

## **ENGINEERING EXHIBIT**

### **Application for Modification of Digital Low Power Television Construction Permit**

prepared for

#### **Gray Television Licensee, LLC**

WZAW-LD Wausau, WI

Facility ID 183262

Ch. 33 (digital) 15 kW

*Gray Television Licensee, LLC* (“Gray”) is the permittee of digital Low Power Television station WZAW-LD, Channel 33, Wausau, WI, Facility ID 183262. WZAW-LD is authorized to operate pursuant to a Construction Permit (“CP”, file# 0000001707) with 15 kW effective radiated power (“ERP”), directional. *Gray* herein seeks a minor modification of the CP to specify a reduction in antenna height and use of a different directional antenna pattern. No change in authorized site is proposed.

As authorized, WZAW-LD will utilize the tower structure associated with FCC Antenna Structure Registration number 1063096. As proposed herein, WZAW-LD will utilize a new antenna to be side-mounted on the tower rather than the top-mounted antenna which is currently authorized. No change to the overall structure height will result from this proposal. The site is located more than 121 kilometers (75 miles) from the reference coordinates of the cities listed in Appendix A of DA 09-1487.<sup>1</sup>

The proposed side-mount antenna is a Dielectric model DLP-8B/VP having circular polarization. The ERP is 15 kW using a “full service” out of channel emission mask. A plot of the directional antenna’s azimuthal pattern is supplied in Figure 1.

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<sup>1</sup>“Commencement of Rural, First-come, First-served digital licensing for Low Power Television and TV Translators Beginning August 25, 2009 and Commencement of Nationwide, First-come, First-served Digital Licensing for Low Power Television and TV Translator Services Beginning January 25, 2010,” Public Notice, DA 09-1487, Released June 29, 2009.

Figure 2 depicts the 51 dB $\mu$  coverage contour of the proposed facility as well as those of the current and original CP facilities, and demonstrates that the proposed contour has overlap with those of the existing and original CP facilities. The service area overlap demonstrates compliance with §73.3572 for a minor change.

Interference study per OET Bulletin 69<sup>2</sup> shows that the proposal complies with the FCC's interference protection requirements toward all digital television, television translator, LPTV, and Class A stations. The results, summarized in Table 1, show that any new interference does not exceed the FCC's interference limits (0.5 percent to full power and Class A stations, and 2.0 percent to secondary stations) to any facility except with respect to W34EO-D which does not present a conflict for the proposal.

The authorized W34EO-D facility (file# 0000008337, Ch. 34, Wausau, WI) would receive 2.51 percent interference from the proposed WZAW-LD, which exceeds the 2.0 percent limit towards LPTV stations. This is a reduction in the 2.55 percent interference caused to W34EO-D by the existing WZAW-LD CP facility. Table 2 supplies interference study details regarding the impact to W34EO-D from the authorized and proposed WZAW-LD. Accordingly, the proposal complies with §74.793 regarding interference protection to digital television, low power television, television translator, and Class A television facilities.

The site is located 325 km from the U.S. – Canadian border. The worst-case 19.5 dB $\mu$  F(50,10) co-channel DTV-to-DTV interfering contour is depicted in Figure 3 and does not reach Canada. Thus, international coordination is not required. The nearest FCC monitoring station is 392 km distant at Allegan, MI. This exceeds by a large margin the threshold minimum distance specified in §73.1030(c)(3) that would suggest consideration of the monitoring station. There are no AM stations within 3 km of the site.

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<sup>2</sup>FCC Office of Engineering and Technology Bulletin number 69, *Longley-Rice Methodology for Evaluating TV Coverage and Interference*, February 6, 2004 (“OET-69”). The implementation of OET-69 for this study followed the guidelines of OET-69 as specified therein. The default cell size of 1 km was employed. Comparisons of various results of this computer program (run on a Sun Sparc processor) to the Commission's implementation of OET-69 show excellent correlation.

