LAW OFFICES
MILLER AND NEELY, P. C.
SUITE 704
6900 WISCONSIN AVENUE
BETHESDA, MD 20815

JERROLD D. MILLER
JOHN S. NEELY*

*ADMITTED PA AND DC ONLY

(301) 986-4160
FAX: (301) 986-4162

August 9, 2011

Secretary
Federal Communications Commission
Washington, DC 20554

ATTN: Audio Division (AM)

RE: **Form 302-AM (Moment Method Modeling)**
WRDT(AM) Monroe, Michigan
FAC: 25083

Dear Madam Secretary:

Transmitted herewith in triplicate on behalf of WMUZ Radio, Inc., licensee of the above-referenced station is FCC Form 302-AM, an application for moment method modeling.

A $1,365 filing fee is remitted with this application. The filing fee codes are MOR and MMR. Any questions concerning this matter should be addressed to the undersigned.

Sincerely,

John S. Neely

encs.

Ann

Federal Communications Commission
Washington, D. C. 20554

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

FOR FCC USE ONLY

2011 AUG 16 P 2:40

SNV 8/17/11

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.

FOR COMMISSION USE ONLY
FILE NO. BMML-20110811ACK

SECTION I - APPLICANT FEE INFORMATION

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

WMUZ Radio, Inc. FRN 0003262383

Copy notices and communications to :
Miller and Neely, PC
6900 Wisconsin Ave., Suite 704
Bethesda, MD 20815

MAILING ADDRESS (Line 1) (Maximum 35 characters)
P.O. Box 3003

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Blue Bell	PA	19422

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
(215) 628-3500	WRDT	

2. A. Is a fee submitted with this application? FACID 25083 [X] Yes [ ] No

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

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

C. If Yes, provide the following information:

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

(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
M M R	0 0 0 1	$ 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
`M O R	0 0 0 1	$ 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
$ 1,365.00	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT Kimtron, Inc. FRN 0003-2623-83		
MAILING ADDRESS P.O. Box 3003		
CITY Blue Bell	STATE PA	ZIP CODE 19422

2. This application is for:

[X] Commercial [ ] Noncommercial

[X] 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
FACD 25083 WRDT	Monroe, MI	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 [X] No

If No, explain in an Exhibit. See MoM BSTA-20110721AAI

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. N/A

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. N/A

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

[X] Does not apply

If No, explain in an Exhibit.

Exhibit No. N/A

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 [X] 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. N/A

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. N/A

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	
Donald B. Crawford		
Title	Date	Telephone Number
President	08/01/2011	(215) 628-3500

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

WMUZ Radio, 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
WRDT	N/A	560	Unlimited	0.014	0.500

2. Station location

State	City or Town
Michigan	Monroe

3. Transmitter location

State	County	City or Town	Street address (or other identification)
MI	Monroe	Monroe	5305 Vineyard Drive

4. Main studio location

State	County	City or Town	Street address (or other identification)
MI	Wayne	Detroit	12300 Radio Place

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

State	County	City or Town	Street address (or other identification)
MI	Wayne	Detroit	12300 Radio Place

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. E-1

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
0.4	3.3

Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50	50	0	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		-1.5		1.026		
2		0.0		1.000		
3		-88.6		1.117		
4		-89.6		0.972		

Manufacturer and type of antenna monitor: Potomac Instruments Type 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.) See Exhibit E-1 page 28.

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.
See E-1	See E-1	See E-1	See E-1	Exhibit No. See E-1

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	41 °	53 '	28 "	West Longitude	083 °	25 '	39 "

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. See E-1

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

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

N/A

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

No change in common point resistance - moment-method license application only.

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)
W.C. Alexander	
Address (include ZIP Code)	Date
2821 S. Parker Road	08/01/2011
Suite 1205	Telephone No. (Include Area Code)
Aurora, CO 80014	(303) 433-0104

[X] Technical Director

[ ] Registered Professional Engineer

[ ] Chief Operator

[ ] Technical Consultant

[ ] Other (specify)

EXHIBIT E-1

APPLICATION FOR LICENSE INFORMATION
RADIO STATION WRDT
MONROE, MICHIGAN

WMUZ Radio, Inc.

August 1, 2011

560 kHz 0.5 kW-D/0.014 kW-N DA-D

EXECUTIVE SUMMARY

This engineering exhibit supports an application for license for the existing daytime directional antenna system of radio station WRDT in Monroe, Michigan (FCC FID No. 25083) pursuant to the AM technical rules permitting moment-method modeling of eligible AM directional arrays.

FCC Special Temporary Authority (BSTA-20110721AAI) was obtained on July 21, 2011 to permit operation with parameters at variance from the licensed values while making reference field measurements and performing other tasks relevant to moment-method modeling of the WRDT daytime array.

Information is provided herein showing that the directional antenna parameters for the day pattern authorized by the FCC have been determined in accordance with the requirements of 47 C.F.R. §73.151(c). 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. A modified station license is requested herewith specifying the new night operating parameters.

Daytime Towers

Tower #1 - ASRN 1000331
Tower #2 - ASRN 1000332
Tower #3 - ASRN 1000333
Tower #4 - ASRN 1000334

Nighttime Tower
ASRN 1001506

Analysis of Tower Impedance Measurements to Verify Method of Moments Model

Tower base impedance measurements were made at the final J-plugs within the WRDT ATUs using a Delta Electronics OIB-1 impedance bridge. Downstream of the final J-plug at the ATU output at each tower there is only a piece of feed tubing connecting the ATU output and the tower base. The other WRDT towers were all open-circuited at the output J-plugs.

Expert MININEC Broadcast Professional (version 14.5) was used to model the WRDT night array.

A lumped load with a reactance of –j10,000 ohms was modeled at the base of the other WRDT towers to simulate an open circuit at each tower base.

The WRDT tower heights were adjusted in the model in order to achieve calibration of the model with the measured base impedances. All modeled tower heights were within 75 to 125 percent of the physical tower height as required by the FCC Rules.

All the WRDT towers employ 21 electrical degrees of top-loading. This top-loading is achieved by means of the segments of the top guy wires closest to the towers, which are electrically bonded to the towers. The ends of the top-load segments are connected together in "spider-web" fashion. Top-load wires were modeled at their full electrical lengths and at the actual radius of the wires employed.

The nominal modeled radius for each WRDT tower was 0.2911 meters, which amounts to 100% of the physical radius of the tower as determined by the formula $3T/2\pi$, where T is the tower face width in meters. The WRDT radiators are uniform cross-section triangular towers and have face widths of 0.6097 meters.

Three of the WRDT towers support STL/ICR antennas near the top. Towers 1 and 3 each support a 72-inch parabolic dish antenna at the 121.9-meter level; tower 2 supports a 120-inch parabolic dish at the 121.9 meter level. The top segment of the tower 1, 2 and 3 models was increased in radius to compensate for the aperture of the STL antennas. Isocouplers are in place on towers 2 and 3; the parabolic dish antenna on tower 1 is unused and no isocoupler is in place.

As noted above, each WRDT tower is fed with a length of copper tubing that exhibits a small amount of series inductive reactance, depending on the length. This tubing connects to each tower immediately above the base insulator.

A circuit model was constructed for each tower using the assumed series feed tubing and shunt base region reactances. This model was used with WCAP Professional version 1.1.02 to determine the effects of these reactances on the ATU output impedance at each tower. In each of the WCAP tabulations, node 2 represents the ATU output reference point and node 3 represents the tower base as shown on the circuit model schematic provided with each tabulation. Node 0 represents ground potential. The ATU output impedances can be found in the "TO IMPEDANCE" column of each WCAP tabulation, following the phantom 1.0 ohm resistor inserted in the model to provide a calculation point for the impedance. The complex base impedance of each tower from the moment method model is represented in each case by the complex load from node 3 to ground. A value of 50 pF was assumed for the base insulator. The WCAP circuit model tabulation immediately follows the model for each tower.

§73.151(c)(1)(vii) permits the use of a lumped series inductance of 10 uH or less between the output port of each antenna tuning unit and the associated tower. In each case, the value of lumped series inductance was below this 10 uH limit.

The modeled and measured impedances at the ATU output J-plugs with the other towers open-circuited at their ATU output J-plugs agree within ±2 ohms and ±4 percent as required by the FCC rules.

In the table below, the top and bottom values in the "Shunt C pF" column represent the shunt capacitances of the base insulator and isocoupler, respectively. The top and bottom values in the "Model Radius (m)" and "% Phys. Rad." columns represent for towers 1, 2 and 3 the radius values and percentages for the bottom 19 segments and the top segment respectively.

