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. BMML 20120105AGH

SECTION I - APPLICANT FEE INFORMATION

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

Tri-County Broadcasting Inc.

MAILING ADDRESS (Line 1) (Maximum 35 characters)
1010 Second Street North

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Sauk Rapids	MN	56379

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
(320) 252-6200	WVAL	Facility ID 78914

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	$ 635.00	

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
MOR	0001	$ 730.00	

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
$ 1365.00	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT Tri-County Broadcasting Inc.		
MAILING ADDRESS 1010 Second Street North		
CITY Sauk Rapids	STATE MN	ZIP CODE 56379

2. This application is for:

☑ Commercial ☐ Noncommercial

☑ AM Directional ☐ AM Non-Directional

This license application includes a "method of moments" directional antenna proof.

Call letters	Community of License	Construction Permit File No.	Modification of Construction Permit File No(s).	Expiration Date of Last Construction Permit
WVAL	Sauk Rapids	n/a	n/a	n/a

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. n/a

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. DNA

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. DNA

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. DNA

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. DNA

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.
DNA

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	
Herbert M. Hoppe	Herbert M Hoppe	
Title	Date	Telephone Number
Officer	09/29/2012	(320) 252-6200

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
Tri-County Broadcasting, Inc.

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
WVAL	n/a	800	Unlimited	0.85	2.6

2. Station location	
State	City or Town
Minnesota	Sauk Rapids

3. Transmitter location			
State	County	City or Town	Street address
MN	Benton	Sauk Rapids	10th Ave. NE, 0.6 KM north of Golden Spike Rd.

4. Main studio location			
State	County	City or Town	Street address (or other identification)
MN	Benton	Sauk Rapids	1010 Second St., North

5. Remote control point location (specify only if authorized directional antenna)			
State	County	City or Town	Street address (or other identification)
MN	Benton	Sauk Rapids	1010 Second St., North

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. EE

8. Operating constants:	
RF common point or antenna current (in amperes) without modulation for night system: 4.28	RF common point or antenna current (in amperes) without modulation for day system: 7.49
Measured antenna or common point resistance (in ohms) at operating frequency — Night: 50 Day: 50	Measured antenna or common point reactance (in ohms) at operating frequency — Night: 0 Day: 0

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 (E) 1024199	+47.8°	0°	56.7%	100%	(not required)	
2 (C) 1024200	0°	- -	100%	- -		
4 (S) 1024202	-166.6°	+38.0°	20.2%	70.2%		

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

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.
Vertical uniform cross section triangular steel insulated towers	88.4	89.3	90.2	Exhibit No. n/a

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			
	45 °	36 '	18 "		94 °	08 '	21 "

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. n/a

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

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

Tower numbers changed so all four stations on site use same numbering system.

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

No change. Application being filed to relicense under 47 CFR 73.151(c) Model Proof rules.

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)
Mark A. Mueller	Mark A. Mueller
Address (include ZIP Code) Mueller Broadcast Design 613 S. La Grange Rd. La Grange, IL 60525 mark@muellerbroadcastdesign.com	Date September 19, 2012
	Telephone No. (Include Area Code) (708) 352-2166

[ ] Technical Director

[ ] Registered Professional Engineer

[ ] Chief Operator

[X] Technical Consultant

[ ] Other (specify)

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Engineering Report For
Herbert M. Hoppe
W V A L (A M)
Sauk Rapids, Minnesota
July 2012

This engineering report documents the Directional Antenna Performance Verification measurements for WVAL (AM), FCC facility ID number 78914 Sauk Rapids, Minnesota. WVAL is authorized to operate on 800 KHz with 2.6 KW using a two tower directional antenna daytime and 0.85 KW nighttime using a three tower directional antenna. This Verification is for the purpose of relicensing the WVAL antenna system under the "model proof" rules. All measurements were made personally by the writer in accordance with the FCC rules at 47 CFR 73.151(c).

Eligibility for 73.151(c) Processing

The WVAL antenna system consists of four conventional uniform cross-section insulated steel radiators, series-fed with no top loading. They are 84.9° tall at the WVAL frequency (800 KHz) and are sampled at the base using Delta TCT-3 toroidal current transformers. The ground system is of standard design, consisting of 120 equally-spaced buried bare copper wire radials around each tower 113.4 meters long (109.1°) except for those which intersect, with 4" copper straps terminating the radial intersections and interconnecting the towers. A 4" strap interconnects the towers to each other and to the phasor and transmitter.

Background

The WVAL antenna system shares towers with WXYG (facility ID 161448), WBHR (facility ID 26980) and WMIN (facility ID 161428) all licensed to Sauk Rapids, Minnesota. The combining system was designed and constructed during implementation of the construction permits for WXYG and WMIN. The antenna current sample elements are Delta Electronics TCT-3 current transformers and are located at the output from the series filters on the lead to the tower. There are no shunt elements between the filter and the tower except for the static drain or tower lighting choke which

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presents a high parallel reactance (more than 10 times the tower impedance) at 800 KHz. Equal lengths of Andrew 3/8" LDF2-50 Heliax foam coaxial cable are used as sample lines. A Potomac Instruments AM-19 (204) antenna monitor is used to keep tabs on the array. The monitor was recalibrated and checked for proper operation in accordance with the manufacturer's instructions.

Measurements

The WVAL system was modeled using Westberg Consulting's Phasor Professional 2.1.1 which calculates the tower matrix values as well as the proper operating parameters. The towers and sample lines were measured and documented using an Array Solutions PowerAIM-120 network analyzer serial number 1019 operated in accordance with the manufacturer's instructions. This analyzer has been used in several recent projects and exhibits excellent stability and field performance and since it operates "floating" via battery power and a Bluetooth radio connection to the associated computer no RF ground loop issues arise.

The three WVAL towers are identical and are base sampled using toroidal current transformers. Each tower was disconnected from its ATU at the sample transformer using the jack installed for this purpose and was measured at that point. The other towers were individually shorted and/or left floating for each measurement as required, plus additional measurements with the subject tower base insulator shorted to measure the feedline impedance and electrical length from the ATU to the tower as well as at the tower itself with the ATU disconnected. These measurements are documented below and show good agreement with the Westberg theoretical numbers. Four of the towers on-site are not used by WVAL and were detuned using the appropriate reactance to ground.

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Theoretical Data:

TOWER MODEL INFORMATION

TOWER INFORMATION						
	Tower Height (°)	Spacing (°)	Orientation	Face Width (in.)	Radius (in.)	Velocity Factor
Tower 1	84.9000	0.0000	0.0000	14.0000 / 14.0000	6.4663 / 6.4663	0.950000
Tower 2	84.9000	80.0000	276.0000	14.0000 / 14.0000	6.4663 / 6.4663	0.925000
Tower 3	84.9000	160.0000	276.0000	14.0000 / 14.0000	6.4663 / 6.4663	0.950000
Tower 4	84.9000	145.0000	228.0000	14.0000 / 14.0000	6.4663 / 6.4663	0.925000
Tower 5	57.0000	47.3300	200.5000	12.0000 / 12.0000	5.5426 / 5.5426	0.850000
Tower 6	57.0000	141.8500	290.6000	12.0000 / 12.0000	5.5426 / 5.5426	0.800000
Tower 7	84.9000	112.3000	327.3000	14.0000 / 14.0000	6.4663 / 6.4663	0.940000

MATRIX INFORMATION [47 CFR 73.151(c)(1)]

MATRIX INFORMATION		
	Impedance (other towers open)	Impedance (measured)
Tower 1	38.00 + j16.94	38.18 + j16.40
Tower 2	38.59 + j29.58	38.10 + j31.80
Tower 3	37.98 + j16.82	36.98 + j18.43
Tower 4	42.17 + j33.03	43.40 + j32.9
Tower 5	16.29 - j121.73	16.40 - j119.6
Tower 6	19.26 - j96.34	20.67 – j101.9
Tower 7	38.82 + j22.85	38.71 + j24.31

The Westberg Phasor Professional method-of-moments model fully complies with all FCC requirements for tower radius, height, segment length, and calculation references points. No shunt capacitance was used. Towers were adjusted by varying the propagation velocity as shown above. The measured impedances agree with the model within +/- 2 ohms +/- 4%. Westberg's Phasor Professional uses a single wire of the desired effective radius divided into segments or no more than 10° electrical length each to model the tower.

