ENGINEERING EXHIBIT

Application for Minor Modification of Digital Low Power Television Station Construction Permit

prepared for

Gray Television Licensee, LLC
K23MQ-D Duluth, MN
Facility ID 185810
Ch. 23 2.5 kW Nondirectional

Gray Television Licensee, LLC ("Gray") is the permittee of unbuilt digital Low Power Television station K23MQ-D, Channel 23, Duluth MN, Facility ID 185810. K23MQ-D is authorized to operate pursuant to a Construction Permit ("CP", file# BNPDTL-20100428ABY) with 15 kW effective radiated power ("ERP"), nondirectional. *Gray* herein seeks a modification of the CP to specify a different transmitting location, increased antenna height, and decreased ERP.

The proposed K23MQ-D facility will share the existing broadband antenna utilized by *Gray's* stations KBJR-TV (Ch. 19, Fac ID 33658, Superior WI) and KDLH (Ch. 33, Fac ID 4691, Duluth MN). The broadband antenna is top-mounted on the tower structure associated with FCC Antenna Structure Registration number 1024268, located 22.1 km (13.7 miles) from the current CP site. The site is located more than 75 miles (121 km) from the reference coordinates of the markets listed in Appendix A of DA 09-1487[1]. No change to the overall structure height is proposed.

The broadband antenna is a Dielectric model TUA-O4-10/40H-1-T-R, horizontally polarized. The proposed ERP is 2.5 kW directional using a "full service" out of channel emission mask. Figure 1 depicts the 51 dBµ coverage contour of the proposed facility as well as that of the CP facility, demonstrating compliance with §73.3572 for a minor change.

[1] *"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.

Interference study per OET Bulletin 69[2] 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.

The site is located 145 km from the U.S. – Canada border. For Canada referral purposes, the 24.66 dBµ F(50,10) contour is relevant for digital Low Power Television operations on Channel 23. The 24.66 dBµ F(50,10) contour is depicted in Figure 2 and does not reach Canada. Thus, international coordination is not required.

Human Exposure to Radiofrequency Electromagnetic Field (Environmental)

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 assuming the worst-case of 100 percent antenna relative field in downward elevations, 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 1.5 µW/cm^2, which is 0.4 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. When the antenna's elevation pattern is considered the calculated RF density will be even lower.