### **Human Exposure to Radiofrequency Electromagnetic Field**

The proposed facility was evaluated for human exposure to RF energy using the procedures outlined in the FCC's OET Bulletin Number. 65. Based on OET-65 equation (10) and 15 percent antenna relative field in downward elevations (taken from antenna manufacturer pattern data), the calculated power density attributable to the proposed facility at locations near the transmitter site at a height of two meters above ground level is  $0.27 \mu\text{W}/\text{cm}^2$ , which is 0.1 percent of the general population / uncontrolled maximum permissible exposure limit. This is well below the five percent threshold limit described in §1.1307(b) regarding sites with multiple emitters, categorically excluding the applicant from responsibility for taking any corrective action in the areas where the proposal's contribution is less than five percent.

The general public will not be exposed to RF levels attributable to the proposal in excess of the FCC's guidelines. RF exposure warning signs will continue to be posted. With respect to worker safety, the applicant will coordinate exposure procedures with all pertinent stations and will reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from RF electromagnetic field exposure in excess of FCC guidelines.

Environmental matters covered by this exhibit are limited to the evaluation of exposure to RF electromagnetic field. The proposed facility involves installation of a new transmitting antenna to be side-mounted on an antenna support structure which was constructed prior to March 16, 2001. No change in structure height is proposed.

#### List of Attachments

Figure 1	Antenna Azimuthal Pattern
Figure 2	Coverage Contour Comparison
Figure 3	Interfering Contour to Canada
Table 1	Interference Analysis Results Summary
Table 2	Interference Study Details Regarding W34EO-D
Form 2100	Saved Version of Engineering Sections from FCC Form at Time of Upload

#### **Chesapeake RF Consultants, LLC**

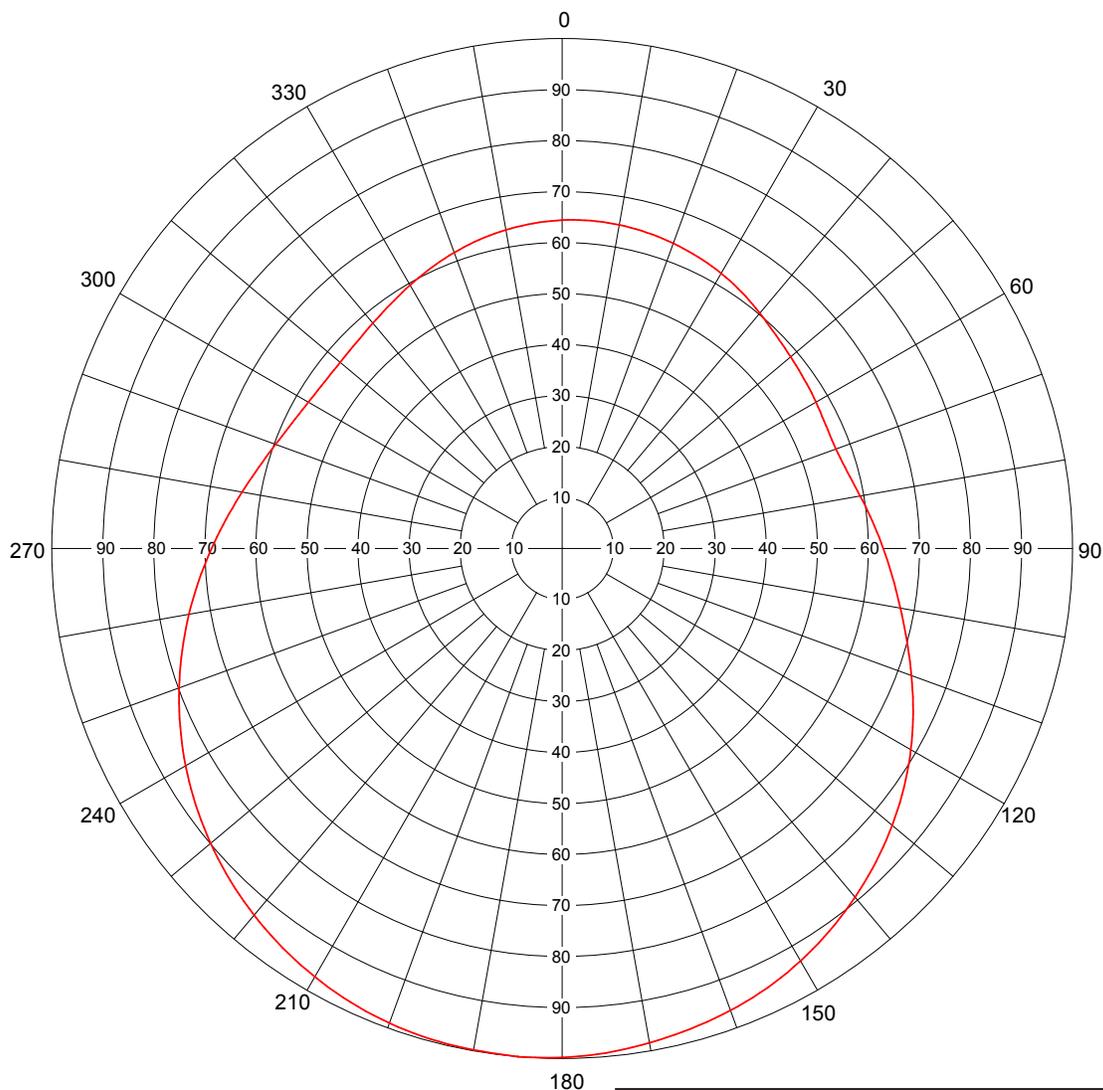
Joseph M. Davis, P.E.                      June 23, 2016  
207 Old Dominion Road                      Yorktown, VA 23692                      703-650-9600



