LERMAN SENTER PLLC

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DENNIS P. CORBETT
202-416-6780
dcorbett@lermansenter.com

January 30, 2009

VIA FEDEX

Federal Communications Commission
c/o U.S. Bank – Government Lockbox # 979089,
SL-MO-C2-GL
1005 Convention Plaza
St. Louis, MO 63101
Attention: FCC Government Lockbox

Re: Application for License to Cover;
WRCA(AM), Waltham, MA
Facility ID No. 60695

Dear Sir or Madam:

I am transmitting herewith, on behalf of WAEC License Limited Partnership, licensee of radio station WRCA(AM), Waltham, Massachusetts (the "Station"), an original and two copies of an application on FCC Form 302-AM for a license to cover the Station's construction permit BMP-20020926ACN.

Also enclosed is a completed FCC Form 159 providing for the credit card payment of the applicable license application filing fee.

Please date-stamp the enclosed "Return Copy" of this filing and return it in the self-addressed, stamped envelope enclosed for that purpose.

Please contact the undersigned counsel if you have any questions regarding this matter.

Sincerely,

Dennis P. Corbett

Enclosure
cc: Ann Gallagher (via email)
Irene Bleiweiss (via email)

READ INSTRUCTIONS CAREFULLY BEFORE PROCEEDING

FEDERAL COMMUNICATIONS COMMISSION
REMITTANCE ADVICE
FORM 159

Approved by OMB
3060-0589
Page No 1 of 1

(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)
Beasley Broadcast Group, Inc.	$1,260.00

(4) STREET ADDRESS LINE NO. 1
3033 Riviera Drive

(5) STREET ADDRESS LINE NO. 2
Suite 200

(6) CITY	(7) STATE	(8) ZIP CODE
Naples	FL	34103

(9) DAYTIME TELEPHONE NUMBER (include area code)	(10) COUNTRY CODE (if not in U.S.A.)
239-263-5000	

FCC REGISTRATION NUMBER (FRN) REQUIRED

(11) PAYER (FRN)	(12) FCC USE ONLY
0004988077	

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
WAEC LICENSE LIMITED PARTNERSHIP

(14) STREET ADDRESS LINE NO. 1
3033 RIVIERA DRIVE

(15) STREET ADDRESS LINE NO. 2
Suite 200

(16) CITY	(17) STATE	(18) ZIP CODE
Naples	FL	34103

(19) DAYTIME TELEPHONE NUMBER (include area code)	(20) COUNTRY CODE (if not in U.S.A.)
239-263-5000	

FCC REGISTRATION NUMBER (FRN) REQUIRED

(21) APPLICANT (FRN)	(22) FCC USE ONLY
0003764602	

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
WRCA	MMR	1
(26A) FEE DUE FOR (PTC)	(27A) TOTAL FEE	FCC USE ONLY
$585.00	$585.00	
(28A) FCC CODE 1	(29A) FCC CODE 2	

(23B) CALL SIGN/OTHER ID	(24B) PAYMENT TYPE CODE	(25B) QUANTITY
WRCA	MOR	1
(26B) FEE DUE FOR (PTC)	(27B) TOTAL FEE	FCC USE ONLY
$675.00	$675.00	
(28B) FCC CODE 1	(29B) FCC CODE 2	

SECTION D – CERTIFICATION

CERTIFICATION STATEMENT

I, _____, 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 Caroline Beasley DATE 1-30-09

SECTION E - CREDIT CARD PAYMENT INFORMATION

MASTERCARD____ VISA____ AMEX X DISCOVER____

ACCOUNT NUMBER _____ EXPIRATION DATE 02/11

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

SIGNATURE Caroline Beasley DATE 1-30-09

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)

WAEC LICENSE LIMITED PARTNERSHIP

MAILING ADDRESS (Line 1) (Maximum 35 characters)
3033 RIVIERA DRIVE

MAILING ADDRESS (Line 2) (Maximum 35 characters)
SUITE 200

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
NAPLES	FL	34103

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
2392635000	WRCA	60695

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
	0001	$	

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
	0001	$	

	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.	$	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT WAEC LICENSE LIMITED PARTNERSHIP		
MAILING ADDRESS 3033 RIVIERA DRIVE , SUITE 200		
CITY NAPLES	STATE FL	ZIP CODE 34103

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
WRCA	WALTHAM, MA	BMJP-20001023AEH	BMP-20020926ACN	5/27/09

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. See Exhibit 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.

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	
Caroline Beasley	Caroline Beasley	
Title	**Date**	**Telephone Number**
VP CFO, SECRETARY & TREASURER OF GENERAL PARTNER	1/30/09	2392635000

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
WAEC LICENSE LIMITED PARTNERSHIP

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☑ 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
WRCA	BMP-20020926ACN	1330	UNLIMITED	17	25

2. Station location

State	City or Town
MASSACHUSETTS	WATERTOWN

3. Transmitter location

State	County	City or Town	Street address (or other identification)
MA	MIDDLESEX	NEWTON	750 SAWMILL BROOK PKWY

4. Main studio location

State	County	City or Town	Street address (or other identification)
MA	SUFFOLK	CAMBRIDGE	552 MASSACHUSETTS AVE

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

State	County	City or Town	Street address (or other identification)
MA	SUFFOLK	CAMBRIDGE	552 MASSACHUSETTS AVE

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. ITEM 11

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
18.9	22.9
Measured antenna or common point resistance (in ohms) at operating frequency	**Measured antenna or common point reactance (in ohms) at operating frequency**
Night: 50.0 Day: 50.0	Night: - Day: -

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	+123.6	+94.2	0.470	0.428	-	-
2	0.0	0.0	1.000	1.000	-	-
3	-117.2	-98.1	0.625	0.470	-	-
4	-25.7	+73.9	0.116	0.719	-	-
5	-	-31.8	-	0.787	-	-

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, STEEL GUYED	59.4	60.3	60.3	Exhibit No. N/A

Excitation ☑ 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
42 ° 17 ' 20 "	71 ° 11 ' 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?

NONE

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

N/A

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
RONALD D. RACKLEY	Ronald D. Rackley
Address (include ZIP Code)	Date
DLR, INC. 201 FLETCHER AVENUE SARASOTA, FL 34237	1/28/2009
	Telephone No. (Include Area Code) 941-329-6000

☐ Technical Director ☑ Registered Professional Engineer

☐ Chief Operator ☐ Technical Consultant

☐ Other (specify)

EXHIBIT 1
WRCA(AM)
FCC FORM 302-AM

In response to Section II, Question 3, Applicant answered "NO" as to whether the station is currently operating pursuant to automatic test authority in accordance with 47 C.F.R. § 73.1620. The facilities for WRCA(AM) constructed pursuant to construction permit BMP-20020926ACN (the "Permit") utilize a directional AM antenna system. Special operating condition #1 of the Permit provides that a complete nondirectional proof of performance, in addition to a complete proof on the (day) and (night) directional antenna system, shall be submitted before program tests are authorized. The permit also imposes other conditions.

The requisite proofs are submitted with this application, a copy of the equipment installation/maintenance agreement between and among WRCA, WKOX and WUNR, as required by Condition 4 of the Permit, is attached hereto, and satisfaction of all other conditions specified in the Permit is demonstrated in the attached engineering exhibit. Program test authority is therefore hereby requested.

AGREEMENT

THIS AGREEMENT entered into this 31 day of January 2009 ("Effective Date") by and among Beasley FM Acquisition Corp., a Delaware corporation ("*Beasley*"), Capstar Radio Operating Company, a Delaware corporation ("*Capstar*"), and Champion Broadcasting System, Inc., a Massachusetts corporation ("*Champion*") (Beasley, Capstar and Champion, each a "*Triplex Partner*" and collectively, the "*Triplex Partners*").

Whereas Champion owns a parcel of land comprised of 19.7 acres, more or less, located at 750 Saw Mill Brook Parkway, Newton, Massachusetts (the "*Site*");

Whereas each Triplex Partner has been authorized by the Federal Communications Commission (the "*FCC*") to broadcast from the Site;

Whereas Champion presently broadcasts WUNR-AM, Beasley presently broadcasts WRCA-AM and Capstar presently broadcasts WKOX-AM (collectively "Stations") from the Site at their currently licensed powers under STA on a new AM antenna system (collectively, the "*Triplex System*");

Whereas the Triplex Partners desire to enter into this Agreement upon the terms and conditions below;

Now, therefore, in consideration of the terms, provisions and covenants of this Agreement, the Triplex Partners hereby agree as follows:

1. The Triplex Partners agree that the required filters and traps to prevent interaction, intermodulation and/or generation of spurious radiation products which may be caused by common usage of the antenna system by each Station have been installed and properly adjusted.

2. The financial burden for the future installation, repair and maintenance of common devices of the Triplex Partners shall be shared equally between the Triplex Partners.

3. The administration of future installation, repair and maintenance of the Stations' common devices shall be the responsibility of the "Triplex Manager" who will be selected by the "Triplex Partners". The initial Triplex Manager will be Capstar.

4. The Triplex Partners shall enter into an Agreement whereby additional duties and financial responsibilities of each Triplex Partner will be determined.

Capstar Radio Operating Company

By: _____
Bill Bielenberg

Beasley FM Acquisition Corp

By: Caroline Beasley, EVP

Champion Broadcasting System, Inc.

By: _____, Pres.

APPLICATION FOR LICENSE INFORMATION
RADIO STATION WRCA
WATERTOWN, MASSACHUSETTS

January 28, 2009

1330 KHZ 25 KW-D 17 KW-N U DA-2

APPLICATION FOR LICENSE INFORMATION
RADIO STATION WRCA
WATERTOWN, MASSACHUSETTS

1330 KHZ 25 KW-D 17 KW-N U DA-2

Executive Summary- WRCA

This engineering exhibit supports an application for license for the newly constructed directional antenna system of radio station WRCA in Watertown, Massachusetts. WRCA operates on 1330 kilohertz. The WRCA move to this site was authorized by FCC construction permit number BMP-20020926ACN.

