DEC 21 2017

171221089966001

READ INSTRUCTIONS CAREFULLY
BEFORE PROCEEDING

FCC/US BANK
FEDERAL COMMUNICATIONS COMMISSION
REMITTANCE ADVICE
FORM 159

2018 JAN -5 AM 8:36

Approved by OMB
3060-0589
Page No 1 of 12

(1) LOCKBOX #	SPECIAL USE ONLY
979089	FCC USE ONLY

SECTION A – PAYER INFORMATION

(2) PAYER NAME (if paying by credit card enter name exactly as it appears on the card)	(3) TOTAL AMOUNT PAID (U.S. Dollars and cents)
Leighton Enterprises, Inc.	$1,505.00

(4) STREET ADDRESS LINE NO.1
619 West St. Germain Street

(5) STREET ADDRESS LINE NO. 2

(6) CITY	(7) STATE	(8) ZIP CODE
St. Cloud	MN	56301

(9) DAYTIME TELEPHONE NUMBER (include area code)	(10) COUNTRY CODE (if not in U.S.A.)
3202511450	

FCC REGISTRATION NUMBER (FRN) REQUIRED

(11) PAYER (FRN)	(12) FCC USE ONLY
0004974358	

IF MORE THAN ONE APPLICANT, USE CONTINUATION SHEETS (FORM 159-C)
COMPLETE SECTION BELOW FOR EACH SERVICE, IF MORE BOXES ARE NEEDED, USE CONTINUATION SHEET

(13) APPLICANT NAME
Leighton Radio Holdings, Inc.

(14) STREET ADDRESS LINE NO.1
619 West St. Germain Street

(15) STREET ADDRESS LINE NO. 2

(16) CITY	(17) STATE	(18) ZIP CODE
St. Cloud	MN	56301

(19) DAYTIME TELEPHONE NUMBER (include area code)	(20) COUNTRY CODE (if not in U.S.A.)
3202511450	

FCC REGISTRATION NUMBER (FRN) REQUIRED

(21) APPLICANT (FRN)	(22) FCC USE ONLY
0024470627	

COMPLETE SECTION C FOR EACH SERVICE, IF MORE BOXES ARE NEEDED, USE CONTINUATION SHEET

(23A) CALL SIGN/OTHER ID	(24A) PAYMENT TYPE CODE	(25A) QUANTITY
KBRF	MMR	1
(26A) FEE DUE FOR (PTC)	(27A) TOTAL FEE	FCC USE ONLY
$700.00	$700.00	
(28A) FCC CODE 1	(29A) FCC CODE 2	
21400		
(23B) CALL SIGN/OTHER ID	(24B) PAYMENT TYPE CODE	(25B) QUANTITY
KBRF	MOR	1
(26B) FEE DUE FOR (PTC)	(27B) TOTAL FEE	FCC USE ONLY
$805.00	$805.00	
(28B)FCC CODE 1	(29B) FCC CODE 2	
21400		

SECTION D – CERTIFICATION

CERTIFICATION STATEMENT
I, JOHN WELSTEAD, certify under penalty of perjury that the foregoing and supporting information is true and correct to the best of my knowledge, information and belief.

SIGNATURE John Welstead DATE 12/19/2017

SECTION E - CREDIT CARD PAYMENT INFORMATION

MASTERCARD_____ VISA_____ AMEX_____ DISCOVER_____

ACCOUNT NUMBER_____ EXPIRATION DATE_____

I hereby authorize the FCC to charge my credit card for the service(s)/authorization herein described.

SIGNATURE_____ DATE_____

25633

Federal Communications Commission
Washington, D. C. 20554

Approved by OMB
3060-0627
Expires 01/31/98

FOR FCC USE ONLY

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.

FOR COMMISSION USE ONLY
FILE NO. BAML-20171221AFK

SECTION I - APPLICANT FEE INFORMATION

1. PAYOR NAME (Last, First, Middle Initial)

Leighton Radio Holdings, Inc.

MAILING ADDRESS (Line 1) (Maximum 35 characters)
619 West St. Germain Street

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
St. Cloud	MN	56301

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
3202511450	KBRF	21400

2. A. Is a fee submitted with this application? [✓] Yes [ ] No

B. If No, indicate reason for fee exemption (see 47 C.F.R. Section

[ ] Governmental Entity [ ] Noncommercial educational licensee [ ] Other (Please explain):

C. If Yes, provide the following information:

Enter in Column (A) the correct Fee Type Code for the service you are applying for. Fee Type Codes may be found in the "Mass Media Services Fee Filing Guide." Column (B) lists the Fee Multiple applicable for this application. Enter fee amount due in Column (C).

(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
MMR	0001	$ 700	

To be used only when you are requesting concurrent actions which result in a requirement to list more than one Fee Type Code.

(A)	(B)	(C)	FOR FCC USE ONLY
MOR	0001	$ 805	

	TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
ADD ALL AMOUNTS SHOWN IN COLUMN C, AND ENTER THE TOTAL HERE. THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.	$ 1505	

RECEIVED
2018 JAN -5 AM 8:36

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT Leighton Radio Holdings, Inc.		
MAILING ADDRESS 619 West St. Germain Street		
CITY St. Cloud	STATE MN	ZIP CODE 56301

2. This application is for:

☐ Commercial ☐ Noncommercial

☑ AM Directional ☐ AM Non-Directional

Call letters	Community of License	Construction Permit File No.	Modification of Construction Permit File No(s).	Expiration Date of Last Construction Permit
KBRF	Fergus Falls MN	BP-20171127ACH		Pending

3. Is the station now operating pursuant to automatic program test authority in accordance with 47 C.F.R. Section 73.1620?

☐ Yes ☑ No

If No, explain in an Exhibit.

Exhibit No. 1

4. Have all the terms, conditions, and obligations set forth in the above described construction permit been fully met?

☐ Yes ☑ No

If No, state exceptions in an Exhibit.

Exhibit No. 1

5. Apart from the changes already reported, has any cause or circumstance arisen since the grant of the underlying construction permit which would result in any statement or representation contained in the construction permit application to be now incorrect?

☐ Yes ☑ No

If Yes, explain in an Exhibit.

Exhibit No.

6. Has the permittee filed its Ownership Report (FCC Form 323) or ownership certification in accordance with 47 C.F.R. Section 73.3615(b)?

☐ Yes ☐ No

☑ Does not apply

If No, explain in an Exhibit.

Exhibit No.

7. Has an adverse finding been made or an adverse final action been taken by any court or administrative body with respect to the applicant or parties to the application in a civil or criminal proceeding, brought under the provisions of any law relating to the following: any felony; mass media related antitrust or unfair competition; fraudulent statements to another governmental unit; or discrimination?

☐ Yes ☑ No

If the answer is Yes, attach as an Exhibit a full disclosure of the persons and matters involved, including an identification of the court or administrative body and the proceeding (by dates and file numbers), and the disposition of the litigation. Where the requisite information has been earlier disclosed in connection with another application or as required by 47 U.S.C. Section 1.65(c), the applicant need only provide: (i) an identification of that previous submission by reference to the file number in the case of an application, the call letters of the station regarding which the application or Section 1.65 information was filed, and the date of filing; and (ii) the disposition of the previously reported matter.

Exhibit No.

8. Does the applicant, or any party to the application, have a petition on file to migrate to the expanded band (1605-1705 kHz) or a permit or license either in the existing band or expanded band that is held in combination (pursuant to the 5 year holding period allowed) with the AM facility proposed to be modified herein?

☐ Yes ☑ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

The APPLICANT hereby waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because use of the same, whether by license or otherwise, and requests and authorization in accordance with this application. (See Section 304 of the Communications Act of 1934, as amended).

The APPLICANT acknowledges that all the statements made in this application and attached exhibits are considered material representations and that all the exhibits are a material part hereof and are incorporated herein as set out in full in

CERTIFICATION

1. By checking Yes, the applicant certifies, that, in the case of an individual applicant, he or she is not subject to a denial of federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. Section 862, or, in the case of a non-individual applicant (e.g., corporation, partnership or other unincorporated association), no party to the application is subject to a denial of federal benefits that includes FCC benefits pursuant to that section. For the definition of a "party" for these purposes, see 47 C.F.R. Section 1.2002(b).

☑ Yes ☐ No

2. I certify that the statements in this application are true, complete, and correct to the best of my knowledge and belief, and are made in good faith.