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,

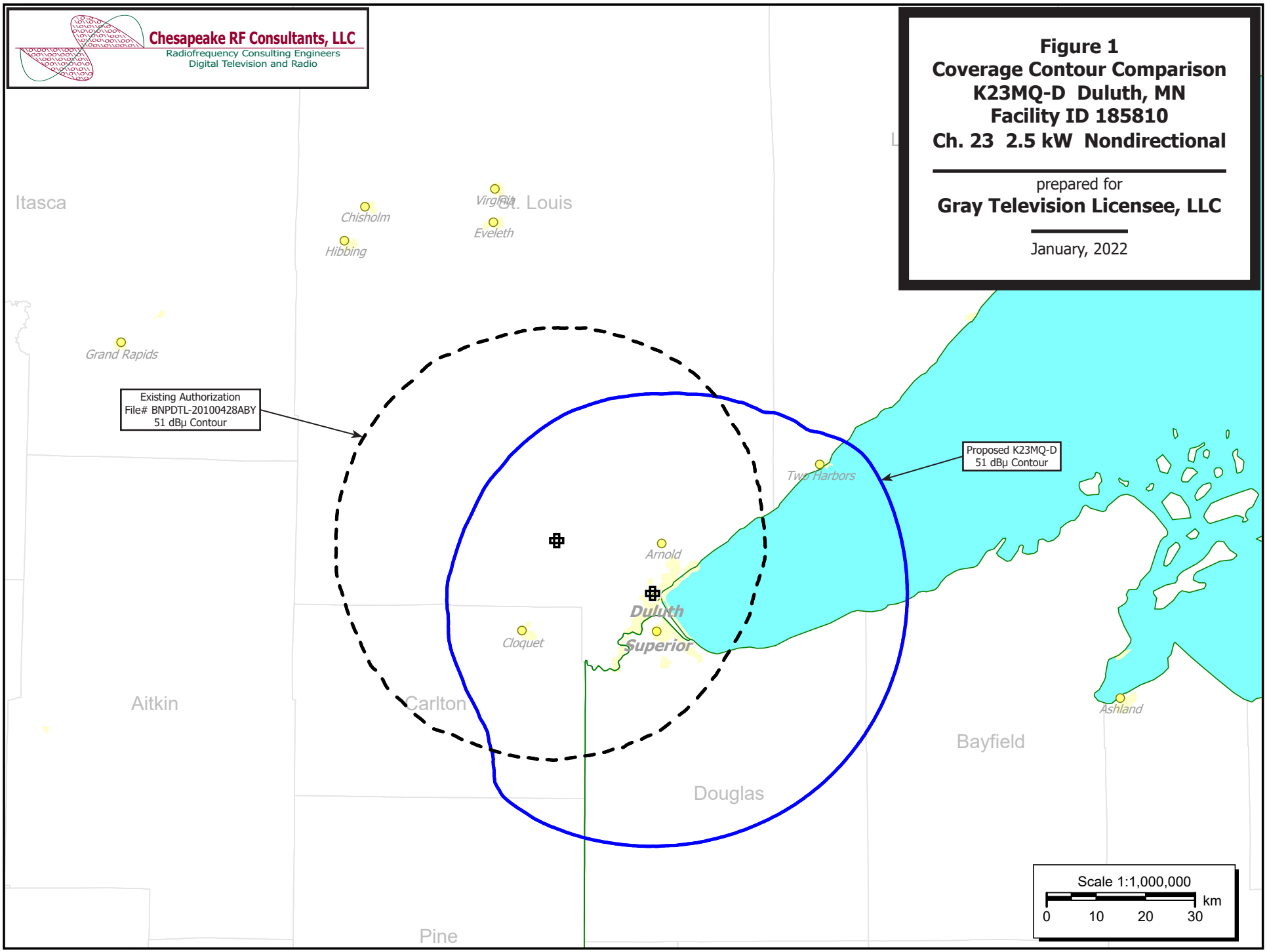
[2]FCC Office of Engineering and Technology Bulletin number 69, *Longley-Rice Methodology for Evaluating TV Coverage and Interference*, February 6, 2004 ("OET-69"). This analysis employed the FCC's current "TVStudy" software with the default application processing template settings, 1 km cell size, and 1 km terrain increment. Comparisons of various results of this computer program (run on a Mac processor) to the FCCs implementation of TVStudy show excellent correlation.

tower, or antenna from RF electromagnetic field exposure in excess of FCC guidelines. This exhibit is limited to the evaluation of exposure to RF electromagnetic field. No change in structure height is proposed.

List of Attachments

Figure 1	Coverage Contour Comparison
Figure 2	Interfering Contour Towards Canada
Table 1	TVStudy Analysis of Proposal
Form 2100	Saved Version of Engineering Sections of FCC Form at Time of Upload

Chesapeake RF Consultants, LLC
Joseph M. Davis, P.E. January 3, 2022
207 Old Dominion Road Yorktown, VA 23692 703-650-9600


Chesapeake RF Consultants, LLC
Radiofrequency Consulting Engineers
Digital Television and Radio
Figure 1
Coverage Contour Comparison
K23MQ-D Duluth, MN
Facility ID 185810
Ch. 23 2.5 kW Nondirectional
prepared for
Gray Television Licensee, LLC
January, 2022
Itasca
Chisholm
Hibbing
Virginia
Eveleth
St. Louis
Grand Rapids
Existing Authorization
File# BNPDTL-20100428ABY
51 dBµ Contour
Proposed K23MQ-D
51 dBµ Contour
Two Harbors
Arnold
Duluth
Superior
Cloquet
Aitkin
Carlton
Douglas
Bayfield
Ashland
Pine
Scale 1:1,000,000
km
0
10
20
30

