccccccccccc	49	0.6670	0.4449	8.45	98.19	64.42	74.11	20.89	
52         0.6200         0.3944         7.49         92.48         56.52         77.25         22.15           55         0.5500         0.3570         7.15         90.59         9.440         72.39         22.81           55         0.5600         0.3600         6.84         88.33         51.52         77.46         23.54           55         0.5000         0.3404         88.32         86.27         49.48         70.47         49.48         70.47         49.48         70.47         49.44         67.31         23.54         53.27         42.28         86.27         44.79         66.81         23.39         53.27         82.24         44.79         66.81         72.70         53.99         5.42         80.08         4.24         67.21         77.09         59         9.02         5.92         80.24         44.79         76.81         77.09         59         9.02         77.80         40.11         66.79         77.27         73.31         65.33         20.47         77.67         73.33         65.33         22.47         66.00         60.03.60         0.02.94         4.43         77.28         40.11         66.79         3.20         66         62.04.60         0.22.94         4	50	0.6540	0.4277	8.13	96.28	61.89	73.75	21.25	
52         0.6280         0.3984         7.49         92.85         56.92         77.25         22.15           53         0.5840         0.3797         7.15         90.99         9.840         72.39         22.81           54         0.5000         0.3600         4.84         88.33         51.52         77.46         22.54           55         0.5600         0.3604         8.627         48.27         47.09         66.11         23.54           56         0.5700         0.3372         4.22         84.21         47.09         66.11         23.19           58         0.5404         0.2999         5.42         80.08         4.244         67.21         77.09           39         0.5200         0.3798         5.32         77.88         40.11         66.79         72.73           61         0.4800         0.3990         4.43         73.67         73.33         65.33         20.47           61         0.4800         0.2902         4.43         73.34         55.35         27.43         65.3         2.24.23         33.0         65.3         2.24.33         59.44         4.25.9         3.25.9         65.0         6.40.0         2.02.94         <	51	0.6410	0.4109	7.81	94.36	59.38	73.53	21.67	
54         0.0000         0.38000         6.84         88.33         51.92         77.46         22.54           55         0.58000         0.3844         6.52         66.27         4.948         78.67         24.33           56         0.5700         0.3272         4.22         84.21         47.69         60.81         25.19           57         0.5580         0.3314         3.92         82.34         44.44         67.91         77.00           58         0.5440         0.2798         5.32         77.88         40.11         66.79         72.73           59         0.3230         0.2798         5.32         77.68         40.11         66.75         72.25           61         0.4500         0.2490         4.73         73.67         73.33         65.33         20.47           62         0.4800         0.3394         4.45         71.25         33.45         62.31         32.09           65         0.4800         0.3200         4.18         69.04         33.34         62.31         32.09           65         0.4800         0.3200         4.18         69.04         33.34         62.31         32.31         99.41         33.23 </td <td></td> <td></td> <td></td> <td></td> <td>92.45</td> <td></td> <td></td> <td></td>					92.45				