Name	Signature	
John Sowada		
Title	Date	Telephone Number
President	11/28/2017	3202511450

WILLFUL FALSE STATEMENTS ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. CODE, TITLE 18, SECTION 1001), AND/OR REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION

FCC NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT AND THE PAPERWORK REDUCTION ACT

The solicitation of personal information requested in this application is authorized by the Communications Act of 1934, as amended. The Commission will use the information provided in this form to determine whether grant of the application is in the public interest. In reaching that determination, or for law enforcement purposes, it may become necessary to refer personal information contained in this form to another government agency. In addition, all information provided in this form will be available for public inspection. If information requested on the form is not provided, the application may be returned without action having been taken upon it or its processing may be delayed while a request is made to provide the missing information. Your response is required to obtain the requested authorization.

Public reporting burden for this collection of information is estimated to average 639 hours and 53 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, can be sent to the Federal Communications Commission, Records Management Branch, Paperwork Reduction Project (3060-0627), Washington, D. C. 20554. Do NOT send completed forms to this address.

THE FOREGOING NOTICE IS REQUIRED BY THE PRIVACY ACT OF 1974, P.L. 93-579, DECEMBER 31, 1974, 5 U.S.C. 552a(e)(3), AND THE PAPERWORK REDUCTION ACT OF 1980, P.L. 96-511, DECEMBER 11, 1980, 44 U.S.C. 3507.

20171127ACH

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
LEIGHTON RADIO HOLDINGS, INC.

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☑ Station License ☐ Direct Measurement of Power **Moment Method Proof**

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts	
				Night	Day
KBRF	BP-20171127ACH	1250 kHz	UNLIMITED	5.0 kW	2.2 kW

2. Station location

State	City or Town
Minnesota	Fergus Falls

3. Transmitter location

State	County	City or Town	Street address (or other identification)
Minnesota	Otter Tail	Fergus Falls	1613 Hwy 210 East

4. Main studio location

State	County	City or Town	Street address (or other identification)
Minnesota	Otter Tail	Fergus Falls	728 Western Avenue

5. Remote control point location (specify only if authorized directional antenna)

State	County	City or Town	Street address (or other identification)
Minnesota	Otter Tail	Fergus Falls	728 Western Avenue

6. Has type-approved stereo generating equipment been installed? ☐ Yes ☑ No

7. Does the sampling system meet the requirements of 47 C.F.R. Section 73.68? ☑ Yes ☐ No ☐ Not Applicable

Attach as an Exhibit a detailed description of the sampling system as installed. Exhibit No. 3.10

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
6.89 Amperes	3.30 Amperes

Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50.0 Ohms	460 Ohms	+j 0.0 Ohms	+j 412.5 Ohms

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
T1 (C)	24.6°	N/A	0.744	N/A	N/A	N/A
T2 (NW)	-20.2°	N/A	0.933	N/A	N/A	N/A
T3 (SE)	0.0°	N/A	1.000	N/A	N/A	N/A

Manufacturer and type of antenna monitor: Potomac Instruments AM-19 (204)

SECTION III - Page 2 256393 20171221AFK

9. Description of antenna system ((f directional antenna is used, the information requested below should be given for each element of the array. Use separate sheets if necessary.)

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
Guyed uniform cross-section steel towers mounted on concrete base piers and insulators	T1=101,T2=97.3,T3=85.9	T1=102.0M T3=86.9M T2=98.4M	T1=103.6M T3=88.4M T2=100.0M	Exhibit No. N/A

Excitation ☑ Series ☐ Shunt ASR T1=1024482 ASR T3=1024481 ASR T2=1024483

Geographic coordinates to nearest second. For directional antenna give coordinates of center of array. For single vertical radiator give tower location. North Latitude Day = 46-16-24.3 West Longitude Day = 96-02-43.5

North Latitude					West Longitude				
46	o	16	'	27.0 Night	96	o	02	'	46.0 Night

If not fully described above, attach as an Exhibit further details and dimensions including any other antenna mounted on tower and associated isolation circuits. Exhibit No. 2.10

Also, if necessary for a complete description, attach as an Exhibit a sketch of the details and dimensions of ground system. Exhibit No. See report

10. In what respect, if any, does the apparatus constructed differ from that described in the application for construction permit or in the permit?

All sample loops and lines above the base insulators of each tower have been removed.

Antenna for translator K253BK (Construction Permit BPFT-20160729ACS) has been added to Tower 1(C)

11. Give reasons for the change in antenna or common point resistance.

Removal of sample loops and lines resulted in daytime antenna resistance change to 460 +j 412.5 ohms.

Night commom point impedance was maintained at 50 ±j 0 ohms.

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

Name (Please Print or Type)	Signature (check appropriate box below)
Richard P. Grzebik	Richard P Grzebik
Address (include ZIP Code)	Date
Munn-Reese P.O. Box 220 Coldwater, MI 49036	November 27, 2017
	Telephone No. (Include Area Code) (517) 278-7339

☐ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☑ Technical Consultant

☐ Other (specify)

Leighton Radio Holdings, Inc.
AM Station KBRF, Fergus Falls MN
FCC Form 302-AM
November 2017
Exhibit 1

Responses to Section II, Items 3 and 4

The station is not operating pursuant to Program Test Authority, but is operating pursuant to the terms of its license and Special Temporary Authority granted in FCC File No. BSTA-20170913ABG. The purposes of this application are (1) to operate pursuant to method-of-moments measurements, and (2) to correct the licensed geographic coordinates. A companion application for construction permit to correct the licensed geographic coordinates is on file in FCC File No. BP-20171127ACH.

MOMENT OF METHOD ANTENNA PROOF OF PERFORMANCE

KBRF(AM) – Fergus Falls, MN

1250 kHz – Facility ID # 21400

November 2017

MUNN-REESE
Broadcast Engineering Consultants
Coldwater, MI 49036

Table of Contents

9. Description of antenna system ((f directional antenna is used, the information requested below should be given for each element of the array. Use separate sheets if necessary.)

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
Guyed uniform cross-section steel towers mounted on concrete base piers and insulators	T1=101,T2=97.3,T3=85.9	T1=102.0M T3=86.9M T2=98.4M	T1=103.6M T3=88.4M T2=100.0M	Exhibit No.

Excitation ☐ Series ☐ Shunt

ASR T1=1024482 ASR T3=1024481
ASR T2=1024483

Geographic coordinates to nearest second. For directional antenna give coordinates of center of array. For single vertical radiator give tower location.

North Latitude Day = 46-16-24.3 West Longitude Day = 96-02-43.5

North Latitude		Night	West Longitude		Night
	o '			o '	

If not fully described above, attach as an Exhibit further details and dimensions including any other antenna mounted on tower and associated isolation circuits. Exhibit No.

Also, if necessary for a complete description, attach as an Exhibit a sketch of the details and dimensions of ground system. Exhibit No.

10. In what respect, if any, does the apparatus constructed differ from that described in the application for construction permit or in the permit?

11. Give reasons for the change in antenna or common point resistance.

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

Name (Please Print or Type)	Signature (check appropriate box below) Richard P Zaglanka
Address (include ZIP Code)	Date
	Telephone No. (Include Area Code)

☐ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☐ Technical Consultant

☐ Other (specify)

CERTIFICATION OF ENGINEERS

The firm of Munn-Reese, Broadcast Engineering Consultants, with offices at 385 Airport Drive, Coldwater, Michigan, has been retained for the purpose of preparing the technical data forming this report.

Some of the data utilized in this report was taken from the FCC Secondary Database and data on file. While this information is believed accurate, errors or omissions in the database and file data are possible. This firm may not be held liable for damages as a result of such data errors or omissions. Other data utilized in this report is based on field measurements and/or observations made by the undersigned, or others under the supervision of the undersigned.

The report has been prepared by properly trained electronics specialists under the direction of the undersigned whose qualifications are a matter of record before the Federal Communications Commission.

I declare under penalty of the laws of perjury that the contents of this report are true and accurate to the best of my knowledge and belief.

