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.

SECTION I - APPLICANT FEE INFORMATION

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

Bonneville International Corporation

MAILING ADDRESS (Line 1) (Maximum 35 characters)
55 North 300 West

MAILING ADDRESS (Line 2) (Maximum 35 characters)
2nd Floor

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Salt Lake City	Utah	84101

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
8015755874	KIRO	FIN 6362

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
M M R	0 0 0 1	$ 645.00	

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
M O R	0 0 0 1	$ 1260.00	

ADD ALL AMOUNTS SHOWN IN COLUMN C,
AND ENTER THE TOTAL HERE.
THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.

TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
$ 1905.00	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT Bonneville International Corporation		
MAILING ADDRESS 55 North 300 West 2nd Floor		
CITY Salt Lake City	STATE Utah	ZIP CODE 84101

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
KIRO	Seattle, Washington	--	--	--

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

☐ Yes ☐ No
N/A

If No, explain in an Exhibit.

Exhibit No.

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

☐ Yes ☐ No
N/A

If No, state exceptions in an Exhibit.

Exhibit No.

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
N/A

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	
Michael L. Dowdle	/s/ Michael L. Dowdle	
Title	Date	Telephone Number
EVP Business Affairs and General Counsel	10/15/2021	8015755874

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.

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant

BONNEVILLE INTERNATIONAL CORPORATION

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

[X] Station License [ ] Direct Measurement of Power

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
KIRO		710	Unlimited	50	50

2. Station location

State	City or Town
Washington	Seattle

3. Transmitter location

State	County	City or Town	Street address (or other identification)
WA	King	Vashon	22805 Dockton Rd SW

4. Main studio location

State	County	City or Town	Street address (or other identification)
WA	King	Seattle	1820 Eastlake Ave E

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

State	County	City or Town	Street address (or other identification)
WA	King	Seattle	1820 Eastlake Ave E

6. Has type-approved stereo generating equipment been installed? [ ] Yes [X] No

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

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

See Engineering report

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
32.45	8.83

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	642	-j11.5	-j147

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
1 (NW)	0		1.0			
2 (SE)	+61.4		1.108			

Manufacturer and type of antenna monitor: Potomac Instruments AM-1901

SECTION III - Page 2

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.
Uniform cross-section guyed steel towers	157.2	159.4	160.3	Exhibit No.

Excitation [X] Series [ ] Shunt

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

North Latitude	West Longitude
47° 23' 55"	122° 26' 0"

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?

None. Replacement of base sample devices.
Ground system is as specified in BML-20070411ADB

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

Impedance for licensed auxiliary operation using Tower #2:
633 -j132.
Base Current 8.89A

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)
Thomas S. Gorton	
Address (include ZIP Code)	Date
Hatfield & Dawson Consulting Engineers 9500 Greenwood Ave N Seattle, WA 98103-3012	October 7, 2021
	Telephone No. (Include Area Code) 206 783 9151

[ ] Technical Director
[X] Registered Professional Engineer
[ ] Chief Operator
[ ] Technical Consultant
[ ] Other (specify)

STEPHEN S. LOCKWOOD, PE, PMP
———
THOMAS M. ECKELS, PE
THOMAS S. GORTON, PE
———
JAMES B. HATFIELD, PE
BENJAMIN F. DAWSON III, PE
ERIK C. SWANSON, PE, PMP
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———
MAURY L. HATFIELD, PE
(1942-2009)
PAUL W. LEONARD, PE
(1925-2011)

Application for Modified License
and
Method of Moments Proof of Performance

KIRO(AM)
Seattle Washington
Facility ID

710 kHz
50 kW DA-N

Bonneville International Corporation

October 2021

APPLICATION FOR MODIFIED LICENSE
RADIO STATION KIRO(AM) Seattle, WA
710 kHz 50 kW DA-N

Purpose of Application

Item 1	Analysis of Tower Impedance Measurements to Verify Method of Moments Model
Item 2	Method of Moments Model Details for Towers Driven Individually
Item 3	Method of Moments Model Details for Directional Antenna Patterns
Item 4	Derivation of Operating Parameters for Directional Antenna
Item 5	Post Construction Array Geometry Statement
Item 6	Sampling System Measurements
Item 7	Reference Field Strength Measurements
Item 8	Direct Measurement of Power

Purpose of Application

This engineering exhibit supports an application by Bonneville International Corporation for a modified station license for radio station KIRO(AM) Seattle, WA (Facility ID 6362). KIRO is a Class A station operating on 710 kHz with a full time power of 50 kW.

