

## **Non-Interference Compliance**

Regarding Facility id 202642

Channel 221

### **Description of Exhibit 13 Contents**

This exhibit demonstrates that the proposed facility complies with contour overlap and interference protection provisions in all of the applicable rule sections and that this application for a construction permit is in full compliance with 47 C.F.R. § 74.1204.

**Let it be noted that should any actual real world interference occur, the applicant acknowledges that it will promptly suspend operation of this translator in accordance with 47 C.F.R. § 74.1203.**

Page 2 of this exhibit is an explanation of the method used to demonstrate compliance with contour overlap and interference provisions based on 47 C.F.R. § 74.1204(d), which states:

*[A]n application otherwise precluded by this section will be accepted if it can be demonstrated that no actual interference will occur due to intervening terrain, lack of population or such other factors as may be applicable.*

Page 3 contains a tabulation of the vertical radiation pattern of the proposed antenna and the minimum ground clearance of the interfering contour based on this pattern.

Page 4 includes a tabulation of the vertical radiation pattern for the proposed antenna provided by the antenna manufacturer.

Page 5 of this exhibit contains the tabulated data from the interference analysis, which shows all stations whose protected contours come within 50 km of the 34 dBμ F(50,10) contour of the proposed translator. These tabulated values were calculated using data from the FCC's CDBS files and 30 arc second terrain data. The column labeled "Adj" shows the number of channels difference between the entry and the proposed translator. The column labeled "Dist" shows the distance in km. The column labeled "Overlap" shows the area of contour overlap in square kilometers.

Page 6 of this exhibit is a portion of a USGS 1:24,000 scale 7.5 minute quadrangle at full scale with the calculated area of interference overlaid. The sheet includes the quadrangle name and measurement scale at the bottom-left corner (note: "Mt" refers to meters). The area of interference was calculated using the free space equation and 120 radials.

Page 7 of this exhibit is an aerial photo of the vicinity surrounding the proposed translator's tower site.

## Compliance with 47 C.F.R. § 74.1204(d)

All authorized second and third adjacent stations with which the proposed translator has contour overlap are tabulated below. Column four show the station's signal level at the proposed translator's tower site, and column five gives the minimum value within the entire standard interfering contour of the proposed translator (100 dBμ for most classes, 94 for class B, 97 for class B1). The minimum second or third adjacent F(50,50) contour within the proposed translator's standard interfering contour was used to calculate the proposed translator's actual "worst-case" interfering contour.

Application_id	File Number	Callsign	Contour at Tower	Min. Contour
155273	BLED19901205KF	KQMN	75.3	75.3
1786375	BNPFT20180129ADM	NEW	85.6	76.4

Minimum F(50,50) Contour of Adjacent Station within  
Proposed Translator's Standard Interfering Contour **75.3**

FCC 02-244 at Section II.A.5 states that "when demonstrating that 'no actual interference will occur due to . . . other factors,' pursuant to Section 74.1204(d), an applicant may use the undesired-to-desired signal ratio method." The undesired-to-desired ratio for second and third adjacent stations required by § 74.1204(a) is 40 dB. Since the minimum protected contour strength within the proposed translator's standard interference contour is **75.3 dBμ**, this makes the proposed translator's worst-case interfering contour **115.3 dBμ**. By the free-space equation, this contour is calculated to extend a maximum of **190.5 m** from the transmit antenna.

The maximum horizontal plane of the interfering contour was calculated for 120 radials and plotted on the pertinent portion of a USGS quadrangle (page 6 of this exhibit). However, the field strength of the proposed translator's antenna varies with angle of depression from horizontal. The antenna relative fields are tabulated on the following page at 5 degree increments, starting at 5 degrees below horizontal. Antenna relative field strength data was provided and certified by the manufacturer of the proposed antenna. Using a free-space calculation that neglects any loss due to reflection, the vertical ground clearance of the proposed translator's interference contour has been tabulated. As shown on the following page, the area of interference clears the tower ground level (TGL) by **8.6 m** at the lowest point.

