

ENGINEERING EXHIBIT

Digital Low Power Television Station Application for Minor Modification of Licensed Facility

prepared for

Gray Television Licensee, LLC

W31EV-D Wausau, WI

Facility ID 184339

Ch. 31 1.2 kW Directional

Gray Television Licensee, LLC (“Gray”) is the licensee of digital Low Power Television station W31EV-D, Channel 31, Facility ID 184339, Wausau WI. W31EV-D is licensed to operate at 15 kW effective radiated power (“ERP”) with a nondirectional antenna (file# 0000159546). *Gray* herein seeks a minor modification Construction Permit to relocate W31EV-D and to utilize a directional antenna at reduced ERP and antenna height.

The proposed facility will employ a side-mounted antenna on an existing antenna support structure located 27.4 km (17.0 miles) from the licensed site. The structure does not require an FCC Antenna Structure Registration number since its overall height is less than 61 meters above ground and the structure passes the FCC’s “TOWAIR” slope test program. No change to the overall structure height is proposed.

The proposed antenna is a Kathrein model K723147 (single panel) having horizontal polarization. The proposed ERP is 1.2 kW using a “simple” out of channel emission mask. A plot of the directional antenna’s azimuthal pattern is supplied in Figure 1. Figure 2 depicts the coverage contour of the proposed facility as well as that of the licensed facility, demonstrating compliance with §73.3572 for a minor change.

Interference study per OET Bulletin 69¹ shows that the proposal complies with the FCC’s interference protection requirements toward all digital television, television translator, LPTV, and

¹FCC 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.

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.

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 20 percent antenna relative field in downward elevations (pattern data shows 20 percent or less relative field at angles 30 to 90 degrees below the antenna), 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 $2.5 \mu\text{W}/\text{cm}^2$, which is 0.6 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 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. This exhibit is limited to the evaluation of exposure to RF electromagnetic field. No increase in structure height is proposed.

List of Attachments

Figure 1	Antenna Azimuthal Pattern
Figure 2	Coverage Contour Comparison
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. February 22, 2022
207 Old Dominion Road Yorktown, VA 23692 703-650-9600

Comparisons of various results of this computer program (run on a Mac processor) to the FCCs implementation of TVStudy show excellent correlation.

**Azimuth Pattern - Relative Field
(True North)**

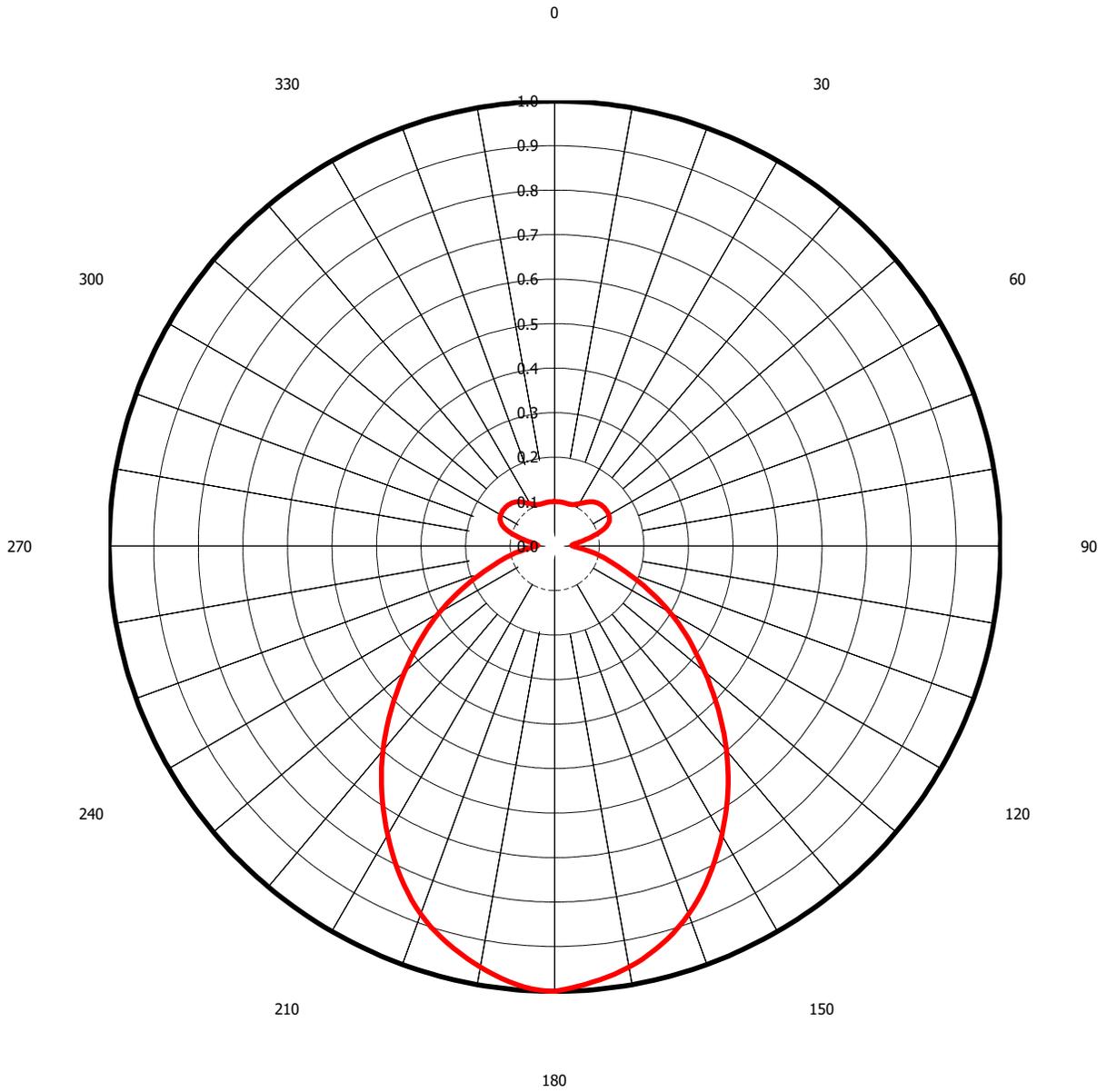
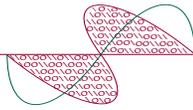