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DETUNED TOWER CURRENTS from Westberg Phasor Professional

Tower 1
0.000000 > 0.000000 - 84.90° above ground
0.060028 > -114.612508 - 75.47° above ground
0.092596 > -115.521422 - 66.03° above ground
0.104135 > -116.525052 - 56.60° above ground
0.094236 > -117.744114 - 47.17° above ground
0.062249 > -119.780704 - 37.73° above ground
0.008135 > -144.355523 - 28.30° above ground
0.071822 > 65.149601 - 18.87° above ground
0.177442 > 62.769797 - 9.43° above ground
0.342287 > 61.590469 - -0.00° above ground

Tower 2
0.000000 > 0.000000 - 84.90° above ground
0.062578 > -113.276030 - 75.47° above ground
0.096764 > -114.289221 - 66.03° above ground
0.109042 > -115.450943 - 56.60° above ground
0.098858 > -116.907218 - 47.17° above ground
0.065441 > -119.393189 - 37.73° above ground
0.009057 > -148.207205 - 28.30° above ground
0.075337 > 66.634376 - 18.87° above ground
0.185989 > 63.664830 - 9.43° above ground
0.357899 > 62.164247 - -0.00° above ground

Tower 3
0.000000 > 0.000000 - 84.90° above ground
0.041703 > 169.210103 - 75.47° above ground
0.063944 > 169.708713 - 66.03° above ground
0.071434 > 170.235989 - 56.60° above ground
0.064123 > 170.884378 - 47.17° above ground
0.041783 > 172.025430 - 37.73° above ground
0.004294 > -170.060192 - 28.30° above ground
0.049706 > -10.750252 - 18.87° above ground
0.121185 > -9.393756 - 9.43° above ground
0.232272 > -8.670895 - -0.00° above ground

Tower 4
0.000000 > 0.000000 - 84.90° above ground
0.046574 > -176.695068 - 75.47° above ground
0.071740 > -176.290006 - 66.03° above ground
0.080433 > -175.884813 - 56.60° above ground
0.072389 > -175.418942 - 47.17° above ground
0.047222 > -174.648152 - 37.73° above ground
0.004679 > -162.494730 - 28.30° above ground
0.056162 > 3.500653 - 18.87° above ground
0.136551 > 4.361619 - 9.43° above ground
0.260381 > 4.793138 - -0.00° above ground

Tower 5
0.000000 > 0.000000 - 57.00° above ground
0.059228 > -89.883307 - 47.50° above ground
0.076958 > -92.957744 - 38.00° above ground
0.060292 > -96.652339 - 28.50° above ground
0.009204 > -125.595888 - 19.00° above ground
0.083063 > 87.553778 - 9.50° above ground
0.242255 > 84.006954 - 0.00° above ground

Tower 6
0.000000 > 0.000000 - 57.00° above ground
0.038827 > -172.452375 - 47.50° above ground
0.051040 > -172.077493 - 38.00° above ground
0.040366 > -171.623896 - 28.50° above ground
0.005714 > -167.955223 - 19.00° above ground
0.055098 > 7.862757 - 9.50° above ground
0.161667 > 8.300824 - 0.00° above ground

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Tower 7
0.000000 > 0.000000 - 84.90° above ground
0.051748 > -145.802651 - 75.47° above ground
0.079962 > -145.856799 - 66.03° above ground
0.090019 > -145.945431 - 56.60° above ground
0.081470 > -146.077282 - 47.17° above ground
0.053697 > -146.321907 - 37.73° above ground
0.006096 > -149.685409 - 28.30° above ground
0.062243 > 34.261753 - 18.87° above ground
0.153357 > 33.959486 - 9.43° above ground
0.294759 > 33.799601 - -0.00° above ground

MATRIX CALCULATIONS from Westberg Phasor Professional

ZMatrix						
38.00 + j16.94	22.22 - j15.14	-6.42 - j18.07	-0.70 - j20.16	21.39 - j2.98	-0.50 - j14.68	10.85 - j20.24
22.22 - j15.14	38.59 + j29.58	22.30 - j15.26	11.80 - j20.88	14.08 - j10.73	18.93 - j9.23	19.74 - j17.75
-6.42 - j18.07	22.30 - j15.26	37.98 + j16.82	6.54 - j20.90	-3.16 - j12.35	23.92 - j2.20	6.09 - j21.11
-0.70 - j20.16	11.80 - j20.88	6.54 - j20.90	42.17 + j33.03	9.33 - j12.88	-1.65 - j14.44	-14.82 - j10.46
21.39 - j2.98	14.08 - j10.73	-3.16 - j12.35	9.33 - j12.88	16.29 - j121.73	-1.47 - j9.38	-0.60 - j13.35
-0.50 - j14.68	18.93 - j9.23	23.92 - j2.20	-1.65 - j14.44	-1.47 - j9.38	19.26 - j96.34	14.92 - j11.96
10.85 - j20.24	19.74 - j17.75	6.09 - j21.11	-14.82 - j10.46	-0.60 - j13.35	14.92 - j11.96	38.82 + j22.85

YMatrix						
0.014131 - j0.009609	0.000191 + j0.010157	-0.001447 + j0.000076	0.003207 + j0.003197	-0.001549 - j0.004132	0.000241 - j0.000017	0.001158 + j0.005066
0.000191 + j0.010157	0.000529 - j0.015813	-0.000127 + j0.010619	0.000771 + j0.005033	-0.000191 - j0.001197	-0.000041 - j0.001751	-0.000301 + j0.006691
-0.001447 + j0.000076	-0.000127 + j0.010619	0.013336 - j0.008426	0.001959 + j0.004478	0.000102 - j0.000209	-0.001145 - j0.005527	0.002658 + j0.004819
0.003207 + j0.003198	0.000771 + j0.005033	0.001959 + j0.004478	0.010759 - j0.008175	-0.001089 - j0.001339	0.000278 + j0.000122	-0.001753 - j0.000611
-0.001549 - j0.004132	-0.000191 - j0.001197	0.000102 - j0.000209	-0.001089 - j0.001339	0.000351 + j0.008897	-0.000009 - j0.000003	0.000346 + j0.000205
0.000241 - j0.000017	-0.000041 - j0.001751	-0.001144 - j0.005527	0.000279 + j0.000122	-0.000009 - j0.000003	0.000257 + j0.011346	-0.000957 - j0.002353
0.001158 + j0.005066	-0.000301 + j0.006691	0.002658 + j0.004819	-0.001753 - j0.000611	0.000346 + j0.000205	-0.000957 - j0.002353	0.011314 - j0.010298

