COVINGTON & BURLING LLP

1201 PENNSYLVANIA AVENUE NW
WASHINGTON, DC 20004-2401
TEL 202.662.6000
FAX 202.662.6291
WWW.COV.COM

BEIJING
BRUSSELS
LONDON
NEW YORK
SAN DIEGO
SAN FRANCISCO
SILICON VALLEY
WASHINGTON

WILLIAM H. FITZ
TEL 202.662.5120
FAX 202.778.5120
WFITZ @ COV.COM

May 17, 2010

By Hand

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, DC 20554

Re:

WLXX-AM License Corp.
WRTO(AM), Chicago, Illinois (11196)
Facility Identification Number
Application for AM Broadcast License

Dear Ms. Dortch:

Transmitted herewith, on behalf of WLXX-AM License Corp., the licensee of WRTO(AM), Chicago, IL is its FCC Form 302-AM application for license to cover a construction permit (BP-20090427AAB). Also enclosed is a file copy of the Electronic Remittance Advice on FCC Form 159, from the Commission's Fee Filer system evidencing that the filing fee of $1,320.00 has been paid electronically today.

Any questions regarding this matter may be directed to the undersigned.

Respectfully submitted,

WH Fitz

William H. Fitz
Counsel for WLXX-AM License Corp.

Enclosures

Remittance ID:1780149 Authorization Number:084502 Successful Authorization -- Date Paid: 5/17/10 FILE COPY ONLY!!

READ IN STRUCTIONS CAREFU LLY BEFORE PROCEEDING (1) LOCK BOX #979089	FEDERAL COMMUNICATIONS COMMISSION **REMITTANCE ADVICE** **FORM 159** PAGE NO 1 OF 1	APPROVED BY OMB 3060-059 SPECIAL USE FCC USE ONLY

SECTION A - Payer Information

(2) PAYER NAME (if paying by credit card, enter name exactly as it appears on your card)	(3) TOTAL AMOUNT PAID (dollars and cents)
WLXX-AM License Corp.	**$1320.00**

(4) STREET ADDRESS LINE NO. 1
5999 Center Drive

(5) STREET ADDRESS LINE NO. 2

(6) CITY	(7) STATE	(8) ZIP CODE
Los Angeles	**CA**	**90045**

(9) DAYTIME TELEPHONE NUMBER (INCLUDING AREA CODE)	(10) COUNTRY CODE (IF NOT IN U.S.A.)
310-3483600	**US**

FCC REGISTRATION NUMBER (FRN) AND TAX IDENTIFICATION NUMBER (TIN) REQUIRED

(11) PAYER (FRN)	(12) FCC USE ONLY
0004946190	

IF PAYER NAME AND THE APPLICANT NAME ARE DIFFERENT, COMPLETE SECTION B
IF MORE THAN ONE APPLICANT, USE CONTINUATION SHEETS (FORM 159-C)

(13) APPLICANT NAME
WLXX-AM License Corp.

(14) STREET ADDRESS LINE NO. 1
5999 Center Drive

(15) STREET ADDRESS LINE NO. 2

(16) CITY	(17) STATE	(18) ZIP CODE
Los Angeles	**CA**	**90045**

(19) DAYTIME TELEPHONE NUMBER (INCLUDING AREA CODE)	(20) COUNTRY CODE (IF NOT IN U.S.A.)
310-3483600	**US**

FCC REGISTRATION NUMBER (FRN) AND TAX IDENTIFICATION NUMBER (TIN) REQUIRED

(21) APPLICANT (FRN)	(22) FCC USE ONLY
0004946190	

COMPLETE SECTION C FOR EACH SERVICE, IF MORE BOXES ARE NEEDED, USE CONTINUATION SHEET

(23A) FCC Call Sign/Other ID	(24A) Payment Type Code(PTC)	(25A) Quantity
WRTO	**MMR**	**1**
(26A) Fee Due for (PTC)	(27A) Total Fee	FCC Use Only
$615.00	**$615.00**	
(28A) FCC CODE 1	(29A) FCC CODE 2	
11196	**Chicago, IL**	

(23B) FCC Call Sign/Other ID	(24B) Payment Type Code(PTC)	(25B) Quantity
WRTO	**MOR**	**1**
(26B) Fee Due for (PTC)	(27B) Total Fee	FCC Use Only
$705.00	**$705.00**	
(28B) FCC CODE 1	(29B) FCC CODE 2	
11196	**Chicago, IL**	

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-20100517AFU

SECTION I - APPLICANT FEE INFORMATION

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

Christopher G. Wood

MAILING ADDRESS (Line 1) (Maximum 35 characters)
5999 Center Drive

MAILING ADDRESS (Line 2) (Maximum 35 characters)

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Los Angeles	CA	90045

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
(310) 348 3600	WRTO	

2. A. Is a fee submitted with this application? [✓] Yes [ ] No

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

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

C. If Yes, provide the following information:

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

(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
M M R	0 0 0 1	$ 615.00	

To be used only when you are requesting concurrent actions which result in a requirement to list more than one Fee Type Code.

(A)	(B)	(C)	FOR FCC USE ONLY
M O R	0 0 0 1	$ 705.00	

ADD ALL AMOUNTS SHOWN IN COLUMN C, AND ENTER THE TOTAL HERE. THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.	TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
	$ 1,320.00	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT WLXX AM LICENSE CORP.		
MAILING ADDRESS 5900 CENTER DRIVE SUITE 4083		
CITY LOS ANGELES	STATE CA	ZIP CODE 90045

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
WRTO	CHICAGO	BP-20090427AAB		05/04/2012

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

☐ Yes ☑ No

N/A directional

If No, explain in an Exhibit.

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

☑ Yes ☐ No

Exhibit No.

If No, state exceptions in an Exhibit.

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

Exhibit No.

If Yes, explain in an Exhibit.

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	
Christopher G. Wood		
Title	Date	Telephone Number
VP and Assistant General Counsel	05/17/10	(310) 348-3600

WILLFUL FALSE STATEMENTS ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. CODE, TITLE 18, SECTION 1001), AND/OR REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION

FCC NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT AND THE PAPERWORK REDUCTION ACT

The solicitation of personal information requested in this application is authorized by the Communications Act of 1934, as amended. The Commission will use the information provided in this form to determine whether grant of the application is in the public interest. In reaching that determination, or for law enforcement purposes, it may become necessary to refer personal information contained in this form to another government agency. In addition, all information provided in this form will be available for public inspection. If information requested on the form is not provided, the application may be returned without action having been taken upon it or its processing may be delayed while a request is made to provide the missing information. Your response is required to obtain the requested authorization.

Public reporting burden for this collection of information is estimated to average 639 hours and 53 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, can be sent to the Federal Communications Commission, Records Management Branch, Paperwork Reduction Project (3060-0627), Washington, D. C. 20554. Do NOT send completed forms to this address.

THE FOREGOING NOTICE IS REQUIRED BY THE PRIVACY ACT OF 1974, P.L. 93-579, DECEMBER 31, 1974, 5 U.S.C. 552a(e)(3), AND THE PAPERWORK REDUCTION ACT OF 1980, P.L. 96-511, DECEMBER 11, 1980, 44 U.S.C. 3507.

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
WLXX-AM LICENSE CORP.

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☑ Station License ☐ Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts	
				Night	Day
WRTO	BP-20090427AAB	1200	UNLIMITED	4.5	20

2. Station location

State	City or Town
IL	CHICAGO

3. Transmitter location

State	County	City or Town	Street address (or other identification)
IL	COOK	CHICAGO	247 W. 127TH sTREET

4. Main studio location

State	County	City or Town	Street address (or other identification)
IL	COOK	CHICAGO	625 N. MICHIGAN AVE SUITE 300

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

State	County	City or Town	Street address (or other identification)
IL	COOK	CHICAGO	625 N. MICHIGAN AVE SUITE 300

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. SEE TECH EXHIBIT

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
9.68	20.5

Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50	50	0	0

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
1	61.1	-56	243	635		
2	0	+55.2	1.0	358		
3	+20	0	307	1.0		
4	+24.1	+72.5	767	.647		
5	+119.1		1.017			
6	+145.3		.645			

Manufacturer and type of antenna monitor: Potomac Instruments AM 1901 SN 796

SECTION III - Page 2

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

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
SELF SUPPORTING SEE TECH EXHIBIT	56.3	57.6	57.6	Exhibit No. N/A

Excitation ☑ Series ☐ Shunt

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

North Latitude	West Longitude
41 ° 39 ' 43 "	87 ° 37 ' 48 "

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 TECH EX

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?
SEE TECH EXHIBIT

11. Give reasons for the change in antenna or common point resistance.
N/A NEWLY CONSTRUCTED SITE

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)
CHARLES W. STAPLES	Charles W Staples
Address (include ZIP Code) 4424 GLENWICK LANE UNIVERSITY PARK, TX 75205	Date 05/17/2010
	Telephone No. (Include Area Code) 214 526 6200

☐ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☑ Technical Consultant

☐ Other (specify)

Engineering Exhibit
Application For License
BP-20090427AAB
WLXX-AM License Corp.
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

Table of Contents

Engineering Exhibit
Application For License
BP-20090427AAB
WLXX-AM License Corp
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

Purpose of Application, Exceptions to Construction Permit

WLXX-AM License Corp ("WLXX") the licensee of WRTO has constructed the facility authorized by BP20090427AAB and hereby submits the application to license the facility. WLXX has chosen to use the method of moments proof authorized under 47 CFR 73.151(c). The newly constructed facility utilized six new towers with all new phasor, ATUs, transmitter, transmission lines, sample lines, sample transformers, and ground system. The site is constructed as described in the above referenced construction permit with the exception of the use of self supporting towers in place of guyed uniform cross section radiators, specified in the application for construction permit. The towers utilized are six identical self-supporting towers with an 81.2 degree electrical, and 56.35 m radiator height. The towers have a 3.65 meter base dimension, three legs, and taper to a uniform 24 inches by the 36.57 meter height above base insulator level. See Exhibit 1 for drawing of the towers used. The tower drawing from ERI shows, in error, the tower as being six feet above ground level rather than 4.27' or 1.3 m in the application for the construction permit mentioned above. The construction permit has the specifications for the bearings and limits of inverse distance fields at 1 kilometer incorrectly stated. The day values are specified as night, and the night values are specified as day. The correct values for day and night were used for adjustment and measurements.

Methodology

Impedances were measured at each tower at the location of the reference point of the toroidial sampling transformer; with all other towers floating by removing ATU output J-plugs. There were no other components shunted across the bases of the other towers with the exception of the static drain chokes. The Phasetek P600-161-3 static drain chokes are slightly capacitive according to manufacturer's specifications at –16.5K ohms at 1200 kHz. The three Austin A-3167 base insulators on each tower are each 10 pF for a total of 30 pF per tower.

Towers were modeled using Mininec Broadcast Professional Expert Version 6.0. Twelve segments with a decreasing radius to represent the taper of the structures were used to represent each of the six 81.2 degree towers using the geometry of the array specified in the above referenced construction permit. Each individual tower base impedance was calculated as a driven source with all other towers floating to obtain a modeled self-impedance. The modeled values of the tower self impedance were then calculated to include the base components, such as stray capacitance of the base insulator, the inductance of the feed, etc. between the base of the tower and the ATU using ECA 2.13, a nodal analysis program, to relate the modeled base resistance and reactance to the ATU measured values. All modeled values of were found to be equivalent to measured values within $\pm$2 ohms and $\pm$4 percent for both resistance and reactance. See the following Exhibit 1 for details and verification of the modeling procedure. Impedance measurements of the tower base self-impedances were measured using a Delta OIB-3 Bridge and a Potomac RX31/SD31 receiver/detector. Inductance of each tower feed was measured with this same equipment, with the base of the tower under test shorted to obtain a measured value of feed inductance for each individual tower.

After verification of the modeling procedure, the method of moments model of the array was utilized for directional antenna calculation of complex voltage values at ground level under each tower using the theoretical parameters of the

day and night parameters in the above referenced construction permit. Using these voltage sources, current magnitudes and phases for each element of the array were derived for the day and critical hours arrays. See Exhibit 2 for details of these calculations. These values of current and phase were normalized to the reference tower and, using ECA, corrected to determine the equivalent value at the sampling point in the ATU. These values were again normalized to the reference tower. See Exhibit 3 for details of the calculations for values at the sampling point using this program and the final antenna monitor parameters specified on the Form 302AM.

The sample lines consist of six identical lengths of ½" foam Heliax transmission line. Impedance measurements made of the sampling system were made with an HP 8752A network analyzer in a calibrated measurement system. Measurements were made at the antenna monitor end of the sample lines connected to the sampling transformers at the tower bases while under open circuit conditions. Additionally, measurements were made at the antenna monitor end of the sample lines without the sample lines connected to the sampling transformers. Frequencies above and below carrier frequency where resonance occurred were determined. As the length of a distortion less 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 resonant frequency below or above carrier frequency (closest one to carrier frequency in terms of the ratio of frequencies) was found to be 450 degrees. The resonant frequency closer to the carrier frequency above carrier frequency is approximately 1653 KHz. The lengths were calculated by the ratio of the frequencies. To determine characteristic impedance values of the lines, open circuit measurements were made with frequencies offset to produce $\pm$ 45 degrees of electrical line length at the resonant frequency (approximately 1061 KHz and 1297 KHz). The characteristic impedance was calculated (using the equation: $\mathbf{Z_0 = ((R_1^2 + X_1^2)^{1/2} X (R_2^2 + X_2^2)^{1/2})^{1/2},}$ where R1 + jX1 and R2 + jX2 are

the measured impedances at the + 45 and –45 degree offset frequencies. The electrical lengths of the sample lines was determined to be within .2° of each other. The sample transformers utilized were six new Phasetek P600-203 1.0 V/A. They were tested by the manufacturer at the time of installation in the new Phasetek ATUs, and certified to be within 1% ratio and 1° accuracy. The antenna monitor is a Potomac Instruments AM 1901, serial number 769. See Exhibit 4 for details of sample system measurements.

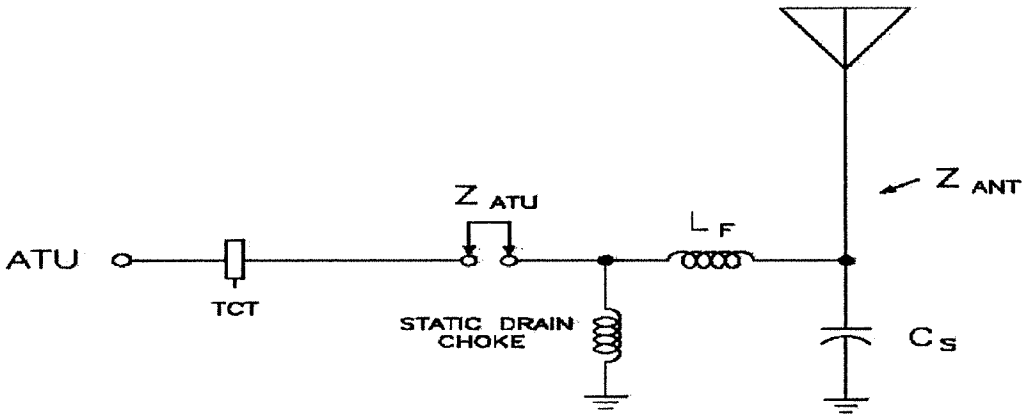
Reference measurements were made at all bearings designated as protections in the construction permit for day and night modes. Additional measurements were made in the major lobe, 13 degrees, of each mode. Please note that the CP has the day bearings and minima specified as night, and the night bearings and minima specified as day. As mentioned previously, the pattern minima for day and night patterns are reversed on the construction permit. The correct values and bearings were used for the reference measurements. All measurements were made for WLXX by Josh Sigstad using FIM 21 serial number 1291. See Exhibit 5 for the measurements.

A survey was done of the new six tower array after completion of all construction. The survey demonstrates that the entire antenna array is constructed well within the tolerances specified in 73.151. See Exhibit 6 for a copy of the certified survey.

