

## **ENGINEERING EXHIBIT**

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

prepared for

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

K22OV-D Caputa, SD

Facility ID 186061

Ch. 22 1 kW Directional

*Gray Television Licensee, LLC* (“Gray”) is the permittee of unbuilt digital Low Power Television station K22OV-D, Channel 22, Caputa SD, Facility ID 186061. K22OV-D is authorized to operate pursuant to a Construction Permit (“CP”, file# 0000157645) with 15 kW effective radiated power (“ERP”), directional. The current CP was obtained as a displacement of the previously authorized operation on Channel 40 (callsign K40MR-D). *Gray* herein seeks a modification of the current CP to specify reduced ERP with the currently authorized antenna.

No change in site location is proposed from that which is currently authorized. The proposed facility will employ a new antenna to be side-mounted on the existing tower structure associated with FCC Antenna Structure Registration number 1042276. No change to the overall structure height is proposed.

The proposed antenna is a Dielectric model TFU-8WB-LP/VP-R C160 having elliptical polarization. The proposed ERP is 1.0 kW horizontally polarized and 0.69 kW vertically polarized 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 51 dBμ coverage contour of the proposed facility as well as those of the current and original CP facilities, demonstrating compliance with §73.3572 for a minor change.

Interference study per OET Bulletin 69<sup>1</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.

### **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 15 percent antenna relative field in downward elevations (pattern data shows 15 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  $0.06 \mu\text{W}/\text{cm}^2$ , which is 0.02 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. This exhibit is limited to the evaluation of exposure to RF electromagnetic field. No increase in structure height is proposed.

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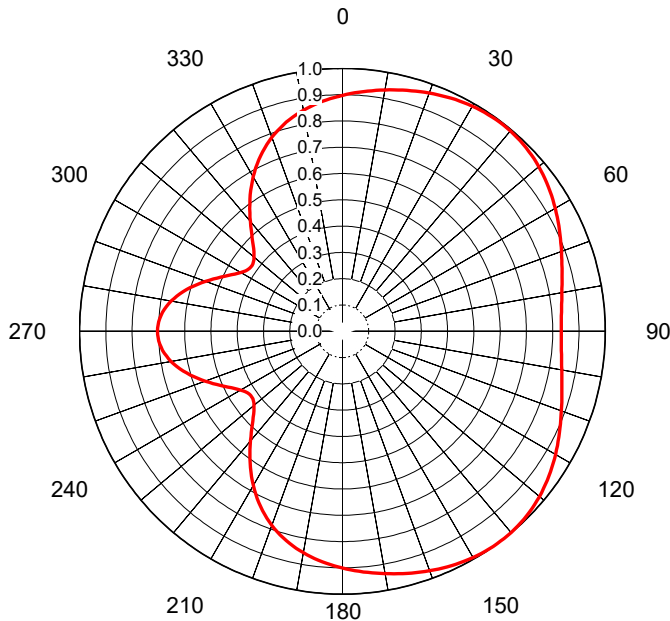
<sup>1</sup>FCC Office of Engineering and Technology Bulletin number 69, *Longley-Rice Methodology for Evaluating TV Coverage and Interference*, February 6, 2004 ("OET-69"). This analysis employed the FCC's current "TVStudy" software with the default application processing template settings, 1 km cell size, and 1.0 km terrain increment. Comparisons of various results of this computer program (run on a Mac processor) to the FCC's implementation of TVStudy show excellent correlation.

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.	December 24, 2021	
207 Old Dominion Road	Yorktown, VA 23692	703-650-9600



## AZIMUTH PATTERN Horizontal Polarization

Proposal No. **20210818jmd**  
Date **18-Aug-21**  
Call Letters **LPTV Ch 22**  
Channel **22**  
Frequency **521 MHz**  
Antenna Type **TFU-8WB-LP/VP-R C160**  
Gain **1.53 (1.85dB)**  
Calculated