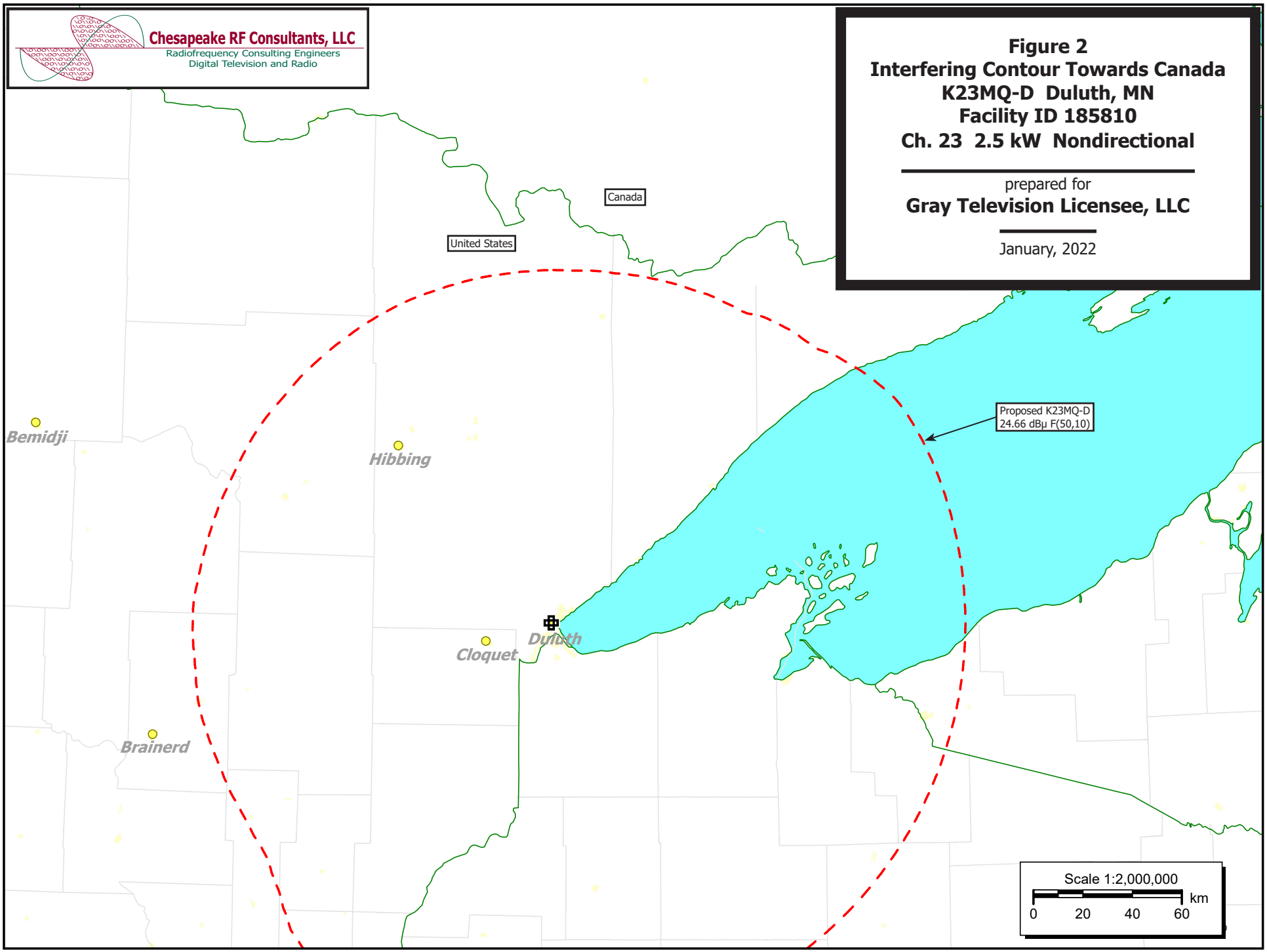

Chesapeake RF Consultants, LLC
Radiofrequency Consulting Engineers
Digital Television and Radio
Figure 2
Interfering Contour Towards Canada
K23MQ-D Duluth, MN
Facility ID 185810
Ch. 23 2.5 kW Nondirectional
prepared for
Gray Television Licensee, LLC
January, 2022
Canada
United States
Proposed K23MQ-D
24.66 dBµ F(50,10)
Bemidji
Hibbing
Cloquet
Duluth
Brainerd
Scale 1:2,000,000
km
0
20
40
60

Table 1 K23MQ-D TVStudy Analysis of Proposal


```
tvstudy v2.2.5 (4uoc83)
Database: localhost,  Study: K23MQ-D prop2.5kW,  Model: Longley-Rice
Start: 2022.01.03 11:02:54

Study created: 2022.01.03 11:02:54

Study build station data: LMS TV 2022-01-02

    Proposal: K23MQ-D D23 LD APP DULUTH, MN
 File number: K23MQ-D prop2.5kW
 Facility ID: 185810
Station data: User record
   Record ID: 4102
     Country: U.S.

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

Search options:
Baseline record excluded if station has CP
```