Information is provided herein demonstrating that the directional antenna parameters for the pattern authorized by the KIRO license (BML-20070411ADB) have been determined in accordance with the requirements of section §73.151(c) of the FCC Rules. The system has been adjusted to produce antenna monitor parameters within +/- 5 percent in ratio and +/- 3 degrees in phase of the modeled values, as required by the Rules.

All measurements contained in this report were made by Stephen S. Lockwood P.E. and the undersigned engineer.

Item 1

Analysis of Tower Impedance Measurements to Verify Method of Moments Model - KIRO

Tower base impedance measurements were made at the locations of the sample system voltage dividers using a Hewlett Packard 8751A network analyzer in a calibrated measurement system. The other tower was grounded at the same point where impedance measurements were made (the "reference points") for each of the measurements.
The reference point measurements are listed in the table below.

KIRO Reference Point Impedance Measurements

Tower	Impedance
1 (NW)	435.8 +j302.6
2 (SE)	423.2 +j276.3

Circuit calculations were performed to relate the method of moments modeled impedances at the tower base feed points to those at the measurement locations as shown in the diagram titled *Analysis of Tower Impedance Measurements to Verify Method of Moments Model*. The impedance of X_S was used in the moment method model as a load at ground level (lumped load) for the grounded towers.

Item 2

Method of Moments Model Details for Towers Driven Individually - KIRO

The array of towers was modeled using Expert MININEC Broadcast Professional Version 14.0. One wire was used to represent each tower. The top and bottom wire end points were specified using electrical degrees in the geographic coordinate system, using the theoretical directional antenna specifications for tower spacing and orientation. Each tower was modeled using 20 wire segments. As the tallest tower in the KIRO model is 139.8 electrical degrees in height, the maximum segment length is 7 electrical degrees.

Each tower's modeled height relative to its physical height falls within the required range of 75 to 125 percent of the actual tower height. The array consists of two uniform cross section triangular towers each having a face width of 4 feet.

KIRO Tower Dimensions - Physical and Modeled

Tower	Physical Height (Degrees)	Modeled Height (degrees)	Modeled Height (percent)	Modeled Radius (meters)	Modeled Radius (percent)
1	134	139.8	104.3	.58	100
2	134	139.1	103.8	.65	112

KIRO MININEC Model Node and Wire Numbering

Tower	Wire Number	Base Node Number
1	1	1
2	2	21

The following pages show the details of the method of moments model.

KIRO Tower 1 Driven, Tower 2 Grounded at Reference Point

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 0            0            0            .58          20
           0            0            139.8
 2    none 160.         130.5        0            .65          20
           160.         130.5        139.1

Number of wires          =  2
          current nodes  =  40

                          minimum                  maximum
Individual wires      wire    value             wire  value
segment length         2      6.955              1    6.99
radius                 1      .58                2    .65


ELECTRICAL DESCRIPTION
Frequencies (KHz)
     frequency                no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   710.         0             1      .0193195       .0194167

Sources
source node    sector  magnitude      phase          type
 1      1       1      1,000.         0              voltage

Lumped loads
             resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     21    0             13.           0           0            0

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IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(KHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 1, sector 1
710.     388.76   297.3    489.41   37.4     12.37   -1.4074  -5.5783
```

KIRO Tower 2 Driven, Tower 2 Grounded at Reference Point

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

wire  caps Distance     Angle        Z            radius      segs
 1    none 0            0           0            .58          20
           0            0           139.8
 2    none 160.         130.5       0            .65          20
           160.         130.5       139.1

Number of wires          =  2
          current nodes  =  40

                        minimum                   maximum
Individual wires      wire    value             wire  value
segment length         2      6.955              1    6.99
radius                 1      .58                2    .65


ELECTRICAL DESCRIPTION
Frequencies (KHz)
     frequency                no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   710.         0             1      .0193195       .0194167

Sources
source node    sector  magnitude      phase          type
 1      21      1       1,000.         0              voltage

Lumped loads
            resistance    reactance     inductance  capacitance passive
load  node  (ohms)        (ohms)        (mH)        (uF)        circuit
 1     1    0             23.           0           0            0

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IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(KHz)    (ohms)   (ohms)   (ohms)   (deg)            dB       dB
source =  1; node 21, sector 1
710.     380.14   281.13   472.8    36.5     11.808  -1.4748  -5.4072
```