54         0.0000         0.38000         6.84         88.33         51.92         77.46         22.54           55         0.58000         0.3844         6.52         66.27         4.948         78.67         24.33           56         0.5700         0.3272         4.22         84.21         47.69         60.81         25.19           57         0.5580         0.3314         3.92         82.34         44.44         67.91         77.00           58         0.5440         0.2798         5.32         77.88         40.11         66.79         72.73           59         0.3230         0.2798         5.32         77.68         40.11         66.75         72.25           61         0.4500         0.2490         4.73         73.67         73.33         65.33         20.47           62         0.4800         0.3394         4.45         71.25         33.45         62.31         32.09           65         0.4800         0.3200         4.18         69.04         33.34         62.31         32.09           65         0.4800         0.3200         4.18         69.04         33.34         62.31         32.31         99.41         33.23 </td <td>53</td> <td>0.6140</td> <td>0.3770</td> <td>7.16</td> <td>90.39</td> <td>54.40</td> <td>72.19</td> <td>22.81</td>	53	0.6140	0.3770	7.16	90.39	54.40	72.19	22.81	
156	54	0.6000	0.3600	6.84	88.33		71.46	23.54	
157   0.5500   0.3314   5.92   82.34   44.34   66.89   26.31     58	55	0.5860	0.3434	6.52	86.27	49.48	70.67	24.53	
58         0.5440         0.2799         5.42         80.08         42.44         67.91         27.72           59         0.5200         0.2798         5.32         77.88         40.11         66.73         28.25           60         0.5540         0.2042         3.02         77.87         40.11         66.23         28.25           61         0.4800         0.2349         4.73         73.66         35.41         64.25         30.75           63         0.4800         0.2349         4.45         71.25         33.45         62.31         22.00           63         0.4800         0.2300         4.18         69.04         31.34         61.32         33.45         62.21         33.0         66.09         22.31         39.49         35.00         66.09         22.31         39.49         35.00         66.09         22.31         39.49         35.00         66.09         22.31         39.49         35.00         55.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00 <td>56</td> <td>0.5720</td> <td>0.3272</td> <td>6.22</td> <td>84.21</td> <td>47.09</td> <td>69.81</td> <td>25.19</td>	56	0.5720	0.3272	6.22	84.21	47.09	69.81	25.19	
58         0.5440         0.2799         5.42         80.08         42.44         67.91         27.72           59         0.5200         0.2798         5.32         77.88         40.11         66.73         28.25           60         0.5540         0.2042         3.02         77.87         40.11         66.23         28.25           61         0.4800         0.2349         4.73         73.66         35.41         64.25         30.75           63         0.4800         0.2349         4.45         71.25         33.45         62.31         22.00           63         0.4800         0.2300         4.18         69.04         31.34         61.32         33.45         62.21         33.0         66.09         22.31         39.49         35.00         66.09         22.31         39.49         35.00         66.09         22.31         39.49         35.00         66.09         22.31         39.49         35.00         55.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00         35.00 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>									
