

ENGINEERING EXHIBIT

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

prepared for

Gray Television Licensee, LLC

K18NW-D Minot, ND

Facility ID 187460

Ch. 18 0.36 kW Directional

Gray Television Licensee, LLC (“Gray”) is the permittee of unbuilt digital Low Power Television station K18NW-D, Channel 18, Minot ND, Facility ID 187460. K18NW-D is authorized to operate pursuant to a Construction Permit (“CP”, file# 0000157642) with 0.15 kW effective radiated power (“ERP”), nondirectional. The current CP came about via a displacement of the previously authorized operation on Channel 38 (callsign K38OK-D, file# BNPDTL-20100609AGO). *Gray* herein seeks a modification of the CP to specify increased ERP, a directional antenna, and reduced antenna height.

As with the current authorization, the proposed facility will employ a new antenna system to be side-mounted on the existing tower structure associated with FCC Antenna Structure Registration number 1046243. No change to the overall structure height is proposed.

The proposed antenna is a Kathrein model 75010325 (single panel) having elliptical polarization. The proposed ERP is 0.36 kW horizontally polarized and 0.15 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 dB μ coverage contour of the proposed facility as well as that of the original CP facility (BNPDTL-20100609AGO), 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*

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 operation 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 considering 25 percent antenna relative field in downward elevations (antenna elevation pattern data shows 25 percent relative field or less for angles 30-90 degrees below the horizontal), the calculated signal density near the tower at two meters above ground level attributable to the proposed facility is $63.3 \mu\text{W}/\text{cm}^2$, which is 19.1 percent of the general population/uncontrolled maximum permitted exposure limit. A summary is provided below of RF signal density calculations that consider other authorized broadcast emitters that are co-located or near enough to be significant emitters.

Summary of Radiofrequency Electromagnetic Field Calculations

| Facility | Channel | ERP (kW) | Polar- ization | Relative Field | Height (meters) | S - Calculated ($\mu\text{W}/\text{cm}^2$) | S - Limit ($\mu\text{W}/\text{cm}^2$) | Percent of Limit |
|--|---------|-------------|-------------------|-----------------------------------|--------------------|---|--|---------------------|
| K18NW-D Minot, ND Proposed Facility | 18 | 0.36 | E | 0.25 | 6.1 | 63.3 | 331 | 19.1% |
| KMOT Minot, ND Lic BLCDDT-20090127AAR | 10 | 7.69 | H | 0.2 | 199 | 0.3 | 200 | 0.2% |
| KFLK(FM) Minot, ND CP 0000166718 | 201 | 100 | C | FMMModel #3 8-bay 1- λ | 149 | 18.6 | 200 | 9.3% |
| Total Calculated Signal Density: | | | | | | | | 28.6% |

ERP: Effective Radiated Power
 Polarization: H – Horizontal; V – Vertical; E – Elliptical; C – Circular
 Field: Elevation Pattern Relative Field Value
 Height: Height of radiation center above ground level
 S-Calc: OET Bulletin 65 calculated value of signal density at two meters above ground level
 S-Limit: §1.1310 uncontrolled/general population limit for signal density

The manufacturer's elevation pattern or generic assumption for each TV antenna was employed with computations per OET-65 equation (10). For FM stations the FCC's "FMMModel"

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.

computer analysis² was utilized. Individual station contributions were determined as a percentage of their respective exposure limit based on operating frequency and then all individual percentages were summed to determine the total RF exposure level. Based on this analysis and considering all broadcast facilities, the summary table shows that the total maximum calculated RF density at two meters above ground level is 28.6 percent of the FCC's uncontrolled / general population MPE limit.

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.

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. | June 29, 2022 | |
| 207 Old Dominion Road | Yorktown, VA 23692 | 703-650-9600 |

²Public Notice "Office of Engineering and Technology Announces Updates to FMModel Software"
DA 16-340, released March 31, 2016.