Item 3

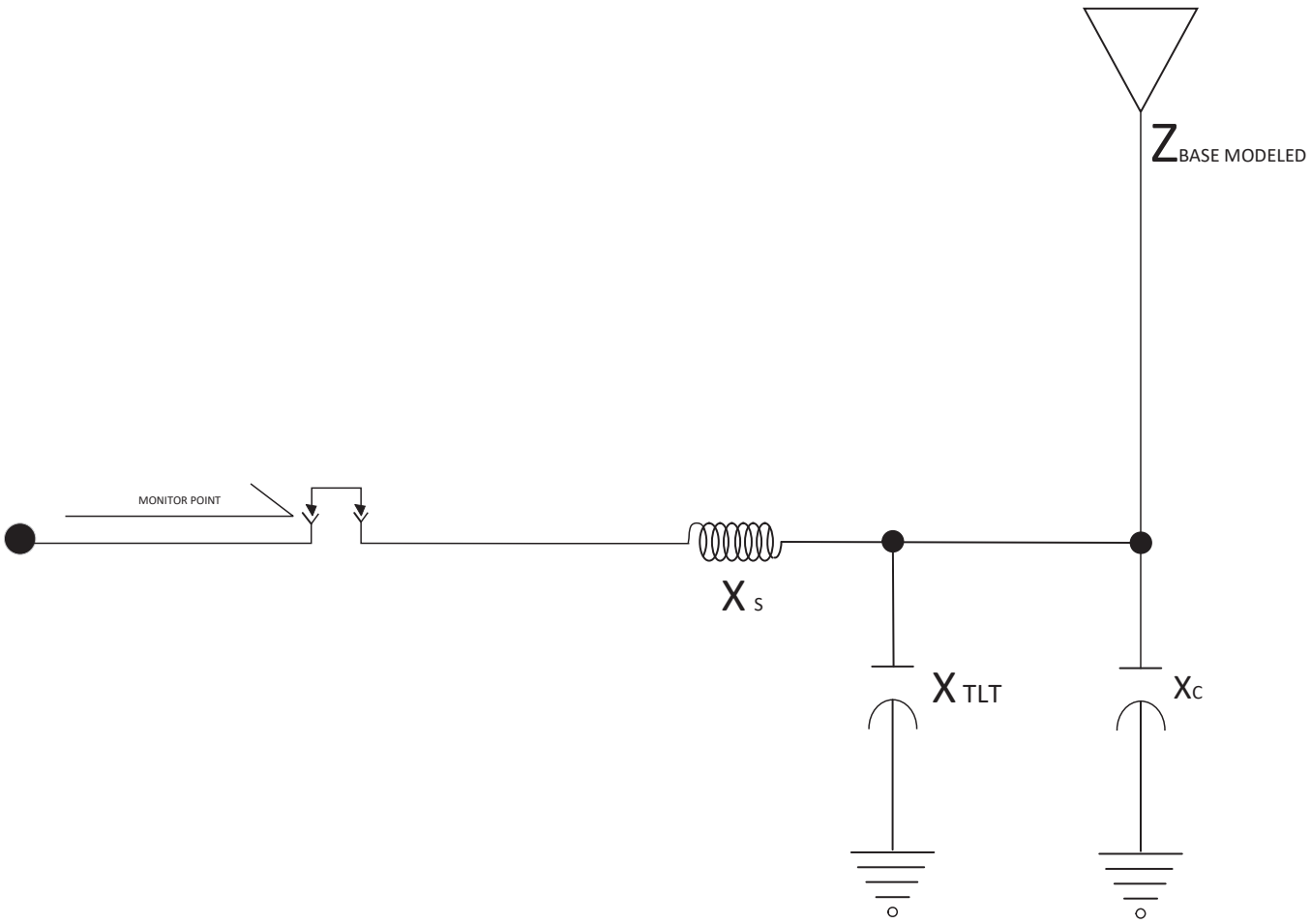
Method of Moments Model Details for Directional Antenna- KIRO

The array of towers was modeled using MININEC with the individual tower characteristics that were verified by the individual tower impedance measurements. Calculations were made to determine the complex voltage values for sources located at ground level under each tower of the array to produce current moment sums for the towers that, when normalized, equated to the theoretical field parameters of the authorized directional antenna patterns. In the schematic diagram on the following page,

X_C represents the capacitance between the tower and ground, including the base insulator
X_S represents the series inductance of the feed line connecting the ATU to the tower
X_{TLT} represents the reactance of the Austin ring lighting transformer

In all cases, the modeled impedance at the reference point is within one ohm of the measured reference point impedance.

