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**Engineering Statement
Application for a new Digital-to-Digital Replacement Translator
Channel 25 at Madison, Wisconsin
For WISC-TV
July 2021**

I. Background

This Engineering Statement has been prepared on behalf of Television Wisconsin, Inc. ("TVW"), the licensee of digital TV station WISC-TV at Madison, Wisconsin. This material has been prepared in connection with an application for a new Digital-to-Digital Replacement Translator ("DTDRT") at Madison, Wisconsin, on UHF Channel 25.

The Commission established the DTDRT service to allow eligible full power television stations to recover lost digital service area that resulted from the reverse auction and repacking process.¹ The Commission concluded that this replacement service may be needed for full power stations that are reassigned to new channels, either in the repacking process or through a winning UHF-to-VHF bid, if the full power station discovered that a portion of their existing pre-auction digital service area was lost after the station transitioned to its new channel. Among other considerations favoring the establishment of this replacement service, the Commission acknowledged that "because radio signals propagate differently on different frequencies, the signal of a station reassigned to a different channel will generally not be receivable in precisely the same locations within a station's contour as it was on the original channel."²

¹ *Amendment of Parts 73 and 74 of the Commission's Rules to Establish Rules for Digital Low Power Television and Television Translator Stations*, Third Report and Order and Fourth Notice of Proposed Rulemaking, MB Docket No. 03-185, FCC 15-175, released December 17, 2015.

² *Ibid*, Footnote 199.

As a part of the DTDRT application process, applicants are required to demonstrate a loss of a portion of their pre-auction digital service area. The Commission declined to establish a specific format for these showings, stating that “[w]e believe that applicants should have flexibility in engineering their showings, provided that they give an accurate assessment of the loss in the pre-auction digital service area.”³

II. Lost Digital Service Area

WISC-TV is the CBS network affiliate in Madison, Wisconsin. WISC-TV for many years operated on UHF Channel 50. Following completion of the Broadcast Incentive Auction, the Commission’s *Channel Reassignment Public Notice* (DA 17-314), released on April 13, 2017, specified WISC-TV’s post-auction facilities on VHF Channel 11. Accordingly, the station completed construction of its Ch11 facility, filing its covering license application on May 1, 2020 (0000113047). WISC-TV subsequently filed a minor modification application for a power increase, and filed the subsequent covering license application on November 19, 2020 (0000126605).

Since that time, the station has experienced numerous complaints of difficulties in reception of the VHF signal, where viewers had previously been able to receive the UHF signal without problem. A large percentage of these complaints appear to originate from viewers who use indoor set-top antennas. From these complaints, it is apparent that in-building penetration of the VHF signal presents challenges, particularly where viewers had become accustomed to UHF indoor reception.

In order to remedy this loss of indoor reception service in its core service area, resulting from the station’s repack onto a VHF channel, WISC-TV proposes herein to construct a DTDRT on UHF Channel 25 to serve Madison. Operation of the DTDRT will ensure that Madison viewers who

³ Ibid, Footnote 212.