19									
60 0.5340 0.2642 5.02 75.67 37.83 65.51 29.47 61.61 0.4990 0.2845 4.45 71.25 33.45 62.31 32.07 62 0.4890 0.2285 4.45 71.25 33.45 62.31 32.09 63 0.4890 0.2285 4.45 71.25 33.45 62.31 32.09 63 0.4890 0.2280 4.18 69.04 33.34 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 33.46 61.32 6								_	
1	60								
62         0.4840         0.2345         4.45         71.25         33.45         62.91         32.90           63         0.4600         0.2200         4.18         60.04         31.34         61.52         33.04           64         0.4530         0.2052         3.30         66.09         29.23         39.94         35.00           65         0.4370         0.3910         3.43         64.33         27.19         38.30         36.70           67         0.4000         0.1048         3.13         59.77         22.35         55.02         99.88           68         0.9000         0.1321         2.49         57.41         2.151         55.22         99.34         17.77           69         0.3700         0.1392         2.44         54.91         19.68         51.26         41.79         14.77         44.75         44.75         17.77         44.75         45.71         17.77         44.75         45.71         17.77         44.75         45.71         17.77         44.75         45.71         17.77         44.75         45.71         17.77         44.75         45.72         47.74         47.75         47.74         47.75         47.74         47.74	61	0.4990	0.2490	4.73	73.46	35.61	64.25		
65         0.4600         0.2200         4.18         69.04         31.34         61.52         33.64           64         0.4530         0.252         3.09         66.69         29.23         55.94         35.06           65         0.4370         0.1810         3.83         64.35         27.19         58.30         36.70           66         0.4220         0.1781         3.18         62.12         25.77         56.73         36.20           68         0.9000         0.1521         2.29         57.41         22.35         55.02         49.98           69         0.3720         0.3991         2.64         54.91         19.66         53.21         41.77           70         0.3570         0.1324         2.42         52.55         17.37         40.39         45.41           71         0.3410         0.1326         2.21         50.00         16.34         47.64         47.54           72         0.3360         0.1050         1.79         47.70         14.74         45.34         49.39         45.11           73         0.3370         0.0765         1.79         47.70         14.74         45.34         47.54         47.74		411114			10110		0.1100		
65 0.4530 0.2052 3.90 66.99 29.33 59.94 55.00 65 66 0.4520 0.1910 3.63 66.33 27.19 58.30 36.70 66 0.4220 0.1911 3.34 62.12 25.77 56.73 34.25 67 0.4600 0.1048 3.13 59.77 23.35 55.02 39.80 68 0.3000 0.1521 2.89 57.41 2.151 55.23 39.82 69 0.3730 0.1393 2.264 58.41 19.68 51.26 45.74 70 0.3570 0.1394 2.24 58.42 19.68 51.26 45.74 77 0.3570 0.1394 2.24 58.25 19.68 51.26 45.74 77 0.3570 0.1394 2.24 58.25 19.68 51.26 45.74 77 0.3570 0.1394 2.24 58.25 19.52 19.68 51.26 45.74 77 0.3570 0.1394 2.24 58.25 19.35 19.68 45.26 45.77 70 0.3570 0.0124 2.24 58.25 19.35 19.68 45.26 45.77 70 0.3570 0.00642 1.99 47.70 14.74 47.86 47.55 77 0.3570 0.00642 1.99 47.70 14.74 45.36 47.8									