**Note: The tallest buildings within the zone of predicted interference are 20ft (6.1m) in height. This proposal provides 8.6m (28.2ft) ground clearance so in accordance with 47 C.F.R. § 74.1204(d) and the clarification provided by the FCC in the decision *Re: Living Way Ministries* (FCC 02-244), a lack of population has been demonstrated within the area of interference and this application is therefore in full compliance with 47 C.F.R. § 74.1204.**

Antenna Manufacturer:	NIC
Antenna Model:	BKG77-2(FW)
CORAGL:	55 m
Maximum ERP:	0.25 kW
Interfering Contour:	115.3 dBμ
Max Int. Contour Distance:	190.5 m
Min Ground Clearance:	8.6 m

The following table shows how the interfering contour ground clearance was calculated.

The formula used to calculate the vertical radiation pattern for the multi-bay antenna array is the exact formula used by the FCC's Office of Engineering and Technology in the FM Model program used to calculate ground-level power density for multi-bay antenna arrays for purposes of compliance with OET65. According to the source code of FM Model, this formula was "derived from Kraus (eqn 4-51 & 5-52), Gailey and Tell, and material from Ben Dawson, Hatfield and Dawson."

- The *Depression Angle* is the angle below horizontal for the radial.
- The *Single-Bay Relative Field* value is the relative field value for the depression angle either provided by the antenna manufacturer or interpolated from the values provided by the manufacturer.
- The *Relative Field Multiplier* is equal to  $\sin(N * \pi \sin \phi) / (N * \sin(\pi \sin \phi))$ , where N is the number of antenna elements in the array, S is the spacing between elements,  $\pi$  is the ratio of a circle's circumference to its diameter, and  $\phi$  is the Depression Angle.
- The *Relative Field Value for the Array* is the absolute value of the product of the Relative Field Factor and the Single-Bay Relative Field value for that radial.
- The *ERP on the Radial* is the square of the *Relative Field Value for the Array* multiplied by the maximum ERP.
- The *Contour Direct Distance* is found by using the free space equation.
- The *Horizontal and Vertical Contour Distances* are calculated from the *Direct Distance* using trigonometry.
- The *Contour Ground Clearance* is the *Vertical Contour Distance* subtracted from the overall antenna height above the ground.

Depression Angle (degree)	Single-Bay Relative Field	Relative Field (hor)	$\sin \phi$	Relative Field Multiplier	Relative Field for Array	ERP on Radial (W)	Contour Direct Distance (m)	Contour Horizontal Distance (m)	Contour Vertical Distance (m)	Contour Ground Clearance (m)
5	0.997	0.998	0.2327	0.9730	0.970	235.3	232.7	231.8	20.3	66.7
10	0.986	0.997	0.4637	0.8944	0.882	194.4	211.5	208.3	36.7	50.3
15	0.969	0.997	0.6911	0.7705	0.747	139.4	179.1	173.0	46.4	40.6
20	0.946	0.995	0.9133	0.6111	0.578	83.6	138.7	130.3	47.4	39.6
25	0.916	0.994	1.1285	0.4280	0.392	38.4	94.0	85.2	39.7	47.3
30	0.879	0.992	1.3352	0.2334	0.205	10.5	49.2	42.6	24.6	62.4
35	0.837	0.99	1.5317	0.0391	0.033	0.3	7.9	6.4	4.5	82.5
40	0.789	0.987	1.7165	-0.1452	0.115	3.3	27.5	21.0	17.7	69.3
45	0.736	0.983	1.8882	-0.3121	0.230	13.2	55.1	39.0	39.0	48.0
50	0.679	0.981	2.0456	-0.4572	0.310	24.1	74.5	47.9	57.0	30.0
55	0.616	0.978	2.1874	-0.5783	0.356	31.7	85.4	49.0	70.0	17.0
60	0.550	0.973	2.3126	-0.6756	0.372	34.5	89.1	44.6	77.2	9.8
65	0.480	0.97	2.4202	-0.7509	0.360	32.5	86.5	36.5	78.4	8.6
70	0.408	0.965	2.5093	-0.8067	0.329	27.1	78.9	27.0	74.2	12.8
75	0.333	0.961	2.5794	-0.8461	0.282	19.8	67.6	17.5	65.3	21.7
80	0.256	0.956	2.6298	-0.8719	0.223	12.5	53.5	9.3	52.7	34.3
85	0.178	0.952	2.6602	-0.8863	0.158	6.2	37.8	3.3	37.7	49.3
90	0.100	0.947	2.6704	-0.8910	0.089	2.0	21.4	0.0	21.4	65.6
Min Ground Clearance (m):										8.6



