Federal Communications Commission
Washington, D. C. 20554

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

FOR FCC USE ONLY

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.)

FOR COMMISSION USE ONLY
FILE NO. BMML-20140318AHI

SECTION I - APPLICANT FEE INFORMATION

Accepted/Filed
MAR 18 2014
FCC Office of the Secretary

1. PAYOR NAME (Last, First, Middle Initial)
CC Licenses, LLC

MAILING ADDRESS (Line 1) (Maximum 35 characters)
2625 S. Memorial Dr

MAILING ADDRESS (Line 2) (Maximum 35 characters)
Suite A

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Tulsa	OK	74129

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
918-664-4581	WDIA	FID 69569

2. A. Is a fee submitted with this application? ☑ Yes ☐ No

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

☐ Governmental Entity ☐ Noncommercial educational licensee ☐ Other (Please explain):

0014042816

C. If Yes, provide the following information:

BZ-19910826AB

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 O R	0 0 0 1	$ 730.00	

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 M R	0 0 0 1	$ 635.00	

	TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
ADD ALL AMOUNTS SHOWN IN COLUMN C, AND ENTER THE TOTAL HERE. THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.	$ 1365.00	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT CC Licenses, LLC		
MAILING ADDRESS 2625 S. Memorial Dr, Ste A		
CITY Tulsa	STATE OK	ZIP CODE 74129

2. This application is for:

☑ Commercial ☐ Noncommercial

☑ AM Directional ☐ AM Non-Directional

Call letters	Community of License	Construction Permit File No.	Modification of Construction Permit File No(s).	Expiration Date of Last Construction Permit
WDIA	Memphis, TN			

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

☐ Yes ☐ No

If No, explain in an Exhibit.

Exhibit No.
NA

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

☐ Yes ☐ No

If No, state exceptions in an Exhibit.

Exhibit No.

5. Apart from the changes already reported, has any cause or circumstance arisen since the grant of the underlying construction permit which would result in any statement or representation contained in the construction permit application to be now incorrect?

☐ Yes ☐ No

If Yes, explain in an Exhibit.

Exhibit No.

6. Has the permittee filed its Ownership Report (FCC Form 323) or ownership certification in accordance with 47 C.F.R. Section 73.3615(b)?

☐ Yes ☐ No

☐ Does not apply

If No, explain in an Exhibit.

Exhibit No.

7. Has an adverse finding been made or an adverse final action been taken by any court or administrative body with respect to the applicant or parties to the application in a civil or criminal proceeding, brought under the provisions of any law relating to the following: any felony; mass media related antitrust or unfair competition; fraudulent statements to another governmental unit; or discrimination?

☐ Yes ☑ No

If the answer is Yes, attach as an Exhibit a full disclosure of the persons and matters involved, including an identification of the court or administrative body and the proceeding (by dates and file numbers), and the disposition of the litigation. Where the requisite information has been earlier disclosed in connection with another application or as required by 47 U.S.C. Section 1.65(c), the applicant need only provide: (i) an identification of that previous submission by reference to the file number in the case of an application, the call letters of the station regarding which the application or Section 1.65 information was filed, and the date of filing; and (ii) the disposition of the previously reported matter.

Exhibit No.

8. Does the applicant, or any party to the application, have a petition on file to migrate to the expanded band (1605-1705 kHz) or a permit or license either in the existing band or expanded band that is held in combination (pursuant to the 5 year holding period allowed) with the AM facility proposed to be modified herein?

☐ Yes ☑ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

The APPLICANT hereby waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because use of the same, whether by license or otherwise, and requests and authorization in accordance with this application. (See Section 304 of the Communications Act of 1934, as amended).

The APPLICANT acknowledges that all the statements made in this application and attached exhibits are considered material representations and that all the exhibits are a material part hereof and are incorporated herein as set out in full in

CERTIFICATION

1. By checking Yes, the applicant certifies, that, in the case of an individual applicant, he or she is not subject to a denial of federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. Section 862, or, in the case of a non-individual applicant (e.g., corporation, partnership or other unincorporated association), no party to the application is subject to a denial of federal benefits that includes FCC benefits pursuant to that section. For the definition of a "party" for these purposes, see 47 C.F.R. Section 1.2002(b).

☑ Yes ☐ No

2. I certify that the statements in this application are true, complete, and correct to the best of my knowledge and belief, and are made in good faith.

Name	Signature	
Stephen G. Davis		
Title	**Date**	**Telephone Number**
Senior Vice President	3/17/14	918-664-4581

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

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
CC Licenses, LLC

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☑ Station License ☐ Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts Night	Power in kilowatts Day
WDIA		1070	Unlimited	5.0	50.0

2. Station location

State	City or Town
TN	Memphis

3. Transmitter location

State	County	City or Town	Street address (or other identification)
TN	Shelby	Memphis	5231 O. K. Robertson Road

4. Main studio location

State	County	City or Town	Street address (or other identification)
TN	Shelby	Memphis	2650 Thousand Oaks Blvd, Ste 4100

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

State	County	City or Town	Street address (or other identification)
TN	Shelby	Memphis	2650 Thousand Oaks Blvd, Ste 4100

6. Has type-approved stereo generating equipment been installed? ☐ Yes ☑ No

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

Attach as an Exhibit a detailed description of the sampling system as installed. Exhibit No. ITEM 5

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
10.39	32.45

Measured antenna or common point resistance (in ohms) at operating frequency Night	Day	Measured antenna or common point reactance (in ohms) at operating frequency Night	Day
50	50	-j7	-j7

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
Twr 1 ASRN 1051772	109.0	55.8	0.519	1.029		
Twr 2 ASRN 1051773	15.0	0.0	0.523	1.000		
Twr 3 ASRN 1051774	0.00	-12.3	1.000	0.647		
Twr 4 ASRN 1051775	-15.3	---	0.553	---		
Twr 5 ASRN 1051776	77.9	---	0.553	---		
Twr 6 ASRN 1051777	94.3	41.6	1.026	0.652		

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

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9. Description of antenna system ((f directional antenna is used, the information requested below should be given for each element of the array. Use separate sheets if necessary.)

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
See Exhibit 2	See Exhibit 2	See Exhibit 2	See Exhibit 2	Exhibit No.

Excitation ☑ Series ☐ Shunt

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

North Latitude				West Longitude			
	35 °	16 '	05 "		90 °	01 '	03 "

If not fully described above, attach as an Exhibit further details and dimensions including any other antenna mounted on tower and associated isolation circuits. Exhibit No.

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

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

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

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)
Allan Brace	[signature]
Address (include ZIP Code) 2625 S. Memorial Suite A Tulsa, OK 74129	Date 3/14/14 Telephone No. (Include Area Code) 918-664-4581

☑ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☐ Technical Consultant

☐ Other (specify)

APPLICATION FOR LICENSE INFORMATION

WDIA (AM)

CC LICENSES, LLC

MEMPHIS, TN

FID 69569

1070 KHZ 50KW D, 5KW N, DA-2

January 31, 2014

APPLICATION FOR LICENSE INFORMATION
WDIA (AM)
MEMPHIS, TN

1070KHZ 50KW D, 5KW N, DA-2

Table of Contents

Executive Summary

This engineering exhibit has been prepared in support of an application for licensing for radio station WDIA, Memphis Tennessee, Facility ID #69569. Measurements included comply with the requirements of Rule Section 73.151c.

The towers and ground system remain as described in current license BZ910826AB. The transmission lines, sample lines, antenna tuning units and phasing system have been replaced with new components of modern design and the system adjusted to operating parameters computed using the Moment Method process as described in Rule Section 73.151c. Mininec Broadcast Professional version 14.6 by EM Scientific Inc. was used in the analysis

The system has been adjusted to produce antenna monitor parameters within +/- 5% in ratio and +/-3 degrees in phase.

The measurements and calculations contained in this report were made by the undersigned and any questions regarding the report should be addressed to:

John F. Warner
johnwarner@clearchannel.com

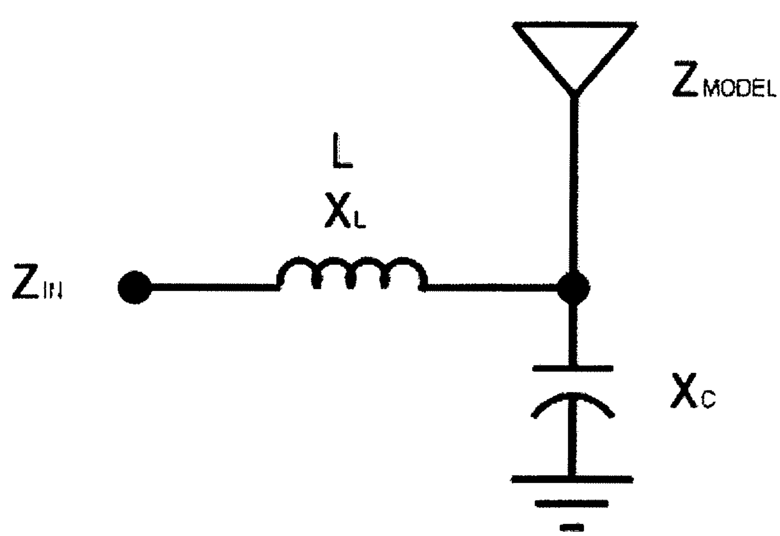
443-255-5299

Analysis of Tower Impedance Measurements to Verify Method of Moments Model

Impedance measurements were made of the individual towers with the other tower bases Open. Measurements were made using a Hewlett-Packard 4396A network analyzer and a Tunwall Radio directional coupler in a calibrated measurement system. Measurements were made immediately adjacent to the torroidal antenna sampling transformers, inside the antenna coupling units. These measured values were related to the modeled values obtained using the WCAP software package from Westberg Consulting. WCAP is based on the SPICE nodal analysis program. Heights of the towers were adjusted as permitted by Rule Section 73.151(c)(1). The tower radii were modeled at their actual values. The towers were segmented so that each segment is less than ten (10) degrees in length.

Tower	Actual Height Degrees	Modeled Height Degrees	Model Percent of Height	Model Equivalent Radius Meters	Model Percent of Radius
1	90.1	97.8	108.5	.218	100
2	90.1	96.9	107.5	.218	100
3	90.1	96.4	107.0	.218	100
4	90.1	94.4	104.8	.218	100
5	90.1	95.1	105.5	.218	100
6	90.1	96.8	107.4	.218	100

The model was verified by comparison of modeled to measured tower impedances. The tower resistance and reactance were measured immediately adjacent to the torroidal base sampling transformers, inside the antenna tuning unit cabinets. The measured and modeled impedances were correlated using the Westberg Consulting WCAP Pro software program. WCAP is based on the SPICE nodal analysis program. The shunt capacitive reactance of the tower base insulator is represented in the drawing below as Xc. The series inductive reactance of the tower feed conductor is represented as Xl. Z model represents the modeled impedance of the tower and Zin represents the impedance measured at the sampling point. In the following WCAP tabulations, the modeled impedance is represented between nodes 2-0. The measured impedance is represented between nodes 1-3. Node 0 represents ground. The calculated reference point impedances appear under the "TO NODE IMPEDANCE" columns of the WCAP calculations, following the phantom 1.0 ohm resistors (R 1-2) that were included in series with the drive current sources (I 0-1) to provide calculation points for the impedances.