Table 1 – Analysis of Tower Impedance Measurements to Verify Moment Method Model

Twr.	Z_{BASE} (Modeled)	Z_{ATU} (Modeled)	Z_{ATU} (Measured)	Series L (uH)	Shunt C pF	Phys. Height (deg.)	Model Height (deg.)	% Phys. Height	Model Radius (m)	% Phys. Rad.
1	63.9 +j167.2	67.8 +j179.2	68.0 +j179.2	2.20	50	84.0	79.80	95.0	0.2911 0.4852	100.0 100.0
2	83.4 +j211.8	105.5 +j268.2	105.0 +j274.4	9.95	50 100	84.0	85.0	101.2	0.2911 0.6793	100.0 100.0
3	62.6 +j164.7	75.0 +j200.7	75.0 +j201.0	6.55	50 100	84.0	79.5	94.6	0.2911 0.4852	100.0 100.0
4	75.3 +j194.3	80.7 +j203.6	81.0 +j196.6	1.00	50	84.0	83.0	98.8	0.2911	100.0

WRDT Calibration Model
Tower 1 driven, all others
floated

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2911	19
		0	0	75.81		
2	none	0	0	75.81	.4852	1
		0	0	79.8		
3	none	0	0	79.8	.0095	5
		11.761	89.001	62.402		
4	none	0	0	79.8	.0095	5
		11.761	208.999	62.402		
5	none	0	0	79.8	.0095	5
		11.761	329.	62.402		
6	none	11.761	89.001	62.402	.0095	5
		11.761	208.999	62.402		
7	none	11.761	208.999	62.402	.0095	5
		11.761	329.	62.402		
8	none	11.761	329.	62.402	.0095	5
		11.761	89.001	62.402		
9	none	202.	283.	0	.2911	19
		202.	283.	80.75		
10	none	202.	283.	80.75	.6793	1
		202.	283.	85.		
11	none	202.	283.	85.	.019	5
		202.748	286.313	67.578		
12	none	202.	283.	85.	.019	5
		191.726	281.355	67.578		
13	none	202.	283.	85.	.019	5
		212.034	281.321	67.578		
14	none	202.748	286.313	67.578	.0095	5
		191.726	281.355	67.578		
15	none	191.726	281.355	67.578	.0095	5
		212.034	281.321	67.578		
16	none	212.034	281.321	67.578	.0095	5
		202.748	286.313	67.578		
17	none	221.1	307.	0	.2911	19
		221.1	307.	75.525		
18	none	221.1	307.	75.525	.4852	1
		221.1	307.	79.5		
19	none	221.1	307.	79.5	.0095	5
		226.904	309.638	62.102		
20	none	221.1	307.	79.5	.0095	5
		209.389	306.904	62.102		
21	none	221.1	307.	79.5	.0095	5
		227.59	304.503	62.102		
22	none	226.904	309.638	62.102	.0095	5
		209.389	306.904	62.102		
23	none	209.389	306.904	62.102	.0095	5
		227.59	304.503	62.102		
24	none	227.59	304.503	62.102	.0095	5
		226.904	309.638	62.102		
25	none	90.	13.	0	.2911	20
		90.	13.	83.		

26	none	90.	13.	83.	.0095	5
		91.568	20.339	65.578		
27	none	90.	13.	83.	.0095	5
		79.628	9.299	65.578		
28	none	90.	13.	83.	.0095	5
		99.936	9.238	65.578		
29	none	91.568	20.339	65.578	.0095	5
		79.628	9.299	65.578		
30	none	79.628	9.299	65.578	.0095	5
		99.936	9.238	65.578		
31	none	99.936	9.238	65.578	.0095	5
		91.568	20.339	65.578		

Number of wires = 31
current nodes = 212

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	18	3.975	9	4.25
radius	3	9.5E-03	10	.6793

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	560.	0	1	.0110417	.0118056

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	54	0	-10,000.	0	0	0
2	107	0	-10,000.	0	0	0
3	160	0	-10,000.	0	0	0

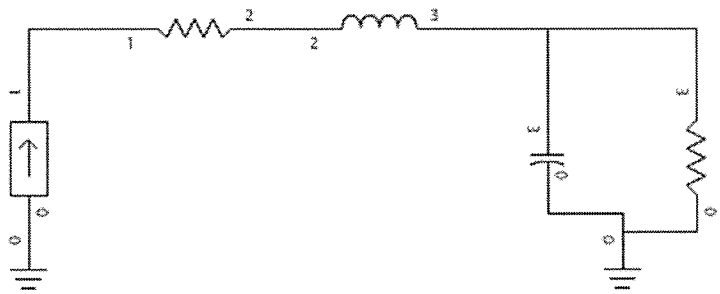
IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
560.	63.888	167.15	178.94	69.1	10.713	-1.6263	-5.0536

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 1 Calibration

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	191.9826 ∡	68.9928°	V
Node:	2	191.6264 ∡	69.2720°	V
Node:	3	184.4069 ∡	68.4207°	V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	1.00 ∡	0.000° V	1.00 ∡	0.000° A
L	2→3	2.20000000	7.74 ∡	90.000° V	1.00 ∡	0.000° A
C	3→0	0.00005000	184.41 ∡	68.421° V	0.03 ∡	158.421° A
R	3→0	63.90000000	184.41 ∡	68.421° V	1.03 ∡	-0.664° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	68.82 + j	179.223	67.82 + j	179.223
L	2→3	2.20000000	67.82 + j	179.223	67.82 + j	171.482
C	3→0	0.00005000	0.00 - j	5684.105	0.00 + j	0.000
R	3→0	63.90000000	63.90 + j	167.200	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	1.00000000	0	1	0.00000000
R	1.00000000	1	2	0.00000000
L	2.20000000	2	3	0.00000000
C	0.00005000	3	0	
R	63.90000000	3	0	167.20000000

WRDT Calibration Model
Tower 2 driven, all others
floated

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2911	19
		0	0	75.81		
2	none	0	0	75.81	.4852	1
		0	0	79.8		
3	none	0	0	79.8	.0095	5
		11.761	89.001	62.402		
4	none	0	0	79.8	.0095	5
		11.761	208.999	62.402		
5	none	0	0	79.8	.0095	5
		11.761	329.	62.402		
6	none	11.761	89.001	62.402	.0095	5
		11.761	208.999	62.402		
7	none	11.761	208.999	62.402	.0095	5
		11.761	329.	62.402		
8	none	11.761	329.	62.402	.0095	5
		11.761	89.001	62.402		
9	none	202.	283.	0	.2911	19
		202.	283.	80.75		
10	none	202.	283.	80.75	.6793	1
		202.	283.	85.		
11	none	202.	283.	85.	.019	5
		202.748	286.313	67.578		
12	none	202.	283.	85.	.019	5
		191.726	281.355	67.578		
13	none	202.	283.	85.	.019	5
		212.034	281.321	67.578		
14	none	202.748	286.313	67.578	.0095	5
		191.726	281.355	67.578		
15	none	191.726	281.355	67.578	.0095	5
		212.034	281.321	67.578		
16	none	212.034	281.321	67.578	.0095	5
		202.748	286.313	67.578		
17	none	221.1	307.	0	.2911	19
		221.1	307.	75.525		
18	none	221.1	307.	75.525	.4852	1
		221.1	307.	79.5		
19	none	221.1	307.	79.5	.0095	5
		226.904	309.638	62.102		
20	none	221.1	307.	79.5	.0095	5
		209.389	306.904	62.102		
21	none	221.1	307.	79.5	.0095	5
		227.59	304.503	62.102		
22	none	226.904	309.638	62.102	.0095	5
		209.389	306.904	62.102		
23	none	209.389	306.904	62.102	.0095	5
		227.59	304.503	62.102		
24	none	227.59	304.503	62.102	.0095	5
		226.904	309.638	62.102		
25	none	90.	13.	0	.2911	20
		90.	13.	83.		
26	none	90.	13.	83.	.0095	5

		91.568	20.339	65.578		
27	none	90.	13.	83.	.0095	5
		79.628	9.299	65.578		
28	none	90.	13.	83.	.0095	5
		99.936	9.238	65.578		
29	none	91.568	20.339	65.578	.0095	5
		79.628	9.299	65.578		
30	none	79.628	9.299	65.578	.0095	5
		99.936	9.238	65.578		
31	none	99.936	9.238	65.578	.0095	5
		91.568	20.339	65.578		

Number of wires = 31
current nodes = 212

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	18	3.975	9	4.25
radius	3	9.5E-03	10	.6793

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	560.	0	1	.0110417	.0118056

Sources

source	node	sector	magnitude	phase	type
1	54	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-10,000.	0	0	0
2	107	0	-10,000.	0	0	0
3	160	0	-10,000.	0	0	0

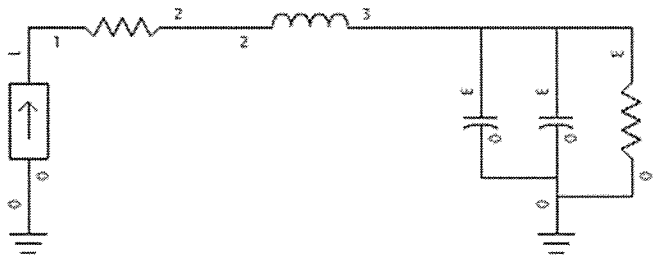
IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 54, sector 1							
560.	83.402	211.83	227.66	68.5	12.951	-1.344	-5.7485

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 2 Calibration

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	288.5916 ∡	68.3537° V
Node:	2	288.2242 ∡	68.5385° V
Node:	3	255.9625 ∡	65.6700° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	1.00 ∡	0.000° V	1.00 ∡	0.000° A
L	2→3	9.95000000	35.01 ∡	90.000° V	1.00 ∡	0.000° A
C	3→0	0.00005000	255.96 ∡	65.670° V	0.05 ∡	155.670° A
C	3→0	0.00010000	255.96 ∡	65.670° V	0.09 ∡	155.670° A
R	3→0	83.40000000	255.96 ∡	65.670° V	1.12 ∡	-2.837° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	106.45 + j	268.240	105.45 + j	268.240
L	2→3	9.95000000	105.45 + j	268.240	105.45 + j	233.230
C	3→0	0.00005000	-0.00 - j	5684.105	0.00 + j	0.000
C	3→0	0.00010000	-0.00 - j	2842.053	0.00 + j	0.000
R	3→0	83.40000000	83.40 + j	211.800	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	1.00000000	0	1	0.00000000
R	1.00000000	1	2	0.00000000
L	9.95000000	2	3	0.00000000
C	0.00005000	3	0	
C	0.00010000	3	0	
R	83.40000000	3	0	211.80000000