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HMatrix - [I] = [H] X [F]						
0.016034 + j0.000967	0.000282 + j0.000616	0.000460 - j0.000041	0.000487 + j0.000070	-0.000111 + j0.000853	0.000499 + j0.000102	0.000456 + j0.000347
0.000293 + j0.000647	0.015277 + j0.001010	0.000293 + j0.000646	0.000464 + j0.000392	0.000311 + j0.000644	0.000168 + j0.000757	0.000354 + j0.000577
0.000459 - j0.000042	0.000282 + j0.000614	0.016034 + j0.000965	0.000482 + j0.000238	0.000482 - j0.000002	-0.000181 + j0.000874	0.000485 + j0.000230
0.000511 + j0.000074	0.000465 + j0.000392	0.000508 + j0.000250	0.015280 + j0.001011	0.000461 + j0.000439	0.000515 + j0.000045	0.000323 - j0.000264
0.000022 + j0.000480	0.000185 + j0.000347	0.000274 + j0.000001	0.000254 + j0.000236	0.025136 + j0.000567	0.000286 + j0.000027	0.000282 + j0.000042
0.000314 + j0.000065	0.000131 + j0.000452	-0.000018 + j0.000547	0.000308 + j0.000028	0.000317 + j0.000030	0.023093 + j0.000625	0.000214 + j0.000370
0.000466 + j0.000354	0.000346 + j0.000562	0.000495 + j0.000238	0.000314 - j0.000257	0.000508 + j0.000072	0.000327 + j0.000604	0.015733 + j0.000986
HMatrix-inverse - [F] = $[H]^{-1}$ X [I]						
62.196970 - j3.601503	-1.346392 - j2.097210	-1.696116 + j0.626238	-1.892187 + j0.083175	0.190571 - j2.024860	-1.369934 + j0.060111	-1.881876 - j1.014694
-1.399032 - j2.199166	65.006871 - j3.835524	-1.410920 - j2.207218	-2.032370 - j1.158210	-0.934467 - j1.392637	-0.697460 - j1.874613	-1.684068 - j1.950499
-1.693798 + j0.626088	-1.356457 - j2.101889	62.186119 - j3.595242	-1.951692 - j0.604611	-1.151848 + j0.311084	0.340401 - j2.263218	-1.972648 - j0.560065
-1.982718 + j0.086632	-2.031329 - j1.159932	-2.046852 - j0.634266	65.347160 - j4.192496	-1.219784 - j0.918707	-1.413672 + j0.176641	-1.020174 + j1.488860
-0.098507 - j1.121569	-0.543099 - j0.737414	-0.644458 + j0.169939	-0.665347 - j0.491113	39.749530 - j0.856615	-0.487912 + j0.080719	-0.696672 + j0.038495
-0.849511 + j0.033460	-0.495774 - j1.100880	-0.039020 - j1.391073	-0.834471 + j0.105971	-0.540439 + j0.089544	43.217681 - j1.122719	-0.667944 - j0.872135
-1.916515 - j1.034386	-1.641415 - j1.897345	-2.010665 - j0.574163	-0.991920 + j1.447020	-1.269352 + j0.069052	-1.044355 - j1.434858	63.378997 - j3.748485

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Tower Currents

Mode 1 - Daytime
Tower 1
0.000000 > 0.000000 - 84.90° above ground
1.357024 > -8.068902 - 75.47° above ground
2.487516 > -7.453395 - 66.03° above ground
3.504808 > -6.801805 - 56.60° above ground
4.398915 > -6.092265 - 47.17° above ground
5.153809 > -5.302854 - 37.73° above ground
5.753237 > -4.402776 - 28.30° above ground
6.183435 > -3.343288 - 18.87° above ground
6.434396 > -2.038851 - 9.43° above ground
6.496630 > 0.000000 - -0.00° above ground
Tower 2
0.000000 > 0.000000 - 84.90° above ground
0.079602 > -110.027695 - 75.47° above ground
0.123007 > -110.700814 - 66.03° above ground
0.138481 > -111.489685 - 56.60° above ground
0.125362 > -112.496265 - 47.17° above ground
0.082718 > -114.240403 - 37.73° above ground
0.010327 > -136.399188 - 28.30° above ground
0.095808 > 69.974737 - 18.87° above ground
0.236005 > 67.888246 - 9.43° above ground
0.453430 > 66.821038 - -0.00° above ground
Tower 3
0.000000 > 0.000000 - 84.90° above ground
0.048422 > -159.101899 - 75.47° above ground
0.074542 > -158.650197 - 66.03° above ground
0.083642 > -158.186935 - 56.60° above ground
0.075504 > -157.643597 - 47.17° above ground
0.049688 > -156.740909 - 37.73° above ground
0.005757 > -144.647467 - 28.30° above ground
0.057687 > 21.060268 - 18.87° above ground

Mode 2
Tower 1
0.000000 > 0.000000 - 84.90° above ground
0.380392 > 38.021823 - 75.47° above ground
0.701198 > 38.903207 - 66.03° above ground
0.994214 > 39.806344 - 56.60° above ground
1.256960 > 40.755408 - 47.17° above ground
1.485248 > 41.771953 - 37.73° above ground
1.674819 > 42.885728 - 28.30° above ground
1.822231 > 44.143281 - 18.87° above ground
1.925538 > 45.624906 - 9.43° above ground
1.991647 > 47.821903 - -0.00° above ground
Tower 2
0.000000 > 0.000000 - 84.90° above ground
0.799477 > -8.171659 - 75.47° above ground
1.458859 > -7.605351 - 66.03° above ground
2.043830 > -6.996684 - 56.60° above ground
2.547779 > -6.321605 - 47.17° above ground
2.960729 > -5.554693 - 37.73° above ground
3.272740 > -4.660181 - 28.30° above ground
3.475270 > -3.581048 - 18.87° above ground
3.561306 > -2.214860 - 9.43° above ground
3.508665 > -0.000000 - -0.00° above ground
Tower 3
0.000000 > 0.000000 - 84.90° above ground
0.030937 > -120.077884 - 75.47° above ground
0.047726 > -120.748663 - 66.03° above ground
0.053684 > -121.486221 - 56.60° above ground
0.048607 > -122.364320 - 47.17° above ground
0.032152 > -123.787615 - 37.73° above ground
0.004080 > -140.889246 - 28.30° above ground
0.036894 > 59.629240 - 18.87° above ground

0.142377 > 22.110160 - 9.43° above ground
0.274646 > 22.631427 - -0.00° above ground
Tower 4
0.000000 > 0.000000 - 84.90° above ground
0.942658 > 33.668396 - 75.47° above ground
1.733205 > 33.999054 - 66.03° above ground
2.447779 > 34.349883 - 56.60° above ground
3.078169 > 34.731984 - 47.17° above ground
3.612022 > 35.156271 - 37.73° above ground
4.036879 > 35.637980 - 28.30° above ground
4.342021 > 36.201419 - 18.87° above ground
4.519211 > 36.890081 - 9.43° above ground
4.559079 > 37.957367 - -0.00° above ground
Tower 5
0.000000 > 0.000000 - 57.00° above ground
0.070489 > -94.068623 - 47.50° above ground
0.092044 > -96.249585 - 38.00° above ground
0.072388 > -98.885019 - 28.50° above ground
0.010610 > -120.067551 - 19.00° above ground
0.099286 > 84.127293 - 9.50° above ground
0.290647 > 81.548434 - 0.00° above ground
Tower 6
0.000000 > 0.000000 - 57.00° above ground
0.049936 > -159.934369 - 47.50° above ground
0.065600 > -159.504676 - 38.00° above ground
0.051834 > -158.931169 - 28.50° above ground
0.007295 > -153.941185 - 19.00° above ground
0.070827 > 20.395270 - 9.50° above ground
0.207610 > 21.033648 - 0.00° above ground
Tower 7
0.000000 > 0.000000 - 84.90° above ground
0.058915 > -159.993548 - 75.47° above ground
0.090911 > -159.719544 - 66.03° above ground