The site is shared with two other stations, WKOX on 1200 kilohertz and WUNR on 1600 kilohertz. Filters are employed at the tower bases to isolate the ATU outputs of each station from those of the others and at the phasor inputs to isolate the transmitters and provide suppression of spurious intermodulation products. WRCA uses all five towers for daytime operation and four of the five towers at night that are employed by the other stations at the site. The unused tower at night is detuned at 1330 kilohertz.

The towers and ground system were constructed in accordance with the terms of the construction permit and specifications that were provided in the application for construction permit.

Information is provided herein demonstrating that the directional antenna parameters for both the daytime and nighttime patterns authorized by the construction permit 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.

Benjamin F. Dawson III, P.E.
January 28, 2009

Ronald D. Rackley, P.E.

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

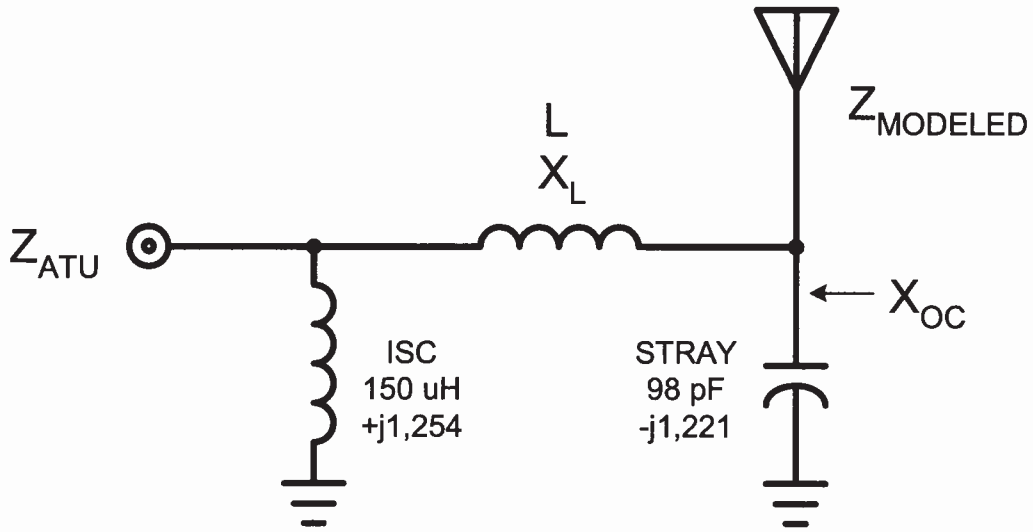
Tower base impedance measurements were made at the final J-plugs within the Antenna Tuning Units ("ATUs") using a Hewlett-Packard 8751A network analyzer and a Tunwall Radio directional coupler in a calibrated measurement system. The other towers were all open circuited at the same points where impedance measurements were made for them (the "reference points") for each of the measurements.

The reference point in each ATU is followed by the shunt connection of the 150 microhenry sampling line isolation coil, which is located within the output section of the cabinet that also houses filters and matching networks and is followed by the feedline that exits the ATU enclosure and is connected to the tower above the base insulator. Circuit calculations were performed to relate the method of moments modeled impedances of the tower feedpoints to the ATU output measurement (reference) points as shown on the following pages. The Xoc shown for each tower, which was calculated for the parallel combination of the two coils in series and the assumed stray capacitance, was used in the method of moments model as a load at ground level for the open circuited case.

In addition to the page showing the schematic of the assumed circuit and tabulation of calculated values, pages showing the results of calculations using the WCAP network analysis program from Westberg Consulting are provided. WCAP performs such calculations using nodal analysis, as do other modern circuit analysis programs such as the commonly available ones based on SPICE software.

In each of the WCAP tabulations, node 2 represents the ATU output reference point and node 3 represents the tower feedpoint. Node 0 represents ground potential. It should be noted that the calculated ATU output impedances appear under the "TO NODE IMPEDANCE" columns of the WCAP tabulations, following the phantom 1.0 ohm resistors (R 1 - 2) that were included in series with the drive current sources (I 0 -1)) to provide calculation points for the impedances. The tower feedpoint impedances from the method of moments model are represented by complex loads from node 3 to ground (R 3 - 0). The assumed stray capacitance of 98 picofarads was used for the calculations of all of the towers, although it appears as 0.0001 (microfarad) on the WCAP printout due to rounding. The numerals in the file names shown on the tabulations correspond to the tower numbers.

The modeled and measured base impedances at the ATU output jacks with the other towers open circuited at their ATU output jacks agree within +/- 2 ohms and +/- 4 percent for resistance, as required by the FCC Rules.



TOWER	L(uH)	X_L	X_{OC}	$Z_{MODELED}$	$Z_{ATU\ (MODELED)}$	$Z_{ATU\ (MEASURED)}$
1	2.250	+j18.8	-j30,002	64.8 +j79.6	63.2 +j95.9	61.9 +j95.7
2	2.33	+j19.5	-j29,618	62.8 +j80.9	61.2 +j97.7	59.0 +j97.6
3	4.643	+j38.8	-j21,985	56.9 +j59.6	53.8 +j93.7	52.1 +j93.7
4	2.668	+j22.3	-j28,180	63.8 +j77.9	61.9 +j97.2	61.0 +j97.1
5	3.339	+j27.9	-j25,701	63.4 +j75.0	61.0 +j99.1	61.2 +j99.0

ANALYSIS OF TOWER IMPEDANCE MEASUREMENTS TO VERIFY METHOD OF MOMENTS MODEL

RADIO STATION WRCA
WATERTOWN, MASSACHUSETTS
1330 KHZ 25 KW-D 17 KW-N U DA-2

DTR/H&D JOINT VENTURE

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = wrcaloc.cir

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	150.0000	2	0	.0000	.0000	.0000
L	2.2500	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	64.8000	3	0	79.6000	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.330

NODE	VOLT MAG	VOLT PHASE
1	115.3866	56.1755
2	114.8330	56.5900
3	101.3901	50.7293

				BRANCH VOLTAGE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE		
				MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE	VSWR
R	1-	2	1.000	1.00	.000	1.00	.000	64.23	95.86	63.23	95.86	
L	2-	0	150.000	114.83	56.590	.09	-33.410	.00	1253.50	.00	.00	
L	2-	3	2.250	17.39	93.126	.92	3.126	73.91	99.76	73.91	80.95	
C	3-	0	.000	101.39	50.729	.08	140.729	.00	-1221.08	.00	.00	
R	3-	0	64.800	101.39	50.729	.99	-.123	64.80	79.60	.00	.00	

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = wrca2oc.cir

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	150.0000	2	0	.0000	.0000	.0000
L	2.3330	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	62.8000	3	0	80.9000	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.330

NODE	VOLT MAG	VOLT PHASE
1	115.8495	57.5144
2	115.3155	57.9336
3	101.1186	52.0585

				BRANCH VOLTAGE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE		
				MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE	VSWR
R	1-	2	1.000	1.00	.000	1.00	.000	62.22	97.72	61.22	97.72	
L	2-	0	150.000	115.32	57.934	.09	-32.066	.00	1253.50	.00	.00	
L	2-	3	2.333	18.00	93.032	.92	3.032	71.81	102.18	71.81	82.68	
C	3-	0	.000	101.12	52.058	.08	142.058	.00	-1221.08	.00	.00	
R	3-	0	62.800	101.12	52.058	.99	-.120	62.80	80.90	.00	.00	

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = wrca3oc.cir

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	150.0000	2	0	.0000	.0000	.0000
L	4.6430	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	56.9000	3	0	59.6000	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.330

NODE	VOLT MAG	VOLT PHASE
1	108.5795	59.6743
2	108.0780	60.1319
3	80.1414	46.1801

				BRANCH VOLTAGE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE		
				MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE	VSWR
R	1-	2	1.000	1.00	.000	1.00	.000	54.82	93.72	53.82	93.72	
L	2-	0	150.000	108.08	60.132	.09	-29.868	.00	1253.50	.00	.00	
L	2-	3	4.643	35.94	92.657	.93	2.657	62.74	98.38	62.74	59.58	
C	3-	0	.000	80.14	46.180	.07	136.180	.00	-1221.08	.00	.00	
R	3-	0	56.900	80.14	46.180	.97	-.148	56.90	59.60	.00	.00	

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = wrca4oc.cir

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	150.0000	2	0	.0000	.0000	.0000
L	2.6680	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	63.8000	3	0	77.9000	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.330

NODE	VOLT MAG	VOLT PHASE
1	115.7700	57.0739
2	115.2295	57.4912
3	99.2033	50.5538

			BRANCH VOLTAGE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE		
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE	VSWR
R	1- 2	1.000	1.00	.000	1.00	.000	62.93	97.17	61.93	97.17	
L	2- 0	150.000	115.23	57.491	.09	-32.509	.00	1253.50	.00	.00	
L	2- 3	2.668	20.60	93.066	.92	3.066	72.57	101.45	72.57	79.16	
C	3- 0	.000	99.20	50.554	.08	140.554	.00	-1221.08	.00	.00	
R	3- 0	63.800	99.20	50.554	.99	-.129	63.80	77.90	.00	.00	

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = wrca5oc.cir

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	150.0000	2	0	.0000	.0000	.0000
L	3.3390	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	63.4000	3	0	75.0000	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.330

NODE	VOLT MAG	VOLT PHASE
1	116.9272	57.9659
2	116.3998	58.3832
3	96.3465	49.6506

			BRANCH VOLTAGE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE		
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE	VSWR
R	1- 2	1.000	1.00	.000	1.00	.000	62.02	99.12	61.02	99.12	
L	2- 0	150.000	116.40	58.383	.09	-31.617	.00	1253.50	.00	.00	
L	2- 3	3.339	25.73	93.026	.92	3.026	71.75	103.84	71.75	75.94	
C	3- 0	.000	96.35	49.651	.08	139.651	.00	-1221.08	.00	.00	
R	3- 0	63.400	96.35	49.651	.98	-.140	63.40	75.00	.00	.00	

Derivation of Operating Parameters for Daytime Directional Antenna - WRCA

The method of moments model of the array, following verification with the measured individual open circuited base impedances, was utilized for directional antenna calculations. 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 pattern. With these voltage sources, the tower currents were calculated. Twelve segments were used for each tower, so that the modeled current pulse between the fourth and fifth segments above ground level would correspond to the sampling loop location on each tower – at 1/3 of the total tower height above the base insulator. As the tower structures, sampling loops and sampling lines are identical, the antenna monitor ratios and phases corresponding to the theoretical parameters were calculated directly from the modeled tower currents.

