25083

DUPLICATE

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

November 1, 2011

Received & Inspected
NOV 01 2011
FCC Mail Room

RECEIVED
2011 NOV -7 A 5:38
MEDIA SERVICES DIVISION

Secretary
Federal Communications Commission
Washington, DC 20554

ATTN: Audio Division (AM)

RE: **Form 302-AM Amendment**
WRDT(AM) Monroe, Michigan
FAC: 25083
BMML-20110811ACK

Dear Madam Secretary:

Transmitted herewith in triplicate on behalf of Kimtron, Inc., is an amendment to the above-referenced application for broadcast license. This amendment is filed in reply to a letter from your Audio Division to the undersigned dated October 19, 2011, seeking supplemental information as needed to complete application processing.

Any questions concerning this matter should be addressed to the undersigned.

Sincerely,

John S. Neely

encs.

DUPLICATE

BMML-20110811ACK
November 2011 amendment

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	10/27/2011	(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.

BMML-20110811ACK
~~November 2011 amendment~~

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: ( ) Indicated Current - Night input pwr. 21.3 watts, 5-turns through TCT

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
0.33 (1.67)	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
190	50	+470	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		1.024		
2		0.0		1.000		
3		-88.6		1.115		
4		-89.6		0.918		

Manufacturer and type of antenna monitor: Potomac Instruments Type 1901

BMML-20110811ACK
November 2011 amendment

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. Exhibit No.

On file - no change.

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) 2821 S. Parker Road Suite 1205 Aurora, CO 80014	Date 10/27/2011 Telephone No. (Include Area Code) (303) 433-0104

[X] Technical Director

[ ] Registered Professional Engineer

[ ] Chief Operator

[ ] Technical Consultant

[ ] Other (specify)

EXHIBIT E-1

AMENDMENT TO
APPLICATION FOR LICENSE INFORMATION
RADIO STATION WRDT
MONROE, MICHIGAN

WMUZ Radio, Inc.

October 27, 2011

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

EXECUTIVE SUMMARY

This engineering exhibit supports an amendment to an application for license for the existing daytime directional antenna system of radio station WRDT in Monroe, Michigan (FCC FID No. 25083, File No. BMML-20110811ACK) pursuant to the AM technical rules permitting moment-method modeling of eligible AM directional arrays. This amendment corrects an error in the tower 4 theoretical field ratio that in turn resulted in an error in the source voltages for the directional model. It also notes that the terminated sample line impedance measurements were made on the carrier frequency, a fact that was omitted in the original filing.

In the interest of keeping all the information together in one cohesive document, this amendment is filed as a complete application, essentially replacing the previous filing complete with technical showings and exhibits. The changes noted above are limited to the daytime directional antenna and circuit models, the terminated sample line impedance measurements (unchanged with the measurement frequency noted) and the reference field strength measurements. Model calibrations, sample system measurements and other elements are unchanged.

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.

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

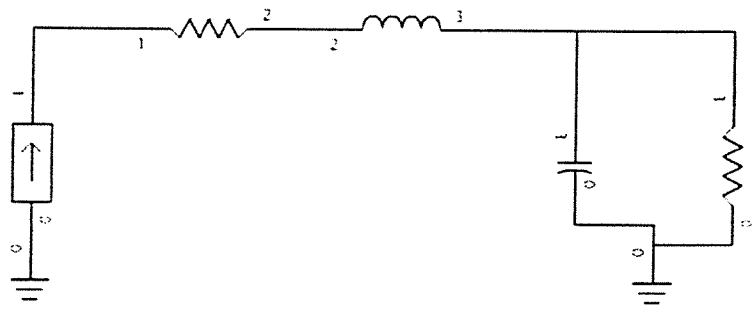
source	node	sector	magnitude	phase	type
1	1	1	1.	0	voltage

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.			178.94	69.1	10.713	-1.6263	-5.0536



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	[illegible]	[illegible]
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)

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

Sources

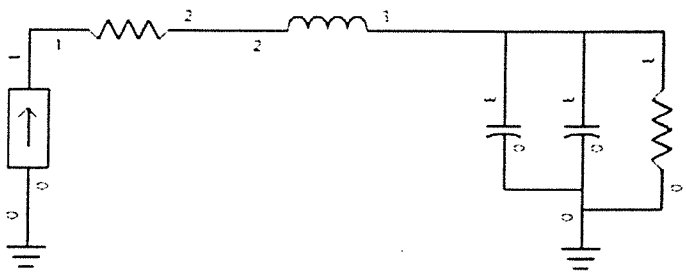
source	node	sector	magnitude	phase	type
1	54	1	1.	0	voltage

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.			227.66	68.5	12.951	-1.344	-5.7485



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	[illegible]	[illegible]
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