November 15, 2017

MUNN-REESE
385 Airport Drive, PO Box 220
Coldwater, Michigan 49036
Telephone: 517-278-7339

By _____
Richard Grzebik, Staff Engineer

By _____
Edmond R. Trombley, Staff Engineer

By _____
Donald J. Baad, Staff Engineer

By _____
Bruce Bellamy, Owner/Engineer

Discussion of Report

The firm of Munn-Reese was retained to prepare an Antenna Proof of Performance under the Moment Method rules as found in §73.151(c), due to the addition of an antenna for translator K253BK on the KBRF directional array. This report supplies technical support for relicensing the existing night directional array of KBRF, Fergus Falls, MN, under the Moment Method rules. KBRF, Facility ID # 21400, currently operates under the authority of File No. BL-19970206AB. KBRF is authorized to operate with a daytime non-directional power of 5.0 kW, and a nighttime power of 2.2 kW using a three tower directional array. Tower 3 (South) is used for the daytime operation. The daytime antenna resistance was re-measured as shown in ***Exhibit 1.20.***

Self-impedance measurements were made at each tower with the other towers "floating" in an open circuit configuration as set forth in §73.151(c)(1). Measurements were made using an HP 8753C Network Analyzer with the Tunwall Radio Directional Couplers designed for AM measurements. The measurements were made at the bowl insulator of each ATU. This ATU output jack was opened to "float" the unused towers. The results of these measurements are shown in ***Exhibit 1.10***, along with the dimensions of the individual towers.

The base insulators were assumed to have a capacitance of 25 pf. At 1250 kHz this is represented in the model by a lumped reactance of –j5093 ohms. It should be noted that Tower 1(C) supports an STL antenna and an FM translator antenna for the K253BK Construction Permit BPFT-20160729ACS. The feedlines cross the Tower 1 base insulator by means of Kintronic isolation transformers. Kintronic Labs estimates the AM shunt capacity of each unit to be 75 pf. At 1250 kHz, this reactance would be –j1697.7 ohms each. When combined with the base insulator at Tower 1, the total lumped shunt reactance is –j727.6 ohms.

Individual printouts from Mininec Broadcast Professional, Version 14.5, are shown for the modeling of each tower in ***Exhibits 1.11 - 1.13***. The base impedance predicted by the Mininec software was adjusted by first combining the predicted base impedance with the assumed parallel shunt reactance and then adding the assumed series reactance to represent the series path between the ATU bowl insulator and the base of the tower. The resulting impedance was then combined with the measured impedance of each lighting choke. The results of these calculations are shown in the "Combined with Choke at Measurement Point" columns of ***Exhibit 1.10***. The circuit diagram and formulas used to calculate these adjusted values are shown at the end of the exhibit.

The predicted self impedance values were calibrated by altering the tower dimensions of the model within the limitations described in §73.151(c)(1)(i)-(ix). The "Model Check" portion of ***Exhibit 1.10*** confirms that each adjusted model is within the dimensional limitations. These cells are conditionally formatted to show green when the dimensions are within the limits and red when the limits are exceeded. The model for each tower was adjusted until the base resistance and reactance predicted by the moment method

Discussion of Report

software, adjusted for the assumed series and shunt reactances, matched the measured data within the ±2 ohms and ±4 percent specified in §73.151(c)(2)(ii).

The modeled tower parameters were used, along with the theoretical field parameters, to generate predicted drive points and base parameters using the moment method software as specified in §73.151(c)(2)(i). The computed data is shown in ***Exhibit 1.30*** for the night pattern. The predicted base voltage and phase were adjusted to reflect the presence of the assumed shunt and series reactances at each tower. These adjusted values are shown in ***Exhibit 1.30***. The calculated sample voltages were normalized to produce the "Night Pattern" "Operating Parameters" shown in the upper right portion of the parameter sheet. Supporting exhibits consisting of the array synthesis for night pattern are shown in ***Exhibit 1.31***. An array summary night pattern has also been included in ***Exhibit 1.32***.

Since both the KBRF non-directional daytime and directional nighttime pattern have been previously licensed and since no changes are proposed in the night-time theoretical pattern, a surveyor's certification of the array geometry is not required. This was clarified in Public Notice, DA 09-2340, released October 29, 2009.

No changes were made to the existing ground system. The ground system consists of 120 equally spaced buried copper wires, 60 meters in length except where shortened and bonded to a transverse strap between towers.

Exhibit 2.10 is a vertical plan showing the addition of the K253BK FM translator antenna on Tower 1(C), and the existing STL receive antenna.

Exhibit 3.10 shows the details of the sample system. The sample lines are Andrew LDF2-50A cable. This cable is listed with a velocity factor of 0.88. The original tower mounted sample loops and sample lines were removed from the tower before modeling, and Kintronic VSU-1 voltage samples were mounted on the exterior of each ATU. The voltage samples were then connected to the center conductor of each tower's ATU bowl insulator. The existing sample system was designed for equal sample line lengths at the sample loops. Due to the unequal tower heights and mounting height differences of each sample loop, sample lines were not equal in length at the output of the sample line isocouplers. So when field engineers measured the open circuit phase delay of these lines in accordance with §73.151(c)(2)(i), they found the "Maximum Deviation" between the longest and shortest lines was 26°, which fails to meet the requirements of the moment method rules. Therefore, tower 3 line was trimmed and towers 1 & 2 had sample line jumpers added until the maximum deviation was 0.15° between the three towers, which is within the required specification. The details are shown in the "Initial Measurement" and "Final Measurement" sections of the exhibit. The "Maximum Deviation" cells have been conditionally formatted to indicate the acceptability of the listed value.

Discussion of Report

The impedance of each line was also measured using the procedure described in §73.151(c)(2)(i). Good agreement was found, and the measured values, shown in ***Exhibit 3.10***, are well within the two ohm tolerance.

The Kintronics voltage sample units were compared side by side before mounting to each tower ATU using the network analyzer. The measured results are shown in ***Exhibit 3.10***. The magnitudes and phases were within the ±2 percent specified by the manufacturer.

As a final step, the impedance of each sample line was again measured from the antenna monitor end with the voltage sample unit attached at the ATU end. The results are also shown in ***Exhibit 3.10***.

The nighttime array was tuned by the field engineers to the parameters generated by the moment method modeling software. Impedance matching at the antenna tuning units and phasor was adjusted where appropriate. Under File No. BL-19970206AB, the KBRF nighttime array used Tower 1 as the reference tower. Under this Method of Moment proof, we are using Tower 3 as the reference tower, in order for the Potomac Instruments AM-19 (204) Antenna Monitor to be within operating range of its ratio metering.

The licensed common point impedance for the night pattern has been maintained at 50 ohms resistance and 0 ohms reactance.

§73.151(c)(3) calls for the establishment of field strength measurement reference points on each of the specified monitoring point radials and the major lobe. These are shown for the night pattern in ***Exhibit 4.10***. Each point includes the measured field strength value, the distance (in km) from the array, the NAD27 geographic coordinates and a brief description of the location.

The modeling of the arrays was performed by Donald J. Baad, Staff Engineer and Bruce Bellamy, Owner/Engineer with this office. Field work was performed by and under the direction of Richard P. Grzebik and Edmond R. Trombley, Staff Engineers with this office. Field strength measurement reference points were located and measured by Mr. Grzebik and Mr. Trombley. Jim Offerdahl, Contract Engineer for KBRF, also assisted Mr. Grzebik and Mr. Trombley with the various aspects of the array.

Exhibit 1.10

Moment Method Modeling Description

KBRF – Fergus Falls, MN

The individual towers of the array were modeled in accordance with §73.151(c)(1). Each tower was assumed to have a capacitive reactance in parallel with the base impedance of the tower. This is shown in the accompanying tabulation as "Shunt X". A series reactance was also assumed for the path between the tower and the measurement point at the output of each ATU. This value is shown as "Series X" in the tabulation. Because of the high self-impedances of the tall towers in this array is was necessary to also include the reactance of the individual lighting chokes that are in parallel with the measurement point at the ATU bowl insulators. The individual lighting chokes were disconnected and measured. The reactance of each choke is shown as "Lighting Choke X" in the tabulation.

To determine the Mininec predicted impedance value at the measuring point, the following procedure was used. The value calculated by Mininec at the base of the tower is shown in the tabulation as "Mininec R and X". This value was first combined with the parallel "Shunt X" using the standard parallel resistance/impedance formula of the inverse of the sum of the inverses. The result is shown in the "Mininec Combined with Shunt" column of the tabulation. The result was then added to the "Series X" value and result is shown in the "Plus Series X" column. And finally, that result was combined in parallel with the measured value of the lighting choke as shown in the "Combined with Choke at Measurement Point" column using the inverse of the sum of the inverses formula. All calculations were performed using complex math in rectangular format to accurately reflect the individual resistance and reactance values.