WRDT Calibration Model
Tower 3 driven, all others
floated

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2911	19
		0	0	75.81		
2	none	0	0	75.81	.4852	1
		0	0	79.8		
3	none	0	0	79.8	.0095	5
		11.761	89.001	62.402		
4	none	0	0	79.8	.0095	5
		11.761	208.999	62.402		
5	none	0	0	79.8	.0095	5
		11.761	329.	62.402		
6	none	11.761	89.001	62.402	.0095	5
		11.761	208.999	62.402		
7	none	11.761	208.999	62.402	.0095	5
		11.761	329.	62.402		
8	none	11.761	329.	62.402	.0095	5
		11.761	89.001	62.402		
9	none	202.	283.	0	.2911	19
		202.	283.	80.75		
10	none	202.	283.	80.75	.6793	1
		202.	283.	85.		
11	none	202.	283.	85.	.019	5
		202.748	286.313	67.578		
12	none	202.	283.	85.	.019	5
		191.726	281.355	67.578		
13	none	202.	283.	85.	.019	5
		212.034	281.321	67.578		
14	none	202.748	286.313	67.578	.0095	5
		191.726	281.355	67.578		
15	none	191.726	281.355	67.578	.0095	5
		212.034	281.321	67.578		
16	none	212.034	281.321	67.578	.0095	5
		202.748	286.313	67.578		
17	none	221.1	307.	0	.2911	19
		221.1	307.	75.525		
18	none	221.1	307.	75.525	.4852	1
		221.1	307.	79.5		
19	none	221.1	307.	79.5	.0095	5
		226.904	309.638	62.102		
20	none	221.1	307.	79.5	.0095	5
		209.389	306.904	62.102		
21	none	221.1	307.	79.5	.0095	5
		227.59	304.503	62.102		
22	none	226.904	309.638	62.102	.0095	5
		209.389	306.904	62.102		
23	none	209.389	306.904	62.102	.0095	5
		227.59	304.503	62.102		
24	none	227.59	304.503	62.102	.0095	5
		226.904	309.638	62.102		
25	none	90.	13.	0	.2911	20
		90.	13.	83.		
26	none	90.	13.	83.	.0095	5

		91.568	20.339	65.578		
27	none	90.	13.	83.	.0095	5
		79.628	9.299	65.578		
28	none	90.	13.	83.	.0095	5
		99.936	9.238	65.578		
29	none	91.568	20.339	65.578	.0095	5
		79.628	9.299	65.578		
30	none	79.628	9.299	65.578	.0095	5
		99.936	9.238	65.578		
31	none	99.936	9.238	65.578	.0095	5
		91.568	20.339	65.578		

Number of wires = 31
current nodes = 212

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	18	3.975	9	4.25
radius	3	9.5E-03	10	.6793

ELECTRICAL DESCRIPTION
Frequencies (KHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	560.	0	1	.0110417	.0118056

Sources

source	node	sector	magnitude	phase	type
1	107	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-10,000.	0	0	0
2	54	0	-10,000.	0	0	0
3	160	0	-10,000.	0	0	0

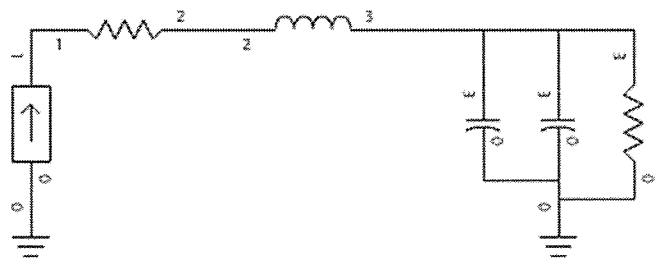
IMPEDANCE
normalization = 50.

freq (KHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 107, sector 1							
560.	62.556	164.72	176.2	69.2	10.631	-1.639	-5.0259

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 3 Calibration

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	214.6159 ∡	69.2637° V
Node:	2	214.2639 ∡	69.5138° V
Node:	3	192.8435 ∡	67.1166° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	1.00 ∡	0.000° V	1.00 ∡	0.000° A
L	2→3	6.55000000	23.05 ∡	90.000° V	1.00 ∡	0.000° A
C	3→0	0.00005000	192.84 ∡	67.117° V	0.03 ∡	157.117° A
C	3→0	0.00010000	192.84 ∡	67.117° V	0.07 ∡	157.117° A
R	3→0	62.60000000	192.84 ∡	67.117° V	1.09 ∡	-2.072° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	75.99 + j	200.713	74.99 + j	200.713
L	2→3	6.55000000	74.99 + j	200.713	74.99 + j	177.666
C	3→0	0.00005000	0.00 - j	5684.105	0.00 + j	0.000
C	3→0	0.00010000	0.00 - j	2842.053	0.00 + j	0.000
R	3→0	62.60000000	62.60 + j	164.700	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	1.00000000	0	1	0.00000000
R	1.00000000	1	2	0.00000000
L	6.55000000	2	3	0.00000000
C	0.00005000	3	0	
C	0.00010000	3	0	
R	62.60000000	3	0	164.70000000

WRDT Calibration Model
Tower 4 driven, all others
floated

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

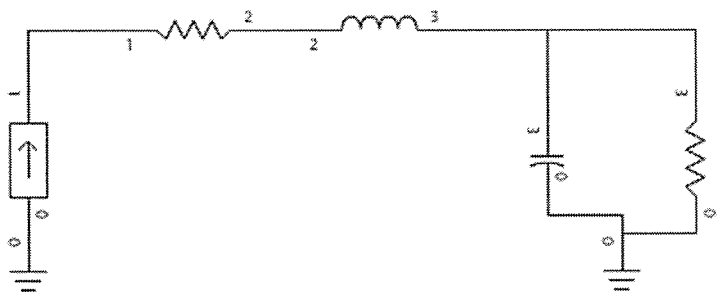
wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2911	19
		0	0	75.81		
2	none	0	0	75.81	.4852	1
		0	0	79.8		
3	none	0	0	79.8	.0095	5
		11.761	89.001	62.402		
4	none	0	0	79.8	.0095	5
		11.761	208.999	62.402		
5	none	0	0	79.8	.0095	5
		11.761	329.	62.402		
6	none	11.761	89.001	62.402	.0095	5
		11.761	208.999	62.402		
7	none	11.761	208.999	62.402	.0095	5
		11.761	329.	62.402		
8	none	11.761	329.	62.402	.0095	5
		11.761	89.001	62.402		
9	none	202.	283.	0	.2911	19
		202.	283.	80.75		
10	none	202.	283.	80.75	.6793	1
		202.	283.	85.		
11	none	202.	283.	85.	.019	5
		202.748	286.313	67.578		
12	none	202.	283.	85.	.019	5
		191.726	281.355	67.578		
13	none	202.	283.	85.	.019	5
		212.034	281.321	67.578		
14	none	202.748	286.313	67.578	.0095	5
		191.726	281.355	67.578		
15	none	191.726	281.355	67.578	.0095	5
		212.034	281.321	67.578		
16	none	212.034	281.321	67.578	.0095	5
		202.748	286.313	67.578		
17	none	221.1	307.	0	.2911	19
		221.1	307.	75.525		
18	none	221.1	307.	75.525	.4852	1
		221.1	307.	79.5		
19	none	221.1	307.	79.5	.0095	5
		226.904	309.638	62.102		
20	none	221.1	307.	79.5	.0095	5
		209.389	306.904	62.102		
21	none	221.1	307.	79.5	.0095	5
		227.59	304.503	62.102		
22	none	226.904	309.638	62.102	.0095	5
		209.389	306.904	62.102		
23	none	209.389	306.904	62.102	.0095	5
		227.59	304.503	62.102		
24	none	227.59	304.503	62.102	.0095	5
		226.904	309.638	62.102		
25	none	90.	13.	0	.2911	20
		90.	13.	83.		
26	none	90.	13.	83.	.0095	5

```
          91.568       20.339       65.578
 27   none 90.          13.          83.          .0095        5
          79.628       9.299        65.578
 28   none 90.          13.          83.          .0095        5
          99.936       9.238        65.578
 29   none 91.568       20.339       65.578       .0095        5
          79.628       9.299       65.578
 30   none 79.628       9.299        65.578       .0095        5
          99.936       9.238        65.578
 31   none 99.936       9.238        65.578       .0095        5
          91.568       20.339       65.578

Number of wires          =  31
          current nodes  =  212

                        minimum                    maximum
Individual wires      wire    value              wire  value
segment length         18     3.975               9    4.25
radius                 3      9.5E-03            10   .6793


ELECTRICAL DESCRIPTION
Frequencies (KHz)
     frequency                 no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   560.         0             1      .0110417       .0118056

Sources
source node    sector  magnitude      phase          type
 1      160     1      1.             0              voltage

Lumped loads
             resistance    reactance     inductance  capacitance passive
load  node   (ohms)        (ohms)        (mH)        (uF)        circuit
 1     1     0             -10,000.      0           0            0
 2     54    0             -10,000.      0           0            0
 3     107   0             -10,000.      0           0            0

IMPEDANCE
   normalization = 50.
freq      resist    react     imped     phase     VSWR     S11       S12
(KHz)     (ohms)    (ohms)    (ohms)    (deg)              dB        dB
source =  1; node 160, sector 1
560.      75.279    194.3     208.38    68.8      12.118   -1.4369   -5.5024
```