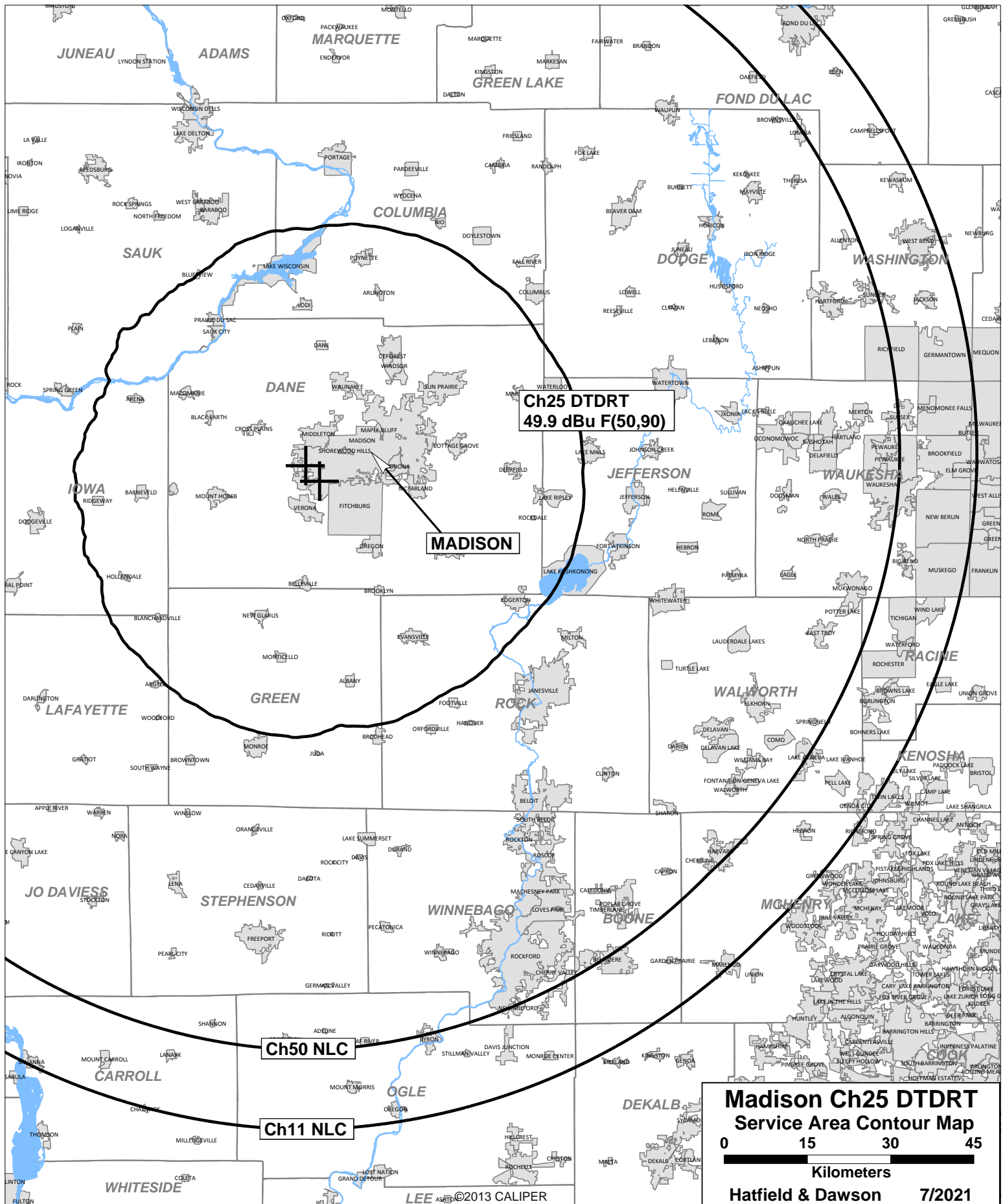
were long accustomed to receiving WISC-TV's CBS network programming on an indoor antenna will once again have that capability.^{4 5}

The attached map exhibit demonstrates that the Ch25 replacement translator 49.9 dBu coverage contour will be completely contained within the WISC-TV Ch11 36 dBu noise limited contour as well as the prior WISC-TV Ch50 42 dBu noise limited contour.

Please see the applicant's legal pleading/waiver request for additional justification for this request.

⁴ It is noted that the other major network stations serving the Madison DMA all operate on UHF RF channels. ABC network programming is on WKOW Ch26, NBC is on WMTV Ch19, Fox is on WMSN-TV Ch18, and PBS is on WHA-TV Ch20.

⁵ While no study was undertaken in connection with this application to document the population of indoor antenna users in Madison, it is posited that larger population centers tend to have a higher number of renters and other residents who are more likely to utilize indoor antennas.



Ch25 DTDRT
49.9 dBu F(50,90)

MADISON

Ch50 NLC

Ch11 NLC

**Madison Ch25 DTDRT
Service Area Contour Map**

0 15 30 45

Kilometers

Hatfield & Dawson

7/2021

LEE ASMT ©2013 CALIPER

III. Interference Study

Study has been made of all cochannel and adjacent-channel facilities in the vicinity of the proposed operation, including a detailed Longley-Rice interference study to demonstrate that the proposed operation will not cause interference to any authorized or pending proposed facilities. This study was performed using the Commission's TVStudy software.

The results of this study indicate that the proposed facility is predicted to cause zero additional interference to any of the listed stations, beyond the allowed values of 0.5% to full-power and Class A stations, and 2.0% to low-power stations. Based on the foregoing interference study, it is believed that the proposed facility can operate without risk of interference to other stations.