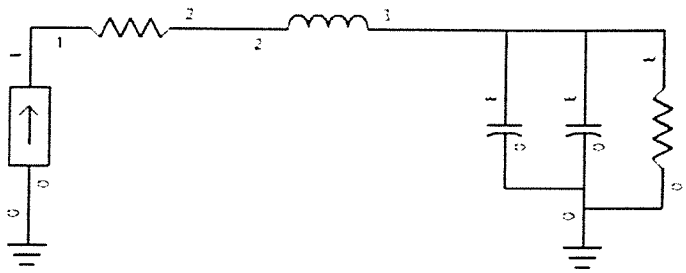
source	node	sector	magnitude	phase	type
1	107	1	1.	0	voltage

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.	[illegible]	[illegible]	176.2	69.2	10.631	-1.639	-5.0259



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	[illegible]	[illegible]
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

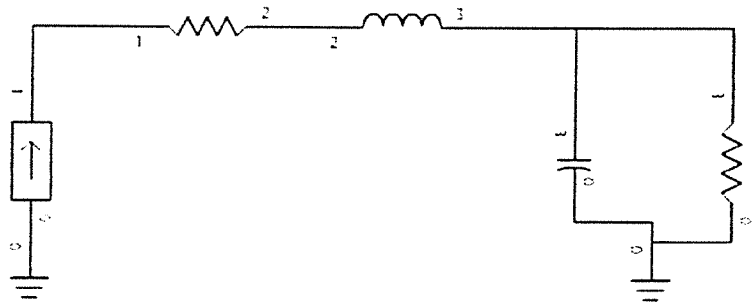
source	node	sector	magnitude	phase	type
1	160	1	1.	0	voltage

Lumped loads

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	107	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 160, sector 1							
560.	[illegible]	[illegible]	208.38	68.8	12.118	-1.4369	-5.5024



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	[illegible]	[illegible]
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	2.1835	+0.3	0.977	+0.032	1.024	-1.5
2	54	2.3073	+1.3	0.900	+0.533	1.000	0.0
3	107	2.5412	+270.5	0.913	+2.758	1.115	-88.6
4	160	1.9709	+271.3	0.969	+0.973	0.918	-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	10	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	316.204	89.	voltage
2	54	1	423.225	86.3	voltage
3	107	1	476.571	334.1	voltage
4	160	1	402.956	334.1	voltage

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.	3.1322	144.78	144.81	88.8	149.86	-.11592	-15.794
source = 2; node 54, sector 1							
560.	15.938	182.74	183.43	85.	45.338	-.38322	-10.734
source = 3; node 107, sector 1							
560.	83.168	168.09	187.54	63.7	8.9472	-1.9497	-4.4165
source = 4; node 160, sector 1							
560.	93.487	181.82	204.45	62.8	9.3705	-1.861	-4.5778

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	[illegible]	[illegible]	2.18351	.0106534
2	0	0	3.99	2.31082	.2	2.3108	8.44E-03
3	0	0	7.98	2.38798	.2	2.38797	6.89E-03
4	0	0	11.97	2.44548	.1	2.44547	5.51E-03
5	0	0	15.96	2.48739	.1	2.48739	4.23E-03
6	0	0	19.95	2.5155	.1	2.5155	3.02E-03
7	0	0	23.94	2.5308	0.0	2.5308	1.88E-03
8	0	0	27.93	2.53402	0.0	2.53402	8.04E-04
9	0	0	31.92	2.5258	360.	2.5258	-2.01E-04
10	0	0	35.91	2.50683	360.	2.50683	-1.13E-03
11	0	0	39.9	2.478	360.	2.478	-1.98E-03
12	0	0	43.89	2.44047	359.9	2.44047	-2.73E-03
13	0	0	47.88	2.39602	359.9	2.39602	-3.39E-03
14	0	0	51.87	2.34747	359.9	2.34747	-3.92E-03
15	0	0	55.86	2.29953	359.9	2.29953	-4.33E-03
16	0	0	59.85	2.25929	359.9	2.25928	-4.59E-03
17	0	0	63.84	2.22725	359.9	2.22724	-4.71E-03
18	0	0	67.83	2.18445	359.9	2.18444	-4.66E-03
19	0	0	71.82	2.12488	359.9	2.12487	-4.44E-03
END	0	0	75.81	2.05556	359.9	2.05556	-4.07E-03
2J1	0	0	75.81	2.05556	359.9	2.05556	-4.07E-03
END	0	0	79.8	1.96182	359.9	1.96182	-3.4E-03
2J2	0	0	79.8	.660266	359.7	.660254	-4.E-03
22	.0410104	-2.35184	76.3204	.613206	359.7	.613195	-3.66E-03
23	.0820208	-4.70368	72.8408	.550284	359.7	.550274	-3.28E-03
24	.123031	-7.05553	69.3612	.481531	359.6	.481522	-2.96E-03
25	.164042	-9.40737	65.8816	.410426	359.6	.410417	-2.7E-03
END	.205052	-11.7592	62.402	.34242	359.6	.342411	-2.52E-03
2J2	0	0	79.8	.662111	.1	.662109	1.68E-03
27	-2.0573	1.14033	76.3204	.615124	.2	.61512	2.18E-03
28	-4.1146	2.28067	72.8408	.55238	.3	.552372	2.95E-03
29	-6.1719	3.421	69.3612	.483902	.5	.483886	3.89E-03
30	-8.2292	4.56133	65.8816	.413155	.7	.413125	4.95E-03
END	-10.2865	5.70166	62.402	.34557	1.	.345517	6.05E-03
2J2	0	0	79.8	.639459	359.9	.639458	-1.08E-03
32	2.01623	1.21147	76.3204	.592279	359.9	.592278	-9.46E-04
33	4.03246	2.42295	72.8408	.529041	359.9	.52904	-1.12E-03
34	6.04869	3.63442	69.3612	.459766	359.8	.459763	-1.64E-03
35	8.06492	4.84589	65.8816	.387912	359.6	.387904	-2.51E-03
END	10.0811	6.05736	62.402	.318946	359.3	.318925	-3.64E-03
2J3	.205052	-11.7592	62.402	.165464	358.2	.165383	-5.16E-03
37	-1.89326	-8.26704	62.402	.100452	357.2	.100333	-4.88E-03
38	-3.99157	-4.77486	62.402	.0325538	352.3	.0322613	-4.35E-03
39	-6.08988	-1.28269	62.402	.0354153	185.9	-.0352301	-3.62E-03
40	-8.18819	2.20949	62.402	.10317	181.5	-.103135	-2.7E-03
END	-10.2865	5.70166	62.402	.167878	180.6	-.16787	-1.67E-03
2J4	-10.2865	5.70166	62.402	.177701	1.4	.177647	4.38E-03
43	-6.21297	5.7728	62.402	.112892	2.7	.11277	5.24E-03
44	-2.13944	5.84394	62.402	.0448603	7.3	.0444935	5.72E-03
45	1.93409	5.91508	62.402	.0242858	166.3	-.023594	5.76E-03
46	6.00762	5.98622	62.402	.0926279	176.7	-.0924761	5.3E-03
END	10.0811	6.05736	62.402	.158559	178.4	-.158499	4.38E-03