Comparison of Measured to Modeled Base Impedances

Tower	L (uh)	Xl (+j)	Xc (-j)	Z modeled	Z in modeled	Z measured
1	3.272	+j22	-j5950	53.4 +j62	54.5 +j84.2	53.7 +j84
2	5.667	+j38.1	-j5950	52.4 +j56.8	53.4 +j95.0	52.9 +j94.9
3	5.1	+j34.3	-j5950	51.7 +j53.4	52.6 +j87.7	52.5 +j87.7
4	5.5	+j37	-j5950	47.0 +j42.6	47.7 +j79.5	47.5 +j79.6
5	4.64	+j31.2	-j5950	49.2 +j46.6	50.0 +j77.7	50.1 +j77.8
6	3.79	+j25.5	-j5950	52.6 +j55.7	53.6 +j81.2	53.4 +j81.2

The modeled and measured impedances agree within +/-2 Ohms and +/-4% as required by the rules when the effects of the shunt capacitance (Xc) and the series hookup reactance (Xl) are considered.

Tower 1 base, others open

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 100823.5259 ∡ 56.5832° V

Node: 2 82684.6653 ∡ 48.7424° V

Node: 3 100276.2744 ∡ 57.0601° V

WCAP PART			BRANCH VOLTAGE		BRANCH CURRENT	
R	2→0	53.40000000	82684.67 ∡	48.742° V	1010.49 ∡	-0.520° A
R	1→3	1.00000000	1000.00 ∡	0.000° V	1000.00 ∡	0.000° A
L	3→2	3.27200000	21997.68 ∡	90.000° V	1000.00 ∡	0.000° A
C	2→0	0.00002500	82684.67 ∡	48.742° V	13.90 ∡	138.742° A

WCAP PART			FROM IMPEDANCE		TO IMPEDANCE	
R	2→0	53.40000000	53.40 + j	62.000	0.00 + j	0.000
R	1→3	1.00000000	55.53 + j	84.156	**54.53 + j**	**84.156**
L	3→2	3.27200000	54.53 + j	84.156	54.53 + j	62.158
C	2→0	0.00002500	-0.00 - j	5949.717	0.00 + j	0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	1000.00000000	0	1	0.00000000
R	53.40000000	2	0	62.00000000
R	1.00000000	1	3	0.00000000
L	3.27200000	3	2	0.00000000
C	0.00002500	2	0	

Tower 2 base, others open

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 109454.0197 ∡ 60.1910° V

Node: 2 78020.4975 ∡ 46.7979° V

Node: 3 108960.3638 ∡ 60.6472° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	52.40000000	78020.50 ∡ 46.798° V	1009.60 ∡ -0.509° A
R	1→3	1.00000000	1000.00 ∡ 0.000° V	1000.00 ∡ 0.000° A
L	3→2	5.66700000	38099.29 ∡ 90.000° V	1000.00 ∡ -0.000° A
C	2→0	0.00002500	78020.50 ∡ 46.798° V	13.11 ∡ 136.798° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	52.40000000	52.40 + j 56.800	0.00 + j 0.000
R	1→3	1.00000000	54.41 + j 94.972	**53.41 + j 94.972**
L	3→2	5.66700000	53.41 + j 94.972	53.41 + j 56.873
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	1000.00000000	0	1	0.00000000
R	52.40000000	2	0	56.80000000
R	1.00000000	1	3	0.00000000
L	5.66700000	3	2	0.00000000
C	0.00002500	2	0	

Tower 3 base, others open

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 102809.6936 ∡ 58.5531° V

Node: 2 74996.9003 ∡ 45.4243° V

Node: 3 102291.5432 ∡ 59.0310° V

WCAP PART			BRANCH VOLTAGE		BRANCH CURRENT	
R	2→0	51.70000000	74996.90 ∡	45.424° V	1009.02 ∡	-0.502° A
R	1→3	1.00000000	1000.00 ∡	0.000° V	1000.00 ∡	0.000° A
L	3→2	5.10000000	34287.34 ∡	90.000° V	1000.00 ∡	0.000° A
C	2→0	0.00002500	74996.90 ∡	45.424° V	12.61 ∡	135.424° A

WCAP PART			FROM IMPEDANCE		TO IMPEDANCE	
R	2→0	51.70000000	51.70 + j	53.400	0.00 + j	0.000
R	1→3	1.00000000	53.64 + j	87.709	**52.64 + j**	**87.709**
L	3→2	5.10000000	52.64 + j	87.709	52.64 + j	53.422
C	2→0	0.00002500	0.00 - j	5949.717	0.00 + j	0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	1000.00000000	0	1	0.00000000
R	51.70000000	2	0	53.40000000
R	1.00000000	1	3	0.00000000
L	5.10000000	3	2	0.00000000
C	0.00002500	2	0	

T4 base, others open

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 93260.9598 ∡ 58.5083° V

Node: 2 63932.0820 ∡ 41.7228° V

Node: 3 92742.5047 ∡ 59.0351° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	47.03900000	63932.08 ∡ 41.723° V	1007.18 ∡ -0.456° A
R	1→3	1.00000000	1000.00 ∡ 0.000° V	1000.00 ∡ 0.000° A
L	3→2	5.50000000	36976.55 ∡ 90.000° V	1000.00 ∡ 0.000° A
C	2→0	0.00002500	63932.08 ∡ 41.723° V	10.75 ∡ 131.723° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	47.03900000	47.04 + j 42.621	0.00 + j 0.000
R	1→3	1.00000000	48.72 + j 79.525	**47.72 + j 79.525**
L	3→2	5.50000000	47.72 + j 79.525	47.72 + j 42.549
C	2→0	0.00002500	0.01 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	1000.00000000	0	1	0.00000000
R	47.03900000	2	0	42.62100000
R	1.00000000	1	3	0.00000000
L	5.50000000	3	2	0.00000000
C	0.00002500	2	0	

T5 base, others open

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 92967.9838 ∡ 56.7480° V

Node: 2 68298.3530 ∡ 42.9679° V

Node: 3 92423.4453 ∡ 57.2665° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	49.20000000	68298.35 ∡ 42.968° V	1007.86 ∡ -0.478° A
R	1→3	1.00000000	1000.00 ∡ 0.000° V	1000.00 ∡ 0.000° A
L	3→2	4.64000000	31194.76 ∡ 90.000° V	1000.00 ∡ 0.000° A
C	2→0	0.00002500	68298.35 ∡ 42.968° V	11.48 ∡ 132.968° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	49.20000000	49.20 + j 46.600	0.00 + j 0.000
R	1→3	1.00000000	50.98 + j 77.746	**49.98 + j 77.746**
L	3→2	4.64000000	49.98 + j 77.746	49.98 + j 46.551
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	1000.00000000	0	1	0.00000000
R	49.20000000	2	0	46.60000000
R	1.00000000	1	3	0.00000000
L	4.64000000	3	2	0.00000000
C	0.00002500	2	0	

T6 base, others open

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 97870.3453 ∡ 56.0944° V

Node: 2 77331.9453 ∡ 46.1283° V

Node: 3 97316.0588 ∡ 56.5831° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	52.60000000	77331.95 ∡ 46.128° V	1009.41 ∡ -0.511° A
R	1→3	1.00000000	1000.00 ∡ 0.000° V	1000.00 ∡ 0.000° A
L	3→2	3.79000000	25480.20 ∡ 90.000° V	1000.00 ∡ 0.000° A
C	2→0	0.00002500	77331.95 ∡ 46.128° V	13.00 ∡ 136.128° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	52.60000000	52.60 + j 55.700	0.00 + j 0.000
R	1→3	1.00000000	54.59 + j 81.228	**53.59 + j 81.228**
L	3→2	3.79000000	53.59 + j 81.228	53.59 + j 55.748
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	1000.00000000	0	1	0.00000000
R	52.60000000	2	0	55.70000000
R	1.00000000	1	3	0.00000000
L	3.79000000	3	2	0.00000000
C	0.00002500	2	0	

Tower 1 driven, others open

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.07	**53.424**	**61.968**	81.818	49.2	3.1216	-5.768	-1.337

GEOMETRY

Wire coordinates in degrees; other dimensions in meters

Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.218	12
		0	0	97.8		
2	none	90.	190.2	0	.218	12
		90.	190.2	96.9		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.4		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	94.4		
5	none	420.	270.2	0	.218	12
		420.	270.2	95.1		
6	none	210.	270.2	0	.218	12
		210.	270.2	96.8		

Number of wires = 6

current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	7.86667	1	8.15
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.07	0	1	.0218519	.0226389

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	13	0	-5,950.	0	0	0
2	25	0	-5,950.	0	0	0
3	37	0	-5,950.	0	0	0
4	49	0	-5,950.	0	0	0
5	61	0	-5,950.	0	0	0

Tower 2 driven, others open

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 13, sector 1							
1.07	**52.426**	**56.846**	77.33	47.3	2.8888	-6.2725	-1.1686

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.218	12
		0	0	97.8		
2	none	90.	190.2	0	.218	12
		90.	190.2	96.9		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.4		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	94.4		
5	none	420.	270.2	0	.218	12
		420.	270.2	95.1		
6	none	210.	270.2	0	.218	12
		210.	270.2	96.8		

Number of wires = 6
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	7.86667	1	8.15
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.07	0	1	.0218519	.0226389

Sources

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

Lumped loads

passive load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	circuit
1	25	0	-5,950.	0	0	0
2	37	0	-5,950.	0	0	0
3	49	0	-5,950.	0	0	0
4	61	0	-5,950.	0	0	0
5	1	0	-5,950.	0	0	0

Tower 3 driven, others open

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 25, sector 1							
1.07	**51.728**	**53.439**	74.374	45.9	2.7404	-6.6455	-1.0596

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.218	12
		0	0	97.8		
2	none	90.	190.2	0	.218	12
		90.	190.2	96.9		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.4		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	94.4		
5	none	420.	270.2	0	.218	12
		420.	270.2	94.4		
6	none	210.	270.2	0	.218	12
		210.	270.2	96.8		

Number of wires = 6
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	7.86667	1	8.15
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.07	0	1	.0218519	.0226389

Sources

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

Lumped loads

passive load circuit	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	
1	37	0	-5,950.	0	0	0
2	49	0	-5,950.	0	0	0
3	61	0	-5,950.	0	0	0
4	1	0	-5,950.	0	0	0
5	13	0	-5,950.	0	0	0