Study created: 2021.07.13 08:53:33

Study build station data: LMS TV 2021-07-12

Proposal: WISC-DRT D25 LD APP MADISON, WI
 File number: WISC25DTRT
 Facility ID: 99999
 Station data: User record
 Record ID: 1277
 Country: U.S.
 Zone: I

Build options:
 Protect pre-transition records not on baseline channel

Stations potentially affected by proposal:

IX	Call	Chan	Svc	Status	City, State	File Number	Distance
No	KIMT	D24	DT	LIC	MASON CITY, IA	BLANK0000067292	264.0 km
No	WRJK-LP	D24	LD	CP	ARLINGTON HEIGHTS, IL	BMPDTL20140211ACV	199.7
No	WFLD	D24	DT	CP	CHICAGO, IL	BLANK0000072366	199.6
No	WHOI	D24	DT	LIC	PEORIA, IL	BLANK0000100514	266.8
No	WDMW-LD	D24	LD	CP	JANESVILLE, WI	BLANK0000129490	107.2
No	WDMW-LD	D24	LD	LIC	JANESVILLE, WI	BLANK0000126931	88.5
Yes	WZCK-LD	D24	LD	LIC	MADISON, WI	BLANK0000112772	3.4
No	WHRM-TV	D24	DT	CP	WAUSAU, WI	BLANK0000035674	210.7
No	WHRM-TV	D24	DT	LIC	WAUSAU, WI	BLEDT20051014AAW	210.7
No	K28KK-D	D25	LD	LIC	DECORAH, IA	BLANK0000112327	186.2
No	KTIN	D25	DT	LIC	FORT DODGE, IA	BLEDT20070822ACB	400.0
Yes	KWKB	D25	DT	LIC	IOWA CITY, IA	BLCDT20070130AJQ	209.9
Yes	WBKM-LP	D25+	LD	CP	CHANA, IL	BLANK0000054706	117.5
No	W25EW-D	D25	LD	CP	JACKSONVILLE, IL	BLANK0000013744	373.3
Yes	WEEK-TV	D25	DT	LIC	PEORIA, IL	BLANK0000137499	266.8
No	WMKB-LP	N25z	TX	LIC	Rochelle, IL	BLTTL20070813AFM	117.5
No	W25FH-D	D25	LD	LIC	FORT WAYNE, IN	BLANK0000088484	418.8
No	WRTV	D25	DT	LIC	INDIANAPOLIS, IN	BLCDT20090623ACJ	443.6
No	WCWW-LD	D25	LD	LIC	SOUTH BEND, IN	BLANK0000100628	314.8
No	WWTV	D25	LD	LIC	CADILLAC, MI	BLANK0000124418	361.5
No	WOGC-CD	D25	DC	LIC	HOLLAND, MI	BLDTA20120316ADA	289.8
No	WJGP-LD	D25	LD	LIC	KALAMAZOO, MI	BLANK0000130548	355.3
No	KJNK-LD	D25	LD	LIC	MINNEAPOLIS, MN	BLDTT20090528ACL	370.8
No	KJNK-LD	D25	LD	LIC	MINNEAPOLIS, MN	BLANK0000129957	370.8
No	K25NK-D	D25	LD	LIC	ROCHESTER, MN	BLANK0000151246	254.6
No	K25LC-D	D25	LD	CP	WINONA, MN	BNPDTL20090825BYN	197.6
Yes	W25FT-D	D25	LD	CP	BARABOO, WI	BLANK0000151594	119.6
Yes	WQOW	D25	DT	LIC	EAU CLAIRE, WI	BLANK0000135118	251.7
No	W25EY-D	D25	LD	CP	ELK MOUND, WI	BNPDTL20100513AEV	273.3
Yes	WPNE-TV	D25	DT	LIC	GREEN BAY, WI	BLANK0000117903	195.2

No	WPVN-CD	D26	DC	LIC	CHICAGO, IL	BLANK0000106475	199.0
No	WRDH-LP	D26	LD	CP	HOLCOMB, IL	BDCCDTL20061030ANL	117.5
No	WMBD-TV	D26	DT	LIC	PEORIA, IL	BLANK0000098193	266.2
No	KXLT-TV	D26	DT	LIC	ROCHESTER, MN	BLANK0000063320	253.6
No	W26FD-D	D26	LD	CP	LA CROSSE, WI	BLANK0000071991	191.0
No	WKOW	D26	DT	LIC	MADISON, WI	BLCDT20111006AAO	3.8
No	WTSJ-LD	D26	LD	LIC	MILWAUKEE, WI	BLANK0000106850	130.2
No	W26EE-D	D26	LD	LIC	WITTENBERG, WI	BLDTL20120620ABV	218.7