2J5	10.0811	6.05736	62.402	.160428	.3	.160426	7.34E-04
49	8.10593	2.49405	62.402	.094325	359.7	.0943241	-4.14E-04
50	6.13071	-1.06927	62.402	.0252876	356.8	.025249	-1.4E-03
51	4.15549	-4.63258	62.402	.0431763	182.8	-.0431242	-2.12E-03
52	2.18027	-8.1959	62.402	.111787	181.3	-.111758	-2.54E-03
END	.205052	-11.7592	62.402	.177048	180.9	-.177028	-2.64E-03
GND	45.4401	196.823	0	2.30728	1.3	2.3067	.051603
55	45.4401	196.823	4.25	2.48494	.9	2.48462	.0397587
56	45.4401	196.823	8.5	2.59571	.7	2.59552	.0315972
57	45.4401	196.823	12.75	2.68079	.5	2.68068	.0244545
58	45.4401	196.823	17.	2.74573	.4	2.74567	.0179855
59	45.4401	196.823	21.25	2.79288	.2	2.79285	.0120582
60	45.4401	196.823	25.5	2.8235	.1	2.82349	6.62E-03
61	45.4401	196.823	29.75	2.83847	0.0	2.83847	1.65E-03
62	45.4401	196.823	34.	2.83852	359.9	2.83852	-2.86E-03
63	45.4401	196.823	38.25	2.82444	359.9	2.82443	-6.89E-03
64	45.4401	196.823	42.5	2.79714	359.8	2.79712	-.0104415
65	45.4401	196.823	46.75	2.75788	359.7	2.75785	-.0134847
66	45.4401	196.823	51.	2.7085	359.7	2.70845	-.0160068
67	45.4401	196.823	55.25	2.65189	359.6	2.65183	-.0179931
68	45.4401	196.823	59.5	2.59301	359.6	2.59294	-.0194364
69	45.4401	196.823	63.75	2.54027	359.5	2.54019	-.0203446
70	45.4401	196.823	68.	2.50035	359.5	2.50026	-.0207295
71	45.4401	196.823	72.25	2.4538	359.5	2.45371	-.0205343
72	45.4401	196.823	76.5	2.38606	359.5	2.38598	-.0197378
END	45.4401	196.823	80.75	2.30681	359.5	2.30674	-.0184571
2J9	45.4401	196.823	80.75	2.30681	359.5	2.30674	-.0184571
END	45.4401	196.823	85.	2.17535	359.6	2.1753	-.0157526
2J10	45.4401	196.823	85.	.711241	359.3	.711187	-8.73E-03
75	47.7419	196.375	81.5156	.66119	359.3	.661142	-7.98E-03
76	50.0436	195.928	78.0312	.590333	359.3	.590285	-7.52E-03
77	52.3453	195.481	74.5468	.512071	359.1	.512014	-7.63E-03
78	54.647	195.033	71.0624	.430658	358.9	.430576	-8.41E-03
END	56.9488	194.586	67.578	.352185	358.4	.352047	-9.85E-03
2J10	45.4401	196.823	85.	.72532	359.9	.725318	-1.64E-03
80	43.9018	195.053	81.5156	.675404	360.	.675404	-5.71E-04
81	42.3635	193.283	78.0312	.604965	.1	.604964	7.36E-04
82	40.8252	191.513	74.5468	.527333	.2	.527329	2.E-03
83	39.2868	189.743	71.0624	.446765	.4	.446754	3.14E-03
END	37.7485	187.973	67.578	.369325	.6	.369302	4.09E-03
2J10	45.4401	196.823	85.	.738811	359.6	.738791	-5.38E-03
85	44.6768	199.04	81.5156	.688969	359.7	.688956	-4.19E-03
86	43.9135	201.257	78.0312	.618735	359.8	.61873	-2.58E-03
87	43.1502	203.474	74.5468	.54143	359.9	.541429	-8.62E-04
88	42.3869	205.691	71.0624	.461316	.1	.461315	8.59E-04
END	41.6235	207.908	67.578	.384465	.4	.384457	2.46E-03
2J11	56.9488	194.586	67.578	.179425	358.5	.179366	-4.6E-03
90	53.1087	193.263	67.578	.106975	356.8	.106806	-6.01E-03
91	49.2687	191.941	67.578	.0316455	347.3	.0308708	-6.96E-03
92	45.4286	190.618	67.578	.0449058	189.5	-.0442929	-7.39E-03
93	41.5885	189.296	67.578	.119994	183.5	-.119769	-7.34E-03
END	37.7485	187.973	67.578	.191563	182.	-.191441	-6.84E-03
2J12	37.7485	187.973	67.578	.177882	359.1	.177861	-2.75E-03
96	38.5235	191.96	67.578	.106439	359.	.106423	-1.86E-03
97	39.2985	195.947	67.578	.0316056	358.6	.0315959	-7.82E-04
98	40.0735	199.934	67.578	.0425552	179.4	-.0425529	4.4E-04
99	40.8485	203.921	67.578	.11715	179.1	-.117137	1.77E-03
END	41.6235	207.908	67.578	.188124	179.	-.188098	3.14E-03
2J13	41.6235	207.908	67.578	.196439	1.6	.196359	5.59E-03