The model was then adjusted bring the calculated "Combined with Choke at Measurement Point" values to within ±2 ohms and ±4% of the actual measured self-impedances shown near the top of the tabulation. All measured self-impedances were obtained with the unused towers floating.

The actual dimensions of the individual towers are shown at the top of the tabulation. The "Model Check" section near the middle of the tabulation shows the final values that were used in the Mininec model to achieve the desired results. These values are all within the tolerances allowed in §73.151(c)(1).

Exhibit 1.10

Moment Method Modeling Data Summary Sheet

KBRF - Fergus Falls, MN

Modeling Software: Mininec Broadcast Professional - Version 14.5

Station: KBRF - Fergus Falls, MN

Freq (kHz) 1250

Self-Impedances:
Measured

FCC Twr #	Open R	Open X	Electrical Ht (°)	Number of Faces	Face Width (in)	Equiv Radius (m)
1 - C	317.50	-389.10	151.6°	3	24	0.291
2 - NW	758.30	-45.70	146.1°	3	24	0.291
3 - SE	335.00	339.50	128.9°	3	24	0.291

Model Check

FCC Twr #	Adjusted Ht(°)	Adjusted Radius(m)	Number Segments
1 - C	155.0°	0.280	20
2 - NW	155.7°	0.291	20
3 - SE	137.0°	0.240	20

FCC Twr #	Mininec R	Mininec X	Shunt X	Series X	Lighting Choke X
1 - C	825.37	-235.73	-727.6	40.00	5230
2 - NW	757.98	-81.85	-5093	40.00	5300
3 - SE	337.16	277.22	-5093	65.00	5140

FCC Twr #	Mininec Combined with Shunt R	Mininec Combined with Shunt X	Plus Series X R	Plus Series X X	Combined with Choke at Measurement Point R	Combined with Choke at Measurement Point X
1 - C	271.53	-410.69	271.53	-370.69	313.55	-381.44
2 - NW	718.77	-185.84	718.77	-145.84	745.52	-46.00
3 - SE	375.26	266.91	375.26	331.91	329.56	334.37

Exhibit 1.11 – Tower 1 -C Model

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KBRF - Fergus Falls MN - DA-N

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.28	20
		0	0	155.		
2	none	120.5	319.5	0	.291	20
		120.5	319.5	155.7		
3	none	160.5	149.5	0	.24	20
		160.5	149.5	137.		

Number of wires = 3
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	6.85	2	7.785
radius	3	.24	2	.291

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.25	0	1	.0190278	.021625

Sources

source	node	sector	magnitude	phase	type
1	1	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	21	0	-5,093.	0	0	0
2	41	0	-5,093.	0	0	0

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IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB

source = 1; node 1, sector 1

Exhibit 1.11 – Tower 1 -C Model

1.25 825.37 -235.73 858.37 344.1 17.859 -.97376 -6.9711

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CURRENT rms
Frequency = 1.25 MHz
Input power = 2,200. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	1.63263	15.9	1.56985	.448367
2	0	0	7.75	1.72249	335.2	1.56329	-.723254
3	0	0	15.5	2.15213	315.8	1.5437	-1.49954
4	0	0	23.25	2.63021	305.1	1.5114	-2.1526
5	0	0	31.	3.08137	298.4	1.46689	-2.70981
6	0	0	38.75	3.47798	293.9	1.41089	-3.17896
7	0	0	46.5	3.80652	290.7	1.34426	-3.56126
8	0	0	54.25	4.05897	288.2	1.26806	-3.8558
9	0	0	62.	4.23023	286.2	1.18345	-4.06132
10	0	0	69.75	4.3172	284.6	1.09172	-4.17688
11	0	0	77.5	4.3184	283.3	.994256	-4.20239
12	0	0	85.25	4.23384	282.2	.892493	-4.13871
13	0	0	93.	4.06491	281.2	.787912	-3.98782
14	0	0	100.75	3.81423	280.3	.681998	-3.75276
15	0	0	108.5	3.48553	279.5	.576215	-3.43757
16	0	0	116.25	3.0834	278.8	.47196	-3.04707
17	0	0	124.	2.61292	278.2	.370531	-2.58651
18	0	0	131.75	2.07877	277.5	.273039	-2.06076
19	0	0	139.5	1.48353	277.	.180254	-1.47254
20	0	0	147.25	.822337	276.4	.0921351	-.817159
END	0	0	155.	0	0	0	0
GND	91.6289	78.2585	0	.15702	59.8	.0790048	.135697
22	91.6289	78.2585	7.785	.83647	59.8	.420798	.722919
23	91.6289	78.2585	15.57	1.28227	59.8	.644895	1.1083
24	91.6289	78.2585	23.355	1.65458	59.8	.831896	1.43024
25	91.6289	78.2585	31.14	1.96926	59.8	.989819	1.70242
26	91.6289	78.2585	38.925	2.2308	59.8	1.12097	1.92871
27	91.6289	78.2585	46.71	2.4399	59.8	1.22572	2.10967
28	91.6289	78.2585	54.495	2.596	59.9	1.30386	2.24481
29	91.6289	78.2585	62.28	2.69836	59.9	1.35505	2.33345
30	91.6289	78.2585	70.065	2.74644	59.9	1.37906	2.37511
31	91.6289	78.2585	77.85	2.74027	59.9	1.3759	2.3698
32	91.6289	78.2585	85.635	2.68039	59.9	1.34589	2.31799
33	91.6289	78.2585	93.42	2.56808	59.9	1.28964	2.22077
34	91.6289	78.2585	101.205	2.40523	59.8	1.2081	2.07982
35	91.6289	78.2585	108.99	2.19435	59.8	1.10248	1.89729
36	91.6289	78.2585	116.775	1.93842	59.8	.97424	1.67581

Exhibit 1.11 – Tower 1 -C Model

37	91.6289	78.2585	124.56	1.64063	59.8	.824933	1.41815
38	91.6289	78.2585	132.345	1.30395	59.8	.655984	1.12693
39	91.6289	78.2585	140.13	.929923	59.8	.468102	.803515
40	91.6289	78.2585	147.915	.515466	59.8	.259652	.445293
END	91.6289	78.2585	155.7	0	0	0	0
GND	-138.292	-81.4599	0	.10928	73.5	.0310404	.104778
42	-138.292	-81.4599	6.85	.513181	73.5	.145876	.492011
43	-138.292	-81.4599	13.7	.776311	73.5	.22094	.744208
44	-138.292	-81.4599	20.55	.993042	73.4	.283027	.951855
45	-138.292	-81.4599	27.4	1.17381	73.4	.335087	1.12497
46	-138.292	-81.4599	34.25	1.32215	73.4	.378094	1.26693
47	-138.292	-81.4599	41.1	1.43922	73.4	.41235	1.37888
48	-138.292	-81.4599	47.95	1.52537	73.3	.437914	1.46116
49	-138.292	-81.4599	54.8	1.58068	73.3	.454769	1.51385
50	-138.292	-81.4599	61.65	1.60526	73.2	.462894	1.53707
51	-138.292	-81.4599	68.5	1.59938	73.2	.462307	1.5311
52	-138.292	-81.4599	75.35	1.56348	73.2	.45308	1.49639
53	-138.292	-81.4599	82.2	1.49826	73.1	.435348	1.43362
54	-138.292	-81.4599	89.05	1.40469	73.1	.409315	1.34373
55	-138.292	-81.4599	95.9	1.28389	73.	.375235	1.22784
56	-138.292	-81.4599	102.75	1.13717	73.	.333403	1.0872
57	-138.292	-81.4599	109.6	.965822	72.9	.284112	.923088
58	-138.292	-81.4599	116.45	.770899	72.8	.227575	.736542
59	-138.292	-81.4599	123.3	.552497	72.8	.163715	.527684
60	-138.292	-81.4599	130.15	.307793	72.7	.0915746	.293854
END	-138.292	-81.4599	137.	0	0	0	0

Exhibit 1.12 – Tower 2 - NW Model

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GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.28	20
		0	0	155.		
2	none	120.5	319.5	0	.291	20
		120.5	319.5	155.7		
3	none	160.5	149.5	0	.24	20
		160.5	149.5	137.		