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 4 Calibration

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	219.3733 ∡	68.1322° V
Node:	2	219.0028 ∡	68.3750° V
Node:	3	215.7358 ∡	68.0306° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	1.00 ∡	0.000° V	1.00 ∡	0.000° A
L	2→3	1.00000000	3.52 ∡	90.000° V	1.00 ∡	0.000° A
C	3→0	0.00005000	215.74 ∡	68.031° V	0.04 ∡	158.031° A
R	3→0	75.30000000	215.74 ∡	68.031° V	1.04 ∡	-0.786° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	81.71 + j	203.588	80.71 + j	203.588
L	2→3	1.00000000	80.71 + j	203.588	80.71 + j	200.070
C	3→0	0.00005000	0.00 - j	5684.105	0.00 + j	0.000
R	3→0	75.30000000	75.30 + j	194.300	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	1.00000000	0	1	0.00000000
R	1.00000000	1	2	0.00000000
L	1.00000000	2	3	0.00000000
C	0.00005000	3	0	
R	75.30000000	3	0	194.30000000

Derivation of Operating Parameters for Daytime Directional Antenna

Once calibrated against the measured individual open-circuited base impedances, the moment method model was utilized for day directional antenna calculations. Two sets of calculations were run as described below. These calculations were made to determine the complex voltage source values to be applied at ground level for each driven tower of the array to produce the current moment sums for the towers which, when normalized to the reference tower, equate to the theoretical field parameters of the authorized directional pattern, normalized to a tower 2 reference. These voltage sources were then applied in the model and the tower currents were calculated.

Twenty (20) total segments were used for each tower. The WRDT towers are base sampled, which is permitted for towers of 120 electrical degrees or less. As such, the first (ground) segment of each tower was used to determine the model operating parameters of the array.

A circuit model was constructed to determine the effect of the series feed inductance and the shunt base region capacitance on the ATU output current. The circuit model for each tower is the same circuit model used for model verification above, substituting the directional mode model-predicted operating impedance for each tower. Again, this model was used with WCAP Professional version 1.1.02. The results are tabulated in the table below along with the base operating parameters for the day array.

Twr.	Node	Current Magnitude (amperes)	Current Phase (degrees)	WCAP Current Offset for Unity I_{BASE}	WCAP Phase Offset for Unity $Ø_{BASE}$ (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase (degrees)
1	1	2.1630	+0.2	0.975	+0.016	1.026	-1.5
2	54	2.2760	+1.2	0.903	+0.516	1.000	0.0
3	107	2.5144	+270.4	0.913	+2.721	1.117	-88.6
4	160	2.0630	+271.2	0.968	+0.964	0.972	-89.6

WRDT Daytime Directional Model

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2911	19
		0	0	75.81		
2	none	0	0	75.81	.4852	1
		0	0	79.8		
3	none	0	0	79.8	.0095	5
		11.761	89.001	62.402		
4	none	0	0	79.8	.0095	5
		11.761	208.999	62.402		
5	none	0	0	79.8	.0095	5
		11.761	329.	62.402		
6	none	11.761	89.001	62.402	.0095	5
		11.761	208.999	62.402		
7	none	11.761	208.999	62.402	.0095	5
		11.761	329.	62.402		
8	none	11.761	329.	62.402	.0095	5
		11.761	89.001	62.402		
9	none	202.	283.	0	.2911	19
		202.	283.	80.75		
10	none	202.	283.	80.75	.6793	1
		202.	283.	85.		
11	none	202.	283.	85.	.019	5
		202.748	286.313	67.578		
12	none	202.	283.	85.	.019	5
		191.726	281.355	67.578		
13	none	202.	283.	85.	.019	5
		212.034	281.321	67.578		
14	none	202.748	286.313	67.578	.0095	5
		191.726	281.355	67.578		
15	none	191.726	281.355	67.578	.0095	5
		212.034	281.321	67.578		
16	none	212.034	281.321	67.578	.0095	5
		202.748	286.313	67.578		
17	none	221.1	307.	0	.2911	19
		221.1	307.	75.525		
18	none	221.1	307.	75.525	.4852	1
		221.1	307.	79.5		
19	none	221.1	307.	79.5	.0095	5
		226.904	309.638	62.102		
20	none	221.1	307.	79.5	.0095	5
		209.389	306.904	62.102		
21	none	221.1	307.	79.5	.0095	5
		227.59	304.503	62.102		
22	none	226.904	309.638	62.102	.0095	5
		209.389	306.904	62.102		
23	none	209.389	306.904	62.102	.0095	5
		227.59	304.503	62.102		
24	none	227.59	304.503	62.102	.0095	5
		226.904	309.638	62.102		
25	none	90.	13.	0	.2911	20
		90.	13.	83.		
26	none	90.	13.	83.	.0095	5
		91.568	20.339	65.578		
27	none	90.	13.	83.	.0095	5

```
          79.628       9.299        65.578
 28   none 90.          13.          83.          .0095        5
          99.936       9.238        65.578
 29   none 91.568       20.339       65.578       .0095        5
          79.628       9.299        65.578
 30   none 79.628       9.299        65.578       .0095        5
          99.936       9.238        65.578
 31   none 99.936       9.238        65.578       .0095        5
          91.568       20.339       65.578

Number of wires          =  31
          current nodes  =  212

                        minimum                    maximum
Individual wires      wire    value              wire  value
segment length         18     3.975               9    4.25
radius                 3      9.5E-03            10   .6793


ELECTRICAL DESCRIPTION
Frequencies (KHz)
     frequency                 no. of  segment length (wavelengths)
 no. lowest       step         steps   minimum        maximum
 1   560.         0             1      .0110417       .0118056

Sources
source node    sector  magnitude      phase          type
 1      1       1      309.451        89.5           voltage
 2      54      1      420.667        86.5           voltage
 3      107     1      468.637        334.3          voltage
 4      160     1      422.424        334.3          voltage

IMPEDANCE
   normalization = 50.
freq     resist   react    imped    phase    VSWR    S11      S12
(KHz)    (ohms)   (ohms)   (ohms)   (deg)             dB       dB
source =  1; node 1, sector 1
560.     1.5319   143.06   143.07   89.4     299.87  -5.8E-02 -18.778

source =  2; node 54, sector 1
560.     15.404   184.18   184.83   85.2     47.579  -.36517  -10.934

source =  3; node 107, sector 1
560.     82.091   167.33   186.38   63.9     8.9606  -1.9468  -4.4217

source =  4; node 160, sector 1
560.     92.581   182.63   204.76   63.1     9.492   -1.837   -4.623
```

CURRENT peak
Frequency = 560 KHz
Input power = 500. watts
Efficiency = 100. %

coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	2.16295	.2	2.16294	6.03E-03
2	0	0	3.99	2.2875	.1	2.28749	4.99E-03
3	0	0	7.98	2.36293	.1	2.36292	4.23E-03
4	0	0	11.97	2.41906	.1	2.41905	3.53E-03
5	0	0	15.96	2.45985	.1	2.45985	2.84E-03
6	0	0	19.95	2.48709	0.0	2.48709	2.16E-03
7	0	0	23.94	2.50173	0.0	2.50173	1.49E-03
8	0	0	27.93	2.50448	0.0	2.50448	8.39E-04
9	0	0	31.92	2.49599	0.0	2.49599	2.E-04
10	0	0	35.91	2.47694	360.	2.47694	-4.15E-04
11	0	0	39.9	2.44819	360.	2.44819	-9.96E-04
12	0	0	43.89	2.41091	360.	2.41091	-1.53E-03
13	0	0	47.88	2.36684	360.	2.36684	-2.01E-03
14	0	0	51.87	2.31877	359.9	2.31877	-2.42E-03
15	0	0	55.86	2.27136	359.9	2.27136	-2.74E-03
16	0	0	59.85	2.23161	359.9	2.23161	-2.96E-03
17	0	0	63.84	2.20003	359.9	2.20003	-3.06E-03
18	0	0	67.83	2.15787	359.9	2.15787	-3.03E-03
19	0	0	71.82	2.09916	359.9	2.09916	-2.88E-03
END	0	0	75.81	2.03085	359.9	2.03085	-2.61E-03
2J1	0	0	75.81	2.03085	359.9	2.03085	-2.61E-03
END	0	0	79.8	1.93844	359.9	1.93844	-2.09E-03
2J2	0	0	79.8	.652249	359.7	.65224	-3.58E-03
22	.0410104	-2.35184	76.3204	.605852	359.7	.605843	-3.31E-03
23	.0820209	-4.70369	72.8408	.543721	359.7	.543713	-3.03E-03
24	.123031	-7.05553	69.3612	.475822	359.7	.475813	-2.78E-03
25	.164042	-9.40737	65.8816	.405579	359.6	.40557	-2.6E-03
END	.205052	-11.7592	62.402	.33836	359.6	.338351	-2.47E-03
2J2	0	0	79.8	.654764	.2	.65476	2.38E-03
27	-2.0573	1.14033	76.3204	.608443	.3	.608437	2.81E-03
28	-4.1146	2.28067	72.8408	.546502	.4	.546491	3.52E-03
29	-6.1719	3.421	69.3612	.478895	.5	.478874	4.42E-03
30	-8.2292	4.56133	65.8816	.409039	.8	.409002	5.48E-03
END	-10.2865	5.70166	62.402	.342278	1.1	.342214	6.61E-03
2J2	0	0	79.8	.631438	359.9	.631438	-8.86E-04
32	2.01623	1.21147	76.3204	.584918	359.9	.584918	-8.35E-04
33	4.03246	2.42295	72.8408	.522472	359.9	.52247	-1.1E-03
34	6.04869	3.63442	69.3612	.454046	359.8	.454042	-1.73E-03
35	8.06492	4.84589	65.8816	.383051	359.6	.383041	-2.69E-03
END	10.0812	6.05736	62.402	.314867	359.3	.314843	-3.9E-03
2J3	.205052	-11.7592	62.402	.163252	358.1	.163163	-5.37E-03
37	-1.89326	-8.26704	62.402	.0989868	357.	.0988544	-5.12E-03
38	-3.99157	-4.77486	62.402	.0318958	351.7	.0315613	-4.61E-03
39	-6.08988	-1.28269	62.402	.0353648	186.3	-.0351526	-3.87E-03
40	-8.18819	2.20949	62.402	.102306	181.6	-.102264	-2.93E-03
END	-10.2865	5.70167	62.402	.16624	180.6	-.166229	-1.87E-03
2J4	-10.2865	5.70166	62.402	.176049	1.5	.175985	4.73E-03
43	-6.21297	5.7728	62.402	.112018	2.9	.111877	5.62E-03
44	-2.13944	5.84394	62.402	.0448115	7.8	.0443921	6.12E-03
45	1.93409	5.91508	62.402	.0237278	165.	-.0229207	6.14E-03
46	6.00762	5.98622	62.402	.0912032	176.4	-.0910281	5.65E-03
END	10.0812	6.05736	62.402	.156385	178.3	-.156315	4.67E-03