Date **23 Jun 2016**  
Call Letters **WZAW-LD** Channel  
Location **Wausau, WI**  
Customer **Gray Television**  
Antenna Type **DLP-12B/VP**

### AZIMUTH PATTERN

Gain **1.70 (2.30 dB)** Frequency **MHz**  
Calculated / Measured **Calculated** Drawing # **TLP-B**



**Figure 1**  
**Antenna Azimuthal Pattern**  
**WZAW-LD Wausau, WI**  
**Facility ID 183262**  
**Ch. 33 (digital) 15 kW**

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prepared for  
**Gray Television Licensee, LLC**

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June, 2016

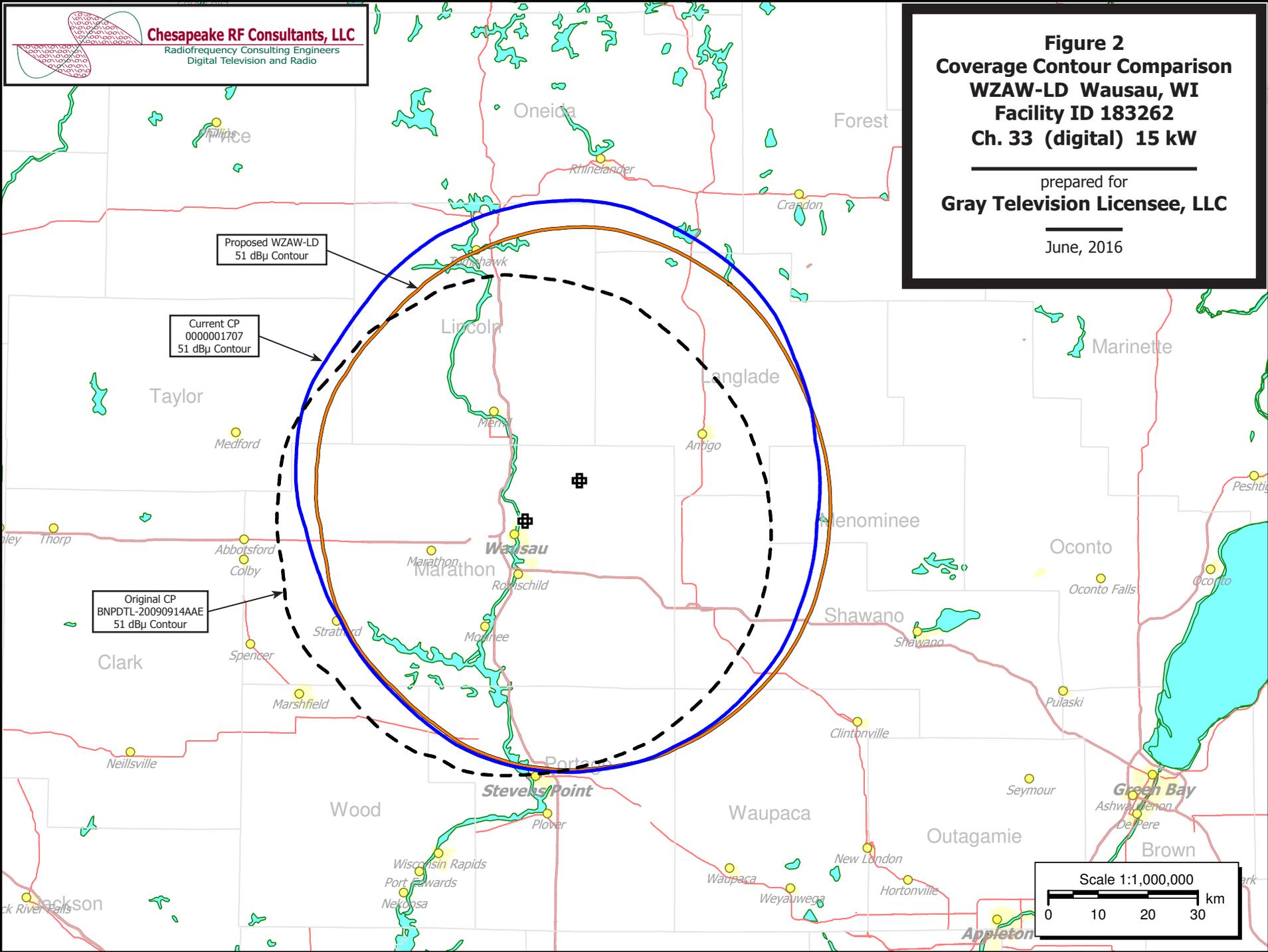
**Figure 2**  
**Coverage Contour Comparison**  
**WZAW-LD Wausau, WI**  
**Facility ID 183262**  
**Ch. 33 (digital) 15 kW**

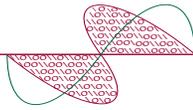
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prepared for  
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June, 2016