102	44.6886	205.244	67.578	.125435	3.1	.125257	6.68E-03
103	47.7536	202.579	67.578	.0507823	8.2	.0502614	7.26E-03
104	50.8187	199.915	67.578	.0255773	163.6	-.0245346	7.23E-03
105	53.8837	197.25	67.578	.100453	176.3	-.100239	6.55E-03
END	56.9488	194.586	67.578	.172761	178.3	-.172681	5.25E-03
GND	133.061	176.578	0	[illegible]	[illegible]	.021002	-2.54111
108	133.061	176.578	3.975	2.71466	268.6	-.0643649	-2.7139
109	133.061	176.578	7.95	2.82244	267.6	-.120625	-2.81986
110	133.061	176.578	11.925	2.90513	266.7	-.167748	-2.90028
111	133.061	176.578	15.9	2.96797	266.	-.20834	-2.96065
112	133.061	176.578	19.875	3.01322	265.4	-.24348	-3.00337
113	133.061	176.578	23.85	3.04211	264.8	-.273698	-3.02977
114	133.061	176.578	27.825	3.05547	264.4	-.299299	-3.04077
115	133.061	176.578	31.8	3.05406	264.	-.320489	-3.0372
116	133.061	176.578	35.775	3.03872	263.6	-.337433	-3.01993
117	133.061	176.578	39.75	3.01048	263.3	-.350299	-2.99003
118	133.061	176.578	43.725	2.97077	263.1	-.359287	-2.94896
119	133.061	176.578	47.7	2.92172	262.8	-.364677	-2.89887
120	133.061	176.578	51.675	2.86678	262.6	-.366899	-2.8432
121	133.061	176.578	55.65	2.81171	262.5	-.366661	-2.7877
122	133.061	176.578	59.625	2.76504	262.4	-.365006	-2.74084
123	133.061	176.578	63.6	2.72705	262.4	-.362075	-2.70291
124	133.061	176.578	67.575	2.67482	262.4	-.355404	-2.6511
125	133.061	176.578	71.55	2.60155	262.4	-.344422	-2.57865
END	133.061	176.578	75.525	2.5159	262.5	-.330433	-2.49411
2J17	133.061	176.578	75.525	2.5159	262.5	-.330433	-2.49411
END	133.061	176.578	79.5	2.39944	262.6	-.30995	-2.37934
2J18	133.061	176.578	79.5	.787233	262.2	-.107094	-.779914
128	135.399	176.21	76.0204	.728255	262.3	-.0971722	-.721743
129	137.737	175.842	72.5408	.649751	262.5	-.0852444	-.644135
130	140.075	175.473	69.0612	.564333	262.5	-.0735915	-.559514
131	142.412	175.105	65.5816	.476321	262.4	-.0629481	-.472143
END	144.75	174.737	62.102	.392439	262.1	-.0541962	-.388679
2J18	133.061	176.578	79.5	.803869	262.1	-.110524	-.796235
133	131.596	174.75	76.0204	.745472	262.3	-.100379	-.738683
134	130.13	172.922	72.5408	.667797	262.4	-.0877783	-.662003
135	128.664	171.093	69.0612	.583429	262.6	-.0750622	-.57858
136	127.199	169.265	65.5816	.496684	262.7	-.0630371	-.492667
END	125.733	167.436	62.102	.414223	262.7	-.0527294	-.410853
2J18	133.061	176.578	79.5	.80848	263.4	-.0923323	-.80319
138	132.233	178.774	76.0204	.749993	263.7	-.0820393	-.745492
139	131.404	180.97	72.5408	.672021	264.1	-.0690688	-.668462
140	130.576	183.165	69.0612	.587253	264.6	-.0557622	-.584599
141	129.747	185.361	65.5816	.500031	265.1	-.0429155	-.498186
END	128.918	187.556	62.102	.417045	265.7	-.0315733	-.415848
2J19	144.75	174.737	62.102	.195856	263.4	-.022482	-.194561
143	140.947	173.277	62.102	.116009	262.6	-.0148891	-.115049
144	137.143	171.817	62.102	.032596	258.4	-6.57E-03	-.0319268
145	133.34	170.357	62.102	.0503584	87.7	2.03E-03	.0503174
146	129.537	168.897	62.102	.133248	85.3	.010992	.132794
END	125.733	167.436	62.102	.212133	84.6	.0198159	.211205
2J20	125.733	167.436	62.102	.202343	260.6	-.0329135	-.199648
149	126.37	171.46	62.102	.123711	259.	-.023594	-.12144
150	127.007	175.484	62.102	.0416035	251.2	-.0133985	-.0393869
151	127.644	179.508	62.102	.0422425	94.	-2.95E-03	.0421392
152	128.281	183.532	62.102	.124613	86.5	7.7E-03	.124375
END	128.918	187.556	62.102	.203717	85.	.0178893	.20293
2J21	128.918	187.556	62.102	.213357	266.3	-.013684	-.212918
155	132.085	184.992	62.102	.134151	268.4	-3.84E-03	-.134096