Tower 4 driven, others open

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 37, sector 1							
1.07	47.039	42.621	63.476	42.2	2.3507	-7.8915	-.77014

GEOMETRY

Wire coordinates in degrees; other dimensions in meters

Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.218	12
		0	0	97.8		
2	none	90.	190.2	0	.218	12
		90.	190.2	96.9		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.4		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	94.4		
5	none	420.	270.2	0	.218	12
		420.	270.2	95.1		
6	none	210.	270.2	0	.218	12
		210.	270.2	96.8		

Number of wires = 6

current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	7.86667	1	8.15
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.07	0	1	.0218519	.0226389

Sources

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

Lumped loads

passive load circuit	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	
1	61	0	-5,950.	0	0	0
2	1	0	-5,950.	0	0	0
3	13	0	-5,950.	0	0	0
4	25	0	-5,950.	0	0	0
5	49	0	-5,950.	0	0	0

Tower 5 driven, others open

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 49, sector 1							
1.07	**49.225**	**46.6**	67.783	43.4	2.4792	-7.4291	-.86586

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

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.218	12
		0	0	97.8		
2	none	90.	190.2	0	.218	12
		90.	190.2	96.9		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.4		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	94.4		
5	none	420.	270.2	0	.218	12
		420.	270.2	95.1		
6	none	210.	270.2	0	.218	12
		210.	270.2	96.8		

Number of wires = 6
current nodes = 72

Individual wires	minimum wire	minimum value	maximum wire	maximum value
segment length	4	7.86667	1	8.15
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION
Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.07	0	1	.0218519	.0226389

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	61	0	-5,950.	0	0	0
2	1	0	-5,950.	0	0	0
3	13	0	-5,950.	0	0	0
4	25	0	-5,950.	0	0	0
5	37	0	-5,950.	0	0	0

Tower 6 driven, others open

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 61, sector 1							
1.07	**52.649**	**55.696**	76.642	46.6	2.8273	-6.4216	-1.1236

GEOMETRY

Wire coordinates in degrees; other dimensions in meters

Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.218	12
		0	0	97.8		
2	none	90.	190.2	0	.218	12
		90.	190.2	96.9		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.4		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	94.6		
5	none	420.	270.2	0	.218	12
		420.	270.2	95.1		
6	none	210.	270.2	0	.218	12
		210.	270.2	96.8		

Number of wires = 6

current nodes = 72

Individual wires	minimum wire	minimum value	maximum wire	maximum value
segment length	4	7.88333	1	8.15
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION

Frequencies (MHz)

no.	frequency lowest	step	no. of steps	segment length (wavelengths) minimum	maximum
1	1.07	0	1	.0218982	.0226389

Sources

source	node	sector	magnitude	phase	type
1	61	1	1.	0	voltage

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-5,950.	0	0	0
2	13	0	-5,950.	0	0	0
3	25	0	-5,950.	0	0	0
4	37	0	-5,950.	0	0	0
5	49	0	-5,950.	0	0	0

Derivation of Operating Parameters for Daytime Antenna Array

Following verification of the moment method model of the individual array elements, by comparison of the measured and modeled base impedances, directional antenna array base parameters were calculated. Calculations were made to determine the complex voltage sources which when applied to the base of each array element produce current moment sums which when normalized, equate to the theoretical field parameters of the authorized directional pattern. Using these voltages, the tower currents were calculated. The currents at the ATU sampling points were related to those of the moment method model by using the WCAP Pro nodal analysis program from Westberg Consulting. The assumptions that were used for the single tower calculations were used in the directional array case as well. In the following WCAP calculations node 1 represents the reference point, node 2 represents the tower feedpoint, and node 0 represents ground. The tower operating impedance is represented from node 2 to ground ((R 2-0). The current magnitude and phases at the sample point are represented across the phantom one (1) ohm resistor which was added to facilitate calculation. The value shown at R 1-3 has been rounded by the program. The actual current values shown as "I" in the "WCAP INPUT DATA" represent the values before rounding and were used in the calculation of antenna monitor amplitude and phase indications to yield greater accuracy.

In so much as the sample lines are equal in length and the sample torroids responses are identical, the antenna monitor currents and phases have been calculated directly from the reference point currents and phases. The antenna monitor reference is Tower #2. . The antenna monitor is a Potomac Instruments Model 1901. The calibration of the monitor was verified to be within manufacturers specifications when compared to a Hewlett-Packard 4396A network analyzer.

Towers 4 and 5 are not used in the daytime array and have been detuned by a reactive element inserted between the tower bases and ground.

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.07 MHz

tower	field ratio magnitude	phase (deg)
1	1.	70.
2	1.	10.
3	.6	0
4	1.E-07	0
5	1.E-07	0
6	.6	60.

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	983.142	121.	20.5144	73.4
13	1,781.91	52.5	19.9966	17.2
25	668.324	24.8	12.8728	5.1
37	57.5241	290.9	.104086	24.4
49	44.5854	322.2	.0824891	58.6
61	179.204	169.4	12.965	59.5

Sum of square of source currents = 2,309.05

Total power = 50,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00735319	-.00813564
Y(1, 2)	.00466856	.00222599
Y(1, 3)	.00154864	-.000872165
Y(1, 4)	6.7132E-06	.000590454
Y(1, 5)	-.000204816	.000927032
Y(1, 6)	.0027782	-.00162721
Y(2, 1)	.00466853	.00222607
Y(2, 2)	.00864191	-.00863415

Y(2, 3)	.00293144	-.0015364
Y(2, 4)	-.000250185	.000989129
Y(2, 5)	-.000270184	.000876084
Y(2, 6)	.00310309	-.00108615
Y(3, 1)	.00154864	-.000872131
Y(3, 2)	.00293145	-.00153639
Y(3, 3)	.0100611	-.00879585
Y(3, 4)	.00360012	-.00136142
Y(3, 5)	.00357758	-.000651427
Y(3, 6)	.00610473	.00244596
Y(4, 1)	6.7132E-06	.000590456
Y(4, 2)	-.000250186	.00098914
Y(4, 3)	.00360013	-.00136136
Y(4, 4)	.0101261	-.00909655
Y(4, 5)	.00546694	.00401029
Y(4, 6)	.00193933	-.000627503
Y(5, 1)	-.000204815	.000927043
Y(5, 2)	-.000270183	.000876106
Y(5, 3)	.0035776	-.000651408
Y(5, 4)	.00546699	.00401022
Y(5, 5)	.00991599	-.00890345
Y(5, 6)	.0032783	-.00128506
Y(6, 1)	.00277821	-.00162719
Y(6, 2)	.00310311	-.00108616
Y(6, 3)	.00610475	.00244591
Y(6, 4)	.00193934	-.000627554
Y(6, 5)	.00327829	-.0012851
Y(6, 6)	.00954303	-.00874091

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	53.6722	62.0972
Z(1, 2)	26.9267	-27.0064
Z(1, 3)	-18.6032	3.73198
Z(1, 4)	10.0383	-5.18728

Z(1, 5)	11.218	-.346042
Z(1, 6)	-17.6525	-7.52424
Z(2, 1)	26.9262	-27.0067
Z(2, 2)	52.5962	56.9808
Z(2, 3)	-17.4919	-7.39497
Z(2, 4)	10.8121	-.263093
Z(2, 5)	11.3387	.815344
Z(2, 6)	-18.4415	-5.75488
Z(3, 1)	-18.6031	3.73203
Z(3, 2)	-17.4919	-7.39491
Z(3, 3)	51.8926	53.6046
Z(3, 4)	-16.3048	-7.24332
Z(3, 5)	-17.6723	-5.7134
Z(3, 6)	26.9777	-26.7435
Z(4, 1)	10.0382	-5.18734
Z(4, 2)	10.8121	-.263185
Z(4, 3)	-16.305	-7.24311
Z(4, 4)	47.2448	42.7431
Z(4, 5)	24.7782	-24.2649
Z(4, 6)	-17.6269	3.29809
Z(5, 1)	11.2179	-.34611
Z(5, 2)	11.3387	.815265
Z(5, 3)	-17.6724	-5.71321
Z(5, 4)	24.7785	-24.2647
Z(5, 5)	49.3541	46.7349
Z(5, 6)	-17.1319	-7.31664
Z(6, 1)	-17.6525	-7.52413
Z(6, 2)	-18.4415	-5.75483
Z(6, 3)	26.9779	-26.7434
Z(6, 4)	-17.6269	3.29789
Z(6, 5)	-17.1318	-7.31679
Z(6, 6)	52.7986	55.8842

CURRENT NODES

	coordinates (degrees)			connections		node
wire	X	Y	Z	end1	end2	no.
1	0	0	0	GND	1	1
1	0	0	8.15	1	1	2
1	0	0	16.3	1	1	3
1	0	0	24.45	1	1	4
1	0	0	32.6	1	1	5
1	0	0	40.75	1	1	6
1	0	0	48.9	1	1	7
1	0	0	57.05	1	1	8
1	0	0	65.2	1	1	9
1	0	0	73.35	1	1	10
1	0	0	81.5	1	1	11
1	0	0	89.65	1	END	12
2	-88.5776	15.9376	0	GND	2	13
2	-88.5776	15.9376	8.075	2	2	14
2	-88.5776	15.9376	16.15	2	2	15
2	-88.5776	15.9376	24.225	2	2	16
2	-88.5776	15.9376	32.3	2	2	17
2	-88.5776	15.9376	40.375	2	2	18
2	-88.5776	15.9376	48.45	2	2	19
2	-88.5776	15.9376	56.525	2	2	20
2	-88.5776	15.9376	64.6	2	2	21
2	-88.5776	15.9376	72.675	2	2	22
2	-88.5776	15.9376	80.75	2	2	23
2	-88.5776	15.9376	88.825	2	END	24
3	-87.8586	225.928	0	GND	3	25
3	-87.8586	225.928	8.03333	3	3	26
3	-87.8586	225.928	16.0667	3	3	27
3	-87.8586	225.928	24.1	3	3	28
3	-87.8586	225.928	32.1333	3	3	29
3	-87.8586	225.928	40.1667	3	3	30
3	-87.8586	225.928	48.2	3	3	31
3	-87.8586	225.928	56.2333	3	3	32
3	-87.8586	225.928	64.2667	3	3	33
3	-87.8586	225.928	72.3	3	3	34
3	-87.8586	225.928	80.3333	3	3	35
3	-87.8586	225.928	88.3667	3	END	36