S									
66 0.4220 0.1781 3.38 62.12 25.27 56.75 38.25 67 0.4000 0.1646 3.13 59.77 23.35 55.02 39.25 68 0.3000 0.1521 2.29 57.41 22.15 55.23 41.77 0.3570 0.2570 0.3591 2.24 54.91 19.66 5.126 45.74 77 0.3570 0.2570 0.2591 2.24 54.91 19.66 51.26 45.74 77 0.3570 0.2570 0.2591 2.24 54.91 19.66 51.26 45.74 77 0.3570 0.2570 0.2591 2.24 54.91 19.66 51.26 45.74 77 0.3570 0.2570 0.2591 2.21 50.20 16.34 47.66 47.54 47.50 1.77 49.29 45.19 77 0.3500 0.0165 1.99 45.11 19.21 47.70 14.74 45.55 49.66 17.77 0.3570 0.0591 1.100 42.69 11.77 41.04 35.30 49.67 47.70 14.74 45.75 49.67 49.	65							_	
68 0.3900 0.31648 3.31 59.77 23.35 55.02 39.98 66 68 0.3900 0.3541 2.28 35.741 21.51 53.23 41.77 69 0.3570 0.3551 2.28 55.41 21.51 53.23 41.77 70 0.3570 0.3552 2.24 55.81 136.88 53.36 43.74 77 0.3570 0.3570 0.3575 2.26 55.81 136.88 53.36 43.74 77 0.3570 0.3570 0.3274 2.21 52.55 17.97 40.39 45.51 77 0.3570 0.3274 40.39 45.51 52.51 57 57 57 57 57 57 57 57 57 57 57 57 57	66			3.38			56.75		
68 0.3900 0.1521 2.29 57.41 21.51 53.23 41.77 69.0 6.3750 0.1357 2.289 57.41 21.51 53.23 41.77 70 0.3570 0.1357 2.24 2.42 52.55 17.57 49.39 45.61 70 0.3570 0.1274 2.42 52.55 17.57 49.39 45.61 70 0.3570 0.1274 2.42 52.55 17.57 49.39 45.61 71 0.3410 0.1165 2.21 50.00 16.84 47.66 47.54 47.56 47.54 47.60 47.54 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.60 47.54 47.5				4100					
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71 0.3410 0.3163 2.21 50.20 16.34 47.66 47.54 72 0.3240 0.3050 1.39 47.70 14.74 45.36 49.75 73 0.3070 0.0562 1.79 47.70 14.74 45.36 49.75 74 0.3070 0.0561 1.79 45.19 13.21 45.22 51.78 74 0.3200 0.0561 1.79 45.19 13.21 45.22 51.78 75 0.2720 0.0945 1.42 40.19 10.04 58.62 56.18 76 0.2500 0.0551 1.25 37.69 91.2 96.07 58.45 77 0.2300 0.0557 1.59 37.69 91.2 96.57 58.45 78 0.2200 0.0567 1.59 59.18 79.51 54.28 60.72 78 0.2200 0.0568 0.39 32.55 6.76 31.82 60.72 79 0.2060 0.0468 0.39 32.55 6.76 31.82 60.72 79 0.2060 0.0468 0.39 32.55 6.76 31.82 60.72 80 0.1860 0.0596 0.66 27.36 4.75 26.47 66.33 81 0.1860 0.0596 0.66 27.36 4.75 26.47 66.33 82 0.1510 0.0022 0.54 24.73 3.87 24.43 70.57 83 0.1510 0.0022 0.54 24.73 3.87 24.43 70.57 84 0.1510 0.0022 0.54 19.58 2.23 3.09 22.01 72.99 85 0.01300 0.0077 0.54 19.58 2.23 10.75 15.45 75.57 86 0.0700 0.00070 0.18 14.13 12.2 14.68 80.20 86 0.0700 0.00075 0.18 14.13 1.22 14.68 80.20 87 0.0500 0.00075 0.07 8.69 0.45 8.67 86.33 88 0.0400 0.00015 0.07 8.69 0.45 8.67 86.33 88 0.0400 0.00015 0.07 8.69 0.45 8.67 86.33 89 0.0210 0.0001 0.00 0.00 0.00 3.09 0.05 3.09 9.95	69	0.3730	0.1391	2.64	54.91	19.68	51.26	43.74	
77 0.3240 0.1050 1.99 47.70 14.14 45.36 48.96 17.77 17.78 17	70	0.3570	0.1274	2.42	52.55	17.97	49.39	45.61	
73         0.5070         0.0942         1.79         45.19         15.21         48.22         53.78           76         0.2790         0.0945         1.40         42.69         11.77         41.04         53.56           75         0.2790         0.0945         1.42         40.19         10.04         38.82         56.18           76         0.2590         0.0657         1.25         37.69         9.12         36.57         36.21           78         0.2230         0.0571         1.09         33.18         7.91         34.28         