Pattern Number **WB-C160-22 Hpol**

Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value
0	0.897	36	0.995	72	0.878	108	0.877	144	1.000	180	0.901	216	0.599	252	0.579	288	0.579
1	0.901	37	0.995	73	0.873	109	0.882	145	0.999	181	0.897	217	0.585	253	0.591	289	0.567
2	0.905	38	0.995	74	0.869	110	0.887	146	0.999	182	0.893	218	0.571	254	0.602	290	0.555
3	0.908	39	0.995	75	0.865	111	0.891	147	0.998	183	0.889	219	0.558	255	0.614	291	0.542
4	0.912	40	0.994	76	0.861	112	0.896	148	0.997	184	0.885	220	0.544	256	0.624	292	0.530
5	0.915	41	0.994	77	0.858	113	0.901	149	0.995	185	0.880	221	0.531	257	0.634	293	0.518
6	0.919	42	0.993	78	0.854	114	0.906	150	0.994	186	0.876	222	0.518	258	0.644	294	0.506
7	0.922	43	0.991	79	0.851	115	0.911	151	0.992	187	0.871	223	0.505	259	0.653	295	0.495
8	0.925	44	0.990	80	0.848	116	0.916	152	0.990	188	0.866	224	0.493	260	0.662	296	0.484
9	0.929	45	0.988	81	0.845	117	0.921	153	0.988	189	0.861	225	0.482	261	0.669	297	0.473
10	0.932	46	0.986	82	0.843	118	0.926	154	0.986	190	0.856	226	0.471	262	0.676	298	0.464
11	0.936	47	0.984	83	0.840	119	0.931	155	0.983	191	0.850	227	0.462	263	0.683	299	0.455
12	0.939	48	0.981	84	0.838	120	0.936	156	0.981	192	0.844	228	0.453	264	0.688	300	0.447
13	0.942	49	0.978	85	0.837	121	0.941	157	0.978	193	0.838	229	0.445	265	0.693	301	0.440
14	0.945	50	0.975	86	0.835	122	0.946	158	0.975	194	0.831	230	0.439	266	0.697	302	0.434
15	0.949	51	0.972	87	0.834	123	0.950	159	0.972	195	0.825	231	0.433	267	0.700	303	0.430
16	0.952	52	0.969	88	0.833	124	0.955	160	0.969	196	0.818	232	0.429	268	0.702	304	0.427
17	0.955	53	0.965	89	0.833	125	0.959	161	0.966	197	0.810	233	0.427	269	0.703	305	0.425
18	0.958	54	0.961	90	0.833	126	0.963	162	0.963	198	0.802	234	0.425	270	0.703	306	0.425
19	0.961	55	0.957	91	0.833	127	0.967	163	0.960	199	0.794	235	0.426	271	0.703	307	0.427
20	0.964	56	0.953	92	0.833	128	0.971	164	0.957	200	0.785	236	0.427	272	0.702	308	0.429
21	0.967	57	0.949	93	0.834	129	0.975	165	0.953	201	0.776	237	0.430	273	0.700	309	0.433
22	0.970	58	0.944	94	0.835	130	0.978	166	0.950	202	0.767	238	0.435	274	0.697	310	0.439
23	0.973	59	0.940	95	0.836	131	0.982	167	0.947	203	0.757	239	0.441	275	0.693	311	0.445
24	0.976	60	0.935	96	0.838	132	0.984	168	0.943	204	0.747	240	0.447	276	0.688	312	0.453
25	0.978	61	0.930	97	0.840	133	0.987	169	0.940	205	0.736	241	0.455	277	0.682	313	0.462
26	0.981	62	0.925	98	0.842	134	0.990	170	0.936	206	0.725	242	0.464	278	0.676	314	0.472
27	0.983	63	0.921	99	0.845	135	0.992	171	0.933	207	0.714	243	0.474	279	0.669	315	0.483
28	0.985	64	0.916	100	0.847	136	0.994	172	0.930	208	0.702	244	0.484	280	0.661	316	0.494
29	0.987	65	0.911	101	0.850	137	0.995	173	0.926	209	0.690	245	0.495	281	0.653	317	0.506
30	0.989	66	0.906	102	0.854	138	0.997	174	0.923	210	0.678	246	0.507	282	0.644	318	0.519
31	0.990	67	0.901	103	0.857	139	0.998	175	0.919	211	0.665	247	0.518	283	0.634	319	0.532
32	0.992	68	0.896	104	0.861	140	0.999	176	0.915	212	0.652	248	0.531	284	0.624	320	0.545
33	0.993	69	0.891	105	0.865	141	1.000	177	0.912	213	0.639	249	0.543	285	0.613	321	0.558
34	0.994	70	0.887	106	0.869	142	1.000	178	0.908	214	0.626	250	0.555	286	0.602	322	0.572
35	0.994	71	0.882	107	0.873	143	1.000	179	0.904	215	0.612	251	0.567	287	0.591	323	0.586