Number of wires = 3
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	6.85	2	7.785
radius	3	.24	2	.291

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.25	0	1	.0190278	.021625

Sources

source	node	sector	magnitude	phase	type
1	21	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-727.6	0	0	0
2	41	0	-5,093.	0	0	0

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IMPEDANCE
normalization = 50.

freq	resist	react	imped	phase	VSWR	S11	S12
(MHz)	(ohms)	(ohms)	(ohms)	(deg)		dB	dB

source = 1; node 21, sector 1

Exhibit 1.12 – Tower 2 - NW Model

1.25 757.98 -81.854 762.39 353.8 15.337 -1.1343 -6.3855

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CURRENT rms
Frequency = 1.25 MHz
Input power = 2,200. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	.675536	17.8	.643346	.206045
2	0	0	7.75	1.08346	17.8	1.03171	.330842
3	0	0	15.5	1.34676	17.8	1.28211	.412255
4	0	0	23.25	1.56097	17.9	1.48554	.479353
5	0	0	31.	1.73587	18.	1.65137	.535015
6	0	0	38.75	1.87442	18.	1.78243	.580001
7	0	0	46.5	1.97736	18.1	1.8795	.614368
8	0	0	54.25	2.0447	18.2	1.94263	.63795
9	0	0	62.	2.07642	18.3	1.97188	.65055
10	0	0	69.75	2.07266	18.3	1.96743	.652036
11	0	0	77.5	2.03386	18.4	1.92975	.642383
12	0	0	85.25	1.96087	18.5	1.8597	.62171
13	0	0	93.	1.85493	18.6	1.75851	.59028
14	0	0	100.75	1.71769	18.6	1.62775	.548512
15	0	0	108.5	1.55112	18.7	1.46936	.496954
16	0	0	116.25	1.35746	18.7	1.28544	.436264
17	0	0	124.	1.13905	18.8	1.07826	.367151
18	0	0	131.75	.898018	18.9	.849812	.290271
19	0	0	139.5	.635497	18.9	.601194	.205967
20	0	0	147.25	.349467	19.	.330501	.113563
END	0	0	155.	0	0	0	0
GND	91.6289	78.2585	0	1.70366	6.2	1.69381	.182915
22	91.6289	78.2585	7.785	1.92205	331.4	1.68686	-.921282
23	91.6289	78.2585	15.57	2.34304	315.3	1.66615	-1.64735
24	91.6289	78.2585	23.355	2.78399	305.9	1.63197	-2.2555
25	91.6289	78.2585	31.14	3.19276	299.8	1.58488	-2.77162
26	91.6289	78.2585	38.925	3.54795	295.5	1.52557	-3.20321
27	91.6289	78.2585	46.71	3.83806	292.3	1.45497	-3.55159
28	91.6289	78.2585	54.495	4.05594	289.8	1.37413	-3.81607
29	91.6289	78.2585	62.28	4.19697	287.8	1.28426	-3.99565
30	91.6289	78.2585	70.065	4.25839	286.2	1.18668	-4.0897
31	91.6289	78.2585	77.85	4.23897	284.8	1.08282	-4.09834
32	91.6289	78.2585	85.635	4.13889	283.6	.97415	-4.02262
33	91.6289	78.2585	93.42	3.95966	282.6	.862196	-3.86465
34	91.6289	78.2585	101.205	3.70396	281.7	.748481	-3.62755
35	91.6289	78.2585	108.99	3.3755	280.8	.634507	-3.31533
36	91.6289	78.2585	116.775	2.9788	280.1	.521711	-2.93276

Exhibit 1.12 – Tower 2 - NW Model

37	91.6289	78.2585	124.56	2.51877	279.4	.411415	-2.48494
38	91.6289	78.2585	132.345	2.	278.8	.304742	-1.97665
39	91.6289	78.2585	140.13	1.42497	278.2	.202424	-1.41052
40	91.6289	78.2585	147.915	.789103	277.6	.104274	-.782183
END	91.6289	78.2585	155.7	0	0	0	0
GND	-138.292	-81.4599	0	.0216992	275.9	2.25E-03	-.0215828
42	-138.292	-81.4599	6.85	.101929	275.9	.0105585	-.101381
43	-138.292	-81.4599	13.7	.154263	276.	.0160114	-.15343
44	-138.292	-81.4599	20.55	.197439	276.	.0205418	-.196367
45	-138.292	-81.4599	27.4	.233524	276.	.0243627	-.232249
46	-138.292	-81.4599	34.25	.263212	276.	.0275448	-.261767
47	-138.292	-81.4599	41.1	.28673	276.	.0301089	-.285145
48	-138.292	-81.4599	47.95	.304135	276.1	.0320581	-.30244
49	-138.292	-81.4599	54.8	.315433	276.1	.0333888	-.313661
50	-138.292	-81.4599	61.65	.320635	276.1	.0340961	-.318817
51	-138.292	-81.4599	68.5	.319776	276.1	.0341767	-.317945
52	-138.292	-81.4599	75.35	.31293	276.2	.0336295	-.311118
53	-138.292	-81.4599	82.2	.300221	276.2	.0324569	-.298462
54	-138.292	-81.4599	89.05	.281815	276.2	.0306642	-.280142
55	-138.292	-81.4599	95.9	.257918	276.3	.0282598	-.256365
56	-138.292	-81.4599	102.75	.228765	276.3	.0252528	-.227367
57	-138.292	-81.4599	109.6	.19459	276.4	.0216515	-.193381
58	-138.292	-81.4599	116.45	.155571	276.4	.0174568	-.154589
59	-138.292	-81.4599	123.3	.111694	276.5	.0126461	-.110976
60	-138.292	-81.4599	130.15	.0623448	276.6	7.13E-03	-.0619361
END	-138.292	-81.4599	137.	0	0	0	0

Exhibit 1.13 – Tower 3 - SE Model

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GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.28	20
		0	0	155.		
2	none	120.5	319.5	0	.291	20
		120.5	319.5	155.7		
3	none	160.5	149.5	0	.24	20
		160.5	149.5	137.		

Number of wires = 3
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	6.85	2	7.785
radius	3	.24	2	.291

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.25	0	1	.0190278	.021625

Sources

source	node	sector	magnitude	phase	type
1	41	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-727.6	0	0	0
2	21	0	-5,093.	0	0	0

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IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB

source = 1; node 41, sector 1

Exhibit 1.13 – Tower 3 - SE Model

1.25 337.16 277.22 436.49 39.4 11.362 -1.5329 -5.2667

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CURRENT rms
Frequency = 1.25 MHz
Input power = 2,200. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	.650648	341.5	.617187	-.205967
2	0	0	7.75	1.04354	341.6	.989936	-.330162
3	0	0	15.5	1.29714	341.6	1.23067	-.40991
4	0	0	23.25	1.50346	341.6	1.42666	-.474367
5	0	0	31.	1.67192	341.6	1.58684	-.526564
6	0	0	38.75	1.80542	341.7	1.71393	-.567464
7	0	0	46.5	1.90464	341.7	1.80854	-.597361
8	0	0	54.25	1.96966	341.8	1.87074	-.61635
9	0	0	62.	2.00042	341.8	1.90044	-.624499
10	0	0	69.75	1.99706	341.9	1.89774	-.621938
11	0	0	77.5	1.96002	341.9	1.86304	-.608886
12	0	0	85.25	1.89009	341.9	1.79706	-.585674
13	0	0	93.	1.78845	342.	1.70089	-.552748
14	0	0	100.75	1.65665	342.	1.57598	-.510667
15	0	0	108.5	1.49655	342.1	1.42407	-.460077
16	0	0	116.25	1.31026	342.1	1.24716	-.401702
17	0	0	124.	1.09998	342.2	1.04731	-.336284
18	0	0	131.75	.867687	342.3	.826392	-.264495
19	0	0	139.5	.614409	342.3	.58535	-.186719
20	0	0	147.25	.338103	342.4	.322218	-.102417
END	0	0	155.	0	0	0	0
GND	91.6289	78.2585	0	.0300305	226.	-.0208533	-.0216095
22	91.6289	78.2585	7.785	.159989	226.1	-.111025	-.115195
23	91.6289	78.2585	15.57	.245285	226.1	-.170039	-.17678
24	91.6289	78.2585	23.355	.316548	226.2	-.219168	-.228404
25	91.6289	78.2585	31.14	.376815	226.3	-.260522	-.272245
26	91.6289	78.2585	38.925	.426943	226.3	-.294707	-.308915
27	91.6289	78.2585	46.71	.467064	226.4	-.321824	-.338494
28	91.6289	78.2585	54.495	.497071	226.6	-.341821	-.360886
29	91.6289	78.2585	62.28	.516818	226.7	-.354619	-.37596
30	91.6289	78.2585	70.065	.526202	226.8	-.360181	-.383612
31	91.6289	78.2585	77.85	.525215	226.9	-.358547	-.383791
32	91.6289	78.2585	85.635	.513961	227.1	-.349836	-.376525
33	91.6289	78.2585	93.42	.492668	227.3	-.33427	-.361919
34	91.6289	78.2585	101.205	.461687	227.5	-.312158	-.340165
35	91.6289	78.2585	108.99	.421479	227.7	-.283895	-.311525
36	91.6289	78.2585	116.775	.372592	227.9	-.249939	-.276325