60.72           78         0.2230         0.0581         0.39         32.33         6.76         31.42         63.72           80         0.1860         0.0048         0.39         32.33         6.76         31.42         65.32           80         0.1860         0.0046         0.26         27.38         4.75         26.97         68.03           81         0.1660         0.0022         0.43         22.23         3.09         22.01         72.99           82         0.1510         0.0228         0.43         22.23         3.09         22.01         72.99           83	71	0.3410	0.1163	2.21	50.20	16.34	47.46	47.54	
74         0.2900         0.0941         1.00         42.99         11.77         41.04         53.96           75         0.27700         0.0248         1.42         40.19         10.40         58.12         56.18           76         0.2500         0.0855         1.25         37.69         9.12         36.57         38.43           77         0.2390         0.0591         1.09         35.18         7.91         34.28         60.27           78         0.2210         0.0881         0.39         32.33         5.76         31.22         61.18           80         0.1800         0.0504         0.06         2.73         2.73         2.48         65.32           81         0.1800         0.0504         0.06         2.73         2.73         2.43         70.72         66.03           82         0.1510         0.0222         0.44         24.73         3.87         2.443         70.27         66.03           83         0.1300         0.0217         0.34         19.58         2.29         19.43         73.73         74.19         73.27         74.19         74.31         74.79         74.19         74.31         74.79         74.31	72	0.3240	0.1050	1.99	47.70	14.74	45.36	49.64	
75 0.2790 0.0785 1.42 40.19 10.40 38.82 56.18 76 0.2560 0.0655 1.125 37.69 9.12 36.37 36.27 77 0.2390 0.0571 1.09 35.18 7.91 34.28 60.72 78 0.2210 0.0488 0.03 32.35 0.06 31.42 61.18 79 0.2040 0.0416 0.79 30.03 37.73 29.48 65.32 80 0.1860 0.0546 0.66 27.38 47.5 72.697 66.03 81 0.1860 0.0582 0.54 24.75 3.87 26.47 66.32 82 0.1310 0.0522 0.54 22.23 3.09 22.01 72.39 83 0.1330 0.0277 0.34 19.58 2.39 19.43 75.37 84 0.140 0.0503 0.25 10.78 17.75 16.69 78.31 85 0.0960 0.0092 0.18 34.33 12.3 14.08 80.32 85 0.0960 0.0093 0.17 11.48 0.00 11.48 83.55 86 0.0400 0.0005 0.07 8.69 0.45 867 86.33 88 0.0400 0.0005 0.07 8.69 0.45 867 86.33 88 0.0400 0.0005 0.07 8.69 0.45 867 86.33 88 0.0400 0.0005 0.03 3.09 0.05 3.09 0.21 5.88 80.1	73	0.3070	0.0942	1.79	45.19	13.21	43.22	51.78	
76 0.2800 0.0655 1.25 37.60 9.12 36.57 58.43 7.77 0.2580 0.0655 1.126 37.80 9.12 36.57 58.43 7.77 0.2580 0.0651 1.09 35.18 7.51 34.28 60.72 77 0.2580 0.0646 0.35 32.25 6.76 31.27 65.18 7.79 0.2046 0.0416 0.379 30.03 5.73 20.44 65.31 80 0.1800 0.0946 0.66 2.738 4.75 26.97 64.03 81 0.1800 0.0922 0.44 24.73 38.67 24.43 70.57 82 0.1510 0.0022 0.44 24.73 38.67 24.43 70.57 82 0.1510 0.0022 0.45 24.73 38.67 24.43 70.57 82 0.1510 0.0022 0.45 24.73 38.67 21.75 98.60 0.0022 0.45 22.33 3.09 22.01 72.99 84 0.140 0.0022 0.45 19.58 22.33 3.09 22.01 72.99 84 0.140 0.0017 0.44 19.58 22.33 3.09 22.01 72.99 84 0.140 0.0017 0.45 19.58 22.33 10.75 19.40 19.50	74	0.2900	0.0841	1.60	42.69	11.77	41.04	53.96	