0.091533 > 58.017220 - 9.43° above ground
0.177027 > 57.256749 - -0.00° above ground
Tower 4
0.000000 > 0.000000 - 84.90° above ground
0.229170 > -163.562870 - 75.47° above ground
0.410100 > -163.677080 - 66.03° above ground
0.562165 > -163.819822 - 56.60° above ground
0.683386 > -163.998886 - 47.17° above ground
0.770839 > -164.225851 - 37.73° above ground
0.821605 > -164.520027 - 28.30° above ground
0.832945 > -164.916467 - 18.87° above ground
0.801749 > -165.486991 - 9.43° above ground
0.706191 > -166.602424 - -0.00° above ground
Tower 5
0.000000 > 0.000000 - 57.00° above ground
0.023990 > -87.171868 - 47.50° above ground
0.031840 > -89.310387 - 38.00° above ground
0.025530 > -91.805135 - 28.50° above ground
0.004242 > -108.982530 - 19.00° above ground
0.034246 > 91.048672 - 9.50° above ground
0.102205 > 88.605243 - 0.00° above ground
Tower 6
0.000000 > 0.000000 - 57.00° above ground
0.031973 > -106.150794 - 47.50° above ground
0.042074 > -107.505591 - 38.00° above ground
0.033335 > -109.203704 - 28.50° above ground
0.004928 > -122.770679 - 19.00° above ground
0.045414 > 72.749199 - 9.50° above ground
0.133442 > 71.007594 - 0.00° above ground
Tower 7
0.000000 > 0.000000 - 84.90° above ground
0.038314 > -109.733844 - 75.47° above ground
0.059027 > -110.237125 - 66.03° above ground

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0.102194 > -159.455555 - 56.60° above ground	0.066245 > -110.810183 - 56.60° above ground
0.092324 > -159.160207 - 47.17° above ground	0.059739 > -111.523951 - 47.17° above ground
0.060669 > -158.680838 - 37.73° above ground	0.039149 > -112.744534 - 37.73° above ground
0.006644 > -151.915981 - 28.30° above ground	0.004301 > -130.186353 - 28.30° above ground
0.070841 > 20.148871 - 18.87° above ground	0.046046 > 70.172198 - 18.87° above ground
0.173917 > 20.695534 - 9.43° above ground	0.112623 > 68.766172 - 9.43° above ground
0.333679 > 20.965602 - -0.00° above ground	0.215713 > 68.053385 - -0.00° above ground

TOWER DRIVE INFORMATION – DAY

	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Antenna Monitor*	Power (W)
Tower 1	1.0000	0.0000	49.26 + j5.39	6.50 ∠ 0.00	100.0% ∠ 0.0°	2079.0716
Tower 2	0.0000	0.0000	-15.57 - j638.74	0.45 ∠ 66.82	(detuned)	-3.2016
Tower 3	0.0000	0.0000	7.61 - j655.28	0.27 ∠ 22.63	(detuned)	0.5742
Tower 4	0.7200	40.0000	25.26 + j7.22	4.56 ∠ 37.96	70.2% ∠ +38.0°	525.1168
Tower 5	0.0000	0.0000	-27.03 - j886.00	0.29 ∠ 81.53	(detuned)	-2.2842
Tower 6	0.0000	0.0000	6.62 - j846.98	0.21 ∠ 21.04	(detuned)	0.2856
Tower 7	0.0000	0.0000	3.93 - j644.94	0.33 ∠ 20.97	(detuned)	0.4376

Towers 2, 3, 5, 6, 7 are detuned using the appropriate series reactance.

TOWER DRIVE INFORMATION – NIGHT

	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Antenna Monitor*	Power (W)
Tower 1	0.5000	47.5000	51.61 - j27.87	1.99 ∠ 47.82	56.7% ∠ +47.82°	204.7391
Tower 2	1.0000	0.0000	53.76 + j38.91	3.51 ∠ 0.00	100.0% ∠ 0.0°	661.8195
Tower 3	0.0000	0.0000	-10.98 - j657.45	0.18 ∠ 57.26	(detuned)	-0.3440
Tower 4	0.2500	-160.0000	-30.38 + j204.64	0.71 ∠ -166.60	20.2% ∠ -166.6°	-15.1513
Tower 5	0.0000	0.0000	-25.07 - j897.47	0.10 ∠ 88.59	(detuned)	-0.2620
Tower 6	0.0000	0.0000	-17.56 - j848.59	0.13 ∠ 70.99	(detuned)	-0.3129
Tower 7	0.0000	0.0000	-10.50 - j643.55	0.22 ∠ 68.08	(detuned)	-0.4884

Towers 3, 5, 6, 7 are detuned using the appropriate series reactance.

*** = These are the pattern parameters used to tune the array and are on the Form 302.**

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Sample System Verification [47 CFR 73.151(c)(2)]

Sample Lines: Andrew 3/8" LDF2-50 foam dielectric Heliax coaxial cable

88% velocity factor, 50 +/-1 ohms

Lines were cut to equal electrical length and terminated with proper connectors.

Sample Element Type: Delta Electronics TCT-3 Toroidal Current Transformers

Location: At output of diplex filter on lead to tower.

Operating Potential: Grounded

Antenna Monitor: Potomac Instruments AM-19 (204) s/n 1469

TCT-3 Serial Numbers & Z at 800 KHz:

Tower 1 (E):	16293	50.2 +j0.52 ohms
Tower 2 (C):	16294	50.6 +j0.66 ohms
Tower 4 (S):	16291	50.1 +j0.72 ohm

(Current Transformers are matched within 0.4 ohm resistance and j0.2 ohms reactance)

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TCT-3 Phase and Ratio Test (Tower 2 is reference):

Tower 1:	1.000/ +0.3°
Tower 4:	1.005/ +0.5°

(Current Transformers are matched within +/-0.25% ratio and +/-0.10° phase)

The phase and ratio calibration test was done with transformers removed from the ACUs and configured in pairs with the #2 transformer adjacent to each other reading RF current to tower #2 in ND mode at 500 watts. The cables used to connect the TCTs to the monitor are identical in electrical length and characteristic impedance and are maintained by the writer for this purpose.

Sample Line Length Test (see graph data which follows):

Tower 1 Closest Odd ¼ wave Resonant Frequency: 600.394 KHz (1229.19 feet)
359.76° at 800 KHz

Tower 2 Closest Odd ¼ wave Resonant Frequency: 598.898 KHz (1232.26 feet)
360.66° at 800 KHz

Tower 4 Closest Odd ¼ wave Resonant Frequency: 599.045 KHz (1231.96 feet)
360.57° at 800 KHz

Maximum Difference in Electrical Length: 3.07 feet, 0.9° at 800 KHz

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Sample Line Impedance Test (see graph data which follows):

Tower 1 (East) Sample Line Mean Zmag:	50.54 ohms
Tower 2 (Center) Sample Line Mean Zmag:	50.93 ohms
Tower 4 (South) Sample Line Mean Zmag:	52.20 ohms

Maximum Variation in Sample Line Impedance: 1.66 ohms

Sample Impedance From Monitor End (with sample element connected, see graph data):

Tower 1 (South) Sample Impedance:	49.004 +j3.320 ohms
Tower 2 (Center) Sample Impedance:	50.903 +j1.878 ohms
Tower 4 (South) Sample Impedance:	49.777 –j0.862 ohms