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

Channel: D25
Mask: Full Service
Latitude: 43 1 48.00 N (NAD83)
Longitude: 89 30 17.00 W
Height AMSL: 414.5 m
HAAT: 0.0 m
Peak ERP: 15.0 kW
Antenna: Omnidirectional
Elev Pattn: Generic
Elec Tilt: 0.75

49.9 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	15.0 kW	117.7 m	45.8 km
45.0	15.0	145.4	47.7
90.0	15.0	139.5	47.3
135.0	15.0	107.9	44.9
180.0	15.0	113.7	45.5
225.0	15.0	110.5	45.2
270.0	15.0	95.8	43.5
315.0	15.0	89.5	42.7

Database HAAT does not agree with computed HAAT
Database HAAT: 0 m Computed HAAT: 115 m

Distance to Canadian border: 528.7 km

Distance to Mexican border: 1813.8 km

Conditions at FCC monitoring station: Allegan MI
Bearing: 98.1 degrees Distance: 293.2 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 261.6 degrees Distance: 1343.2 km

Study cell size: 1.00 km
Profile point spacing: 1.00 km

Maximum new IX to full-service and Class A: 0.50%
Maximum new IX to LPTV: 2.00%

---- Below is IX received by proposal WISC25DTRT ----

Proposal receives 13.90% interference from scenario 1
No IX check failures found.

IV. RF Exposure Study

Hatfield & Dawson Consulting Engineers

The power density calculations shown below were made using the techniques outlined in OET Bulletin No. 65. "Ground level" calculations in this report have been made at a reference height of 2 meters above ground to provide a worst-case estimate of exposure for persons standing on the ground in the vicinity of the tower. The equation shown below was used to calculate the ground level power density figures from each antenna.

$$S(\mu W / cm^2) = \frac{33.40981 \times AdjERP(Watts)}{D^2}$$

Where: *AdjERP(Watts)* is the maximum lobe effective radiated power times the element pattern factor times the array pattern factor.

D is the distance in meters from the center of radiation to the calculation point.

Power density levels produced by the proposed facility were calculated for an elevation of 2 meters above ground using the manufacturer's vertical plane pattern for the horizontally-polarized ERI model ALP8L3 antenna proposed in this application. The highest calculated power density from the proposed antenna alone occurs at a point 28 meters from the base of the antenna support structure. At this point the power density from the proposed facility is calculated to be 5.1 $\mu W/cm^2$, which is 1.4% of 357.3 $\mu W/cm^2$ (the FCC maximum for uncontrolled environments at the Channel 25 frequency).

These calculations show that the maximum calculated power density produced at two meters above ground level by the proposed operation alone is less than 5% of the applicable FCC exposure limit at all locations between 1 and 500 meters from the base of the antenna support structure. Section 1.1307(b) of the Commission's Rules excludes applications for new facilities or modifications to existing facilities from the requirement of preparing an environmental assessment when the calculated emissions from the applicant's proposed facility are predicted to be less than 5% of the applicable FCC exposure limit. Therefore, the proposed facility is in compliance with Section 1.1301 *et seq* and no further analysis of RF exposure at this site is required in this application.

Pursuant to OET Bulletin No. 65, all station personnel and contractors are required to follow appropriate safety procedures before any work is commenced on the antenna tower, including reduction in power or discontinuance of operation before any maintenance work is undertaken. The

permittee/licensee in coordination with other users of the site must reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radiofrequency exposure in excess of FCC guidelines.