Engineering Exhibit 1
Modeling and Verification of Modeling
Application For License
BP-20090427AAB
WLXX-AM License Corp
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

Tower Impedance Measurements Compared to

Method of Moments Model



TOWER	Specified Cs (pf)	Measured L_F (µH)	Measured X_F (O)	Modeled Z_{ANT} (O)	Modeled Z_{ATU} (O)	Measured Z_{ATU} (O)
1	30	2.79	+j21.0	35.4 –j0.9	35.6 +j19.8	35.5 +j19.2
2	30	2.59	+j19.5	31.8 –j12.2	31.7 +j7.1	31.5 +j7.2
3	30	1.99	+j15.0	34.3 –j2.5	34.4 +j12.2	34.5 +j12.0
4	30	2.55	+j19.2	34.4 –j10.6	34.4 +j8.3	34.5 +j8.4
5	30	3.10	+j23.4	33.7 –j12.8	33.6 +j10.3	33.5 +j10.2
6	30	3.41	+j25.7	36.0 –j7.8	36.0 +j17.6	36.0 +j17.4

WRTO MODEL SUMMARY

Twr #	*Model Zant*	*Model Zatu*	*Measured Zatu*	*Lf (uH)*
1	35.4 –j0.9	35.6 +j19.8	35.5 +j19.2	2.79
2	31.8 –j12.2	31.7 +j7.1	31.5 +j7.2	2.59
3	34.3 –j2.5	34.4 +j12.2	34.5 +j12.0	1.99
4	34.4 –j10.6	34.4 +j8.3	34.5 +j8.4	2.55
5	33.7 –j12.8	33.6 +j10.3	33.5 +j10.2	3.10
6	36.0 –j7.8	36.0 +j17.6	36.0 +j17.4	3.41

Base insulators: (3) Austin A-3167
Total 30 pF

Phasetek Inc. P600-161-3 static drain chokes
Measures –j16.5K @ 1200 kHz

WRTO TOWER 1 (OTHERS OPEN)

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	0	0	0	0
2	13	0	-4,421.	0	0	0
3	25	0	-4,421.	0	0	0
4	37	0	-4,421.	0	0	0
5	49	0	-4,421.	0	0	0
6	61	0	-4,421.	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.2	35.423	-.94082	35.435	-1.52	1.4125	-15.34	-1.6289

CURRENT rms
Frequency = 1.2 MHz
Input power = .0141053 watts
Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	.019955	1.52	.019948	5.3E-04
2	0	0	7.425	.0197862	-1.52	.0197793	-5.25E-04
3	0	0	14.85	.0193035	-3.05	.0192761	-1.03E-03
4	0	0	22.275	.0184936	-4.28	.0184421	-1.38E-03
END	0	0	29.7	.0172938	-5.37	.0172178	-1.62E-03
2J1	0	0	29.7	.0172938	-5.37	.0172178	-1.62E-03
6	0	0	37.1	.016106	-6.12	.0160143	-1.72E-03
7	0	0	44.5	.0145686	-6.83	.0144654	-1.73E-03
8	0	0	51.9	.0127379	-7.5	.0126291	-1.66E-03
END	0	0	59.3	.010508	-8.18	.0104013	-1.49E-03
2J2	0	0	59.3	.010508	-8.18	.0104013	-1.49E-03
10	0	0	67.725	8.49E-03	-8.7	8.39E-03	-1.28E-03
11	0	0	76.15	6.09E-03	-9.21	6.01E-03	-9.75E-04
12	0	0	84.575	3.39E-03	-9.72	3.34E-03	-5.72E-04
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	1.04E-04	-138.08	-7.71E-05	-6.93E-05
14	-78.2854	-41.2752	7.425	8.72E-04	-138.02	-6.48E-04	-5.83E-04
15	-78.2854	-41.2752	14.85	1.16E-03	-137.9	-8.61E-04	-7.78E-04
16	-78.2854	-41.2752	22.275	1.36E-03	-137.75	-1.E-03	-9.11E-04
END	-78.2854	-41.2752	29.7	1.46E-03	-137.57	-1.08E-03	-9.87E-04
2J4	-78.2854	-41.2752	29.7	1.46E-03	-137.57	-1.08E-03	-9.87E-04
18	-78.2854	-41.2752	37.1	1.48E-03	-137.42	-1.09E-03	-1.E-03
19	-78.2854	-41.2752	44.5	1.44E-03	-137.24	-1.05E-03	-9.74E-04
20	-78.2854	-41.2752	51.9	1.33E-03	-137.05	-9.71E-04	-9.04E-04

END	-78.2854	-41.2752	59.3	1.15E-03	-136.84	-8.36E-04	-7.84E-04
2J5	-78.2854	-41.2752	59.3	1.15E-03	-136.84	-8.36E-04	-7.84E-04
22	-78.2854	-41.2752	67.15	9.63E-04	-136.68	-7.01E-04	-6.61E-04
23	-78.2854	-41.2752	75.	7.18E-04	-136.51	-5.21E-04	-4.94E-04
24	-78.2854	-41.2752	82.85	4.15E-04	-136.34	-3.E-04	-2.87E-04
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	8.59E-05	-163.88	-8.25E-05	-2.38E-05
26	-73.2367	101.545	7.425	7.23E-04	-163.89	-6.95E-04	-2.01E-04
27	-73.2367	101.545	14.85	9.65E-04	-163.91	-9.27E-04	-2.67E-04
28	-73.2367	101.545	22.275	1.13E-03	-163.94	-1.09E-03	-3.13E-04
END	-73.2367	101.545	29.7	1.22E-03	-163.97	-1.18E-03	-3.38E-04
2J7	-73.2367	101.545	29.7	1.22E-03	-163.97	-1.18E-03	-3.38E-04
30	-73.2367	101.545	37.1	1.24E-03	-164.	-1.2E-03	-3.43E-04
31	-73.2367	101.545	44.5	1.21E-03	-164.04	-1.16E-03	-3.33E-04
32	-73.2367	101.545	51.9	1.13E-03	-164.09	-1.08E-03	-3.09E-04
END	-73.2367	101.545	59.3	9.79E-04	-164.15	-9.42E-04	-2.68E-04
2J8	-73.2367	101.545	59.3	9.79E-04	-164.15	-9.42E-04	-2.68E-04
34	-73.2367	101.545	67.35	8.26E-04	-164.2	-7.94E-04	-2.25E-04
35	-73.2367	101.545	75.4	6.17E-04	-164.27	-5.94E-04	-1.67E-04
36	-73.2367	101.545	83.45	3.57E-04	-164.35	-3.44E-04	-9.64E-05
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	5.66E-05	87.92	2.06E-06	5.66E-05
38	-158.264	159.93	7.425	4.77E-04	87.9	1.75E-05	4.77E-04
39	-158.264	159.93	14.85	6.37E-04	87.86	2.38E-05	6.37E-04
40	-158.264	159.93	22.275	7.49E-04	87.79	2.88E-05	7.48E-04
END	-158.264	159.93	29.7	8.14E-04	87.7	3.27E-05	8.13E-04
2J10	-158.264	159.93	29.7	8.14E-04	87.7	3.27E-05	8.13E-04
42	-158.264	159.93	37.1	8.29E-04	87.6	3.47E-05	8.28E-04
43	-158.264	159.93	44.5	8.1E-04	87.47	3.58E-05	8.09E-04
44	-158.264	159.93	51.9	7.57E-04	87.3	3.56E-05	7.56E-04
END	-158.264	159.93	59.3	6.62E-04	87.08	3.37E-05	6.62E-04
2J11	-158.264	159.93	59.3	6.62E-04	87.08	3.37E-05	6.62E-04
46	-158.264	159.93	67.375	5.61E-04	86.88	3.05E-05	5.6E-04
47	-158.264	159.93	75.45	4.22E-04	86.64	2.47E-05	4.21E-04
48	-158.264	159.93	83.525	2.46E-04	86.37	1.56E-05	2.45E-04
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	9.03E-05	175.63	-9.E-05	6.88E-06
50	-137.915	-24.0701	7.425	7.59E-04	175.59	-7.57E-04	5.84E-05
51	-137.915	-24.0701	14.85	1.01E-03	175.51	-1.01E-03	7.91E-05
52	-137.915	-24.0701	22.275	1.18E-03	175.42	-1.18E-03	9.45E-05
END	-137.915	-24.0701	29.7	1.28E-03	175.31	-1.27E-03	1.05E-04
2J13	-137.915	-24.0701	29.7	1.28E-03	175.31	-1.27E-03	1.05E-04
54	-137.915	-24.0701	37.1	1.29E-03	175.22	-1.29E-03	1.08E-04
55	-137.915	-24.0701	44.5	1.26E-03	175.12	-1.25E-03	1.07E-04
56	-137.915	-24.0701	51.9	1.16E-03	175.02	-1.16E-03	1.01E-04
END	-137.915	-24.0701	59.3	1.E-03	174.91	-9.96E-04	8.87E-05
2J14	-137.915	-24.0701	59.3	1.E-03	174.91	-9.96E-04	8.87E-05
58	-137.915	-24.0701	66.925	8.42E-04	174.83	-8.39E-04	7.59E-05
59	-137.915	-24.0701	74.55	6.3E-04	174.74	-6.27E-04	5.78E-05
60	-137.915	-24.0701	82.175	3.66E-04	174.64	-3.64E-04	3.42E-05
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	5.99E-05	46.92	4.09E-05	4.38E-05
62	-213.087	156.528	7.425	5.05E-04	46.86	3.45E-04	3.68E-04
63	-213.087	156.528	14.85	6.75E-04	46.76	4.63E-04	4.92E-04
64	-213.087	156.528	22.275	7.94E-04	46.64	5.45E-04	5.77E-04
END	-213.087	156.528	29.7	8.65E-04	46.49	5.95E-04	6.27E-04
2J16	-213.087	156.528	29.7	8.65E-04	46.49	5.95E-04	6.27E-04

66	-213.087	156.528	37.1	8.82E-04	46.37	6.08E-04	6.38E-04
67	-213.087	156.528	44.5	8.64E-04	46.24	5.98E-04	6.24E-04
68	-213.087	156.528	51.9	8.09E-04	46.1	5.61E-04	5.83E-04
END	-213.087	156.528	59.3	7.12E-04	45.95	4.95E-04	5.12E-04
2J17	-213.087	156.528	59.3	7.12E-04	45.95	4.95E-04	5.12E-04
70	-213.087	156.528	67.525	6.04E-04	45.82	4.21E-04	4.33E-04
71	-213.087	156.528	75.75	4.55E-04	45.68	3.18E-04	3.25E-04
72	-213.087	156.528	83.975	2.65E-04	45.54	1.86E-04	1.89E-04
END	-213.087	156.528	92.2	0	0	0	0

WRTO TOWER 1 (OTHERS OPEN)

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.79u	
6	C2	3	0	30.p	
7	R3	3	0	35.4	J-0.9

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	406.938u	-67.809	29.094	-67.3466n
1.2M	V:2	406.065u	-67.828	29.162	-67.5054n
1.2M	V:3	354.329u	-69.012	-2.049	4.74262n
1.2M	Z:R1	40.6938	16.095	29.094	-67.3466n

Z (IN) = 35.6 +j 19.8

WRTO TOWER 2 (OTHERS OPEN)

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-4,421.	0	0	0
2	13	0	0	0	0	0
3	25	0	-4,421.	0	0	0
4	37	0	-4,421.	0	0	0
5	49	0	-4,421.	0	0	0
6	61	0	-4,421.	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 13, sector 1							
1.2	31.778	-12.227	34.05	-21.04	1.7225	-11.523	-2.6788

CURRENT rms

Frequency = 1.2 MHz

Input power = .013705 watts

Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	1.08E-04	-118.65	-5.19E-05	-9.51E-05
2	0	0	7.425	9.12E-04	-118.59	-4.36E-04	-8.01E-04
3	0	0	14.85	1.22E-03	-118.47	-5.8E-04	-1.07E-03
4	0	0	22.275	1.43E-03	-118.33	-6.76E-04	-1.25E-03
END	0	0	29.7	1.55E-03	-118.14	-7.29E-04	-1.36E-03
2J1	0	0	29.7	1.55E-03	-118.14	-7.29E-04	-1.36E-03
6	0	0	37.1	1.57E-03	-117.98	-7.37E-04	-1.39E-03
7	0	0	44.5	1.53E-03	-117.79	-7.14E-04	-1.36E-03
8	0	0	51.9	1.43E-03	-117.57	-6.61E-04	-1.27E-03
END	0	0	59.3	1.25E-03	-117.33	-5.75E-04	-1.11E-03
2J2	0	0	59.3	1.25E-03	-117.33	-5.75E-04	-1.11E-03
10	0	0	67.725	1.05E-03	-117.11	-4.81E-04	-9.39E-04
11	0	0	76.15	7.88E-04	-116.88	-3.56E-04	-7.02E-04
12	0	0	84.575	4.55E-04	-116.65	-2.04E-04	-4.06E-04
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	.020767	21.04	.0193818	7.46E-03
14	-78.2854	-41.2752	7.425	.0202312	18.27	.0192111	6.34E-03
15	-78.2854	-41.2752	14.85	.0195406	16.85	.0187021	5.66E-03
16	-78.2854	-41.2752	22.275	.0185492	15.69	.0178582	5.02E-03
END	-78.2854	-41.2752	29.7	.017177	14.65	.0166187	4.34E-03
2J4	-78.2854	-41.2752	29.7	.017177	14.65	.0166187	4.34E-03
18	-78.2854	-41.2752	37.1	.0158681	13.94	.015401	3.82E-03
19	-78.2854	-41.2752	44.5	.0142133	13.25	.013835	3.26E-03
20	-78.2854	-41.2752	51.9	.0122743	12.6	.0119789	2.68E-03
END	-78.2854	-41.2752	59.3	9.94E-03	11.92	9.72E-03	2.05E-03

2J5	-78.2854	-41.2752	59.3	9.94E-03	11.92	9.72E-03	2.05E-03
22	-78.2854	-41.2752	67.15	8.E-03	11.44	7.84E-03	1.59E-03
23	-78.2854	-41.2752	75.	5.73E-03	10.95	5.63E-03	1.09E-03
24	-78.2854	-41.2752	82.85	3.19E-03	10.47	3.14E-03	5.8E-04
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	7.92E-05	-167.42	-7.73E-05	-1.73E-05
26	-73.2367	101.545	7.425	6.67E-04	-167.45	-6.51E-04	-1.45E-04
27	-73.2367	101.545	14.85	8.9E-04	-167.51	-8.69E-04	-1.93E-04
28	-73.2367	101.545	22.275	1.04E-03	-167.58	-1.02E-03	-2.24E-04
END	-73.2367	101.545	29.7	1.13E-03	-167.68	-1.11E-03	-2.42E-04
2J7	-73.2367	101.545	29.7	1.13E-03	-167.68	-1.11E-03	-2.42E-04
30	-73.2367	101.545	37.1	1.15E-03	-167.76	-1.12E-03	-2.44E-04
31	-73.2367	101.545	44.5	1.12E-03	-167.87	-1.1E-03	-2.36E-04
32	-73.2367	101.545	51.9	1.04E-03	-167.99	-1.02E-03	-2.17E-04
END	-73.2367	101.545	59.3	9.08E-04	-168.14	-8.89E-04	-1.87E-04
2J8	-73.2367	101.545	59.3	9.08E-04	-168.14	-8.89E-04	-1.87E-04
34	-73.2367	101.545	67.35	7.66E-04	-168.27	-7.5E-04	-1.56E-04
35	-73.2367	101.545	75.4	5.73E-04	-168.43	-5.62E-04	-1.15E-04
36	-73.2367	101.545	83.45	3.32E-04	-168.6	-3.26E-04	-6.57E-05
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	6.05E-05	111.73	-2.24E-05	5.62E-05
38	-158.264	159.93	7.425	5.09E-04	111.7	-1.88E-04	4.73E-04
39	-158.264	159.93	14.85	6.8E-04	111.64	-2.51E-04	6.32E-04
40	-158.264	159.93	22.275	7.99E-04	111.55	-2.94E-04	7.43E-04
END	-158.264	159.93	29.7	8.68E-04	111.44	-3.17E-04	8.08E-04
2J10	-158.264	159.93	29.7	8.68E-04	111.44	-3.17E-04	8.08E-04
42	-158.264	159.93	37.1	8.84E-04	111.33	-3.22E-04	8.24E-04
43	-158.264	159.93	44.5	8.64E-04	111.19	-3.12E-04	8.06E-04
44	-158.264	159.93	51.9	8.07E-04	111.02	-2.9E-04	7.53E-04
END	-158.264	159.93	59.3	7.07E-04	110.81	-2.51E-04	6.61E-04
2J11	-158.264	159.93	59.3	7.07E-04	110.81	-2.51E-04	6.61E-04
46	-158.264	159.93	67.375	5.99E-04	110.62	-2.11E-04	5.6E-04
47	-158.264	159.93	75.45	4.5E-04	110.4	-1.57E-04	4.22E-04
48	-158.264	159.93	83.525	2.62E-04	110.15	-9.04E-05	2.46E-04
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	1.25E-04	-92.44	-5.33E-06	-1.25E-04
50	-137.915	-24.0701	7.425	1.05E-03	-92.26	-4.16E-05	-1.05E-03
51	-137.915	-24.0701	14.85	1.4E-03	-91.92	-4.69E-05	-1.4E-03
52	-137.915	-24.0701	22.275	1.63E-03	-91.48	-4.2E-05	-1.63E-03
END	-137.915	-24.0701	29.7	1.76E-03	-90.9	-2.78E-05	-1.76E-03
2J13	-137.915	-24.0701	29.7	1.76E-03	-90.9	-2.78E-05	-1.76E-03
54	-137.915	-24.0701	37.1	1.78E-03	-90.4	-1.24E-05	-1.78E-03
55	-137.915	-24.0701	44.5	1.72E-03	-89.8	6.07E-06	-1.72E-03
56	-137.915	-24.0701	51.9	1.58E-03	-89.12	2.43E-05	-1.58E-03
END	-137.915	-24.0701	59.3	1.36E-03	-88.32	3.99E-05	-1.36E-03
2J14	-137.915	-24.0701	59.3	1.36E-03	-88.32	3.99E-05	-1.36E-03
58	-137.915	-24.0701	66.925	1.14E-03	-87.69	4.59E-05	-1.14E-03
59	-137.915	-24.0701	74.55	8.5E-04	-87.01	4.43E-05	-8.49E-04
60	-137.915	-24.0701	82.175	4.92E-04	-86.31	3.17E-05	-4.91E-04
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	5.91E-05	90.5	-5.12E-07	5.91E-05
62	-213.087	156.528	7.425	4.98E-04	90.45	-3.87E-06	4.98E-04
63	-213.087	156.528	14.85	6.66E-04	90.35	-4.05E-06	6.66E-04
64	-213.087	156.528	22.275	7.82E-04	90.23	-3.12E-06	7.82E-04
END	-213.087	156.528	29.7	8.51E-04	90.08	-1.2E-06	8.51E-04
2J16	-213.087	156.528	29.7	8.51E-04	90.08	-1.2E-06	8.51E-04
66	-213.087	156.528	37.1	8.68E-04	89.96	6.76E-07	8.68E-04