77 0.2590 0.0571 1.09 35.18 7.91 34.28 60.72 78 0.2210 0.0488 0.33 22.33 6.76 31.27 63.17 79 0.2040 0.0416 0.79 30.03 5.73 29.48 65.32 80 0.1800 0.0594 0.06 27.38 4.75 26.97 68.03 81 0.1800 0.0592 0.54 2.73 8.47 2.87 26.97 68.03 82 0.1510 0.0228 0.43 22.23 3.09 22.01 72.99 83 0.1330 0.0177 0.34 19.56 2.39 19.43 75.37 84 0.140 0.0130 0.25 1.75 17.75 16.09 78.31 85 0.0900 0.0002 0.18 24.13 12.3 12.3 14.08 80.02 86 0.0700 0.00016 0.12 11.48 0.00 11.45 83.55 87 0.0590 0.00015 0.07 8.69 0.45 8.67 86.33 88 0.0400 0.0015 0.07 8.69 0.45 8.67 86.33 88 0.0400 0.0016 0.07 8.69 0.45 8.67 86.33	75	0.2750	0.0745	1.42	40.19	10.40	38.82	56.18	
78 0.2700 0.0488 0.09 32.55 6.76 31.82 63.18 65.57 79 0.2500 0.0416 0.79 30.03 5.73 29.48 65.52 80 0.1860 0.0546 0.56 27.38 4.75 26.27 66.03 61 0.1860 0.0522 0.54 24.73 3.87 24.43 70.57 62.03	76	0.2560	0.0655	1.25	37.69	9.12	36.57	58.43	
79 0.2040 0.0416 0.79 30.03 5.73 29.48 65.52 80 0.1800 0.05946 0.06 27.38 4.75 26.97 66.55 81 0.1800 0.05946 0.06 27.38 4.75 26.97 66.55 81 0.1800 0.0592 0.54 24.73 3.87 24.43 70.57 62 0.1510 0.0228 0.45 22.23 3.09 22.01 72.99 83 0.1330 0.0228 0.45 22.23 3.09 22.01 72.99 84 0.1340 0.0130 0.25 16.78 17.75 16.69 78.31 85 0.0500 0.0029 0.18 24.13 1.23 14.08 80.92 85 0.0700 0.0001 0.001 0.14 14.8 14.13 1.23 14.08 80.92 85 0.0700 0.0001 0.0015 11.48 0.08 11.45 83.55 87 0.0500 0.0035 0.07 8.69 0.45 8.67 86.33 88 0.0400 0.0016 0.023 3.89 0.21 5.88 85.39 0.21 5.88 89.0000 0.0016 0.03 3.69 0.05 3.59 93.38	77	0.2390	0.0571	1.09	35.18	7.91	34.28	60.72	
80         0.1860         0.0946         0.66         27.38         4.75         26.97         68.03           81         0.1680         0.0032         0.54         24.73         3.87         34.43         73.29           82         0.1510         0.0228         0.43         22.23         3.09         22.01         72.39           83         0.1350         0.0377         0.34         19.58         2.59         19.43         78.57           84         0.1460         0.0303         0.25         16.78         1.75         16.69         78.31           85         0.0960         0.0092         0.18         34.13         12.3         14.08         88.08         88.08         88.05	78	0.2210	0.0488	0.93	32.53	6.76	31.82	63.18	
81         0.1680         0.0282         0.54         24.73         3.87         24.43         70.57           82         0.1510         0.0228         0.08         22.23         3.09         22.01         72.99           83         0.1330         0.0177         0.34         19.58         2.29         19.48         75.37           84         0.1440         0.0130         0.25         16.78         1.75         16.69         78.31           85         0.0900         0.0002         0.18         14.13         1.23         14.08         30.45           86         0.0700         0.0065         0.12         11.48         0.80         11.45         83.55           87         0.0590         0.0039         0.07         8.69         0.45         8.67         86.33           80         0.0400         0.0016         0.03         5.89         0.21         5.88         89.12           89         0.0210         0.0004         0.01         3.09         0.05         3.39         99.32	79	0.2040	0.0416	0.79	30.03	5.73	29.48	65.52	