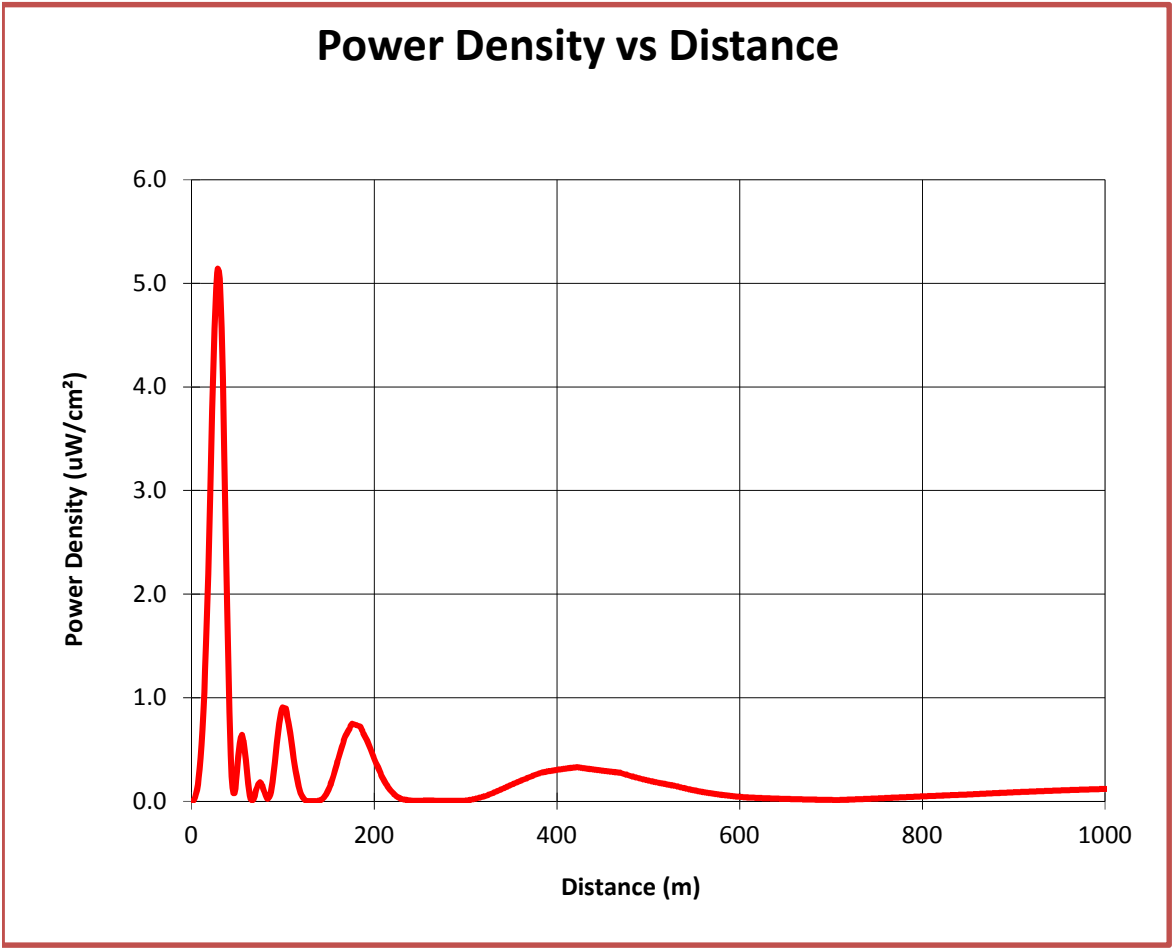
July 13, 2021

Erik C. Swanson, P.E.

WISC-DTDRT Ch25 Madison
Ground-Level Power Density Calculations
Using Manufacturer's Vertical Plane Pattern

Antenna	ALP8L3		
ERP	15,000	Watts H (avg)	
	-	Watts V (avg)	
Antenna AGL	76.2	meters less 2m is	74.2 meters above the reference plane
MBT	0	degrees	

Calculated
Maximum is 5.1 uW/cm² at 28 meters from the tower



WISC-DTDR Ch25 Madison
Ground-Level Power Density Calculations
Using Manufacturer's Vertical Plane Pattern