Tower	Modeled Current Pulse	Current Magnitude (amperes)	Current Phase (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase (degrees)
1	5	5.637	94.1	0.428	94.2
2	17	13.178	359.9	1.000	0.0
3	29	6.197	261.8	0.470	-98.1
4	41	9.470	73.8	0.719	73.9
5	53	10.369	328.1	0.787	-31.8

Derivation of Operating Parameters for Nighttime Directional Antenna - WRCA

The method of moments model of the array, following verification with the measured individual open circuited base impedances, was utilized for directional antenna calculations. 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 pattern. With these voltage sources, the tower currents were calculated. Twelve segments were used for each tower, so that the modeled current pulse between the fourth and fifth segments above ground level would correspond to the sampling loop location on each tower – at 1/3 of the total tower height above the base insulator. As the tower structures, sampling loops and sampling lines are identical, the antenna monitor ratios and phases corresponding to the theoretical parameters were calculated directly from the modeled tower currents.

Tower	Modeled Current Pulse	Current Magnitude (amperes)	Current Phase (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase (degrees)
1	5	8.041	123.6	0.470	123.6
2	17	17.115	360	1.000	0.0
3	29	10.698	242.8	0.625	-117.2
4	41	1.983	334.3	0.116	-25.7
5	53	.0111	--	Nulled	--

Method of Moments Model Details for Towers Driven Individually - WRCA

The array of towers was modeled using Expert MININEC Broadcast Professional Version 14.5. One wire was used to represent each tower. The top and bottom wire end points were specified using meters in the Cartesian coordinate system, as converted from the theoretical directional antenna specifications taking into account the carrier frequency wavelength. The modeling option to place a "cap" on the upper end of each wire was chosen. Each tower was modeled using 12 wire segments. As the towers are physically 94.9 degrees in electrical height, the segment length is 7.91 electrical degrees.

The individual tower characteristics were adjusted to provide a match of their modeled impedances, when presented to a circuit model which included branches representing the stray capacitances, feedline hookup inductances and sampling line isolation coils at the tower bases, with the base impedances that were measured at the output jacks of the Antenna Tuning Units while the other towers of the array were open circuited. The method of moments model assumed loads at ground level having the reactances that were calculated for them using the base circuit models for the open circuited towers of the array.

Each tower's modeled height relative to its physical height falls within the required range of 75 to 125 percent and each modeled radius falls within the required range of 80 percent to 150 percent of the radius of a circle having a circumference equal to the sum of the widths of the tower sides. The array consists of identical, uniform cross section towers having a face width of 24 inches.

Tower	Physical Height (meters)	Modeled Height (meters)	Modeled Percent of Height	Modeled Radius (meters)	Percent of Equivalent Radius
1	59.4	63.1	106.2	0.29	100
2	59.4	63.5	106.9	0.29	100
3	59.4	61.0	102.7	0.29	100
4	59.4	62.9	105.9	0.29	100
5	59.4	62.6	105.4	0.29	100

The following pages show the details of the method of moments models for the individually driven towers. The numerals in the file names shown on the tabulations correspond to the tower numbers.

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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							
1.33	64.832	79.641	102.69	50.9	3.7585	-4.736	-1.7786

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GEOMETRY
Dimensions in meters
Environment: perfect ground

wire	caps	X	Y	Z	radius	segs
1	2	0	0	0	.29	12
		0	0	63.1		
2	2	18.7	51.4	0	.29	12
		18.7	51.4	63.5		
3	2	30.6	100.2	0	.29	12
		30.6	100.2	61.		
4	2	-88.6	38.9	0	.29	12
		-88.6	38.9	62.9		
5	2	-76.7	97.9	0	.29	12
		-76.7	97.9	62.6		

Number of wires = 5
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	5.1075	2	5.31583
segment/radius ratio	3	17.6121	2	18.3305
radius	1	.29	1	.29

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0226584	.0235826

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	1	0	0	0	0	0
2	13	0	-29,618.	0	0	0
3	25	0	-21,985.	0	0	0
4	37	0	-28,180.	0	0	0
5	49	0	-25,701.	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 13, sector 1							
1.33	62.799	80.932	102.44	52.2	3.8805	-4.5799	-1.8598

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GEOMETRY
Dimensions in meters
Environment: perfect ground

wire	caps	X	Y	Z	radius	segs
1	2	0	0	0	.29	12
		0	0	63.1		
2	2	18.7	51.4	0	.29	12
		18.7	51.4	63.5		
3	2	30.6	100.2	0	.29	12
		30.6	100.2	61.		
4	2	-88.6	38.9	0	.29	12
		-88.6	38.9	62.9		
5	2	-76.7	97.9	0	.29	12
		-76.7	97.9	62.6		

Number of wires = 5
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	5.1075	2	5.31583
segment/radius ratio	3	17.6121	2	18.3305
radius	1	.29	1	.29

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0226584	.0235826

Sources

source	node	sector	magnitude	phase	type
1	13	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-30,002.	0	0	0
2	13	0	0	0	0	0
3	25	0	-21,985.	0	0	0
4	37	0	-28,180.	0	0	0
5	49	0	-25,701.	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 25, sector 1							
1.33	56.851	59.649	82.402	46.4	2.9265	-6.1847	-1.196

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GEOMETRY
Dimensions in meters
Environment: perfect ground

wire	caps	X	Y	Z	radius	segs
1	2	0	0	0	.29	12
		0	0	63.1		
2	2	18.7	51.4	0	.29	12
		18.7	51.4	63.5		
3	2	30.6	100.2	0	.29	12
		30.6	100.2	61.		
4	2	-88.6	38.9	0	.29	12
		-88.6	38.9	62.9		
5	2	-76.7	97.9	0	.29	12
		-76.7	97.9	62.6		

Number of wires = 5
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	5.1075	2	5.31583
segment/radius ratio	3	17.6121	2	18.3305
radius	1	.29	1	.29

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0226584	.0235826

Sources

source	node	sector	magnitude	phase	type
1	25	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-30,002.	0	0	0
2	13	0	-29,618.	0	0	0
3	25	0	0	0	0	0
4	37	0	-28,180.	0	0	0
5	49	0	-25,701.	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 37, sector 1							
1.33	63.82	77.947	100.74	50.7	3.6931	-4.8242	-1.7347

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GEOMETRY
Dimensions in meters
Environment: perfect ground

wire	caps	X	Y	Z	radius	segs
1	2	0	0	0	.29	12
		0	0	63.1		
2	2	18.7	51.4	0	.29	12
		18.7	51.4	63.5		
3	2	30.6	100.2	0	.29	12
		30.6	100.2	61.		
4	2	-88.6	38.9	0	.29	12
		-88.6	38.9	62.9		
5	2	-76.7	97.9	0	.29	12
		-76.7	97.9	62.6		

Number of wires = 5
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	5.1075	2	5.31583
segment/radius ratio	3	17.6121	2	18.3305
radius	1	.29	1	.29

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0226584	.0235826

Sources

source	node	sector	magnitude	phase	type
1	37	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-30,002.	0	0	0
2	13	0	-29,618.	0	0	0
3	25	0	-21,985.	0	0	0
4	37	0	0	0	0	0
5	49	0	-25,701.	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 49, sector 1							
1.33	63.427	74.977	98.206	49.8	3.5475	-5.0331	-1.6357

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GEOMETRY
Dimensions in meters
Environment: perfect ground

wire	caps	X	Y	Z	radius	segs
1	2	0	0	0	.29	12
		0	0	63.1		
2	2	18.7	51.4	0	.29	12
		18.7	51.4	63.5		
3	2	30.6	100.2	0	.29	12
		30.6	100.2	61.		
4	2	-88.6	38.9	0	.29	12
		-88.6	38.9	62.9		
5	2	-76.7	97.9	0	.29	12
		-76.7	97.9	62.6		

Number of wires = 5
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	5.1075	2	5.31583
segment/radius ratio	3	17.6121	2	18.3305
radius	1	.29	1	.29

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0226584	.0235826

Sources

source	node	sector	magnitude	phase	type
1	49	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-30,002.	0	0	0
2	13	0	-29,618.	0	0	0
3	25	0	-21,985.	0	0	0
4	37	0	-28,180.	0	0	0
5	49	0	0	0	0	0

Method of Moments Model Details for Daytime Directional Antenna- WRCA

The array of towers was modeled using Expert MININEC Broadcast Professional Version 14.5 with the individual towers 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 pattern. The following pages contain details of the method of moments model of the directional antenna pattern.

Tower	Wire	Base Node
1	1	1
2	2	13
3	3	25
4	4	37
5	5	49

The top end Z coordinates for the wires in the current tabulation are 0.29 meter greater than the tower heights specified in the model because the end cap option was selected for the top of each tower and the specified wire radius was added automatically for the calculations. It should be noted that voltages and currents shown on the tabulations that are not specified as "rms" values are the corresponding peak values.