4	-87.1077	435.932	0	GND	4	37
4	-87.1077	435.932	7.86667	4	4	38
4	-87.1077	435.932	15.7333	4	4	39
4	-87.1077	435.932	23.6	4	4	40
4	-87.1077	435.932	31.4667	4	4	41
4	-87.1077	435.932	39.3333	4	4	42
4	-87.1077	435.932	47.2	4	4	43
4	-87.1077	435.932	55.0667	4	4	44
4	-87.1077	435.932	62.9333	4	4	45
4	-87.1077	435.932	70.8	4	4	46
4	-87.1077	435.932	78.6667	4	4	47
4	-87.1077	435.932	86.5333	4	END	48
5	1.46622	419.997	0	GND	5	49
5	1.46622	419.997	7.925	5	5	50
5	1.46622	419.997	15.85	5	5	51
5	1.46622	419.997	23.775	5	5	52
5	1.46622	419.997	31.7	5	5	53
5	1.46622	419.997	39.625	5	5	54
5	1.46622	419.997	47.55	5	5	55
5	1.46622	419.997	55.475	5	5	56
5	1.46622	419.997	63.4	5	5	57
5	1.46622	419.997	71.325	5	5	58
5	1.46622	419.997	79.25	5	5	59
5	1.46622	419.997	87.175	5	END	60
6	.733109	209.999	0	GND	6	61
6	.733109	209.999	8.06667	6	6	62
6	.733109	209.999	16.1333	6	6	63
6	.733109	209.999	24.2	6	6	64
6	.733109	209.999	32.2667	6	6	65
6	.733109	209.999	40.3333	6	6	66
6	.733109	209.999	48.4	6	6	67
6	.733109	209.999	56.4667	6	6	68
6	.733109	209.999	64.5333	6	6	69
6	.733109	209.999	72.6	6	6	70
6	.733109	209.999	80.6667	6	6	71
6	.733109	209.999	88.7333	6	END	72

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

wire segs	caps	Distance	Angle	Z	radius	
1	none	0	0	0	.218	12
		0	0	97.8		
2	none	90.	190.2	0	.218	12
		90.	190.2	96.9		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.4		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	94.4		
5	none	420.	270.2	0	.218	12
		420.	270.2	95.1		
6	none	210.	270.2	0	.218	12
		210.	270.2	96.8		

Number of wires = 6
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	7.86667	1	8.15
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION
Frequencies (MHz)

frequency			no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.07	0	1	.0218519	.0226389

Sources

source	node	sector	magnitude	phase	type
1	1	1	1,390.37	121.	voltage
2	13	1	2,520.	52.5	voltage
3	25	1	945.153	24.8	voltage
*4	37	1	81.3513	290.9	voltage
*5	49	1	63.0532	322.2	voltage
6	61	1	253.433	169.4	voltage

* Towers 4 and 5 are not driven in the day array. Voltages indicated are the voltages developed across the detuning reactors when these elements are detuned.

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.07	32.343	35.365	47.924	47.6	2.5783	-7.1096	-.93963
source = 2; node 13, sector 1							
1.07	72.726	51.494	89.111	35.3	2.4657	-7.475	-.85581
source = 3; node 25, sector 1							
1.07	48.875	17.512	51.917	19.7	1.4235	-15.151	-.13471
source = 4; node 37, sector 1							
1.07	-34.159	-551.61	552.67	266.5	****	****	****
source = 5; node 49, sector 1							
1.07	-60.541	-537.08	540.48	263.6	****	****	****
source = 6; node 61, sector 1							
1.07	-4.6991	12.999	13.822	109.9	****	****	****

CURRENT rms

Frequency = 1.07 MHz

Input power = 50,000. watts

Efficiency = 100. %

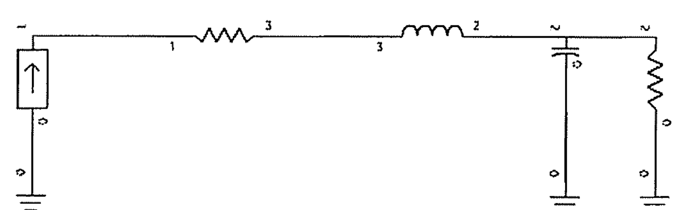
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	20.5145	73.4	5.84505	19.6641
2	0	0	8.15	20.8806	72.1	6.41071	19.8722
3	0	0	16.3	20.722	71.3	6.65349	19.6248
4	0	0	24.45	20.1503	70.6	6.69925	19.0041
5	0	0	32.6	19.1906	70.	6.56672	18.0321
6	0	0	40.75	17.8644	69.5	6.26612	16.7294
7	0	0	48.9	16.1958	69.	5.80607	15.1193
8	0	0	57.05	14.2113	68.6	5.1955	13.2276
9	0	0	65.2	11.9397	68.1	4.44388	11.0819
10	0	0	73.35	9.40824	67.8	3.56027	8.70859
11	0	0	81.5	6.63617	67.4	2.55065	6.12642
12	0	0	89.65	3.61134	67.0	1.40883	3.3252
END	0	0	97.8	0	0	0	0
GND	-88.5776	15.9376	0	19.9966	17.2	19.1003	5.9196
14	-88.5776	15.9376	8.075	20.6045	14.3	19.9659	5.08999
15	-88.5776	15.9376	16.15	20.6271	12.5	20.1386	4.46245
16	-88.5776	15.9376	24.225	20.2093	11.1	19.8334	3.88006
17	-88.5776	15.9376	32.3	19.3761	9.9	19.0884	3.32634
18	-88.5776	15.9376	40.375	18.1471	8.9	17.93	2.79851
19	-88.5776	15.9376	48.45	16.5444	8.	16.384	2.29815
20	-88.5776	15.9376	56.525	14.5931	7.2	14.4782	1.8283
21	-88.5776	15.9376	64.6	12.3208	6.5	12.2419	1.3922
22	-88.5776	15.9376	72.675	9.75406	5.8	9.70341	.992742
23	-88.5776	15.9376	80.75	6.91135	5.2	6.88242	.631711
24	-88.5776	15.9376	88.825	3.77819	4.7	3.76558	.30838
END	-88.5776	15.9376	96.9	0	0	0	0

GND	-87.8586	225.928	0	12.8728	5.1	12.8228	1.13373
26	-87.8586	225.928	8.03333	12.9388	3.1	12.9204	.689342
27	-87.8586	225.928	16.0667	12.7423	1.8	12.7362	.394044
28	-87.8586	225.928	24.1	12.3171	.7	12.3161	.159067
29	-87.8586	225.928	32.1333	11.6734	359.9	11.6734	-.0265239
30	-87.8586	225.928	40.1667	10.8221	359.1	10.8209	-.166613
31	-87.8586	225.928	48.2	9.77668	358.5	9.77313	-.263158
32	-87.8586	225.928	56.2333	8.55242	357.9	8.54652	-.317724
33	-87.8586	225.928	64.2667	7.16595	357.3	7.15825	-.331963
34	-87.8586	225.928	72.3	5.63317	356.9	5.62476	-.307693
35	-87.8586	225.928	80.3333	3.96509	356.4	3.95742	-.246592
36	-87.8586	225.928	88.3667	2.15402	356.	2.14886	-.149063
END	-87.8586	225.928	96.4	0	0	0	0
GND	-87.1077	435.932	0	.104085	24.4	.0947813	.0430129
38	-87.1077	435.932	7.86667	.0627561	26.5	.0561593	.0280081
39	-87.1077	435.932	15.7333	.035599	29.6	.0309593	.017573
40	-87.1077	435.932	23.6	.0143134	37.8	.0113131	8.77E-03
41	-87.1077	435.932	31.4667	4.03E-03	161.2	-3.81E-03	1.3E-03
42	-87.1077	435.932	39.3333	.0156294	198.1	-.0148541	-4.86E-03
43	-87.1077	435.932	47.2	.0241071	203.6	-.0220914	-9.65E-03
44	-87.1077	435.932	55.0667	.028856	206.7	-.0257845	-.0129548
45	-87.1077	435.932	62.9333	.0300228	209.2	-.0262115	-.01464
46	-87.1077	435.932	70.8	.0277848	211.6	-.0236754	-.0145421
47	-87.1077	435.932	78.6667	.0222867	214.	-.0184831	-.0124528
48	-87.1077	435.932	86.5333	.0135222	216.5	-.0108665	-8.05E-03
END	-87.1077	435.932	94.4	0	0	0	0
GND	1.46622	419.997	0	.0824925	58.6	.0429195	.070448
50	1.46622	419.997	7.925	.0504404	62.3	.0234265	.0446703
51	1.46622	419.997	15.85	.029319	67.5	.0112267	.0270844
52	1.46622	419.997	23.775	.0127962	79.8	2.26E-03	.0125949
53	1.46622	419.997	31.7	4.14E-03	171.1	-4.09E-03	6.4E-04
54	1.46622	419.997	39.625	.012074	227.5	-8.16E-03	-8.9E-03
55	1.46622	419.997	47.55	.0190111	237.4	-.0102371	-.0160194
56	1.46622	419.997	55.475	.0232166	242.7	-.010637	-.0206365
57	1.46622	419.997	63.4	.0246444	246.8	-9.69E-03	-.0226594
58	1.46622	419.997	71.325	.0233015	250.5	-7.76E-03	-.0219699
59	1.46622	419.997	79.25	.0191368	254.1	-5.25E-03	-.0184015
60	1.46622	419.997	87.175	.0119206	257.6	-2.57E-03	-.0116412
END	1.46622	419.997	95.1	0	0	0	0
GND	.733109	209.999	0	12.965	59.5	6.57903	11.1717
62	.733109	209.999	8.06667	12.9823	59.7	6.55004	11.2088
63	.733109	209.999	16.1333	12.7468	59.8	6.40724	11.0195
64	.733109	209.999	24.2	12.288	59.9	6.15788	10.6337
65	.733109	209.999	32.2667	11.6169	60.	5.80656	10.0616
66	.733109	209.999	40.3333	10.7454	60.1	5.35888	9.3138
67	.733109	209.999	48.4	9.68739	60.2	4.82156	8.40227
68	.733109	209.999	56.4667	8.45848	60.2	4.20229	7.34076
69	.733109	209.999	64.5333	7.07525	60.3	3.50919	6.14368
70	.733109	209.999	72.6	5.55347	60.3	2.75004	4.82476
71	.733109	209.999	80.6667	3.90367	60.4	1.93006	3.39316
72	.733109	209.999	88.7333	2.11801	60.4	1.04552	1.84196
END	.733109	209.999	96.8	0	0	0	0

Antenna Monitor Indications Derived From Indicated Base Current Magnitudes and Phases

Tower	Model Pulse	Model Current Magnitude At Torroid, Amps	Model Current Phase At Torroid, Degrees	**Indicated Antenna Monitor Ratio**	**Indicated Antenna Monitor Phase**
1	1	20.39	+73.74	**1.029**	**+55.8°**
2	16	19.82	+17.9	**1.000**	**0.0°**
3	31	12.83	+5.6	**.647**	**-12.3°**
6	76	12.93	+59.48	**.652**	**+41.6°**