Maximum Variation in Sample Resistance: 1.899 ohms

Maximum Variation in Sample Reactance: j4.182 ohms

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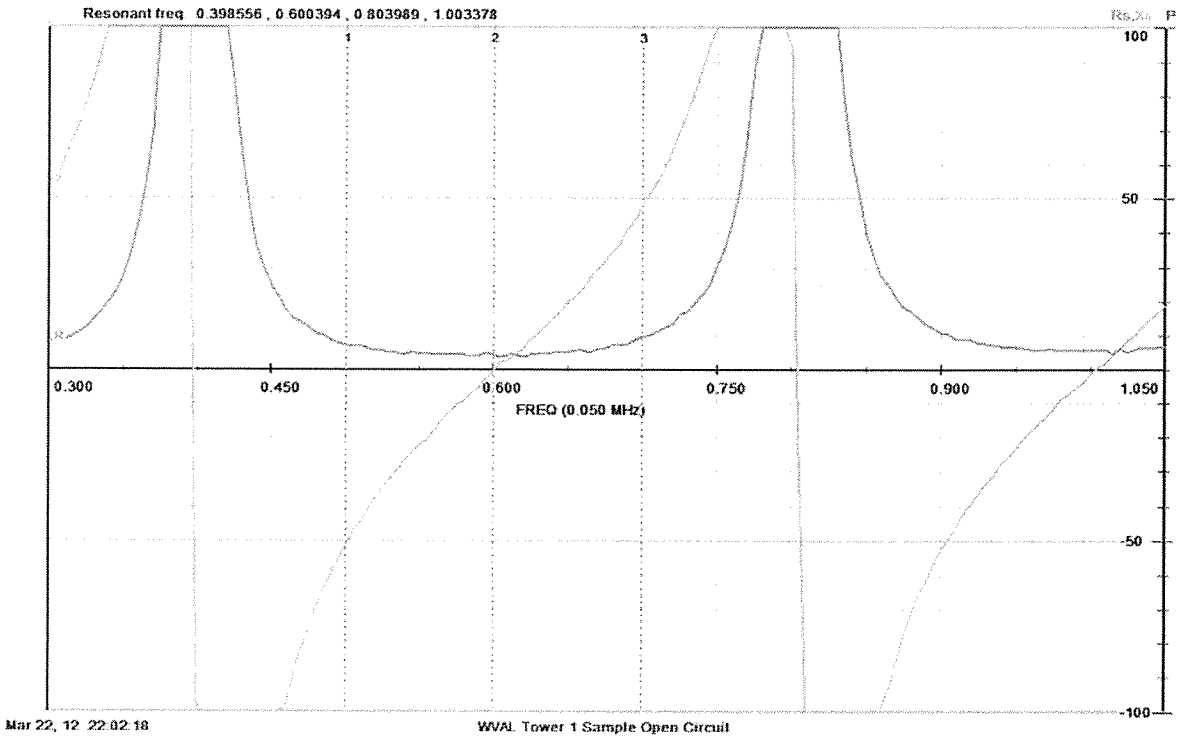
Tower 1 (East) Sample Line (open circuit)



Marker	Freq	Rs	Xs	Zmag
[1]	0.500328	7.285	-51.575	52.087
[2]	0.600394	4.435	-0.000	
[3]	0.700460	9.567	48.102	49.044

Markers: [1] = closest odd quarter wave minus 1/8 wavelength
[2] = closest odd quarter wave
[3] = closest odd quarter wave plus 1/8 wavelength

Mean Tower 1 Sample Line Zmag: 50.54 ohms

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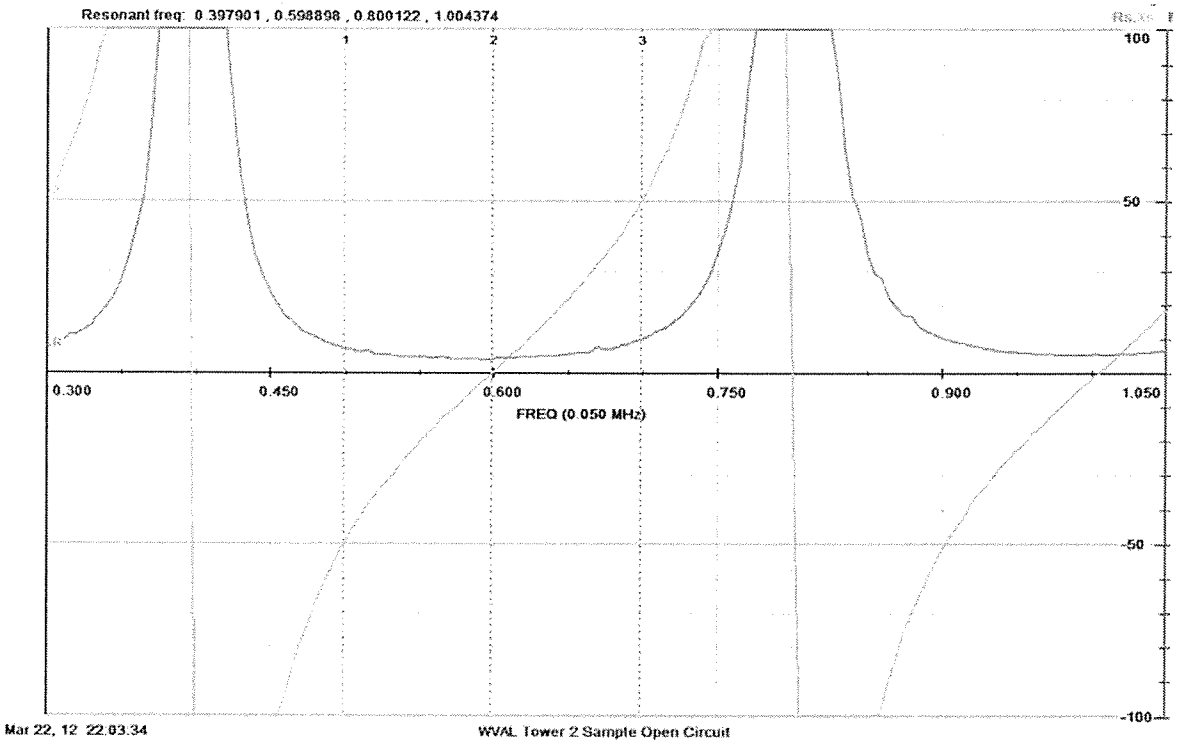
Tower 2 (Center) Sample Line (open circuit)



Marker	Freq	Rs	Xs	Zmag
[1]	0.499082	7.528	-50.117	50.680
[2]	0.598898	4.363	-0.000	
[3]	0.698714	10.111	50.170	51.179

Markers: [1] = closest odd quarter wave minus 1/8 wavelength
[2] = closest odd quarter wave
[3] = closest odd quarter wave plus 1/8 wavelength

Mean Tower 2 Sample Line Zmag: 50.93 ohms

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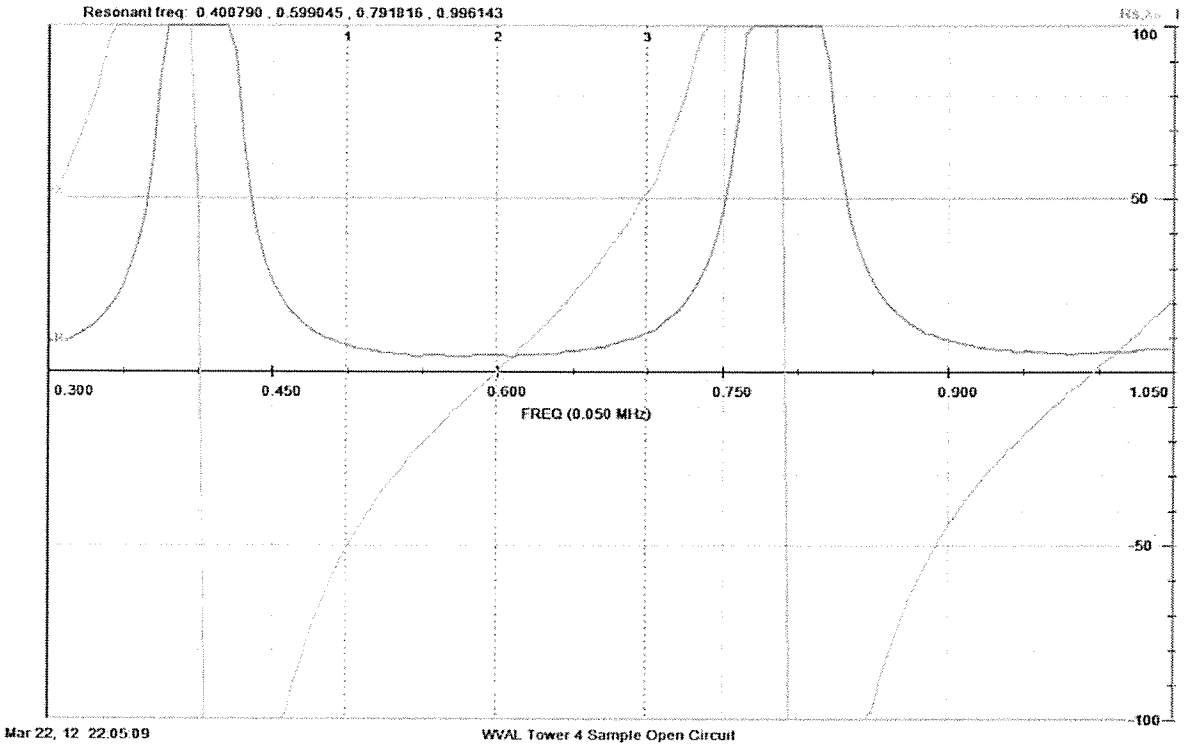
Tower 4 (South) Sample Line (open circuit)