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GEOMETRY
Dimensions in meters
Environment: perfect ground

wire	caps	X	Y	Z	radius	segs
1	2	0	0	0	.29	12
		0	0	63.1		
2	2	18.7	51.4	0	.29	12
		18.7	51.4	63.5		
3	2	30.6	100.2	0	.29	12
		30.6	100.2	61.		
4	2	-88.6	38.9	0	.29	12
		-88.6	38.9	62.9		
5	2	-76.7	97.9	0	.29	12
		-76.7	97.9	62.6		

Number of wires = 5
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	5.1075	2	5.31583
segment/radius ratio	3	17.6121	2	18.3305
radius	1	.29	1	.29

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0226584	.0235826

Sources

source	node	sector	magnitude	phase	type
1	1	1	293.228	199.7	voltage
2	13	1	1,514.68	50.	voltage
3	25	1	1,753.92	311.3	voltage
4	37	1	725.1	160.1	voltage
5	49	1	1,523.	14.3	voltage

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MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.33 MHz

tower	field ratio magnitude	phase (deg)
1	.426	93.9
2	1.	0
3	.451	-97.9
4	.713	73.8
5	.776	-31.7

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	207.343	199.7	5.99693	92.9
13	1,071.04	50.	13.2884	6.9
25	1,240.21	311.3	5.28641	282.1
37	512.723	160.1	9.66722	74.4
49	1,076.93	14.3	10.2382	337.9

Sum of square of source currents = 877.532
Total power = 25,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00632091	-.00521311
Y(1, 2)	.0034774	.00373249
Y(1, 3)	.00188428	.000401001
Y(1, 4)	.0032676	.0010005
Y(1, 5)	.00191251	.000784035
Y(2, 1)	.00347747	.00373242
Y(2, 2)	.00366466	-.00382908
Y(2, 3)	.00375804	.00447565
Y(2, 4)	.00208988	.00160285
Y(2, 5)	.00234893	.00174293
Y(3, 1)	.00188421	.000401021
Y(3, 2)	.00375782	.00447591
Y(3, 3)	.0077169	-.0066351
Y(3, 4)	.00167534	.000598421
Y(3, 5)	.00331039	.000584793
Y(4, 1)	.00326761	.0010005
Y(4, 2)	.00208984	.0016029
Y(4, 3)	.00167541	.000598382
Y(4, 4)	.006836	-.00480861
Y(4, 5)	.00424242	.00320415
Y(5, 1)	.00191251	.000784031
Y(5, 2)	.00234886	.00174299
Y(5, 3)	.00331045	.000584722
Y(5, 4)	.0042424	.00320417
Y(5, 5)	.00730719	-.00501904

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	64.832	79.6173
Z(1, 2)	32.5949	-28.7466
Z(1, 3)	-13.0622	-26.5033
Z(1, 4)	-7.04205	-26.7905
Z(1, 5)	-22.6308	-10.179
Z(2, 1)	32.5952	-28.7464
Z(2, 2)	62.893	80.9581
Z(2, 3)	35.3443	-24.7237
Z(2, 4)	-16.974	-19.7076
Z(2, 5)	-15.3608	-20.2923
Z(3, 1)	-13.0629	-26.5028
Z(3, 2)	35.3418	-24.7256
Z(3, 3)	56.8622	59.6603
Z(3, 4)	-22.5417	-3.34856
Z(3, 5)	-12.1494	-20.2391
Z(4, 1)	-7.04211	-26.7904
Z(4, 2)	-16.9742	-19.7075
Z(4, 3)	-22.5417	-3.34895
Z(4, 4)	63.8496	77.9359
Z(4, 5)	28.7641	-32.0165
Z(5, 1)	-22.6309	-10.1788
Z(5, 2)	-15.3609	-20.2921
Z(5, 3)	-12.149	-20.2393
Z(5, 4)	28.7639	-32.0166
Z(5, 5)	63.4339	74.9663

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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							
1.33	-9.9422	33.131	34.591	106.7	****	****	****
source = 2; node 13, sector 1							
1.33	58.847	55.067	80.594	43.1	2.6847	-6.7975	-1.0185
source = 3; node 25, sector 1							
1.33	204.52	114.91	234.59	29.3	5.4424	-3.2286	-2.8025
source = 4; node 37, sector 1							
1.33	3.9541	52.908	53.056	85.7	26.846	-.64739	-8.5859
source = 5; node 49, sector 1							
1.33	84.597	62.544	105.21	36.5	2.8579	-6.3466	-1.1459

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CURRENT rms
Frequency   = 1.33 MHz
Input power = 25,000. watts
Efficiency = 100. %
coordinates in meters

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	5.99598	93.	-.313413	5.98778
2	0	0	5.2825	6.12374	93.5	-.371909	6.11244
3	0	0	10.565	6.08267	93.8	-.398007	6.06964
4	0	0	15.8475	5.91744	93.9	-.407008	5.90343
5	0	0	21.13	5.63651	94.1	-.401159	5.62222
6	0	0	26.4125	5.24703	94.2	-.38198	5.23311
7	0	0	31.695	4.75664	94.2	-.350948	4.74368
8	0	0	36.9775	4.17382	94.3	-.309681	4.16232
9	0	0	42.26	3.50758	94.2	-.259941	3.49794
10	0	0	47.5425	2.76656	94.2	-.203548	2.75906
11	0	0	52.825	1.95664	94.2	-.14214	1.95147
12	0	0	58.1075	1.07434	94.1	-.0766626	1.0716
END	0	0	63.39	0	0	0	0
GND	18.7	51.4	0	13.2933	6.9	13.1971	1.59709
14	18.7	51.4	5.31583	13.8542	4.	13.8201	.970234
15	18.7	51.4	10.6317	13.9411	2.3	13.9296	.568032
16	18.7	51.4	15.9475	13.7083	1.	13.7061	.244208
17	18.7	51.4	21.2633	13.1776	359.9	13.1776	-.0158876
18	18.7	51.4	26.5792	12.3658	359.	12.3639	-.216818
19	18.7	51.4	31.895	11.2901	358.2	11.2844	-.36002
20	18.7	51.4	37.2108	9.97007	357.4	9.96009	-.446102
21	18.7	51.4	42.5267	8.4269	356.8	8.41347	-.475611
22	18.7	51.4	47.8425	6.68122	356.1	6.6661	-.449188
23	18.7	51.4	53.1583	4.74761	355.6	4.73339	-.367137
24	18.7	51.4	58.4742	2.61791	355.	2.60799	-.227748
END	18.7	51.4	63.79	0	0	0	0
GND	30.6	100.2	0	5.2883	282.	1.0967	-5.17333
26	30.6	100.2	5.1075	5.84911	272.7	.278163	-5.84249
27	30.6	100.2	10.215	6.13767	267.9	-.222772	-6.13362
28	30.6	100.2	15.3225	6.2522	264.5	-.603765	-6.22298
29	30.6	100.2	20.43	6.19652	261.8	-.885469	-6.13293
30	30.6	100.2	25.5375	5.97339	259.6	-1.07546	-5.87578
31	30.6	100.2	30.645	5.58694	257.8	-1.17729	-5.46149
32	30.6	100.2	35.7525	5.04338	256.3	-1.19358	-4.9001
33	30.6	100.2	40.86	4.35041	255.	-1.12694	-4.20192
34	30.6	100.2	45.9675	3.51604	253.8	-.97991	-3.37673
35	30.6	100.2	51.075	2.54508	252.8	-.754078	-2.4308
36	30.6	100.2	56.1825	1.42999	251.8	-.446831	-1.35838
END	30.6	100.2	61.29	0	0	0	0
GND	-88.6	38.9	0	9.66678	74.4	2.60381	9.3095
38	-88.6	38.9	5.26583	10.0411	74.2	2.73785	9.66061
39	-88.6	38.9	10.5317	10.0736	74.1	2.76764	9.68593
40	-88.6	38.9	15.7975	9.8772	73.9	2.73128	9.49206
41	-88.6	38.9	21.0633	9.4702	73.8	2.63423	9.09646
42	-88.6	38.9	26.3292	8.86593	73.8	2.48004	8.512
43	-88.6	38.9	31.595	8.07773	73.7	2.27198	7.75163
44	-88.6	38.9	36.8608	7.12018	73.6	2.01356	6.82953
45	-88.6	38.9	42.1267	6.0086	73.5	1.70848	5.76058

46	-88.6	38.9	47.3925	4.75765	73.4	1.36021	4.55906
47	-88.6	38.9	52.6583	3.37728	73.3	.97092	3.23471
48	-88.6	38.9	57.9242	1.86113	73.2	.538073	1.78165
END	-88.6	38.9	63.19	0	0	0	0
GND	-76.7	97.9	0	10.2393	337.8	9.48187	-3.86487
50	-76.7	97.9	5.24083	10.7482	333.7	9.63932	-4.75481
51	-76.7	97.9	10.4817	10.8725	331.4	9.54666	-5.20314
52	-76.7	97.9	15.7225	10.7407	329.6	9.26465	-5.43399
53	-76.7	97.9	20.9633	10.3685	328.1	8.80575	-5.47406
54	-76.7	97.9	26.2042	9.76786	326.9	8.18126	-5.33649
55	-76.7	97.9	31.445	8.95105	325.8	7.40335	-5.03108
56	-76.7	97.9	36.6858	7.93236	324.8	6.48541	-4.56747
57	-76.7	97.9	41.9267	6.72755	324.	5.44169	-3.95574
58	-76.7	97.9	47.1675	5.35205	323.2	4.28575	-3.20575
59	-76.7	97.9	52.4083	3.81626	322.5	3.02688	-2.32419
60	-76.7	97.9	57.6492	2.11227	321.8	1.65989	-1.30632
END	-76.7	97.9	62.89	0	0	0	0

Method of Moments Model Details for Nighttime Directional Antenna- WRCA

The array of towers was modeled using Expert MININEC Broadcast Professional Version 14.5 with the individual towers 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 pattern. The following pages contain details of the method of moments model of the directional antenna pattern.

Tower	Wire	Base Node
1	1	1
2	2	13
3	3	25
4	4	37
5	5	49

The top end Z coordinates for the wires in the current tabulation are 0.29 meter greater than the tower heights specified in the model because the end cap option was selected for the top of each tower and the specified wire radius was added automatically for the calculations. It should be noted that voltages and currents shown on the tabulations that are not specified as "rms" values are the corresponding peak values.