82         0.1510         0.0228         0.43         22.23         3.09         22.01         72.99           83         0.1330         0.0177         0.34         19.58         2.39         19.43         75.57           84         0.1340         0.0130         0.25         16.78         1.75         16.09         78.31           85         0.0960         0.0092         0.18         24.13         1.23         14.08         80.92           86         0.0700         0.0061         0.12         1.14.8         0.00         11.45         83.55           87         0.0590         0.0035         0.07         8.69         0.45         8.67         86.33           88         0.0400         0.0016         0.03         5.89         0.21         5.86         80.12           89         0.0210         0.0004         0.01         3.09         0.05         3.59         9.93	80	0.1860	0.0346	0.66	27.58	4.75	26.97	68.03	
82         0.1510         0.0228         0.48         22.23         3.09         12.01         72.99           83         0.1330         0.0177         0.34         19.58         2.39         19.43         75.57           84         0.1340         0.0130         0.25         16.78         1.75         16.69         78.31           85         0.0960         0.0002         0.18         24.13         1.23         14.08         80.92           86         0.0780         0.0061         0.12         1.1.48         0.80         10.45         8.8.7           87         0.0590         0.0035         0.07         8.69         0.45         8.67         86.33           88         0.0400         0.0016         0.03         5.89         0.21         5.86         80.12           29         0.0210         0.0004         0.01         3.09         0.05         3.09         9.93	81	0.1680	0.0282	0.54	24.73	3.87	24.43	70.57	
83         0.1390         0.0177         0.34         19.58         2.99         19.43         78.57           94         0.140         0.033         0.25         16.78         1.75         16.69         78.51           85         0.0960         0.0061         0.18         34.13         1.23         14.08         80.92           86         0.0780         0.0061         0.12         11.48         0.80         11.45         83.55           87         0.0590         0.0035         0.07         8.69         0.45         8.67         86.33           88         0.0400         0.0016         0.03         5.89         0.21         5.88         80.12           89         0.0210         0.0004         0.01         3.09         0.05         3.09         9.31	82	0.1510	0.0228	0.43		3.09	22.01	72.99	
86 0.1140 0.0330 0.25 16.78 1.75 16.69 78.31 85 0.0960 0.0002 0.18 14.13 1.23 14.08 80.05 18 14.13 1.23 14.08 80.05 18 14.09 18 1	83	0.1330		0.34	19.58	2.39	19.43	75.57	
86 0.0780 0.0061 0.12 11.48 0.80 11.45 83.55 87 0.0590 0.0035 0.07 8.69 0.45 8.67 86.33 88 0.0400 0.0016 0.03 5.89 0.21 5.88 88.12 89 0.0210 0.0004 0.01 3.09 0.05 3.09 93.31	84	0.1140	0.0130	0.25	16.78		16.69	78.31	
87 0.0590 0.0055 0.07 8.69 0.45 8.67 86.33 86 0.0400 0.0015 0.03 3.89 0.21 5.88 89.12 89 0.0220 0.0004 0.01 3.99 0.05 3.09 93.91	85	0.0960	0.0092	0.18	14.13	1.23	14.08	80.92	
87 0.0590 0.0205 0.07 8.69 0.45 8.67 86.33 86 0.0400 0.0016 0.03 3.89 0.21 5.88 89.12 89 0.0230 0.0004 0.01 3.09 0.05 3.09 93.91	86	0.0780	0.0061	0.12	11.48	0.80	11.45	83.55	
89 0.0210 0.0004 0.01 3.09 0.05 3.09 91.91									
	88	0.0400	0.0016	0.03	5.89	0.21	5.88	89.12	
	89			0.01					
30 0.000 0.000 0.00 0.00 0.00 95.00	90	0.0000	0.0000	0.00	0.00	0.00	0.00	95.00	



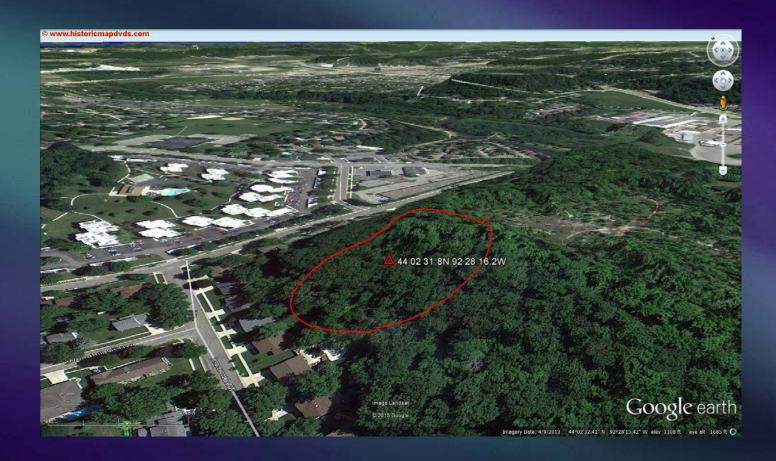
- Closest ground approach: 20.4 m (67 feet)
- Horizontal distance: 74.6 m (~245 feet)



- Local terrain should be considered.
- Site elevation may vary approaching structures.



- Local terrain should be considered.
- Site elevation may vary approaching structures.



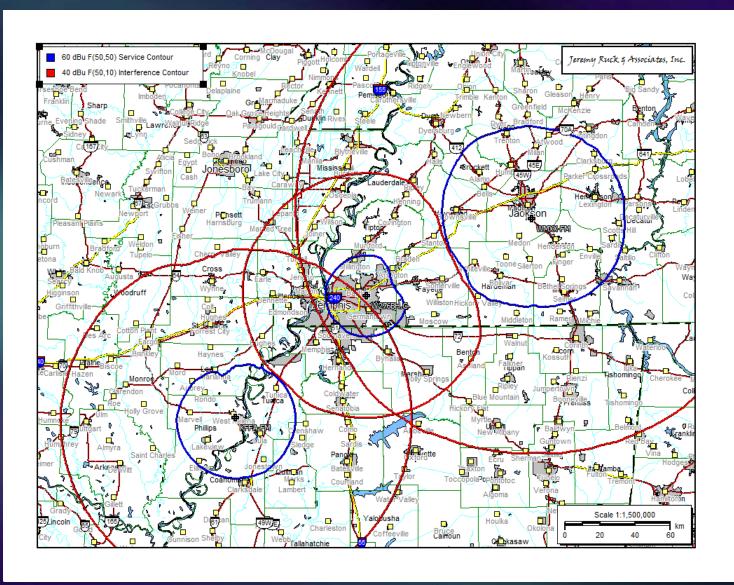
- Local terrain should be considered.