Marker	Freq	Rs	Xs	Zmag
[1]	0.499204	8.088	-50.877	51.516
[2]	0.599045	4.934	-0.000	
[3]	0.698886	11.318	+51.661	52.886

Markers: [1] = closest odd quarter wave minus 1/8 wavelength
[2] = closest odd quarter wave
[3] = closest odd quarter wave plus 1/8 wavelength

Mean Tower 3 Sample Line Zmag: 52.20 ohms

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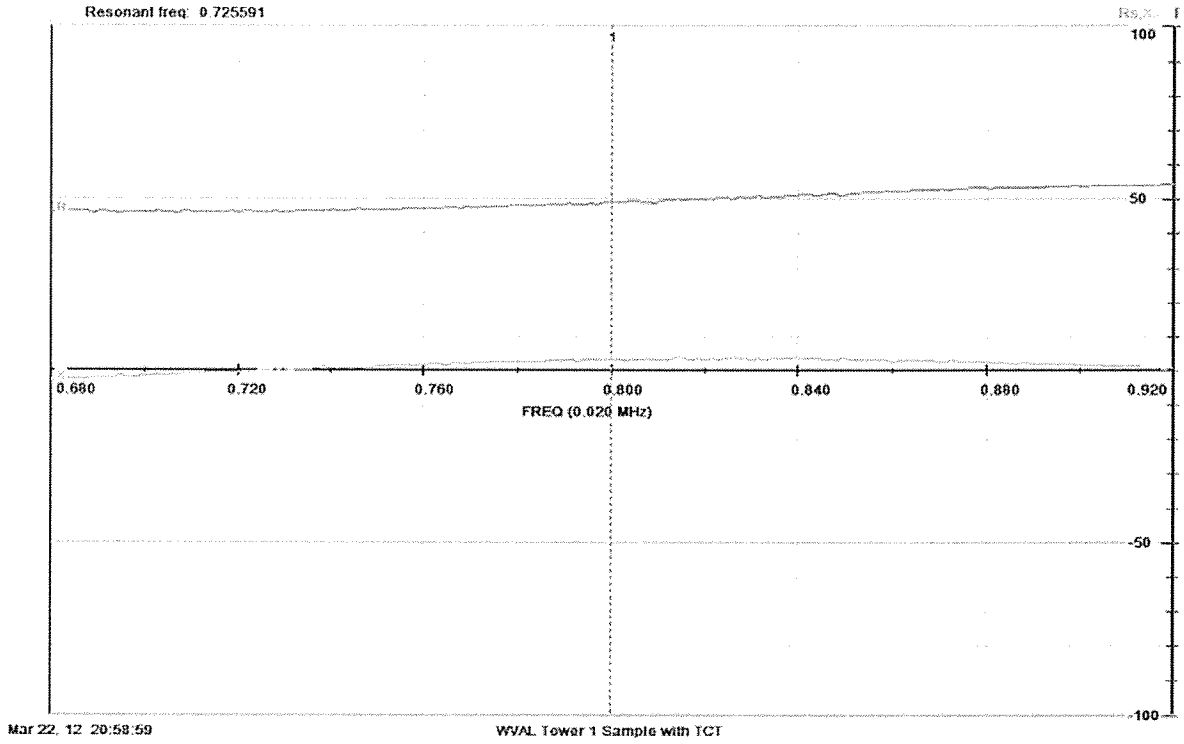
Sample lines from antenna monitor end with TCT-3s connected at towers as normal:

Tower 1 (East)



Impedance of Tower 1 line at 800 KHz, monitor end with transformer connected at other end:

49.004 +j3.320 ohms

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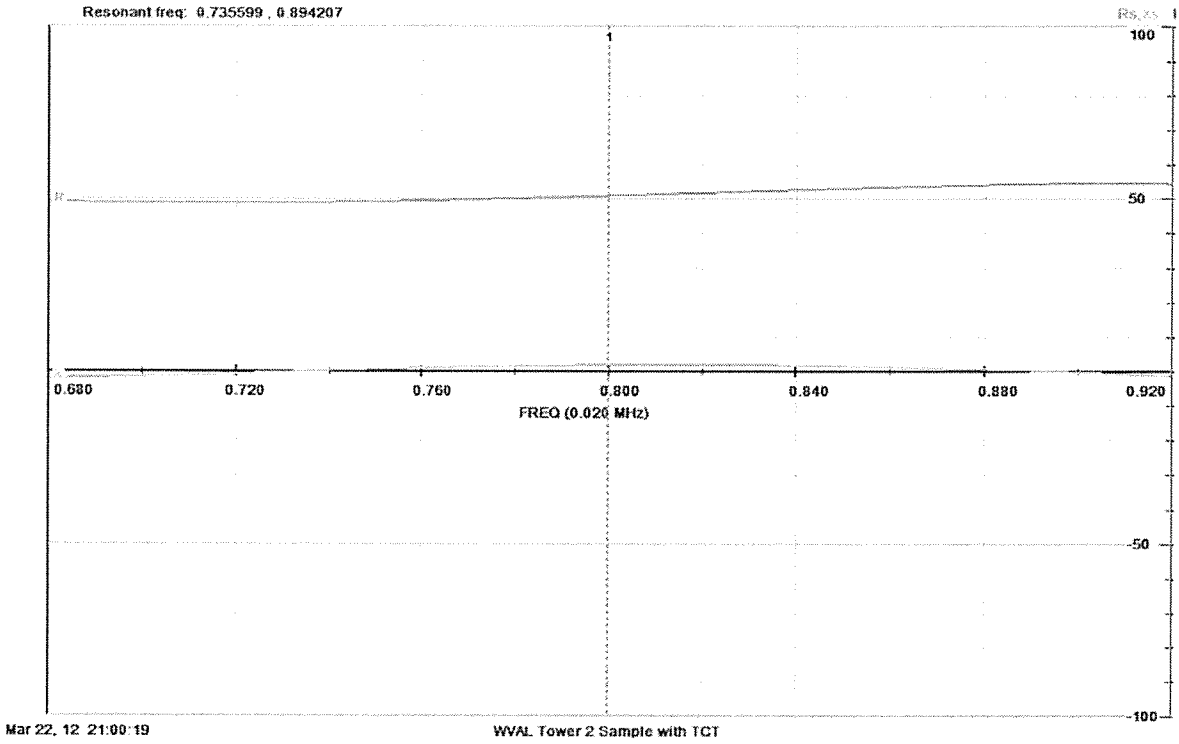
Tower 2 (Center)