Tower	X_S	X_{TLT}	X_C	Z Base Modeled	Z MP Modeled	Z MP Measured
1	+j23	-j10k	-j10k	388.8 +j297.3	436.5 +j303.0	435.8 +J302.6
2	+j13	-j10k	-j10k	380.1 +j281.1	424.0 +j276.7	423.2 +J276.3



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HATFIELD & DAWSON CONSULTING ENGINEERS	KIRO 710 kHz SEATTLE, WA	10/11/2021

KIRO Driven Array - Night Pattern

KIRO

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.58	20
		0	0	139.8		
2	none	160.	130.5	0	.65	20
		160.	130.5	139.1		

Number of wires = 2
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	2	6.955	1	6.99
radius	1	.58	2	.65

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	710.	0	1	.0193195	.0194167

Sources

source	node	sector	magnitude	phase	type
1	1	1	4,918.75	61.1	voltage
2	21	1	5,463.74	124.5	voltage

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IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
710.	**329.83**	**156.77**	365.19	25.4	8.1151	-2.1516	-4.0817
source = 2; node 21, sector 1							
710.	**258.21**	**353.91**	438.09	53.9	14.992	-1.1604	-6.299

CURRENT rms
Frequency = 710 KHz
Input power = 50,000. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	**9.52413**	**35.6**	7.74099	5.54852
2	0	0	6.99	11.0508	21.9	10.2524	4.12401
3	0	0	13.98	12.1784	15.2	11.7538	3.18774
4	0	0	20.97	13.1325	10.4	12.9169	2.36935
5	0	0	27.96	13.9048	6.7	13.8085	1.63405
6	0	0	34.95	14.4867	3.8	14.4542	.970377
7	0	0	41.94	14.87	1.4	14.8652	.375771
8	0	0	48.93	15.0486	359.4	15.0479	-.149028
9	0	0	55.92	15.0195	357.7	15.0074	-.602044
10	0	0	62.91	14.7822	356.2	14.7496	-.981034
11	0	0	69.9	14.3391	354.9	14.2815	-1.28401
12	0	0	76.89	13.6948	353.7	13.6114	-1.50948
13	0	0	83.88	12.857	352.6	12.7498	-1.65663
14	0	0	90.87	11.8349	351.6	11.7084	-1.72538
15	0	0	97.86	10.6397	350.7	10.5003	-1.71639
16	0	0	104.85	9.28353	349.9	9.13915	-1.63091
17	0	0	111.84	7.77852	349.1	7.63824	-1.47058
18	0	0	118.83	6.1344	348.4	6.00842	-1.23684
19	0	0	125.82	4.35319	347.7	4.25278	-.92962
20	0	0	132.81	2.41501	347.	2.35303	-.543626
END	0	0	139.8	0	0	0	0
GND	-103.912	-121.665	0	**8.81884**	**70.7**	2.92043	8.32124
22	-103.912	-121.665	6.955	11.6884	60.9	5.69307	10.2082
23	-103.912	-121.665	13.91	13.4804	56.9	7.3629	11.292
24	-103.912	-121.665	20.865	14.9131	54.3	8.70619	12.1079
25	-103.912	-121.665	27.82	16.0427	52.4	9.794	12.7062
26	-103.912	-121.665	34.775	16.8908	50.9	10.6538	13.1071
27	-103.912	-121.665	41.73	17.4649	49.7	11.296	13.32
28	-103.912	-121.665	48.685	17.7685	48.7	11.7253	13.3505
29	-103.912	-121.665	55.64	17.8046	47.9	11.9447	13.2034
30	-103.912	-121.665	62.595	17.5776	47.1	11.9572	12.8841
31	-103.912	-121.665	69.55	17.0934	46.5	11.7668	12.3986
32	-103.912	-121.665	76.505	16.36	45.9	11.3791	11.7545
33	-103.912	-121.665	83.46	15.3877	45.4	10.8008	10.9602
34	-103.912	-121.665	90.415	14.1889	45.	10.0406	10.0255
35	-103.912	-121.665	97.37	12.7775	44.5	9.10832	8.96117
36	-103.912	-121.665	104.325	11.1683	44.1	8.01442	7.77811
37	-103.912	-121.665	111.28	9.37549	43.8	6.76919	6.48675
38	-103.912	-121.665	118.235	7.41052	43.4	5.38085	5.09531
39	-103.912	-121.665	125.19	5.27461	43.1	3.85031	3.60509
40	-103.912	-121.665	132.145	2.9429	42.8	2.15916	1.99968
END	-103.912	-121.665	139.1	0	0	0	0

Medium wave array vertical current moment (amps-degrees) rms
(Calculation assumes tower wires are grouped together.
The first wire of each group must contain the source.)

tower	magnitude	phase (deg)
1	2,538.9	0.0
2	2,987.02	49.

Comparison of Current Moments with Theoretical Antenna Field Parameters

Tower	Current Moment Magnitude	Current Moment Phase	Normalized Magnitude	Normalized Phase	Standard Pattern Ratio	Standard Pattern Phase
1	2538.9	0	1	0	1	0
2	2987.02	49	1.1765*	+49	0.85	+49

As shown in the tables above, the base voltages used in the Method of Moments computer model produce current moments in each of the towers that are identical to the field ratios and phases (+/- 0.1°) of the theoretical antenna parameters specified in the KIRO station license.