2J5	10.0812	6.05736	62.402	.15853	.3	.158528	7.72E-04
49	8.10593	2.49405	62.402	.0931565	359.7	.0931555	-4.45E-04
50	6.13071	-1.06927	62.402	.0248855	356.5	.0248403	-1.5E-03
51	4.15549	-4.63258	62.402	.042842	183.1	-.0427809	-2.29E-03
52	2.18027	-8.1959	62.402	.110687	181.4	-.110652	-2.77E-03
END	.205052	-11.7592	62.402	.175212	181.	-.175188	-2.91E-03
GND	45.4401	196.823	0	2.27602	1.2	2.27548	.0492461
55	45.4401	196.823	4.25	2.45269	.9	2.45239	.0379853
56	45.4401	196.823	8.5	2.5629	.7	2.56272	.0302198
57	45.4401	196.823	12.75	2.64762	.5	2.64751	.0234175
58	45.4401	196.823	17.	2.71236	.4	2.7123	.0172509
59	45.4401	196.823	21.25	2.75946	.2	2.75943	.0115947
60	45.4401	196.823	25.5	2.79019	.1	2.79018	6.4E-03
61	45.4401	196.823	29.75	2.80539	0.0	2.80539	1.64E-03
62	45.4401	196.823	34.	2.80582	359.9	2.80582	-2.67E-03
63	45.4401	196.823	38.25	2.79223	359.9	2.79222	-6.54E-03
64	45.4401	196.823	42.5	2.76553	359.8	2.76551	-9.95E-03
65	45.4401	196.823	46.75	2.72697	359.7	2.72694	-.0128712
66	45.4401	196.823	51.	2.67837	359.7	2.67832	-.0152996
67	45.4401	196.823	55.25	2.62258	359.6	2.62252	-.0172154
68	45.4401	196.823	59.5	2.56451	359.6	2.56444	-.0186102
69	45.4401	196.823	63.75	2.51248	359.6	2.5124	-.0194901
70	45.4401	196.823	68.	2.47309	359.5	2.47301	-.0198647
71	45.4401	196.823	72.25	2.4271	359.5	2.42702	-.0196798
72	45.4401	196.823	76.5	2.36015	359.5	2.36007	-.0189149
END	45.4401	196.823	80.75	2.28175	359.6	2.28168	-.0176817
2J9	45.4401	196.823	80.75	2.28175	359.6	2.28168	-.0176817
END	45.4401	196.823	85.	2.15168	359.6	2.15162	-.0150724
2J10	45.4401	196.823	85.	.703856	359.3	.703807	-8.31E-03
75	47.7419	196.375	81.5156	.654326	359.3	.654282	-7.59E-03
76	50.0436	195.928	78.0312	.584204	359.3	.58416	-7.16E-03
77	52.3453	195.481	74.5468	.506772	359.2	.506719	-7.3E-03
78	54.647	195.033	71.0624	.426239	358.9	.426162	-8.09E-03
END	56.9488	194.586	67.578	.348618	358.4	.348488	-9.53E-03
2J10	45.4401	196.823	85.	.717776	359.9	.717775	-1.22E-03
80	43.9018	195.053	81.5156	.668378	360.	.668378	-1.82E-04
81	42.3635	193.283	78.0312	.598678	.1	.598678	1.08E-03
82	40.8252	191.513	74.5468	.521878	.3	.521872	2.3E-03
83	39.2868	189.743	71.0624	.442185	.4	.442171	3.42E-03
END	37.7485	187.973	67.578	.365592	.7	.365566	4.35E-03
2J10	45.4401	196.823	85.	.730064	359.6	.730043	-5.54E-03
85	44.6768	199.04	81.5156	.680748	359.6	.680734	-4.39E-03
86	43.9135	201.257	78.0312	.611234	359.7	.611228	-2.83E-03
87	43.1502	203.474	74.5468	.534752	359.9	.53475	-1.16E-03
88	42.3869	205.691	71.0624	.455523	.1	.455522	5.13E-04
END	41.6235	207.908	67.578	.379519	.3	.379513	2.07E-03
2J11	56.9488	194.586	67.578	.176937	358.5	.176879	-4.52E-03
90	53.1087	193.263	67.578	.105299	356.8	.105132	-5.92E-03
91	49.2687	191.941	67.578	.0307843	347.1	.0300102	-6.86E-03
92	45.4286	190.618	67.578	.0449446	189.3	-.0443486	-7.29E-03
93	41.5885	189.296	67.578	.119233	183.5	-.119013	-7.24E-03
END	37.7485	187.973	67.578	.190015	182.	-.189895	-6.76E-03
2J12	37.7485	187.973	67.578	.175688	359.2	.175671	-2.41E-03
96	38.5235	191.96	67.578	.105039	359.2	.105028	-1.54E-03
97	39.2985	195.947	67.578	.0310396	359.1	.0310358	-4.82E-04
98	40.0735	199.934	67.578	.0422858	179.	-.0422798	7.13E-04
99	40.8485	203.921	67.578	.116031	179.	-.116013	2.01E-03
END	41.6235	207.908	67.578	.186229	179.	-.186199	3.34E-03
2J13	41.6235	207.908	67.578	.19339	1.6	.193314	5.41E-03

102	44.6886	205.244	67.578	.123173	3.	.123003	6.47E-03
103	47.7536	202.579	67.578	.0493565	8.2	.0488543	7.02E-03
104	50.8187	199.915	67.578	.0260547	164.5	-.0251017	6.98E-03
105	53.8837	197.25	67.578	.100152	176.4	-.0999532	6.3E-03
END	56.9488	194.586	67.578	.171682	178.3	-.171609	5.01E-03
GND	133.061	176.578	0	2.51443	270.4	.0175625	-2.51437
108	133.061	176.578	3.975	2.68525	268.6	-.0660169	-2.68444
109	133.061	176.578	7.95	2.79132	267.5	-.121088	-2.78869
110	133.061	176.578	11.925	2.87264	266.7	-.167204	-2.86777
111	133.061	176.578	15.9	2.93439	266.	-.206916	-2.92708
112	133.061	176.578	19.875	2.97877	265.4	-.241282	-2.96898
113	133.061	176.578	23.85	3.007	264.8	-.27082	-2.99478
114	133.061	176.578	27.825	3.01993	264.4	-.29583	-3.0054
115	133.061	176.578	31.8	3.01829	264.	-.316514	-3.00165
116	133.061	176.578	35.775	3.00292	263.6	-.333035	-2.98439
117	133.061	176.578	39.75	2.97481	263.3	-.345558	-2.95467
118	133.061	176.578	43.725	2.93541	263.1	-.354281	-2.91395
119	133.061	176.578	47.7	2.88681	262.8	-.359479	-2.86434
120	133.061	176.578	51.675	2.83242	262.7	-.361578	-2.80924
121	133.061	176.578	55.65	2.77792	262.5	-.361276	-2.75432
122	133.061	176.578	59.625	2.73176	262.4	-.359602	-2.70799
123	133.061	176.578	63.6	2.69422	262.4	-.356694	-2.6705
124	133.061	176.578	67.575	2.6426	262.4	-.35012	-2.6193
125	133.061	176.578	71.55	2.57023	262.4	-.339314	-2.54773
END	133.061	176.578	75.525	2.48568	262.5	-.325564	-2.46426
2J17	133.061	176.578	75.525	2.48568	262.5	-.325564	-2.46426
END	133.061	176.578	79.5	2.3707	262.6	-.305445	-2.35095
2J18	133.061	176.578	79.5	.77577	262.2	-.105259	-.768596
128	135.399	176.21	76.0204	.717553	262.4	-.0955126	-.711168
129	137.737	175.842	72.5408	.639974	262.5	-.0837795	-.634467
130	140.075	175.473	69.0612	.555575	262.5	-.0723113	-.550849
131	142.412	175.105	65.5816	.468616	262.4	-.0618289	-.464519
END	144.75	174.737	62.102	.385717	262.1	-.0531972	-.382031
2J18	133.061	176.578	79.5	.793493	262.1	-.109097	-.785958
133	131.596	174.75	76.0204	.735845	262.3	-.0991325	-.729137
134	130.13	172.922	72.5408	.659115	262.4	-.0867472	-.653382
135	128.664	171.093	69.0612	.575771	262.6	-.0742446	-.570965
136	127.199	169.265	65.5816	.490071	262.7	-.062417	-.486079
END	125.733	167.436	62.102	.408597	262.6	-.0522739	-.405239
2J18	133.061	176.578	79.5	.801584	263.5	-.0910883	-.796392
138	132.233	178.774	76.0204	.743823	263.8	-.0809685	-.739403
139	131.404	180.97	72.5408	.666882	264.1	-.0682113	-.663385
140	130.576	183.165	69.0612	.583199	264.6	-.0551065	-.58059
141	129.747	185.361	65.5816	.497064	265.1	-.0424371	-.495249
END	128.918	187.556	62.102	.415096	265.7	-.0312336	-.413919
2J19	144.75	174.737	62.102	.193137	263.5	-.0219754	-.191883
143	140.947	173.277	62.102	.114208	262.7	-.0144808	-.113286
144	137.143	171.817	62.102	.0317499	258.6	-6.28E-03	-.031123
145	133.34	170.357	62.102	.0502185	87.5	2.2E-03	.0501703
146	129.537	168.897	62.102	.132152	85.2	.0110266	.131691
END	125.733	167.436	62.102	.21012	84.6	.0197161	.209193
2J20	125.733	167.436	62.102	.198731	260.6	-.0325577	-.196046
149	126.37	171.46	62.102	.121027	258.9	-.0233758	-.118748
150	127.007	175.484	62.102	.0399434	250.5	-.0133222	-.0376562
151	127.644	179.508	62.102	.0430157	94.	-3.01E-03	.04291
152	128.281	183.532	62.102	.124401	86.5	7.51E-03	.124174
END	128.918	187.556	62.102	.202562	85.	.0175825	.201797
2J21	128.918	187.556	62.102	.212561	266.3	-.0136511	-.212122
155	132.085	184.992	62.102	.13429	268.3	-3.91E-03	-.134233