Impedance of Tower 2 line at 880 KHz, monitor end with transformer connected at other end:

50.903 +j1.878 ohms

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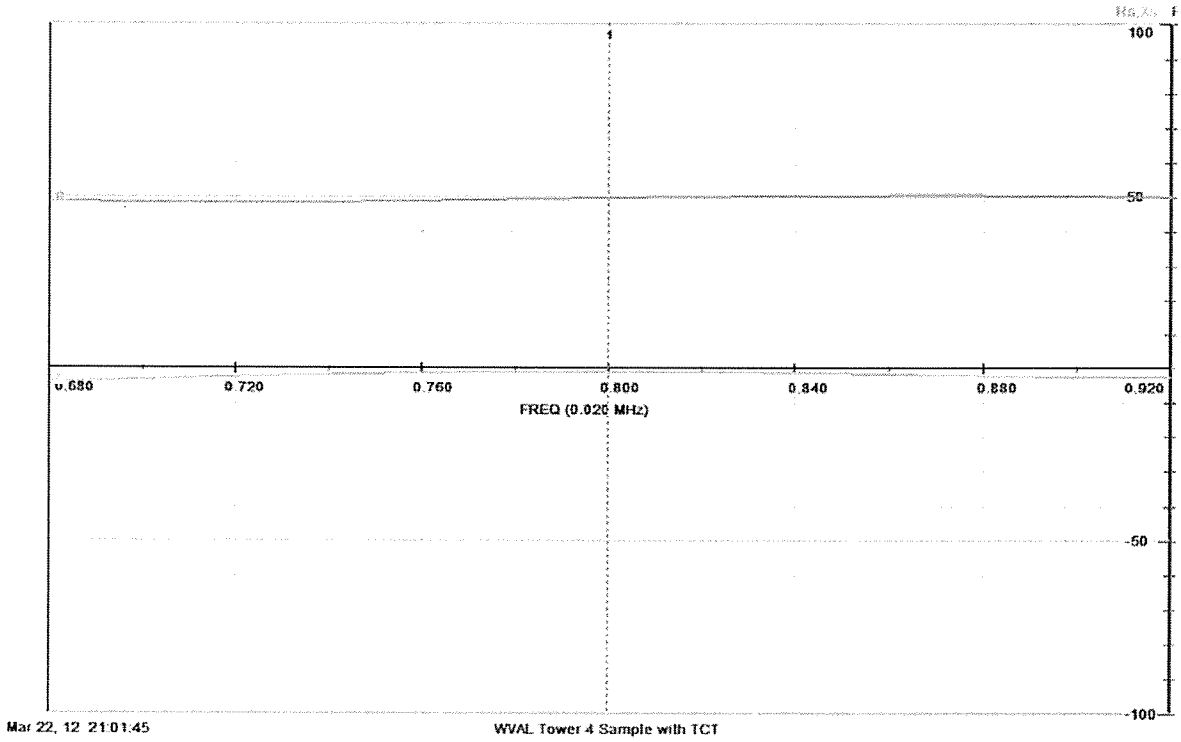
Tower 4 (South)



Impedance of Tower 4 line at 800 KHz, monitor end with transformer connected at other end:

49.777 –j0.862 ohms

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WVAL Daytime Reference Field Strength Measurements

[47 CFR 73.151(c)(3)]

Point	Distance	mv/m	Coordinates (NAD 83)	Description
48° True (Minima, monitor point radial)				
1:	2.85 km	125	45.621952, -94.112107	4*: 1.41 KM north of Golden Spike Rd on 25th Ave NE at fence post
2:	4.60	85.0	45.628397, -94.101770	6: 723 Townhall Rd.
3:	7.05	66.0	45.632453, -94.095375	7: 45th St NE between creek and house
122° True (Maxima)				
1:	3.40	155	45.588645, -94.102840	6: 15th St. NE at 29th Ave NE
2:	4.55	120	45.583452, -94.090539	8: 35th Ave. NE at "stop ahead"
3:	4.95	115	45.581153, -94.085069	9: SR23 in median
213° True (Minima, monitor point radial)				
1:	1.73	62.0	45.591568, -94.151540	5*: 1st St. South, W edge of football field
2:	2.10	51.0	45.588760, -94.154079	6: 301 9th Ave South
3:	2.55	43.0	45.585629, -94.157014	8: 417 5th St. South
243° True (Minima, monitor point radial)				
1:	1.88	55.0	45.597134, -94.160817	4: 212 9th Ave North
2:	2.12	49.5	45.596124, -94.163572	5: 308 7TH Ave North
3:	2.37	46.0	45.595148, -94.166311	6*: 5th Ave at 4th St North, north corner
330° True (Maxima)				
1:	1.60	375	45.617244, -94.149479	2: CR 29 across from east substation fence edge
2:	2.35	285	45.623080, -94.154424	4: 5th Ave NE
3:	5.80	92.0	45.649158, -94.176242	6: US 10 northbound at CR 33 exit light pole

* - licensed monitor point
Numbers before description are antenna proof point numbers.

Measurements taken July 14, 2012.

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WVAL Nighttime Reference Field Strength Measurements

[47 CFR 73.151(c)(3)]

105° True (Minima, monitor point radial)

1:	3.90	24.8	45.595708, -94.090988	6*: 35th Ave NW ½ mile N of 15th St. NE at phone pedestal
2:	6.55	14.0	45.589653, -94.058784	7: 50th Ave NE at 16th St. NE
3:	7.05	15.5	45.588490, -94.052026	9: NW corner SR 23 at SR 95

213° True (Maxima)

1:	1.73	195	45.591568, -94.151540	5*: 1st St. South, W edge of football field
2:	2.10	170	45.588760, -94.154079	6: 301 9th Ave South
3:	2.55	130	45.585629, -94.157014	8: 417 5th St. South

296.5° True (Minima, monitor point radial)

1:	1.60	168	45.610983, -94.157791	1*: 5th Ave NE at driveway
2:	2.30	130	45.613995, -94.165748	3: US 10 northbound at mile marker 174
3:	3.05	90.0	45.616875, -94.174630	5: SR 15 at median crossover north of CR 29

355° True (Maxima)

1:	1.40	240	45.617331, -94.140814	4: CR 29 at pole across from landscape supply co
2:	3.05	105	45.631862, -94.142643	5: 45th St. NE at field drive to south
3:	5.60	54.5	45.654543, -94.145483	6: CR 33 across from power pole

* - licensed monitor point
Numbers before description are antenna proof point numbers.

Measurements taken July 14, 2012.