BK077

<b>Vertical</b>	-66	0.297	54	0.479	174	0.468
<b>Values</b>	-63	0.345	57	0.436	177	0.479
-180 0.487	-60	0.391	60	0.391		
-177 0.478	-57	0.436	63	0.345		
-174 0.467	-54	0.479	66	0.297		
-171 0.460	-51	0.523	69	0.253		
-168 0.454	-48	0.568	72	0.211		
-165 0.447	-45	0.616	75	0.176		
-162 0.439	-42	0.661	78	0.145		
-159 0.429	-39	0.706	81	0.120		
-156 0.419	-36	0.745	84	0.105		
-153 0.402	-33	0.783	87	0.100		
-150 0.385	-30	0.818	90	0.105		
-147 0.369	-27	0.852	93	0.118		
-144 0.359	-24	0.881	96	0.134		
-141 0.350	-21	0.910	99	0.151		
-138 0.338	-18	0.934	102	0.168		
-135 0.326	-15	0.954	105	0.185		
-132 0.314	-12	0.972	108	0.202		
-129 0.303	-9	0.987	111	0.219		
-126 0.290	-6	0.999	114	0.236		
-123 0.278	-3	0.999	117	0.252		
-120 0.265	0	1.000	120	0.265		
-117 0.251	3	0.999	123	0.278		
-114 0.236	6	0.999	126	0.290		
-111 0.218	9	0.987	129	0.304		
-108 0.202	12	0.972	132	0.314		
-105 0.185	15	0.954	135	0.327		
-102 0.168	18	0.934	138	0.338		
-99 0.151	21	0.910	141	0.350		
-96 0.134	24	0.881	144	0.360		
-93 0.118	27	0.852	147	0.370		
-90 0.105	30	0.818	150	0.386		
-87 0.100	33	0.783	153	0.403		
-84 0.105	36	0.745	156	0.420		
-81 0.120	39	0.706	159	0.430		
-78 0.145	42	0.661	162	0.440		
-75 0.176	45	0.616	165	0.448		
-72 0.211	48	0.568	168	0.455		
-69 0.253	51	0.523	171	0.461		