Tower 1 Base, Day Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 1357.4160 ∡ 133.2981° V

Node: 2 983.0079 ∡ 120.9823° V

Node: 3 1347.1998 ∡ 134.0458° V

	WCAP PART		BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	32.34300000	983.01 ∡ 120.982° V	20.51 ∡ 73.427° A
R	1→3	1.00000000	20.39 ∡ 73.740° V	20.39 ∡ 73.740° A
L	3→2	3.27200000	448.53 ∡ 163.740° V	20.39 ∡ 73.740° A
C	2→0	0.00002500	983.01 ∡ 120.982° V	0.17 ∡ -149.018° A

	WCAP PART		FROM IMPEDANCE	TO IMPEDANCE
R	2→0	32.34300000	32.34 + j 35.365	0.00 + j 0.000
R	1→3	1.00000000	33.73 + j 57.395	32.73 + j 57.395
L	3→2	3.27200000	32.73 + j 57.395	32.73 + j 35.397
C	2→0	0.00002500	-0.00 - j 5949.717	0.00 + j

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**20.39000000**	**0**	**1**	**73.74000000**
R	32.34300000	2	0	35.36500000
R	1.00000000	1	3	0.00000000
L	3.27200000	3	2	0.00000000
C	0.00002500	2	0	

Tower 2 Base. Day Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 2308.6494 ∡ 67.8244° V

Node: 2 1781.4566 ∡ 52.4942° V

Node: 3 2295.9394 ∡ 68.2028° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	72.72600000	1781.46 ∡ 52.494° V	19.99 ∡ 17.194° A
R	1→3	1.00000000	19.82 ∡ 17.900° V	19.82 ∡ 17.900° A
L	3→2	5.66700000	755.13 ∡ 107.900° V	19.82 ∡ 17.900° A
C	2→0	0.00002500	1781.46 ∡ 52.494° V	0.30 ∡ 142.494° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	72.72600000	72.73 + j 51.494	0.00 + j 0.000
R	1→3	1.00000000	74.99 + j 89.131	73.99 + j 89.131
L	3→2	5.66700000	73.99 + j 89.131	73.99 + j 51.031
C	2→0	0.00002500	-0.01 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**19.82000000**	**0**	**1**	**17.90000000**
R	72.72600000	2	0	51.49400000
R	1.00000000	1	3	0.00000000
L	5.66700000	3	2	0.00000000
C	0.00002500	2	0	

Tower 3 Base, Day Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 921.8676 ∡ 51.3248° V

Node: 2 668.0463 ∡ 24.8406° V

Node: 3 912.9571 ∡ 51.9013° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	48.87500000	668.05 ∡ 24.841° V	12.87 ∡ 5.128° A
R	1→3	1.00000000	12.83 ∡ 5.600° V	12.83 ∡ 5.600° A
L	3→2	5.10000000	439.91 ∡ 95.600° V	12.83 ∡ 5.600° A
C	2→0	0.00002500	668.05 ∡ 24.841° V	0.11 ∡ 114.841° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	48.87500000	48.88 + j 17.512	0.00 + j 0.000
R	1→3	1.00000000	50.16 + j 51.446	49.16 + j 51.446
L	3→2	5.10000000	49.16 + j 51.446	49.16 + j 17.159
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**12.83000000**	**0**	**1**	**5.60000000**
R	48.87500000	2	0	17.51200000
R	1.00000000	1	3	0.00000000
L	5.10000000	3	2	0.00000000
C	0.00002500	2	0	

Tower 6 Base, Day Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 500.1736 ∡ 154.9980° V

Node: 2 179.1134 ∡ 169.4001° V

Node: 3 501.5820 ∡ 156.4683° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	-4.69910000	179.11 ∡ 169.400° V	12.96 ∡ 59.525° A
R	1→3	1.00000000	12.93 ∡ 59.480° V	12.93 ∡ 59.480° A
L	3→2	3.79000000	329.46 ∡ 149.480° V	12.93 ∡ 59.480° A
C	2→0	0.00002500	179.11 ∡ 169.400° V	0.03 ∡ -100.600° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	-4.69910000	-4.70 + j 12.999	0.00 + j 0.000
R	1→3	1.00000000	-3.72 + j 38.504	-4.72 + j 38.504
L	3→2	3.79000000	-4.72 + j 38.504	-4.72 + j 13.024
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**12.93000000**	**0**	**1**	**59.48000000**
R	-4.69910000	2	0	12.99900000
R	1.00000000	1	3	0.00000000
L	3.79000000	3	2	0.00000000
C	0.00002500	2	0	

Derivation of Operating Parameters for Nightime Antenna Array

Following verification of the moment method model of the individual array elements, by comparison of the measured and modeled base impedances, directional antenna array base parameters were calculated. Calculations were made to determine the complex voltage sources which when applied to the base of each array element produce current moment sums which when normalized, equate to the theoretical field parameters of the authorized directional pattern. Using these voltages, the tower currents were calculated. The currents at the ATU sampling points were related to those of the moment method model by using the WCAP Pro nodal analysis program from Westberg Consulting. The assumptions that were used for the single tower calculations were used in the directional array case as well. In the following WCAP calculations node 1 represents the reference point, node 2 represents the tower feedpoint, and node 0 represents ground. The tower operating impedance is represented from node 2 to ground ((R 2-0). The current magnitude and phases at the sample point are represented across the phantom one (1) ohm resistor which was added to facilitate calculation. The value shown at R 1-3 has been rounded by the program. The actual current values shown as "I" in the "WCAP INPUT DATA" represent the values before rounding and were used in the calculation of antenna monitor amplitude and phase indications to yield greater accuracy.

In so much as the sample lines are equal in length and the sample torroids responses are identical, the antenna monitor currents and phases have been calculated directly from the reference point currents and phases. The antenna monitor reference is Tower #3. The antenna monitor is a Potomac Instruments Model 1901. The calibration of the monitor was verified to be within manufacturer's specifications when compared to a Hewlett-Packard 4396A network analyzer.

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.07 MHz

tower	field ratio magnitude	phase (deg)
1	1.	115.
2	1.	15.
3	1.932	0
4	1.	-15.
5	1.	85.
6	1.932	100.

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	187.662	200.1	3.58193	115.6
13	284.895	60.6	3.60155	21.1
25	590.899	49.	6.89773	6.1
37	259.361	21.1	3.79287	350.9
49	120.998	183.6	3.79011	84.6
61	318.34	181.2	7.06487	100.9

Sum of square of source currents = 304.087
Total power = 5,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00722508	-.00810105
Y(1, 2)	.00454715	.002063
Y(1, 3)	.00149046	-.000947407
Y(1, 4)	2.6773E-05	.000571967
Y(1, 5)	-.000168818	.000874641
Y(1, 6)	.00265734	-.00168536
Y(2, 1)	.00454712	.00206306
Y(2, 2)	.0082933	-.00853711
Y(2, 3)	.00279016	-.00160787
Y(2, 4)	-.000209709	.000943123
Y(2, 5)	-.000226215	.000816884
Y(2, 6)	.00294068	-.0011815
Y(3, 1)	.00149046	-.000947377
Y(3, 2)	.00279017	-.00160786
Y(3, 3)	.00965131	-.00883871
Y(3, 4)	.00339148	-.00153921
Y(3, 5)	.00332004	-.000886522
Y(3, 6)	.00584982	.00207346
Y(4, 1)	2.6773E-05	.000571967
Y(4, 2)	-.000209709	.00094313
Y(4, 3)	.0033915	-.00153916
Y(4, 4)	.0096069	-.00900851
Y(4, 5)	.00523196	.003368
Y(4, 6)	.00181777	-.000793187
Y(5, 1)	-.000168817	.000874649

Y(5, 2)	-.000226213	.000816902
Y(5, 3)	.00332006	-.000886522
Y(5, 4)	.00523202	.0033679
Y(5, 5)	.00909796	-.0087231
Y(5, 6)	.00299716	-.00143013
Y(6, 1)	.00265735	-.00168535
Y(6, 2)	.00294069	-.00118151
Y(6, 3)	.00584985	.00207341
Y(6, 4)	.00181777	-.000793238
Y(6, 5)	.00299715	-.00143016
Y(6, 6)	.00906525	-.0087057

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	54.0486	63.2232
Z(1, 2)	27.1864	-27.382
Z(1, 3)	-18.7967	3.87887
Z(1, 4)	10.1616	-5.34297
Z(1, 5)	11.4501	-.433659
Z(1, 6)	-17.8871	-7.52999
Z(2, 1)	27.186	-27.3823
Z(2, 2)	53.4009	59.2408
Z(2, 3)	-17.7742	-7.40632
Z(2, 4)	11.0137	-.347221
Z(2, 5)	11.6366	.746802
Z(2, 6)	-18.7764	-5.74105
Z(3, 1)	-18.7966	3.87896
Z(3, 2)	-17.7742	-7.40624
Z(3, 3)	52.6692	55.8373
Z(3, 4)	-16.6128	-7.26641
Z(3, 5)	-18.132	-5.71295
Z(3, 6)	27.3812	-27.2974
Z(4, 1)	10.1616	-5.34306
Z(4, 2)	11.0137	-.347313
Z(4, 3)	-16.6129	-7.2662
Z(4, 4)	48.2687	46.0865
Z(4, 5)	25.3823	-25.0551
Z(4, 6)	-17.9707	3.50466
Z(5, 1)	11.4501	-.433732
Z(5, 2)	11.6366	.746752
Z(5, 3)	-18.132	-5.71284
Z(5, 4)	25.3828	-25.0548
Z(5, 5)	51.043	51.7968
Z(5, 6)	-17.6134	-7.37807
Z(6, 1)	-17.8871	-7.52988
Z(6, 2)	-18.7764	-5.7411
Z(6, 3)	27.3814	-27.2972
Z(6, 4)	-17.9708	3.50439
Z(6, 5)	-17.6132	-7.37821
Z(6, 6)	53.7961	58.6972