Exhibit 1.13 – Tower 3 - SE Model

37	91.6289	78.2585	124.56	.315616	228.1	-.210783	-.234912
38	91.6289	78.2585	132.345	.251084	228.3	-.166887	-.187596
39	91.6289	78.2585	140.13	.179258	228.6	-.118534	-.134473
40	91.6289	78.2585	147.915	.0994895	228.9	-.0654183	-.0749573
END	91.6289	78.2585	155.7	0	0	0	0
GND	-138.292	-81.4599	0	2.55443	320.6	1.97312	-1.62232
42	-138.292	-81.4599	6.85	3.12251	309.	1.96604	-2.42586
43	-138.292	-81.4599	13.7	3.52193	303.5	1.94486	-2.93624
44	-138.292	-81.4599	20.55	3.84988	299.7	1.90986	-3.34276
45	-138.292	-81.4599	27.4	4.11215	296.9	1.86142	-3.66673
46	-138.292	-81.4599	34.25	4.30971	294.7	1.80009	-3.91577
47	-138.292	-81.4599	41.1	4.44218	292.9	1.72659	-4.0929
48	-138.292	-81.4599	47.95	4.50912	291.4	1.64175	-4.19962
49	-138.292	-81.4599	54.8	4.51048	290.1	1.54652	-4.23706
50	-138.292	-81.4599	61.65	4.44675	288.9	1.44198	-4.20646
51	-138.292	-81.4599	68.5	4.31905	287.9	1.32928	-4.10941
52	-138.292	-81.4599	75.35	4.12918	287.	1.20966	-3.94802
53	-138.292	-81.4599	82.2	3.87953	286.2	1.0844	-3.7249
54	-138.292	-81.4599	89.05	3.57311	285.5	.954812	-3.44317
55	-138.292	-81.4599	95.9	3.21333	284.8	.822209	-3.10636
56	-138.292	-81.4599	102.75	2.8039	284.2	.687851	-2.71822
57	-138.292	-81.4599	109.6	2.34851	283.6	.552896	-2.2825
58	-138.292	-81.4599	116.45	1.85013	283.1	.418266	-1.80223
59	-138.292	-81.4599	123.3	1.30954	282.5	.284372	-1.27829
60	-138.292	-81.4599	130.15	.720742	282.	.150268	-.704903
END	-138.292	-81.4599	137.	0	0	0	0

Exhibit 1.20 – Day Non-Directional Impedance Measurement

KBRF – Fergus Falls, MN

Measured Daytime Tower 3 Impedance = 460 +j 412.5 Ohms

Daytime Power of 5.0 kW.

Base current of 3.30 Amperes

Daytime Tower 3 measurement was performed by Mr. Edmond Trombley of Munn-Reese, using a Delta OIB-3 operating impedance bridge, S/N 572.

Exhibit 1.30

Moment Method Night Parameter Discussion

KBRF – Fergus Falls, MN

The nighttime operating parameters were derived using the data developed in the individual tower models. Mininec calculated the driving point impedance, voltage and current at the base of each tower in the array using the "**Field Parameters**" shown in the "**Night Pattern**" section of the accompanying parameter sheet. In order to obtain the antenna monitor operating parameters, this data was modified to reflect the effect of the reactance values used in the modeling of each tower.

The Mininec calculated values of driving point impedance, base voltage and base current are shown in the "**Mininec Model Data**" section of the parameter sheet. The base voltage and base current are shown in polar coordinates taken from the Mininec printouts. However, these values were converted to rectangular coordinates for use in the calculations using complex numbers. Also shown in this section are the shunt and series X values from the tower modelling data. All calculations were performed using the complex number functions of Excel 2016.

The derivations of the sample voltages are shown in the "**Computation of Operating Parameters**" section of the parameter sheet. The current in the shunt reactance ("**Shunt X Current**") was calculated using Ohms Law (I = E / Z). This current was then added to the Mininec base current as shown in the "**Total Current**" column. The total current was then used to calculate the voltage across the series reactance (E = I x Z) and can be found in the "**Series X Voltage**" column. This voltage was added to the Mininec base voltage to calculate the "**Sample Voltage**" shown in the last column.

These values were then converted back to polar coordinates as shown in the "**Sample Voltage**" column near the top of the parameter sheet in the "**Night Pattern**" section. The polar values were then normalized to the highest voltage tower to obtain the antenna monitor operating parameters shown in the "**Operating Parameters**" column in the top row of the parameter sheet.

Exhibit 1.30

Moment Method Night Pattern Parameter Sheet

KBRF - Fergus Falls, MN

Modeling Software: Mininec Broadcast Professional - Version 14.5

Station: KBRF - Fergus Falls, MN

Freq (kHz) 1250

Night Pattern

	Field Parameters		Sample Voltage		Operating Parameters	
Twr	Ratio	Phase	Mag	Phs	Ratio	Phase
1 - C	1.000	0.0°	601.99	77.3	0.744	24.6°
2 - NW	0.923	-39.5°	754.63	32.6	0.933	-20.2°
3 - SE	1.008	-24.2°	808.94	52.7	1.000	0.0°

Mininec Model Data

	Drive Point		Base Voltage		Base Current		Shunt	Series
Twr	R	X	Mag	Phs	Mag	Phs	X	X
1 - C	272.23	330.10	590.826	74	1.38085	23.5	-727.6	40
2 - NW	679.73	49.62	756.023	29.2	1.1093	25	-5093	40
3 - SE	274.88	312.24	729.155	47.4	1.75279	358.7	-5093	65

Computation of Operating Parameters

	Shunt X Current		Total Current		Series X Voltage		Sample Voltage	
Twr	Real	Img	Real	Img	Real	Img	Real	Img
1 - C	-0.78056	0.22382	0.48576	0.77444	-30.977	19.430	131.88	587.37
2 - NW	-0.07242	0.12958	0.93295	0.59839	-23.936	37.318	636.01	406.15
3 - SE	-0.10539	0.09691	1.64695	0.05714	-3.714	107.052	489.83	643.78

Exhibit 1.31 – Night Pattern Synthesis

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MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.25 MHz

tower	field ratio magnitude	phase (deg)
1	1.	0
2	.923	-39.5
3	1.008	-24.2

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	590.826	74.	1.38085	23.5
21	756.023	29.2	1.1093	25.
41	729.155	47.4	1.75279	358.7

Sum of square of source currents = 12.4191
Total power = 2,200. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00132677	-.000240282
Y(1, 2)	.000535027	-.000298174
Y(1, 3)	.000254024	-.000606391
Y(2, 1)	.000535026	-.000298175
Y(2, 2)	.00128576	-7.802E-05
Y(2, 3)	-.000330183	-6.4612E-05
Y(3, 1)	.000254054	-.000606397
Y(3, 2)	-.000330183	-6.4621E-05
Y(3, 3)	.00152998	-.00150086

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	892.822	-215.601
Z(1, 2)	-423.741	291.368
Z(1, 3)	-302.161	138.237
Z(2, 1)	-423.74	291.368
Z(2, 2)	946.111	-158.85
Z(2, 3)	189.782	-24.4793
Z(3, 1)	-302.149	138.244
Z(3, 2)	189.777	-24.4826
Z(3, 3)	422.101	274.089

Exhibit 1.32 – Night Pattern Summary

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KBRF - Fergus Falls MN - DA-N

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.28	20
		0	0	155.		
2	none	120.5	319.5	0	.291	20
		120.5	319.5	155.7		
3	none	160.5	149.5	0	.24	20
		160.5	149.5	137.		