Better than SWR

# **Adjacent Channel Study** **For Station NEW, Facility\_id: 202642**

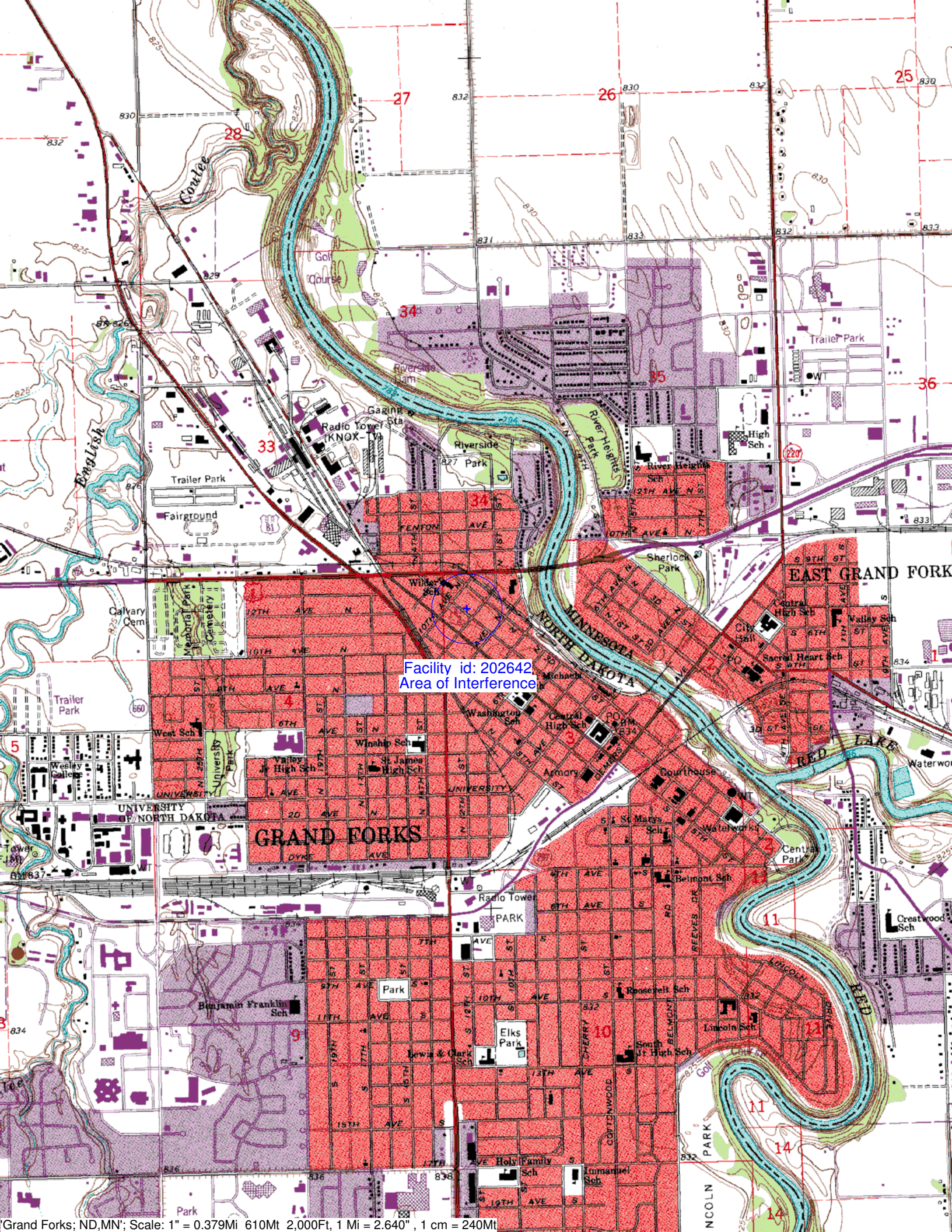
## **Co-channel through third adjacent:**

App_id	Fac_id	File_Number	Call	Licensee	Class	City	State	Status	ERP	RCAMSL	Char	Adj	Dist	Overlap
1786375	202079	BNPFT-20180129ADI	NEW	REAL PRESENCE RADIO	D	GRAND FORKS	ND	APP	0.25	272	223	2	1.6	1.4918
155273	42974	BLED-19901205KF	KQMN	MINNESOTA PUBLIC RADIO	C1	THIEF RIVER FAL	MN	LIC	84	474	218	3	32.7	1.4918
44334	49213	BLED-19820621AB	KDSU	NORTH DAKOTA STATE UNIVER	C	FARGO	ND	LIC	100	593	220	1	102.8	0

## **Intermediate Frequencies (53 and 54 channels difference):**

App_id	Fac_id	File_Number	Call	Licensee	Class	City	State	Status	ERP	RCAMSL	Channel	Adj	Dist	Clr
167931	42922	BLH-19911216KA	KNTN	MINNESOTA PUBLIC RADIO	C1	THIEF RIVER FAL	MN	LIC	100	439	274	53	32.7	10.7





Facility id: 202642  
Area of Interference