**Figure 1**  
**Antenna Azimuthal Pattern**  
**K22OV-D Caputa, SD**  
**Facility ID 186061**  
**Ch. 22 1 kW Directional**

prepared for  
**Gray Television Licensee, LLC**

December, 2021

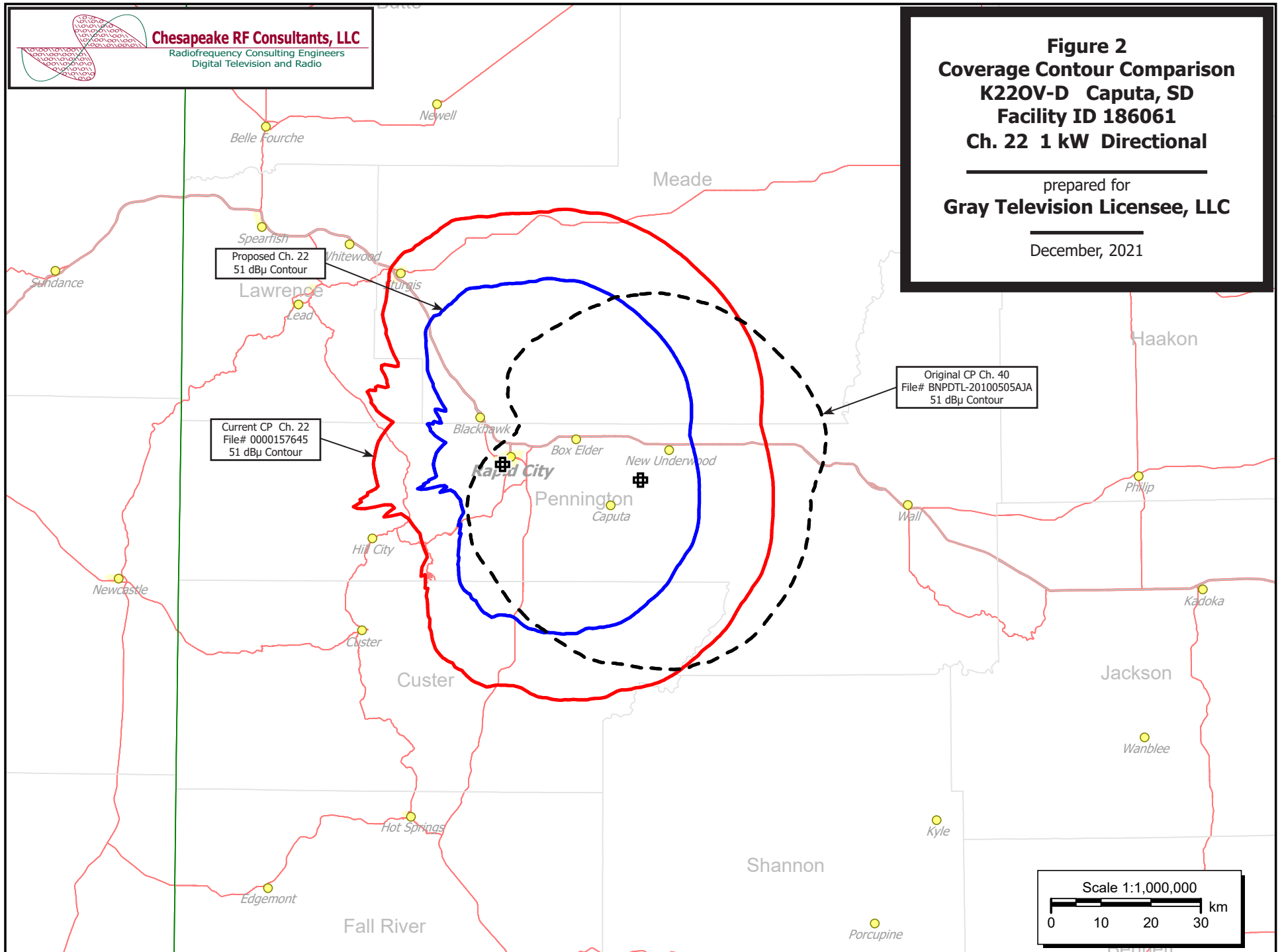


**Chesapeake RF Consultants, LLC**  
Radiofrequency Consulting Engineers  
Digital Television and Radio

**Figure 2**  
**Coverage Contour Comparison**  
**K22OV-D Caputa, SD**  
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# **Table 1 K220V-D TVStudy Analysis of Proposal** (page 1 of 3)



tvstudy v2.2.5 (4uoc83)  
Database: localhost, Study: K220V-D 1kW, Model: Longley-Rice  
Start: 2021.12.24 10:22:46