CURRENT NODES

wire	coordinates (degrees) X	Y	Z	connections end1	end2	node no.
1	0	0	0	GND	1	1
1	0	0	8.15	1	1	2
1	0	0	16.3	1	1	3
1	0	0	24.45	1	1	4
1	0	0	32.6	1	1	5
1	0	0	40.75	1	1	6
1	0	0	48.9	1	1	7
1	0	0	57.05	1	1	8
1	0	0	65.2	1	1	9
1	0	0	73.35	1	1	10
1	0	0	81.5	1	1	11
1	0	0	89.65	1	END	12
2	-88.5776	15.9376	0	GND	2	13
2	-88.5776	15.9376	8.075	2	2	14
2	-88.5776	15.9376	16.15	2	2	15
2	-88.5776	15.9376	24.225	2	2	16
2	-88.5776	15.9376	32.3	2	2	17
2	-88.5776	15.9376	40.375	2	2	18
2	-88.5776	15.9376	48.45	2	2	19
2	-88.5776	15.9376	56.525	2	2	20
2	-88.5776	15.9376	64.6	2	2	21
2	-88.5776	15.9376	72.675	2	2	22
2	-88.5776	15.9376	80.75	2	2	23
2	-88.5776	15.9376	88.825	2	END	24
3	-87.8586	225.928	0	GND	3	25
3	-87.8586	225.928	8.03333	3	3	26
3	-87.8586	225.928	16.0667	3	3	27
3	-87.8586	225.928	24.1	3	3	28
3	-87.8586	225.928	32.1333	3	3	29
3	-87.8586	225.928	40.1667	3	3	30
3	-87.8586	225.928	48.2	3	3	31
3	-87.8586	225.928	56.2333	3	3	32
3	-87.8586	225.928	64.2667	3	3	33
3	-87.8586	225.928	72.3	3	3	34
3	-87.8586	225.928	80.3333	3	3	35
3	-87.8586	225.928	88.3667	3	END	36
4	-87.1077	435.932	0	GND	4	37
4	-87.1077	435.932	7.86667	4	4	38
4	-87.1077	435.932	15.7333	4	4	39
4	-87.1077	435.932	23.6	4	4	40
4	-87.1077	435.932	31.4667	4	4	41
4	-87.1077	435.932	39.3333	4	4	42
4	-87.1077	435.932	47.2	4	4	43
4	-87.1077	435.932	55.0667	4	4	44
4	-87.1077	435.932	62.9333	4	4	45
4	-87.1077	435.932	70.8	4	4	46
4	-87.1077	435.932	78.6667	4	4	47
4	-87.1077	435.932	86.5333	4	END	48

5	1.46622	419.997	0	GND	5	49
5	1.46622	419.997	7.925	5	5	50
5	1.46622	419.997	15.85	5	5	51
5	1.46622	419.997	23.775	5	5	52
5	1.46622	419.997	31.7	5	5	53
5	1.46622	419.997	39.625	5	5	54
5	1.46622	419.997	47.55	5	5	55
5	1.46622	419.997	55.475	5	5	56
5	1.46622	419.997	63.4	5	5	57
5	1.46622	419.997	71.325	5	5	58
5	1.46622	419.997	79.25	5	5	59
5	1.46622	419.997	87.175	5	END	60
6	.733109	209.999	0	GND	6	61
6	.733109	209.999	8.06667	6	6	62
6	.733109	209.999	16.1333	6	6	63
6	.733109	209.999	24.2	6	6	64
6	.733109	209.999	32.2667	6	6	65
6	.733109	209.999	40.3333	6	6	66
6	.733109	209.999	48.4	6	6	67
6	.733109	209.999	56.4667	6	6	68
6	.733109	209.999	64.5333	6	6	69
6	.733109	209.999	72.6	6	6	70
6	.733109	209.999	80.6667	6	6	71
6	.733109	209.999	88.7333	6	END	72

CURRENT rms
Frequency = 1.07 MHz
Input power = 5,000. watts
Efficiency = 100. %
coordinates in degrees

current				mag	phase	real	imaginary
no.	X	Y	Z	(amps)	(deg)	(amps)	(amps)
GND	0	0	0	3.58193	115.6	-1.54853	3.22991
2	0	0	8.16667	3.68869	115.4	-1.58265	3.33191
3	0	0	16.3333	3.68647	115.3	-1.57366	3.33372
4	0	0	24.5	3.60417	115.1	-1.53171	3.2625
5	0	0	32.6667	3.44753	115.	-1.45912	3.12352
6	0	0	40.8333	3.22097	114.9	-1.35784	2.92078
7	0	0	49.	2.92911	114.8	-1.22996	2.65836
8	0	0	57.1667	2.57699	114.7	-1.07786	2.34075
9	0	0	65.3333	2.17001	114.6	-.904015	1.97274
10	0	0	73.5	1.71334	114.5	-.710876	1.55891
11	0	0	81.6667	1.21063	114.4	-.500207	1.10246
12	0	0	89.8333	.65984	114.3	-.271457	.601415
END	0	0	98.	0	0	0	0

GND	-88.5776	15.9376	0	3.60155	21.1	3.36083	1.29459
14	-88.5776	15.9376	8.10833	3.70684	18.6	3.513	1.18299
15	-88.5776	15.9376	16.2167	3.70657	17.1	3.54296	1.08908
16	-88.5776	15.9376	24.325	3.62701	15.9	3.48848	.992799
17	-88.5776	15.9376	32.4333	3.47298	14.9	3.35639	.892333
18	-88.5776	15.9376	40.5417	3.24837	14.	3.15141	.787767
19	-88.5776	15.9376	48.65	2.9574	13.3	2.8782	.679841
20	-88.5776	15.9376	56.7583	2.60486	12.6	2.54184	.569547
21	-88.5776	15.9376	64.8667	2.19598	12.	2.1477	.457944
22	-88.5776	15.9376	72.975	1.73581	11.5	1.70098	.346
23	-88.5776	15.9376	81.0833	1.22792	11.	1.20536	.234336
24	-88.5776	15.9376	89.1917	.670081	10.5	.658782	.12253
END	-88.5776	15.9376	97.3	0	0	0	0
GND	-87.8586	225.928	0	6.89774	6.1	6.85817	.737781
26	-87.8586	225.928	8.06667	7.13817	3.6	7.12382	.452454
27	-87.8586	225.928	16.1333	7.16205	2.1	7.15726	.261702
28	-87.8586	225.928	24.2	7.02743	.9	7.02658	.108843
29	-87.8586	225.928	32.2667	6.74452	359.9	6.74451	-.012934
30	-87.8586	225.928	40.3333	6.32106	359.	6.32018	-.105871
31	-87.8586	225.928	48.4	5.76527	358.3	5.76274	-.170929
32	-87.8586	225.928	56.4667	5.08645	357.6	5.08217	-.208779
33	-87.8586	225.928	64.5333	4.2947	357.1	4.28906	-.220117
34	-87.8586	225.928	72.6	3.39979	356.5	3.39356	-.205714
35	-87.8586	225.928	80.6667	2.40851	356.	2.40277	-.166206
36	-87.8586	225.928	88.7333	1.3163	355.6	1.31239	-.101312
END	-87.8586	225.928	96.8	0	0	0	0
GND	-87.1077	435.932	0	3.79288	350.9	3.74534	-.59861
38	-87.1077	435.932	7.91667	3.85831	348.6	3.78155	-.765804
39	-87.1077	435.932	15.8333	3.82996	347.1	3.73272	-.857544
40	-87.1077	435.932	23.75	3.72656	345.9	3.61388	-.909452
41	-87.1077	435.932	31.6667	3.552	344.9	3.42905	-.926466
42	-87.1077	435.932	39.5833	3.30984	344.	3.18202	-.910916
43	-87.1077	435.932	47.5	3.00408	343.3	2.877	-.864516
44	-87.1077	435.932	55.4167	2.63934	342.6	2.51867	-.788954
45	-87.1077	435.932	63.3333	2.22058	342.	2.11197	-.685989
46	-87.1077	435.932	71.25	1.75257	341.5	1.66159	-.557325
47	-87.1077	435.932	79.1667	1.23847	341.	1.17067	-.404175
48	-87.1077	435.932	87.0833	.675565	340.5	.636731	-.22575
END	-87.1077	435.932	95.	0	0	0	0
GND	1.46622	419.997	0	3.79011	84.6	.358559	3.77311
50	1.46622	419.997	8.	3.84528	84.8	.350454	3.82928
51	1.46622	419.997	16.	3.80744	84.9	.339107	3.79231
52	1.46622	419.997	24.	3.69549	85.	.323477	3.6813
53	1.46622	419.997	32.	3.51396	85.	.303539	3.50083
54	1.46622	419.997	40.	3.26685	85.1	.279398	3.25488
55	1.46622	419.997	48.	2.95851	85.1	.25122	2.94782
56	1.46622	419.997	56.	2.59378	85.2	.219201	2.5845
57	1.46622	419.997	64.	2.17777	85.2	.183551	2.17002
58	1.46622	419.997	72.	1.71535	85.2	.144449	1.70926
59	1.46622	419.997	80.	1.20979	85.2	.10194	1.20548
60	1.46622	419.997	88.	.65856	85.2	.0555985	.656209
END	1.46622	419.997	96.	0	0	0	0

GND	.733109	209.999	0	7.06487	100.9	-1.33073	6.93842
62	.733109	209.999	8.10833	7.23484	100.5	-1.32445	7.11258
63	.733109	209.999	16.2167	7.20542	100.3	-1.29414	7.08825
64	.733109	209.999	24.325	7.02546	100.2	-1.24143	6.91491
65	.733109	209.999	32.4333	6.70522	100.	-1.16748	6.6028
66	.733109	209.999	40.5417	6.25297	99.9	-1.07375	6.16009
67	.733109	209.999	48.65	5.67745	99.8	-.962012	5.59536
68	.733109	209.999	56.7583	4.9883	99.6	-.834287	4.91804
69	.733109	209.999	64.8667	4.19577	99.5	-.692719	4.13819
70	.733109	209.999	72.975	3.30968	99.4	-.539399	3.26543
71	.733109	209.999	81.0833	2.33683	99.3	-.375911	2.30639
72	.733109	209.999	89.1917	1.27297	99.1	-.202069	1.25683
END	.733109	209.999	97.3	0	0	0	0

IMPEDANCE normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.07	4.9374	51.027	51.266	84.5	20.724	-.83888	-7.5535
source = 2; node 13, sector 1							
1.07	60.154	48.188	77.075	38.7	2.3875	-7.753	-.79753
source = 3; node 25, sector 1							
1.07	61.921	55.957	83.459	42.1	2.6848	-6.7973	-1.0186
source = 4; node 37, sector 1							
1.07	57.936	31.296	65.848	28.4	1.8062	-10.834	-.37411
source = 5; node 49, sector 1							
1.07	-4.8794	26.935	27.374	100.3	****	****	****
source = 6; node 61, sector 1							
1.07	7.3734	41.734	42.38	80.	11.566	-1.5057	-5.3316

GEOMETRY

Wire coordinates in degrees; other dimensions in meters

Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.218	12
		0	0	98.		
2	none	90.	190.2	0	.218	12
		90.	190.2	97.3		
3	none	242.41	248.75	0	.218	12
		242.41	248.75	96.8		
4	none	444.55	258.7	0	.218	12
		444.55	258.7	95.		
5	none	420.	270.2	0	.218	12
		420.	270.2	96.		
6	none	210.	270.2	0	.218	12
		210.	270.2	97.3		

Number of wires = 6

current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	7.91667	1	8.16667
radius	1	.218	1	.218

ELECTRICAL DESCRIPTION

Frequencies (MHz)