156	135.251	182.428	62.102	.0527015	276.3	5.8E-03	-.0523812
157	138.417	179.864	62.102	.0327671	62.9	.0149407	.0291626
158	141.584	177.301	62.102	.113938	78.1	.0235626	.111475
END	144.75	174.737	62.102	.192694	80.7	.0312217	.190148
GND	87.6933	-20.2456	0	2.06302	271.2	.0431209	-2.06257
161	87.6933	-20.2456	4.15	2.22078	269.1	-.0342238	-2.22051
162	87.6933	-20.2456	8.3	2.3202	267.9	-.0855696	-2.31862
163	87.6933	-20.2456	12.45	2.39739	266.9	-.12869	-2.39393
164	87.6933	-20.2456	16.6	2.457	266.1	-.165924	-2.45139
165	87.6933	-20.2456	20.75	2.50099	265.5	-.198233	-2.49312
166	87.6933	-20.2456	24.9	2.53042	264.9	-.226083	-2.5203
167	87.6933	-20.2456	29.05	2.54599	264.4	-.249741	-2.53371
168	87.6933	-20.2456	33.2	2.54832	263.9	-.269384	-2.53404
169	87.6933	-20.2456	37.35	2.53808	263.5	-.285156	-2.52201
170	87.6933	-20.2456	41.5	2.5161	263.2	-.297202	-2.49848
171	87.6933	-20.2456	45.65	2.48352	262.9	-.305693	-2.46463
172	87.6933	-20.2456	49.8	2.44203	262.7	-.310865	-2.42216
173	87.6933	-20.2456	53.95	2.39438	262.5	-.313083	-2.37382
174	87.6933	-20.2456	58.1	2.34521	262.3	-.312946	-2.32423
175	87.6933	-20.2456	62.25	2.30215	262.2	-.311421	-2.28099
176	87.6933	-20.2456	66.4	2.26933	262.2	-.309094	-2.24818
177	87.6933	-20.2456	70.55	2.22761	262.2	-.303839	-2.20679
178	87.6933	-20.2456	74.7	2.16656	262.2	-.294599	-2.14644
179	87.6933	-20.2456	78.85	2.09265	262.2	-.282345	-2.07351
END	87.6933	-20.2456	83.	2.01457	262.3	-.268451	-1.9966
2J25	87.6933	-20.2456	83.	.675136	263.3	-.0790602	-.670491
181	87.3264	-22.5618	79.5156	.623071	263.6	-.069905	-.619138
182	86.9596	-24.878	76.0312	.557475	263.9	-.0590998	-.554333
183	86.5927	-27.1942	72.5468	.486368	264.3	-.048159	-.483977
184	86.2258	-29.5104	69.0624	.413064	264.8	-.0376926	-.41134
END	85.859	-31.8266	65.578	.34313	265.2	-.0285485	-.34194
2J25	87.6933	-20.2456	83.	.678853	262.3	-.09153	-.672655
186	85.871	-18.7698	79.5156	.626912	262.5	-.0822848	-.621489
187	84.0486	-17.2941	76.0312	.561704	262.7	-.0712284	-.55717
188	82.2263	-15.8183	72.5468	.491202	263.	-.0598664	-.48754
189	80.4039	-14.3426	69.0624	.418697	263.3	-.0488098	-.415842
END	78.5816	-12.8668	65.578	.349698	263.6	-.0389425	-.347523
2J25	87.6933	-20.2456	83.	.660745	261.5	-.0978611	-.653458
191	89.8826	-19.4051	79.5156	.608691	261.6	-.0889938	-.602151
192	92.0719	-18.5647	76.0312	.543215	261.6	-.0789146	-.537453
193	94.2612	-17.7242	72.5468	.472302	261.6	-.0691115	-.467218
194	96.4505	-16.8838	69.0624	.399237	261.3	-.0601674	-.394677
END	98.6398	-16.0433	65.578	.329556	260.8	-.0528382	-.325292
2J26	85.859	-31.8266	65.578	.167109	263.5	-.019022	-.166023
196	84.4035	-28.0347	65.578	.100576	263.9	-.0107296	-.100002
197	82.948	-24.2427	65.578	.0310165	266.8	-1.75E-03	-.0309669
198	81.4925	-20.4507	65.578	.0381156	78.8	7.39E-03	.0373928
199	80.0371	-16.6588	65.578	.107287	81.1	.0166787	.105982
END	78.5816	-12.8668	65.578	.173055	81.5	.0255691	.171155
2J27	78.5816	-12.8668	65.578	.176874	265.7	-.0133734	-.176368
202	82.5932	-13.5021	65.578	.111321	267.5	-4.86E-03	-.111215
203	86.6049	-14.1374	65.578	.0427958	274.7	3.54E-03	-.0426494
204	90.6165	-14.7727	65.578	.0280858	66.2	.0113512	.0256897
205	94.6282	-15.408	65.578	.0965457	78.8	.018671	.0947231
END	98.6398	-16.0433	65.578	.162733	81.1	.0251426	.160779
2J28	98.6398	-16.0433	65.578	.166828	260.4	-.0276956	-.164513
208	96.0837	-19.2	65.578	.100549	257.8	-.0212443	-.0982795
209	93.5275	-22.3566	65.578	.0320125	244.	-.0140127	-.0287827
210	90.9713	-25.5133	65.578	.0407636	99.	-6.41E-03	.0402571

211	88.4152	-28.67	65.578	.109738	89.2	1.6E-03	.109726
END	85.859	-31.8266	65.578	.176175	86.9	9.53E-03	.175917

CURRENT MOMENTS(amp-degrees) peak

Frequency = 560 KHz
Input power = 500. watts

			vertical current moment	
wire	magnitude	phase (deg)	magnitude	phase (deg)
1	270.644	360.	270.644	360.
2	5.75091	359.9	5.75091	359.9
3	15.7789	359.7	13.0723	179.7
4	15.8732	.5	13.1504	180.5
5	15.1003	359.8	12.5101	179.8
6	.132578	247.	0	0
7	.359305	28.4	0	0
8	.269637	190.4	0	0
9	321.557	360.	321.557	360.
10	6.7995	359.6	6.7995	359.6
11	16.8493	359.2	13.9789	179.2
12	17.3184	.2	14.3676	180.2
13	17.7193	359.8	14.7005	179.8
14	.289145	223.5	0	0
15	.166212	177.6	0	0
16	.398207	29.	0	0
17	325.499	264.2	325.499	264.2
18	7.00689	262.6	7.00689	262.6
19	18.5388	262.4	15.3293	82.4
20	19.1013	262.4	15.8435	82.4
21	19.3427	264.3	16.0364	84.3
22	.284226	100.6	0	0
23	.254093	161.1	0	0
24	.45595	310.8	0	0
25	291.913	264.2	291.913	264.2
26	16.1706	264.	13.4152	84.
27	16.3186	262.8	13.5383	82.8
28	15.7308	261.5	13.0504	81.5
29	.127402	45.2	0	0
30	.325126	310.	0	0
31	.34352	149.8	0	0