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

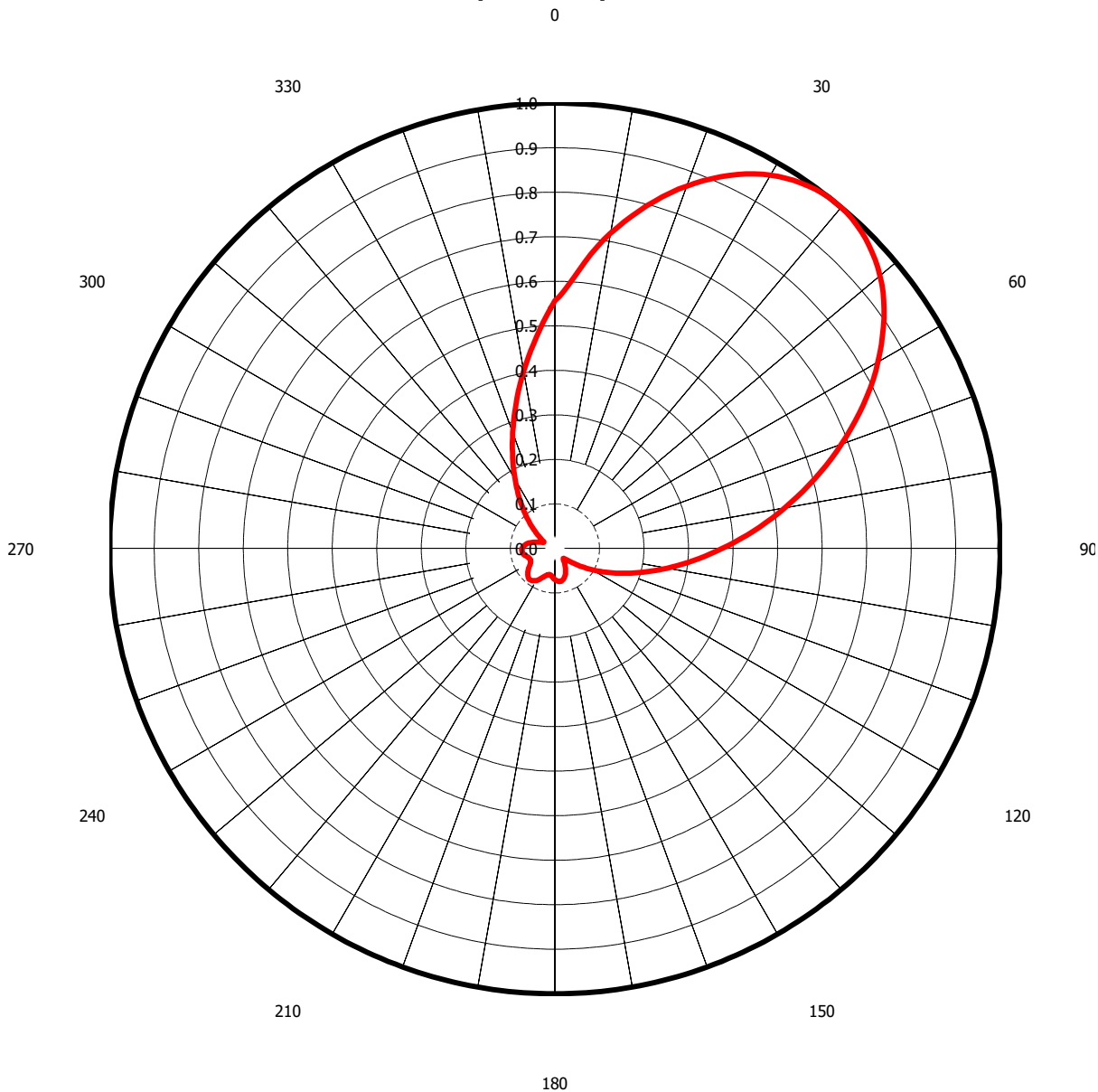
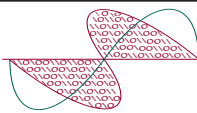


Figure 1
Antenna Azimuthal Pattern
K18NW-D Minot, ND
Facility ID 187460
Ch. 18 0.36 kW Directional