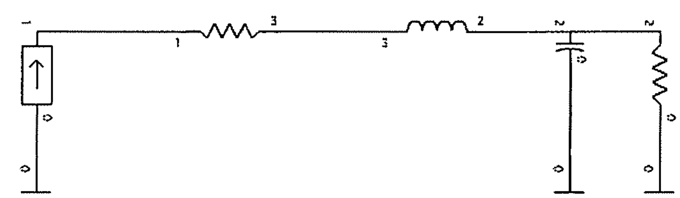
	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.07	0	1	.0219907	.0226852

Sources

source	node	sector	magnitude	phase	type
1	1	1	265.394	200.1	voltage
2	13	1	402.902	60.6	voltage
3	25	1	835.657	49.	voltage
4	37	1	366.792	21.1	voltage
5	49	1	171.117	183.6	voltage
6	61	1	450.2	181.2	voltage

Antenna Monitor Indications Derived From Indicated Base Current Magnitudes and Phases

Tower	Model Pulse	Model Current Amplitude At Torroid, Amps	Model Ciurrent Phase At Torroid, Degrees	**Indicated Antenna Monitor Ratio**	**Indicated Antenna Monitor Phase**
1	1	3.552	115.65	**.519**	**+109.0**
2	13	3.575	21.7	**.523**	**+15.0**
3	25	6.84	6.7	**1.000**	**0.00**
4	37	3.78	-8.55	**.553**	**-15.3**
5	49	3.78	84.55	**.553**	**+77.9**
6	61	7.015	100.98	**1.026**	**+94.3**



Tower 1 Base, Night Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 261.8122 ∡ -159.0372° V

Node: 2 183.6696 ∡ -159.9247° V

Node: 3 261.5459 ∡ -158.2617° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	4.93740000	183.67 ∡ -159.925° V	3.58 ∡ 115.602° A
R	1→3	1.00000000	3.55 ∡ 115.650° V	3.55 ∡ 115.650° A
L	3→2	3.27200000	78.14 ∡ -154.350° V	3.55 ∡ 115.650° A
C	2→0	0.00002500	183.67 ∡ -159.925° V	0.03 ∡ -69.925° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	4.93740000	4.94 + j 51.027	0.00 + j 0.000
R	1→3	1.00000000	6.02 + j 73.462	5.02 + j 73.462
L	3→2	3.27200000	5.02 + j 73.462	5.02 + j 51.464
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**3.55200000**	**0**	**1**	**115.65000000**
R	4.93740000	2	0	51.02700000
R	1.00000000	1	3	0.00000000
L	3.27200000	3	2	0.00000000
C	0.00002500	2	0	

Tower 2 Base, Night Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1	379.4648 ∡	75.8705° V
Node: 2	277.7793 ∡	59.8134° V
Node: 3	377.3832 ∡	76.3106° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	60.15400000	277.78 ∡ 59.813° V	3.60 ∡ 21.116° A
R	1→3	1.00000000	3.57 ∡ 21.700° V	3.57 ∡ 21.700° A
L	3→2	5.66700000	136.20 ∡ 111.700° V	3.57 ∡ 21.700° A
C	2→0	0.00002500	277.78 ∡ 59.813° V	0.05 ∡ 149.813° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	60.15400000	60.15 + j 48.188	0.00 + j 0.000
R	1→3	1.00000000	62.13 + j 86.058	61.13 + j 86.058
L	3→2	5.66700000	61.13 + j 86.058	61.13 + j 47.958
C	2→0	0.00002500	-0.01 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**3.57500000**	**0**	**1**	**21.70000000**
R	60.15400000	2	0	48.18800000
R	1.00000000	1	3	0.00000000
L	5.66700000	3	2	0.00000000
C	0.00002500	2	0	

Tower 3 Base, Night Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1	756.3854 ∡	61.2765° V
Node: 2	576.2473 ∡	48.2017° V
Node: 3	752.4414 ∡	61.7009° V

WCAP PART			BRANCH VOLTAGE		BRANCH CURRENT	
R	2→0	61.92100000	576.25 ∡	48.202° V	6.90 ∡	6.098° A
R	1→3	1.00000000	6.84 ∡	6.700° V	6.84 ∡	6.700° A
L	3→2	5.10000000	234.53 ∡	96.700° V	6.84 ∡	6.700° A
C	2→0	0.00002500	576.25 ∡	48.202° V	0.10 ∡	138.202° A

WCAP PART			FROM IMPEDANCE		TO IMPEDANCE	
R	2→0	61.92100000	61.92 + j	55.957	0.00 + j	0.000
R	1→3	1.00000000	64.10 + j	90.113	63.10 + j	90.113
L	3→2	5.10000000	63.10 + j	90.113	63.10 + j	55.825
C	2→0	0.00002500	-0.00 - j	5949.717	0.00 + j	0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**6.84000000**	**0**	**1**	**6.70000000**
R	61.92100000	2	0	55.95700000
R	1.00000000	1	3	0.00000000
L	5.10000000	3	2	0.00000000
C	0.00002500	2	0	

Tower 4 Base, Night Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 341.2740 ∡ 40.1863° V

Node: 2 250.2114 ∡ 19.2663° V

Node: 3 338.7929 ∡ 40.6668° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	57.93600000	250.21 ∡ 19.266° V	3.80 ∡ -9.111° A
R	1→3	1.00000000	3.78 ∡ -8.550° V	3.78 ∡ -8.550° A
L	3→2	5.50000000	139.77 ∡ 81.450° V	3.78 ∡ -8.550° A
C	2→0	0.00002500	250.21 ∡ 19.266° V	0.04 ∡ 109.266° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	57.93600000	57.94 + j 31.296	0.00 + j 0.000
R	1→3	1.00000000	59.54 + j 67.865	58.54 + j 67.865
L	3→2	5.50000000	58.54 + j 67.865	58.54 + j 30.888
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**3.78000000**	**0**	**1**	**-8.55000000**
R	57.93600000	2	0	31.29600000
R	1.00000000	1	3	0.00000000
L	5.50000000	3	2	0.00000000
C	0.00002500	2		

Tower 5 Base, Night Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 220.6772 ∡ 178.4039° V

Node: 2 103.9420 ∡ -175.1348° V

Node: 3 220.9634 ∡ 179.3819° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	-4.87940000	103.94 ∡ -175.135° V	3.80 ∡ 84.597° A
R	1→3	1.00000000	3.78 ∡ 84.550° V	3.78 ∡ 84.550° A
L	3→2	4.64000000	117.92 ∡ 174.550° V	3.78 ∡ 84.550° A
C	2→0	0.00002500	103.94 ∡ -175.135° V	0.02 ∡ -85.135° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	-4.87940000	-4.88 + j 26.935	0.00 + j 0.000
R	1→3	1.00000000	-3.92 + j 58.248	-4.92 + j 58.248
L	3→2	4.64000000	-4.92 + j 58.248	-4.92 + j 27.053
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**3.78000000**	**0**	**1**	**84.55000000**
R	-4.87940000	2	0	26.93500000
R	1.00000000	1	3	0.00000000
L	4.64000000	3	2	0.00000000
C	0.00002500	2	0	

Tower 6 Base, Night Array

WCAP OUTPUT AT FREQUENCY: 1.070 MHz

NODE VOLTAGES

Node: 1 477.2305 ∡ -176.1788° V

Node: 2 299.3980 ∡ -179.1109° V

Node: 3 476.4071 ∡ -175.3417° V

WCAP PART			BRANCH VOLTAGE	BRANCH CURRENT
R	2→0	7.37340000	299.40 ∡ -179.111° V	7.06 ∡ 100.908° A
R	1→3	1.00000000	7.01 ∡ 100.980° V	7.01 ∡ 100.980° A
L	3→2	3.79000000	178.74 ∡ -169.020° V	7.01 ∡ 100.980° A
C	2→0	0.00002500	299.40 ∡ -179.111° V	0.05 ∡ -89.111° A

WCAP PART			FROM IMPEDANCE	TO IMPEDANCE
R	2→0	7.37340000	7.37 + j 41.734	0.00 + j 0.000
R	1→3	1.00000000	8.48 + j 67.500	7.48 + j 67.500
L	3→2	3.79000000	7.48 + j 67.500	7.48 + j 42.019
C	2→0	0.00002500	0.00 - j 5949.717	0.00 + j 0.000

WCAP INPUT DATA:

	1.0700	0.00000000	0	
I	**7.01500000**	**0**	**1**	**100.98000000**
R	7.37340000	2	0	41.73400000
R	1.00000000	1	3	0.00000000
L	3.79000000	3	2	0.00000000
C	0.00002500	2		

Sample System Verification

The following calculations confirm that the sample system as installed complies with Rule Section 73.151(c)(2)(1) in all respects. The sample torroids are Delta model TCT3 and their outputs are in agreement within the manufacturer's specification of +/-2% and +/-2°. The antenna monitor is a Potomac Instruments model 1901. The calibration of the monitor was compared to a Agilent 4496A network analyzer, operating in the phase and amplitude mode and was found to be accurate within the manufacturers specifications. The sample lines are equal in length and constructed of ½" Andrew LDF4-50A coaxial cable that has a solid outer conductor and foam dielectric. The cables are equal in length within 1° as required. The cables have all been buried so as to be exposed to the same environmental conditions. The length of the cables was confirmed by measuring the impedance, looking into the line with the far end opened. The lines were found to be 5/4 wavelength long at the frequencies listed. These frequencies were used to calculate the electrical lengths of the lines at the operating frequency of 1070 kHz. Frequencies were calculated at which the lines were +/- 45° the length of the resonate frequency. The impedance was then calculated using the following formula:

$$Zo = ((R1^2+X1^2)^{½} * (R2^2+X2^2)^{½})^{½}$$

Sample Line Length Calculation

Tower	5/4 Wavelength Resonate Frequency kHz	Electrical Length At 1070 kHz, Degrees
1	1030.50	467.25
2	1029.50	467.70
3	1029.90	467.52
4	1029.90	467.52
5	1029.90	467.52
6	1029.10	467.88

Sample Line Impedance Calculations

Tower	450° Resonate Frequency, kHz	45° Above Resonate Frequency kHz	Resistance Ohms	Reactance Ohms	45° Below Resonate Frequency kHz	Resistance Ohms	Reactance Ohms	Characteristic Impedance
1	1030.50	1133.55	8.89	50.00	927.45	7.01	-50.06	50.66
2	1029.50	1132.45	8.85	49.95	926.55	7.01	-50.21	50.71
3	1029.90	1132.89	8.87	49.79	926.91	7.08	-49.92	50.50
4	1029.90	1132.89	8.84	50.19	926.91	7.02	50.19	50.82
5	1029.90	1132.89	8.86	50.21	926.91	7.04	-50.25	50.86
6	1029.10	1132.01	8.89	49.72	926.19	7.04	-50.00	50.50

The sample torroid calibration was confirmed by passing a common conductor through the torroids. The common conductor was driven by a Agilent 4396A vector network analyzer that was properly calibrated for response measurement. The output from the tower 1 torroid was fed to the reference receiver of the analyzer and the other outputs were alternately fed to the B input. The output of the towers 2 – 6 torroids were compared to that of the tower 1 torroid and the results noted in the chart below.