67	-213.087	156.528	44.5	8.5E-04	89.81	2.79E-06	8.5E-04
68	-213.087	156.528	51.9	7.96E-04	89.65	4.8E-06	7.96E-04
END	-213.087	156.528	59.3	7.E-04	89.47	6.46E-06	7.E-04
2J17	-213.087	156.528	59.3	7.E-04	89.47	6.46E-06	7.E-04
70	-213.087	156.528	67.525	5.94E-04	89.32	7.07E-06	5.94E-04
71	-213.087	156.528	75.75	4.47E-04	89.14	6.68E-06	4.47E-04
72	-213.087	156.528	83.975	2.61E-04	88.95	4.77E-06	2.61E-04
END	-213.087	156.528	92.2	0	0	0	0

WRTO TOWER 2 (OTHERS OPEN)

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.59u	
6	C2	3	0	30.p	
7	R3	3	0	31.8	J-12.2

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	325.196u	-69.757	12.562	-29.0794n
1.2M	V:2	324.221u	-69.783	12.601	-29.1683n
1.2M	V:3	339.691u	-69.378	-21.514	49.8n
1.2M	Z:R1	32.5196	15.121	12.562	-29.0794n

Z (IN) = 31.7 +j 7.1

WRTO TOWER 3 (OTHERS OPEN)

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-4,421.	0	0	0
2	13	0	-4,421.	0	0	0
3	25	0	0	0	0	0
4	37	0	-4,421.	0	0	0
5	49	0	-4,421.	0	0	0
6	61	0	-4,421.	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 25, sector 1							
1.2	34.268	-2.4933	34.358	-4.16	1.4659	-14.473	-1.819

CURRENT rms

Frequency = 1.2 MHz

Input power = .0145142 watts

Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	8.86E-05	-161.27	-8.4E-05	-2.85E-05
2	0	0	7.425	7.47E-04	-161.28	-7.07E-04	-2.4E-04
3	0	0	14.85	9.97E-04	-161.3	-9.45E-04	-3.2E-04
4	0	0	22.275	1.17E-03	-161.31	-1.11E-03	-3.75E-04
END	0	0	29.7	1.27E-03	-161.34	-1.21E-03	-4.07E-04
2J1	0	0	29.7	1.27E-03	-161.34	-1.21E-03	-4.07E-04
6	0	0	37.1	1.3E-03	-161.36	-1.23E-03	-4.14E-04
7	0	0	44.5	1.27E-03	-161.4	-1.2E-03	-4.04E-04
8	0	0	51.9	1.19E-03	-161.44	-1.12E-03	-3.77E-04
END	0	0	59.3	1.04E-03	-161.49	-9.88E-04	-3.31E-04
2J2	0	0	59.3	1.04E-03	-161.49	-9.88E-04	-3.31E-04
10	0	0	67.725	8.8E-04	-161.54	-8.35E-04	-2.79E-04
11	0	0	76.15	6.59E-04	-161.6	-6.25E-04	-2.08E-04
12	0	0	84.575	3.82E-04	-161.68	-3.62E-04	-1.2E-04
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	7.82E-05	175.75	-7.8E-05	5.79E-06
14	-78.2854	-41.2752	7.425	6.58E-04	175.73	-6.56E-04	4.9E-05
15	-78.2854	-41.2752	14.85	8.77E-04	175.67	-8.75E-04	6.62E-05
16	-78.2854	-41.2752	22.275	1.03E-03	175.6	-1.02E-03	7.88E-05
END	-78.2854	-41.2752	29.7	1.11E-03	175.51	-1.11E-03	8.71E-05
2J4	-78.2854	-41.2752	29.7	1.11E-03	175.51	-1.11E-03	8.71E-05
18	-78.2854	-41.2752	37.1	1.13E-03	175.43	-1.12E-03	8.99E-05
19	-78.2854	-41.2752	44.5	1.1E-03	175.33	-1.09E-03	8.93E-05
20	-78.2854	-41.2752	51.9	1.02E-03	175.22	-1.01E-03	8.48E-05

END	-78.2854	-41.2752	59.3	8.83E-04	175.09	-8.79E-04	7.56E-05
2J5	-78.2854	-41.2752	59.3	8.83E-04	175.09	-8.79E-04	7.56E-05
22	-78.2854	-41.2752	67.15	7.44E-04	174.98	-7.42E-04	6.51E-05
23	-78.2854	-41.2752	75.	5.57E-04	174.85	-5.55E-04	5.E-05
24	-78.2854	-41.2752	82.85	3.24E-04	174.71	-3.22E-04	2.98E-05
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	.0205804	4.16	.0205261	1.49E-03
26	-73.2367	101.545	7.425	.0203525	1.21	.0203479	4.31E-04
27	-73.2367	101.545	14.85	.0198165	-.27	.0198163	-9.47E-05
28	-73.2367	101.545	22.275	.0189415	-1.47	.0189353	-4.85E-04
END	-73.2367	101.545	29.7	.0176586	-2.53	.0176413	-7.8E-04
2J7	-73.2367	101.545	29.7	.0176586	-2.53	.0176413	-7.8E-04
30	-73.2367	101.545	37.1	.0163963	-3.25	.0163699	-9.3E-04
31	-73.2367	101.545	44.5	.0147694	-3.94	.0147344	-1.02E-03
32	-73.2367	101.545	51.9	.012837	-4.6	.0127957	-1.03E-03
END	-73.2367	101.545	59.3	.0104854	-5.26	.0104413	-9.61E-04
2J8	-73.2367	101.545	59.3	.0104854	-5.26	.0104413	-9.61E-04
34	-73.2367	101.545	67.35	8.47E-03	-5.75	8.42E-03	-8.48E-04
35	-73.2367	101.545	75.4	6.08E-03	-6.23	6.04E-03	-6.6E-04
36	-73.2367	101.545	83.45	3.39E-03	-6.71	3.37E-03	-3.96E-04
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	1.01E-04	-141.65	-7.9E-05	-6.25E-05
38	-158.264	159.93	7.425	8.47E-04	-141.6	-6.64E-04	-5.26E-04
39	-158.264	159.93	14.85	1.13E-03	-141.51	-8.84E-04	-7.03E-04
40	-158.264	159.93	22.275	1.32E-03	-141.4	-1.03E-03	-8.24E-04
END	-158.264	159.93	29.7	1.43E-03	-141.28	-1.12E-03	-8.95E-04
2J10	-158.264	159.93	29.7	1.43E-03	-141.28	-1.12E-03	-8.95E-04
42	-158.264	159.93	37.1	1.45E-03	-141.18	-1.13E-03	-9.09E-04
43	-158.264	159.93	44.5	1.41E-03	-141.08	-1.1E-03	-8.87E-04
44	-158.264	159.93	51.9	1.31E-03	-140.98	-1.02E-03	-8.26E-04
END	-158.264	159.93	59.3	1.14E-03	-140.89	-8.85E-04	-7.2E-04
2J11	-158.264	159.93	59.3	1.14E-03	-140.89	-8.85E-04	-7.2E-04
46	-158.264	159.93	67.375	9.61E-04	-140.82	-7.45E-04	-6.07E-04
47	-158.264	159.93	75.45	7.19E-04	-140.77	-5.57E-04	-4.54E-04
48	-158.264	159.93	83.525	4.16E-04	-140.73	-3.22E-04	-2.63E-04
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	6.97E-05	178.33	-6.97E-05	2.03E-06
50	-137.915	-24.0701	7.425	5.87E-04	178.31	-5.86E-04	1.73E-05
51	-137.915	-24.0701	14.85	7.81E-04	178.26	-7.81E-04	2.37E-05
52	-137.915	-24.0701	22.275	9.13E-04	178.19	-9.13E-04	2.88E-05
END	-137.915	-24.0701	29.7	9.86E-04	178.11	-9.86E-04	3.26E-05
2J13	-137.915	-24.0701	29.7	9.86E-04	178.11	-9.86E-04	3.26E-05
54	-137.915	-24.0701	37.1	9.98E-04	178.03	-9.97E-04	3.43E-05
55	-137.915	-24.0701	44.5	9.68E-04	177.94	-9.67E-04	3.48E-05
56	-137.915	-24.0701	51.9	8.94E-04	177.83	-8.93E-04	3.39E-05
END	-137.915	-24.0701	59.3	7.69E-04	177.69	-7.69E-04	3.1E-05
2J14	-137.915	-24.0701	59.3	7.69E-04	177.69	-7.69E-04	3.1E-05
58	-137.915	-24.0701	66.925	6.48E-04	177.58	-6.47E-04	2.74E-05
59	-137.915	-24.0701	74.55	4.84E-04	177.45	-4.84E-04	2.15E-05
60	-137.915	-24.0701	82.175	2.81E-04	177.3	-2.81E-04	1.32E-05
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	8.97E-05	174.68	-8.93E-05	8.32E-06
62	-213.087	156.528	7.425	7.55E-04	174.63	-7.52E-04	7.07E-05
63	-213.087	156.528	14.85	1.01E-03	174.53	-1.E-03	9.6E-05
64	-213.087	156.528	22.275	1.18E-03	174.42	-1.18E-03	1.15E-04
END	-213.087	156.528	29.7	1.28E-03	174.29	-1.28E-03	1.28E-04
2J16	-213.087	156.528	29.7	1.28E-03	174.29	-1.28E-03	1.28E-04

66	-213.087	156.528	37.1	1.31E-03	174.19	-1.3E-03	1.32E-04
67	-213.087	156.528	44.5	1.28E-03	174.09	-1.27E-03	1.32E-04
68	-213.087	156.528	51.9	1.19E-03	173.98	-1.19E-03	1.25E-04
END	-213.087	156.528	59.3	1.04E-03	173.87	-1.04E-03	1.12E-04
2J17	-213.087	156.528	59.3	1.04E-03	173.87	-1.04E-03	1.12E-04
70	-213.087	156.528	67.525	8.84E-04	173.79	-8.79E-04	9.56E-05
71	-213.087	156.528	75.75	6.63E-04	173.71	-6.59E-04	7.27E-05
72	-213.087	156.528	83.975	3.85E-04	173.62	-3.83E-04	4.28E-05
END	-213.087	156.528	92.2	0	0	0	0

WRTO TOWER 3 (OTHERS OPEN)

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	1.99u	
6	C2	3	0	30.p	
7	R3	3	0	34.3	J-2.5

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	364.886u	-68.757	19.483	-45.0988n
1.2M	V:2	363.943u	-68.779	19.535	-45.2203n
1.2M	V:3	343.84u	-69.273	-4.738	10.9686n
1.2M	Z:R1	36.4886	15.622	19.483	-45.0988n

Z (IN) = 34.4 +j 12.2

WRTO TOWER 4 (OTHERS OPEN)

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-4,421.	0	0	0
2	13	0	-4,421.	0	0	0
3	25	0	-4,421.	0	0	0
4	37	0	0	0	0	0
5	49	0	-4,421.	0	0	0
6	61	0	-4,421.	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 37, sector 1							
1.2	34.381	-10.646	35.991	-17.21	1.5715	-13.063	-2.1832

CURRENT rms
Frequency = 1.2 MHz
Input power = .0132706 watts
Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	5.59E-05	103.58	-1.31E-05	5.44E-05
2	0	0	7.425	4.72E-04	103.53	-1.1E-04	4.59E-04
3	0	0	14.85	6.32E-04	103.45	-1.47E-04	6.14E-04
4	0	0	22.275	7.44E-04	103.34	-1.72E-04	7.24E-04
END	0	0	29.7	8.11E-04	103.21	-1.85E-04	7.9E-04
2J1	0	0	29.7	8.11E-04	103.21	-1.85E-04	7.9E-04
6	0	0	37.1	8.29E-04	103.09	-1.88E-04	8.07E-04
7	0	0	44.5	8.14E-04	102.94	-1.82E-04	7.93E-04
8	0	0	51.9	7.64E-04	102.77	-1.69E-04	7.45E-04
END	0	0	59.3	6.75E-04	102.57	-1.47E-04	6.59E-04
2J2	0	0	59.3	6.75E-04	102.57	-1.47E-04	6.59E-04
10	0	0	67.725	5.73E-04	102.39	-1.23E-04	5.6E-04
11	0	0	76.15	4.31E-04	102.17	-9.09E-05	4.21E-04
12	0	0	84.575	2.51E-04	101.94	-5.19E-05	2.46E-04
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	5.72E-05	107.95	-1.76E-05	5.44E-05
14	-78.2854	-41.2752	7.425	4.81E-04	107.9	-1.48E-04	4.58E-04
15	-78.2854	-41.2752	14.85	6.43E-04	107.8	-1.97E-04	6.12E-04
16	-78.2854	-41.2752	22.275	7.55E-04	107.68	-2.29E-04	7.19E-04
END	-78.2854	-41.2752	29.7	8.19E-04	107.53	-2.47E-04	7.81E-04
2J4	-78.2854	-41.2752	29.7	8.19E-04	107.53	-2.47E-04	7.81E-04
18	-78.2854	-41.2752	37.1	8.33E-04	107.4	-2.49E-04	7.95E-04
19	-78.2854	-41.2752	44.5	8.12E-04	107.25	-2.41E-04	7.76E-04
20	-78.2854	-41.2752	51.9	7.56E-04	107.08	-2.22E-04	7.23E-04
END	-78.2854	-41.2752	59.3	6.58E-04	106.89	-1.91E-04	6.29E-04

2J5	-78.2854	-41.2752	59.3	6.58E-04	106.89	-1.91E-04	6.29E-04
22	-78.2854	-41.2752	67.15	5.56E-04	106.74	-1.6E-04	5.33E-04
23	-78.2854	-41.2752	75.	4.18E-04	106.56	-1.19E-04	4.01E-04
24	-78.2854	-41.2752	82.85	2.44E-04	106.37	-6.86E-05	2.34E-04
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	9.64E-05	-128.6	-6.02E-05	-7.54E-05
26	-73.2367	101.545	7.425	8.11E-04	-128.57	-5.06E-04	-6.34E-04
27	-73.2367	101.545	14.85	1.08E-03	-128.52	-6.74E-04	-8.46E-04
28	-73.2367	101.545	22.275	1.27E-03	-128.45	-7.88E-04	-9.92E-04
END	-73.2367	101.545	29.7	1.37E-03	-128.37	-8.51E-04	-1.07E-03
2J7	-73.2367	101.545	29.7	1.37E-03	-128.37	-8.51E-04	-1.07E-03
30	-73.2367	101.545	37.1	1.39E-03	-128.3	-8.62E-04	-1.09E-03
31	-73.2367	101.545	44.5	1.35E-03	-128.21	-8.37E-04	-1.06E-03
32	-73.2367	101.545	51.9	1.26E-03	-128.12	-7.76E-04	-9.88E-04
END	-73.2367	101.545	59.3	1.09E-03	-128.02	-6.72E-04	-8.6E-04
2J8	-73.2367	101.545	59.3	1.09E-03	-128.02	-6.72E-04	-8.6E-04
34	-73.2367	101.545	67.35	9.19E-04	-127.94	-5.65E-04	-7.25E-04
35	-73.2367	101.545	75.4	6.86E-04	-127.85	-4.21E-04	-5.42E-04
36	-73.2367	101.545	83.45	3.97E-04	-127.77	-2.43E-04	-3.14E-04
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	.0196466	17.21	.0187674	5.81E-03
38	-158.264	159.93	7.425	.0191921	14.21	.0186047	4.71E-03
39	-158.264	159.93	14.85	.0185723	12.68	.0181193	4.08E-03
40	-158.264	159.93	22.275	.0176658	11.44	.0173149	3.5E-03
END	-158.264	159.93	29.7	.0163992	10.33	.0161336	2.94E-03
2J10	-158.264	159.93	29.7	.0163992	10.33	.0161336	2.94E-03
42	-158.264	159.93	37.1	.0151841	9.57	.0149728	2.52E-03
43	-158.264	159.93	44.5	.0136416	8.83	.0134798	2.1E-03
44	-158.264	159.93	51.9	.0118293	8.14	.0117101	1.67E-03
END	-158.264	159.93	59.3	9.64E-03	7.42	9.56E-03	1.25E-03
2J11	-158.264	159.93	59.3	9.64E-03	7.42	9.56E-03	1.25E-03
46	-158.264	159.93	67.375	7.77E-03	6.89	7.71E-03	9.32E-04
47	-158.264	159.93	75.45	5.56E-03	6.36	5.53E-03	6.16E-04
48	-158.264	159.93	83.525	3.1E-03	5.83	3.08E-03	3.15E-04
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	5.65E-05	144.02	-4.57E-05	3.32E-05
50	-137.915	-24.0701	7.425	4.75E-04	143.98	-3.84E-04	2.79E-04
51	-137.915	-24.0701	14.85	6.33E-04	143.91	-5.12E-04	3.73E-04
52	-137.915	-24.0701	22.275	7.42E-04	143.8	-5.99E-04	4.38E-04
END	-137.915	-24.0701	29.7	8.03E-04	143.66	-6.47E-04	4.76E-04
2J13	-137.915	-24.0701	29.7	8.03E-04	143.66	-6.47E-04	4.76E-04
54	-137.915	-24.0701	37.1	8.14E-04	143.53	-6.55E-04	4.84E-04
55	-137.915	-24.0701	44.5	7.91E-04	143.37	-6.35E-04	4.72E-04
56	-137.915	-24.0701	51.9	7.33E-04	143.17	-5.86E-04	4.39E-04
END	-137.915	-24.0701	59.3	6.32E-04	142.92	-5.05E-04	3.81E-04
2J14	-137.915	-24.0701	59.3	6.32E-04	142.92	-5.05E-04	3.81E-04
58	-137.915	-24.0701	66.925	5.33E-04	142.71	-4.24E-04	3.23E-04
59	-137.915	-24.0701	74.55	4.E-04	142.47	-3.17E-04	2.43E-04
60	-137.915	-24.0701	82.175	2.33E-04	142.19	-1.84E-04	1.43E-04
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	1.34E-04	-93.63	-8.5E-06	-1.34E-04
62	-213.087	156.528	7.425	1.13E-03	-93.43	-6.75E-05	-1.13E-03
63	-213.087	156.528	14.85	1.5E-03	-93.04	-7.97E-05	-1.5E-03
64	-213.087	156.528	22.275	1.76E-03	-92.53	-7.78E-05	-1.76E-03
END	-213.087	156.528	29.7	1.9E-03	-91.89	-6.26E-05	-1.9E-03
2J16	-213.087	156.528	29.7	1.9E-03	-91.89	-6.26E-05	-1.9E-03
66	-213.087	156.528	37.1	1.93E-03	-91.31	-4.4E-05	-1.93E-03