prepared for
Gray Television Licensee, LLC

June, 2022



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

Figure 2
Coverage Contour Comparison
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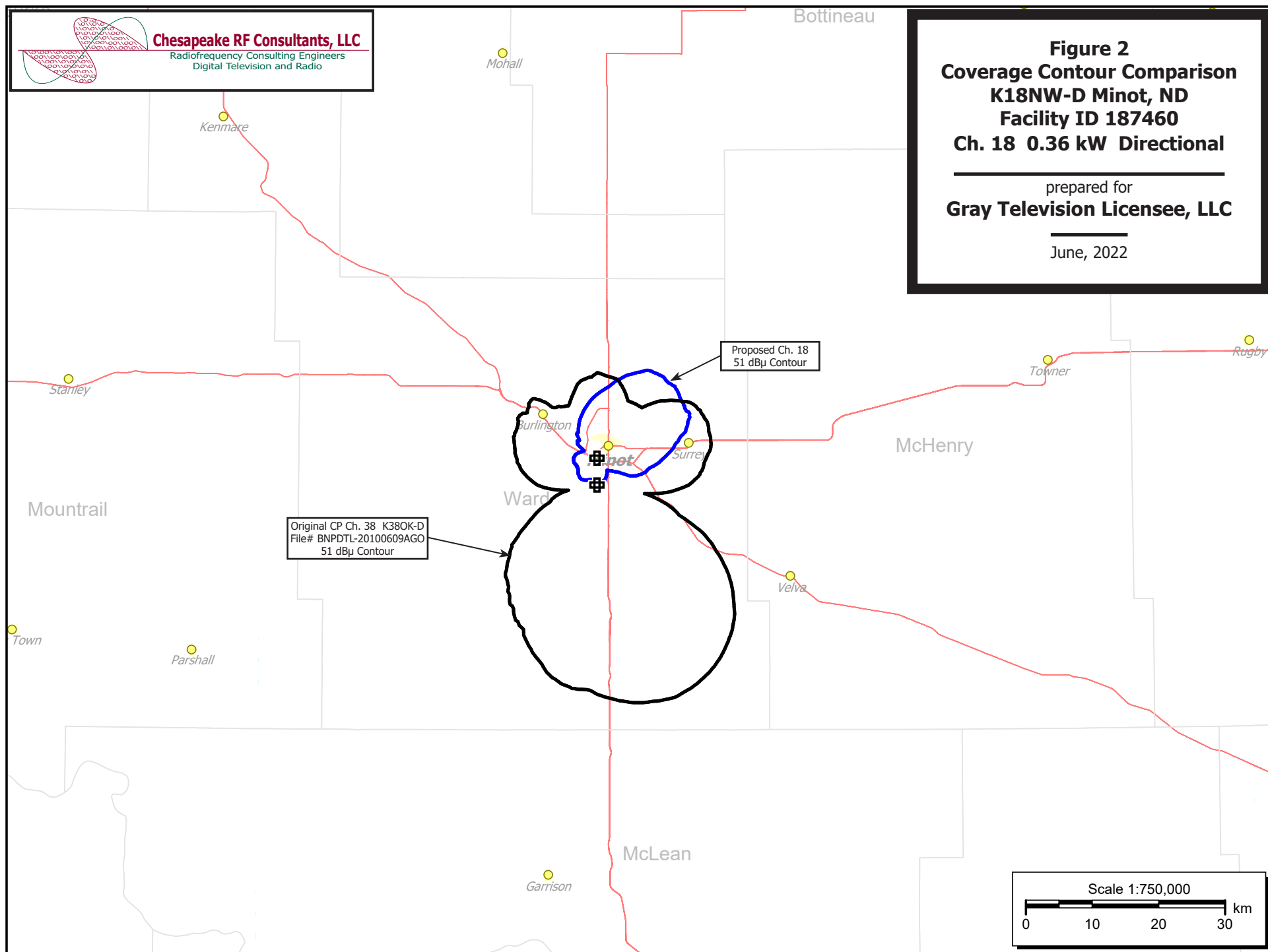


Table 1 K18NW-D TV Study Analysis of Proposal
(page 1 of 2)



tvstudy v2.2.5 (4uoc83)
Database: localhost, Study: K18NW-D CP-Mod, Model: Longley-Rice
Start: 2022.06.29 10:50:20

Study created: 2022.06.29 10:50:20

Study build station data: LMS TV 2022-06-29

Proposal: K18NW-D D18 LD APP MINOT, ND
File number: K18NW-D CP-Mod
Facility ID: 187460
Station data: User record
Record ID: 4506
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 | KBYM | D17 | DT | LIC | BISMARCK, ND | BLCDT20090701ADJ | 185.0 km |
| No | K18CR-D | D18 | LD | LIC | CIRCLE, ETC., MT | BLANK0000139790 | 322.1 |
| No | K18CR-D | N18 | TX | LIC | CIRCLE, ETC., MT | BLTT19900806IW | 323.2 |
| No | K18NP-D | D18 | LD | CP | FARGO, ND | BLANK0000072030 | 375.2 |
| No | K18NP-D | D18 | LD | APP | FARGO, ND | BLANK0000193286 | 375.2 |
| No | K18NT-D | D18 | LD | LIC | GRAND FORKS, ND | BLANK0000151962 | 319.6 |
| No | K18NT-D | D18 | LD | CP | GRAND FORKS, ND | BLANK0000153437 | 319.6 |
| No | KXMA-TV | D19 | DT | LIC | DICKINSON, ND | BLCDT20090715AHZ | 204.5 |
| No | K21GQ-D | N21- | TX | LIC | MINOT, ND | BLTTL20030825AMY | 6.0 |

No non-directional AM stations found within 0.8 km

Directional AM stations within 3.2 km:
KCJB 910 L DA2 D MINOT, ND BMML20110909ADB
KCJB 910 L DA2 N MINOT, ND BMML20110909ADB