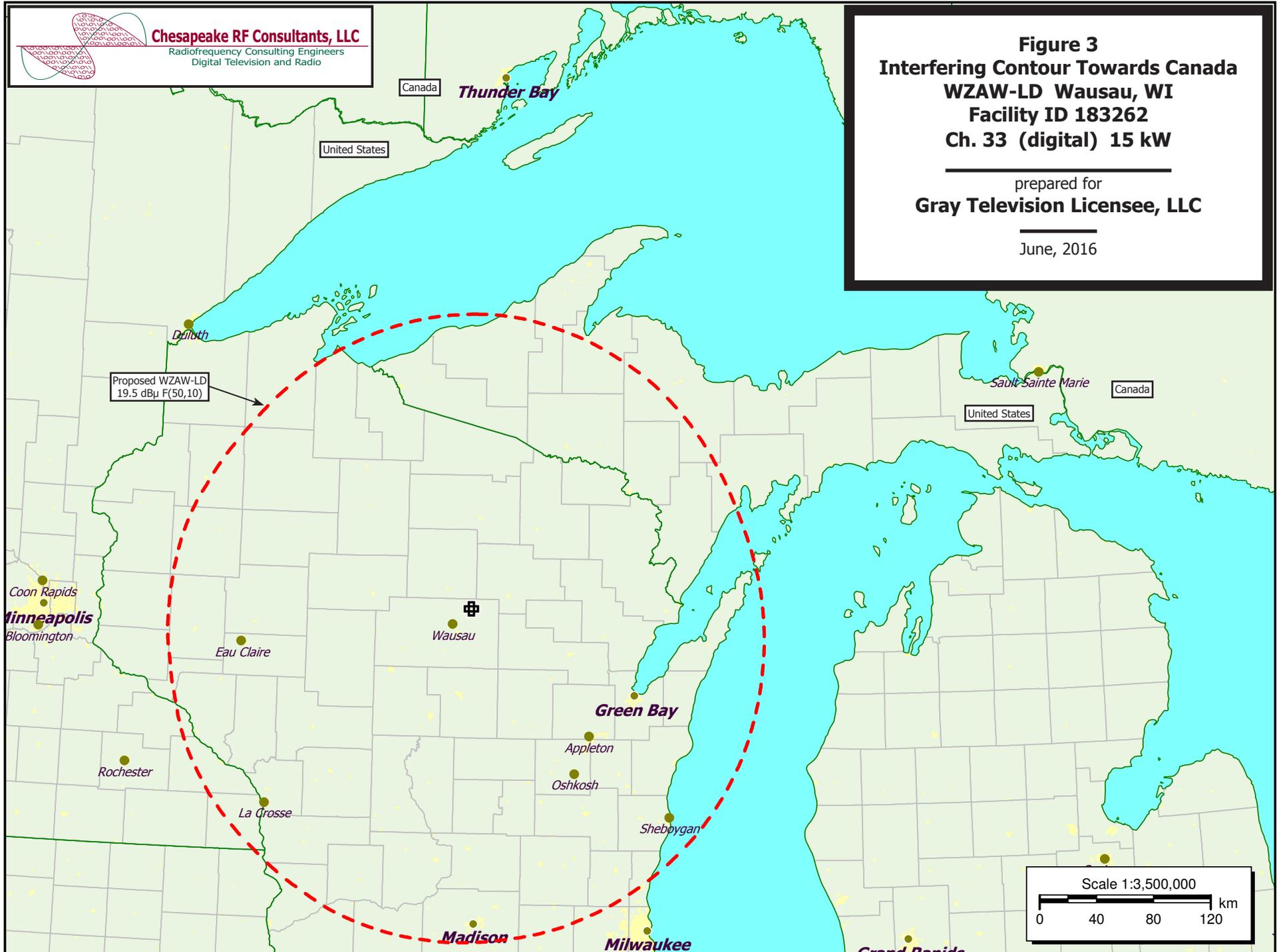


**Chesapeake RF Consultants, LLC**  
Radiofrequency Consulting Engineers  
Digital Television and Radio

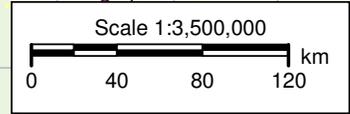
**Figure 3**  
**Interfering Contour Towards Canada**  
**WZAW-LD Wausau, WI**  
**Facility ID 183262**  
**Ch. 33 (digital) 15 kW**

prepared for  
**Gray Television Licensee, LLC**

June, 2016



Proposed WZAW-LD  
19.5 dBμ F(50,10)



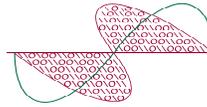
**Table 1**

**Interference Analysis Results Summary**

prepared for

**Gray Television Licensee, LLC**

WZAW-LD Wausau, WI



**Chesapeake RF Consultants, LLC**

Radiofrequency Consulting Engineers  
Digital Television and Radio

WZAW-LD	USERRECORD-01	WAUSAU	WI US
Channel 33	ERP 15. kW	HAAT 312. m	RCAMSL 00738 m FULL SERVICE MASK
Latitude 045-03-22		Longitude 0089-27-53	
Dir Antenna	Make usr	Model DIE TLP-B	Beam tilt N Ref Azimuth 185.