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GEOMETRY
Dimensions in meters
Environment: perfect ground

wire	caps	X	Y	Z	radius	segs
1	2	0	0	0	.29	12
		0	0	63.1		
2	2	18.7	51.4	0	.29	12
		18.7	51.4	63.5		
3	2	30.6	100.2	0	.29	12
		30.6	100.2	61.		
4	2	-88.6	38.9	0	.29	12
		-88.6	38.9	62.9		
5	2	-76.7	97.9	0	.29	12
		-76.7	97.9	62.6		

Number of wires = 5
current nodes = 60

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	5.1075	2	5.31583
segment/radius ratio	3	17.6121	2	18.3305
radius	1	.29	1	.29

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.33	0	1	.0226584	.0235826

Sources

source	node	sector	magnitude	phase	type
1	1	1	749.439	204.4	voltage
2	13	1	2,241.89	69.2	voltage
3	25	1	2,094.33	317.5	voltage
4	37	1	271.839	8.5	voltage
5	49	1	462.808	255.7	voltage

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MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.33 MHz

tower	field ratio magnitude	phase (deg)
1	.467	123.6
2	1.	0
3	.601	-117.1
4	.115	-25.6
5	0	0

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	529.933	204.4	8.01619	125.2
13	1,585.25	69.2	16.2267	4.7
25	1,480.92	317.5	9.05449	248.4
37	192.219	8.5	2.05497	344.6
49	327.255	255.7	.747195	345.1

Sum of square of source currents = 828.659
Total power = 17,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00632091	-.00521311
Y(1, 2)	.0034774	.00373249
Y(1, 3)	.00188428	.000401001
Y(1, 4)	.0032676	.0010005
Y(1, 5)	.00191251	.000784035
Y(2, 1)	.00347747	.00373242
Y(2, 2)	.00366466	-.00382908
Y(2, 3)	.00375804	.00447565
Y(2, 4)	.00208988	.00160285
Y(2, 5)	.00234893	.00174293
Y(3, 1)	.00188421	.000401021
Y(3, 2)	.00375782	.00447591
Y(3, 3)	.0077169	-.0066351
Y(3, 4)	.00167534	.000598421
Y(3, 5)	.00331039	.000584793
Y(4, 1)	.00326761	.0010005
Y(4, 2)	.00208984	.0016029
Y(4, 3)	.00167541	.000598382
Y(4, 4)	.006836	-.00480861
Y(4, 5)	.00424242	.00320415
Y(5, 1)	.00191251	.000784031
Y(5, 2)	.00234886	.00174299
Y(5, 3)	.00331045	.000584722
Y(5, 4)	.0042424	.00320417
Y(5, 5)	.00730719	-.00501904

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	64.832	79.6173
Z(1, 2)	32.5949	-28.7466
Z(1, 3)	-13.0622	-26.5033
Z(1, 4)	-7.04205	-26.7905
Z(1, 5)	-22.6308	-10.179
Z(2, 1)	32.5952	-28.7464
Z(2, 2)	62.893	80.9581
Z(2, 3)	35.3443	-24.7237
Z(2, 4)	-16.974	-19.7076
Z(2, 5)	-15.3608	-20.2923
Z(3, 1)	-13.0629	-26.5028
Z(3, 2)	35.3418	-24.7256
Z(3, 3)	56.8622	59.6603
Z(3, 4)	-22.5417	-3.34856
Z(3, 5)	-12.1494	-20.2391
Z(4, 1)	-7.04211	-26.7904
Z(4, 2)	-16.9742	-19.7075
Z(4, 3)	-22.5417	-3.34895
Z(4, 4)	63.8496	77.9359
Z(4, 5)	28.7641	-32.0165
Z(5, 1)	-22.6309	-10.1788
Z(5, 2)	-15.3609	-20.2921
Z(5, 3)	-12.149	-20.2393
Z(5, 4)	28.7639	-32.0166
Z(5, 5)	63.4339	74.9663

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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							
1.33	12.372	64.93	66.098	79.2	11.013	-1.5817	-5.1534
source = 2; node 13, sector 1							
1.33	41.998	88.214	97.701	64.5	5.5562	-3.161	-2.8647
source = 3; node 25, sector 1							
1.33	58.359	152.8	163.56	69.1	9.9246	-1.7563	-4.7804
source = 4; node 37, sector 1							
1.33	85.536	37.928	93.567	23.9	2.171	-8.6528	-.63673
source = 5; node 49, sector 1							
1.33	3.8877	-439.03	439.04	270.5	1,004.5	-1.7E-02	-24.008

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CURRENT rms
Frequency = 1.33 MHz
Input power = 17,000. watts
Efficiency = 100. %
coordinates in meters

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	8.01761	125.2	-4.62026	6.5525
2	0	0	5.2825	8.41386	124.6	-4.77556	6.92727
3	0	0	10.565	8.48985	124.2	-4.77401	7.02043
4	0	0	15.8475	8.35994	123.9	-4.66456	6.93762
5	0	0	21.13	8.04172	123.6	-4.45588	6.69435
6	0	0	26.4125	7.54763	123.4	-4.15497	6.30102
7	0	0	31.695	6.88987	123.2	-3.76914	5.76748
8	0	0	36.9775	6.08169	122.9	-3.3065	5.10431
9	0	0	42.26	5.13717	122.7	-2.77571	4.32272
10	0	0	47.5425	4.06994	122.5	-2.18528	3.4335
11	0	0	52.825	2.88967	122.2	-1.54161	2.4441
12	0	0	58.1075	1.59213	122.	-.843727	1.35019
END	0	0	63.39	0	0	0	0
GND	18.7	51.4	0	16.226	4.7	16.1724	1.31791
14	18.7	51.4	5.31583	17.3784	2.7	17.3598	.80475
15	18.7	51.4	10.6317	17.7498	1.5	17.7435	.47385
16	18.7	51.4	15.9475	17.6478	.7	17.6466	.205788
17	18.7	51.4	21.2633	17.1145	360.	17.1145	-.0111315
18	18.7	51.4	26.5792	16.177	359.4	16.176	-.180255
19	18.7	51.4	31.895	14.8608	358.8	14.8577	-.302264
20	18.7	51.4	37.2108	13.193	358.4	13.1876	-.377077
21	18.7	51.4	42.5267	11.203	357.9	11.1957	-.404481
22	18.7	51.4	47.8425	8.91939	357.5	8.91111	-.384281
23	18.7	51.4	53.1583	6.36224	357.2	6.35439	-.315949
24	18.7	51.4	58.4742	3.52081	356.8	3.51529	-.197177
END	18.7	51.4	63.79	0	0	0	0
GND	30.6	100.2	0	9.05421	248.4	-3.33256	-8.4186
26	30.6	100.2	5.1075	10.1935	245.8	-4.17485	-9.29932
27	30.6	100.2	10.215	10.6946	244.5	-4.60394	-9.65288
28	30.6	100.2	15.3225	10.8508	243.5	-4.83375	-9.71469
29	30.6	100.2	20.43	10.698	242.8	-4.88933	-9.51528
30	30.6	100.2	25.5375	10.2554	242.2	-4.78271	-9.07184
31	30.6	100.2	30.645	9.53923	241.7	-4.52255	-8.39901
32	30.6	100.2	35.7525	8.56568	241.3	-4.1172	-7.51129
33	30.6	100.2	40.86	7.35177	240.9	-3.57536	-6.42382
34	30.6	100.2	45.9675	5.91372	240.6	-2.90533	-5.15084
35	30.6	100.2	51.075	4.2616	240.3	-2.11253	-3.70115
36	30.6	100.2	56.1825	2.38426	240.	-1.19158	-2.06515
END	30.6	100.2	61.29	0	0	0	0
GND	-88.6	38.9	0	2.05439	344.6	1.9805	-.546015
38	-88.6	38.9	5.26583	2.11243	340.4	1.98957	-.709918
39	-88.6	38.9	10.5317	2.11208	337.9	1.95639	-.795883
40	-88.6	38.9	15.7975	2.06818	335.9	1.88782	-.844688
41	-88.6	38.9	21.0633	1.98256	334.3	1.78581	-.861065
42	-88.6	38.9	26.3292	1.85694	332.9	1.6524	-.847234
43	-88.6	38.9	31.595	1.69338	331.6	1.48993	-.804778
44	-88.6	38.9	36.8608	1.49439	330.5	1.30101	-.735233
45	-88.6	38.9	42.1267	1.26277	329.5	1.08846	-.640201

46	-88.6	38.9	47.3925	1.00131	328.6	.854935	-.521253
47	-88.6	38.9	52.6583	.711853	327.8	.602277	-.379469
48	-88.6	38.9	57.9242	.392883	327.	.329449	-.214057
END	-88.6	38.9	63.19	0	0	0	0
GND	-76.7	97.9	0	.745399	345.2	.720645	-.190501
50	-76.7	97.9	5.24083	.45031	344.9	.434769	-.117283
51	-76.7	97.9	10.4817	.261757	344.5	.252293	-.0697493
52	-76.7	97.9	15.7225	.110321	343.8	.105924	-.030833
53	-76.7	97.9	20.9633	.0111877	174.5	-.0111371	1.06E-03
54	-76.7	97.9	26.2042	.104472	165.4	-.101103	.0263178
55	-76.7	97.9	31.445	.170777	164.8	-.164766	.0449107
56	-76.7	97.9	36.6858	.210343	164.4	-.202559	.0566922
57	-76.7	97.9	41.9267	.223512	164.	-.214892	.0614771
58	-76.7	97.9	47.1675	.210665	163.7	-.202217	.0590579
59	-76.7	97.9	52.4083	.171989	163.4	-.16482	.0491374
60	-76.7	97.9	57.6492	.106675	163.1	-.102047	.0310817
END	-76.7	97.9	62.89	0	0	0	0

Summary of Post Construction Certified Array Geometry- WRCA

The tower relative distances provided in feet on the Certified Survey drawing of Appendix A were converted to electrical degrees at 1330 kilohertz and used along with the survey tower azimuths relative to True North to calculate the distance in electrical degrees from the location specified in the theoretical directional antenna pattern array geometry. This figure provides a tabulation showing those distances and other data that is relevant to their determination.

Tower	Specified Array Geometry			Post-Construction Certification*		Distance From Specified Base Location	
	Spacing (Deg.)	Spacing (Feet)	Azimuth (Deg. T.)	Spacing (Feet)	Azimuth (Deg. T.)	(Feet)	(Deg.)
1	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
2	87.3	179.3	70.0	179.7	70.2	0.7	0.3
3	167.3	343.7	73.0	343.9	73.1	0.6	0.3
4	154.5	317.4	156.3	318.4	156.2	1.1	0.6
5	198.6	408.0	128.1	408.8	128.1	0.8	0.4

*From January 5, 2009 Record Survey Plan prepared by Verne T. Porter Jr. PLS

The "as built" tower displacements from their specified locations expressed in electrical degrees at carrier frequency, which correspond to space phasing differences in the far-field radiation pattern of the array, are well below the +/- 3 degree operating phase range specified for antenna monitor parameters by the FCC Rules.