Record parameters as studied:

Channel: D18
Mask: Simple
Latitude: 48 12 56.00 N (NAD83)
Longitude: 101 19 7.00 W
Height AMSL: 545.3 m (Adjusted based on actual ground elevation calculation)
HAAT: 0.0 m
Peak ERP: 0.360 kW
Antenna: Kathrein-750 10325 1x (ID 1009080) 40.0 deg
Elev Pattern: Generic

49.1 dBu contour:

| Azimuth | ERP | HAAT | Distance |
|---------|----------|--------|----------|
| 0.0 deg | 0.111 kW | 32.6 m | 11.1 km |
| 45.0 | 0.343 | 50.0 | 18.7 |
| 90.0 | 0.051 | 50.3 | 11.5 |
| 135.0 | 0.000 | 19.9 | 2.9 |
| 180.0 | 0.002 | -13.7 | 3.9 |
| 225.0 | 0.003 | -37.7 | 4.3 |
| 270.0 | 0.002 | -16.3 | 4.0 |
| 315.0 | 0.002 | 34.6 | 4.5 |

Database HAAT does not agree with computed HAAT
Database HAAT: 0 m Computed HAAT: 15 m

Proposal 24.15 dBu contour does not cross Canadian border
Distance to Canadian border: 87.1 km

Distance to Mexican border: 1878.3 km

Conditions at FCC monitoring station: Grand Island NE
Bearing: 163.2 degrees Distance: 842.1 km

Table 1 K18NW-D TVStudy Analysis of Proposal
(page 2 of 2)



Proposal is not within the West Virginia quiet zone area

Conditions at Table Mountain receiving zone:
Bearing: 200.5 degrees Distance: 948.4 km

No land mobile station failures found

Proposal is not within the Offshore Radio Service protected area

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

| | Call | Chan | Svc | Status | City, State | File Number | Distance |
|----------|--------------|-------|-----|-----------------|-------------|----------------|------------|
| Desired: | K18NW-D | D18 | LD | APP | MINOT, ND | K18NW-D CP-Mod | |
| | Service area | | | Terrain-limited | | IX-free | Percent IX |
| 271.1 | 44,689 | 269.1 | | 44,522 | 269.1 | 44,522 | 0.00 0.00 |

**Channel and
Facility
Information**

| Section | Question | Response |
|-------------|--------------|----------|
| Facility ID | 187460 | |
| State | North Dakota | |
| City | MINOT | |
| LPD Channel | 18 | |

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 | 1046243 |
| Coordinates (NAD83) | Latitude | 48° 12' 56.0" N+ |
| | Longitude | 101° 19' 07.0" W- |
| | Structure Type | TOWER-A free standing or guyed struct |
| | Overall Structure Height | 210.3 meters |
| | Support Structure Height | 147.1 meters |
| | Ground Elevation (AMSL) | 535.2 meters |
| Antenna Data | Height of Radiation Center Above Ground Level | 6.1 meters |
| | Height of Radiation Center Above Mean Sea Level | 541.3 meters |
| | Effective Radiated Power | 0.36 kW |

**Antenna
Technical Data**

| Section | Question | Response |
|--------------------------------|---|--------------------|
| Antenna Type | Antenna Type | Directional Custom |
| | Do you have an Antenna ID? | Yes |
| | Antenna ID | 1009080 |
| Antenna Manufacturer and Model | Manufacturer: | Kathrein |
| | Model | 750 10325 1x |
| | Rotation | 40 degrees |
| | Electrical Beam Tilt | Not Applicable |
| | Mechanical Beam Tilt | Not Applicable |
| | toward azimuth | |
| | Polarization | Elliptical |
| 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 | 0.048 | 180 | 0.090 | 270 | 0.056 |
| 10 | 0.953 | 100 | 0.029 | 190 | 0.079 | 280 | 0.107 |
| 20 | 0.838 | 110 | 0.046 | 200 | 0.063 | 290 | 0.179 |
| 30 | 0.685 | 120 | 0.066 | 210 | 0.062 | 300 | 0.277 |
| 40 | 0.524 | 130 | 0.075 | 220 | 0.072 | 310 | 0.404 |
| 50 | 0.376 | 140 | 0.070 | 230 | 0.074 | 320 | 0.556 |
| 60 | 0.255 | 150 | 0.060 | 240 | 0.063 | 330 | 0.719 |
| 70 | 0.163 | 160 | 0.066 | 250 | 0.042 | 340 | 0.866 |
| 80 | 0.095 | 170 | 0.083 | 260 | 0.029 | 350 | 0.968 |

Additional Azimuths

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