Stations potentially affected by proposal:

IX	Call	Chan	Svc	Status	City, State	File Number	Distance
No	K15GT-D	N15-	TX	LIC	HIBBING, MN	BLTT20040909ABE	91.5 km
No	K16BQ-D	N16+	TX	LIC	BRAINERD, MN	BLTT19880608IT	165.2
No	K22OS-D	D22	LD	CP	BRAINERD, MN	BLANK0000156034	162.6
No	WUCW	D22	DT	LIC	MINNEAPOLIS, MN	BLCDT20060405AAI	207.7
No	K22MR-D	D22-	LD	LIC	VIRGINIA, MN	BLANK0000073048	83.5
No	K23KZ-D	D23	LD	LIC	BIGFORK/MARCELL, MN	BLDTT20111107ALI	151.8
No	KQEG-CD	D23	DC	LIC	LA CRESCENT, MN	BLANK0000001542	344.0
No	K23FP-D	D23	LD	LIC	OLIVIA, MN	BLDTT20120213ABJ	310.9
No	K23MF-D	D23	LD	LIC	ST. JAMES, MN	BLANK0000123670	355.4
Yes	KTCI-TV	D23	DT	LIC	ST. PAUL, MN	BLEDT20100326AAI	207.6
No	K23PT-D	D23	LD	CP	WELLS, MN	BLANK0000153904	371.2
No	KCPM-LP	D23+	LD	APP	FARGO, ND	BLANK0000151969	355.1
No	W23FC-D	D23	LD	LIC	EAU CLAIRE, WI	BLANK0000164596	215.8
No	WBAY-TV	D23	DT	LIC	GREEN BAY, WI	BLANK0000163423	414.9
No	KSAX	D24	DT	LIC	ALEXANDRIA, MN	BLANK0000074900	264.7
No	K24JR-D	D24	LD	APP	ORR, MN	BLDTT20120315AAK	142.7
No	WEAU	D24	LD	APP	EAU CLAIRE, WI	BLANK0000121739	226.7
No	W24CL-D	D24	LD	LIC	GRANTSBURG, WI	BLANK0000062268	108.8
No	K31GH-D	N31-	TX	LIC	HAYWARD, WI	BLTTL20020729AAS	103.4

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

```
    Channel: D23
       Mask: Full Service
   Latitude:  46 47 21.10 N (NAD83)
  Longitude:  92  6 51.40 W
Height AMSL: 616.8 m
       HAAT: 0.0 m
   Peak ERP: 2.50 kW
    Antenna: Omnidirectional
Elev Pattrn: Generic
  Elec Tilt: 0.80
```

49.7 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	2.50 kW	194.7 m	41.8 km
45.0	2.50	308.9	47.9
90.0	2.50	433.8	53.2
135.0	2.50	433.8	53.2
180.0	2.50	419.9	52.7
225.0	2.50	298.9	47.4
270.0	2.50	215.6	43.0
315.0	2.50	188.9	41.5

Database HAAT does not agree with computed HAAT

Table 1 K23MQ-D TVStudy Analysis of Proposal

Database HAAT: 0 m Computed HAAT: 312 m

Proposal 24.66 dBu contour does not cross Canadian border
Distance to Canadian border: 145.4 km

Distance to Mexican border: 2054.3 km

Conditions at FCC monitoring station: Allegan MI
Bearing: 131.5 degrees Distance: 672.7 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 239.8 degrees Distance: 1286.7 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%

Interference to BLEDT20100326AAI LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KTCI-TV	D23	DT	LIC	ST. PAUL, MN	BLEDT20100326AAI	
Undesireds:	K23MQ-D	D23	LD	APP	DULUTH, MN	K23MQ-D prop2.5kW	207.6 km
	WUCW	D22	DT	LIC	MINNEAPOLIS, MN	BLCDT20060405AAI	1.3
	KCWI-TV	D23	DT	APP	AMES, IA	BPCDT20130205AAY	361.0
	KQEG-CD	D23	DC	LIC	LA CRESCENT, MN	BLANK0000001542	205.6
	W23BW-D	D23	DC	CP	MADISON, WI	BLANK0000127546	366.7
	KIMT	D24	DT	LIC	MASON CITY, IA	BLANK0000067292	179.0

Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX	
28803.0	3,608,122	28475.0	3,601,591	28172.3	3,593,852	28167.3	3,593,827	0.02	0.00

Undesired	Total IX		Unique IX, before		Unique IX, after	
K23MQ-D D23 LD APP	5.0	25			5.0	25
WUCW D22 DT LIC	251.3	6,807	247.3	6,759	247.3	6,759
KCWI-TV D23 DT APP	21.1	696	16.1	668	16.1	668
KQEG-CD D23 DC LIC	34.3	268	32.3	248	32.3	248
KIMT D24 DT LIC	3.0	16	1.0	16	1.0	16

Interference to BLEDT20100326AAI LIC scenario 2

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KTCI-TV	D23	DT	LIC	ST. PAUL, MN	BLEDT20100326AAI	
Undesireds:	K23MQ-D	D23	LD	APP	DULUTH, MN	K23MQ-D prop2.5kW	207.6 km
	WUCW	D22	DT	LIC	MINNEAPOLIS, MN	BLCDT20060405AAI	1.3
	KCWI-TV	D23	DT	LIC	AMES, IA	BLCDT20090612AIO	361.0
	KQEG-CD	D23	DC	LIC	LA CRESCENT, MN	BLANK0000001542	205.6
	W23BW-D	D23	DC	CP	MADISON, WI	BLANK0000127546	366.7
	KIMT	D24	DT	LIC	MASON CITY, IA	BLANK0000067292	179.0

Service area		Terrain-limited		IX-free, before		IX-free, after		Percent New IX	
28803.0	3,608,122	28475.0	3,601,591	28185.4	3,594,515	28180.4	3,594,490	0.02	0.00

Undesired	Total IX		Unique IX, before		Unique IX, after	
K23MQ-D D23 LD APP	5.0	25			5.0	25
WUCW D22 DT LIC	251.3	6,807	250.3	6,787	250.3	6,787
KCWI-TV D23 DT LIC	3.0	5	3.0	5	3.0	5
KQEG-CD D23 DC LIC	34.3	268	32.3	248	32.3	248
KIMT D24 DT LIC	3.0	16	2.0	16	2.0	16

Table 1 K23MQ-D TVStudy Analysis of Proposal

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

Interference to proposal scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	K23MQ-D	D23	LD	APP	DULUTH, MN	K23MQ-D prop2.5kW	
Undesireds:	KTCI-TV	D23	DT	LIC	ST. PAUL, MN	BLEDT20100326AAI	207.6 km

Service area		Terrain-limited		IX-free		Percent IX	
7271.4	196,969	7239.2	196,489	7230.0	196,391	0.13	0.05

Undesired	Total IX		Unique IX		Prcnt Unique IX	
KTCI-TV D23 DT LIC	9.1	98	9.1	98	0.13	0.05

Channel and Facility Information

Section	Question	Response
Facility ID	185810	
State	Minnesota	
City	DULUTH	
LPD Channel	23	

Primary station proposed to be rebroadcast:

Facility Id	Call Sign	City	State

Antenna Location Data

Section	Question	Response
Antenna Structure Registration	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes
	ASR Number	1024268
Coordinates (NAD83)	Latitude	46° 47' 21.1" N+
	Longitude	092° 06' 51.4" W-
	Structure Type	GTOWER-Guyed Structure Used for Communication Purposes
	Overall Structure Height	245.0 meters
	Support Structure Height	218.5 meters
	Ground Elevation (AMSL)	379.5 meters
Antenna Data	Height of Radiation Center Above Ground Level	237.3 meters
	Height of Radiation Center Above Mean Sea Level	616.8 meters
	Effective Radiated Power	2.5 kW

Antenna Technical Data

Section	Question	Response
Antenna Type	Antenna Type	Non-Directional
	Do you have an Antenna ID?	
	Antenna ID	
Antenna Manufacturer and Model	Manufacturer:	Dielectric
	Model	TUA-O4-10/40H-1-T-R
	Rotation	
	Electrical Beam Tilt	0.8
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Horizontal
Elevation Radiation Pattern	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