3717 23rd Street S
St. Cloud, MN 56301
Tel 320-251-4553
Fax 320-251-6252

Bonestroo

GEODETIC COORDINATE CERTIFICATION

TOWER 1
Ground Elevation = 1080.7

	DEGREES	MINUTES	SECONDS	DATUM
LATITUDE	45	36	17.45 N	NAD 83
LONGITUDE	94	08	25.31 W	NAD 83

TOWER 2
Ground Elevation = 1080.2

	DEGREES	MINUTES	SECONDS	DATUM
LATITUDE	45	36	17.17 N	NAD 83
LONGITUDE	94	08	21.49 W	NAD 83

TOWER 3
Ground Elevation = 1081.5

	DEGREES	MINUTES	SECONDS	DATUM
LATITUDE	45	36	16.89 N	NAD 83
LONGITUDE	94	08	17.68 W	NAD 83

TOWER 4
Ground Elevation = 1080.0

	DEGREES	MINUTES	SECONDS	DATUM
LATITUDE	45	36	13.62 N	NAD 83
LONGITUDE	94	08	22.84 W	NAD 83

TOWER 5
Ground Elevation = 1081.4

	DEGREES	MINUTES	SECONDS	DATUM
LATITUDE	45	36	15.39 N	NAD 83
LONGITUDE	94	08	18.48 W	NAD 83

TOWER 6
Ground Elevation = 1080.7

	DEGREES	MINUTES	SECONDS	DATUM
LATITUDE	45	36	18.58 N	NAD 83
LONGITUDE	94	08	24.09 W	NAD 83

TOWER 7
Ground Elevation = 1080.0

	DEGREES	MINUTES	SECONDS	DATUM
LATITUDE	45	36	20.09 N	NAD 83
LONGITUDE	94	08	20.54 W	NAD 83

Calculated Geodetic Bearings between towers:

Tower 2 to Tower 1 - North 83° 54' 31" West - Distance = 272.9'
Tower 2 to Tower 3 - South 83° 57' 24" East - Distance = 272.5'
Tower 2 to Tower 4 - South 15° 03' 10" West - Distance = 372.1'
Tower 2 to Tower 5 - South 49° 51' 31" East - Distance = 279.8'
Tower 2 to Tower 6 - North 52° 10' 55" West - Distance = 233.7'
Tower 2 to Tower 7 - North 12° 54' 27" East - Distance = 303.8'

Date: June 15, 2010
Project #: 000929-10005-0
Location: SE1/4 Sec. 13, T36N, R31W, Benton County, Minnesota.

I certify that the Latitude and the Longitude are accurate to within plus or minus 5 feet horizontally; and that the site elevation is accurate to within 10 feet vertically. Relative tolerance between points is +\- 0.5 feet. The horizontal datum (coordinates) are in terms of the North American Datum of 1983 (NAD83) and are expressed as degrees, minutes, and seconds to the nearest hundredth of a second. The vertical datum (height) is in terms of the North American Vertical Datum of 1988 and is determined to the nearest foot.

Timothy D. Larson

Timothy D. Larson, Professional Land Surveyor
State of Minnesota, License# 43809

15 June, 2010
Date

Mueller Broadcast Design
613 S. La Grange Road
La Grange, Illinois 60525
(708) 352-2166

Tower Survey [47 CFR 73.151(c)(1)(ix)]

All seven towers were surveyed on June 15, 2010 by Timothy D. Larson, a licensed Professional Land Surveyor in the state of Minnesota (license number 43809), and were found to be as follows as shown on the report:

Tower 2 (C) to 1* (W): 272.9 feet (79.87°) at 276.09° True

Tower 2 (C) to 3 (E): 272.5 feet (79.76°) at 96.04° True (theo. 80° at 96°T)

Tower 2 (C) to 4 (S): 372.1 feet (108.91°) at 195.05° True (theo. 109.1° at 195.0°T)

Tower 2 (C) to 5* (SE): 279.5 feet (81.80°) at 130.14° True

Tower 2 (C) to 6* (NW): 233.7 feet (68.40°) at 307.82° True

Tower 2 (C) to 7* (N): 303.8 feet (88.92°) at 12.91° True

Tower numbers 1 and 3 are reversed on the surveyor report. For convenience in comparison with the numbering used on the Form 302, the tower spacings and bearings are recalculated below using actual tower 1 (E) as the reference:

Actual Tower Number	Survey Tower Number	Distance in Meters from Tower 1	Distance in Degrees from Tower 1	Licensed Distance in Degrees	Bearing, Degrees True from Tower 1	Licensed Bearing (degrees true)
1 (E)	3	(reference)	(reference)	(reference)	(ref.)	(reference)
2 (C)	2	83.08	79.76	80.0	276.1	276.0
3 (W)	1	166.20	159.55	*	276.0	*
4 (S)	4	150.67	144.64	145.0	227.9	228.0
5 (SE)	5	49.30	39.06	*	200.5	*
6 (SW)	6	148.10	117.30	*	290.6	*
7 (N)	7	116.59	92.34	*	327.9	*

This corresponds to a maximum relative spacing error for towers 1, 2 and 4 of less than 0.4° and bearing error of 0.1°, well within the allowed tolerances of +/- 1.5°. The actual tower spacings and orientation were used in the model. * = tower is not used by WVAL

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Preparer's Certification

This engineering report was prepared by me from data personally collected on site using equipment owned and maintained by me for this purpose. It is true and correct to the best of my knowledge and belief. The WVAL antenna system is properly constructed and adjusted and program test authority is hereby requested.

September 19, 2012

Mark A. Mueller

Mueller Broadcast Design
613 S. La Grange Road
La Grange, Illinois 60525
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WBHR TOWER DRIVE INFORMATION - DAY						
	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Power (W)	Antenna Monitor
Tower 2 C	0.7800	0.0000	37.98 - j52.26	12.37 ∠ -88.43	5815.3140	75.2% ∠ -88.4°
Tower 4 S	1.0000	90.0000	15.59 - j78.46	16.46 ∠ 0.00	4226.1239	100.0% ∠ 0.0°

WBHR TOWER DRIVE INFORMATION - NIGHT						
	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Power (W)	Antenna Monitor
Tower 1 E	1.0000	0.0000	18.92 - j77.55	3.52 ∠ 0.00	234.3421	100.0% ∠ 0.0°
Tower 3 W	0.6800	-49.0000	42.78 - j78.18	2.39 ∠ -47.11	244.8501	67.9% ∠ -47.1°
Tower 4 S	0.1000	-30.0000	121.12 - j227.63	0.43 ∠ -19.41	22.8265	12.2% ∠ -19.4°

WVAL TOWER DRIVE INFORMATION - DAY						
	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Power (W)	Antenna Monitor
Tower 1 E	1.0000	0.0000	49.26 + j5.39	6.50 ∠ 0.00	2079.0716	100% ∠ 0.0°
Tower 4 S	0.7200	40.0000	25.26 + j7.22	4.56 ∠ 37.96	525.1168	70.2% ∠ +38.0°

WVAL TOWER DRIVE INFORMATION - NIGHT						
	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Power (W)	Antenna Monitor
Tower 1 E	0.5000	47.5000	51.61 - j27.87	1.99 ∠ 47.82	204.7391	56.7% ∠ +47.8°
Tower 2 C	1.0000	0.0000	53.76 + j38.91	3.51 ∠ 0.00	661.8195	100.0% ∠ +0.0°
Tower 4 S	0.2500	-160.0000	-30.38 + j204.64	0.71 ∠ -166.60	-15.1513	20.2% ∠ -166.6°

WMIN TOWER DRIVE INFORMATION - DAY						
	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Power (W)	Antenna Monitor
Tower 2 C	1.0000	-44.0000	164.29 + j119.13	2.02 ∠ -29.90	669.1162	0.493 ∠ -29.9°
Tower 5 SE	1.0000	0.0000	16.08 - j56.35	4.10 ∠ 0.00	270.8856	1.000 ∠ 0°
Tower 7 N	1.0000	-78.0000	184.49 + j116.35	2.03 ∠ -61.97	759.6516	0.495 ∠ -62.0°

WMIN TOWER DRIVE INFORMATION - NIGHT						
	Field Ratios	Field Phase	Drive Imped. (Ω)	Current	Power (W)	Antenna Monitor
Tower 1 E	1.0000	135.0000	20.94 + j146.57	1.40 ∠ 135.75	40.8871	0.528 ∠ +135.8°
Tower 3 W	0.8000	18.0000	41.39 + j204.51	1.04 ∠ 19.07	44.9149	0.393 ∠ +19.1°
Tower 5 SE	1.0000	0.0000	19.94 - j29.81	2.65 ∠ 0.00	140.3180	1.000 ∠ 0°
Tower 6 NW	0.8000	155.0000	2.82 - j54.04	2.20 ∠ 153.54	13.6512	0.830 ∠ +153.5°