The LMS application requires NAD-83 coordinates. FCC internal systems then convert to NAD-27 and port over to CDBS for processing. This interference analysis utilizes truncated NAD-27 coordinates to replicate FCC processing.

Ch.	Call	City/State	Dist (km)	Status	Application Ref. No.	---Population (2000 Census)---	
						Baseline	New Interference
30	W30BU	GREEN BAY WI	140.2	LIC	BLTTL-20030923AAD	---	none
32	W32CV	IRONWOOD MI	163.9	APP	BLANK-4626	---	none
32	W32CV	IRONWOOD MI	163.9	LIC	BLTT-20040217ACE	---	none
32	K32GF	RHINELANDER WI	81.6	LIC	BLTT-20050929AGL	---	none
33	KAAL	MASON CITY IA	393.9	LIC	BLCDDT-20091009AAG	---	none
33	WCHU-LD	CHICAGO IL	381.0	LIC	BLDTL-20110928ALC	---	none
33	WCHU-LD	CHICAGO IL	381.0	CP	BDISDTL-20100720ABQ	---	none
33	WCHU-LD	CHICAGO IL	381.0	CP MOD	BMPDTL-20110912ACN	---	none
33	WOHO-CD	HOLLAND MI	375.3	LIC	BLDTA-20120316ACT	---	none
33	W33DR-D	HOUGHTON LAKE MI	376.1	CP	BNPDTL-20100223AAM	---	none
33	W33DS-D	ST. IGNACE MI	376.0	CP	BNPDTL-20100223ADS	---	none
33	K33MH-D	ALBANY MN	405.2	CP	BNPDTL-20100505AKI	---	none
33	KDLH	DULUTH MN	281.2	LIC	BLANK-7407	251,441	461 (0.18%)
33	K33LN-D	MINNEAPOLIS MN	299.3	LIC	BLDTA-20111219AEB	---	none
33	K33LJ-D	ROCHESTER MN	263.1	CP	BNPDTL-20100216ADX	---	none
33	W33DH-D	EAU CLAIRE WI	152.0	CP	BNPDTL-20100208ABH	---	none
33	W33DG-D	LA CROSSE WI	183.0	CP	BNPDTL-20100201AEU	170,478	0 (0.00%)
33	WITI	MILWAUKEE WI	251.8	LIC	BLCDDT-20091106AEL	2,900,671	4,561 (0.16%)
34	W34EO-D	WAUSAU WI	55.4	CP MOD	BLANK-8337	244,251	6,138 (2.51%)*
36	W36DH	WAUPACA WI	83.1	LIC	BLTT-20060824AAL	---	none

\*The current WZAW-LD CP facility causes 2.55 percent interference to W34EO-D (CP), and the proposed WZAW-LD reduces the interference to W34EO-D (CP) to 2.51 percent. See Table 2 for raw analysis report concerning W34EO-D.

**Table 2**

**Interference Study Details Regarding W34EO-D**

(page 1 of 2)



**Existing Condition  
Authorized WZAW-LD Interference to W34EO-D (CP): 2.55 percent**

WZAW-LD BLANK -0000001707 WAUSAU WI US  
 Channel 33 ERP 15. kW HAAT 357 m RCAMSL 00751 m FULL SERVICE MASK  
 Latitude 045-03-22 Longitude 0089-27-53  
 Status CP MOD Zone Border Site number: 01  
 Dir Antenna Make CDB Model 0000000090296 Beam tilt Y Ref Azimuth 0.0  
 Last update 20150623 Cutoff date 20150609 Docket  
 Comments  
 Applicant GRAY TELEVISION LICENSEE, LLC

Cell Size for Service Analysis 1.0 km/side  
 Distance Increments for Longley-Rice Analysis 1.00 km  
 %%