Sampling System Measurements - WRCA

Impedance measurements were made of the antenna monitor sampling system using a Hewlett-Packard 8751A network analyzer and a Tunwall Radio directional coupler 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 loops on the towers. The measurements made with the sampling loops disconnected were for the entire sampling line runs, including the sampling line isolation coils at the tower bases and the sampling lines on the towers, under open-circuited conditions.

The following table shows the frequencies above and below the carrier frequency where resonance – zero reactance corresponding with low resistance – was found. As the length of a distortionless transmission line is 180 electrical degrees at the difference frequency between adjacent frequencies of resonance, and frequencies of resonance occur at odd multiples of 90 degrees electrical length, the sampling line length at the resonant frequency below carrier frequency – which is the closest one to the carrier frequency – was found to be 450 electrical degrees. The electrical length at carrier frequency appearing in the table below was calculated by ratioing the frequencies.

The measurements with the sampling loops connected were made at the carrier frequency, 1330 KHz..

Tower	Sampling Line Open-Circuited Resonance Below 1330 KHz (KHz)	Sampling Line Open-Circuited Resonance Above 1330 KHz (KHz)	Sampling Line Calculated Electrical Length at 1330 KHz (Degrees)	1330 KHz Measured Impedance with Sampling Loop Connected (Ohms)
1	1185.0	1662.5	505.1	4.5 –j25.5
2	1185.0	1662.5	505.1	4.6 –j26.0
3	1185.0	1662.5	505.1	4.5 –j25.9
4	1185.0	1662.5	505.1	4.5 –j25.7
5	1184.5	1662.0	505.3	4.6 –j 25.5

The sampling line lengths meet the requirement that they be equal in length 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. As the sampling system serves three stations, on frequencies of 1200 KHz, 1330 KHz and 1600 KHz and the upper and lower frequencies of resonance bracket the frequencies of all three stations, the +45 degree measurements were made offset from the lower frequency of resonance and the –45 degree measurements were made offset from the upper frequency of resonance.

The characteristic impedance was calculated using the following formula, where $R_1 + j X_1$ and $R_2 + j X_2$ are the measured impedances at the +45 and –45 degree offset frequencies, respectively:

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

Tower	+45 Degree Offset Frequency (KHz)	+45 Degree Measured Impedance (Ohms)	-45 Degree Offset Frequency (KHz)	-45 Degree Measured Impedance (Ohms)	Calculated Characteristic Impedance (Ohms)
1	1303.5	8.0 +j49.6	1544.0	8.9 -j49.5	50.2
2	1303.5	8.1 +j49.4	1544.0	9.0 -j49.4	50.1
3	1303.5	8.0 +j49.4	1544.0	8.9 -j49.4	50.1
4	1303.5	8.0 +j49.5	1544.0	9.0 -j49.5	50.2
5	1303.0	8.2 +j49.6	1543.5	9.1 -j49.5	50.3

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

Reference Field Strength Measurements - WRCA

Reference field strength measurements were made using a Potomac Instruments field strength meter of known calibration at three locations along radials at the azimuths with radiation values specified on the construction permit and, additionally, on a major lobe radial for each directional pattern. The measured field strengths and descriptions and GPS coordinates for the reference measurement points are shown on the following pages

Reference Field Strength Measurements

WRCA - Day

Radial	Point	Distance (km)	Field (mV/m)	Coordinates		Description
73	1	1.59	1191	42° 17' 36"N	71° 10' 15.2"W	At stone cemetery wall across from #865 Lagrange
	2	1.67	1059	42° 17' 36.3"N	71° 10'11.2"W	Corner of parking lot, #96 Anderer Lane
	3	1.96	596	42° 17' 40.5"N	71° 09' 59.7"W	On sidewalk across from #131 Furbush
156	1	1.8	88.3	42° 16' 26.7"N	71° 10' 48.7"W	At gate to driveway #28 Grandfield St
	2	2.06	66.2	42° 16' 19.1"N	71° 10' 43.8"W	Sidewalk in front of #12 Riverdale
	3	4.33	22.1	42° 15' 11.9"N	71° 10' 03.8"W	Median strip Washington St. in front of #170, 1 building south of Halfway
200	1	3.12	39.7	42° 15' 45.2"N	71° 12' 07.6"W	North side West Common St, 100'E of Entrance New Bridge on Charles
	2	4.51	19.4	42° 15' 02.9"N	71° 12' 27.5"W	Center of street, west end of Westfield St Opposite fire hydrant
	3	6.34	9.7	42° 14' 07.4"N	71° 12' 54.8"W	South side of Pleasant Valley Dr at center of Driveway #77
284.5	1	3.11	14	42° 17' 44.9"N	71° 13' 32.7"W	East sidewalk Parker Rd across from center of driveway #14 Parker
	2	3.53	19.4	42° 17' 47.7"N	71° 13' 50.5"W	East side Park Ave across from #9 Park
	3	4.5	15.9	42° 17' 57.7"N	71° 14' 31.1"W	West end of Castano Ct by stone wall

Reference Field Strength Measurements

WRCA - Night

Radial	Point	Distance (km)	Field (mV/m)	Coordinates		Description
87	1	1.52	838	42° 17' 22.9"N	71° 10 14.7"W	Entrance to St Josephs Cemetery, 100' north of Brook Farm Road
	2	1.86	495	42° 17' 22.6"N	71° 09' 59.7"W	Southwest corner Lasell St and Newfield St
	3	2.35	637	42° 17' 23.2"N	71° 09' 38.6"W	Sidewalk in front of #17 Greenfield
184	1	1.99	36.1	42° 16' 15.7"N	71° 11' 25.8"W	South side Needham St 100' east of bridge across from pole #49
	2	4.21	5.46	42° 15' 03.7"N	71° 11' 35.4"W	Across from #97 Westfield Rd
	3	6.11	5.1	42° 14' 02.2"N	71° 11' 34.1"W	Southbound shoulder of Rt 128 .8 km north of Exit 15
234	1	3.85	18.2	42° 16' 07.9"N	71° 13' 38.1"W	East side of Canterbury across from driveway To #6
	2	4.1	17.5	42° 16' 02.9"N	71° 13' 46.6"W	Center of driveway to #169 Fox Hill, located on Webster
	3	4.39	16.4	42° 15' 56.8"N	71° 13' 56.6"W	Mailbox #227 Fox Hill
276	1	2.33	49.2	42° 17' 28"N	71° 13' 02.5"W	Mailbox #421 Greendale
	2	2.56	34.6	42° 17' 28.2"N	71° 13' 12.1"W	At curb, center of driveway #184 Richdale Rd
	3	2.77	20	42° 17' 30.5"N	71° 13' 20.9"W	Sidewalk in front of #122 Richdale
326	1	2.25	14.6	42° 18' 19.9"N	71° 12' 16.6"W	On sewer manhole cover, center of cul-de-sac at end of Stephen Place
	2	2.82	14.2	42° 18' 34.8"N	71° 12' 31.9"W	South side Winchester Park Drive, 50' west of Mailbox #61
	3	3.85	2.2	42° 19' 03.8"N	71° 12 54.3"W	North end of cul-de-sac Josselyn Place

Direct Measurement of Power - WRCA

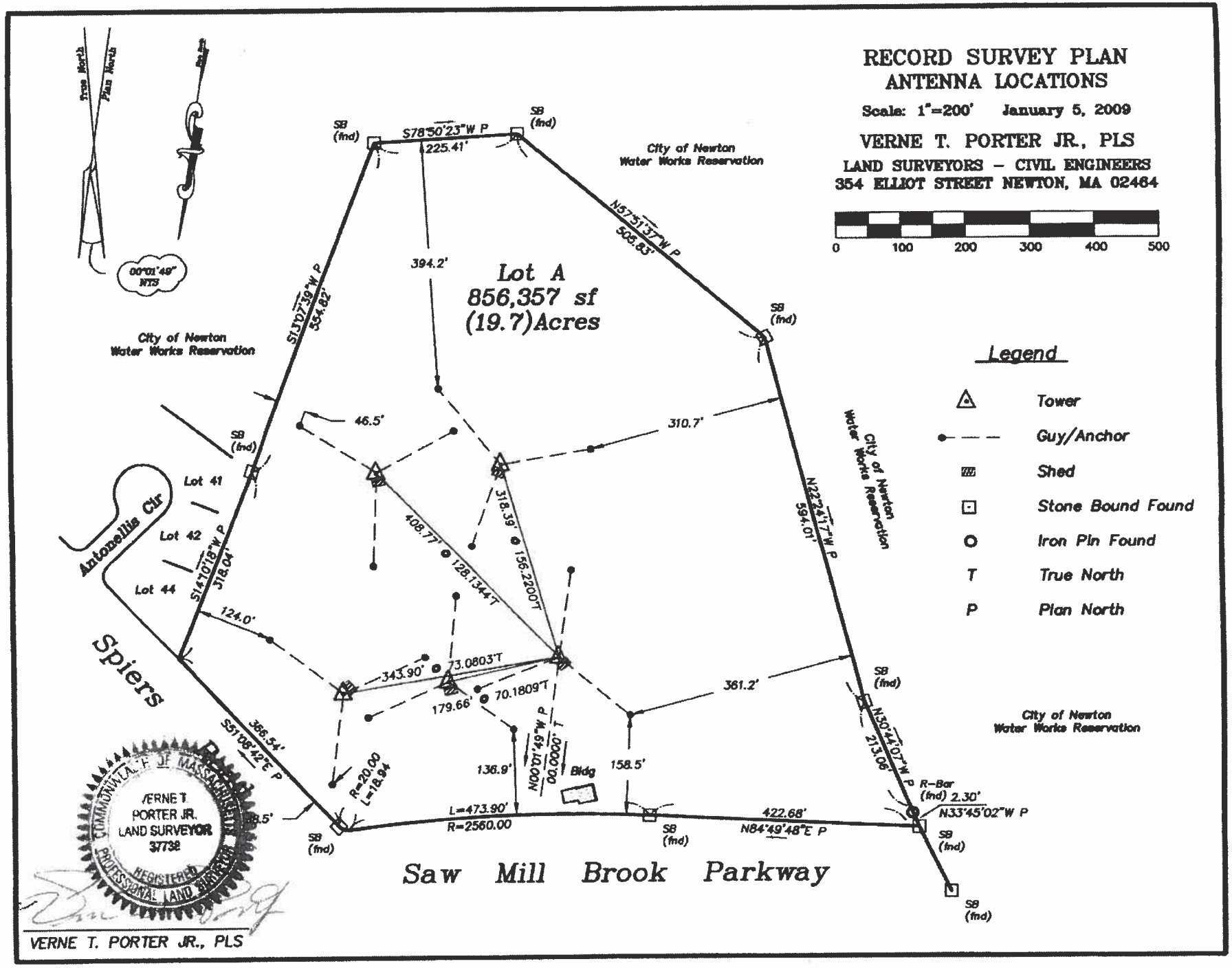
Common point impedance measurements were made using a Hewlett-Packard 8751A network analyzer and a Tunwall Radio directional coupler in a calibrated measurement system. The measurements were made at the phasor cabinet input jack adjacent to the common point current meter that is used to determine operating power. The resistance value was adjusted to provide the correct input power with the specified common point current. The reactance value was adjusted to cancel incidental inductance in the circuit between the transmitter output port and the common point in the phasor cabinet, including the main-auxiliary switching contactor, to provide a non-reactive load for the transmitter at carrier frequency.