- Site elevation may vary approaching structures.



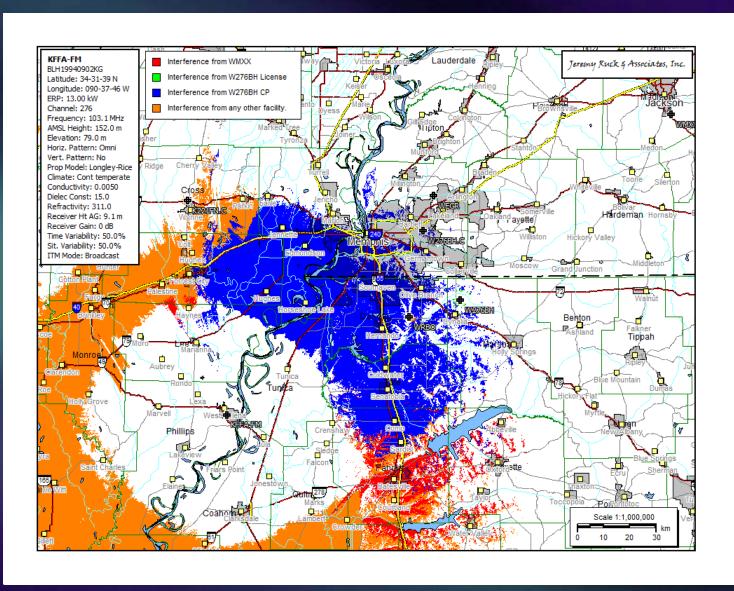
#### More on interference studies

- Absence of interference does not necessarily follow from lack of contour overlap.
- The converse is also true.
- Contour proximity can be a huge pitfall for translators in co- and 1<sup>st</sup> adjacent channel situations.
- "Grantability" versus "Survivability"

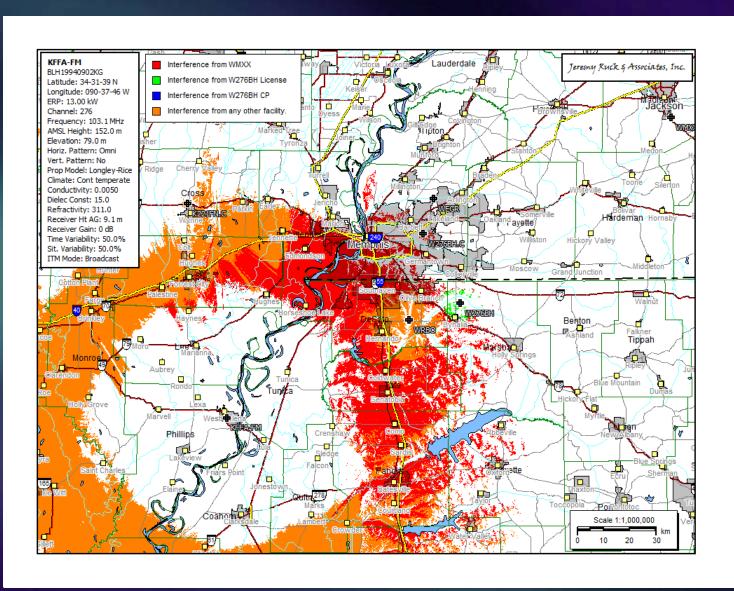
# "Grantability" versus "Survivability"



# "Grantability" versus "Survivability"



# "Grantability" versus "Survivability"



# Jeremy's Crystal Ball

- LPFM demand will be robust.
- Expect interference from new LPFM.
- Minimal avenues for mitigation.
- No hammer unless community of license.
- Another translator window possible.
- Likely limited to AM licensees.
- Should mainly impact more rural areas.
- Fewer translator relocation opportunities.

# Translators and LPFM

# Questions and Discussion

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