* Due to the height of the KIRO towers, it was necessary to replace the base current sampling transformers with base voltage samples in order to re-license KIRO using a Method of Moments proof of performance. After replacing the sample system, it became apparent that the array was adjusted to the inverse of the standard pattern specified in the CDBS. Only minor adjustments to the array were required to obtain the antenna monitor values indicated by the moment method model, which is based on the inverse pattern.

Bonneville requests that the CDBS be updated to reflect the inverse pattern parameters shown above by replacing the field ratio of tower #2, 0.85 with its reciprocal, 1.1765 (rounded to three decimal places). As these revised parameters produce an identical pattern to the licensed parameters and therefore have no effect on the allocation situation, staff has advised that the filing of an application on FCC Form 301 is not necessary.

Item 4

Derivation of Operating Parameters for Directional Antennas - KIRO

The voltages at the tower reference points have been calculated by using the computer circuit simulation program pspice. A pspice model has been made for each tower using the antenna base currents and base impedances calculated by MININEC and shown in the driven array model above, and the reactances listed previously in the table *Analysis of Tower Impedance Measurements to Verify Method of Moments Model*. The magnitude and phase of the current source in the pspice model was adjusted so that the current calculated in the output branch of the pspice model (the current through resistor R_L) was the same as the base current for the tower calculated by MININEC. These calculated voltages are then normalized to the reference tower to obtain the antenna monitor phase and ratio readings, as shown in the tables labeled Antenna Monitor Parameters, which follow the pspice data below.

```
 ## KIRO TOWER 1 BASE MODEL

 ****     CIRCUIT DESCRIPTION

********************************************************************************


.OPT LIST NOPAGE NODE NOMOD
.AC LIN 1 710kHz 710kHz

IIN             0               1       AC 9.2467 39.5
LXs             1               3               5.156uH
CXc             3               0               44.8pF
LL              3               4               35.142uH
RL              4               0               329.83ohms


.PRINT AC IM(RL) IP(RL) VM(1) VP(1)

##.PROBE
.END




 ****     AC ANALYSIS                       TEMPERATURE =   27.000 DEG C


  FREQ        IM(RL)      IP(RL)      VM(1)       VP(1)

   7.100E+05   9.524E+00   3.561E+01   3.562E+03   6.421E+01
```

```
 ## KIRO TOWER 2 BASE MODEL

 ****     CIRCUIT DESCRIPTION

*******************************************************************************


.OPT LIST NOPAGE NODE NOMOD
.AC LIN 1 710kHz 710kHz

IIN             0               1       AC 8.2078 73.9
LXs             1               3               2.914uH
CXc             3               0               44.8pF
LL              3               4               79.333uH
RL              4               0               258.21ohms


.PRINT AC IM(RL) IP(RL) VM(1) VP(1)

##.PROBE
.END




 ****     AC ANALYSIS                       TEMPERATURE =   27.000 DEG C


  FREQ         IM(RL)       IP(RL)       VM(1)        VP(1)

   7.100E+05    8.819E+00    7.072E+01    3.947E+03    1.256E+02
```

Antenna Monitor Parameters - Night Pattern - KIRO

Tower	Ref Point Voltage Magnitude	Ref Point Voltage Phase	Normalized Magnitude	Normalized Phase
1	3562	64.2	1	0
2	3947	125.6	1.108	+61.4

Summary of Post Construction Array Geometry - KIRO

The KIRO antenna array has been previously licensed by means of a measurement based proof of performance, therefore a survey of the array geometry is not required.

Item 6

Sampling System Measurements - KIRO

Impedance measurements were made of the antenna monitor sampling system using a Hewlett Packard 8751A network analyzer in a calibrated measurement system. The measurements were made looking into the antenna monitor ends of the sampling lines for two conditions – with and without the sampling lines connected to the sampling transformers at the antenna tuning units.

The sample lines are equal lengths of 1/2" Heliax type cable.

The following table shows the frequency closest to the carrier frequency where series resonance – zero reactance corresponding with low resistance – was found. As frequencies of resonance occur at odd multiples of 90 degrees electrical length, the sampling line length at the resonant frequency above carrier frequency – which is the closest one to the carrier frequency – was found to be 270 electrical degrees. The electrical length at carrier frequency appearing in the table below was calculated by multiplying 270 degrees by the ratio of the carrier frequency (710 kHz) to the resonant frequency.