156	135.251	182.428	62.102	.0516158	276.7	5.99E-03	-.0512673
157	138.417	179.864	62.102	.0347604	64.	.015235	.0312439
158	141.584	177.301	62.102	.117006	78.2	.0239609	.114526
END	144.75	174.737	62.102	.196692	80.7	.0317142	.194118
GND	87.6933	-20.2456	0	[illegible]	[illegible]	.0435614	-1.97044
161	87.6933	-20.2456	4.15	2.12098	269.2	-.0309153	-2.12075
162	87.6933	-20.2456	8.3	2.21557	267.9	-.0803579	-2.21411
163	87.6933	-20.2456	12.45	2.28899	266.9	-.121881	-2.28574
164	87.6933	-20.2456	16.6	2.34567	266.1	-.157738	-2.34036
165	87.6933	-20.2456	20.75	2.38747	265.5	-.188853	-2.37999
166	87.6933	-20.2456	24.9	2.4154	264.9	-.215676	-2.40575
167	87.6933	-20.2456	29.05	2.43011	264.4	-.238465	-2.41838
168	87.6933	-20.2456	33.2	2.43221	263.9	-.25739	-2.41855
169	87.6933	-20.2456	37.35	2.42233	263.5	-.272591	-2.40694
170	87.6933	-20.2456	41.5	2.40126	263.2	-.284207	-2.38438
171	87.6933	-20.2456	45.65	2.37008	262.9	-.292403	-2.35197
172	87.6933	-20.2456	49.8	2.33043	262.7	-.297409	-2.31137
173	87.6933	-20.2456	53.95	2.28489	262.5	-.299571	-2.26517
174	87.6933	-20.2456	58.1	2.23793	262.3	-.299468	-2.2178
175	87.6933	-20.2456	62.25	2.19681	262.2	-.298025	-2.1765
176	87.6933	-20.2456	66.4	2.16547	262.1	-.295805	-2.14517
177	87.6933	-20.2456	70.55	2.12565	262.1	-.290775	-2.10567
178	87.6933	-20.2456	74.7	2.0674	262.2	-.281929	-2.04809
179	87.6933	-20.2456	78.85	1.99689	262.2	-.270197	-1.97852
END	87.6933	-20.2456	83.	1.9224	262.3	-.256896	-1.90516
2J25	87.6933	-20.2456	83.	.644403	263.3	-.0750594	-.640017
181	87.3264	-22.5618	79.5156	.594735	263.6	-.0662915	-.591029
182	86.9596	-24.878	76.0312	.532146	264.	-.0559389	-.529198
183	86.5927	-27.1942	72.5468	.464287	264.4	-.0454524	-.462057
184	86.2258	-29.5104	69.0624	.394323	264.8	-.0354173	-.392729
END	85.859	-31.8266	65.578	.327568	265.3	-.0266467	-.326482
2J25	87.6933	-20.2456	83.	.647973	262.2	-.0876756	-.642014
186	85.871	-18.7698	79.5156	.598429	262.4	-.0788167	-.593216
187	84.0486	-17.2941	76.0312	.536222	262.7	-.0682085	-.531866
188	82.2263	-15.8183	72.5468	.468968	263.	-.0572948	-.465455
189	80.4039	-14.3426	69.0624	.399805	263.3	-.0466619	-.397073
END	78.5816	-12.8668	65.578	.333986	263.6	-.0371588	-.331912
2J25	87.6933	-20.2456	83.	.630201	261.4	-.0941608	-.623127
191	89.8826	-19.4051	79.5156	.58054	261.5	-.0856836	-.574182
192	92.0719	-18.5647	76.0312	.518086	261.6	-.0760672	-.512471
193	94.2612	-17.7242	72.5468	.450436	261.5	-.0667328	-.445465
194	96.4505	-16.8838	69.0624	.380723	261.2	-.0582383	-.376242
END	98.6398	-16.0433	65.578	.31423	260.6	-.0513038	-.310013
2J26	85.859	-31.8266	65.578	.159528	263.5	-.0181926	-.158487
196	84.4035	-28.0347	65.578	.0960138	263.9	-.0102304	-.0954672
197	82.948	-24.2427	65.578	.0296228	266.9	-1.6E-03	-.0295795
198	81.4925	-20.4507	65.578	.0363692	78.6	7.2E-03	.0356502
199	80.0371	-16.6588	65.578	.102368	80.9	.0161442	.101087
END	78.5816	-12.8668	65.578	.165115	81.4	.0247124	.163255
2J27	78.5816	-12.8668	65.578	.169116	265.8	-.0124464	-.168657
202	82.5932	-13.5021	65.578	.106595	267.7	-4.26E-03	-.10651
203	86.6049	-14.1374	65.578	.0412702	275.3	3.78E-03	-.0410964
204	90.6165	-14.7727	65.578	.0266057	65.	.0112406	.0241146
205	94.6282	-15.408	65.578	.0918251	78.6	.018196	.0900042
END	98.6398	-16.0433	65.578	.154967	81.	.0243153	.153047
2J28	98.6398	-16.0433	65.578	.159269	260.2	-.0269885	-.156966
208	96.0837	-19.2	65.578	.096031	257.4	-.0208883	-.0937317
209	93.5275	-22.3566	65.578	.030781	242.9	-.0140264	-.0273994
210	90.9713	-25.5133	65.578	.0390913	100.	-6.78E-03	.0384982