Number of wires = 3
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	6.85	2	7.785
radius	3	.24	2	.291

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.25	0	1	.0190278	.021625

Sources

source	node	sector	magnitude	phase	type
1	1	1	835.554	74.	voltage
2	21	1	1,069.18	29.2	voltage
3	41	1	1,031.18	47.4	voltage

Exhibit 1.32 – Night Pattern Summary

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IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.25	272.23	330.1	427.87	50.5	13.56	-1.2834	-5.92
source = 2; node 21, sector 1							
1.25	679.73	49.615	681.54	4.2	13.667	-1.2733	-5.9496
source = 3; node 41, sector 1							
1.25	274.88	312.24	416.	48.6	12.694	-1.3713	-5.6742

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CURRENT rms
Frequency = 1.25 MHz
Input power = 2,200. watts
Efficiency = 100. %
coordinates in degrees

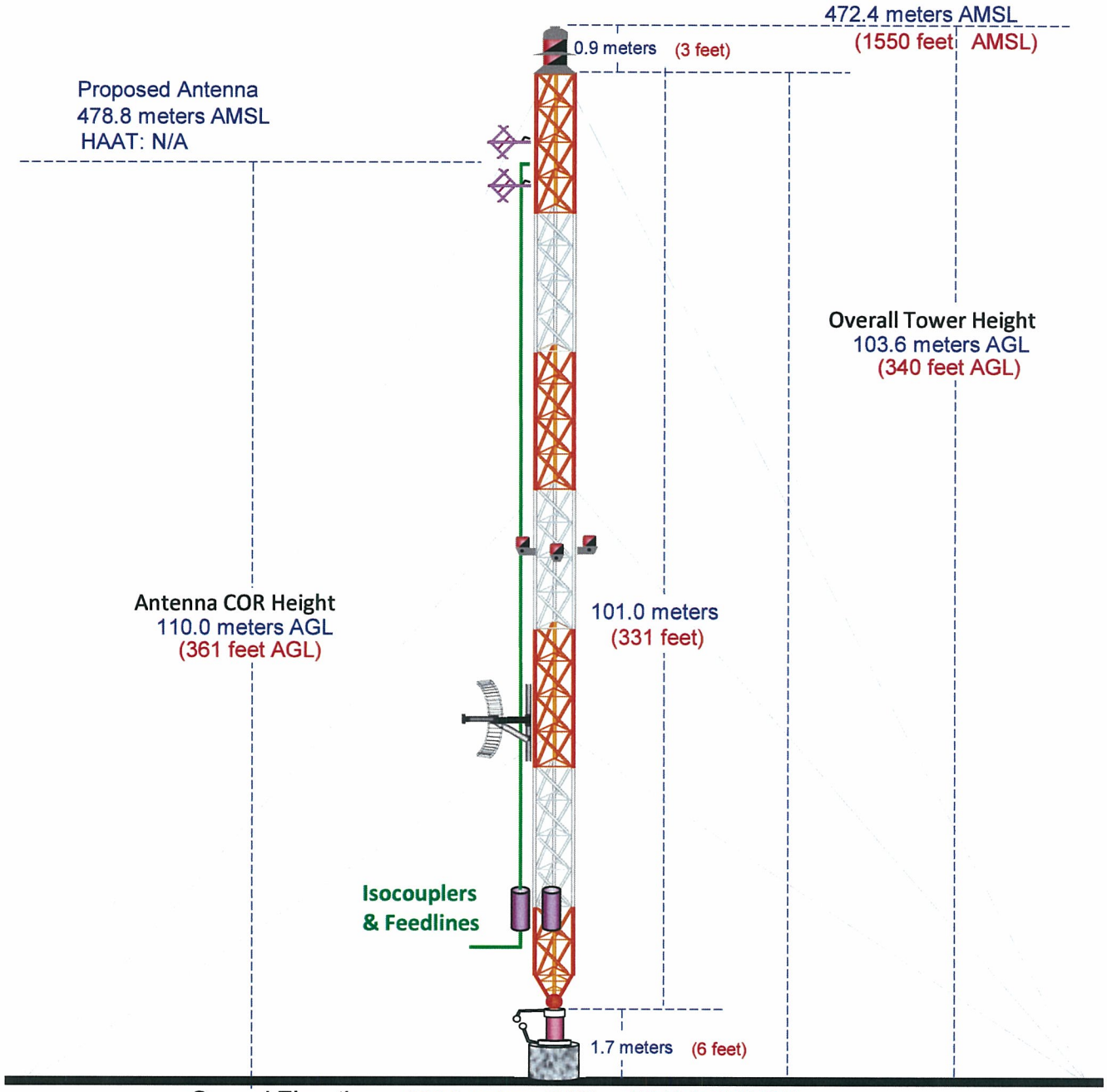
current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	1.38085	23.5	1.26586	.55167
2	0	0	7.75	1.78385	13.4	1.73507	.414328
3	0	0	15.5	2.05773	8.9	2.03272	.31986
4	0	0	23.25	2.28166	6.	2.26935	.236726
5	0	0	31.	2.46181	3.8	2.45649	.161766
6	0	0	38.75	2.59956	2.1	2.59786	.0941104
7	0	0	46.5	2.69487	.7	2.69466	.0336673
8	0	0	54.25	2.74743	359.6	2.74736	-.0193895
9	0	0	62.	2.75713	358.7	2.75637	-.0648131
10	0	0	69.75	2.72427	357.8	2.72234	-.102372
11	0	0	77.5	2.64961	357.1	2.64632	-.131895
12	0	0	85.25	2.53444	356.5	2.5298	-.153295
13	0	0	93.	2.38054	356.	2.37471	-.166579
14	0	0	100.75	2.1902	355.5	2.18344	-.171854
15	0	0	108.5	1.96606	355.1	1.95876	-.169321
16	0	0	116.25	1.71112	354.7	1.70369	-.159268
17	0	0	124.	1.42839	354.3	1.42131	-.142042
18	0	0	131.75	1.12061	354.	1.11438	-.118004
19	0	0	139.5	.789299	353.6	.784444	-.087407
20	0	0	147.25	.432045	353.3	.429135	-.05006
END	0	0	155.	0	0	0	0

Exhibit 1.32 – Night Pattern Summary

GND	91.6289	78.2585	0	1.10929	25.	1.00534	.468855
22	91.6289	78.2585	7.785	1.31782	355.9	1.31449	-.0937533
23	91.6289	78.2585	15.57	1.57868	342.8	1.50801	-.467048
24	91.6289	78.2585	23.355	1.83544	334.7	1.65994	-.783221
25	91.6289	78.2585	31.14	2.06757	329.3	1.77794	-1.05534
26	91.6289	78.2585	38.925	2.26567	325.4	1.86457	-1.28711
27	91.6289	78.2585	46.71	2.42418	322.4	1.92071	-1.47902
28	91.6289	78.2585	54.495	2.53944	320.1	1.9468	-1.63056
29	91.6289	78.2585	62.28	2.60909	318.1	1.94326	-1.741
30	91.6289	78.2585	70.065	2.63169	316.6	1.91065	-1.80976
31	91.6289	78.2585	77.85	2.60675	315.2	1.84983	-1.83664
32	91.6289	78.2585	85.635	2.5345	314.	1.76193	-1.8219
33	91.6289	78.2585	93.42	2.41598	313.	1.6484	-1.76628
34	91.6289	78.2585	101.205	2.25287	312.1	1.51097	-1.67104
35	91.6289	78.2585	108.99	2.04746	311.3	1.35162	-1.53792
36	91.6289	78.2585	116.775	1.80246	310.6	1.17247	-1.36901
37	91.6289	78.2585	124.56	1.52084	309.9	.975702	-1.16661
38	91.6289	78.2585	132.345	1.20532	309.3	.763231	-.93288
39	91.6289	78.2585	140.13	.85731	308.7	.536142	-.668978
40	91.6289	78.2585	147.915	.474012	308.2	.292863	-.372718
END	91.6289	78.2585	155.7	0	0	0	0
GND	-138.292	-81.4599	0	1.75279	358.7	1.75235	-.0394312
42	-138.292	-81.4599	6.85	2.1722	349.4	2.13546	-.397844
43	-138.292	-81.4599	13.7	2.45337	345.1	2.3708	-.631156
44	-138.292	-81.4599	20.55	2.67912	342.1	2.54953	-.823158
45	-138.292	-81.4599	27.4	2.85659	339.9	2.68207	-.983155
46	-138.292	-81.4599	34.25	2.98795	338.1	2.77237	-1.11435
47	-138.292	-81.4599	41.1	3.07373	336.7	2.82218	-1.21784
48	-138.292	-81.4599	47.95	3.1142	335.4	2.83262	-1.29404
49	-138.292	-81.4599	54.8	3.10965	334.4	2.80464	-1.3431
50	-138.292	-81.4599	61.65	3.06069	333.5	2.73934	-1.36523
51	-138.292	-81.4599	68.5	2.9683	332.7	2.63801	-1.36077
52	-138.292	-81.4599	75.35	2.83384	332.	2.50223	-1.33023
53	-138.292	-81.4599	82.2	2.65908	331.4	2.33383	-1.27435
54	-138.292	-81.4599	89.05	2.44614	330.8	2.13491	-1.19406
55	-138.292	-81.4599	95.9	2.19742	330.2	1.90774	-1.0905
56	-138.292	-81.4599	102.75	1.91549	329.8	1.65471	-.964905
57	-138.292	-81.4599	109.6	1.60288	329.3	1.37812	-.818541
58	-138.292	-81.4599	116.45	1.26165	328.9	1.07984	-.652458
59	-138.292	-81.4599	123.3	.892279	328.4	.760374	-.466898
60	-138.292	-81.4599	130.15	.490724	328.1	.416397	-.25966
END	-138.292	-81.4599	137.	0	0	0	0