Analysis of Interference to Affected Station 18

Analysis of current record  
 Channel Call City/State Application Ref. No.  
 34 W34EO-D WAUSAU WI BLANK -0000008337

Stations Potentially Affecting This Station

Chan	Call	City/State	Dist(km)	Status	Application	Ref. No.
33	WZAW-LD	WAUSAU WI	55.3	CP MOD	BLANK	-0000001707
34	KQIN	DAVENPORT IA	372.6	LIC	BLEDT	-20120921ADS
34	KTCA-TV	SAINT PAUL MN	261.6	LIC	BLEDT	-20060802AAO
34	WISN-TV	MILWAUKEE WI	229.8	LIC	BLCDT	-20101104AAA
35	WEZY-LP	TOMAH WI	101.0	CP	BDISDTL	-20120511AEI

Total scenarios = 1

Result key: 4  
 Scenario 1 Affected station 18  
 Before Analysis

Results for: 34A WI WAUSAU BLANK 0000008337 CP  
 HAAT 120.0 m, ATV ERP 15.0 kW  
 POPULATION AREA (sq km)  
 within Noise Limited Contour 244482 6192.1  
 not affected by terrain losses 244343 6191.1  
 lost to NTSC IX 0 0.0  
 lost to additional IX by ATV 92 3.0  
 lost to ATV IX only 92 3.0  
 lost to all IX 92 3.0

Potential Interfering Stations Included in above Scenario 1

34A MN SAINT PAUL	BLEDT	20060802AAO	LIC
34A WI MILWAUKEE	BLCDT	20101104AAA	LIC

After Analysis

Results for: 34A WI WAUSAU BLANK 0000008337 CP  
 HAAT 120.0 m, ATV ERP 15.0 kW  
 POPULATION AREA (sq km)  
 within Noise Limited Contour 244482 6192.1  
 not affected by terrain losses 244343 6191.1  
 lost to NTSC IX 0 0.0  
 lost to additional IX by ATV 6332 26.0  
 lost to ATV IX only 6332 26.0  
 lost to all IX 6332 26.0

Potential Interfering Stations Included in above Scenario 1

34A MN SAINT PAUL	BLEDT	20060802AAO	LIC
34A WI MILWAUKEE	BLCDT	20101104AAA	LIC
33A WI WAUSAU	BLANK	0000001707	CP

Percent new interference from proposal: 2.5547 to BLANK 0000008337

Worst case new IX 2.5547% Scenario 1

**Table 2**

**Interference Study Details Regarding W34EO-D**  
(page 2 of 2)



**Proposed Condition**  
**Proposed WZAW-LD Interference to W34EO-D (CP): 2.51 percent**

WZAW-LD USERRECORD-01 WAUSAU WI US  
 Channel 33 ERP 15. kW HAAT 312. m RCAMSL 00738 m FULL SERVICE MASK  
 Latitude 045-03-22 Longitude 0089-27-53  
 Status APP Zone 2 Border Site number: 01  
 Dir Antenna Make usr Model DIE\_TLP-B Beam tilt N Ref Azimuth 185.  
 Last update Cutoff date Docket  
 Comments  
 Applicant

Cell Size for Service Analysis 1.0 km/side  
 Distance Increments for Longley-Rice Analysis 1.00 km  
 #####

Analysis of Interference to Affected Station 20

Analysis of current record  
 Channel Call City/State Application Ref. No.  
 34 W34EO-D WAUSAU WI BLANK -0000008337

Stations Potentially Affecting This Station

Chan	Call	City/State	Dist(km)	Status	Application	Ref. No.
34	KQIN	DAVENPORT IA	372.6	LIC	BLEDT	-20120921ADS
34	KTCA-TV	SAINT PAUL MN	261.6	LIC	BLEDT	-20060802AAO
34	WISN-TV	MILWAUKEE WI	229.8	LIC	BLCDT	-20101104AAA
35	WEZY-LP	TOMAH WI	101.0	CP	BDISDTL	-20120511AEI
33	WZAW-LD	WAUSAU WI	55.4	APP	USERRECORD-01	