67	-213.087	156.528	44.5	1.88E-03	-90.62	-2.02E-05	-1.88E-03
68	-213.087	156.528	51.9	1.75E-03	-89.84	5.03E-06	-1.75E-03
END	-213.087	156.528	59.3	1.53E-03	-88.91	2.9E-05	-1.52E-03
2J17	-213.087	156.528	59.3	1.53E-03	-88.91	2.9E-05	-1.52E-03
70	-213.087	156.528	67.525	1.29E-03	-88.12	4.22E-05	-1.29E-03
71	-213.087	156.528	75.75	9.62E-04	-87.25	4.61E-05	-9.61E-04
72	-213.087	156.528	83.975	5.57E-04	-86.36	3.54E-05	-5.56E-04
END	-213.087	156.528	92.2	0	0	0	0

WRTO TOWER 4 (OTHERS OPEN)

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.55u	
6	C2	3	0	30.p	
7	R3	3	0	34.4	J-10.6

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	353.486u	-69.033	13.603	-31.489n
1.2M	V:2	352.514u	-69.056	13.641	-31.5775n
1.2M	V:3	359.147u	-68.895	-17.694	40.9584n
1.2M	Z:R1	35.3486	15.484	13.603	-31.489n

Z (IN) = 34.4 +j 8.3

WRTO TOWER 5 (OTHERS OPEN)

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

Sources

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

Lumped loads

load	node	resistance (ohms)	reactance (ohms)	inductance (mH)	capacitance (uF)	passive circuit
1	1	0	-4,421.	0	0	0
2	13	0	-4,421.	0	0	0
3	25	0	-4,421.	0	0	0
4	37	0	-4,421.	0	0	0
5	49	0	0	0	0	0
6	61	0	-4,421.	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 49, sector 1							
1.2	33.677	-12.821	36.035	-20.84	1.6497	-12.21	-2.4433

CURRENT rms

Frequency = 1.2 MHz

Input power = .0129674 watts

Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	8.91E-05	-165.11	-8.61E-05	-2.29E-05
2	0	0	7.425	7.51E-04	-165.13	-7.26E-04	-1.93E-04
3	0	0	14.85	1.E-03	-165.19	-9.7E-04	-2.57E-04
4	0	0	22.275	1.18E-03	-165.25	-1.14E-03	-3.E-04
END	0	0	29.7	1.28E-03	-165.33	-1.24E-03	-3.25E-04
2J1	0	0	29.7	1.28E-03	-165.33	-1.24E-03	-3.25E-04
6	0	0	37.1	1.31E-03	-165.41	-1.27E-03	-3.3E-04
7	0	0	44.5	1.28E-03	-165.49	-1.24E-03	-3.21E-04
8	0	0	51.9	1.2E-03	-165.59	-1.16E-03	-2.98E-04
END	0	0	59.3	1.05E-03	-165.7	-1.02E-03	-2.6E-04
2J2	0	0	59.3	1.05E-03	-165.7	-1.02E-03	-2.6E-04
10	0	0	67.725	8.92E-04	-165.8	-8.65E-04	-2.19E-04
11	0	0	76.15	6.69E-04	-165.92	-6.49E-04	-1.63E-04
12	0	0	84.575	3.88E-04	-166.05	-3.76E-04	-9.35E-05
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	1.18E-04	-92.61	-5.39E-06	-1.18E-04
14	-78.2854	-41.2752	7.425	9.95E-04	-92.42	-4.21E-05	-9.94E-04
15	-78.2854	-41.2752	14.85	1.32E-03	-92.06	-4.77E-05	-1.32E-03
16	-78.2854	-41.2752	22.275	1.55E-03	-91.6	-4.32E-05	-1.55E-03
END	-78.2854	-41.2752	29.7	1.67E-03	-91.01	-2.94E-05	-1.67E-03
2J4	-78.2854	-41.2752	29.7	1.67E-03	-91.01	-2.94E-05	-1.67E-03
18	-78.2854	-41.2752	37.1	1.69E-03	-90.49	-1.44E-05	-1.69E-03
19	-78.2854	-41.2752	44.5	1.64E-03	-89.87	3.67E-06	-1.64E-03
20	-78.2854	-41.2752	51.9	1.51E-03	-89.18	2.17E-05	-1.51E-03

END	-78.2854	-41.2752	59.3	1.31E-03	-88.37	3.73E-05	-1.31E-03
2J5	-78.2854	-41.2752	59.3	1.31E-03	-88.37	3.73E-05	-1.31E-03
22	-78.2854	-41.2752	67.15	1.1E-03	-87.72	4.38E-05	-1.1E-03
23	-78.2854	-41.2752	75.	8.2E-04	-87.01	4.28E-05	-8.19E-04
24	-78.2854	-41.2752	82.85	4.75E-04	-86.29	3.07E-05	-4.74E-04
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	6.68E-05	-165.01	-6.45E-05	-1.73E-05
26	-73.2367	101.545	7.425	5.62E-04	-165.04	-5.43E-04	-1.45E-04
27	-73.2367	101.545	14.85	7.5E-04	-165.09	-7.25E-04	-1.93E-04
28	-73.2367	101.545	22.275	8.79E-04	-165.17	-8.5E-04	-2.25E-04
END	-73.2367	101.545	29.7	9.53E-04	-165.26	-9.22E-04	-2.42E-04
2J7	-73.2367	101.545	29.7	9.53E-04	-165.26	-9.22E-04	-2.42E-04
30	-73.2367	101.545	37.1	9.68E-04	-165.35	-9.37E-04	-2.45E-04
31	-73.2367	101.545	44.5	9.43E-04	-165.45	-9.13E-04	-2.37E-04
32	-73.2367	101.545	51.9	8.78E-04	-165.58	-8.5E-04	-2.19E-04
END	-73.2367	101.545	59.3	7.64E-04	-165.73	-7.4E-04	-1.88E-04
2J8	-73.2367	101.545	59.3	7.64E-04	-165.73	-7.4E-04	-1.88E-04
34	-73.2367	101.545	67.35	6.44E-04	-165.86	-6.25E-04	-1.57E-04
35	-73.2367	101.545	75.4	4.82E-04	-166.01	-4.68E-04	-1.17E-04
36	-73.2367	101.545	83.45	2.79E-04	-166.18	-2.71E-04	-6.67E-05
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	5.64E-05	147.64	-4.77E-05	3.02E-05
38	-158.264	159.93	7.425	4.75E-04	147.59	-4.01E-04	2.55E-04
39	-158.264	159.93	14.85	6.34E-04	147.51	-5.35E-04	3.41E-04
40	-158.264	159.93	22.275	7.44E-04	147.41	-6.27E-04	4.01E-04
END	-158.264	159.93	29.7	8.08E-04	147.27	-6.8E-04	4.37E-04
2J10	-158.264	159.93	29.7	8.08E-04	147.27	-6.8E-04	4.37E-04
42	-158.264	159.93	37.1	8.22E-04	147.14	-6.91E-04	4.46E-04
43	-158.264	159.93	44.5	8.03E-04	146.99	-6.73E-04	4.37E-04
44	-158.264	159.93	51.9	7.49E-04	146.81	-6.27E-04	4.1E-04
END	-158.264	159.93	59.3	6.55E-04	146.59	-5.47E-04	3.61E-04
2J11	-158.264	159.93	59.3	6.55E-04	146.59	-5.47E-04	3.61E-04
46	-158.264	159.93	67.375	5.54E-04	146.4	-4.62E-04	3.07E-04
47	-158.264	159.93	75.45	4.16E-04	146.18	-3.46E-04	2.32E-04
48	-158.264	159.93	83.525	2.42E-04	145.94	-2.01E-04	1.36E-04
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	.0196229	20.84	.0183387	6.98E-03
50	-137.915	-24.0701	7.425	.0190995	17.9	.0181747	5.87E-03
51	-137.915	-24.0701	14.85	.0184345	16.39	.0176852	5.2E-03
52	-137.915	-24.0701	22.275	.0174826	15.17	.0168738	4.57E-03
END	-137.915	-24.0701	29.7	.0161662	14.06	.0156816	3.93E-03
2J13	-137.915	-24.0701	29.7	.0161662	14.06	.0156816	3.93E-03
54	-137.915	-24.0701	37.1	.0149113	13.31	.0145107	3.43E-03
55	-137.915	-24.0701	44.5	.0133256	12.58	.0130055	2.9E-03
56	-137.915	-24.0701	51.9	.0114676	11.89	.0112214	2.36E-03
END	-137.915	-24.0701	59.3	9.23E-03	11.18	9.05E-03	1.79E-03
2J14	-137.915	-24.0701	59.3	9.23E-03	11.18	9.05E-03	1.79E-03
58	-137.915	-24.0701	66.925	7.43E-03	10.69	7.3E-03	1.38E-03
59	-137.915	-24.0701	74.55	5.32E-03	10.19	5.24E-03	9.42E-04
60	-137.915	-24.0701	82.175	2.97E-03	9.69	2.93E-03	5.E-04
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	5.51E-05	141.23	-4.3E-05	3.45E-05
62	-213.087	156.528	7.425	4.64E-04	141.18	-3.62E-04	2.91E-04
63	-213.087	156.528	14.85	6.2E-04	141.09	-4.82E-04	3.89E-04
64	-213.087	156.528	22.275	7.28E-04	140.97	-5.66E-04	4.59E-04
END	-213.087	156.528	29.7	7.92E-04	140.82	-6.14E-04	5.E-04
2J16	-213.087	156.528	29.7	7.92E-04	140.82	-6.14E-04	5.E-04

66	-213.087	156.528	37.1	8.06E-04	140.68	-6.24E-04	5.11E-04
67	-213.087	156.528	44.5	7.89E-04	140.52	-6.09E-04	5.02E-04
68	-213.087	156.528	51.9	7.38E-04	140.34	-5.68E-04	4.71E-04
END	-213.087	156.528	59.3	6.48E-04	140.13	-4.97E-04	4.15E-04
2J17	-213.087	156.528	59.3	6.48E-04	140.13	-4.97E-04	4.15E-04
70	-213.087	156.528	67.525	5.49E-04	139.94	-4.2E-04	3.53E-04
71	-213.087	156.528	75.75	4.13E-04	139.73	-3.15E-04	2.67E-04
72	-213.087	156.528	83.975	2.4E-04	139.49	-1.83E-04	1.56E-04
END	-213.087	156.528	92.2	0	0	0	0

WRTO TOWER 5 (OTHERS OPEN)

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	3.1u	
6	C2	3	0	30.p	
7	R3	3	0	33.7	J-12.8

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	351.733u	-69.076	17.006	-39.3667n
1.2M	V:2	350.777u	-69.099	17.054	-39.4773n
1.2M	V:3	359.542u	-68.885	-21.355	49.4331n
1.2M	Z:R1	35.1733	15.462	17.006	-39.3667n

Z (IN) = 33.6 +j 10.3

WRTO TOWER 6 (OTHERS OPEN)

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

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	-4,421.	0	0	0
2	13	0	-4,421.	0	0	0
3	25	0	-4,421.	0	0	0
4	37	0	-4,421.	0	0	0
5	49	0	-4,421.	0	0	0
6	61	0	0	0	0	0

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 61, sector 1							
1.2	36.026	-7.7743	36.856	-12.18	1.4544	-14.651	-1.7782

CURRENT rms

Frequency = 1.2 MHz

Input power = .0132611 watts

Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	5.77E-05	57.58	3.1E-05	4.87E-05
2	0	0	7.425	4.87E-04	57.55	2.61E-04	4.11E-04
3	0	0	14.85	6.52E-04	57.48	3.51E-04	5.5E-04
4	0	0	22.275	7.69E-04	57.39	4.14E-04	6.48E-04
END	0	0	29.7	8.39E-04	57.28	4.53E-04	7.06E-04
2J1	0	0	29.7	8.39E-04	57.28	4.53E-04	7.06E-04
6	0	0	37.1	8.57E-04	57.18	4.65E-04	7.21E-04
7	0	0	44.5	8.42E-04	57.07	4.58E-04	7.07E-04
8	0	0	51.9	7.91E-04	56.93	4.32E-04	6.63E-04
END	0	0	59.3	7.E-04	56.77	3.83E-04	5.85E-04
2J2	0	0	59.3	7.E-04	56.77	3.83E-04	5.85E-04
10	0	0	67.725	5.94E-04	56.62	3.27E-04	4.96E-04
11	0	0	76.15	4.48E-04	56.45	2.47E-04	3.73E-04
12	0	0	84.575	2.61E-04	56.26	1.45E-04	2.17E-04
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	5.45E-05	81.72	7.84E-06	5.39E-05
14	-78.2854	-41.2752	7.425	4.59E-04	81.67	6.65E-05	4.54E-04
15	-78.2854	-41.2752	14.85	6.13E-04	81.58	8.98E-05	6.07E-04
16	-78.2854	-41.2752	22.275	7.2E-04	81.45	1.07E-04	7.12E-04
END	-78.2854	-41.2752	29.7	7.82E-04	81.31	1.18E-04	7.73E-04
2J4	-78.2854	-41.2752	29.7	7.82E-04	81.31	1.18E-04	7.73E-04
18	-78.2854	-41.2752	37.1	7.95E-04	81.18	1.22E-04	7.86E-04
19	-78.2854	-41.2752	44.5	7.76E-04	81.04	1.21E-04	7.67E-04
20	-78.2854	-41.2752	51.9	7.23E-04	80.88	1.15E-04	7.14E-04