211	88.4151	-28.67	65.578	.104809	89.5	8.67E-04	.104805
END	85.859	-31.8266	65.578	.168208	87.1	8.45E-03	.167995

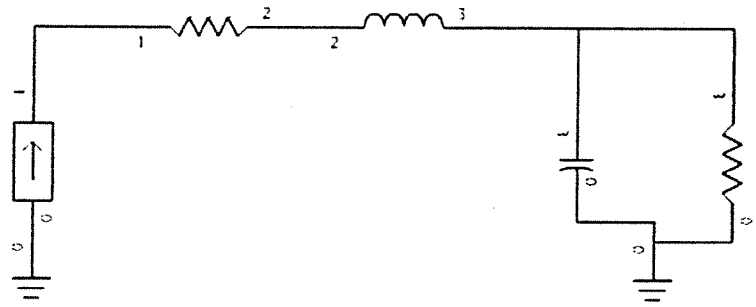
CURRENT MOMENTS(amp-degrees) peak

Frequency = 560 KHz
Input power = 500. watts

			vertical current moment	
wire	magnitude	phase (deg)	magnitude	phase (deg)
1	273.828	360.	273.828	360.
2	5.82029	359.9	5.82029	359.9
3	15.9695	359.6	13.2302	179.6
4	16.0419	.4	13.2901	180.4
5	15.2912	359.8	12.6682	179.8
6	.122493	249.7	0	0
7	.346693	27.5	0	0
8	.268025	189.7	0	0
9	325.317	360.	325.317	360.
10	6.87432	359.6	6.87432	359.6
11	17.0254	359.1	14.1249	179.1
12	17.4994	.1	14.5178	180.1
13	17.9381	359.8	14.8821	179.8
14	.281236	225.9	0	0
15	.161818	180.5	0	0
16	.427686	27.9	0	0
17	329.338	264.2	329.338	264.2
18	7.09183	262.6	7.09183	262.6
19	18.8269	262.4	15.5675	82.4
20	19.3544	262.4	16.0535	82.4
21	19.4847	264.3	16.1541	84.3
22	.275772	102.4	0	0
23	.24492	169.6	0	0
24	.425694	315.8	0	0
25	278.617	264.2	278.617	264.2
26	15.4358	264.1	12.8057	84.1
27	15.5792	262.8	12.9248	82.8
28	15.0026	261.4	12.4462	81.4
29	.123227	43.6	0	0
30	.326556	310.2	0	0
31	.345748	151.1	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	240.461	360.
2	288.668	360.
3	288.669	264.4
4	240.461	264.4