Sample Line Measurements - KIRO

Tower	Sample Line Open Circuited Resonant Frequency (kHz)	Sample Line Electrical Length at 710 kHz	Measured Impedance at 710 kHz with Voltage Sample Connected*
1	797.787	241.20	14.3 +j95.8
2	795.052	241.12	14.9 +j97.5

* Measurements made with antenna in night directional mode

The sample line lengths meet the requirement that they be equal in length to within 1 electrical degree.

In order to determine the characteristic impedance values of the sampling lines, open-circuited measurements were made with frequencies offset to produce +/- 45 degrees of electrical length from resonance. The characteristic impedance was calculated using the following formula, where R1 +j X1 and R2 +j X2 are the measured impedances at the +45 and –45 degree offset frequencies, respectively:

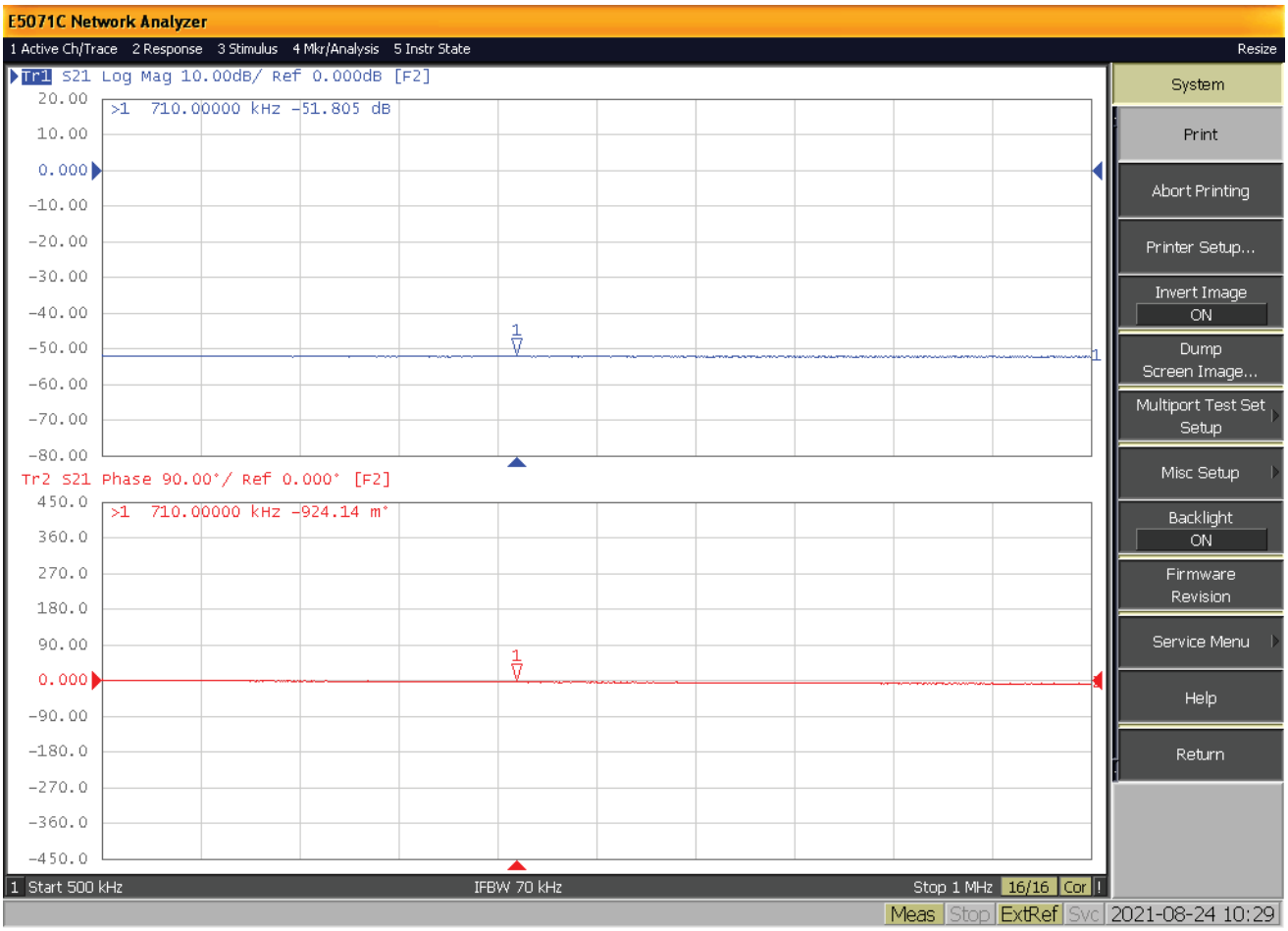
$$Zo = ((R_1^2 + X_1^2)^{1/2} \times (R_2^2 + X_2^2)^{1/2})^{1/2}$$