Exhibit 2.10 - Tower 1 (C)
Vertical Plan of Antenna System

THE SITE IS LOCATED AT 1613 Hwy 210 E; THE CITY OF FERGUS FALLS ; OTTER TAIL COUNTY; MINNEASOTA.	
Antenna Structure Registration No. 1024482	Latitude (D M S) Longitude (D M S) NAD 27 datum values: 46-16-27.3 N 96-02-47.3 W NAD 83 datum values: 46-16-27.4 N 96-02-46.1 W



Munn–Reese
Broadcast Engineering Consultants
Coldwater, MI 49036

Exhibit 3.10 Sample System Verification

KBRF - Fergus Falls, MN

Carrier Freq (kHz) 1250

Sample Line

Manufacturer	Model	Velocity Factor (0.xx)	Design Length (feet)	Full Wave Freq (kHz)	
Andrew	LDF2-50	0.88	630	1373.9	3/8 line

Theoretical Calculations

	90°	270°	450°	630°
Resonant Frequency (kHz)	343.5	1030.4	1717.3	2404.3
Distance from Carrier (kHz)	-906.5	-219.6	467.3	1154.3

Initial Measurements (Before Trimming Line Lengths) 9/18/2017

Sample Lines	Selected Resonance (Electrical °)	Measured Freq at Resonance (MHz)	Line Length at Carrier Freq (Electrical °)	Maximum Deviation	No Smoothing	averaging on
Twr 1 C	270°	1.57965	213.7°	*25.98721085*		
Twr 2 N	270°	1.5504	217.7°			
Twr 3 S	270°	1.40835	239.6°			

Final Measurements (After Trimming Line Lengths)

Measurement Date: 9/20/2017

Sample Lines	Selected Resonance (Electrical °)	Measured Freq at Resonance (MHz)	Line Length at Carrier Freq (Electrical °)	Maximum Deviation	No Smoothing	averaging on
Twr 1	270°	1.25425	269.1°	*0.150093293*		
Twr 2	270°	1.25495	268.9°			
Twr 3	270°	1.25469	269.0°			

Sample Line Impedance Measurements

Measurement Date: 9/20/2017

Sample Lines	+45° Frequency (MHz)	Measured Resistance	Measured Reactance	Line Impedance	Geometric Mean Impedance	Maximum Deviation
Twr 1	1.46329	7.71	49.68	50.27	50.15	*0.44*
Twr 2	1.46411	7.64	49.59	50.18	50.05	
Twr 3	1.46381	7.74	50.15	50.74	50.49	

Sample Lines	-45° Frequency (MHz)	Measured Resistance	Measured Reactance	Line Impedance
Twr 1	1.04521	5.21	-49.76	50.03
Twr 2	1.04579	5.16	-49.65	49.92
Twr 3	1.04558	5.19	-49.96	50.23

Sampling Devices

Measurement Date: 9/18/2017

Location	Manufacturer	Model	Serial Number	Magnitude	Phase
Twr 1	Kintronics	VSU-1	051517-01	*1.000*	*0.000*
Twr 2	Kintronics	VSU-1	051517-02	*0.996*	*-0.56*
Twr 3	Kintronics	VSU-1	051517-03	*0.993*	*-0.240*

Sample Line Measurements with Sampling Devices Attached

Measurement Date: 9/20/2017

Sample Line	Frequency (MHz)	Measured Resistance	Measured Reactance	Impedance Magnitude	
Twr 1	1250	366.7	-369.5	520.58	w//volt sample & output J plug pulled
Twr 2	1250	319.4	-357.6	479.47	
Twr 3	1250	303.5	-356.9	468.50	

Exhibit 4.10 - KBRF Fergus Falls, MN Night Field Strength Measurement Reference Points

KBRF(AM) - Fergus Falls, MN 1250 kHz					
Night Directional Pattern - September 23, 2017					
Radial:	**0.0°**				FIM-41 s/n 1149 - Calibrated 5/4/2016
		Distance	**NAD27**		
Point #	**mV/m**	**km**	**North Latitude**	**West Longitude**	**Description**
1	58.0	2.50	46-17-48	96-02-46	SE corner of E. Fir Ave. & E. Hills Dr.
2	54.0	2.75	46-17-56	96-02-46	S of Traile 32 in culdusack (Lakeview Estates)
3	34.0	3.88	46-18-33	96-02-46	On CR-111 N of large barn
Radial:	**53.0°**				FIM-41 s/n 1149 - Calibrated 5/4/2016
		Distance	**NAD27**		
Point #	**mV/m**	**km**	**North Latitude**	**West Longitude**	**Description**
1	205.0	2.82	46-17-22	96-01-00	In front of 22475 226th Ave.
2	195.0	3.29	46-17-31	96-00-42	W of 22837 226th Ave.
3	140.0	3.62	46-17-37	96-00-30	On 230th Ave. near Telco box 98E12S3
Radial:	**110.0°**				FIM-41 s/n 1149 - Calibrated 5/4/2016
		Distance	**NAD27**		
Point #	**mV/m**	**km**	**North Latitude**	**West Longitude**	**Description**
1	41.0	4.70	46-15-35	95-59-19	On CR33 near field driveway
2	27.0	7.04	46-15-09	95-57-36	On CR124 in curve near fiber cable marker
3	12.0	9.93	46-14-37	95-55-29	On 270th Ave. next to Rosvold Lake
Radial:	**181.0°**				FIM-41 s/n 1149 - Calibrated 5/4/2016
		Distance	**NAD27**		
Point #	**mV/m**	**km**	**North Latitude**	**West Longitude**	**Description**
1	41.0	2.87	46-14-54	96-02-48	W side of US59BR S of Pebble Lake Golf Dr.
2	15.0	6.34	46-13-02	96-02-51	On 175th St. 0.15 miles E of 25
3	10.0	7.14	46-12-36	96-02-52	On 170th St. on curve 0.18 miles E of 25
Radial:	**238.0°**				FIM-41 s/n 1149 - Calibrated 5/4/2016
		Distance	**NAD27**		
Point #	**mV/m**	**km**	**North Latitude**	**West Longitude**	**Description**
1	195.0	3.27	46-15-31	96-04-56	On S Oak St. near end of road
2	130.0	5.16	46-14-58	96-06-11	On Wendell Rd. 0.2 miles N of Dayton Lake Rd.
3	115.0	5.76	46-14-48	96-06-34	On Dayton Lake Rd. near property line 0.3 miles W of Wendell Rd.
Radial:	**293.0°**				FIM-41 s/n 1149 - Calibrated 5/4/2016
		Distance	**NAD27**		
Point #	**mV/m**	**km**	**North Latitude**	**West Longitude**	**Description**
1	36.0	2.91	46-17-04	96-04-52	S of N Oak St. & W Cavour Ave. Int.
2	31.0	3.27	46-17-08	96-05-07	Front of 632 W Summit Ave.
3	26.0	3.51	46-17-11	96-05-18	W of N First Ave. & S Linden St. Int.