Antenna Monitor and Sampling System - WRCA

The antenna monitor is a Potomac Instruments model AM-1901 with factory-installed filters to select the WRCA carrier frequency and reject the frequencies of the other two stations. Single –turn unshielded sampling loops are installed at 65 feet above the base insulator on each of the 195 foot tall towers of the array to serve the antenna monitors of all three stations. The loops are connected through equal length ½ inch foam heliax sampling lines to a panel containing terminating resistors inside the transmitter building, to which the three stations' antenna monitors are connected. The three antenna monitors have high-impedance bridging inputs and they were factory calibrated as a system with the terminating resistor panel.

Appendix A

Certified Post Construction Array Geometry Survey


RECORD SURVEY PLAN
ANTENNA LOCATIONS
Scale: 1"=200' January 5, 2009
VERNE T. PORTER JR., PLS
LAND SURVEYORS – CIVIL ENGINEERS
354 ELLIOT STREET NEWTON, MA 02464
0 100 200 300 400 500
True North
Plan North
00°01'49" NTS
Lot A
856,357 sf
(19.7)Acres
City of Newton
Water Works Reservation
S78°50'23"W P
225.41'
N57°51'37"W P
503.83'
S13°07'39"W P
554.82'
S14°10'18"W P
318.04'
N22°24'17"W P
594.01'
394.2'
46.5'
310.7'
318.39'
156.2200'T
408.77'
128.1344'T
124.0'
343.90'
73.0803'T
70.1809'T
179.66'
361.2'
S51°08'42"E P
356.54'
R=20.00
L=18.84
136.9'
N30°49'10"W P
100.00'
Bldg
158.5'
213.06'
N30°44'07"W P
R-Bar
(fnd) 2.30'
N33°45'02"W P
L=473.90'
R=2560.00
422.68'
N84°49'48"E P
Lot 41
Lot 42
Lot 44
Antonellis Cir
Spiers
Saw Mill Brook Parkway
SB (fnd)
Legend
Tower
Guy/Anchor
Shed
Stone Bound Found
Iron Pin Found
T True North
P Plan North
COMMONWEALTH OF MASSACHUSETTS
VERNE T PORTER JR.
LAND SURVEYOR
37732
REGISTERED PROFESSIONAL LAND SURVEYOR
VERNE T. PORTER JR., PLS

Appendix B

Spurious Emission Measurements

January 15, 2009

Notes on Boston Intermod Measurements

Measurements made with Potomac FIM 4100 SN #133

Measurements made on access road to Brook Farm Historical Site at edge of road by brick and stone wall.

42° 17' 25.1° N
71° 10' 40.5° W

800 kHz station WNNW licensed to Lawrence, Massachusetts has signal strength of 0.46 mV/m over measurement point and surrounding area. Unable to locate a point orthogonal to a line between transmitter site and WNNW where signal from WNNW could be nulled sufficiently for meaningful measurements. No degradation of the 800 kHz signal was observed on or around the WKOX/WRCA/WUNR site.

John Warner

WRCA

FREQUENCY (kHz)	FIELD (mV/m)	EMISSION LEVEL (dB)		FIELD (mV/m)	EMISSION LEVEL (dB)
	1330 (Day)			1330 (Night)	
1330	1,780			1,640	
2660	.034	-94.4		.034	-93.7
3990	.022	-98.2		.026	-96.0
540	.046	-91.8		.040	-92.3
660	.130	-82.7		.134	-81.8
800					
930	.100	-85.0		.100	-84.3
1060					
1070	.120	-83.4		.120	-82.7
1340	.100	-85.0		.080	-86.3
1460	.140	-82.1		.100	-84.3
1470	.130	-82.7		.130	-82.0
1730	.050	-91.0		.050	-90.3
1740	.020	-99.0		.030	-94.8
1860	.020	-99.0		.020	-98.3
1870	.061	-89.3		.030	-94.8

1060 kHz re-measured with co-channel WBIX turned off.

FREQUENCY (kHz)	FIELD (mV/m)	EMISSION LEVEL (dB)
1330	1,880	
1060	.068	-88.8

John Warner

Appendix C

RFR Measurements

HATFIELD & DAWSON
CONSULTING ELECTRICAL ENGINEERS
9500 GREENWOOD AVE. N.
SEATTLE, WASHINGTON 98103

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THOMAS M. ECKELS, PE
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ERIK C. SWANSON, PE
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OAKHURST, NSW
AUSTRALIA

ELECTROMAGNETIC FIELD MEASUREMENTS

AT THE WKOX(AM), WRCA(AM) WUNR(AM)

TRANSMITTER SITE

NEWTON, MA

750 Saw Mill Brook Parkway, Newton MA

21 NOVEMBER 2008

INTRODUCTION

On 7 November 2008, radiofrequency field measurements were made around the AM transmitting facility at 750 Saw Mill Brook Parkway, Newton, MA. The measurements were made between the hours of 10:00 AM and 12:00 noon. All AM transmitters were operating at 100% of the power authorized by the FCC for this facility. The following table is a summary of the authorized facilities.

Station	Frequency	Daytime Power Number of Towers Used	Nighttime Power Number of Towers Used
WKOX	1200 kHz	50 kW - 3 Towers	50 kW - 3 Towers
WRCA	1330 kHz	25 kW - 5 Towers	17 kW - 4 Towers
WUNR	1600 kHz	20 kW - 5 Towers	20 kW - 5 Towers

FCC EXPOSURE GUIDELINES

The FCC Maximum Permissible Exposure (MPE) for radiofrequency fields, outlined in *47 C.F.R §1.1310 Radiofrequency radiation exposure limits,* was developed as a result of the 1996 Telecommunications Act. Congress required the Federal Communications Commission (FCC) to adopt guidelines and methods for evaluating the environmental effects of radiofrequency exposure. The FCC based these guidelines on the RF safety standards developed by the Institute of Electrical and Electronics Engineers (IEEE), which were adopted by the American National Standards Institute (ANSI), and those standards of the National Council on Radiation Protection and Measurements (NCRP). Specifically, the Standards are contained in the reports *Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz* ANSI/IEEE C95.1-1992, and *Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields*, NCRP Report No. 86, 1986. The FCC rulemaking process invited recommendations in the form of comments from the public and other interested parties. These parties included governmental agencies such as the U.S. Environmental Protection Agency (EPA), National Institute for Occupational Safety and Health (NOSH), individual researchers, and

institutions and industrial interests. The FCC guidelines in essence are comprised of the more restrictive aspects of both the ANSI/IEEE and NCRP recommendations.

The IEEE developed their exposure standard by following a rigorous scientific process. The IEEE committees are made up of volunteers from government , research and industry who serve without compensation. The C95.1-1992 standard represents a consensus of the broad expertise of those committee members. The members of the committee reviewed all available scientific research literature on this subject. The literature showing radiofrequency exposure risks to humans was reviewed for engineering, biological and statistical validity. The evaluation of the literature identified an exposure threshold for unfavorable biological effects in humans. A safety factor of 10 was applied to this exposure threshold for workers, and an additional safety factor of 5 was applied for general public.

The NCRP is a nonprofit corporation chartered by Congress to collect, analyze, develop and disseminate information and recommendation on exposure to both ionizing and non-ionizing radiation. The NCRP also based its recommendations on a review of the scientific literature for exposure to humans.

The Maximum Permissible Exposure (MPE) limits for the General Population[1] for the Medium Wave frequencies to be used by these stations are:

Frequency	Electric Field (V/m)	Magnetic Field (A/m)	Power Density (mW/cm^2)
0.300 MHz - 1.340 MHz	614	1.63	100
1.340 MHz - 30 MHz	824/f	2.19/f	900/f
Where f is frequency in MHz			

For the stations to be located at this site, the MPE are:

[1]Uncontrolled Exposure, as outlined in *47 C.F.R §1.1310 Radiofrequency radiation exposure limits*

Station - Frequency	Electric Field (V/m)	Magnetic Field (A/m)	Power Density (mW/cm^2)
WKOX(AM), 1200 kHz	614	1.63	100
WRCA(AM), 1330 kHz	614	1.63	100
WUNR(AM),1600 kHz	515	1.35	70.3

SITE ACCESS AND LOCATION

The Saw Mill Brook transmitter site is located within the city of Newton MA. This site is privat property and is posted with "No Trespassing" and RF Exposure caution signs. The areas around the tower bases are fenced with chain-link fence with a locked gate and are posted with the appropriate RFR caution signs. All station personnel and contractors are required to follow safety procedures before any work is commenced on the site. There are no areas that are accessible to the general public that exceed the FCC MPE limits for the general public.

MEASUREMENT PROCEDURES

Measurement procedures outlined in **OET BULLETIN 65, (EDITION 97-01),** [OET 65] **"Evaluating Compliance With FCC-Specified Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"**, ***ANSI/IEEE Std C95.3-1991, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields--RF and Microwave***, and **NCRP Report No. 119, *"A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields"*** were used for the measurements taken at the Saw Mill Brook Parkway site. Spatially averaged measurements were made at the points where the highest fields were found.