END	-78.2854	-41.2752	59.3	6.29E-04	80.7	1.02E-04	6.21E-04
2J5	-78.2854	-41.2752	59.3	6.29E-04	80.7	1.02E-04	6.21E-04
22	-78.2854	-41.2752	67.15	5.33E-04	80.56	8.74E-05	5.25E-04
23	-78.2854	-41.2752	75.	4.E-04	80.4	6.68E-05	3.95E-04
24	-78.2854	-41.2752	82.85	2.33E-04	80.22	3.96E-05	2.3E-04
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	8.38E-05	-177.27	-8.37E-05	-3.99E-06
26	-73.2367	101.545	7.425	7.05E-04	-177.3	-7.05E-04	-3.32E-05
27	-73.2367	101.545	14.85	9.42E-04	-177.36	-9.41E-04	-4.34E-05
28	-73.2367	101.545	22.275	1.11E-03	-177.43	-1.1E-03	-4.95E-05
END	-73.2367	101.545	29.7	1.2E-03	-177.53	-1.2E-03	-5.17E-05
2J7	-73.2367	101.545	29.7	1.2E-03	-177.53	-1.2E-03	-5.17E-05
30	-73.2367	101.545	37.1	1.22E-03	-177.61	-1.22E-03	-5.07E-05
31	-73.2367	101.545	44.5	1.19E-03	-177.72	-1.19E-03	-4.73E-05
32	-73.2367	101.545	51.9	1.11E-03	-177.83	-1.11E-03	-4.18E-05
END	-73.2367	101.545	59.3	9.64E-04	-177.98	-9.64E-04	-3.4E-05
2J8	-73.2367	101.545	59.3	9.64E-04	-177.98	-9.64E-04	-3.4E-05
34	-73.2367	101.545	67.35	8.14E-04	-178.1	-8.14E-04	-2.7E-05
35	-73.2367	101.545	75.4	6.09E-04	-178.24	-6.09E-04	-1.87E-05
36	-73.2367	101.545	83.45	3.54E-04	-178.4	-3.53E-04	-9.88E-06
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	1.31E-04	-98.62	-1.96E-05	-1.29E-04
38	-158.264	159.93	7.425	1.1E-03	-98.43	-1.61E-04	-1.09E-03
39	-158.264	159.93	14.85	1.47E-03	-98.06	-2.05E-04	-1.45E-03
40	-158.264	159.93	22.275	1.71E-03	-97.57	-2.26E-04	-1.7E-03
END	-158.264	159.93	29.7	1.85E-03	-96.95	-2.24E-04	-1.84E-03
2J10	-158.264	159.93	29.7	1.85E-03	-96.95	-2.24E-04	-1.84E-03
42	-158.264	159.93	37.1	1.87E-03	-96.39	-2.09E-04	-1.86E-03
43	-158.264	159.93	44.5	1.82E-03	-95.73	-1.82E-04	-1.81E-03
44	-158.264	159.93	51.9	1.69E-03	-94.97	-1.46E-04	-1.69E-03
END	-158.264	159.93	59.3	1.47E-03	-94.06	-1.04E-04	-1.47E-03
2J11	-158.264	159.93	59.3	1.47E-03	-94.06	-1.04E-04	-1.47E-03
46	-158.264	159.93	67.375	1.24E-03	-93.3	-7.14E-05	-1.24E-03
47	-158.264	159.93	75.45	9.26E-04	-92.47	-3.99E-05	-9.25E-04
48	-158.264	159.93	83.525	5.36E-04	-91.6	-1.5E-05	-5.36E-04
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	5.38E-05	132.62	-3.64E-05	3.96E-05
50	-137.915	-24.0701	7.425	4.53E-04	132.59	-3.06E-04	3.33E-04
51	-137.915	-24.0701	14.85	6.04E-04	132.51	-4.08E-04	4.45E-04
52	-137.915	-24.0701	22.275	7.07E-04	132.41	-4.77E-04	5.22E-04
END	-137.915	-24.0701	29.7	7.66E-04	132.27	-5.15E-04	5.67E-04
2J13	-137.915	-24.0701	29.7	7.66E-04	132.27	-5.15E-04	5.67E-04
54	-137.915	-24.0701	37.1	7.77E-04	132.14	-5.21E-04	5.76E-04
55	-137.915	-24.0701	44.5	7.55E-04	131.97	-5.05E-04	5.61E-04
56	-137.915	-24.0701	51.9	6.99E-04	131.76	-4.66E-04	5.22E-04
END	-137.915	-24.0701	59.3	6.04E-04	131.5	-4.E-04	4.52E-04
2J14	-137.915	-24.0701	59.3	6.04E-04	131.5	-4.E-04	4.52E-04
58	-137.915	-24.0701	66.925	5.1E-04	131.27	-3.36E-04	3.83E-04
59	-137.915	-24.0701	74.55	3.82E-04	131.01	-2.51E-04	2.88E-04
60	-137.915	-24.0701	82.175	2.22E-04	130.71	-1.45E-04	1.68E-04
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	.0191858	12.18	.0187541	4.05E-03
62	-213.087	156.528	7.425	.0188278	9.05	.0185932	2.96E-03
63	-213.087	156.528	14.85	.0182682	7.46	.0181135	2.37E-03
64	-213.087	156.528	22.275	.0174196	6.18	.0173183	1.88E-03
END	-213.087	156.528	29.7	.0162132	5.03	.0161507	1.42E-03
2J16	-213.087	156.528	29.7	.0162132	5.03	.0161507	1.42E-03

66	-213.087	156.528	37.1	.0150446	4.25	.0150032	1.12E-03
67	-213.087	156.528	44.5	.013552	3.5	.0135267	8.27E-04
68	-213.087	156.528	51.9	.0117903	2.79	.0117764	5.73E-04
END	-213.087	156.528	59.3	9.66E-03	2.06	9.65E-03	3.47E-04
2J17	-213.087	156.528	59.3	9.66E-03	2.06	9.65E-03	3.47E-04
70	-213.087	156.528	67.525	7.79E-03	1.51	7.79E-03	2.05E-04
71	-213.087	156.528	75.75	5.58E-03	.95	5.58E-03	9.27E-05
72	-213.087	156.528	83.975	3.11E-03	.41	3.11E-03	2.21E-05
END	-213.087	156.528	92.2	0	0	0	0

WRTO TOWER 6 (OTHERS OPEN)

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	3.41u	
6	C2	3	0	30.p	
7	R3	3	0	36.	J-7.8

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	400.884u	-67.940	25.980	-60.1395n
1.2M	V:2	399.986u	-67.959	26.043	-60.2848n
1.2M	V:3	367.95u	-68.684	-12.825	29.6875n
1.2M	Z:R1	40.0884	16.030	25.980	-60.1395n

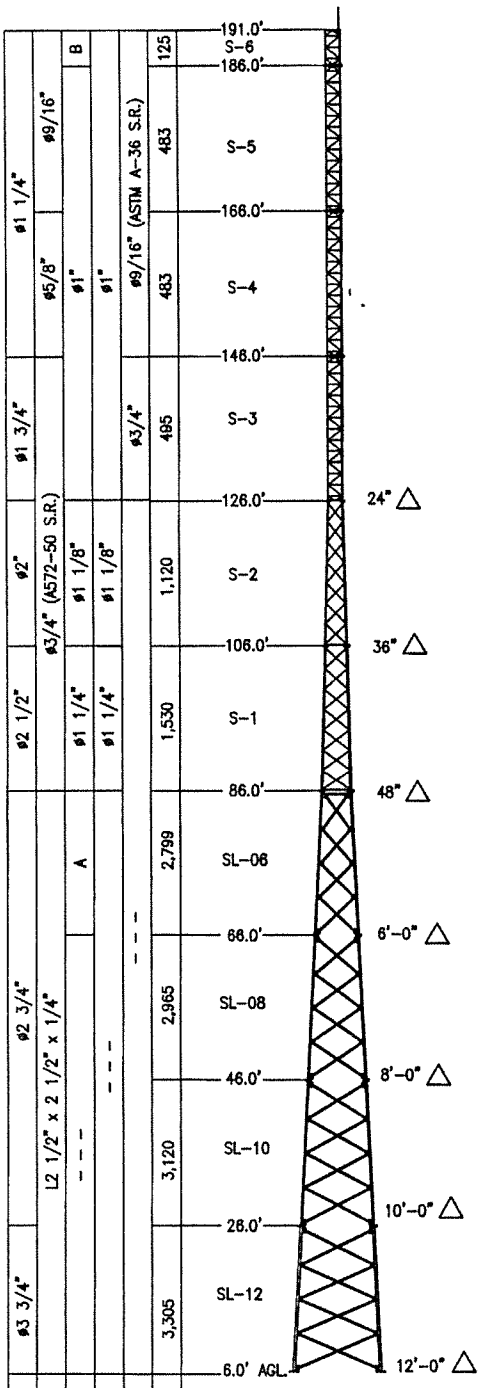
Z (IN) = 36.0 +j 17.6

DESIGNED ANTENNA LOADING

ANTENNA TYPE	ELEVATION (A.G.L.)	LINE

MATERIAL LIST

MARK	SIZE
A	L2 1/2" X 2 1/2" X 1/4"
B	1" X 1/2" PL



LEGS (ASTM A572-50 S.R.)	#3 3/4"	#2 3/4"	#2 1/2"	#2"	#1 3/4"	#1 1/4"	
DIAGONALS (ASTM A-36 ANGLE OR A-36 S.R.)	L2 1/2" x 2 1/2" x 1/4"		#3/4" (A572-50 S.R.)			#5/8"	#9/16"
TOP GIRTS (ASTM A-36 ANGLE OR PL, A572-50 S.R.)	- - -	A	#1 1/4"	#1 1/8"	#1"		B
BOTTOM GIRTS (ASTM A572-50 S.R.)	- - -		#1 1/4"	#1 1/8"	#1"		
HORIZONTALS (ASTM A572-50 S.R.)	- - -				#3/4"	#9/16" (ASTM A-36 S.R.)	
WEIGHT IN LBS. PER SECTION	3,305	3,120	2,965	2,799	1,530	1,120	495	483	125

TOWER DESIGN NOTES

1. TOWER DESIGNED FOR A 75 MPH BASIC WIND IN ACCORDANCE WITH THE TIA/EIA-222-F STANDARD.
2. TOWER IS ALSO DESIGNED FOR A 65 MPH BASIC WIND SPEED W/ 1/2" ICE IN ACCORDANCE WITH THE TIA/EIA-222-F STANDARD.
3. DEFLECTIONS ARE BASED UPON A 50 MPH WIND.
4. TOWER SECTIONS HAVE FLANGE CONNECTIONS.
5. CONNECTIONS USE GALVANIZED A-325 BOLTS, LOCKING DEVICES AND NUT. INSTALLATION PER EIA-222 SPECIFICATIONS.
6. TOWER MEMBERS ARE "HOT DIPPED" GALVANIZED IN ACCORDANCE WITH ASTM A-123 AND A-153 STANDARDS.
7. WELDS ARE FABRICATED WITH ER-70S-6 ELECTRODES.
8. UNLESS OTHERWISE STATED, FASTENER COMPONENTS UTILIZED ON THIS TOWER SHALL BE AS FOLLOWS:

COMPONENT	DESCRIPTION
STRUCTURAL BOLT	ASTM A-325
HEAVY HEX NUT	ASTM A-563
ANCO LOCKNUT	ASTM A-563 HEAVY HEX NUT W/ STAINLESS PIN
FLATWASHER	ASTM F-436
LOCKWASHER	ASME B18.21.1

MAX. CORNER REACTIONS AT BASE:
DOWN: 83K
UPLIFT: -66K
SHEAR: 7K

AXIAL
23 KIP

SHEAR
10 KIP

MOMENT
785 KIP-FT

65 MPH WIND - 0.5000 IN. ICE

AXIAL
18 KIP

SHEAR
10 KIP

MOMENT
643 KIP-FT

REACTIONS - 75 MPH WIND

NO	REVISION	DATE

NAME: TOWER ELEVATION
FOR: CHICAGO, IL
PATH: G:\DRAFTING\ALL\PROJECTS\23059\001
DRAWING: 1/200
DRAWN: CLM
DATE: 11/05/2008
SCALE: AS NOTED
DRAWING NO: E-1
REVISION NO: 1

ELECTRONICS RESEARCH, INC.
Established 1949
7777 GARDNER RD.
CHANDLER, IN 47610-9637
PHONE: (812) 925-6000
FAX: (812) 925-4028
CERTIFIED STEEL FABRICATOR

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.
TOLERANCES
1. HOLES ARE +1/16" UNLESS OTHERWISE SPECIFIED

Engineering Exhibit 2
Array Geometry and Modeling Calculations
Application For License
BP-20090427AAB
WLXX-AM License Corp.
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

WRTO DAY

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

Sources

source	node	sector	magnitude	phase	type
1	1	1	1,201.66	7.3	voltage
2	13	1	784.579	-11.42	voltage
3	25	1	1,074.61	55.4	voltage
4	37	1	423.281	85.31	voltage
5	49	1	589.403	-14.55	voltage
6	61	1	139.274	94.05	voltage

IMPEDANCE

normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.2	80.735	-11.17	81.504	-7.88	1.6639	-12.068	-2.4899
source = 2; node 13, sector 1							
1.2	-71.114	-64.186	95.797	-137.93	****	****	****
source = 3; node 25, sector 1							
1.2	44.396	-13.031	46.269	-16.36	1.3498	-16.545	-1.4
source = 4; node 37, sector 1							
1.2	14.38	-24.318	28.252	-59.4	4.3577	-4.0588	-8.5589
source = 5; node 49, sector 1							
1.2	7.2791	-321.75	321.83	-88.7	291.45	-6.E-02	-43.3
source = 6; node 61, sector 1							
1.2	-70.8	-357.62	364.56	-101.2	****	****	****
Parallel combination of all sources.							
1.2	9.64499	-11.527	15.0299	-50.08	5.4696	-3.2122	-10.197

CURRENT rms

Frequency = 1.2 MHz

Input power = 20,000. watts

Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	10.4293	15.17	10.0657	2.72982
2	0	0	7.425	10.2443	8.17	10.1404	1.45508
3	0	0	14.85	9.99191	4.62	9.95938	.80554
4	0	0	22.275	9.59099	1.8	9.58624	.301734
END	0	0	29.7	8.99699	-.68	8.99636	-.10684
2J1	0	0	29.7	8.99699	-.68	8.99636	-.10684
6	0	0	37.1	8.40273	-2.34	8.39572	-.343072
7	0	0	44.5	7.62477	-3.91	7.607	-.520363
8	0	0	51.9	6.68885	-5.37	6.65948	-.626185
END	0	0	59.3	5.53822	-6.83	5.49888	-.65892
2J2	0	0	59.3	5.53822	-6.83	5.49888	-.65892
10	0	0	67.725	4.48697	-7.94	4.44399	-.619615
11	0	0	76.15	3.22957	-9.02	3.18964	-.506302
12	0	0	84.575	1.80373	-10.06	1.77601	-.31498
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	5.79345	126.51	-3.44696	4.65645

14	-78.2854	-41.2752	7.425	5.22713	133.21	-3.57914	3.80955
15	-78.2854	-41.2752	14.85	4.86799	137.04	-3.56251	3.3175
16	-78.2854	-41.2752	22.275	4.49651	140.32	-3.46046	2.8712
END	-78.2854	-41.2752	29.7	4.07155	143.38	-3.26771	2.4289
2J4	-78.2854	-41.2752	29.7	4.07155	143.38	-3.26771	2.4289
18	-78.2854	-41.2752	37.1	3.70914	145.51	-3.05731	2.10013
19	-78.2854	-41.2752	44.5	3.28148	147.61	-2.77095	1.75783
20	-78.2854	-41.2752	51.9	2.80388	149.61	-2.41874	1.41825
END	-78.2854	-41.2752	59.3	2.2482	151.69	-1.97924	1.06631
2J5	-78.2854	-41.2752	59.3	2.2482	151.69	-1.97924	1.06631
22	-78.2854	-41.2752	67.15	1.79925	153.18	-1.60572	.811765
23	-78.2854	-41.2752	75.	1.28131	154.69	-1.15832	.547774
24	-78.2854	-41.2752	82.85	.710355	156.17	-.649811	.286968
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	16.429	71.76	5.14203	15.6036
26	-73.2367	101.545	7.425	16.0056	67.88	6.02583	14.828
27	-73.2367	101.545	14.85	15.4784	65.89	6.3222	14.1283
28	-73.2367	101.545	22.275	14.7202	64.28	6.38821	13.2618
END	-73.2367	101.545	29.7	13.6662	62.84	6.23898	12.159
2J7	-73.2367	101.545	29.7	13.6662	62.84	6.23898	12.159
30	-73.2367	101.545	37.1	12.6562	61.86	5.96941	11.1599
31	-73.2367	101.545	44.5	11.3734	60.92	5.52825	9.9395
32	-73.2367	101.545	51.9	9.86484	60.03	4.92725	8.54618
END	-73.2367	101.545	59.3	8.04184	59.14	4.12518	6.90319
2J8	-73.2367	101.545	59.3	8.04184	59.14	4.12518	6.90319
34	-73.2367	101.545	67.35	6.48384	58.48	3.38931	5.52745
35	-73.2367	101.545	75.4	4.64734	57.83	2.47413	3.93402
36	-73.2367	101.545	83.45	2.58892	57.2	1.4023	2.17625
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	10.5982	144.71	-8.65116	6.12205
38	-158.264	159.93	7.425	10.1268	143.43	-8.13314	6.03363
39	-158.264	159.93	14.85	9.68021	142.74	-7.70398	5.86132
40	-158.264	159.93	22.275	9.1129	142.15	-7.19537	5.5921
END	-158.264	159.93	29.7	8.37929	141.59	-6.566	5.20578
2J10	-158.264	159.93	29.7	8.37929	141.59	-6.566	5.20578
42	-158.264	159.93	37.1	7.70751	141.19	-6.00633	4.83008
43	-158.264	159.93	44.5	6.8805	140.8	-5.33167	4.3491
44	-158.264	159.93	51.9	5.93053	140.4	-4.5696	3.78021
END	-158.264	159.93	59.3	4.8044	139.98	-3.6792	3.08962
2J11	-158.264	159.93	59.3	4.8044	139.98	-3.6792	3.08962
46	-158.264	159.93	67.375	3.85369	139.65	-2.937	2.49498
47	-158.264	159.93	75.45	2.7478	139.31	-2.08362	1.79135
48	-158.264	159.93	83.525	1.52281	138.97	-1.14877	.999645
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	1.29549	74.15	.353767	1.24625
50	-137.915	-24.0701	7.425	.667347	73.05	.194563	.638355
51	-137.915	-24.0701	14.85	.352102	71.55	.111436	.334003
52	-137.915	-24.0701	22.275	.112599	66.44	.0450009	.103216
END	-137.915	-24.0701	29.7	.0789252	-97.98	-.0109617	-.0781603
2J13	-137.915	-24.0701	29.7	.0789252	-97.98	-.0109617	-.0781603
54	-137.915	-24.0701	37.1	.184253	-104.05	-.0447242	-.178742
55	-137.915	-24.0701	44.5	.259566	-105.94	-.0713051	-.24958
56	-137.915	-24.0701	51.9	.299323	-107.15	-.0882835	-.286008
END	-137.915	-24.0701	59.3	.302404	-108.22	-.0945743	-.287235
2J14	-137.915	-24.0701	59.3	.302404	-108.22	-.0945743	-.287235
58	-137.915	-24.0701	66.925	.277547	-108.94	-.0901057	-.262513
59	-137.915	-24.0701	74.55	.223126	-109.69	-.0751723	-.210081