Sample Torroid Calibration Verification

Tower	Serial Number	Indicated Amplitude	Indicated Phase°
1	3260	1.0000	0.00
2	3945	1.0035	-0.03
3	17932	1.0088	+0.04
4	17930	1.0026	+0.02
5	17933	1.0045	+0.012
6	17931	1.0070	+0.031

Sample Lines Terminated By Torroids

Tower	Serial Number	Impedance at Input to Sample Line with Torroid Connected
1	3260	50.4 -j2.8
2	3945	50.5 –j2.7
3	17932	50.0 –j2.5
4	17930	50.6 –j2.5
5	17933	50.5 –j2.5
6	17931	50.1 –j2.5

Item 6

Direct Measurement of Power

The common point networks in both the daytime and nighttime phasors were adjusted to provide the proper operating resistance of 50 ohms and a reactance of 0 (zero) ohms to the transmitter output. In order to compensate for hookup inductance between the power measurement point and the transmitter the common point reactance was set for a value of –j7.0 at the measurement point. The daytime and nighttime operating powers were calculated by adding +5.3% to the daytime and +8.0% to the nighttime nominal operating powers of 50.0 kW and 5.0 kW respectively. The common point currents were then calculated as indicated below.

Pattern	Nominal Power Watts	Operating Power Watts	Operating Common Point Current, Amps
Day	50000	52650	32.45
Night	5000	5400	10.39

Reference Field Strength Measurements

Reference field strength measurements were made on radials that have monitor point limits on the current license as well as in the main lobes of the patterns as follows:

Day Array Radial	Point #	Distance km	Field Strength mv/M	Description
51°T	51 A	4.32	32.00	35° 17' 33.0"N 89° 58' 49.9"W - 20m W MB 6054 Woodstock-Cuba Rd. N side
	51 B	5.82	13.00	35° 18' 3.7"N 89° 58' 3.5"W - Little John Rd. N side, 100' E of hill crest, across from old gravel driveway
	51 C	7.34	8.40	35° 18' 34.6"N 89° 57' 16.6"W - Ward Rd. N side 75' W of Millington Rd.
121°T	121 A	4.01	101.00	35° 14' 58.0"N 89° 58' 46.7"W - 4532 Sunnyview, E side
	121 B	5.94	32.90	35° 14' 25.8"N 89° 57' 40.9"W - Point Church Rd., 50' S Hawkins Mill Rd. W side
	121 C	7.24	13.20	35° 14' 4.3"N 89° 56' 56.7"W - In traffic triangle, Allen Park Rd. & Hawkins Mill Rd. W side
*182°T	182.A	3.57	740.00	35° 14' 9.5"N 90° 1' 9.1"W - Old Millington Rd. S of Watkins, E side (flood damaged area, no landmarks)
	182 B	4.76	176.00	35° 13' 31.1"N 90° 1' 11.2"W - Carolton Ave/Quimby Dr/Terrace Dr. on storm drain cover
	182 C	6.05	264.00	35° 12' 49.2"N 90° 1' 13.3"W - Canfield Ave., 50' W of Ridgecrest, S side, under tree.
245°T	245 A	2.75	271.00	35° 15' 20.0"N 90° 2' 36.6"W - Dead End of Horton Rd.
	245 B	3.96	119.00	35° 15' 12.0"N 90° 3' 20.4"W - Across from MB 4680 Benjestown Rd. W side
	245 C	9.69	32.00	35° 13' 53.5"N 90° 6' 46.0"W - Arkansas Co Rd. 35 (Gammon Rd.) 540m S MB 6048
301°T	301 A	2.32	102.00	35° 16' 43.7"N 90° 2' 20.9"W - MB 5614 Benjestown Rd.
	301 B	4.00	56.50	35° 17' 11.1"N 90° 3' 18.3"W - 5875 Ramsey Rd. @ driveway
	301 C	12.89	8.20	35° 19' 39.9"N 90° 8' 20.7"W - Sluice Rd. @ crest of Levee, N side. Last 2.65 miles dirt, not accessable when wet.
343°T	343 A	3.89	74.00	35° 18' 8.2"N 90° 1' 50.1"W - 50' SE MB 981 Sylvan Rd. NE side.
	343 B	6.89	18.60	35° 19' 41.3"N 90° 2' 22.8"W - MB 7403 Benjestown Rd.
	343 C	7.56	14.60	35° 20' 1.8"N 90° 2' 32.4"W - Shelby Forest State Park, New Park Road, on crest between two sharp turns, in woods

Night Array Radial	Point#	Distance km	Field Strength Mv/m	Description
46°T	46A	3.83	1.89	35° 17' 34.1"N 89° 59' 9.8"W - Caney Creek Ct & Catskill Ct on sewer cover
	46B	5.64	1.53	35° 18' 14.0"N 89° 58' 17.2"W - 10m W of MB 2780 Littlejohn Rd., S side
	46C	6.90	0.57	35° 18' 42.8"N 89° 57' 41.5"W - 10m W of MB 3050 Ward Rd. S side
59°T	59A	3.84	1.15	35° 17' 13.0"N 89° 58' 49.0"W - Rust Rd, 30m S of house 5892
	59B	4.71	1.78	35° 17' 25.3"N 89° 58' 18.2"W - MB 6029 Hamlett
	59C	7.68	0.32	35° 18' 14.9"N 89° 56' 37.4"W - Home Acres & Chase Rd. E side under tree.
121°T	121A	4.03	10.90	35° 14' 58.0"N 89° 58' 46.7"W - 4532 Sunnyview, E side
	121B	5.99	3.60	35° 14' 25.8"N 89° 57' 40.9"W - Ponit Church Rd., 50' S Hawkins Mill Rd. W side
	121C	7.26	1.05	35° 14' 4.3"N 89° 56' 56.7"W - In traffic triangle, Allen Park Rd. & Hawkins Mill Rd. W side
134°T	134A	3.78	7.18	35° 14' 38.7"N 89° 59' 16.7"W - Hawkins Rd. 50m N of University @ barricade
	134B	4.82	6.10	35° 14' 15.6"N 89° 58' 46.7"W - MB 2519 Redvers
	134C	5.79	3.46	35° 13' 53.4"N 89° 58' 19.1"W - Across from 2746 Gruben
*182°T	182A	3.57	345.00	35° 14' 9.4"N 90° 1' 9.2"W - 4532 Sunnyview, E side
	182B	4.76	111.00	35° 13' 30.9"N 90° 1' 11.3"W - Point Church Rd., 50' S Hawkins Mill Rd. W side
	182C	6.05	115.00	35° 12' 49.2"N 90° 1' 13.3"W - In traffic triangle, Allen Park Rd. & Hawkins Mill Rd. W side
239°T	239A	2.81	22.60	35° 15' 17.9"N 90° 2' 38.5"W - 100m N MB 4706 Horton Rd. W side
	239B	3.94	15.30	35° 14' 59.3"N 90° 3' 17.1"W - 10m S MB 4558 Benjestown Rd. W side
	239C	10.27	2.33	35° 13' 13.7"N 90° 6' 52.3"W - Gammon Rd (AR CR 35) 150m N of Marion Lake Rd. E side
271°T	271A	2.69	5.11	35° 16' 6.6"N 90° 2' 49.9"W - 20' N FP in front of 5219 Benjestown Rd. W side
	271B	2.95	4.32	35° 16' 6.5"N 90° 3' 0.1"W - .1mi S MB 5237 Ramsay Rd, SW side
	271C	14.24	1.05	35° 16' 12.7"N 90° 10' 28.2"W - Goodwin Rd, 2.45km N of Gammon Rd.

Night Array Radial	Point#	Distance km	Field Strength Mv/m	Description
301°T	301A	2.31	9.96	35° 16' 43.6"N 90° 2' 21.5"W - MB 5614 Benjestown Rd.
	301B	3.97	1.72	35° 17' 11.3"N 90° 3' 18.1"W - 5875 Ramsey Rd. @ driveway
	301C	12.88	0.73	35° 19' 41.0"N 90° 8' 20.8"W - Sluice Rd. @ crest of Levee, N side. Last 2.65 miles dirt, not accessable when wet.
343°T	343A	3.99	2.97	35° 18' 8.3"N 90° 1' 50.1"W - 50' SE MB 981 Sylvan Rd. NE side.
	343B	7.00	1.10	35° 19' 42.1"N 90° 2' 23.1"W - MB 7403 Benjestown Rd.
	343C	7.67	0.90	35° 20' 2.8"N 90° 2' 31.7"W - Shelby Forest State Park, New Park Road, on crest between two sharp turns, in woods

* Indicates Main Lobe

Measurements were made by the undersigned on July 1-3, 2013 with Potomac Instruments FIM41 serial #2119 which was calibrated by it's manufacturer on October 23, 2112.

Item 8

RFR Compliance

Operation of WDIA at 50 kW daytime and 5 kW nighttime will not result in exposure of workers or the general public to RF radiation in excess of levels specified in 47CFR 1.1310. The perimeter of the property is encircled with fences to preclude the entry of the general public to the site. The tower bases are elevated and are reached by stairs. Signage has been installed at the bottom of the stairs to mark the areas where electric or magnetic fields would exceed permissible limits. Provisions have been made to provide hardware that will allow operation of the station in a non-directional mode at reduced power so that any area of the site may be entered with the associated tower de-energized. If it becomes necessary for workers to enter the tower base areas for maintenance, the station will either reduce power or cease operation to provide RFR safety for the workers.

Ground System Description

The ground system remains as described in the current license and consists of 120 – 61.0 meter buried copper radials equally spaced about each tower with intersecting radials from adjacent towers shortened and bonded to a common copper strap and with the center of the ground systems bonded together with copper strap. Additional 15.2 meter equally spaced radials are installed about towers 1, 2, 3, and 6.

Exhibit 2

Tower description

WDIA (AM)

CC Licenses, LLC

Memphis, TN

FID 69569

Tower #	ASRN	Tower Type	Overall Height in meters above base insulator	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (including obstruction lighting
1	1051772	Series fed, uniform cross section, guyed	70.1	74.2	75.1
2	1051773	Series fed, uniform cross section, guyed	70.1	74.0	74.9
3	1051774	Series fed, uniform cross section, guyed	70.1	73.0	73.9
4	1051775	Series fed, uniform cross section, guyed	70.1	71.4	72.3
5	1051776	Series fed, uniform cross section, guyed	70.1	71.0	71.9
6	1051777	Series fed, uniform cross section, guyed	70.1	73.6	74.5