Study created: 2021.12.24 10:22:46

Study build station data: LMS TV 2021-12-23

Proposal: K220V-D D22 LD APP CAPUTA, SD  
File number: K220V-D 1kW  
Facility ID: 186061  
Station data: User record  
Record ID: 4095  
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
Yes	KNBN	D21	DT	CP	RAPID CITY, SD	BLANK0000035769	2.9 km
Yes	KNBN	D21	DT	LIC	RAPID CITY, SD	BLCDT20090206ACK	2.9
No	K22KW-D	D22	LD	LIC	JULESBURG, CO	BLDTT20120430AAL	358.6
No	K22NN-D	D22	LD	LIC	FORSYTH, MT	BLANK0000124961	362.5
No	KHMT	D22	DT	LIC	HARDIN, MT	BLCDT20090226AAD	427.3
No	KBME-TV	D22	DT	LIC	BISMARCK, ND	BLEDT20020122AAD	339.5
No	K22OU-D	D22	LD	CP	RELIANCE, SD	BLANK0000157105	291.9
No	K49LJ-D	D22	LD	CP	CASPER, WY	BLANK0000035784	287.4
No	K22AD	D22	LD	CP	GILLETTE, WY	BLANK0000115871	180.1
No	K22AD	N22	TX	LIC	GILLETTE, WY	BLTTL19940224JS	180.1
No	K22NJ-D	D22	LD	LIC	LUCERNE, WY	BLANK0000156701	373.1
No	KEVN-LD	D23	LD	LIC	RAPID CITY, SD	BLANK0000005141	0.0
No	KKRA-LP	N24	TX	LIC	RAPID CITY, SD	BLTTL19980213JB	2.9

No non-directional AM stations found within 0.8 km

No directional AM stations found within 3.2 km

Record parameters as studied:

Channel: D22  
Mask: Simple  
Latitude: 44 4 0.00 N (NAD83)  
Longitude: 103 15 3.00 W  
Height AMSL: 1275.9 m  
HAAT: 0.0 m  
Peak ERP: 1.00 kW  
Antenna: Dielectric-TFU-8WB-LP/VP-R (ID 1008573) 90.0 deg  
Elev Pattn: Generic  
Elec Tilt: 1.05

49.6 dBu contour:

Azimuth	ERP	HAAT	Distance
0.0 deg	0.806 kW	224.8 m	37.7 km
45.0	0.969	294.5	42.1
90.0	0.694	299.1	40.5
135.0	0.977	283.7	41.7
180.0	0.812	125.6	31.9
225.0	0.242	13.3	12.7
270.0	0.494	8.6	15.3
315.0	0.242	65.6	19.0

Database HAAT does not agree with computed HAAT  
Database HAAT: 0 m Computed HAAT: 164 m

Distance to Canadian border: 548.3 km

Distance to Mexican border: 1394.8 km

**Table 1 K220V-D TVStudy Analysis of Proposal**  
(page 2 of 3)



Conditions at FCC monitoring station: Grand Island NE  
Bearing: 129.8 degrees Distance: 527.4 km

Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:  
Bearing: 201.2 degrees Distance: 464.5 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%

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Interference to BLANK0000035769 CP scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KNBN	D21	DT	CP	RAPID CITY, SD	BLANK0000035769	
Undesireds:	K220V-D	D22	LD	APP	CAPUTA, SD	K220V-D 1kW	2.9 km
	Service area		Terrain-limited		IX-free, before	IX-free, after	Percent New IX
	16786.8	152,591	15692.8	138,770	15692.8	138,770	0.15 0.00
Undesired				Total IX	Unique IX, before	Unique IX, after	
K220V-D D22 LD APP			24.2	0		24.2 0	

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Interference to BLCDT20090206ACK LIC scenario 1