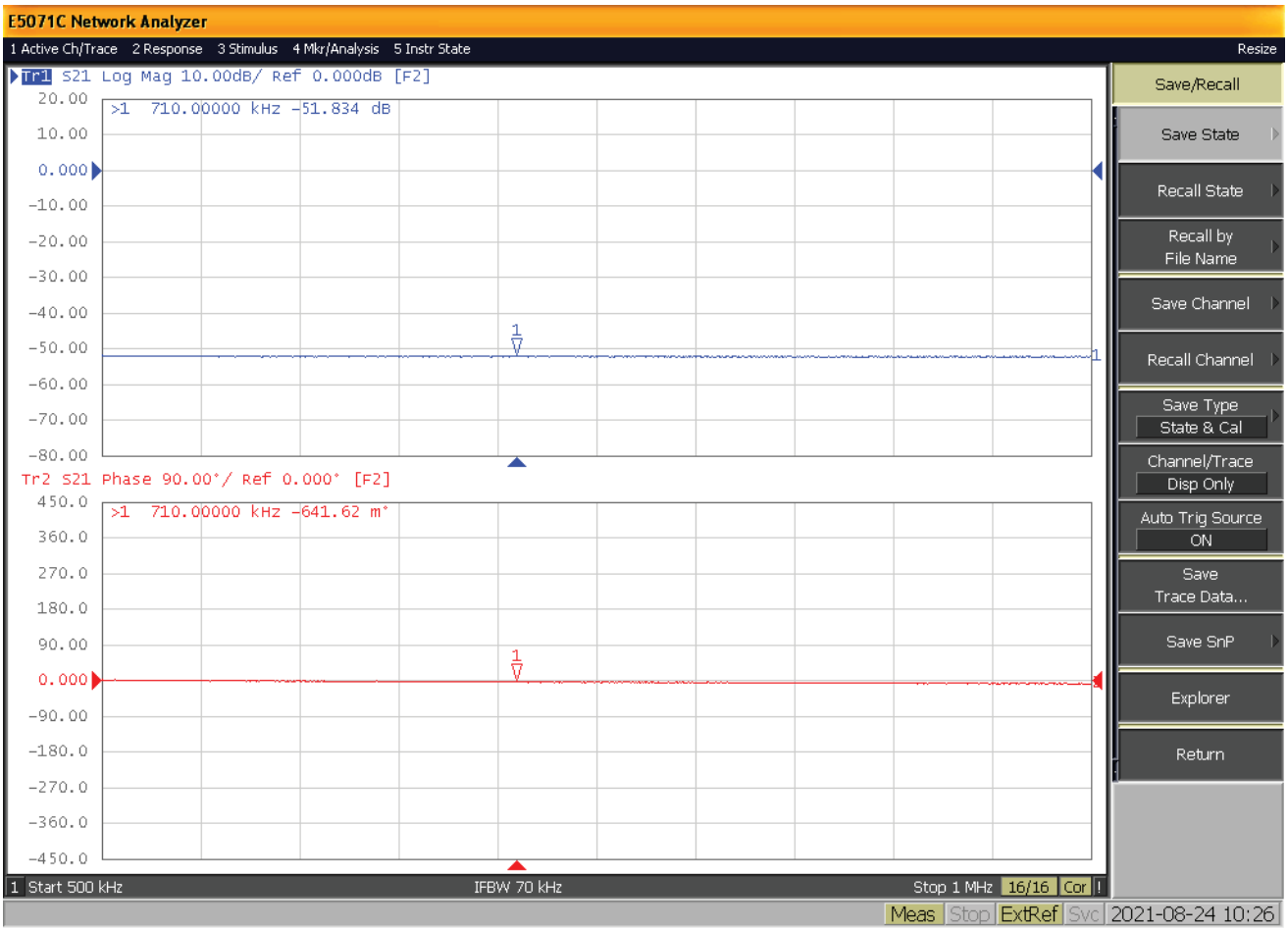
KIRO Sample Line Characteristic Impedance Calculations

Tower	-45° Offset Frequency (kHz)	-45° Offset Measured Impedance	+45° Offset Frequency (kHz)	+45° Measured Impedance	Calculated Characteristic Impedance
1	662.323	4.3 -j50.8	927.252	6.5 +j50.8	51.1
2	662.543	4.3 -j51	927.561	6.3 +j51	51.3

The sample line measured characteristic impedances meet the requirement that they be equal within 2 ohms.

The manufacturers calibration measurements of the voltage sampling units are provided on the following pages.