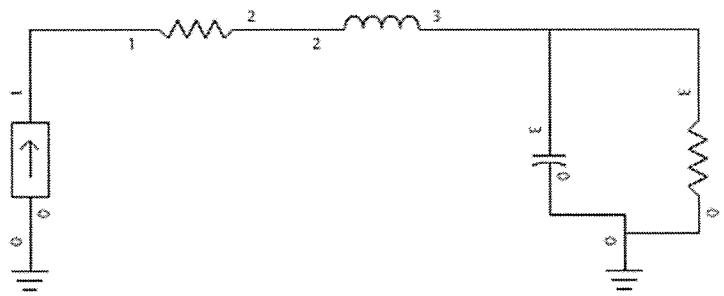
Medium wave array vertical current moment (amps-degrees) peak
(Calculation assumes tower wires are grouped together.
The first wire of each group must contain the source.)

tower	magnitude	phase (deg)
1	237.663	0.0
2	285.31	0.0
3	285.311	264.4
4	251.929	264.4

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 1 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	325.7817 ∡	89.2474° V
Node:	2	325.7529 ∡	89.6182° V
Node:	3	309.4329 ∡	89.5867° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	2.11 ∡	0.216° V	2.11 ∡	0.216° A
L	2→3	2.20000000	16.32 ∡	90.216° V	2.11 ∡	0.216° A
C	3→0	0.00005000	309.43 ∡	89.587° V	0.05 ∡	179.587° A
R	3→0	1.53190000	309.43 ∡	89.587° V	2.16 ∡	0.200° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	2.61 + j	154.494	1.61 + j	154.494
L	2→3	2.20000000	1.61 + j	154.494	1.61 + j	146.753
C	3→0	0.00005000	0.01 - j	5684.105	0.00 + j	0.000
R	3→0	1.53190000	1.53 + j	143.060	0.00 + j	0.000

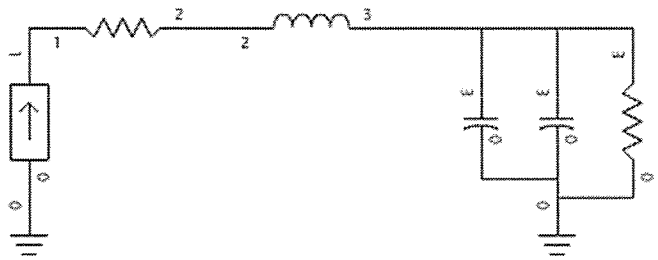
WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	2.10840000	0	1	0.21600000
R	1.00000000	1	2	0.00000000
L	2.20000000	2	3	0.00000000
C	0.00005000	3	0	
R	1.53190000	3	0	143.06000000

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 2 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	492.5397 ∡	86.9538° V
Node:	2	492.3733 ∡	87.1921° V
Node:	3	420.6904 ∡	86.4192° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	2.05 ∡	1.716° V	2.05 ∡	1.716° A
L	2→3	9.95000000	71.95 ∡	91.716° V	2.06 ∡	1.716° A
C	3→0	0.00005000	420.69 ∡	86.419° V	0.07 ∡	176.419° A
C	3→0	0.00010000	420.69 ∡	86.419° V	0.15 ∡	176.419° A
R	3→0	15.40400000	420.69 ∡	86.419° V	2.28 ∡	1.200° A

	WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	1→2	1.00000000	19.90 + j 238.851	18.90 + j 238.851
L	2→3	9.95000000	18.90 + j 238.851	18.90 + j 203.841
C	3→0	0.00005000	0.00 - j 5684.105	0.00 + j 0.000
C	3→0	0.00010000	0.00 - j 2842.053	0.00 + j 0.000
R	3→0	15.40400000	15.40 + j 184.180	0.00 + j 0.000

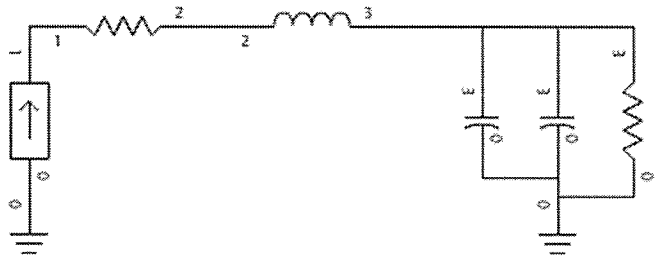
WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	2.05500000	0	1	1.71600000
R	1.00000000	1	2	0.00000000
L	9.95000000	2	3	0.00000000
C	0.00005000	3	0	
C	0.00010000	3	0	
R	15.40400000	3	0	184.18000000

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 3 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	516.6001 ∡	-23.1234° V
Node:	2	515.5894 ∡	-22.8947° V
Node:	3	468.6331 ∡	-25.7321° V

	WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	1→2	1.00000000	2.29 ∡ -86.879° V	2.29 ∡ -86.879° A
L	2→3	6.55000000	52.89 ∡ 3.121° V	2.29 ∡ -86.879° A
C	3→0	0.00005000	468.63 ∡ -25.732° V	0.08 ∡ 64.268° A
C	3→0	0.00010000	468.63 ∡ -25.732° V	0.16 ∡ 64.268° A
R	3→0	82.09100000	468.63 ∡ -25.732° V	2.51 ∡ -89.600° A

	WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	1→2	1.00000000	99.54 + j 201.903	98.54 + j 201.903
L	2→3	6.55000000	98.54 + j 201.903	98.54 + j 178.856
C	3→0	0.00005000	0.00 - j 5684.105	0.00 + j 0.000
C	3→0	0.00010000	0.00 - j 2842.053	0.00 + j 0.000
R	3→0	82.09100000	82.09 + j 167.330	0.00 + j 0.000

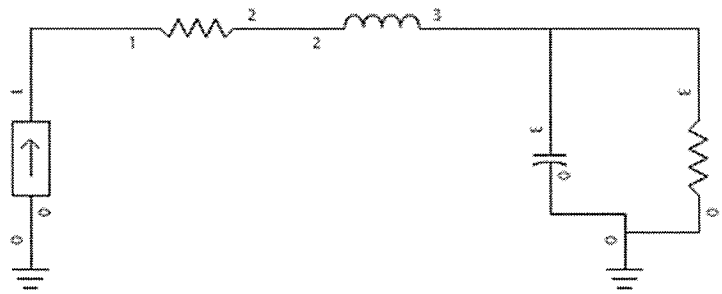
WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	2.29490000	0	1	-86.87900000
R	1.00000000	1	2	0.00000000
L	6.55000000	2	3	0.00000000
C	0.00005000	3	0	
C	0.00010000	3	0	
R	82.09100000	3	0	167.33000000

Center Frequency: 0.56 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



WCAP - WRDT Tower 4 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES
Node: 1 429.5601 ∡ -25.4798° V
Node: 2 428.6371 ∡ -25.2433° V
Node: 3 422.4116 ∡ -25.6820° V

	WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	1→2	1.00000000	2.00 ∡ -87.836° V	2.00 ∡ -87.836° A
L	2→3	1.00000000	7.03 ∡ 2.164° V	2.00 ∡ -87.836° A
C	3→0	0.00005000	422.41 ∡ -25.682° V	0.07 ∡ 64.318° A
R	3→0	92.58100000	422.41 ∡ -25.682° V	2.06 ∡ -88.800° A

	WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	1→2	1.00000000	99.80 + j 190.549	98.80 + j 190.549
L	2→3	1.00000000	98.80 + j 190.549	98.80 + j 187.030
C	3→0	0.00005000	0.00 - j 5684.105	0.00 + j 0.000
R	3→0	92.58100000	92.58 + j 182.630	0.00 + j 0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	1.99700000	0	1	-87.83600000
R	1.00000000	1	2	0.00000000
L	1.00000000	2	3	0.00000000
C	0.00005000	3	0	
R	92.58100000	3	0	182.63000000

Summary of Post Construction Certified Array Geometry

With respect to Question 9, Section III, Page 2 of the attached Form 302-AM, the tower information is as follows:

Tower No.	ASRN	Height above base insulator (meters)	Height above ground w/o obst. lighting (meters)	Overall height above ground (meters)
1	1000331	124.9	126.2	127.0
2	1000332	124.9	126.2	127.0
3	1000333	124.9	126.2	127.0
4	1000334	124.9	126.2	127.0

All towers are uniform cross-section, steel, guyed vertical radiators.

Because WRDT is an existing licensed facility, in accordance with the Public Notice, Media Bureau Clarifies Procedures for AM Directional Antenna Performance Verification Using Moment Method Modeling (FCC DA 09-2340) dated October 29, 2009, it is exempt from the requirement to submit a surveyor's certification.

Sampling System

The sampling system consists of Delta Electronics TCT-3 current transformers installed at the output of each antenna tuning unit, immediately adjacent to the final ATU J-plug. Samples from the current transformers are fed to the antenna monitor via equal lengths of 3/8-inch foam-dielectric coaxial transmission lines. The antenna monitor is a Potomac Instruments Type 1901, which was calibrated according to the manufacturer's instructions.

Impedance measurements were made of the antenna sampling system using an Agilent 8735A network analyzer. The measurements were made looking into the antenna monitor ends of the sample lines with the tower ends of the sample lines open-circuited.

The table below shows the frequencies above the carrier frequency where resonance, defined as zero reactance corresponding with low resistance, was found. No resonant frequency was found below the carrier frequency within the network analyzer's operating range. As the length of 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 sample line length at the resonant frequency immediately above carrier frequency, which is the closest one to the carrier frequency, was found to be 270 electrical degrees. The electrical length at carrier frequency appearing in the table below was calculated by ratioing the frequencies.