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	KNBN	D21	DT	LIC	RAPID CITY, SD	BLCDT20090206ACK	
Undesireds:	K220V-D	D22	LD	APP	CAPUTA, SD	K220V-D 1kW	2.9 km
	Service area		Terrain-limited		IX-free, before	IX-free, after	Percent New IX
	15089.8	145,842	14087.7	135,249	14087.7	135,249	0.29 0.00
Undesired				Total IX	Unique IX, before	Unique IX, after	
K220V-D D22 LD APP			41.4	0		41.4 0	

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Interference to proposal scenario 1  
2.81% interference received

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	K220V-D	D22	LD	APP	CAPUTA, SD	K220V-D 1kW	
Undesireds:	KNBN	D21	DT	CP	RAPID CITY, SD	BLANK0000035769	2.9 km
	K22AD	D22	LD	CP	GILLETTE, WY	BLANK0000115871	180.1
	KEVN-LD	D23	LD	LIC	RAPID CITY, SD	BLANK0000005141	0.0
	Service area		Terrain-limited		IX-free	Percent IX	
	3421.9	111,628	3112.1	110,113	2691.3	107,017	13.52 2.81
Undesired				Total IX	Unique IX	Prcnt Unique IX	
KNBN D21 DT CP			417.7	3,096	403.6	3,068	12.97 2.79
KEVN-LD D23 LD LIC			17.1	28	3.0	0	0.10 0.00

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Interference to proposal scenario 2

	Call	Chan	Svc	Status	City, State	File Number	Distance
Desired:	K220V-D	D22	LD	APP	CAPUTA, SD	K220V-D 1kW	
Undesireds:	KNBN	D21	DT	LIC	RAPID CITY, SD	BLCDT20090206ACK	2.9 km
	K22AD	D22	LD	CP	GILLETTE, WY	BLANK0000115871	180.1
	KEVN-LD	D23	LD	LIC	RAPID CITY, SD	BLANK0000005141	0.0
	Service area		Terrain-limited		IX-free	Percent IX	

**Table 1 K220V-D TVStudy Analysis of Proposal**  
(page 3 of 3)



3421.9	111,628	3112.1	110,113	2836.2	107,945	8.87	1.97
Undesired			Total IX		Unique IX	Prcnt Unique IX	
KNBN D21 DT LIC	272.9		2,168	258.8	2,140	8.31	1.94
KEVN-LD D23 LD LIC	17.1		28	3.0	0	0.10	0.00



**Channel and  
Facility  
Information**

Section	Question	Response
Facility ID	186061	
State	South Dakota	
City	CAPUTA	
LPD Channel	22	

**Primary station proposed to be rebroadcast:**

Facility Id	Call Sign	City	State
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**Antenna Location  
Data**

Section	Question	Response
<b>Antenna Structure Registration</b>	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes
	ASR Number	1042276
<b>Coordinates (NAD83)</b>	Latitude	44° 04' 00.0" N+
	Longitude	103° 15' 03.0" W-
	Structure Type	TOWER-A free standing or guyed struct
	Overall Structure Height	190.8 meters
	Support Structure Height	167.6 meters
	Ground Elevation (AMSL)	1132.6 meters
<b>Antenna Data</b>	Height of Radiation Center Above Ground Level	143.3 meters
	Height of Radiation Center Above Mean Sea Level	1275.9 meters
	Effective Radiated Power	1 kW

**Antenna  
Technical Data**

Section	Question	Response
<b>Antenna Type</b>	Antenna Type	Directional Custom
	Do you have an Antenna ID?	Yes
	Antenna ID	1008573
<b>Antenna Manufacturer and Model</b>	Manufacturer:	Dielectric
	Model	TFU-8WB-LP/VP-R
	Rotation	90 degrees
	Electrical Beam Tilt	1.05
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Elliptical
<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:	Simple

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

Degree	Value	Degree	Value	Degree	Value	Degree	Value
0	0.833	90	0.901	180	0.703	270	0.898
10	0.847	100	0.856	190	0.662	280	0.932
20	0.887	110	0.785	200	0.555	290	0.965
30	0.936	120	0.678	210	0.447	300	0.989
40	0.978	130	0.544	220	0.439	310	0.994
50	0.999	140	0.439	230	0.545	320	0.975
60	0.994	150	0.447	240	0.679	330	0.935
70	0.969	160	0.555	250	0.785	340	0.887
80	0.936	170	0.662	260	0.854	350	0.848

**Additional Azimuths**

Degree	V <sub>A</sub>
53	1
307	0.995