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Tr1 S21 Log Mag 10.00dB/ Ref 0.000dB [F2]
>1 710.00000 kHz -51.805 dB
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
Tr2 S21 Phase 90.00°/ Ref 0.000° [F2]
>1 710.00000 kHz -924.14 m°
450.0
360.0
270.0
180.0
90.00
0.000
-90.00
-180.0
-270.0
-360.0
-450.0
1 Start 500 kHz
IFBW 70 kHz
Stop 1 MHz
16/16
Cor
System
Print
Abort Printing
Printer Setup...
Invert Image
ON
Dump
Screen Image...
Multiport Test Set
Setup
Misc Setup
Backlight
ON
Firmware
Revision
Service Menu
Help
Return
Meas
Stop
ExtRef
Svc
2021-08-24 10:29


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Tr1 S21 Log Mag 10.00dB/ Ref 0.000dB [F2]
>1 710.00000 kHz -51.834 dB
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
Tr2 S21 Phase 90.00°/ Ref 0.000° [F2]
>1 710.00000 kHz -641.62 m°
450.0
360.0
270.0
180.0
90.00
0.000
-90.00
-180.0
-270.0
-360.0
-450.0
1 Start 500 kHz
IFBW 70 kHz
Stop 1 MHz
16/16
Cor
Save/Recall
Save State
Recall State
Recall by File Name
Save Channel
Recall Channel
Save Type
State & Cal
Channel/Trace
Disp Only
Auto Trig Source
ON
Save Trace Data...
Save SnP
Explorer
Return
Meas
Stop
ExtRef
Svc
2021-08-24 10:26

Item 7

Reference Field Strength Measurements - KIRO

Reference field strength measurements were made along radials of minimum and maximum radiation for the directional pattern. The transmitter power was adjusted to 52.65kW for the night pattern.

Measurements were made using a Potomac Instruments field strength meter, model FIM-41, serial # 867 This meter was calibrated by the manufacturer in August 2021.
All measurements were taken by the undersigned engineer

The measured field strengths and descriptions including GPS (NAD83) coordinates for the reference measurement points are shown on the following pages.

KIRO Reference Point Measurements

95°

8.57km	47 23 29.5 N 122 19 16.6 W
30 mV/m	NW corner 10th Ave S & S 234th PL
9.07km	47 23 26.8 N 122 18 53.2 W
27.5 mV/m	Mailboxes on S 235th PL east of 14th Ave S
10.3km	47 23 24.7 N 122 17 52.4 W
27.5 mV/m	Street sign at NW corner of 28th Ave A & S 236th St

165°

9.03km	47 19 12.1 N 122 24 12.3 W
31 mV/m	25 MPH sign on 55th Ave SW south of SW 315th St
10.4km	47 18 17.9 N 122 23 55.0 W
17 mV/m	Fire hydrant at SW 327th Pl & 51st Pl SW
12.0km	47 17 39.7 N 122 23 40.6 W
8.5 mV/m	Parking lot of Northshore Golf Course next to maintenance building

238°

11.0km	47 20 48.1 N 122 33 29.5 W
160 mV/m	Dead end of Sunrise Beach Dr
12.1km	47 20 26.1 N 122 34 14.5 W
110 mV/m	Fire hydrant at 90th St Ct NW & 24th Ave NW
12.8km	47 20 20.6 N 122 34 46.0 W
90 mV/m	South side of 89th St NW west of Crescent Valley Dr NW

310

12.0km	47 28 2.9 N 122 33 22.2 W
54 mV/m	Speed Limit 10 sign SE Snowy Way east of Orchard Ave
12.5km	47 28 6.0 N 122 33 49.9 W
37 mV/m	Driveway of 8903 Genesis Lane
14.3km	47 28 56.4 N 122 34 41.5 W
20 mV/m	Gate to Stormwater facility #415 at end of Richards Ave SE

Direct Measurement of Power - KIRO

Common point impedance measurements were made using a Hewlett Packard 8751A network analyzer in a calibrated measurement system. The measurements were made at the phasor cabinet input jack adjacent to the common point current meter that is used to determine operating power. The common point impedance was adjusted to 50 j0 on the transmitter's diagnostic screen. The final measured common point impedance is 50 -j11.5

Bonneville requests authorization to determine operating power via the transmitter power output meter. The transmitter is a Nautel NX50.

Certification

This Engineering Report has been prepared personally by the undersigned or under my immediate supervision, and all representations are true and correct to the best of my knowledge. I am an experienced radio engineer whose qualifications are a matter of record with the Federal Communications Commission, I am an engineer in the firm of Hatfield & Dawson Consulting Engineers, LLC, and I am Registered as a Professional Engineer in the States of Washington and Oregon.

October 7, 2021

Thomas S. Gorton P.E.