Figure 1
Antenna Azimuthal Pattern
W31EV-D Wausau, WI
Facility ID 184339
Ch. 31 1.2 kW Directional

prepared for
Gray Television Licensee, LLC

February, 2022



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

Rick
Ladysmith

Figure 2
Coverage Contour Comparison
W31EV-D Wausau, WI
Facility ID 184339
Ch. 31 1.2 kW Directional

prepared for
Gray Television Licensee, LLC

February, 2022

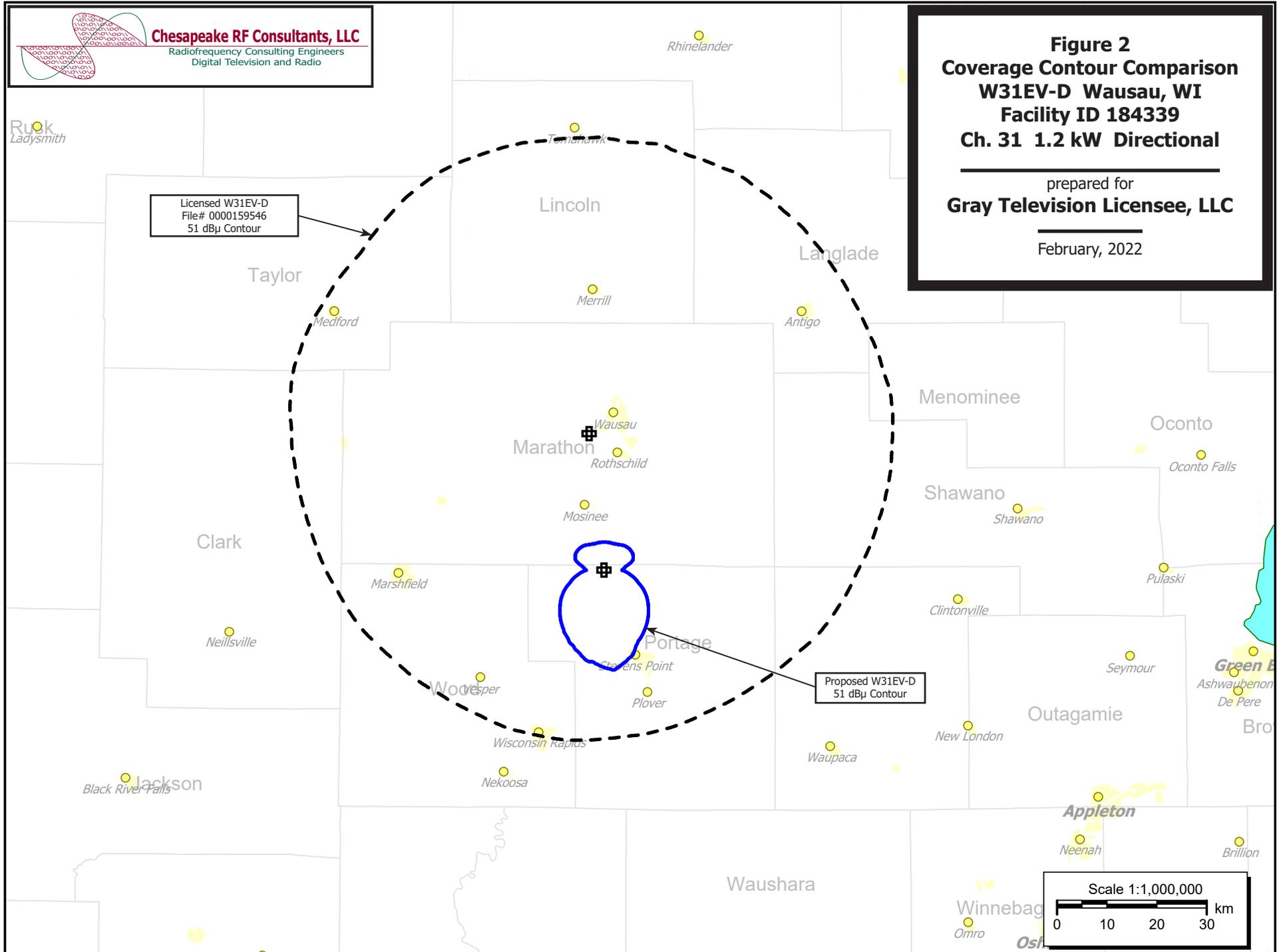


Table 1 W31EV-D TVStudy Analysis of Proposal
 (page 1 of 2)



tvstudy v2.2.5 (4uoc83)
 Database: localhost, Study: W31EV-D prop, Model: Longley-Rice
 Start: 2022.02.21 15:35:07

Study created: 2022.02.21 15:35:07

Study build station data: LMS TV 2022-02-18

Proposal: W31EV-D D31 LD APP WAUSAU, WI
 File number: W31EV-D prop
 Facility ID: 184339
 Station data: User record
 Record ID: 4210
 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	KSTC-TV	D30	DT	LIC	MINNEAPOLIS, MN	BLANK0000080959	277.9 km
No	KSTC-TV	D30	DT	CP	MINNEAPOLIS, MN	BLANK00000158230	277.9
No	WEAU	D30	LD	LIC	EAU CLAIRE, WI	BLANK00000124038	167.7
No	W30EN-D	D30	LD	CP	EAU CLAIRE, WI	BLANK00000071871	141.1
No	W30DZ-D	D30	LD	LIC	FENCE, WI	BLANK00000060424	152.0
No	W30BU	D30+	LD	CP	GREEN BAY, WI	BLANK00000072177	136.8
No	W30BU	N30+	TX	LIC	GREEN BAY, WI	BLTTTL20030923AAD	136.8
No	WPXE-TV	D30	DT	LIC	KENOSHA, WI	BLANK00000087614	225.4