60	-137.915	-24.0701	82.175	.137596	-110.44	-.0480517	-.128933
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	.270242	-164.75	-.260722	-.0710943
62	-213.087	156.528	7.425	.12883	-153.06	-.114853	-.0583611
63	-213.087	156.528	14.85	.0661636	-135.29	-.0470233	-.046545
64	-213.087	156.528	22.275	.0321771	-91.11	-6.26E-04	-.032171
END	-213.087	156.528	29.7	.0339238	-26.02	.030486	-.0148804
2J16	-213.087	156.528	29.7	.0339238	-26.02	.030486	-.0148804
66	-213.087	156.528	37.1	.0440225	-1.18	.0440132	-9.07E-04
67	-213.087	156.528	44.5	.0516671	15.14	.0498729	.0134973
68	-213.087	156.528	51.9	.0553987	28.44	.0487124	.0263841
END	-213.087	156.528	59.3	.0553655	41.21	.0416546	.0364724
2J17	-213.087	156.528	59.3	.0553655	41.21	.0416546	.0364724
70	-213.087	156.528	67.525	.0519478	50.44	.0330815	.0400523
71	-213.087	156.528	75.75	.0435495	59.18	.0223144	.0373982
72	-213.087	156.528	83.975	.0283749	66.82	.0111692	.0260841
END	-213.087	156.528	92.2	0	0	0	0

WRTO DAY

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.2 MHz

tower	field ratio magnitude	phase (deg)
1	1.	0
2	.45	142.2
3	1.507	63.3
4	.928	141.7
5	0	0
6	0	0

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	849.704	7.3	10.4514	15.88
13	554.781	-11.42	5.85176	125.9
25	759.861	55.4	16.468	72.14
37	299.305	85.31	10.6421	144.84
49	416.771	-14.55	1.35905	74.21
61	98.4814	94.05	.284737	-165.17

Sum of square of source currents = 1,059.7
Total power = 20,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.0415836	-.0207646
Y(1, 2)	-.0578982	.0181938
Y(1, 3)	-.0146623	.0231258
Y(1, 4)	.0209966	-.0263618
Y(1, 5)	.0406435	.000213436
Y(1, 6)	-.0254442	.0196572
Y(2, 1)	-.0579116	.0181874
Y(2, 2)	.138406	.000340577
Y(2, 3)	.0259844	-.0132121
Y(2, 4)	-.0264922	.0248852
Y(2, 5)	-.0989584	-.0166441
Y(2, 6)	.036563	-.0259832
Y(3, 1)	-.0146671	.0231262
Y(3, 2)	.0259846	-.0132128
Y(3, 3)	.0282247	-.0285932
Y(3, 4)	-.039674	.0500939
Y(3, 5)	-.0274229	.0156277
Y(3, 6)	.0379205	-.0281924
Y(4, 1)	.0210009	-.0263633
Y(4, 2)	-.0264914	.0248886
Y(4, 3)	-.0396714	.0500923
Y(4, 4)	.125736	-.0872311
Y(4, 5)	.0230059	-.0214899
Y(4, 6)	-.112262	.0614258
Y(5, 1)	.0406544	.000221982
Y(5, 2)	-.0989649	-.0166512
Y(5, 3)	-.0274259	.0156259
Y(5, 4)	.023009	-.0214868

Y(5, 5)	.0882998	.0281101
Y(5, 6)	-.0298666	.0240478
Y(6, 1)	-.0254477	.019659
Y(6, 2)	.0365616	-.025989
Y(6, 3)	.0379152	-.028192
Y(6, 4)	-.112255	.0614285
Y(6, 5)	-.0298621	.0240528
Y(6, 6)	.118007	-.0376104

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	35.5688	-1.27308
Z(1, 2)	15.1074	-17.5897
Z(1, 3)	4.78849	-18.5439
Z(1, 4)	-12.6615	.584292
Z(1, 5)	-1.88421	-19.9071
Z(1, 6)	-9.63254	9.10215
Z(2, 1)	15.102	-17.5908
Z(2, 2)	31.8751	-12.2542
Z(2, 3)	-2.36857	-16.7796
Z(2, 4)	-12.9337	-.447396
Z(2, 5)	24.5273	-10.6475
Z(2, 6)	-11.9041	4.1521
Z(3, 1)	4.78646	-18.5437
Z(3, 2)	-2.36787	-16.7805
Z(3, 3)	34.2966	-2.9715
Z(3, 4)	12.2045	-17.9955
Z(3, 5)	-1.46151	-15.1665
Z(3, 6)	-3.10951	-18.9729
Z(4, 1)	-12.6609	.584684
Z(4, 2)	-12.9338	-.447944
Z(4, 3)	12.2046	-17.995
Z(4, 4)	34.4459	-10.6012
Z(4, 5)	-10.2016	-7.85872
Z(4, 6)	28.3184	-10.6761
Z(5, 1)	-1.88783	-19.9044
Z(5, 2)	24.5247	-10.6492
Z(5, 3)	-1.46295	-15.1653
Z(5, 4)	-10.2021	-7.85772
Z(5, 5)	33.5414	-12.9602
Z(5, 6)	-10.7708	-6.46722
Z(6, 1)	-9.6319	9.10228
Z(6, 2)	-11.9044	4.15181
Z(6, 3)	-3.10929	-18.9729
Z(6, 4)	28.3201	-10.6745
Z(6, 5)	-10.7705	-6.46836
Z(6, 6)	36.0549	-7.83406

WRTO NIGHT

WRTO

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

wire	caps	Radius	Angle	Z	radius	segs
1	none	0	0	0	1.164	4
		0	0	29.7		
2	none	0	0	29.7	.7568	4
		0	0	59.3		
3	none	0	0	59.3	.3495	4
		0	0	93.		
4	none	88.5	207.8	0	1.164	4
		88.5	207.8	29.7		
5	none	88.5	207.8	29.7	.7568	4
		88.5	207.8	59.3		
6	none	88.5	207.8	59.3	.3495	4
		88.5	207.8	90.7		
7	none	125.2	125.8	0	1.164	4
		125.2	125.8	29.7		
8	none	125.2	125.8	29.7	.7568	4
		125.2	125.8	59.3		
9	none	125.2	125.8	59.3	.3495	4
		125.2	125.8	91.5		
10	none	225.	134.7	0	1.164	4
		225.	134.7	29.7		
11	none	225.	134.7	29.7	.7568	4
		225.	134.7	59.3		
12	none	225.	134.7	59.3	.3495	4
		225.	134.7	91.6		
13	none	140.	189.9	0	1.164	4
		140.	189.9	29.7		
14	none	140.	189.9	29.7	.7568	4
		140.	189.9	59.3		
15	none	140.	189.9	59.3	.3495	4
		140.	189.9	89.8		
16	none	264.4	143.7	0	1.164	4
		264.4	143.7	29.7		
17	none	264.4	143.7	29.7	.7568	4
		264.4	143.7	59.3		
18	none	264.4	143.7	59.3	.3495	4
		264.4	143.7	92.2		

Number of wires = 18
current nodes = 72

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	3	8.425	2	7.4
radius	3	.3495	1	1.164

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.2	0	1	.0205556	.0234028

Sources

source	node	sector	magnitude	phase	type
1	1	1	567.62	-41.05	voltage
2	13	1	295.317	-10.7	voltage
3	25	1	507.955	-10.42	voltage
4	37	1	275.956	37.52	voltage
5	49	1	258.984	31.69	voltage
6	61	1	190.607	64.57	voltage

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR dB	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.2	183.17	61.483	193.22	18.55	4.1056	-4.318	-8.1403
source = 2; node 13, sector 1							
1.2	23.988	-6.4043	24.828	-14.95	2.1285	-8.8566	-3.8862
source = 3; node 25, sector 1							
1.2	118.8	-77.668	141.94	-33.18	3.5291	-5.061	-7.0996
source = 4; node 37, sector 1							
1.2	29.788	4.859	30.181	9.26	1.7029	-11.698	-2.6161
source = 5; node 49, sector 1							
1.2	-.76313	-21.486	21.5	-92.03	****	****	****
source = 6; node 61, sector 1							
1.2	2.0144	-24.869	24.95	-85.37	30.969	-.56114	-24.074
Parallel combination of all sources.							
1.2	5.30478	-5.91685	7.94668	-48.12	9.5589	-1.824	-14.452

CURRENT rms
Frequency = 1.2 MHz
Input power = 4,500. watts
Efficiency = 100. %

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	2.07809	-59.6	1.05148	-1.79244
2	0	0	7.425	2.32003	-73.69	.65138	-2.22671
3	0	0	14.85	2.43064	-79.48	.44391	-2.38976
4	0	0	22.275	2.47015	-83.51	.279098	-2.45434
END	0	0	29.7	2.43436	-86.69	.14052	-2.4303
2J1	0	0	29.7	2.43436	-86.69	.14052	-2.4303
6	0	0	37.1	2.34799	-88.64	.0557926	-2.34733
7	0	0	44.5	2.19518	-90.36	-.013961	-2.19513
8	0	0	51.9	1.97842	-91.87	-.064465	-1.97737
END	0	0	59.3	1.68183	-93.29	-.0964527	-1.67906
2J2	0	0	59.3	1.68183	-93.29	-.0964527	-1.67906
10	0	0	67.725	1.3893	-94.31	-.104321	-1.38538
11	0	0	76.15	1.01873	-95.27	-.0934824	-1.01443
12	0	0	84.575	.578946	-96.15	-.0620516	-.575611
END	0	0	93.	0	0	0	0
GND	-78.2854	-41.2752	0	8.41381	4.24	8.39074	.622747

14	-78.2854	-41.2752	7.425	8.26443	2.18	8.25846	.314157
15	-78.2854	-41.2752	14.85	8.01066	1.15	8.00904	.161138
16	-78.2854	-41.2752	22.275	7.62232	.35	7.62217	.0465809
END	-78.2854	-41.2752	29.7	7.07001	-.34	7.06989	-.0418315
2J4	-78.2854	-41.2752	29.7	7.07001	-.34	7.06989	-.0418315
18	-78.2854	-41.2752	37.1	6.53636	-.79	6.53575	-.0897177
19	-78.2854	-41.2752	44.5	5.85724	-1.2	5.85597	-.122342
20	-78.2854	-41.2752	51.9	5.05856	-1.56	5.05668	-.137945
END	-78.2854	-41.2752	59.3	4.09446	-1.91	4.09218	-.13671
2J5	-78.2854	-41.2752	59.3	4.09446	-1.91	4.09218	-.13671
22	-78.2854	-41.2752	67.15	3.2958	-2.15	3.29349	-.123588
23	-78.2854	-41.2752	75.	2.3585	-2.37	2.35648	-.0975972
24	-78.2854	-41.2752	82.85	1.3125	-2.58	1.31118	-.0590082
END	-78.2854	-41.2752	90.7	0	0	0	0
GND	-73.2367	101.545	0	2.53153	22.76	2.33442	.979353
26	-73.2367	101.545	7.425	2.26242	11.39	2.21789	.446653
27	-73.2367	101.545	14.85	2.12078	4.85	2.1132	.179159
28	-73.2367	101.545	22.275	1.98391	-.7	1.98377	-.0241027
END	-73.2367	101.545	29.7	1.82841	-5.77	1.81916	-.183688
2J7	-73.2367	101.545	29.7	1.82841	-5.77	1.81916	-.183688
30	-73.2367	101.545	37.1	1.69192	-9.22	1.67004	-.271215
31	-73.2367	101.545	44.5	1.52412	-12.53	1.48781	-.330727
32	-73.2367	101.545	51.9	1.32863	-15.61	1.27963	-.357485
END	-73.2367	101.545	59.3	1.09147	-18.68	1.03395	-.349653
2J8	-73.2367	101.545	59.3	1.09147	-18.68	1.03395	-.349653
34	-73.2367	101.545	67.35	.886361	-20.89	.828102	-.316042
35	-73.2367	101.545	75.4	.640607	-23.04	.589493	-.25075
36	-73.2367	101.545	83.45	.360107	-25.09	.326124	-.152711
END	-73.2367	101.545	91.5	0	0	0	0
GND	-158.264	159.93	0	6.46769	28.26	5.69704	3.06182
38	-158.264	159.93	7.425	6.46402	25.73	5.8231	2.80625
39	-158.264	159.93	14.85	6.32415	24.5	5.75463	2.6228
40	-158.264	159.93	22.275	6.06594	23.55	5.56068	2.42373
END	-158.264	159.93	29.7	5.67055	22.74	5.22982	2.19183
2J10	-158.264	159.93	29.7	5.67055	22.74	5.22982	2.19183
42	-158.264	159.93	37.1	5.27372	22.21	4.88235	1.99368
43	-158.264	159.93	44.5	4.75689	21.73	4.41887	1.76112
44	-158.264	159.93	51.9	4.13919	21.3	3.85649	1.50347
END	-158.264	159.93	59.3	3.38471	20.88	3.16235	1.20658
2J11	-158.264	159.93	59.3	3.38471	20.88	3.16235	1.20658
46	-158.264	159.93	67.375	2.73302	20.6	2.55831	.961464
47	-158.264	159.93	75.45	1.96123	20.33	1.8391	.681274
48	-158.264	159.93	83.525	1.09345	20.08	1.027	.375364
END	-158.264	159.93	91.6	0	0	0	0
GND	-137.915	-24.0701	0	8.52106	123.72	-4.73077	7.08719
50	-137.915	-24.0701	7.425	8.17284	123.78	-4.54424	6.79303
51	-137.915	-24.0701	14.85	7.81876	123.78	-4.34778	6.49845
52	-137.915	-24.0701	22.275	7.35637	123.76	-4.08798	6.11593
END	-137.915	-24.0701	29.7	6.74947	123.7	-3.74524	5.61502
2J13	-137.915	-24.0701	29.7	6.74947	123.7	-3.74524	5.61502
54	-137.915	-24.0701	37.1	6.18986	123.64	-3.42904	5.15325
55	-137.915	-24.0701	44.5	5.49892	123.55	-3.03938	4.5826
56	-137.915	-24.0701	51.9	4.70402	123.45	-2.59261	3.92507
END	-137.915	-24.0701	59.3	3.76044	123.31	-2.06487	3.1428
2J14	-137.915	-24.0701	59.3	3.76044	123.31	-2.06487	3.1428
58	-137.915	-24.0701	66.925	3.01416	123.19	-1.64994	2.52248
59	-137.915	-24.0701	74.55	2.14862	123.05	-1.17189	1.8009

60	-137.915	-24.0701	82.175	1.19232	122.9	-.647714	1.00104
END	-137.915	-24.0701	89.8	0	0	0	0
GND	-213.087	156.528	0	5.40395	149.94	-4.67726	2.70663
62	-213.087	156.528	7.425	5.15753	149.75	-4.45515	2.59842
63	-213.087	156.528	14.85	4.92505	149.6	-4.24805	2.49202
64	-213.087	156.528	22.275	4.63111	149.44	-3.98782	2.35468
END	-213.087	156.528	29.7	4.25257	149.24	-3.65422	2.17509
2J16	-213.087	156.528	29.7	4.25257	149.24	-3.65422	2.17509
66	-213.087	156.528	37.1	3.90741	149.06	-3.35137	2.00901
67	-213.087	156.528	44.5	3.48436	148.84	-2.98179	1.80269
68	-213.087	156.528	51.9	3.00077	148.6	-2.56121	1.56361
END	-213.087	156.528	59.3	2.43102	148.29	-2.06814	1.27774
2J17	-213.087	156.528	59.3	2.43102	148.29	-2.06814	1.27774
70	-213.087	156.528	67.525	1.94315	148.02	-1.64829	1.02907
71	-213.087	156.528	75.75	1.37966	147.72	-1.16639	.736879
72	-213.087	156.528	83.975	.760626	147.38	-.640682	.409974
END	-213.087	156.528	92.2	0	0	0	0

WRTO NIGHT

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.2 MHz

tower	field ratio magnitude	phase (deg)
1	.345	-85.8
2	1.	0
3	.261	-4.1
4	.806	23.1
5	.952	123.6
6	.61	149.1

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	401.368	-41.05	2.05992	-57.99
13	208.821	-10.7	8.42531	4.45
25	359.178	-10.42	2.56246	23.77
37	195.13	37.52	6.46602	28.52
49	183.129	31.69	8.55261	123.72
61	134.779	64.57	5.42643	149.97

Sum of square of source currents = 452.396
Total power = 4,500. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.0415836	-.0207646
Y(1, 2)	-.0578982	.0181938
Y(1, 3)	-.0146623	.0231258
Y(1, 4)	.0209966	-.0263618
Y(1, 5)	.0406435	.000213436
Y(1, 6)	-.0254442	.0196572
Y(2, 1)	-.0579116	.0181874
Y(2, 2)	.138406	.000340577
Y(2, 3)	.0259844	-.0132121
Y(2, 4)	-.0264922	.0248852
Y(2, 5)	-.0989584	-.0166441
Y(2, 6)	.036563	-.0259832
Y(3, 1)	-.0146671	.0231262
Y(3, 2)	.0259846	-.0132128
Y(3, 3)	.0282247	-.0285932
Y(3, 4)	-.039674	.0500939
Y(3, 5)	-.0274229	.0156277
Y(3, 6)	.0379205	-.0281924
Y(4, 1)	.0210009	-.0263633
Y(4, 2)	-.0264914	.0248886
Y(4, 3)	-.0396714	.0500923
Y(4, 4)	.125736	-.0872311
Y(4, 5)	.0230059	-.0214899
Y(4, 6)	-.112262	.0614258
Y(5, 1)	.0406544	.000221982
Y(5, 2)	-.0989649	-.0166512
Y(5, 3)	-.0274259	.0156259
Y(5, 4)	.023009	-.0214868