WCAP - WRDT Tower 1 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

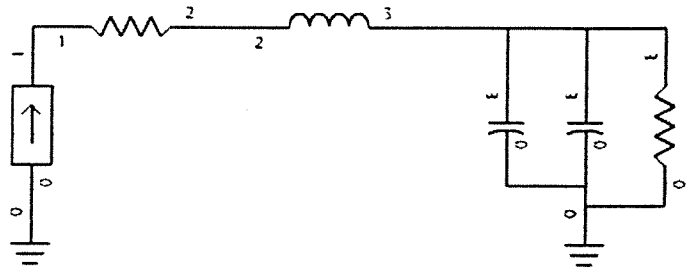
Node:	1	332.7231 ∡	88.7569° V
Node:	2	332.6714 ∡	89.1232° V
Node:	3	316.2034 ∡	89.0602° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	2.13 ∡	0.332° V	2.13 ∡	0.332° A
L	2→3	2.20000000	16.47 ∡	90.332° V	2.13 ∡	0.332° A
C	3→0	0.00005000	316.20 ∡	89.060° V	0.06 ∡	179.060° A
R	3→0	3.13220000	316.20 ∡	89.060° V	2.18 ∡	0.300° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	4.30 + j	156.303	3.30 + j	156.303
L	2→3	2.20000000	3.30 + j	156.303	3.30 + j	148.562
C	3→0	0.00005000	0.00 - j	5684.105	0.00 + j	0.000
R	3→0	3.13220000	3.13 + j	144.780	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	2.12790000	0	1	0.33200000
R	1.00000000	1	2	0.00000000
L	2.20000000	2	3	0.00000000
C	0.00005000	3	0	
R	3.13220000	3	0	144.78000000



WCAP - WRDT Tower 2 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

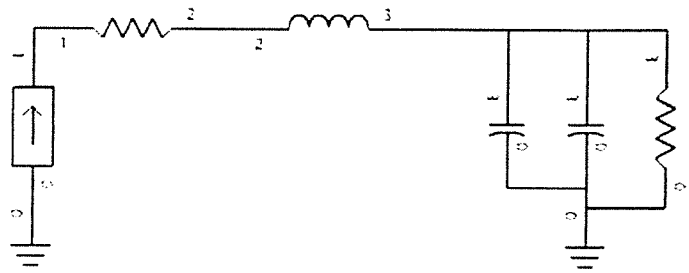
Node:	1	496.1008 ∡	86.8860° V
Node:	2	495.9253 ∡	87.1259° V
Node:	3	423.2252 ∡	86.3151° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	2.08 ∡	1.833° V	2.08 ∡	1.833° A
L	2→3	9.95000000	72.99 ∡	91.833° V	2.08 ∡	1.833° A
C	3→0	0.00005000	423.23 ∡	86.315° V	0.07 ∡	176.315° A
C	3→0	0.00010000	423.23 ∡	86.315° V	0.15 ∡	176.315° A
R	3→0	15.93800000	423.23 ∡	86.315° V	2.31 ∡	1.300° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	20.52 + j	237.074	19.52 + j	237.074
L	2→3	9.95000000	19.52 + j	237.074	19.52 + j	202.064
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	15.93800000	15.94 + j	182.740	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	2.08480000	0	1	1.83300000
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	15.93800000	3	0	182.74000000



WCAP - WRDT Tower 3 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

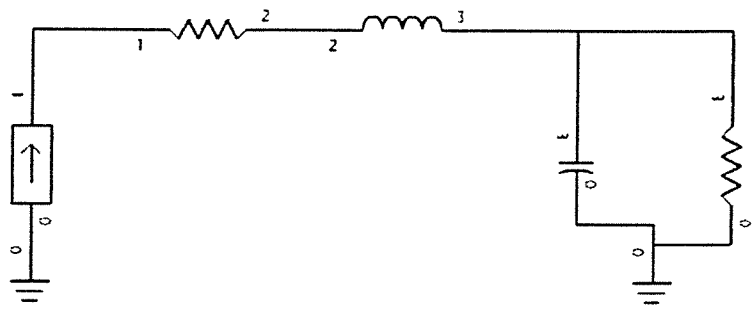
Node:	1	524.9358 ∡	-23.2106° V
Node:	2	523.9066 ∡	-22.9836° V
Node:	3	476.5678 ∡	-25.8251° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	2.32 ∡	-86.742° V	[illegible]	[illegible]
L	2→3	6.55000000	53.43 ∡	3.258° V	2.32 ∡	-86.742° A
C	3→0	0.00005000	476.57 ∡	-25.825° V	0.08 ∡	64.175° A
C	3→0	0.00010000	476.57 ∡	-25.825° V	0.17 ∡	64.175° A
R	3→0	83.16800000	476.57 ∡	-25.825° V	2.54 ∡	-89.500° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	100.92 + j	202.688	99.92 + j	202.688
L	2→3	6.55000000	99.92 + j	202.688	99.92 + j	179.641
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	83.16800000	83.17 + j	168.090	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000		0
I	2.31840000	0	1	273.25800000
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	83.16800000	3	0	168.09000000