Distance From Tower (meters)	Hypotenuse (meters)	Depression Angle (with MBT adjust) (degrees)	Interpolated Rel Field	Adjusted ERP (watts)	Power Density uW/cm ²
0	74.20	90.00	0.000	0.0	0.00
1	74.21	89.23	0.007	0.7	0.00
2	74.23	88.46	0.013	2.7	0.02
3	74.26	87.68	0.020	6.1	0.04
4	74.31	86.91	0.028	11.6	0.07
5	74.37	86.14	0.035	18.1	0.11
6	74.44	85.38	0.042	26.8	0.16
7	74.53	84.61	0.050	37.9	0.23
8	74.63	83.85	0.059	51.9	0.31
9	74.74	83.08	0.068	69.3	0.41
10	74.87	82.32	0.078	90.8	0.54
11	75.01	81.57	0.088	116.3	0.69
12	75.16	80.81	0.099	145.9	0.86
13	75.33	80.06	0.109	178.6	1.05
14	75.51	79.32	0.120	217.0	1.27
15	75.70	78.57	0.132	260.8	1.52
16	75.91	77.83	0.144	310.5	1.80
17	76.12	77.10	0.156	366.8	2.11
18	76.35	76.36	0.169	427.4	2.45
19	76.59	75.64	0.181	490.4	2.79
20	76.85	74.91	0.192	555.0	3.14
21	77.11	74.20	0.204	623.3	3.50
22	77.39	73.49	0.215	691.6	3.86
23	77.68	72.78	0.225	758.6	4.20
24	77.98	72.08	0.234	821.4	4.51
25	78.30	71.38	0.241	872.7	4.76
26	78.62	70.69	0.247	916.4	4.95
27	78.96	70.00	0.252	952.3	5.10
28	79.31	69.33	0.254	967.9	5.14
29	79.67	68.65	0.255	972.7	5.12
30	80.04	67.99	0.254	967.0	5.04
31	80.42	67.33	0.249	932.1	4.82
32	80.81	66.67	0.243	886.1	4.53
33	81.21	66.02	0.235	830.3	4.21
34	81.62	65.38	0.224	751.8	3.77
35	82.04	64.75	0.211	668.9	3.32
36	82.47	64.12	0.197	580.5	2.85
37	82.91	63.50	0.180	485.5	2.36
38	83.36	62.88	0.162	394.1	1.89
39	83.83	62.27	0.142	302.5	1.44
40	84.29	61.67	0.122	221.5	1.04
41	84.77	61.08	0.101	152.1	0.71
42	85.26	60.49	0.080	95.0	0.44
43	85.76	59.91	0.059	52.9	0.24
44	86.26	59.33	0.043	28.1	0.13

45	86.78	58.76	0.034	17.6	0.08
46	87.30	58.20	0.035	18.2	0.08
47	87.83	57.65	0.043	27.8	0.12
48	88.37	57.10	0.056	46.5	0.20
49	88.92	56.56	0.068	69.6	0.29
50	89.47	56.03	0.080	97.0	0.40
51	90.04	55.50	0.089	118.9	0.49
52	90.61	54.98	0.097	141.6	0.58
53	91.18	54.46	0.101	152.3	0.61
54	91.77	53.95	0.104	161.8	0.64
55	92.36	53.45	0.102	157.2	0.62
56	92.96	52.96	0.100	151.5	0.59
57	93.57	52.47	0.095	134.3	0.51
58	94.18	51.99	0.089	118.0	0.44
59	94.80	51.51	0.079	92.9	0.35
60	95.42	51.04	0.069	71.1	0.26
61	96.06	50.58	0.057	48.7	0.18
62	96.69	50.12	0.045	30.5	0.11
63	97.34	49.67	0.032	15.4	0.05
64	97.99	49.22	0.019	5.2	0.02
65	98.64	48.78	0.013	2.6	0.01
66	99.31	48.35	0.015	3.5	0.01
67	99.97	47.92	0.019	5.4	0.02
68	100.65	47.50	0.030	13.1	0.04
69	101.32	47.08	0.040	24.0	0.08
70	102.01	46.67	0.047	33.6	0.11
71	102.70	46.26	0.054	43.4	0.14
72	103.39	45.86	0.059	51.9	0.16
73	104.09	45.47	0.061	56.2	0.17
74	104.79	45.08	0.064	60.6	0.18
75	105.50	44.69	0.062	58.0	0.17
76	106.22	44.31	0.060	53.8	0.16
77	106.93	43.94	0.057	48.7	0.14
78	107.66	43.57	0.051	38.5	0.11
79	108.38	43.21	0.044	29.7	0.08
80	109.11	42.85	0.038	21.6	0.06
81	109.85	42.49	0.031	14.3	0.04
82	110.59	42.14	0.024	8.5	0.02
83	111.33	41.80	0.025	9.3	0.03
84	112.08	41.46	0.031	14.7	0.04
85	112.83	41.12	0.038	21.4	0.06
86	113.59	40.79	0.048	35.0	0.09
87	114.34	40.46	0.061	55.9	0.14
88	115.11	40.14	0.074	81.4	0.21
89	115.87	39.82	0.086	110.7	0.28
90	116.64	39.50	0.098	143.6	0.35
91	117.42	39.19	0.110	180.4	0.44
92	118.19	38.89	0.121	217.8	0.52
93	118.97	38.58	0.130	253.0	0.60
94	119.76	38.29	0.139	290.3	0.68
95	120.54	37.99	0.148	329.2	0.76
96	121.33	37.70	0.153	352.9	0.80