Y(5, 5)	.0882998	.0281101
Y(5, 6)	-.0298666	.0240478
Y(6, 1)	-.0254477	.019659
Y(6, 2)	.0365616	-.025989
Y(6, 3)	.0379152	-.028192
Y(6, 4)	-.112255	.0614285
Y(6, 5)	-.0298621	.0240528
Y(6, 6)	.118007	-.0376104

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	35.5688	-1.27308
Z(1, 2)	15.1074	-17.5897
Z(1, 3)	4.78849	-18.5439
Z(1, 4)	-12.6615	.584292
Z(1, 5)	-1.88421	-19.9071
Z(1, 6)	-9.63254	9.10215
Z(2, 1)	15.102	-17.5908
Z(2, 2)	31.8751	-12.2542
Z(2, 3)	-2.36857	-16.7796
Z(2, 4)	-12.9337	-.447396
Z(2, 5)	24.5273	-10.6475
Z(2, 6)	-11.9041	4.1521
Z(3, 1)	4.78646	-18.5437
Z(3, 2)	-2.36787	-16.7805
Z(3, 3)	34.2966	-2.9715
Z(3, 4)	12.2045	-17.9955
Z(3, 5)	-1.46151	-15.1665
Z(3, 6)	-3.10951	-18.9729
Z(4, 1)	-12.6609	.584684
Z(4, 2)	-12.9338	-.447944
Z(4, 3)	12.2046	-17.995
Z(4, 4)	34.4459	-10.6012
Z(4, 5)	-10.2016	-7.85872
Z(4, 6)	28.3184	-10.6761
Z(5, 1)	-1.88783	-19.9044
Z(5, 2)	24.5247	-10.6492
Z(5, 3)	-1.46295	-15.1653
Z(5, 4)	-10.2021	-7.85772
Z(5, 5)	33.5414	-12.9602
Z(5, 6)	-10.7708	-6.46722
Z(6, 1)	-9.6319	9.10228
Z(6, 2)	-11.9044	4.15181
Z(6, 3)	-3.10929	-18.9729
Z(6, 4)	28.3201	-10.6745
Z(6, 5)	-10.7705	-6.46836
Z(6, 6)	36.0549	-7.83406

Engineering Exhibit 3

Base Calculations of Parameters At Sample Transformers
Application For License
BP-20090427AAB
WLXX-AM License Corp.
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

WRTO MODEL SUMMARY

Twr #	*Model Zant*	*Model Zatu*	*Measured Zatu*	*Lf (uH)*
1	35.4 –j0.9	35.6 +j19.8	35.5 +j19.2	2.79
2	31.8 –j12.2	31.7 +j7.1	31.5 +j7.2	2.59
3	34.3 –j2.5	34.4 +j12.2	34.5 +j12.0	1.99
4	34.4 –j10.6	34.4 +j8.3	34.5 +j8.4	2.55
5	33.7 –j12.8	33.6 +j10.3	33.5 +j10.2	3.10
6	36.0 –j7.8	36.0 +j17.6	36.0 +j17.4	3.41

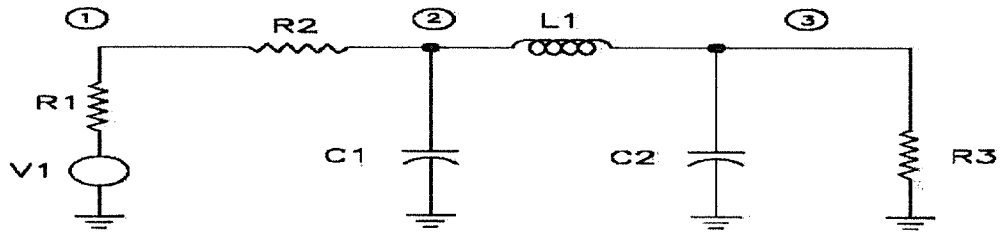
Base insulators: (3) Austin A-3167
Total 30 pF

Phasetek Inc. P600-161-3 static drain chokes
Measures –j16.5K @ 1200 kHz

WRTO MODEL SUMMARY cont.

Twr #	*Normalized current moments @ tower feed point*	*Base network (in/out)*	*Normalized TCT value*
DAY			
1	.635 / -56.6°	1.0022 / +1.3°	.635 / -56.0°
2	.353 / +54.8°	1.0174 / +1.1°	.358 / +55.2°
3	1.000 / 0.0°	1.0029 / +0.7°	1.000 / 0.0°
4	.645 / +73.0°	1.0058 / +0.2°	.647 / +72.5°
NIGHT			
1	.247 / -63.8°	.9825 / +3.1°	.243 / -61.1°
2	1.000 / 0.0°	1.0007 / +0.4°	1.000 / +0.0°
3	.301 / +18.5°	1.0219 / +1.9°	.307 / +20.0°
4	.769 / +24.0°	.9975 / +0.5°	.767 / +24.1°
5	1.013 / +119.5°	1.0047 / +0.0°	1.017 / +119.1°
6	.642 / +145.7°	1.0056 / +0.0°	.645 / +145.3°

Tower Base Circuit Analysis Model



The above circuit was analyzed with the engineering circuit analysis program (ECA) for each tower. Resistors R1 (100k O) and R2 (0.1 O) were located in the circuit for measurement locations of impedance and current.

For each of the individual tower impedance calculations, the complex value of R3 was that obtained from the program Expert Mininec Broadcast Professional Version 6.0 for that specific tower. The input impedance to the circuit was calculated to represent the value at the test jack located at the Antenna Tuning Unit (ATU) output.

In the case of the directional array, the complex value of R3 for each tower was set to the Expert Mininec Broadcast Professional Version 6.0 calculated impedance at each source location. The current magnitude and phase variation was calculated for each tower from the input to the output of each circuit. These values, once normalized, were used to modify the calculated source current magnitude and phase to determine the sampling TCT values.

WRTO TOWER 1 DAY

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.79u	
6	C2	3	0	30.p	
7	R3	3	0	80.7	J-11.2

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	807.792u	-61.854	5.687	-13.165n
1.2M	V:2	806.798u	-61.865	5.694	-13.1813n
1.2M	V:3	812.29u	-61.806	-9.227	21.3579n
1.2M	Z:R1	80.7792	19.073	5.687	-13.165n
1.2M	I:R2	9.99196u	-100.007	-0.005	10.6257p
1.2M	I:R3	9.97u	-100.026	-1.325	3.06769n

Z (IN) = 80.4 +j 8.0

I (IN/OUT) = 1.0022, 1.3 DEG.

WRTO TOWER 2 DAY

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.59u	
6	C2	3	0	30.p	
7	R3	3	0	71.1	J-64.2

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	821.502u	-61.708	-33.173	76.7897n
1.2M	V:2	820.666u	-61.717	-33.211	76.8781n
1.2M	V:3	940.925u	-60.529	-43.201	100.002n
1.2M	Z:R1	82.1502	19.146	-33.173	76.7897n
1.2M	I:R2	9.99312u	-100.006	0.026	-59.6581p
1.2M	I:R3	9.82219u	-100.156	-1.120	2.59363n

Z (IN) = 68.8 -j 45.0

I (IN/OUT) = 1.0174, 1.1 DEG.

WRTO TOWER 3 DAY

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	1.99u	
6	C2	3	0	30.p	
7	R3	3	0	44.4	J-13.

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	442.491u	-67.082	1.919	-4.44203n
1.2M	V:2	441.492u	-67.102	1.923	-4.45209n
1.2M	V:3	461.1u	-66.724	-17.047	39.4601n
1.2M	Z:R1	44.2491	16.459	1.919	-4.44203n
1.2M	I:R2	9.99558u	-100.004	-0.001	1.96606p
1.2M	I:R3	9.9667u	-100.029	-0.727	1.68313n

Z (IN) = 44.2 +j 1.5

I (IN/OUT) = 1.0029, 0.7 DEG.

WRTO TOWER 4 DAY

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.55u	
6	C2	3	0	30.p	
7	R3	3	0	14.4	J-24.3

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	151.783u	-76.376	-19.218	44.4853n
1.2M	V:2	150.839u	-76.430	-19.343	44.7748n
1.2M	V:3	280.792u	-71.032	-59.581	137.92n
1.2M	Z:R1	15.1783	11.812	-19.218	44.4853n
1.2M	I:R2	9.99857u	-100.001	0.003	-6.62717p
1.2M	I:R3	9.94086u	-100.052	-0.232	536.918p

Z (IN) = 14.9 -j 3.1

I (IN/OUT) = 1.0058, 0.2 DEG.

WRTO TOWER 1 NIGHT

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.79u	
6	C2	3	0	30.p	
7	R3	3	0	183.2	J 61.5

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	0.00203283	-53.838	21.167	-48.9983n
1.2M	V:2	0.0020319	-53.842	21.177	-49.0219n
1.2M	V:3	0.00196311	-54.141	15.455	-35.7764n
1.2M	Z:R1	203.283	23.081	21.167	-48.9983n
1.2M	I:R2	9.98105u	-100.016	-0.042	97.5398p
1.2M	I:R3	10.1585u	-99.863	-3.101	7.1792n

Z (IN) = 189.6 +j 73.4

I (IN/OUT) = .9825, 3.1 DEG.

WRTO TOWER 2 NIGHT

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.59u	
6	C2	3	0	30.p	
7	R3	3	0	24.	J-6.4

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	273.395u	-71.264	28.337	-65.5956n
1.2M	V:2	272.516u	-71.292	28.437	-65.8266n
1.2M	V:3	248.159u	-72.105	-15.332	35.4912n
1.2M	Z:R1	27.3395	14.368	28.337	-65.5956n
1.2M	I:R2	9.99759u	-100.002	-0.007	17.2154p
1.2M	I:R3	9.99082u	-100.008	-0.401	927.757p

Z (IN) = 24.1 +j 13.0

I (IN/OUT) = 1.0007, 0.4 DEG.

WRTO TOWER 3 NIGHT

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	1.99u	
6	C2	3	0	30.p	
7	R3	3	0	118.8	J-77.7

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	0.00130917	-57.660	-29.652	68.6384n
1.2M	V:2	0.00130831	-57.666	-29.673	68.6886n
1.2M	V:3	0.00138752	-57.155	-35.057	81.1494n
1.2M	Z:R1	130.917	21.170	-29.652	68.6384n
1.2M	I:R2	9.98862u	-100.010	0.037	-85.9997p
1.2M	I:R3	9.77449u	-100.198	-1.870	4.32928n

Z (IN) = 113.8 -j 64.8

I (IN/OUT) = 1.0219, 1.9 DEG.

WRTO TOWER 4 NIGHT

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	2.55u	
6	C2	3	0	30.p	
7	R3	3	0	29.8	J 4.9

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	383.917u	-68.315	38.495	-89.1083n
1.2M	V:2	383.135u	-68.333	38.588	-89.3238n
1.2M	V:3	302.675u	-70.380	8.834	-20.4488n
1.2M	Z:R1	38.3917	15.842	38.495	-89.1083n
1.2M	I:R2	9.997u	-100.003	-0.014	31.7034p
1.2M	I:R3	10.0223u	-99.981	-0.504	1.16595n

Z (IN) = 30.0 +j 23.9

I (IN/OUT) = .9975, 0.5 DEG.

WRTO TOWER 5 NIGHT

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	3.1u	
6	C2	3	0	30.p	
7	R3	3	0	0.8	J-21.5

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	21.6959u	-93.272	65.709	-152.105n
1.2M	V:2	21.3041u	-93.431	68.161	-157.781n
1.2M	V:3	214.131u	-73.386	-87.883	203.433n
1.2M	Z:R1	2.16959	3.364	65.709	-152.105n
1.2M	I:R2	9.99991u	-100.000	-0.001	2.62279p
1.2M	I:R3	9.9527u	-100.041	-0.014	32.8456p

Z (IN) = 0.9 +j 2.0

I (IN/OUT) = 1.0047, 0.0 DEG.

WRTO TOWER 6 NIGHT

BRANCH	LABEL	NODES		VALUE	
1	V1	0	0	1.	
2	R1	1	0	100.K	
3	R2	1	2	0.1	
4	C1	2	0	8.p	
5	L1	2	3	3.41u	
6	C2	3	0	30.p	
7	R3	3	0	2.	J-24.9

FREQ.	PROBE	VALUE	dB	PHASE	PHASE DELAY
1.2M	V:1	22.8437u	-92.825	24.550	-56.8297n
1.2M	V:2	21.938u	-93.176	25.636	-59.3418n
1.2M	V:3	248.412u	-72.097	-85.441	197.78n
1.2M	Z:R1	2.28437	3.588	24.550	-56.8297n
1.2M	I:R2	9.99979u	-100.000	-0.001	1.25886p
1.2M	I:R3	9.94435u	-100.048	-0.033	76.745p

Z (IN) = 2.1 +j 0.9

I (IN/OUT) = 1.0056, 0.0 DEG.

Engineering Exhibit 4
Sample System Verification
Application For License
BP-20090427AAB
WLXX-AM License Corp.
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

WRTO Tower Sample Line Measurements

	Resonant Frequency (kHz) Below 1200kHz	Resonant Frequency (kHz) Above 1200kHz	Calculated Electrical Length (deg) at 1200 kHz	Meaured Impedance Connected to TCT
Tower 1	1178.4	1651.9	458.2	50.6 -j4.1
Tower 2	1179.0	1653.1	458.0	50.7 -j4.0
Tower 3	1178.8	1652.6	458.1	50.6 -j4.1
Tower 4	1179.1	1653.3	458.0	50.4 -j4.0
Tower 5	1179.0	1653.3	458.0	50.5 -j3.9
Tower 6	1179.0	1653.2	458.0	50.7 -j4.0

	+45 Degree Offset Frequency (kHz)	+45 Degree Measured Impedance (Ohms)	-45 Degree Offset Frequency (kHz)	-45 Degree Measured Impedance (Ohms)	Calculated Characteristic Impedance (Ohms)
Tower 1	1296.3	8.3 +j49.9	1060.6	6.5 -j50.3	50.65
Tower 2	1296.8	8.2 +j49.8	1061.1	6.5 -j50.4	50.64
Tower 3	1296.7	8.2 +j49.9	1060.9	6.5 -j50.3	50.64
Tower 4	1297.0	8.2 +j49.8	1061.2	6.4 -j50.4	50.64
Tower 5	1296.9	8.2 +j49.7	1061.1	6.5 -j50.4	50.59
Tower 6	1296.8	8.3 +j49.8	1061.1	6.5 -j50.4	50.65

MAX Impedance	50.65
MIN Impedance	50.59
MAXIMUM IMPEDANCE DELTA	**0.06**

Above measured using HP 8752A network analyzer

Engineering Exhibit 5
Reference Measurements
Application For License
BP-20090427AAB
WLXX-AM License Corp.
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

WRTO Reference Measurements
All measurements by J. Sigstad using Potomac FIM 21 SN 1291
Note: Pattern minima specified on contstruction permit are reversed between day and night. Measured radials reflect correct day and night patterns
All times CST. All readings are mV/m

13°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 41' 20.5"N 87° 37' 17.8" W	3.08	115	80	Corner 113th Street and alley 110' west of S. Michigan	21-Jan	13:16
2	41° 41' 45.4'N 87° 37' 10.2"W	3.87	110	80	East side of street in front of 10908 S Edbrooke Ave	"	13:05
3	41° 42' 6.6"N 87° 37' 3.9"W	4.54	110	77	10538S Prairie Ave on sidewalk	"	12:45

75°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 40' 22.4"N 87° 34' 31"W	4.71		3.4	12241 S Stoney Island Ave	20-Jan	10:53
2	41° 40' 33.8"N 87° 33' 33.7"W	6.08		4.1	West side of AveO 100yards from 118th St Intersectio	"	11:07
3	41° 40' 51.9"N 87° 32' 2.9"W	8.25		6	118th St in alley 100' N of street	"	11:26

120.5°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 38' 2.5"N 87° 33' 59.9"W	6.11		7	Alley 210 meters east of Paxton Ave	18-Jan	10:24
2	41° 37' 57.5"N 87° 33' 48.5"W	6.42		8	Alley behind 154 Yates Ave	"	10:52
3	41° 37' 52.8"N 87° 33' 37.9"W	6.7		10	24512 S Hoxie Ave	"	11:07

187.5°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 38' 5.7"N 87° 38' 5.2"W	3.03		15	Alley behind 14304 S Parnell Ave	29-Dec	13:30
2	41° 37' 47.4"N 87° 38' 8.4"W	3.59		11.5	581 Shore Dr front sidewalk	"	13:09
3	41° 37' 41.3"N 87° 38' 9.4"W	3.78		18.5	14354 Parnell Ave in alley behind	"	13:03
4	41° 37' 23"N 87° 38' 12.7"W	4.35		16	70 m east of 14670 Jefferson St in Alley	"	12:43