WCAP - WRDT Tower 4 DA-D

WCAP OUTPUT AT FREQUENCY: 0.560 MHz

NODE VOLTAGES

Node:	1	409.7585 ∡	-25.7032° V
Node:	2	408.8669 ∡	-25.4670° V
Node:	3	402.9368 ∡	-25.9114° V

	WCAP PART		BRANCH VOLTAGE		BRANCH CURRENT	
R	1→2	1.00000000	1.91 ∡	-87.727° V	1.91 ∡	-87.727° A
L	2→3	1.00000000	6.71 ∡	2.273° V	1.91 ∡	-87.727° A
C	3→0	0.00005000	402.94 ∡	-25.911° V	0.07 ∡	64.089° A
R	3→0	93.48700000	402.94 ∡	-25.911° V	1.97 ∡	-88.700° A

	WCAP PART		FROM IMPEDANCE		TO IMPEDANCE	
R	1→2	1.00000000	100.74 + j	189.652	99.74 + j	189.652
L	2→3	1.00000000	99.74 + j	189.652	99.74 + j	186.134
C	3→0	0.00005000	0.00 - j	5684.105	0.00 + j	0.000
R	3→0	93.48700000	93.49 + j	181.820	0.00 + j	0.000

WCAP INPUT DATA:

	0.5600	0.00000000	0	
I	1.90810000	0	1	272.27300000
R	1.00000000	1	2	0.00000000
L	1.00000000	2	3	0.00000000
C	0.00005000	3	0	
R	93.48700000	3	0	181.82000000

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 on the carrier frequency 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 October 26, 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	10/26/11	1413	110	1st Baptist Church lot
2	4.63	41-55-54.3	83-24-53.8	10/26/11	1417	90	NE corner Lorain & John Rolfe
3	5.43	41-56-19.3	83-24-46.3	10/26/11	1423	86	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	10/26/11	1451	3.9	623 Norwood Drive
2	5.00	41-54-05.2	83-22-09.2	10/26/11	1458	3.6	Water Treatment Plant
3	5.68	41-54-10.6	83-21-38.6	10/26/11	1503	2.2	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	10/26/11	1516	43	371 Holly Glen St.
2	1.9	41-53-19.6	83-24-17.1	10/26/11	0901	36	15207 Hull Road
3	2.65	41-53-17.0	83-23-44.9	10/26/11	0908	22	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	10/26/11	0916	4.1	Hull Rd. and Albain Rd.
2	3.09	41-52-21.6	83-24-00.4	10/26/11	0925	4.7	SB I-75 0.1 mi. south of Albain Rd.
3	4.02	41-52-02.0	83-23-27.7	10/26/11	0934	2.8	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	10/26/11	0954	5.8	I-75N service plaza
2	3.81	41-51-41.6	83-24-14.8	10/26/11	0938	4.8	13308 Lighthouse Rd.
3	4.74	41-51-16.6	83-23-54.0	10/26/11	1004	4.4	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	10/26/11	1118	4.3	Laplaisance Rd. 210 ft. SW of 12904
2	4.91	41-50-51.9	83-25-11.6	10/26/11	1014	2.2	5633 N. Otter Creek Rd.
3	5.42	41-50-34.5	83-25-08.5	10/26/11	1021	3.0	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	10/26/11	1046	7.0	Across from 4856 Laplaisance Rd.
2	5.52	41-50-35.3	83-26-31.9	10/26/11	1038	4.6	Stein Rd. at RR Crossing Sign
3	7.11	41-49-44.9	83-26-47.9	10/26/11	1106	3.6	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	10/26/11	0946	2.7	4118 S. Otter Creek Rd.
2	6.17	41-50-44.4	83-28-04.0	10/26/11	1054	1.2	12294 S. Dixie Hwy.
3	7.49	41-50-05.9	83-28-38.7	10/26/11	1058	1.4	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	10/26/11	1127	8.4	3534 N. Otter Creek Rd.
2	5.52	41-51-49.6	83-28-58.4	10/26/11	1139	5.6	13546 Dunlap Rd.
3	7.68	41-51-12.0	83-30-15.3	10/26/11	1144	3.1	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	10/26/11	1131	3.3	2843 N. Otter Creek Rd.
2	6.66	41-52-30.1	83-30-19.3	10/26/11	1259	1.7	1906 S. Otter Creek Rd.
3	7.34	41-52-24.7	83-30-46.1	10/26/11	1306	2.5	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	10/26/11	1331	16.0	15795 Virginia Court
2	6.74	41-54-36.7	83-30-16.9	10/26/11	1316	11.0	2112 Strausburg Rd.
3	8.71	41-54-57.3	83-31-38.2	10/26/11	1321	8.0	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	10/26/11	1335	13.0	16000 Hodge Rd.
2	4.71	41-55-05.6	83-28-16.8	10/26/11	1341	10.0	1500 Raisenville Rd.
3	7.02	41-55-52.3	83-29-34.4	10/26/11	1347	5.8	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