Twr.	Sample Line Open-Circuited Resonance Above 560 kHz (kHz)	Sample Line Calculated Electrical Length At 560 kHz (deg.)
1	720.48	209.86
2	722.76	209.20
3	723.60	208.96
4	722.52	209.27

The length difference between the longest and shortest sample lines amounts to 0.90 degrees at the carrier frequency. As such, the sample lines meet the requirement in the Rules that they be equal in length within one electrical degree.

To determine the characteristic impedance values of the sample lines, open-circuited measurements were made with frequencies offset to produce ± 45 degrees of electrical length from resonance.

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

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

Twr.	+ 45 Deg. Offset Frequency (kHz)	+45 Deg. Measured Impedance (ohms)	- 45 Deg. Offset Frequency (kHz)	-45 Deg. Measured Impedance (ohms)	Calculated Characteristic Impedance (ohms)
1	840.56	14.2 +j46.6	600.40	9.8 –j48.3	49.0
2	843.22	14.5 +j47.1	602.30	9.8 –j48.0	49.1
3	844.20	14.3 +j47.2	603.00	9.6 –j48.3	49.3
4	842.94	14.4 +j46.5	602.10	9.7 –j47.5	48.6

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

The calibration of the Delta TCT-3 current transformers was verified by removing them all from the ATUs and installing them on a test jig so that each was located very close to the adjacent transformer (spacing of less than two inches). Short transmission lines of equal length were connected between the outputs of all four current transformers and the inputs of the antenna monitor. As noted above, the Potomac 1901 antenna monitor was calibrated using the internal calibration function. A single source of RF current on the carrier frequency was fed through a conductor passing through all of the current transformers, and the differential phases and ratios were noted on the antenna monitor as follows:

Twr.	Serial No.	Ratio	Phase (deg.)
1	004	0.994	+0.9
2	003	1.000	0.0
3	005	0.995	-0.2
4	002	0.996	-0.5

The requirement that the sample current transformers are accurate to within the manufacturer's specification (±2% ratio and ±2 degrees phase) has thus been demonstrated.

The impedance of each of the sample lines was measured with the sample current transformers attached. These impedances are tabulated below:

Twr.	R (ohms)	X (ohms)
1	53.7	+0.6
2	53.4	+0.3
3	53.5	+0.6
4	53.5	+0.3

Direct Measurement of Power

Common point impedance measurements were made using a Delta CPB-1 common point bridge installed in the common point bus of the phasing and coupling system. The resistance value was adjusted to 50 ohms and the reactance value was adjusted to zero.

Appendix A

Reference Field Strength Measurements

Reference field strength measurements were made on July 27, 2011 using Potomac Instruments FIM-41 serial No. 2143, calibrated August 14, 2002, at three locations along each of the major lobe and null radials of each pattern. This meter was checked on 560 kHz against FIM-41 serial number 1898, calibrated October 27, 2009, and was found to be in agreement. The calibration certificate for FIM-41 S/N 1898 is included herewith. The measured field strengths and descriptions and NAD-83 GPS coordinates for the reference measurement points are shown in the following tables.

Radial 13.0°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.90	41-55-32.6	83-25-00.4	07/27/11	1432	110.0	1st Baptist Church lot
2	4.63	41-55-54.3	83-24-53.8	07/27/11	1439	84.0	NE corner Lorain & John Rolfe
3	5.43	41-56-19.3	83-24-46.3	07/27/11	1444	83.0	1621 Northridge Drive

Radial 76.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	4.15	41-53-58.9	83-22-43.9	07/27/11	1017	2.6	623 Norwood Drive
2	5.00	41-54-05.2	83-22-09.2	07/27/11	1028	1.8	Water Treatment Plant
3	5.68	41-54-10.6	83-21-38.6	07/27/11	1038	2.0	E. Elm Ave. 50' west of utility pole S10WE844

Radial 97.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	1.6	41-53-21.1	83-24-30.3	07/27/11	0952	36.0	371 Holly Glen St.
2	1.9	41-53-19.6	83-24-17.1	07/27/11	0958	23.9	15207 Hull Road
3	2.65	41-53-17.0	83-23-44.9	07/27/11	1005	20.0	N. side of Laplaisance Rd.

Radial 131.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	2.52	41-52-34.9	83-24-18.8	07/27/11	1137	4.5	Hull Rd. and Albain Rd.
2	3.09	41-52-21.6	83-24-00.4	07/27/11	1209	3.5	SB I-75 0.1 mi. south of Albain Rd.
3	4.02	41-52-02.0	83-23-27.7	07/27/11	1129	2.5	Laplaisande Rd. 20' SW of mail box 13773

Radial 149.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.60	41-51-48.1	83-24-17.8	07/27/11	1521	7.6	I-75N service plaza
2	3.81	41-51-41.6	83-24-14.8	07/27/11	1117	6.6	13308 Lighthouse Rd.
3	4.74	41-51-16.6	83-23-54.0	07/27/11	1110	6.0	Allen Hurst Rd. N. of Mortor Creek Rd.

Radial 172.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.77	41-51-27.5	83-25-17.5	07/27/11	1102	4.7	Laplaisance Rd. 210 ft. SW of 12904
2	4.91	41-50-51.9	83-25-11.6	07/27/11	1057	3.5	5633 N. Otter Creek Rd.
3	5.42	41-50-34.5	83-25-08.5	07/27/11	1051	3.4	S. Otter Creek Rd. 300 ft. NW of N 75 Sign

Radial 193.0°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.85	41-51-26.7	83-26-15.8	07/27/11	1218	6.0	Across from 4856 Laplaisance Rd.
2	5.52	41-50-35.3	83-26-31.9	07/27/11	1233	4.1	Stein Rd. at RR Crossing Sign
3	7.11	41-49-44.9	83-26-47.9	07/27/11	1240	3.4	At Left Curve sign on Kelly Rd.

Radial 213.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.79	41-51-45.7	83-27-10.1	07/27/11	1225	1.60	4118 S. Otter Creek Rd.
2	6.17	41-50-44.4	83-28-04.0	07/27/11	1254	0.62	12294 S. Dixie Hwy.
3	7.49	41-50-05.9	83-28-38.7	07/27/11	1247	0.52	300 ft. SE of 2966 Wood Rd.

Radial 236.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.42	41-52-26.7	83-27-44.6	07/27/11	1330	6.0	3534 N. Otter Creek Rd.
2	5.52	41-51-49.6	83-28-58.4	07/27/11	1311	3.6	13546 Dunlap Rd.
3	7.68	41-51-12.0	83-30-15.3	07/27/11	1304	2.2	150 ft. W. of 2160 W. Stein Rd.

Radial 254.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	4.51	41-52-49.0	83-28-47.6	07/27/11	1327	2.0	2843 N. Otter Creek Rd.
2	6.66	41-52-30.1	83-30-19.3	07/27/11	1321	1.5	1906 S. Otter Creek Rd.
3	7.34	41-52-24.7	83-30-46.1	7/27/11	1317	1.4	Strausburg Rd. S. of S. Otter Creek Rd.

Radial 288.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.91	41-54-08.3	83-28-19.6	07/27/11	1340	18.0	15795 Virginia Court
2	6.74	41-54-36.7	83-30-16.9	07/27/11	1349	12.0	2112 Strausburg Rd.
3	8.71	41-54-57.3	83-31-38.2	07/27/11	1355	8.4	S. of 1984 Martell Rd.

Radial 309.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Description
1	3.46	41-54-38.3	83-27-34.3	07/27/11	1418	11.0	16000 Hodge Rd.
2	4.71	41-55-05.6	83-28-16.8	07/27/11	1410	9.2	1500 Raisenville Rd.
3	7.02	41-55-52.3	83-29-34.4	07/27/11	1404	4.8	1011 Strausburg Rd.

Appendix B

Field Intensity Meter Certificate of Calibration

POTOMAC INSTRUMENTS, INC.
Frederick, Maryland

CERTIFICATE OF CALIBRATION

Field Intensity Meter Type FIM-41 Serial Number 1898

This instrument was calibrated in an induction field of 220.0 millivolts per meter. At each measurement frequency the measured field was recorded and a correction factor K was computed; the indicated field must be multiplied by K to obtain the true field.

kHz	K	kHz	K	MHz	K	MHz	K
540	1.000	1100	1.000	1.6	1.000	3.5	1.000
600	1.000	1200	1.000	1.9	1.000	3.8	1.000
700	1.000	1300	1.000	2.2	1.000	4.1	1.000
800	1.000	1400	1.000	2.5	1.000	4.4	1.000
900	1.000	1500	1.000	2.8	1.000	4.7	1.000
1000	1.000	1600	1.000	3.2	1.000	5.0	1.000

The calibrating field is maintained equal to the National Institute of Standards and Technology (NIST) standard field within an accuracy of 1.0 percent. NIST states that the absolute accuracy of its field is "believed to be within 3.0 percent."

The error at points on the meter scale other than the calibration point is less than 3.0 percent. The attenuator ratios are correct within 2.0 percent. These accuracies apply for battery voltages that are indicated by the instrument's battery check circuit to be useable.

NEXT RECOMMENDED CALIBRATION DATE, 2011

Calibrated by _____ Date: Oct. 27, 2009

STATE OF MARYLAND

Personally appeared before me on, October 29, 2009, Neil Telfer, who testified under oath that the above calibration was made either by himself or under his direction and that the statements in the above certificate are true to the best of his knowledge and belief.

MARCELLA R. LALIBERTE NOTARY PUBLIC FREDERICK COUNTY, MD

Marcella R. Laliberte
NOTARY PUBLIC
Frederick County
State of Maryland
My Commission Expires
December 17, 2012

_____
Notary Public