212°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 38' 0.7"N 87° 39' 13.5"W	3.72		13	Thornton Rd 500 m SE of Ashland	21-Jan	9:33
2	41° 37' 29.6"N 87° 39' 39.5"W	4.85		7.6	Wood St 50 meters S of railroad tracks (West side)	"	9:12
3	41° 37' 17.3"N 87° 39' 49.8"W	5.3		4	14728 Winchester Ave, alley behind	"	9:00

282.5°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 40' 4"N 87° 39' 57.5"W	3.06		4.3	12416 Wood St sidewalk	21-Jan	11:17
2	41° 40' 11.5"N 87° 40' 42.4"W	4.08		2.2	SE Corner 123rd ST and Gregory St	"	11:02
3	41° 40' 17.5"N 87° 41' 16.6"W	4.94		1.2	12204 Highland Ave front sidewalk	"	9:55

93.5°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time

1	41° 39' 37"N 87° 35' 37.2"W	3.03	38		intersection of S Doty Ave and e 130th St West corner	20-Jan	10:40
2	41° 39' 35.3"N 87° 35' 0.3" W	3.9	40		intersection of S Doty Ave and e 130th St East corner	"	10:37
3	41° 39' 30.7" N 87° 33' 19.9"W	6.21	18		13018 S Maniste Ave	"	10:30

134.5°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 38' 13.5"N 87° 35' 46.2"W	3.94	12		864 E 142nd on front sidewalk	18-Jan	9:47
2	41° 38' 5.4"N 87° 35' 35.2"W	4.3	21		14308 Ellis Ave front sidewalk	"	9:56
3	41° 37' 53.8"N 87° 35' 19.4"W	4.8	9		145th St 45 m W of Woodlawn Ave	"	10:12

185.5°

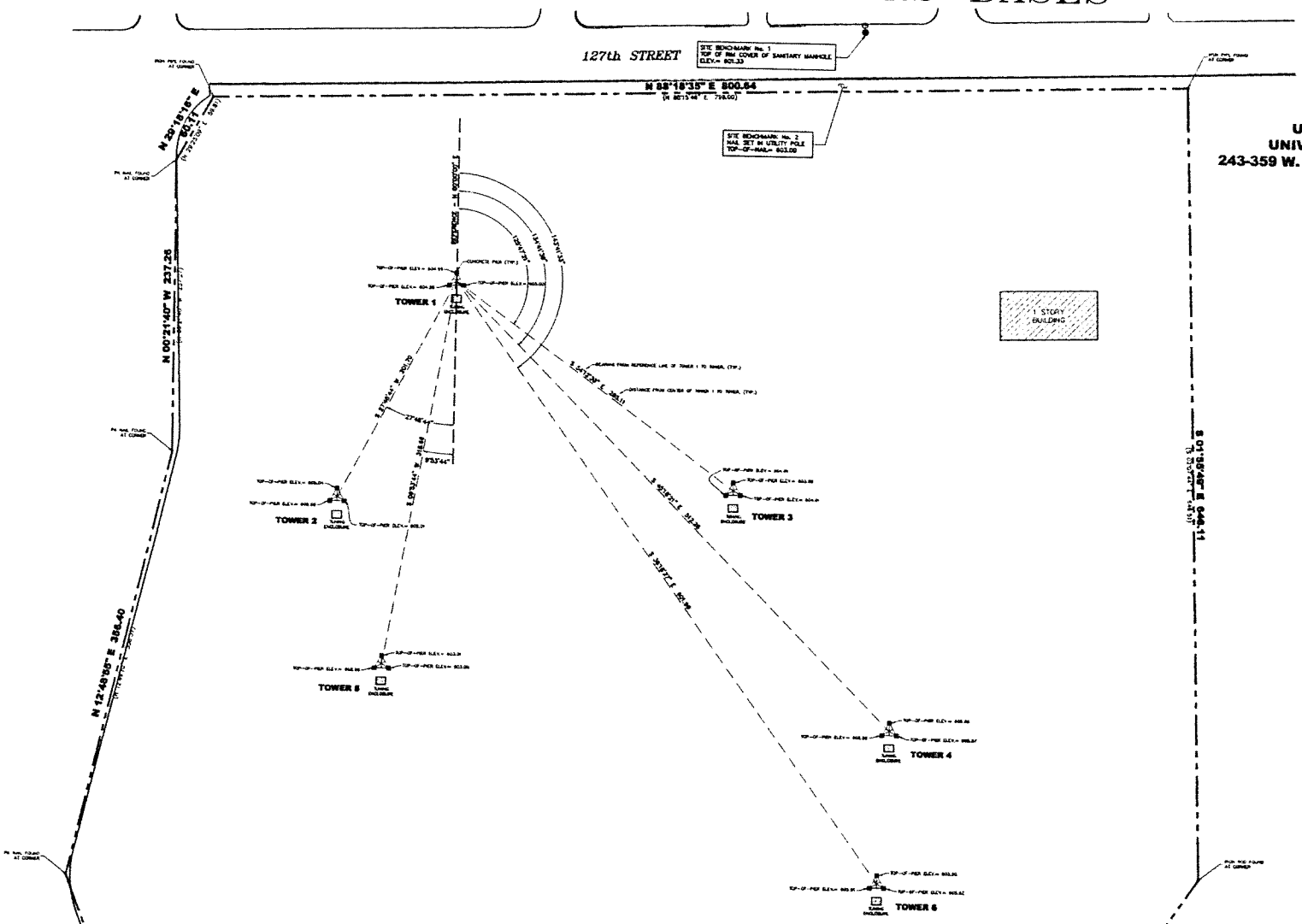
Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 38' 1"N 87° 38' 1.1" W	3.16	64		461 W 145th St front sidewalk	30-Dec	10:52
2	41° 37' 24.8"N 87° 38' 5.8"W	4.28	14		Train station parking lot 20 meters S of access road	"	10:35
3	41° 36' 49.2"N 87° 38' 10.4"W	5.38	19		SE corner of Halsted and # 152nd St	"	10:24

310.5°

Point	Location	Distance (Km)	Day	Night	Description	Date	Time
1	41° 40' 46.9"N 87° 39' 28.2"W	3.04	210		11782 S Bishop front sidewalk	11-Jan	10:45
2	41° 41' 6.1"N 87° 39' 58.3"W	3.95	190		11448 S Watkins Ave	"	11:03
3	41° 41' 20.6"N 87° 40' 21.1"W	4.64	187		11236 S Longwood front sidewalk	"	11:21

Engineering Exhibit 6
As Built Survey
Application For License
BP-20090427AAB
WLXX-AM License Corp.
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

AS-BUILT of TOWERS BASES



UNIVISION RADIO TOWERS
UNIVISION RADIO CHICAGO, INC.
243-359 W. 127th STREET., CHICAGO, IL 60628

BENCH MARK USED:

ALL ELEVATION REFER TO TOP OF RIM COVER OF SANITARY MANHOLE ON 127th ST., NOTED AS "SITE BENCHMARK No. 1" ON THIS DRAWING.
ELEVATION= 801.33
ELEVATION OBTAINED FROM POINT BLOCK ATTRIBUTES IN CAD DRAWING "E20070125b--sl_TOPO.dwg", DRAWING RECEIVED ON 10/08/2008 AND PROVIDED BY RBS-SORIL.

SPECIFIC NOTES:

1) BASIS OF BEARING IS NAD 83 (1997 ADJ.), ILLINOIS EAST ZONE AS SHOWN ON "TOPOGRAPHICAL SURVEY" BY "AMERICAN SURVEYING CONSULTANTS, P.C.", DATED 01/04/07, APPEARING AS SHEET "SURV" IN A SET OF DRAWINGS BY "FSN", DATED 09/05/08.

2) CURB LINE AND MANHOLES OF 127th ST. ARE SHOWN AS PER CAD DRAWING "E20070125b--sl_TOPO.dwg", RECEIVED ON 10/08/2008 AND PROVIDED BY RBS-SORIL.

3) TOWERS REARRANGING IS SHOWN FOR DRAWING "WBTO CHICAGO", "RADIAL DETAIL" PROVIDED BY MICK RILEY ON 03/26/09 VIA E-MAIL. BASE AND PREPARER OF DRAWING ARE NOT SHOWN ON THE DRAWING.
ALSO
DRAWING "A0.10", PREPARED BY "FSN", LAST REVISION: 11.04.2008 – "REVISED PER PLANNING REVIEW"

4) CHAIN LINK FENCE AROUND ENTIRE SITE, GRAVEL YARD WITH CHAIN LINK ENCLOSURE SURROUNDING RADIO TOWERS, GRAVEL ROADS CONNECTING TOWERS, ORNAMENTAL FENCE AND ENTRANCE GATE AND PAVED AREAS AROUND SINGLE STORY BUILDING ARE NOT SHOWN HEREON.

Legend

FENCE
WD = WOOD FENCE C.L. = CHAIN LINK
N.F. = NORTH FACE S.F. = SOUTH FACE
I.P. = IRON PIPE I.R. = IRON ROD

GRAPHIC SCALE
(IN FEET)
1 inch = 40 ft.

THIS SURVEY IS VALID ONLY WITH AN EMBOSSED SEAL

PREPARED BY **McTIGUE & SPIEWAK, INC.**
PROFESSIONAL DESIGN FIRM, LAND SURVEYING CORPORATION

STATE OF ILLINOIS }
COUNTY OF COOK } S.S.

McTIGUE & SPIEWAK, INC. A PROFESSIONAL DESIGN FIRM, LAND SURVEYING CORPORATION, LICENSE No. 184-002770 HEREBY CERTIFIES THAT AN AS-BUILT SURVEY HAS BEEN MADE UNDER THE DIRECTION AND SUPERVISION OF AN ILLINOIS PROFESSIONAL LAND SURVEYOR OF THE ABOVE DESCRIBED PROPERTY AND THAT THE PLAT HEREON DRAWN IS A CORRECT REPRESENTATION OF SAID AS-BUILT SURVEY.

CHICAGO, ILLINOIS, DATED THIS 12th DAY OF APRIL A.D. 2012.

BY _____
ILLINOIS PROFESSIONAL LAND SURVEYOR
LICENSE EXPIRES 11/30/2010

Engineering Exhibit 7

WNWI Night Before And After Construction Measurements
Application For License
BP-20090427AAB
WLXX-AM License Corp.
WRTO (AM) 1200 KHz
20 KW DA-D 4.5 KW DA-N
Facility ID 11196
Chicago, Illinois

WNWI Night before and after WRTO tower construction measurements
2000 Measurements supplied by WNWI, other measurements by J. Sigstad using FIM21 SN 1291

86°

Point #	Date	Time	mV/m	Latitude	Longitude	Distance	2000 (mV/m)	Ratio
4	6/18/2009	20:30	11.5	41° 38' 37.78" N	87° 38' 10" W	0.81	11.9	0.9664
5				41° 38' 38.09" N	87° 38' 4.17" W	0.95	18.1	0.0000
6	6/18/2009	20:37	15.5	41° 38' 38.49" N	87° 37' 56.38" W	1.13	16.2	0.9568
7	6/18/2009	20:40	10	41° 38' 38.81" N	87° 37' 49.43" W	1.29	10.9	0.9174
8				41° 38' 39.01" N	87° 37' 46.63" W	1.35	10.5	0.0000
9	6/18/2009	20:49	10	41° 38' 39.19" N	87° 37' 42.59" W	1.45	10.2	0.9804
10	6/18/2009	20:53	9.4	41° 38' 39.58" N	87° 37' 35.49" W	1.61	9.9	0.9495
11				41° 38' 40.16" N	87° 37' 24.5" W	1.87	10.1	0.0000
12	6/18/2009	21:01	8.3	41° 38' 40.40" N	87° 37' 21" W	1.95	8.6	0.9651
13	6/18/2009	21:07	8.3	41° 38' 41.13" N	87° 37' 6.38" W	2.29	8.3	1.0000
14	6/18/2009	21:10	7	41° 38' 41.32" N	87° 37' 2.86" W	2.37	7.7	0.9091
15				41° 38' 41.66" N	87° 36' 56.42" W	2.52	4.95	0.0000
16	6/18/2009	21:17	3.7	41° 38' 42.75" N	87° 36' 35.7" W	3.00	4.2	0.8810
Ratio for radial compared to 2000 measurements								**0.947**

99°

Point #	Date	Time	mV/m	Latitude	Longitude	Distance	2000 (mV/m)	Ratio
3				41°38'29.56"N	87°37'50.62"W	1.27	13.2	
4				41°38'28.77"N	87°37'44.02"W	1.43	9.9	
5				41°38'27.99"N	87°37'37.31"W	1.58	7.55	
6	6/18/2009	21:29	4.5	41°38'26.40"N	87°37'24.01"W	1.90	4.8	0.9375
7	6/18/2009	21:32	3.5	41°38'25.40"N	87°37'15.49"W	2.09	3.65	0.9589
8	6/18/2009	21:35	4.7	41°38'24.75"N	87°37'10.07"W	2.22	5.65	0.8319
9	6/18/2009	21:40	4.2	41°38'23.75"N	87°37'1.61"W	2.42	4.9	0.8571
10	6/18/2009	21:43	4	41°38'23.14"N	87°36'56.53"W	2.54	5.1	0.7843
11	6/18/2009	21:46	3.6	41°38'22.11"N	87°36'47.88"W	2.74	4.7	0.7660
12	6/18/2009	21:50	3.4	41°38'21.33"N	87°36'41.26"W	2.90	4.2	0.8095
13	6/18/2009	21:57	3.6	41°38'19.71"N	87°36'27.51"W	3.22	5	0.7200
Ratio for radial compared to 2000 measurements								**0.833**

241°

Point #	Date	Time	mV/m	Latitude	Longitude	Distance	2000 (mV/m)	Ratio
2	6/18/2009	22:06	11	41°38'13.73"N	87°39'38.75"W	1.42	11.65	0.9442
3				41°38'11.03"N	87°39'45.28"W	1.59	9.15	0.0000
4				41°38'8.97"N	87°39'50.19"W	1.72	9.9	0.0000
5	6/18/2009	22:15	6.7	41°37'58.59"N	87°40'15.26"W	2.38	7.3	0.9178
6	6/18/2009	22:18	4.5	41°37'51.43"N	87°40'32.54"W	2.84	4.8	0.9375
7	6/18/2009	22:22	5.3	41°37'49.27"N	87°40'37.75"W	2.98	5.6	0.9464
8	6/18/2009	22;27	5.5	41°37'46.31"N	87°40'44.87"W	3.17	6.2	0.8871
9	6/18/2009	22;31	4	41°37'43.83"N	87°40'50.88"W	3.32	4.95	0.8081
10	6/18/2009	22:35	3.5	41°37'41.35"N	87°40'56.86"W	3.48	3.72	0.9409
11	6/18/2009	22:41	3.7	41°37'36.15"N	87°41'9.37"W	3.81	4.5	0.8222
Ratio for radial compared to 2000 measurements								**0.901**

249°

Point #	Date	Time	mV/m	Latitude	Longitude	Distance	2000 (mV/m)	Ratio
2				41°38'19.20"N	87°39'43.51"W	1.45	10.3	0.0000
3	6/18/2009	23:10	7.2	41°38'10.43"N	87°40'14.07"W	2.20	7.45	0.9664
4	6/18/2009	23:16	5	41°38'3.11"N	87°40'39.61"W	2.84	5.2	0.9615
5	6/18/2009	23:22	5	41°38'0.93"N	87°40'47.18"W	3.02	5.26	0.9506
6	6/18/2009	23:26	4.6	41°37'59.19"N	87°40'53.25"W	3.17	4.95	0.9293
7	6/18/2009	23:31	3.7	41°37'57.33"N	87°40'59.71"W	3.33	3.99	0.9273
8	6/18/2009	23:35	3.2	41°37'55.49"N	87°41'6.06"W	3.49	3.6	0.8889
9	6/18/2009	23:39	4	41°37'51.39"N	87°41'20.35"W	3.85	4.5	0.8889
Ratio for radial compared to 2000 measurements								**0.930**

254°

Point #	Date	Time	mV/m	Latitude	Longitude	Distance	2000	Ratio
2	6/18/2009	23:47	9.5	41°38'23.38"N	87°39'43.81"W	1.41	9.65	0.9845
3				41°38'20.59"N	87°39'56.85"W	1.73	11.65	0.0000
4	6/19/2009	0:01	4.8	41°38'16.25"N	87°40'17.10"W	2.21	4.9	0.9796
5	6/19/2009	0:06	5	41°38'14.73"N	87°40'24.19"W	2.38	4.95	1.0101
6				41°38'13.58"N	87°40'29.57"W	2.51	2.86	0.0000
7	6/19/2009	0:14	3	41°38'12.06"N	87°40'36.63"W	2.68	3.2	0.9375
8	6/19/2009	0:19	3.2	41°38'10.69"N	87°40'42.98"W	2.84	3.3	0.9697
9				41°38'6.17"N	87°41'4.00"W	3.34	5.1	0.0000
10	6/19/2009	0:29	2	41°38'3.62"N	87°41'15.92"W	3.63	2.22	0.9009
11	6/19/2009	0:34	4.7	41°38'1.33"N	87°41'26.53"W	3.88	4.95	0.9495
12	6/19/2009	0:42	3.8	41°37'51.41"N	87°42'12.79"W	5.00	3.2	1.1875
Ratio for radial compared to 2000 measurements								**0.990**