No	K31NJ-D	D31	LD	LIC	LANSING, IA	BLANK00000093973	193.4
No	WFLD	D31	DT	LIC	CHICAGO, IL	BLANK00000055195	351.1
No	W31EZ-D	D31	LD	LIC	CHICAGO, IL	BLANK00000124951	349.6
No	WESV-LD	D31	LD	LIC	CHICAGO, IL	BLANK00000125079	349.6
No	WQAD-TV	D31	DT	LIC	MOLINE, IL	BLANK00000120809	378.4
No	WNIT	D31	DT	LIC	SOUTH BEND, IN	BLANK00000087078	441.2
No	W31FA-D	D31	LD	CP	ELMHURST, MI	BLANK00000143601	374.2
No	W31FF-D	D31	LD	LIC	MAPLE VALLEY, MI	BLANK00000158766	411.2
No	WMKG-CD	D31	DC	LIC	MUSKEGON, MI	BLANK00000107817	322.0
No	K31EF-D	D31	LD	LIC	FROST, MN	BLDPT20090730ACQ	362.0
No	WRPT	D31	DT	LIC	HIBBING, MN	BLEDT20090603AAY	394.1
No	WDMI-LD	D31	LD	LIC	MINNEAPOLIS, MN	BLDPTL20100809CIU	280.9
No	KARE	D31	DT	LIC	MINNEAPOLIS, MN	BLANK00000165989	277.9
No	K31LN-D	D31	LD	CP	ROCHESTER, MN	BNPDTL20100309AAW	232.7
No	K31KX-D	D31	LD	CP	ST CHARLES, MN	BNPDTL20090825BXU	201.4
No	W31DN-D	D31	LD	CP	EAU CLAIRE, WI	BNPDTL20090825AYR	141.1
No	K31GH-D	D31-	LD	LIC	HAYWARD, WI	BLANK0000016624	200.8
No	K31GH-D	N31-	TX	LIC	HAYWARD, WI	BLTTTL20020729AAS	200.8
No	WITI	D31	DT	LIC	MILWAUKEE, WI	BLANK00000086971	225.4
No	WJMN-TV	D32	DT	LIC	ESCANABA, MI	BLANK00000063727	266.1
No	WCCO-TV	D32	DT	LIC	MINNEAPOLIS, MN	BLANK00000176702	277.9
No	W32DW-D	D32	LD	CP	LA CROSSE, WI	BNPDTL20090825CAP	162.2
No	WTMJ-TV	D32	DT	LIC	MILWAUKEE, WI	BLANK00000086939	225.1
No	K18NQ-D	N32-	TX	LIC	RHINELANDER, WI	BLTT20050929AGL	126.3