Total scenarios = 1

Result key: 5  
 Scenario 1 Affected station 20  
 Before Analysis

Results for: 34A WI WAUSAU BLANK 0000008337 CP  
 HAAT 120.0 m, ATV ERP 15.0 kW

	POPULATION	AREA (sq km)
within Noise Limited Contour	244482	6192.1
not affected by terrain losses	244343	6191.1
lost to NTSC IX	0	0.0
lost to additional IX by ATV	92	3.0
lost to ATV IX only	92	3.0
lost to all IX	92	3.0

Potential Interfering Stations Included in above Scenario 1

34A MN SAINT PAUL	BLEDT	20060802AAO	LIC
34A WI MILWAUKEE	BLCDT	20101104AAA	LIC

After Analysis

Results for: 34A WI WAUSAU BLANK 0000008337 CP  
 HAAT 120.0 m, ATV ERP 15.0 kW

	POPULATION	AREA (sq km)
within Noise Limited Contour	244482	6192.1
not affected by terrain losses	244343	6191.1
lost to NTSC IX	0	0.0
lost to additional IX by ATV	6230	21.0
lost to ATV IX only	6230	21.0
lost to all IX	6230	21.0

Potential Interfering Stations Included in above Scenario 1

34A MN SAINT PAUL	BLEDT	20060802AAO	LIC
34A WI MILWAUKEE	BLCDT	20101104AAA	LIC
33A WI WAUSAU	USERRECORD01		APP

Percent new interference from proposal: 2.5130 to BLANK 0000008337

Worst case new IX 2.5130% Scenario 1

**Channel and Facility Information**

Section	Question	Response
Proposed Community of License	Facility ID	183262
	State	Wisconsin
	City	WAUSAU
	LPD Channel	33

**Antenna Location Data**

Section	Question	Response
Antenna Structure Registration	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes
	ASR Number	1063096
Coordinates (NAD83)	Latitude	45° 03' 22.0" N+
	Longitude	089° 27' 54.0" W-
	Structure Type	TOWER-A free standing or guyed struct
	Overall Structure Height	309.0 meters
	Support Structure Height	296.0 meters
	Ground Elevation (AMSL)	448.0 meters
Antenna Data	Height of Radiation Center Above Ground Level	290 meters
	Height of Radiation Center Above Mean Sea Level	738.0 m
	Effective Radiated Power	15 kW

**Antenna  
Technical Data**

Section	Question	Response
<b>Antenna Type</b>	Antenna Type	Directional Custom
	Do you have an Antenna ID?	No
	Antenna ID	
<b>Antenna Manufacturer and Model</b>	Manufacturer:	DIE
	Model	DLP-12B/VP
	Rotation	185 degrees
	Electrical Beam Tilt	1
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Circular
<b>Elevation Radiation Pattern</b>	Does the proposed antenna propose elevation radiation patterns that vary with azimuth for reasons other than the use of mechanical beam tilt?	No
	Uploaded file for elevation antenna (or radiation) pattern data	
	Out-of-Channel Emission Mask:	Full Service

**Directional Antenna Relative Field Values (Pre-rotated Pattern)**

Degree	V <sub>A</sub> (Authorized Value)						
0	1.0	90	0.661	180	0.645	270	0.650
10	0.996	100	0.615	190	0.641	280	0.699
20	0.981	110	0.583	200	0.631	290	0.759
30	0.955	120	0.569	210	0.613	300	0.817
40	0.920	130	0.571	220	0.592	310	0.869
50	0.876	140	0.586	230	0.579	320	0.914
60	0.826	150	0.607	240	0.570	330	0.951
70	0.771	160	0.627	250	0.579	340	0.975
80	0.714	170	0.640	260	0.610	350	0.993

**Additional Azimuths**

Degree	V <sub>A</sub>
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