According to the ANSI C95.3 guidelines (reaffirmed in OET 65) measurements to determine exposure compliance are to be made at distances 20 cm or greater from any object. This is to assure that the measurements are not contaminated by re-radiation from conductive objects.

TEST EQUIPMENT USED

A NARDA Model 8718B Electromagnetic Radiation Survey Meter with a NARDA Model B8742 Isotropic Shaped Electric Field Probe was used to make the measurements. The NARDA B8742 probe provides an output proportional to ***CFR 47 §1.1310 Radiofrequency Radiation Exposure Limits*** (Occupational/Controlled Environments) maximum permissible exposure (MPE) over a frequency range from 300 kHz to 3 GHz.

The NARDA Model 8718B Electromagnetic Radiation Survey Meter allows for accurate and repeatable spatially averaged measurements through the use of its time averaging feature. A single key stroke implements the meter's time averaging function as the probe is swept through an area that approximates that of the human body. Spatial Point fields are also stored by the meter during the spatially averaged measurement.

The NARDA diode probes, such as the Model 8764, are designed to provide signal detection on a square law basis and yields accurate readings of fields from multiple sources. Other available measurement devices, such as those manufactured by Holaday and Wandel & Golterman, use linear detection and square the signals after adding. If there are two signals of roughly equal intensity, $E_1 + E_2$ the desired summation is $(E_1)^2 + (E_2)^2$. The result obtained by squaring the signals after addition is $(E_1)^2 + (E_1)(E_2) + (E_2)^2$. The $(E_1)(E_2)$ term results in a measurement error. For this reason the most accurate measurements of RF fields using diode detection are provided by use of probes such as the NARDA 8742D probe that utilize square law detection. Diode probe errors are also discussed in "*Multiple-Source, Multiple Frequency Error of an Electric Field Meter*" (Randa and Kanda).

Item	Make/Model	Serial Number	Calibration Date
RF Survey Meter	Narda 8718B	0001	November 2007
Isotropic, Magnetic Field Probe	Narda 8754D	01004	November 2007

Isotropic, Electric Field Probe	Narda 8764D	01004	November 2007

MEASURED FIELDS

The measured fields around the AM transmitter site are shown in the following tables. The measured field at each location is shown as the spatially averaged field. These measurements are shown as in V/m or A/m and as a percentage of the General Population/Uncontrolled Environment MPE . Four locations were chosen at a point along each fence line that was closet to the tower. Measurements were made in both the day and nighttime modes. The general area was surveyed and all other areas at the site are below the FCC General Population/Uncontrolled Environment MPE.

The highest exposure area is east side of the north center tower. This location has magnetic fields that are 79.9% of the MPE for the General Population/Uncontrolled Environment.

RESULTS

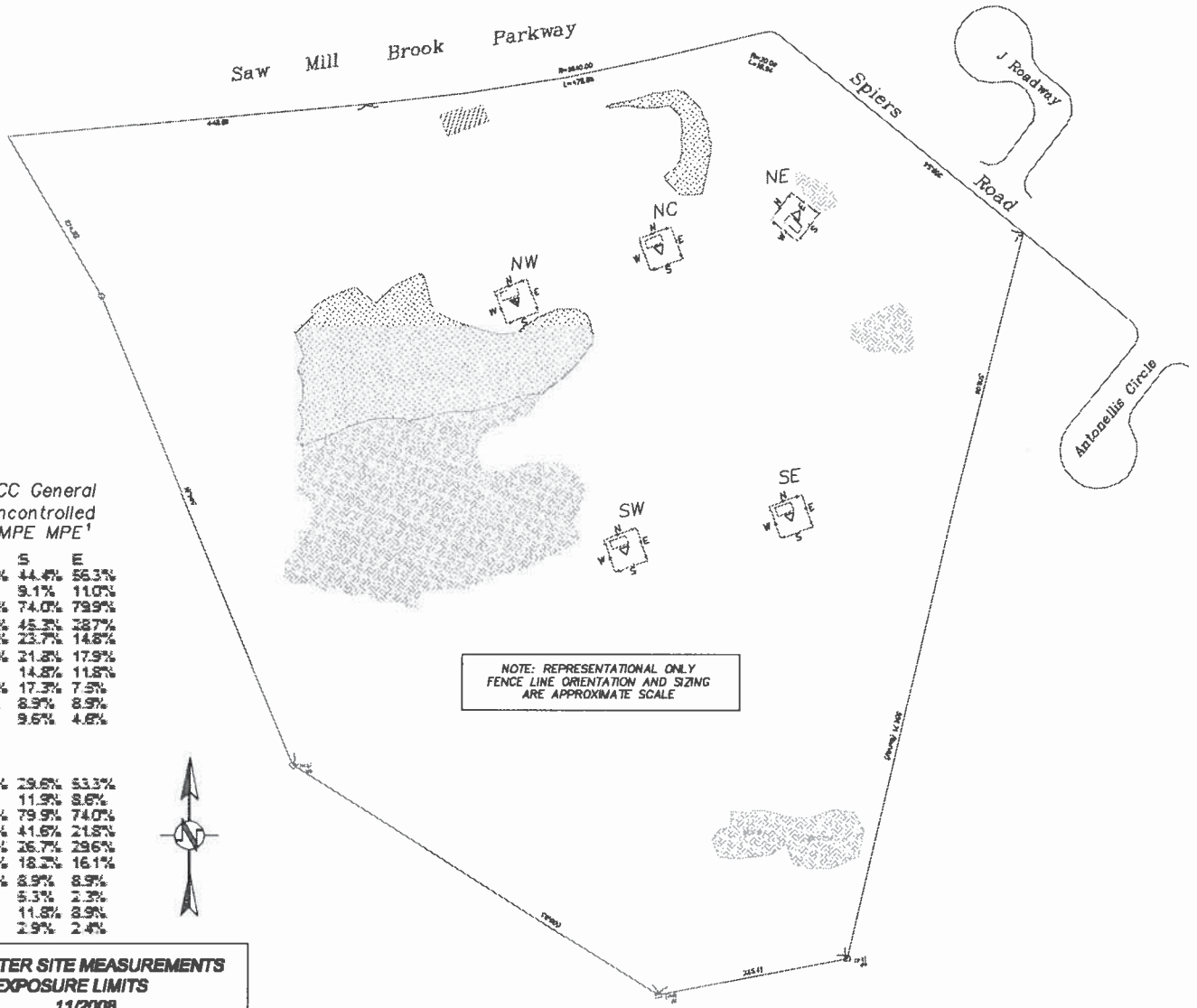
The measurements show that this facility with WKOX, WRCA and WUNR at this site fully complies with FCC requirements. The towers on this site are fenced to restrict access to all areas that are in excess of the MPE as is required by the FCC. Appropriate warning signs that comply with the requirements of OET-65 are posted at all restricted areas. The off-site locations are well within the FCC guidelines for human exposure.

STATEMENT OF ENGINEER

This Engineering Report, regarding radio frequency field measurements around the Transmitter Facility at 750 Saw Mill Brook Parkway in Newton MA, has been prepared by me or under my direct supervision. All representations contained herein are true 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 a partner in the firm of Hatfield and Dawson Consulting Engineers and am Registered as a Professional Engineer in the States of Washington and Alaska.

Stephen S. Lockwood, P.E.

21 November 2008



							Percent of FCC General Population/Uncontrolled Environment MPE MPE[1]			
Day Mode		N	W	S	E		N	W	S	E
NW	H-Field	0.347	0.563	0.609	0.771	A/m	25.3%	41.5%	44.6%	56.3%
	E-Field	35.4	37.9	46.7	55.9	V/m	7.1%	7.4%	9.1%	11.0%
NC	H-Field	0.711	0.690	1.014	1.095	A/m	51.9%	50.4%	74.0%	79.9%
	E-Field	85.5	184.8	333.6	147.7	V/m	11.0%	35.9%	45.3%	28.7%
NE	H-Field	0.244	0.244	0.325	0.203	A/m	17.8%	17.8%	23.7%	14.8%
	E-Field	116.9	75.3	112.3	92.3	V/m	22.7%	14.6%	21.8%	17.9%
SE	H-Field	0.203	0.041	0.203	0.162	A/m	14.8%	3.0%	14.8%	11.8%
	E-Field	70.8	52.3	89.3	38.4	V/m	13.7%	10.2%	17.3%	7.5%
SW	H-Field	0.203	0.081	0.122	0.122	A/m	14.8%	5.9%	8.9%	8.9%
	E-Field	52.3	34.5	49.3	23.8	V/m	10.2%	6.7%	9.6%	4.6%
Night Mode										
NW	H-Field	0.244	0.284	0.406	0.731	A/m	17.8%	20.7%	29.6%	53.3%
	E-Field	28.4	46.7	61.5	44.3	V/m	5.5%	9.1%	11.9%	8.6%
NC	H-Field	0.895	0.771	1.095	1.014	A/m	65.2%	56.3%	79.9%	74.0%
	E-Field	72.3	140.8	214.0	112.3	V/m	14.0%	27.3%	41.6%	21.8%
NE	H-Field	0.528	0.446	0.365	0.406	A/m	38.5%	32.6%	26.7%	29.6%
	E-Field	149.2	63.1	93.8	83.1	V/m	29.0%	12.3%	18.2%	16.1%
SE	H-Field	0.162	0.203	0.122	0.122	A/m	11.8%	14.8%	8.9%	8.9%
	E-Field	49.3	23.8	27.4	11.8	V/m	9.6%	4.6%	5.3%	2.3%
SW	H-Field	0.122	0.122	0.162	0.122	A/m	8.9%	8.9%	11.8%	8.9%
	E-Field	25.3	24.8	14.8	12.3	V/m	4.9%	4.8%	2.9%	2.4%

HATFIELD & DAWSON
CONSULTING ENGINEERS

WUNR - WKOX - WRCA TRANSMITTER SITE MEASUREMENTS OF RADIO FREQUENCY EXPOSURE LIMITS
NEWTON, MA 11/2008