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

Channel: D31
 Mask: Simple
 Latitude: 44 40 31.90 N (NAD83)
 Longitude: 89 39 11.90 W
 Height AMSL: 373.0 m
 HAAT: 0.0 m
 Peak ERP: 1.20 kW
 Antenna: KAT-1x K723147 (ID 1008960) 180.0 deg
 Elev Pattn: Generic

Table 1 W31EV-D TVStudy Analysis of Proposal
 (page 2 of 2)



50.4 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	0.012 kW	15.8 m	5.9 km
45.0	0.022	-2.0	6.8
90.0	0.002	18.4	3.7
135.0	0.324	27.5	13.0
180.0	1.20	37.2	20.1
225.0	0.324	23.8	13.0
270.0	0.002	27.2	3.7
315.0	0.022	20.7	6.8

Database HAAT does not agree with computed HAAT
 Database HAAT: 0 m Computed HAAT: 21 m

Distance to Canadian border: 367.4 km

Distance to Mexican border: 1951.3 km

Conditions at FCC monitoring station: Allegan MI
 Bearing: 126.4 degrees Distance: 376.0 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
 Bearing: 253.9 degrees Distance: 1370.4 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 proposal scenario 1

Desired:	Call	Chan	Svc	Status	City, State	File Number	Distance
	W31EV-D	D31	LD	APP	WAUSAU, WI	W31EV-D prop	
Undesireds:	K31GH-D	D31-	LD	LIC	HAYWARD, WI	BLANK0000016624	200.8 km
	Service area		Terrain-limited		IX-free	Percent IX	
	347.7	13,446	347.7	13,446	347.7	13,446	0.00 0.00

Channel and Facility Information

Section	Question	Response
Facility ID	184339	
State	Wisconsin	
City	WAUSAU	
LPD Channel	31	

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?	No
	ASR Number	
Coordinates (NAD83)	Latitude	44° 40' 31.9" N+
	Longitude	089° 39' 11.9" W-
	Structure Type	LTOWER-Lattice Tower
	Overall Structure Height	30.5 meters
	Support Structure Height	30.5 meters
	Ground Elevation (AMSL)	345.6 meters
Antenna Data	Height of Radiation Center Above Ground Level	27.4 meters
	Height of Radiation Center Above Mean Sea Level	373.0 meters
	Effective Radiated Power	1.2 kW

**Antenna
Technical Data**

Section	Question	Response
Antenna Type	Antenna Type	Directional Custom
	Do you have an Antenna ID?	Yes
	Antenna ID	1008960
Antenna Manufacturer and Model	Manufacturer:	KAT
	Model	1x K723147
	Rotation	180 degrees
	Electrical Beam Tilt	Not Applicable
	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:	Simple

Directional Antenna Relative Field Values (Pre-rotated Pattern)

Degree	Value	Degree	Value	Degree	Value	Degree	Value
0	1.000	90	0.04	180	0.10	270	0.04
10	0.96	100	0.06	190	0.10	280	0.09
20	0.88	110	0.12	200	0.10	290	0.17
30	0.75	120	0.14	210	0.11	300	0.30
40	0.60	130	0.14	220	0.13	310	0.44
50	0.44	140	0.13	230	0.14	320	0.60
60	0.30	150	0.11	240	0.14	330	0.75
70	0.17	160	0.10	250	0.12	340	0.88
80	0.09	170	0.10	260	0.06	350	0.96

Additional Azimuths

Degree	V _A
--------	----------------